UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DataDome S.A. and DataDome Solutions, Inc.,
Petitioner,
v.
Arkose Labs Holdings, Inc.,
Patent Owner.

U.S. Patent No. 7,373,510
Original Issue Date: May 13, 2008
Title: SYSTEM AND METHOD FOR IMPLEMENTING A ROBOT PROOF WEB SITE

Case No. IPR2025-00693

DECLARATION OF DR. DANIEL LOPRESTI

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CHALLENGED CLAIM LISTING

Claim	Limitation No.	Limitation
1	[1-PRE]	A method for preventing robots from browsing a Web site beyond a welcome page, said method in said Web site comprising the steps of:
	[1-A]	receiving an initial request from an undefined originator and responding to said initial request with a challenge that prompts a response from said undefined originator; and receiving a response from said undefined originator and

	[1-B]	checking said response to determine whether said challenge is fulfilled; and
		if said challenge is fulfilled:
		processing any further requests; and
		if said challenge is not fulfilled:
		stopping processing of any further requests,

	[1-C]	wherein said step of stopping processing of said further requests includes the further step of: dropping or redirecting a TCP connection established with said undefined originator

Claim	Limitation No.	Limitation
	[1-D]	logging a source IP address of said undefined originator and starting a timer, further including steps upon receiving a new request of: checking whether a source IP address of said new request matches said logged source IP address; and if said source IP address matches said logged source IP address: checking whether said timer has expired and, if said timer is expired, resetting said logged IP address; and proceeding normally with said new request; and if said timer is not expired, dropping or redirecting said TCP connection; if said source IP address does not match said logged source IP address, proceeding normally with said new request and executing all the above steps with each newly received request.
2	2	The method according to claim 1 wherein: said challenge includes prompting said undefined originator to perform a specific action.
3	3	The method according to claim 2 wherein: said prompting is different at each subsequent access of said web site.
4	4	The method according to claim 3 wherein: said response includes making a choice among a plurality of prompted response options.

Claim	**Limitation No.**	**Limitation**
5	5	The method according to claim 4, wherein said response includes an answer to a quiz.
6	6	The method according to claim 3, wherein said response includes an answer to a quiz.
7	7	The method according to claim 2, wherein said response includes an answer to a quiz.
8	8	The method according to claim 2, wherein said response is suggested by textual meaning.
9	9	The method according to claim 1 wherein: said prompting is different at each subsequent access of said web site.
10	10	The method according to claim 9 wherein: said response includes making a choice among a plurality of prompted response options.
11	11	The method according to claim 10, wherein said response includes an answer to a quiz.
12	12	The method according to claim 9, wherein said response includes an answer to a quiz.
13	13	The method according to claim 1 wherein: said response includes making a choice among a plurality of prompted response options.

Claim	Limitation No.	Limitation
14	14	The method according to claim 13, wherein said response includes an answer to a quiz.
15	15	The method according to claim 13, wherein said response is suggested by textual meaning.
16	16	The method according to claim 9, wherein said response is suggested by textual meaning.
17	17	The method according to claim 1, wherein said response includes an answer to a quiz.
18	18	The method according to claim 17, wherein said response is suggested by textual meaning.
19	19	The method according to claim 1, wherein said response is suggested by textual meaning.
20	[20-PRE]	A computer process for preventing robots from browsing a web site beyond a welcome page, comprising computer-executable steps of:
	[20-A]	receiving an initial request from an undefined originator and responding to said initial request with a challenge that prompts a response from said undefined originator; and receiving a response from said undefined originator and

Claim	**Limitation No.**	**Limitation**

	[20-B]	checking said response to determine whether said challenge is fulfilled; and
		if said challenge is fulfilled:
		processing any further requests; and
		if said challenge is not fulfilled:
		stopping processing of any further requests,

	[20-C]	wherein said step of stopping processing of said further requests includes the further step of: dropping or redirecting a TCP connection established with said undefined originator
	[20-D]	logging a source IP address of said undefined originator and starting a timer, further including computer-executable steps for: checking whether a source IP address of said new request matches said logged source IP address; and if said source IP address matches said logged source IP address: checking whether said timer has expired and, if said timer is expired, resetting said logged IP address; and proceeding normally with said new request; and if said timer is not expired, dropping or redirecting said TCP connection; if said source IP address does not match said logged source IP address, proceeding normally with said new request and executing all the above steps with each newly received request.

Claim	Limitation No.	Limitation
21	21	A computer process according to claim 20, further including computer-executable steps for: prompting said undefined originator to perform a specific action.
22	22	A computer process according to claim 21, further including computer-executable steps for: prompting said undefined originator to make a response chosen from among a plurality of prompted response options.
23	23	A computer process according to claim 20, further including computer-executable steps for: changing said prompting at each access of said website.
24	24	A computer process according to claim 23, further including computer-executable steps for: prompting said undefined originator to make a response chosen from among a plurality of prompted response options.
25	25	A computer process according to claim 20, further including computer-executable steps for: prompting said undefined originator to make a response chosen from among a plurality of prompted response options.
26	26	A computer process according to claim 20, further including computer-executable steps for: prompting said undefined originator to make a response chosen from among a plurality of prompted response options.

Claim	Limitation No.	Limitation
27	27	A computer process according to claim 20, further including computer-executable steps for: prompting said undefined originator to make a response that is an answer to a quiz.
28	28	A computer process according to claim 20, further including computer-executable steps for: prompting said undefined originator to make a response based upon the knowledge content of said prompt.
29	29	The method according to claim 2 [sic] wherein: said response includes making a choice among a plurality of prompted response options.
30	30	The method according to claim 29, wherein said response includes an answer to a quiz.

I. INTRODUCTION

I, Dr. Daniel Lopresti, declare as follows:

1. I have been retained by counsel for DataDome S.A. and DataDome Solutions, Inc. ("DataDome") in the above-captioned *inter partes* review as an independent consultant to offer opinions regarding the validity of the challenged claims in U.S. Patent No. 7,373,510 (the "'510 Patent").

2. In the preparation of this Declaration, I have confined my analysis to the materials and opinions that were available at the time of the preparation of this Declaration – supplemented with my own knowledge and experience in the field. Should new materials, analyses, or opinions be introduced subsequent to the filing of this Declaration, I reserve the right to provide supplementary Declarations to the extent necessary to address any such newly introduced items.

3. If requested, I am prepared to explain in a deposition or at a trial before the Patent Trial and Appeal Board (the "Board") the technology disclosed in the '510 Patent, including the state of the art around September 12, 2000, the earliest alleged priority date of the '510 Patent. Similarly, I am prepared to explain the technology disclosed in the prior art references cited herein. This may include, among other things, background information on the fields of computer security, information security, or cybersecurity.

II. QUALIFICATIONS

4. My qualifications to testify as an expert in computer security, information security, and cybersecurity technology are set forth in my *curriculum vitae*, attached as Appendix A. I have decades of experience as an engineer, scientist, and consultant in the computer security, information security, and cybersecurity fields, including in the areas of network security as implemented on the Internet and Turing tests used to distinguish humans from automated agents such as robots or bots.

5. My *curriculum vitae* contains further details regarding my experience, education, publications, and other qualifications that qualify me to render expert opinions in connection with this proceeding.

III. COMPENSATION

6. I am being compensated for my work in this matter at an hourly rate of $500 for consulting services.

7. My compensation is not contingent upon the opinions I render or the outcome of this proceeding.

IV. MATERIALS CONSIDERED

8. In preparing this declaration, I reviewed and considered the following materials, along with any others referenced in the body of my declaration:

- The ’510 Patent (Ex. 1001) and its file history (Ex. 1002).
- U.S. Patent No. 8,527,337 (“**Lim**”) (Ex. 1004)
- Lim Provisional Application No. 60/144,612 (Ex. 1005)
- Lim Provisional Application No. 60/151,512 (Ex. 1006)
- Lim Provisional Application No. 60/201,539 (Ex. 1007)
- U.S. Patent No. 6,195,698 (“**Lillibridge**”) (Ex. 1008)
- U.S. Patent No. 6,161,185 (“**Guthrie**”) (Ex. 1009)
- U.S. Patent No. 5,826,015 (“**Schmidt**”) (Ex. 1010)
- Excerpts from Department of Defense, “Password Management Guideline” (Ex. 1011)
- Excerpts from MITRE Corp. and U.S. Air Force, “Guidelines for Designing User Interface Software” (Ex. 1012)
- U.S. Patent No. 9,148,427 (“the ’427 Patent”), which is related to the ’510 Patent, and its file history.
- U.S. Patent No. 9,558,340 (“the ’340 Patent”), which is related to the ’510 Patent, and its file history.

9. I may use these documents and information, or other information obtained during the course of this proceeding, as well as representative charts, graphs, schematics and diagrams, animations, and models based on those documents and information, to support and to explain my testimony.

10. My opinions are based in part on a review and analysis of the above-mentioned documents and materials. I have also drawn on my education, experience, and knowledge of basic engineering and scientific principles in

forming my opinions.

V. UNDERSTANDING OF THE LAW

A. Legal Standards

11. I am not an attorney, but I have been informed of several legal principles, which I have employed in forming my opinions in this declaration. I have been informed and understand that each patent claim is considered separately for purposes of validity and that a dependent claim that depends from another claim includes all of the limitations of the claim it depends from.

12. ***Claim Construction***. I have been informed and understand that the claims of the challenged patents in this proceeding are to be construed using the same claim construction standard applied in district court. I have been informed and understand the claim construction analysis begins with the ordinary meaning of a claim term, and there is a presumption that the term carries its plain and ordinary meaning to persons of ordinary skill in the art as of the effective filing date of the patent. I have also been informed and understand that the most important sources for determining the meaning of a claim term are the claims, the specification, and the prosecution history of the patent at issue, which collectively is called "intrinsic evidence." I have been further informed and understand that the meaning of a claim term may also be guided by "extrinsic evidence," such as contemporaneous dictionaries and treatises.

13. ***Burden of Proof***. I have been informed and understand that the petitioner in an *inter partes* review bears the burden of establishing invalidity by "a preponderance of the evidence." I have been further informed and understand that, to prove an assertion by "a preponderance of the evidence," the party with the burden of proof must demonstrate that it is more likely than not that the assertion is true.

14. ***Obviousness***. I have been informed and understand that a patent claim is invalid if it would have been obvious to a person of ordinary skill in the art at the time of the claimed invention. I have been further informed and understand that a claimed invention is not patentable if differences between it and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the pertinent art. I have been informed and understand that factors relevant to the determination of obviousness include the scope and content of the prior art, the level of ordinary skill in the art at the time of the invention, differences between the claimed invention and the prior art, and "secondary considerations" or objective indicia of non-obviousness.

15. I have been informed that a single reference alone can render a patent claim obvious, if any differences between the reference and the claim would have been known or obvious to a POSITA at the time of the invention. That is, if the

POSITA could have adapted the reference to meet the claims of the patent by applying known concepts to achieve expected results, then the patent claims are rendered obvious by that reference.

16. I have been informed and understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I have been further informed and understand that when a patent claim simply arranges old elements with each performing the same function it had been known to perform and yields no more than one of ordinary skill would expect from such an arrangement, the combination is obvious.

17. I have been informed and understand that a patent claim composed of several limitations is not obvious merely because each limitation was independently known in the prior art. Hindsight reasoning is not an appropriate basis for combining references to form an obviousness combination. I have been further informed and understand that it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine multiple prior art references.

18. I have been informed that various "secondary considerations" (sometimes referred to as objective indicia of non-obviousness) may support a determination of non-obviousness and that such secondary considerations must be considered as part of an obviousness analysis. I have been informed that even

strong evidence of secondary considerations may not be sufficient to rebut a strong showing of obviousness. I have been informed that the patentee bears the burden of showing the existence and effect of secondary considerations of non-obviousness, after which the burden of coming forward with rebuttal evidence shifts to the party arguing obviousness. I have been informed that the following secondary considerations may indicate non-obviousness:

- Copying: evidence that others, including the accused infringer, copied the patented invention.
- Long-standing problem or need: evidence of a persistent problem or need in the art that was resolved by the patented invention.
- Prior failure: evidence that others have tried and failed to solve the problem or failed to provide the need resolved by the claimed invention.
- Commercial acquiescence of competitors: the willingness of industry to license the patent at issue.
- Skepticism: evidence that those of ordinary skill in the art were skeptical as to the merits of the invention.
- Praise: evidence of praise directed to an invention by others in the field.
- Unexpected results: evidence that those of ordinary skill in the art were surprised by the capabilities of the claimed invention.

19. I have also been informed that the near-simultaneous invention by others can be evidence that a claimed invention is obvious. I have further been informed and understand that the patentee bears the burden of showing a “nexus”

between the claimed invention and the evidence proffered on secondary considerations (*e.g.*, proof of commercial success of a product that practices the claimed invention is not enough; there must be evidence that the commercial success resulted, at least in part, from the claimed invention).

B. Priority Date

20. I have been informed and understand that a U.S. patent may claim "priority" to the filing date of one or more earlier filed applications. I have been informed that the priority date, also called the "effective filing date," is the earliest filing date to which a claim is entitled and that such date is relevant for determining what qualifies as prior art. I understand that a claim must have written description support in the application(s) to which it claims priority to be entitled to an earlier effective filing date. I have been informed that the priority date determination is done on a claim-by-claim basis and that claims in the same patent may have different priority dates.

C. Level of Skill in the Art

21. I have been informed and understand that the level of ordinary skill in the relevant art at the time of the invention is relevant to inquiries such as the meaning of claim terms, the meaning of disclosures found in the prior art, and the reasons one of ordinary skill in the art may have for combining references.

22. I have been informed and understand that factors that may be considered in determining the level of ordinary skill include: (1) the type of problems encountered in the art; (2) prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the education level of active workers in the relevant field. I have been further informed and understand that a person of ordinary skill in the art is also a person of ordinary creativity.

23. The challenged patent pertains generally to the fields of computer security, information security, and cybersecurity. A person of ordinary skill in the art ("POSITA") at the time of the alleged invention would have had at least a Bachelor's degree in computer science or computer engineering, or a similar discipline, along with 2-3 years of computer security, information security, or cybersecurity experience. Relevant experience can substitute for education and *vice versa*. I was at all relevant times at least a POSITA in the art relevant to the challenged patents.

VI. SUMMARY OF OPINIONS

24. I have been asked to compare various prior art references to Claims 1-30 of the '510 Patent (the "Challenged Claims"). In my opinion, the Challenged Claims are all unpatentable as obvious – based on these prior art references, combined with the knowledge of a POSITA.

25. My substantive analysis in Section X provides examples of why these prior art references render the Challenged Claims unpatentable. I reserve the right to cite and rely on additional portions of these references in any future declarations or depositions.

VII. TECHNOLOGY BACKGROUND

26. Before considering the '510 Patent in detail, some background on the technology of the '510 Patent should be considered.

A. CAPTCHA and Turning Tests

27. Critically, by September 2000, the field of cybersecurity was well established and built upon the decades-old understanding of basic security principles. By that time, the basic principles of user authentication, including using a challenge to distinguish between genuine humans and automated agents or bots using Turing Tests, were already well in place. One such Turing Test was what is now commonly known as CAPTCHA, which stands for "Completely Automated Public Turing Test to tell Computers and Humans Apart," and is a type of challenge-response authentication that is, as its name suggests, a security measure used to distinguish humans from computers, *i.e.*, bots.

28. It is telling that, as discussed in more detail below, the '510 Patent does not even mention well-known prior art methods for distinguishing humans from bots that existed at the time. In fact, the prior art had already taught the

concepts the patent alleges to have invented. While the name CAPTCHA had not yet been coined in 2000, examples of what we commonly think of as a CAPTCHA challenge-response were already known. For example, Lillibridge's 1998 patent filing depicts an example of precisely what we now think of as a CAPTCHA challenge—a string of random characters that has been distorted and rendered into an image that is easy for a human to recognize but challenging for a bot. Ex. 1008, Fig. 4:

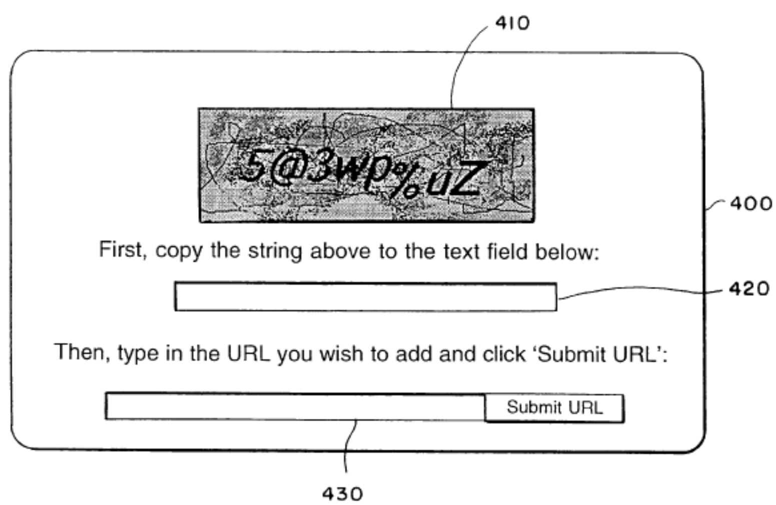

FIG. 4

29. In my personal experience, CAPTCHA challenges like the one depicted in Lillibridge's Figure 4 were in common use on the Internet before 2000. Users of the Internet at that time might have experienced a CAPTCHA that aimed to authenticate website users by distinguishing humans from robots. And the concept of the Turing Test as a way of distinguishing humans from computers was

developed long before by Alan Turing, whose famous "Imitation Game" was published in a 1950 paper called "Computing Machinery and Intelligence." The Turing Test sought to find whether software agents could pass for a human. Thus, the long history of Turing Tests in computer science made the application of them to testing whether users on the Internet were human readily understandable to POSITAs when CAPTCHAs were developed. The application of a test to unknown users trying to access a website was thus a natural evolution that simply relied on a longstanding understanding of basic online security principles and the fundamental capability of humans to perform certain tasks better than a computer.

30. By the time of September 2000, using CAPTCHA to authenticate website users by distinguishing humans from robots was so well-known that systems doing just that had already been known for years, as shown in references like the Lim and Lillibridge patents discussed in this Declaration, which demonstrated detailed execution details and CAPTCHA test variations.

31. Thus, it was a crowded art by September 2000 where the concepts employed in the field were well understood, predictable, and routinely mixed and matched as needed to achieve a POSITA's design goals. This was especially the case for the particularities of such systems—such as the exact form of the challenge, deploying challenges on the web using standard TCP/IP communication protocols on the Internet, and the consequences of failing a challenge—all of

which were known and available for designers to choose from in order to best accommodate their system, as discussed throughout this Declaration.

B. Internet Communications And TCP/IP

32. TCP/IP evolved from work done by DARPA in the 1960s and had become the dominant standard for Internet communications by at least the early 1990s, when it was implemented in Windows 3.1 and subsequent Windows operating systems.

33. IP stands for "Internet Protocol," and is the network layer communications protocol for relaying information over a network. Each computer is assigned a numerical IP address (*e.g.*, 192.0.2.1), which is included in communications to identify both the computer and its location in the network, and thus, the path to it. The header of each IP packet contains the IP address of both the sending and destination computers.

34. TCP stands for "Transmission Control Protocol," and is the transport layer communications protocol. TCP complements IP by operating at the layer between it and the application layer, where applications like Internet browsers operate. While IP handles the actual delivery of data over the network, TCP communicates with the application by presenting it an abstraction of the networking details of the communication and handling transporting the data. For example, TCP handles handshaking, and can detect and handle delivery problems,

such as by requesting re-transmission of IP packets lost due to network congestion. These technologies were foundational to the Internet and received widespread adoption along with the World Wide Web and email in the 1990s.

35. By 2000, a POSITA would have been very familiar with TCP/IP as the common fabric of the Internet. They would have understood that reference to either of TCP or IP would also certainly mean the use of the other, especially with reference to the Web. Accordingly, they would have understood that, when a reference discusses network communications made using IP addresses, those communications would have been ended by dropping or redirecting a TCP connection established with the undefined originator.

C. Lockout Timers

36. Lockout timers, which delay a user's ability to retry an authentication process, have long been used to enhance security of computer systems. Lockout timers advantageously balance the need to allow users to retest after an innocent failure, while also preventing malicious users from using rapid-fire, brute force attempts to guess the correct answer to the challenge. For example, Guthrie (Exhibit 1009) confirms that "[t]he purpose of the lock-out timer is to thwart an unauthorized user from repeatedly 'hammering' the server 104 manually or through an automated application with authorization attempts, while still eventually allowing a legitimate user access to the server 104 without

intervention." Exhibit 1009, 8:24-31. Consider a system that used a 4-digit numeric pin for authentication. That would only require 10,000 attempts to guarantee access in the worst case, and significantly fewer attempts in the average case. In the computer context, where data entry is trivial, an unrestricted automated process could rapidly try all10,000 alternatives if necessary and defeat the authentication process. Lockout timers solve this problem by delaying the frequency by which a system can try to gain access. The obviousness of using lockout timers in this way is confirmed by the extensive discussion in the prior art of using timers to temporarily suspend users after failed access attempts in the prior art. Indeed, this concept was repeatedly taught by the U.S. government in the 1980s.

37. For example, the Department of Defense explained that "in the event of an unsuccessful login attempt, it is quite reasonable to use an internal timer to enforce the desired delay before permitting the next login attempt. The user should not be able to bypass this procedure." Ex. 1011 (Department of Defense, "Password Management Guideline," April 1985) at pp. 11-12.

38. A MITRE Corp. and U.S. Air Force joint publication not only similarly explained that "[a]ccess might be denied temporarily for some computer-imposed time interval, or indefinitely pending review by a system administrator," but also disclosed in detail that a system designer would want to balance the

tradeoff between convenience and security in deciding the length of this suspension. Ex. 1012 (MITRE Corp. and the U.S. Air Force, "Guidelines for Designing User Interface Software," August 1986) at pp. 359-360. As their guidelines explained in detail:

> A record of continuing failure by any particular user to complete successful LOG-ON procedures, including password entry and other tests of claimed user identity, may indicate persistent intrusion attempts. Repeated LOG-ON failures might thus be grounds for denying access to that user. Access might be denied temporarily for some computer-imposed time interval, or indefinitely pending review by a system administrator. The occasional inconvenience to a legitimate user may be tolerable in the interests of increased system security. Analysis of this tradeoff between convenience and security can determine the number and rate of LOG-ON failures that will be tolerated in any particular system application.

Id.

39. An additional example can be seen in U.S. Patent No. 5,826,015 to Thomas Schmidt. Ex. 1010. Schmidt discloses ways that computers can guard against remote users that may be unauthorized. For example, for systems that can be accessed remotely, Schmidt teaches that a lockout timer 126 can be used to limit the frequency of hostile attacks upon the host computer. Ex. 1011, 12:3-5. Schmidt teaches that the purpose of the lockout circuity is to "frustrate a hostile attacker who uses brute force tactics to breach the security of the desktop computer 14 by continuously submitting secure wake-up packets 42 which try all possible password combinations." *Id*., 12:5-10. Schmidt teaches that this lockout timer can

dictate when received packets from the hostile attacker can be temporarily ignored. *Id*., 12:10-13.

VIII. THE ’510 PATENT

40. U.S. Patent No. 7,373,510 (“the ’510 Patent” or “the Challenged Patent”) is entitled “System and Method for Implementing a Robot Proof Web Site.” The ’510 patent claims priority to a European application (No. 00480085), which was filed on September 12, 2000.

41. For purposes of this declaration, I have been instructed to use September 12, 2000 as the priority date of the ’510 Patent. My opinions in this declaration were formed from the perspective of a POSITA as of September 12, 2000, including both the knowledge of a POSITA at that time as well as how a POSITA would have understood the prior art.

42. The objective of the ’510 Patent is to issue a challenge to try and evaluate a new user of a website, which the patent calls an “undefined originator,” to see whether they are a legitimate human user or a robot, also called a “bot.” Ex. 1001, Abstract. If the unknown user succeeds at the challenge, they are assumed to be a human and are allowed to access the website, but if they fail, they are assumed to be a bot and further access to the website is denied. *Id*. This is the basic, prior art, CAPTCHA concept.

43. The ’510 Patent explains that problems caused by servicing requests

from bots were already well-known. *Id*., 1:16-45. For example, it was understood that bots could use up valuable server time and bandwidth, "swamp servers with rapid fire requests" in a Denial of Service (DoS) attack, and traverse parts of servers not suitable for being searched, slowing down the system. *Id*.

44. The '510 Patent acknowledges some types of the existing prior art solutions that could "limit what the robot is allowed to do." *Id*., 1:46-48. These included solutions that "rely on cooperation from the robots" (*e.g.*, the robots.txt protocol, typically referred to as the "Robot Exclusion Protocol"), which it considers inadequate because not all bots may cooperate. *Id*., 1:48-2:3. The patent also describes the "standard way" of preventing access to information on a site was "to protect a Web site through some form of authentication." *Id*., 2:4-8.

45. "Authentication" was of course already a very broad and well-understood concept in online security at the time. However, the '510 Patent does not discuss authentication in any detail or cite to any references or discussions of it. Rather, the patent says only that "the more common" method of authentication was "to manage a list of registered users having a password so as they have to sign on upon accessing the site," and criticizes this method for requiring registration and management of the list. *Id*., 2:8-20.

46. It is telling that the '510 Patent does not state what other prior art authentication methods were, because those methods already taught the concepts

the patent alleges to have invented. As I discussed above, what we now call CAPTCHA was not only widely practiced on the Internet before the ’510 Patent was filed, its use had been the subject of patent applications like Lillibridge and Lim (years before the ’510 Patent in Lillibridge’s case), which had already explained the need to distinguish humans from bots and ways to address that need in more detail than the ’510 Patent does. Indeed, the late 1990s was a period of rapid growth, development, and extensive investment for Internet technologies. In this environment, ideas were readily adopted, deployed, and adapted.

47. This is reflected by Lim and Lillibridge, which show that prior to September 2000, online security was a crowded art, based on concepts that were well understood, predictable, and routinely combined as needed to achieve a POSITA’s design goals. Indeed, as discussed in the following sections, the prior art was so extensive that it had already addressed exactly the alleged problem the ’510 Patent identifies using the same solutions.

A. Problem Addressed by the ’510 Patent and the Alleged Invention

48. As discussed above, while the ’510 Patent admits that techniques for authenticating website users by distinguishing humans from robots were widely used in the prior art, it criticized certain prior art embodiments for requiring registration and management of a list of authorized users. Ex. 1001, 2:8-20.

49. With that framing, the patent asserts that upon “receiving an initial

request from an undefined originator, the Web site responds to the request with a welcome page including a challenge." *Id.*, 2:41-45. If the challenge is passed, the system assumes the user is human and otherwise a robot. *Id.*, 2:45-52.

50. The claims do not focus on the disclosed pictoral challenges and, instead, claim a general challenge plus a conventional lockout timer. However, as I describe above, lockout timers solve a well known authentication problem of balancing the need to let users try again after a failed access, while also preventing the ability to exhaustively guess the answer to the authentication challenge or perform Denial of Service (DoS) of the authentication process.

51. Figures 3-4 of the '510 patent show a preferred embodiment of a timer that locks out users who failed their challenge for a set amount of time:

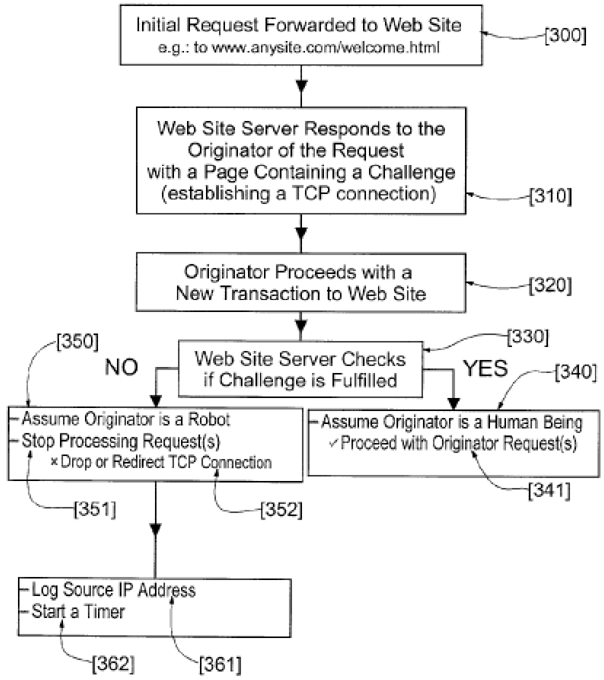

Figure 3

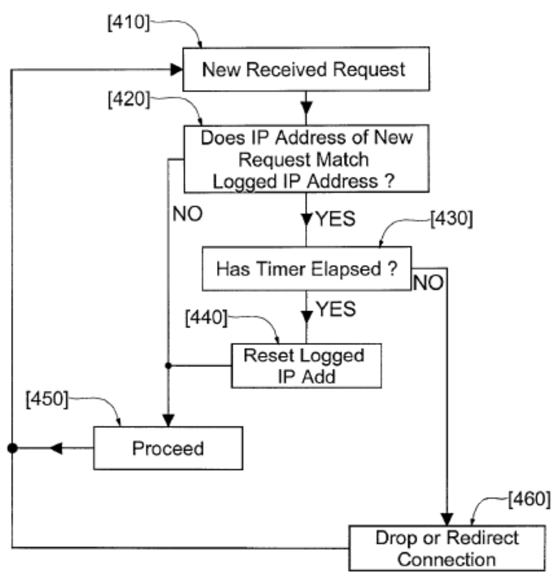

Figure 4

Ex. 1001, Figs. 3-4.

52. Upon access (300), the website server challenges (310) the user. *Id*., 3:59-63. If the user fails the challenge (330), they are assumed to be a robot (350), so the server stops processing their requests (351) (by dropping or redirecting their TCP connections (352)), logs their IP address (361), and starts a timer (362). *Id*., 4:8-15.

53. Upon subsequent requests for access (410), the server checks the requestor's IP address for matches against the stored IP addresses of failed attempts (420). *Id*., 4:16-27. If the address matches and the timer has not elapsed (430), the connection will be dropped or redirected (460). *Id*., 4:28-29, 4:32-34. But if the timer has elapsed (430), the user's logged IP address is reset (440) and they are allowed to attempt a new challenge (450). *Id*., 3:28-31.

54. The '510 patent specification does not explain the timer at length. It does not explain any technical implementation details of the timer, it does not explain the benefits of the timer, and it does not assert that the timer is inventive. Rather, it simply states that the timer ensures that "access to the site may be temporarily barred, from that IP source address" because requests from the IP address are assumed to be from a robot. *Id*., 4:12-21.

55. In fact, from my review, the embodiment shown and described in Fig. 3-4 is the only description of the timer disclosed in the '510 patent. Accordingly, the '510 patent assumes that the implemenation of a timer would be well within the

skill of a POSITA at the time.

B. Prosecution History of the ’510 Patent

56. The ’510 Patent claims priority to foreign application EP 00480085 and was prosecuted in the United States as Application No. 09/901,442. Ex. 1001, (30), (63).

57. On August 16, 2007, the PTO rejected all pending independent claims over Lillibridge (Ex. 1008). *See* Ex. 1002, 107-112. Specifically, the PTO found that Lillibridge disclosed a method for preventing robots from browsing a Web site by issuing a challenge to an undefined originator to either continue processing requests if the challenge is fulfilled or to drop or redirect a TCP connection if the challenge is not. *Id*. However, the PTO found selected dependent claims allowable if rewritten in independent form. *Id*.

58. The applicant rewrote allowable dependent claims 6 and 32 in independent form, which generally recited the disclosed Fig. 4 lock out timer system. *See* Ex. 1002, 97-106. Specifically, claims 6 and 32 each recited the elements of the lockout timer recited in limitation 1[D]. *Id.*

59. The pending claims were allowed, without further substantive commentary from the examiner. *See id*., 146-151 (January 9, 2008, Notice of Allowance). In other words, the claims were allegedly novel over Lillibridge because of the addition of a lockout timer, which tracked the IP address of the user

to temporarily bar that source IP address on a subsequent visit to a website. However, as shown by the prior art discussed in this Petition, this concept was far from inventive at the time.

C. Claim Construction

60. In my opinion, the claims of the ’510 Patent can be interpreted according to their ordinary meanings without construction for the purpose of this IPR.

IX. THE PRIOR ART REFERENCES

A. Lillibridge

61. Lillibridge is titled “method for selectively restricting access to computer systems” and was filed on April 13, 1998. Ex. 1008, (54), (22). It explains that Internet service providers “may want to restrict their servers to only human users” because automated agents, which are also called robots or bots, are sometimes able to pass themselves off as humans and, in doing so, be “malicious, destructive, or otherwise annoying.” *Id.*, 1:20-28.

62. Lillibridge explains that there are a number of different scenarios where bots actings as humans could be problematic online, such as by disrupting everything from polls and advertising to spam emails, by manipulating search engine results, and by wrongly gaining access to proprietary information and engaging in web scraping. Ex. 1008, 1:29-2:14. Bots can be capable of causing

trouble in Internet scenarios like these because "it is difficult for the server computers to differentiate requests submitted by users from those generated by an agent," *i.e.*, a bot. *Id.*, 2:15-18. According to Lillibridge, earlier attempts to address these problems would work "only for specific contexts of a particular service" and were not applicable to "any type of Web server." *Id.*, 2:41-46. As an example, Lillibridge discusses an October 1996 Digital Equipment Corp. polling Website that asked users to click on an image of an American flag placed in random positions on the screen in order to gain access to the poll as a way of trying to secure its polling data ("DEC System"). *Id.*, 2:47-59. But Lillibridge explained that this approach was ineffective because it was easy for computers to do. *Id.* In particular, the DEC System polling website gave the same test to every user and only required clicking on one specific image, an American flag, as opposed to selecting among different images.

63. With this background, Lillibridge identified: a server computer that would "be able to distinguish an ordinary user from an automated agent so that access to the agent can be denied, and while permitting access to real human users." Ex. 1008, 2:60-64. In particular, Lillibridge discloses a server that receives a request from an unknown client and issues a "riddle" to the client. *Id.*, 3:6-20. This riddle could take the form of a string of human-perceptible random characters that are randomly modified, such as by distorting the characters visually

or overlaying them on top of a visually "noisy" background like a maze. *Id*. Note, this generation of random characters allows the creation of different quizzes for different users, thereby addressing the deficiencies of the DEC System prior art, which only provided a single quiz problem to all users.

64. Lillibridge illustrates an example of how its server can generate a riddle in Figure 3 and shows how that example riddle is presented on the client computer to the unknown user in Figure 4. Ex. 1008, Figs. 3-4:

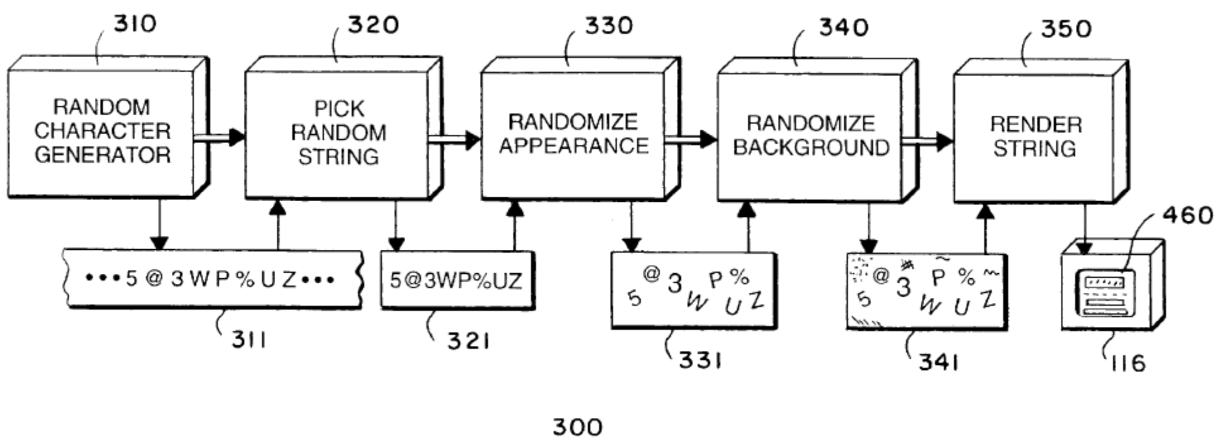

FIG. 3

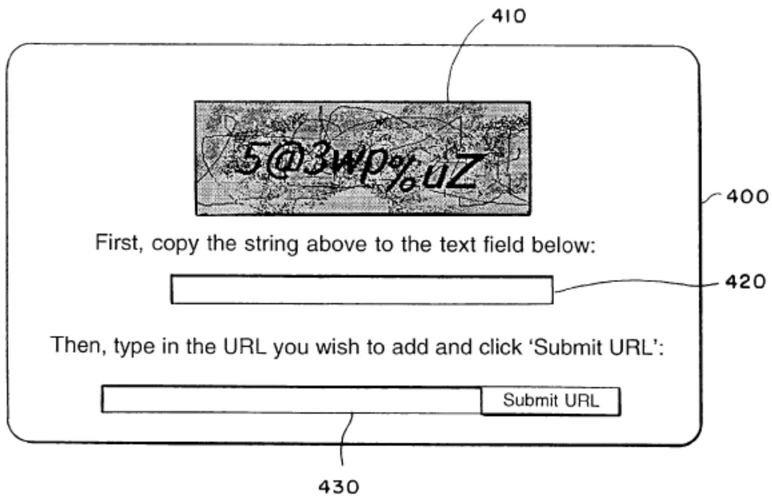

FIG.4

65. The server distinguishes between a human client and an "automated agent," based on whether the correct answer is provided. Ex. 1008, 3:21-28. This is the basic CAPTCHA concept.

66. If the correct answer is not received within a predetermined amount of time, the connection between the client and server computer is terminated by the server on the assumption that an automated agent is operating the client on behalf of the user. Ex. 1008, Abstract, 3:29-34, 6:4-6. Lillibridge teaches that the timer is associated with a unique transaction ID or an IP address to identify the client. Ex. 1008, 8:3-5, 6-17, 27-31.

67. It is important to understand that, even though Lillibridge does not use the word CAPTCHA, that is only because that term had yet to be coined. Lillibridge represents one of several early disclosures of what we now commonly call a CAPTCHA challenge.

68. Regardless of the exact nomenclature used, Lillibridge discloses that the general concept—using a Turing test to distinguish between humans and bots in authenticating an unknown user attempting to access an Internet resource—was already understood and filed for patent protection as early as April 1998, years before the ’510 Patent. Ex. 1008, (22). Indeed, even the DEC System reference provided a Turing test, despite Lillibridge’s opinion that it was too easy to solve. This is a common issue with Turing tests where the capabilities of computers vs. humans change as computers and software systems become more advanced.

69. As I discussed above in Section VIII.B, the ’510 patent’s prosecution history shows the only concept claimed in the ’510 patent that Lillibridge does not allegedly teach is the addition of a lockout timer. But as discussed below that concept was well known in the art.

B. Lim

70. Lim is titled “Internet based system and apparatus for paying users to view content and receiving micropayments,” was filed on July 18, 2000, and claims priority to provisional applications dating back to July 20, 1999. Ex. 1004, (54), (22), (60). Lim relates to Lillibridge in that it also teaches systems and methods for stopping bots from accessing websites by distinguishing them from humans through the presentation of quiz-like challenges that can include various combinations of pictures and text. *Id.*, Abstract. Lim is assigned to Google, and so

represents a snapshot of how Google was already using what we would later call CAPTCHA technologies to provide online security, at least as early as when Lim's provisional applications were filed in 1999 and 2000. *Id.*, (73).

71. Lim addresses the bot problem by, among other things, disclosing a wide variety of challenge questions (*e.g.*, forms of Turing tests), many of which utilize both a set of multiple graphics and a related textual expression that instructs users to select one of the graphics. Lim explains that its challenges can be used to verify "whether or not an Internet operation (*e.g.*, sending an e-mail message or accessing a web site) is being attempted by a human being or an automated process…by using a quiz process that requires user interaction." Ex. 1004, 2:32-38; *see also* Abstract. Lim also explains that its "[q]uizzes may be used as part of a process to verify that a user is human, as opposed to an automated process (*e.g.*, a bot or robot)." *Id.*, 13:15-18.

72. The reason that Lim's quizzes rely on pictures or other images is because, while humans can easily decipher questions or answers embedded in pictures, bots cannot simply do so. Ex. 1004, 13:40-49. The quizzes should be simple for humans to solve, because they are not intended to be a test of knowledge, but a way of distinguishing humans from bots. *Id*.

73. Lim explains that, if the unknown user succeeds at the challenge, the user will be granted access to the computer system and their further requests will

be processed because they have been determined to be a human. Ex. 1004, Fig. 5, 9:59-67 ("quizzes may be introduced at various levels to thwart such automated processes and ***allow access only by live, human users***") (emphasis added).

74. Lim also expressly recognizes the value of a lockout timer and uses one in the disclosed system. The exemplary detail about how subsequent requests can be handled in Fig. 5 includes a lockout timer suspending users for a time period after a failed quiz, step 516. *See*, Ex. 1004, Fig. 5:

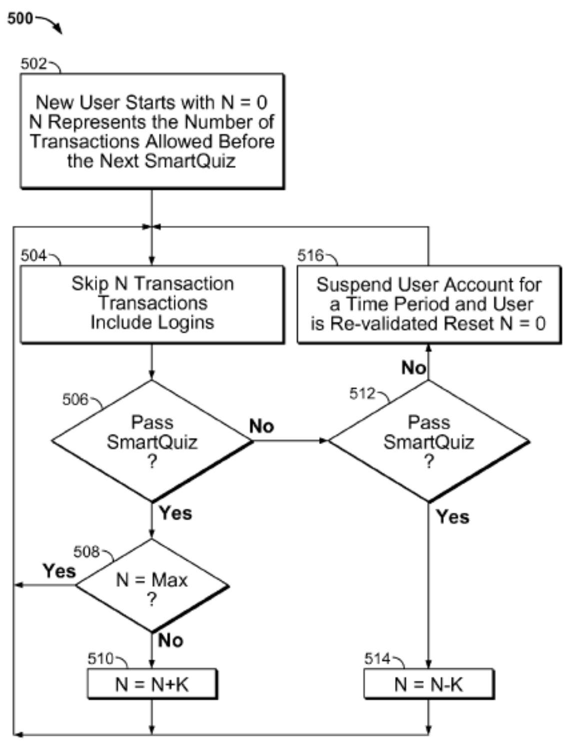

FIG. 5

The value N holds the number of transactions the user is allowed to perform before being quizzed again. Whenever the user passes a quiz, they are allowed to complete K additional transactions over N's previous value before having to pass another quiz (i.e., the system has more trust in them). If they fail a first quiz, then Lim says that optionally they might be given a second quiz. If they pass the second quiz, then they are allowed to complete K fewer transactions over N's previous value before having to pass another quiz (the system has less trust in them). If they fail two quizzes in a row, then they go into the lockout timer mode. In no case will a user be allowed to skip a quiz for more than MAX transactions.

75. This is illustrated in Fig. 5. As Lim shows in Fig. 5, N = 0 for a new user, which means the user is immediately presented with a first quiz as step 504 skips N=0 transactions and proceeds directly to issuing a challenge (at step 506). Ex. 1004, 14:58-15:2. If they pass the first quiz (step 506), they proceed to step 508 which tests the variable N—which represents the number of transactions that the user can engage in before they must take another quiz. *Id*. On a new user's first loop through the Fig. 5, N=zero (0), not the Max (step 508), which results in N being incremented by an interval K (step 510). *Id*. As a result, after a user's first successful quiz answer N=K. The flow of Fig. 5 then loops back to step 504, and the user is then able to engage in at least "N" transactions (*i.e.*, K for this iteration) (510) without being quizzed again (at step 504). The designer can choose K to allow any arbitrary number of transactions after the user successfully answers the first quiz, *e.g.*, 1, 100, 1,000. The sophisticated structure of Lim's Fig. 5 also allows a designer to advantageously allow a user to see fewer and fewer quizzes up

to a Max number of transactions as they successfully answer more and more quizzes. In other words, after the user sees K transactions on its second pass through step 504, if Max is greater than K, then if the user successfully passes a second quiz the user will get to process 2K transactions on its third pass through 504. Thus, the number of transactions between tests would be higher. Of course, a POSITA would recognize the designer can set K to be equal to Max and only have a fixed number of transactions between each successful test. In view of the teaching, a POSITA would understand that Lim discloses the claimed processing of any further requests if said challenge is fulfilled.

1. Lim's Provisional Applications

76. As mentioned above, Lim claims priority to a number of provisional applications. However, because I also understand that Patent Owner has not shown its claims have support prior to Lim's July 18, 2000 filing date, it is not necessary to establish that Lim is entitled to claim priority to any of its three provisional applications at this time.

77. If, however, it were necessary for Lim to claim the benefit of any of its provisional applications, I understand there would need to be support for at least one of Lim's claims in the provisional application at issue and the subject matter relied upon in Lim would also need to have been described in the provisional application at issue.

78. Accordingly, I have been asked to provide a series of tables comparing Lim with the disclosures in each of the Lim provisional applications. These tables are included below as Appendices B-D. As shown in these tables, all three of Lim's provisional applications both provide full support for Claim 1 of Lim and also disclose all the concepts disclosed in Lim relied on in this Declaration.

79. For this reason, I understand that Lim is entitled to claim the benefit of all three of its provisional applications, should it be necessary to do so, and thus is entitled to a priority date of July 20, 1999.

C. Motivation to Combine Lim and Lillibridge

80. A POSITA would have found it obvious to combine Lim and Lillibridge for many reasons.

81. For one thing, Lim and Lillibridge are part of the same field, Internet authentication and security. *See*, *e.g.*, Ex. 1004 (Lim), Abstract, 2:32-38, 13:15-18, 13:40-49; Ex. 1008 (Lillibridge), 1:20-28, 2:15-18, 2:60-64. Moreover, both Lim and Lillibridge are expressly directed to the same specific problem—distinguishing humans and bots in evaluating unknown users of websites—and address that problem by providing tests that would be easy for humans but difficult for bots. *Id*.

82. Going a step further, both Lim and Lillibridge explain that it is important to distinguish humans and bots online in the same use cases, including

preventing advertising fraud. *See, e.g.*, Ex. 1004 (Lim), 13:40-51; Ex. 1008 (Lillibridge), 1:40-46.

83. It is also significant that Lim and Lillibridge are both implemented using the World Wide Web standard network technologies. *See*, *e.g.*, Ex. 1004 (Lim), 1:35-2:9, 4:7-24, 5:6-7:61, 8:18-56, 23:3-43, Figs. 1, 16; Ex. 1008 (Lillibridge), 1:13-19, 2:66-3:5, 3:55-4:6, Fig. 1. Because their building blocks are the same, a POSITA could have predictably and successfully combined Lim and Lillibridge without undue experimentation.

84. I discuss the reasons why a POSITA would have been motivated to combine Lim and Lillibridge to arrive at the particular claims at issue in additional detail in Section X.B.1 below. For example, in that section I explain how a POSITA would have recognized the benefit ensuring that Lim's quizzes are varied from one request to the next based on Lillibridge's express disclosure of generating a modified riddle for each request. *Id*.

D. Guthrie

85. Guthrie is titled "personal authentication system and method for multiple computer platform" and was filed on March 6, 1998. Ex. 1009, (54), (22). Guthrie teaches ways of securely authenticating a client to a server over a network like the Internet. *See, e.g.*, *id*., 1:12-19, 3:53-5:15, Figs. 1A-1B:

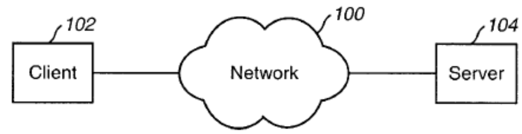

FIG. 1A

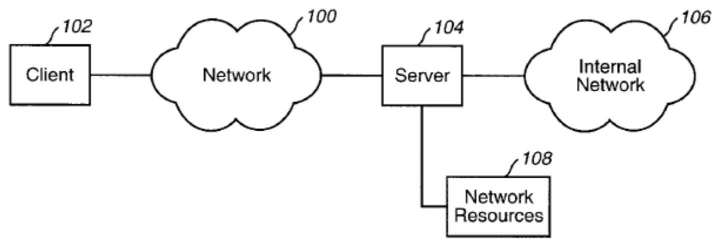

FIG. 1B

86. According to Guthrie, in order to perform network authorization effectively, a system should perform "user authentication, rather than simply machine or system authentication." Ex. 1009, 1:29-37. Guthrie explains that this can be accomplished by distinguishing legitimate human users from "a system that has been pre-programmed with access information (*e.g.*, running a 'script' to permit access)." *Id*. Thus, Guthrie recognizes that automated systems (e.g., bots) have capabilities that must be specifically protected against, in particular the ability to rapidly make many attempts to defeat an authentication.

87. Guthrie teaches that security against these automated systems can be accomplished using a "lockout timer." Specifically, if the user of a client computer fails the authorization process, the server sets a "lockout timer" that prohibits that client from trying to get authorized for some time period. Ex. 1009, 8:10-12. "The

purpose of the lock-out timer is to thwart an unauthorized user from repeatedly 'hammering' the server 104 manually ***or through an automated application*** with authorization attempts, while still eventually allowing a legitimate user access to the server 104 without intervention by the system administrator." *Id*., 8:24-30 (emphasis added). Guthrie explains that the user should only be prohibited from accessing the server for a certain amount of time, so the lockout timer is set for a particular duration. *Id*., 8:18-23. In this way, a lock out timer allows syncing of the system to a more human time scale. Thus, if a human user makes a typo or other mistake when responding to the authentication request, the user can try again after a time. But a bot will not be allowed to rapidly pepper the authentication system with guesses to try to defeat the security. A POSITA reading Guthrie would also recognize that a developer can advantageously set the lockout time period to balance security with disruption to users. For example, a short lockout (*e.g.*, 10 seconds) would be less annoying to humans than a longer timer (*e.g.*, minutes or longer), but would still prevent a bot from making rapid-fire attempts.

88. To implement the lockout timer, whenever a user at a client computer attempts authorization, the server checks their individual user account table 200 and sees if the lockout timer flag 212 has been set for them. Ex. 1009, 7:64-8:10, Fig. 6:

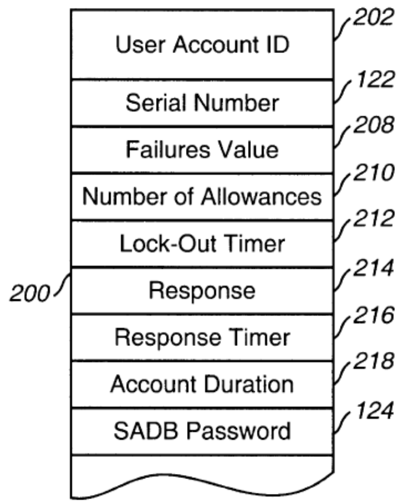

FIG. 6

89. If Guthrie's system sees that both the lockout timer flag has been set for this user, and also that the timer has not yet expired, the user is denied access and receives a failure message. Ex. 1009, 9:6-10. But if either the timer flag has not been set for this user, or the flag had been set but the lockout timer has expired, the rest of the authorization process is able to continue. *Id.*, 8:7-10, 9:6-10, Fig. 7A:

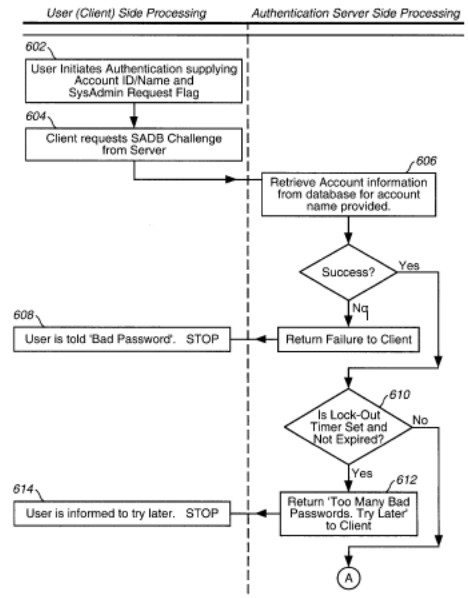

FIG. 7A

90. Guthrie discloses a similar use of a lockout timer in its Figure 8 embodiment. *See* Ex. 1009, 11:42-59 (authentication fails if the user has an unexpired lockout timer set), 12:6-9 (initiating the lockout timer after failed authentication), Figs. 8A-8B:

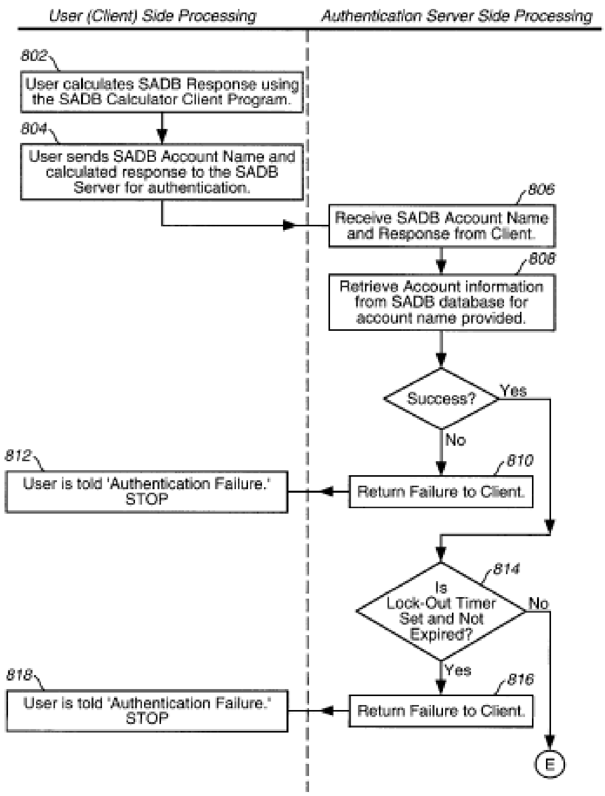

FIG. 8A

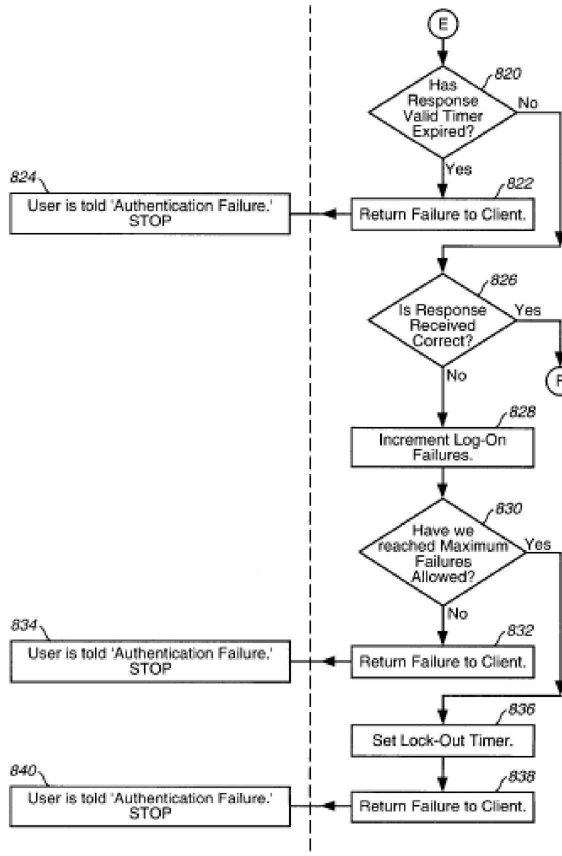

FIG. 8B

91. In this way, Guthrie teaches how to use a lockout timer as part of an Internet security system that aims to prevent "automated" applications, such as bots, from accessing a server. Ex. 1009, 8:24-30. But importantly, Guthrie also teaches how its timer can be used in order to prevent genuine human users that simply fail a quiz once or a few times from being banned from a server forever due to an honest error, by preventing their access only for a certain time before they are allowed to try again. *Id*.

E. Motivation to Combine Lim and Guthrie

92. A POSITA would have found it obvious to combine Lim and Guthrie

for many reasons.

93. Significantly, Lim and Guthrie are part of the same field, Internet authentication and security and both disclose lockout timers. *See, e.g.*, Ex. 1004 (Lim), Abstract, 2:32-38, 13:15-18, 13:40-49, 14:68-15:2; Ex. 1009 (Guthrie), 1:12-19, 1:29-37, 3:53-5:15, 7:64-8:18, Figs. 1A-1B. More than that, both Lim and Guthrie are expressly directed to the same specific problem—distinguishing humans and bots in evaluating unknown users of websites. *Id*.

94. Not only is this the case, both Lim and Guthrie are implemented using the same world wide web network technologies. *See, e.g.*, Ex. 1004 (Lim), 1:35-2:9, 4:7-24, 5:6-7:61, 8:18-56, 23:3-43; Ex. 1009 (Guthrie), 1:12-19, 4:50-5:15, Figs. 1A-1B. Because their building blocks are the same, a POSITA could have predictably and successfully combined Lim and Guthrie without undue experimentation.

95. I discuss the reasons why a POSITA would have been motivated to combine Lim and Guthrie to arrive at the particular claims at issue in additional detail in Section X.A.1 below. For example, in that section I explain why a POSITA would have been inspired to combine Guthrie's lockout timer with Lim's quizzes, to accomplish Lim's goal of distinguishing humans from bots among unknown users attempting to access an Internet resource more effectively and flexibly, as legitimate human users will not be blocked out of the server

permanently. Specifically, Lim contemplates that failing a test can result in the user's account being suspended for some designated time interval or causes some other penalty. Ex. 1004 (Lim), 14:67-15:2, Fig. 5. But Lim does not belabor the point by explaining the implementation of its lockout timer in detail. As the authors of Lim no doubt assumed, and as I agree, a POSITA would have readily been able to implement a lockout timer based on Lim's disclosure. This is a relatively simple programming exercise. Indeed, even the '510 patent itself, provides little detail on the claimed lockout timer and does not suggest implementing such a system would be beyond a POSITA's skill. The description of the lockout timer is a described in a non-technical functional fashion essentially tracking the claims. Ex. 1001 4:13-16; 4:24-34. Nevertheless, to the extent a POSITA reading Lim needed additional detail on how to implement Lim's suspension time period, Guthrie provides that detail.

96. Guthrie provides exemplary details of how suspension can be advantageously accomplished using a conventional lockout timer. Ex. 1009, 8:10-12, 12:6-9, Fig. 8A. This provides a POSITA implementing the Lim system with detailed options for implementing a suspension, which Lim expressly recognized would be beneficial.

97. Guthrie further explains that it is important for its lockout timer to have a limited duration, because it would be disadvantageous to ban a potential

human user forever. Ex. 1009, 8:18-23. This way, Guthrie's lockout timer is able to both "thwart an unauthorized user from repeatedly 'hammering' the server 104 manually or through an automated application with authorization attempts," *i.e.*, prevent bots from accessing an Internet resource, and also "eventually allow[] a legitimate user access to the server 104 without intervention by the system administrator." Ex. 1009, 8:24-30.

98. Guthrie thus recognizes the benefits of locking out an unknown originator that fails an Internet access request only for a specified time period, rather than permanently. A POSITA would have considered it obvious to apply that teaching to Lim's account suspension procedures. They would have been motivated to form this combination because both Lim and Guthrie are attempting to achieve the same goal in the same context: effectively distinguishing humans from bots among unknown users attempting to access an Internet resource. Ex. 1004, 9:46-67, 13:15-28; Ex. 1009, 1:29-37, 8:18-30. Moreover, Guthrie's more expansive disclosure of the benefits of a lockout timer, including avoiding repeatedly "hammering" a system would have further motivated a POSITA to consider its implementation.

F. Motivation to Combine Lim and Guthrie with Lillibridge

99. A POSITA would have found it obvious to combine the system and method of Lim with the features of both Guthrie and Lillibridge because those

references teach elaborations on features of Lim as well as distinct additional features that are complementary and enhance the Lim's bot detection system.

100. As I discuss above in Section IX.E, a POSITA would have found it obvious to combine Lim and Guthrie, for example, to take advantage of the detailed description of Guthrie's lockout timer to aid in embodying Lim's suspension time period. And similarly, as described in Section IX.C, a POSITA would also have found it obvious to combine Lim with Lillibridge to implement Lillibridge's teaching of the importance to modify quizzes from one request to the next.

101. Indeed, all three references are directed to the same specific problem—distinguishing humans and bots in evaluating unknown users of websites. *See, e.g.*, Ex. 1004 (Lim), Abstract, 2:32-38, 13:15-18, 13:40-49; Ex. 1008 (Lillibridge), 1:20-28, 2:15-18, 2:60-64; Ex. 1009 (Guthrie), 1:12-19, 1:29-37, 3:53-5:15, Figs. 1A-1B.

102. Each reference is implemented using Internet and Web technologies. *See, e.g.*, Ex. 1004 (Lim), 1:35-2:9, 4:7-24, 5:6-7:61, 8:18-56, 23:3-43; Ex. 1008 (Lillibridge), 1:40-46; Ex. 1009 (Guthrie), 1:12-19, 4:50-5:15, Figs. 1A-1B. Thus, a POSITA could have predictably and successfully combined them without undue experimentation.

103. Additional details regarding why a POSITA would have been

motivated to combine Lim and Lillibridge with Guthrie to arrive at the particular claims at issue are discussed in Section X.B below. A POSITA would have been motivated to form this predictable combination between references attempting to achieve the same goal in the same context: effectively distinguishing humans from bots among unknown users attempting to access an Internet resource. Ex. 1004, 9:46-67, 13:15-28; Ex. 1008, 1:20-28, 2:15-18, 2:60-64; Ex. 1009, 1:29-37, 8:18-30.

X. INVALIDITY ANALYSIS

104. As explained in detail in my analysis below, it is my conclusion and opinion that the Challenged Claims of the ’510 Patent are invalid.

A. Ground 1 – Claims 1, 2, 7, 8, 13-15, 17-22, and 25-30 Are Obvious Over Lim In Combination With Guthrie

105. In my opinion, Lim in combination with Guthrie renders Claims 1, 2, 7, 8, 13-15, 17-22, and 25-30 of the ’510 Patent obvious.

1. Independent Claim 1

106. In my opinion, Lim in combination with Guthrie renders obvious Claim 1 of the ’510 Patent.

a. [1-PRE]

107. In the event the Claim 1 preamble is found to be limiting, Lim discloses and renders obvious “[a] method for preventing robots from browsing a

Web site beyond a welcome page."

108. Lim discloses "a process for verifying whether or not an Internet operation (*e.g.*, sending an e-mail message or ***accessing a web site***) is being attempted by a human being or an automated process … by using a quiz process that requires user interaction." Ex. 1004, 2:33-39 (emphasis added), *see also*, *e.g.*, Abstract, 8:25-30, 13:15-28, Claim 1, Fig. 1.

109. Lim explains that when a user reaches the welcome page of a website, "new users may be asked to answer one or more questions of a quiz to test whether they are a human user[] or not," so that robots are excluded. Ex. 1004, 9:45-67.

110. A POSITA would have thus understood that Lim's quiz challenges comprise methods for preventing robots from browsing a website beyond a welcome page.

b. Element [1-A]

111. Lim discloses and renders obvious this element of Claim 1: "receiving an initial request from an undefined originator and responding to said initial request with a challenge that prompts a response from said undefined originator; and receiving a response from said undefined originator."

112. Lim's quizzes are challenges and are issued in response to an initial request from an unknown user (*i.e.*, an undefined originator) to access a website. Lim explains that it challenges new users "verifying whether or not an Internet

operation (*e.g.*, sending an e-mail message or ***accessing a web site***) is being attempted by a human being or an automated process" (*i.e.*, a bot). Ex. 1004, 2:33-39 (emphasis added), *see also*, *e.g.*, Abstract, 9:46-67 (new users are "referred to a service provider's Web site" and "may be asked to answer one or more questions of a quiz to test whether they are a human users or not," in order to block "robots or bots"), 13:15-28 (quizzes employed to verify undefined users—such as new users during registration, undefined users during follow-up registrations, and/or users between transactions—are humans and not bots), Claim 1 (claiming "granting the human operator access to a computer-based resource" when they are determined to be human by fulfilling a challenge sent in response to an initial request from an unknown user). Because these are new users, they are an undefined originator and are tested when they are accessing a website because they are making an initial request.

113. Even further, because the intent of the challenges is to distinguish humans from bots, Lim confirms that these challenges are provided to unknown users (*e.g.*, new users); otherwise, there would be no need for the challenge. Lim contemplates that "[***n***]***ew*** users may be referred to a service provider's Web site … offering a service [and b]efore being allowed to register, these ***new users*** may be asked to answer one or more questions of a quick to test whether they are human users or not." Ex. 1004, 9:45-67 (emphasis added).

114. Lim explains that responses to these quizzes are naturally provided by the user. *See* Ex. 1004, 3:1-3, 14:43-45, Abstract, 2:33-39, 9:53-67, 13:15-39, Claim 1. For example, Lim teaches that "[a] separate text box or other data entry device rendered in the web page with the quick question image could then be used by the user to enter his/her answer." Ex. 1004, 13:37-39, 52-56. Thus, Lim discloses "receiving a response from said undefined originator."

115. Thus, Lim explains that its system receives and responds to an undefined originator's initial request with a challenge that prompts a response from the originator and awaits the response. That processing of that response, and Lim's further actions based on it, are discussed for the following limitation.

c. Element [1-B]

116. Lim discloses and renders obvious this element of Claim 1: "checking said response to determine whether said challenge is fulfilled; and if said challenge is fulfilled: processing any further requests; and if said challenge is not fulfilled: stopping processing of any further requests."

117. As I discussed for the previous limitation, Lim presents its quiz challenges to unknown users (or undefined originators) of a website. *See* Section X.A.1.b; Ex. 1004, Abstract, 2:33-39, 9:53-67, 13:15-28, Claim 1.

118. This claim element generally recites the processing of such a response to a challenge and, if the response to the challenge is correct, additional requests

from the undefined originator are processed; if not, additional requests from the undefined originator are not processed.

119. Lim discloses that its quizzes are provided, and its systems determine whether the respective response matches its corresponding correct response. Ex. 1004, 9:64-66, Claim 1 ("determining, by the first computer system, ***whether the respective response matches its corresponding single correct and distinct response***") (emphasis added).

120. And "if said challenge is fulfilled," Lim "process[es] any further requests." This naturally follows from the fact that Lim's tests are designed, like the '510 patent, to allow humans access, while excluding bots. Lim explains that, if the unknown user succeeds at the challenge, the user will be granted access to the computer system and their further requests will be processed because they have been determined to be a human. Ex. 1004, Fig. 5, 9:59-67 ("quizzes may be introduced at various levels to thwart such automated processes and ***allow access only by live, human users***") (emphasis added), Claim 1 ("determining, by the first computer system, ***whether the respective response matches its corresponding single correct and distinct response***: when so, inferring that the respective response was provided by the human operator of the second computer system and granting the human operator access to a computer-based resource" and "***determining an amount of time or amount of resources that will be accessible***

by the human operator before a next prompt is transmitted") (emphasis added), *see also* Abstract, 2:32-39, 8:19-30, 9:45-59, Fig. 1.

121. Lim provides additional detail about how subsequent requests can be handled in its Fig. 5 embodiment. *See*, Ex. 1004, Fig. 5:

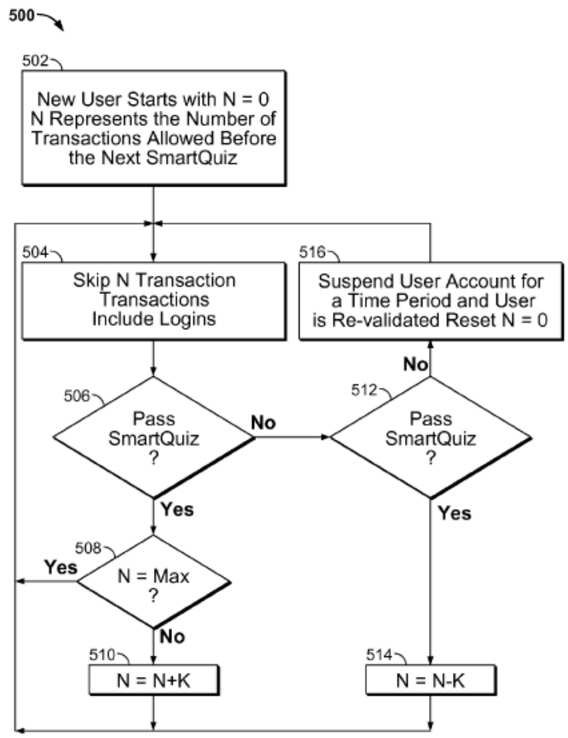

FIG. 5

The value N holds the number of transactions the user is allowed to perform before being quizzed again. Whenever the user passes a quiz, they are allowed to complete K additional transactions over N's previous value before having to pass another quiz (*i.e.*, the system has more trust in them). If they fail a first quiz, then Lim says that optionally they might be given a second quiz. If they pass the second quiz, then they are allowed to complete K fewer transactions over N's previous value before having to pass another quiz (the system has less trust in them). If they fail two quizzes in a row, then they go into the lockout timer mode. In no case will a user be allowed to skip a quiz for more than MAX transactions.

122. This is illustrated in Fig. 5. As Lim shows in Fig. 5, N = 0 for a new user, which means the user is immediately presented with a first quiz as step 504 skips N=0 transactions and proceeds directly to issuing a challenge (at step 506). Ex. 1004, 14:58-15:2. If they pass the first quiz (step 506), they proceed to step 508 which tests the variable N—which represents the number of transactions that the user can engage in before they must take another quiz. *Id.* On a new user's first loop through the Fig. 5, N=zero (0), not the Max (step 508), which results in N being incremented by an interval K (step 510). *Id.* As a result, after a user's first successful quiz answer N=K. The flow of Fig. 5 then loops back to step 504, and the user is then able to engage in at least "N" transactions (*i.e.*, K for this iteration) (510) without being quizzed again (at step 504). The designer can choose K to allow any arbitrary number of transactions after the user successfully answers first quiz, e.g., 1, 100, 1,000. The sophisticated structure of Lim's Fig. 5 also allows a designer to advantageously allow a user to see fewer and fewer quizzes up to a Max number of transactions as they successfully answer more and more quizzes. In other words, after the user sees K transactions on its second pass through step 504, if Max is greater than K, then if the user successfully passes a second quiz the

user will get to process 2K transactions on its third pass through 504. Thus, the number of transactions between tests would be higher. Of course, a POSITA would recognize the designer can set K to be equal to Max and only have a fixed number of transactions between each successful test. In view of the teaching, a POSITA would understand that Lim discloses the claimed processing of any further requests if said challenge is fulfilled.

123. Lim also discloses that "if said challenge is not fulfilled: stopping processing of any further requests." Of course, this is the entire purpose of the test, to determine if the user is a human and, if not, to not provide the service. Accordingly, if the user fails the quiz, Lim dictates that access will be blocked, step 516. *See* Ex. 1004, 14:67-15:2 ("Failing the [optional] retest (step 516) suspends the user's account for a designated time interval or causes some other penalty"), Fig. 5 (showing that a failed smart quiz (at quiz 506 or optional retest 512) allows the system to suspend the account at step 516), 9:59-67, Claim 1 ("***otherwise, not granting the human operator access to the computer-based resource***"), Abstract, 2:32-39, 9:45-59, 14:58-67, Fig. 1.

d. Element [1-C]

124. Lim discloses and renders obvious this element of Claim 1: "wherein said step of stopping processing of said further requests includes the further step of: dropping or redirecting a TCP connection established with said undefined

originator."

125. Lim renders this additional limitation obvious, both alone and in combination with Guthrie.

126. Lim discloses that: 1) its system is designed to protect web servers; 2) when an unknown user fails a challenge their account will be suspended; and 3) during the time when a user's account is suspended, the processing of their requests is stopped because they have been determined to be a robot. *See* Ex. 1004, Claim 1, 9:59-67, 14:67-15:2, Fig. 5.

127. Lim explains that its network communications are conducted over the Internet and involve communications made using IP addresses. Ex. 1004, Figs. 1, 16:

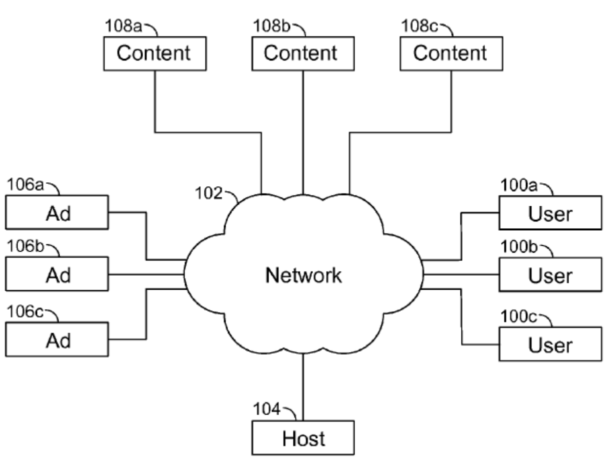

FIG. 1

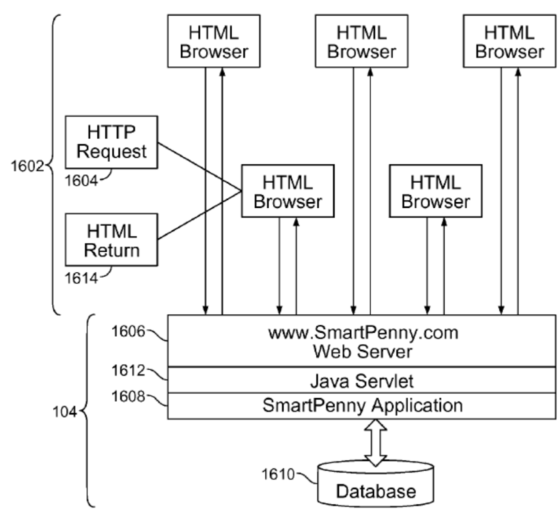

FIG. 16

See also Ex. 1004, 5:6-6:30 (discussing ordinary use of IP addresses to access websites), 8:19-56, 23:4-43 (discussing use of conventional HTTP requests).

128. A POSITA thus would have considered it obvious for Lim to implement the suspension of an unknown user's account by dropping or redirecting a TCP connection established with them. Indeed, website data was, and is, transferred over the Internet using a TCP/IP connection. Lim's references to IP addresses and other related functionalities like HTTP requests would therefore make a POSITA expect that TCP/IP would have been used.

129. As I described above in Section VII, TCP/IP evolved in the 1960s and was the dominant standard for Internet communications by at least the early 1990s. Lim's teaching to suspend the user obviously requires dropping or redirecting a TCP connection, which is the Web's connection interface. This is confirmed by the discussion of the use of IP addresses in additional prior art that, like Lim, involves determining whether an unknown user accessing an Internet resource is a human or a bot. In fact, Lim expressly discusses limiting or restricting the number of users and connects this limitation or restriction to unique identifiers such as the user's IP address. *See* Ex. 1004, 13:4-14. Because the user's IP identifies the client and is part of the TCP/IP protocol, this means that when TCP connection between the client and server is already open, when the user fails a challenge, the server can drop the connection. Moreover, as is done in the case of the ubiquitous "404 error page," it was well known to redirect a user to an error page in the event of any kind of system failure. A POSITA would have understood the benefits error

pages provide to users so they understand what is happening. Accordingly, to provide a better user experience in the event that a human mistakenly fails a quiz, it would be obvious to redirect the TCP connection to an error page in the event of a failed test.

130. Even if a POSITA would not have found it obvious to implement Lim's account suspension process by dropping or redirecting a TCP/IP connection in view of Lim alone, they would have found it obvious to do so in view of Lim combined with Guthrie. Guthrie confirms its network communications are conducted over a TCP/IP based network. Ex. 1009, 5:1-4. If a POSITA reading Lim needed to know implementation details for limiting or restricting its number of users, the POSITA would look to a reference like Guthrie, which explains in detail what happens when people fail such an authentication. For example, Guthrie expressly teaches that "[i]f the lock-out timer flag is set, and not expired, then … the server 104 returns a failure message to the client 102 [and] the client 102 informs the user of such failure, for example, by displaying a message 'Too many incorrect passwords have been attempted, please try later.'" Ex. 1009, 9:6-10. As I discussed above, Guthrie is motivated to minimize the annoyance to legitimate users who might happen to fail a single challenge, which I understand to be a fairly common occurrence. Therefore, a POSITA would understand that it is natural for Guthrie to redirect to an informative error page explaining what happened in the

failed attempt. Indeed, this makes legitimate users feel better (reduces confusion), while not allowing bots any additional information that would prove helpful in breaking into the system. A real human benefits in knowing why they cannot access the system immediately, but that they will be able to try again soon. This same information does not help or hurt a bot. In other words, Guthrie teaches that upon a failed challenge and an expiration of a lockout timer, its suspension includes redirecting their TCP connection to an error page.

131. Therefore, it is obvious to a POSITA that Lim's Internet connection would have been a TCP/IP connection, and that the most obvious way to suspend the user's account would have been to drop or redirect their TCP connection.

e. Element [1-D]

132. Lim discloses and renders obvious this element of Claim 1: "**[i]** logging a source IP address of said undefined originator and starting a timer, further including steps upon receiving a new request of **[ii]** checking whether a source IP address of said new request matches said logged source IP address; and **[ii.a]** if said source IP address matches said logged source IP address: **[iii]** checking whether said timer has expired and, **[iii.a]** if said timer is expired, resetting said logged IP address; and proceeding normally with said new request; and **[iii.b]** if said timer is not expired, dropping or redirecting said TCP connection; **[ii.b]** if said source IP address does not match said logged source IP address,

proceeding normally with said new request and executing all the above steps with each newly received request."

133. This lengthy element merely recites the functionality of a well-known lockout timer, which I describe further above in Section VII. In short, lockout timers monitor suspected users (*e.g.*, via their IP addresses), who have failed an authentication challenge, such that they can be temporarily restricted from accessing a service. Specifically, as recited in this claim element, users are tracked by their **IP address** and an associated **timer** is started (step 1-D.i). For any new requests, the system first checks IP addresses associated with the new request against its logged IP addresses (step 1-D.ii). If the IP address of the new request is not one that has been logged, the new request is subject to the normal bot test (step 1-D.ii.b). If the IP address of the new request matches one that has been logged (step 1-D.ii.a), their associated timer is checked (step 1-D.iii). If their timer is expired (*i.e.*, the temporary lockout is over) (step 1-D.iii.a), then the user's IP address is reset and the system proceeds normally with the new request. If the timer is not expired (*i.e.*, the user is still banned) (step 1-D.iii.b), the user is typically redirected to an error page.

134. Lim renders this additional limitation obvious, both alone and in combination with Guthrie.

<u>Limitation 1-D.i</u>

135. Lim alone or in combination with Guthrie renders obvious: "logging a source IP address of said undefined originator and starting a timer." As discussed above for limitation 1-B, Lim discloses that, when an unknown user fails a challenge, their account will be suspended for a time period, during which time processing of their requests will be stopped, because they have been determined to be a robot. *See* Section X.A.1.c; Ex. 1004, Claim 1, 9:59-67, 14:67-15:2, Fig. 5. Lim also expressly discloses using IP addresses to uniquely identify and restrict users. Ex. 1004, 13:5-14 (emphasis added) ("[c]omputer systems configured in accordance with the present invention ***may limit or restrict*** … users access from computers or other web-capable devices associated with certain unique identifiers such as medium access control (MAC) addresses, ***IP addresses***, or central processing unit (CPU) serial numbers."). Of these, a POSITA would understand IP addresses to be particularly convenient as it is readily accessible to web servers processing the requests. In a fact, a POSITA would understand that for TCP/IP based systems, IP source and destination addresses are part of the pseudo-header, while other identifiers may not be particularly useful.

136. Lim explains that, when an unknown user fails a test, their account is suspended for a time period, which would most obviously be tracked by starting a timer. Ex. 1004, 14:58-15:2 ("As each quiz is taken (step 506) a determination is made as to whether the user passed the test…If the user fails a test, …Failing the

[test] suspends the user's account for ***a designated time interval*** or causes some other penalty"), Fig. 5:

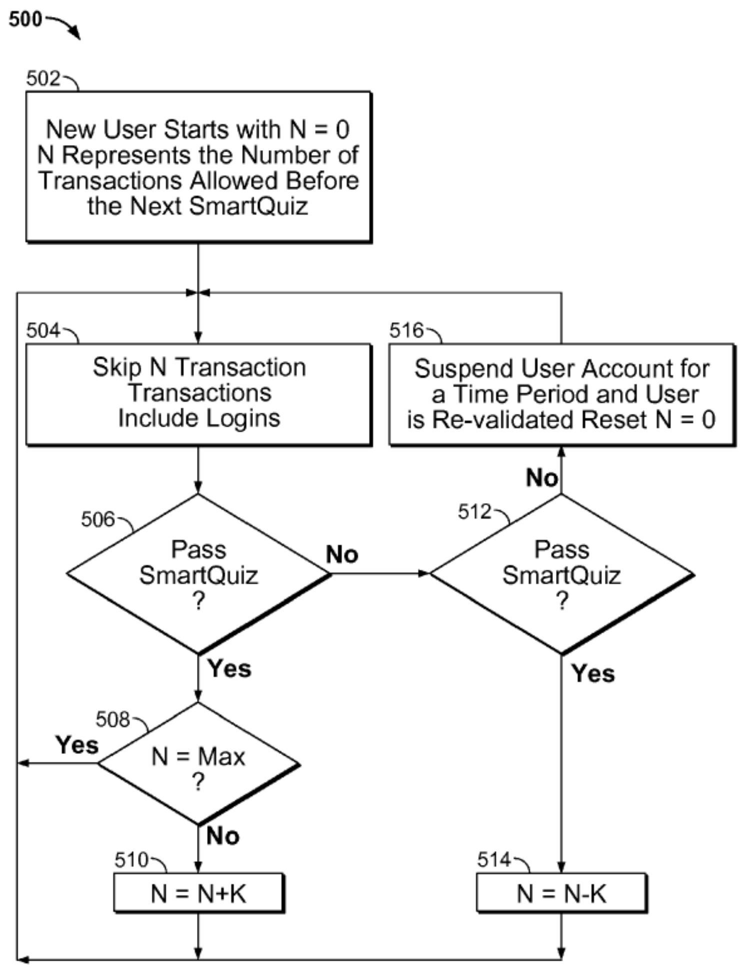

FIG. 5

See also 9:59-67. To affect the suspension for a time period, the Lim system must record some way to track the time, *e.g.*, starting a timer. Moreover, because Lim discloses tracking users by IP addresses, the timer for a particular failed user would need to be associated with that user's IP address. Users arrive at the website at different times. Thus, to accomplish the function of suspending a particular failed user for its specific time period, the Lim system would associate a timer specific to the failed user. A POSITA would have understood that Lim's suspension of a User Account for a time period (Fig. 5) would be done advantageously by logging an IP address of the user and associating it with a timer. Finally, to enforce the suspension time period, Lim's system would need to check the IP addresses of new requests to see if they matched any of the logged IP addresses currently subject to a suspension timer. If Lim did not do so, there would be no way to distinguish suspended IP addresses from those that are free to use the system.

137. A POSITA implementing Lim would have further confirmed the obvious solution of logging an IP address and starting a timer, in view of Guthrie. A POSITA would have been motivated to combine Lim and Guthrie for at least the reasons discussed in Section IX.E above and those that follow.

138. Guthrie details how to implement a "lockout timer" that lasts for a particular duration when a user fails the authorization process. Ex. 1009, 8:10-12, 1:12-19, 29-37, 3:53-5:15, Figs. 1A-1B. Specifically, if an unknown user fails the authorization process, a lockout timer can be set for them. Ex. 1009, 12:6-9 (describing that as shown in Fig. 8B, if the maximum number or set of failures has been reached, then in step 836, the server 104 initiates the lockout timer by setting the lockout timer record 212), Fig. 8B:

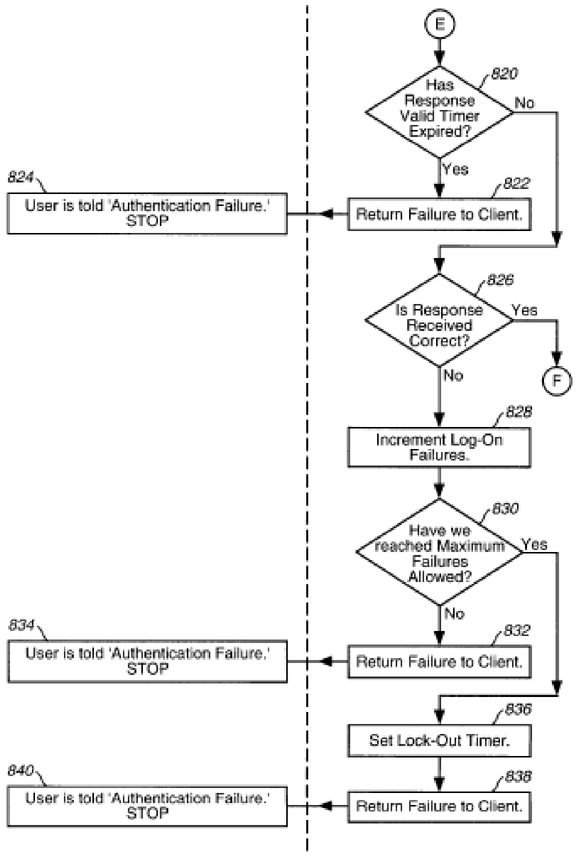

FIG. 8B

139. Guthrie explains that its server "records audit information for each log-on attempt." Ex. 1009, 13:46-47. This information can include "a date and time stamp for each log-in attempt," "an IP address for the client 102," and "any other information that may be determined from the authentication attempt should it represent a failure." Ex. 1009, 13:47-62. Thus, Guthrie explains expressly that, whenever an unknown user fails a log-in attempt, the server logs their source IP address and starts a timer.

Limitation 1-D.ii.a and 1-D.ii.b

140. Lim, alone or in combination with Guthrie, renders obvious

limitations 1-D.ii.a and 1-D.ii.b: "upon receiving a new request of **[ii]** checking whether a source IP address of said new request matches said logged source IP address; and **[ii.a]** if said source IP address matches said logged source IP address … **[ii.b]** if said source IP address does not match said logged source IP address, proceeding normally with said new request and executing all the above steps with each newly received request." This limitation requires checking the source IP address against a log for each new request, which Lim and Guthrie need to do to determine if the IP address associated with the new request is subject to a lockout.

141. As discussed above, Lim discloses tracking users by IP address and suspending them for a time period. To enforce its suspension, a POSITA would understand that Lim's system requires checking the IP addresses of new requests and enforcing controls if the IP address of the new request matches a logged IP address. If Lim did not check the IP addresses of new requests, it would have no way to determine whether the new requestor is subject to a lockout timer. Of course, if the IP address is not logged, the user is a truly new user—not under suspension—and will be treated accordingly, which would involve starting normal bot test processing, as reflected for example in Lim's step 502 of Fig. 5. Ex. 1004, 14:58-15:2. Thus, Lim teaches or renders obvious **branch ii.b** of the limitation (*i.e.*, the "if said source IP address does not match said logged source IP address" branch). On the other hand, if the user's IP address is logged, enforcing the time

period suspension of step 516 would require checking the timer associated with the user's IP address, as recited in branch ii.a of the limitation. Ex. 1004, 14:58-15:2.

142. A POSITA's understanding of how to handle this first conditional branch (branch ii.a) would further be informed by Guthrie, which, as explained above, also discloses logging IP addresses. Ex. 1009, 13:47-53. Guthrie teaches that "the server 104 retrieves the corresponding user account table in the user account database 120 which corresponds to the user account ID received…. If the record for the given account ID is found, then in step 610 the server 104 determines whether a lock-out timer flag is active by reading a lock-out timer record 212 in the user account table 200 (FIG. 6). The lock-out timer flag is activated when the server 104 detects too many successive authorization failures in a row." Ex. 1009, 7:64-8:15. For example, "[a]fter an initial set of failures, the server 104 establishes the lock-out timer at a fairly low duration, such as fifteen minutes, in the lock-out timer record 212." *Id.*, 8:18-21. In other words, the lockout timer 212 includes both a flag and a timer record. Ex. 1009, 7:64-8:10; 11:42-49, Figs. 6, 7A, 8A:

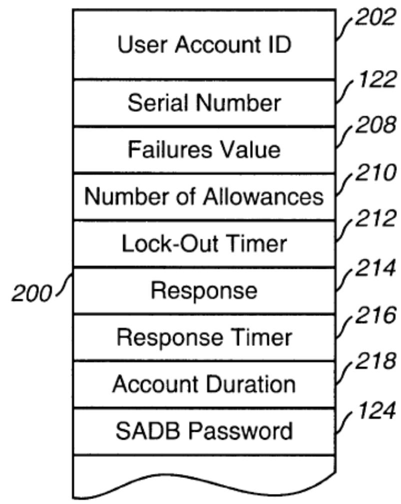

FIG. 6

143. Specifically, "the server 104 determines whether a lock-out timer flag is active by reading a lock-out timer record 212 in the user account table 200," which record 212 includes both a lock-out timer flag and the timer that is started, as recited in limitation ii.a. Ex. 1009, 8:7-16. This is further discussed below with reference to conditionals iii.a and iii.b. Of course, if the user is not logged, they would be treated like a new user and processed normally, as recited in limitation ii.b.

144. For the reasons above, a POSITA would understand that Lim alone or in combination with Guthrie render obvious, "if said source IP address matches said logged source IP address: checking whether said timer has expired …. if said source IP address does not match said logged source IP address, proceeding normally with said new request and executing all the above steps with each newly received request."

Limitations 1-D.iii.a and 1-D.iii.b

145. If the IP check reveals the new request is from a logged IP address (1-D.ii), a POSITA would understand that Lim alone or in combination with Guthrie renders obvious the further conditional steps of describing what happens whether or not the timer is expired in limitations 1-D.iii.a and 1-D.iii.b.

146. Lim discloses (at step 516 of Fig. 2), suspending the user account for a time period after which N is reset to 0.

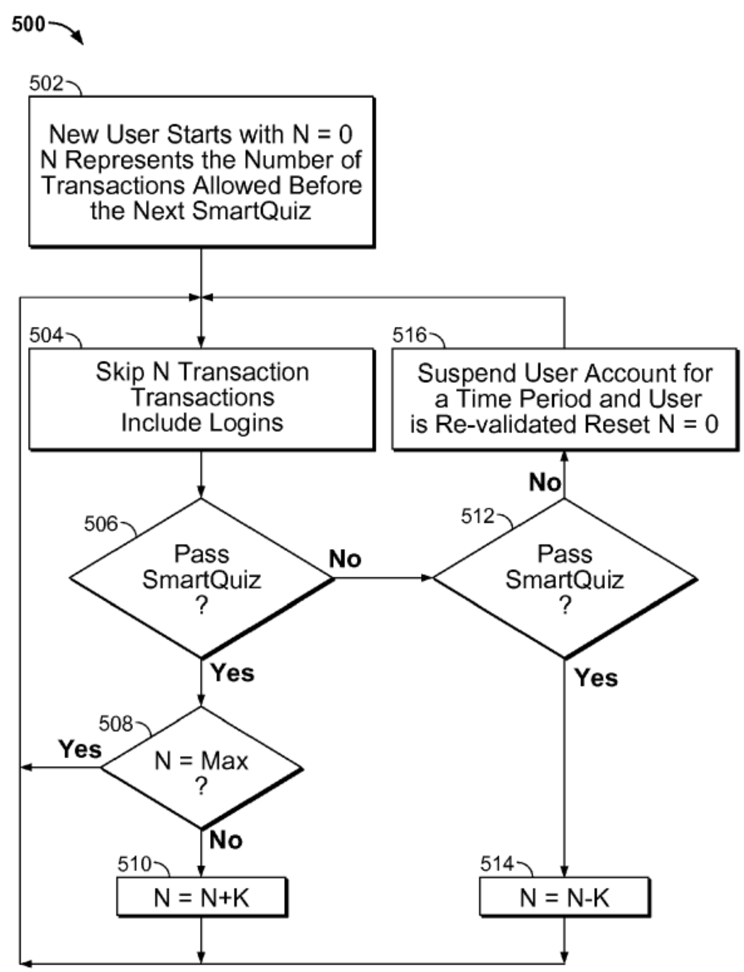

FIG. 5

147. As shown above, after the suspension (*i.e.*, the timer is expired) the flow out of step 516 lead to step 504 and "proceed[s] normally with said new request." Moreover, because N = 0 is the same condition as for a completely new user (compare, step 502), the logging will be reset. Thus, a POSITA would understand that Lim renders the condition where a matched IP and an expired timer (limitation 1-D.iii.a) obvious.

148. Lim's disclosure of suspending the user for a time period also renders obvious the condition where the source IP is matched and the timer is not expired (*i.e.*, the user is still locked out) (limitation 1-D.iii.b) and the user TCP connection is dropped or redirected. This is the enforcement of the suspension described in step 516. Lim's system is built for the Web, which employs TCP/IP. Therefore, A POSITA would understand that enforcement of Lim's suspension would most naturally be accomplished by dropping or redirecting the user's TCP connection.

149. My understanding of a POSITA would have been further confirmed and enhanced by Guthrie. As discussed above with reference to Limitation 1-D.i, Guthrie's Figs. 7A / 8A below show that if the server sees that the lockout timer has been set for this user but has not yet expired (at steps 810 and 814), access is denied, and the server ***redirects*** the client to an authentication failure screen. Ex. 1009, Figs. 7A, 8A, 8:7-10, 9:6-10, 11:42-59.

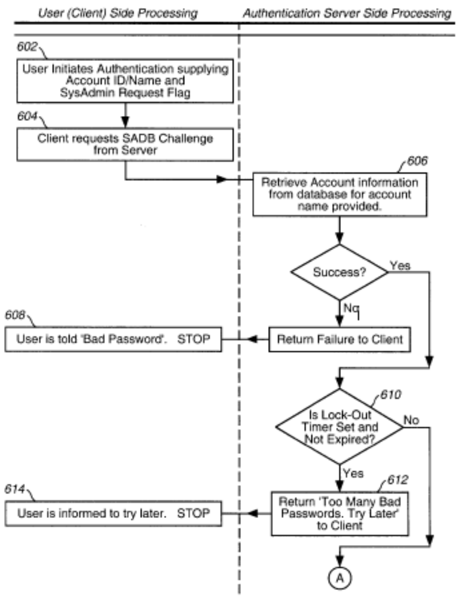

FIG. 7A

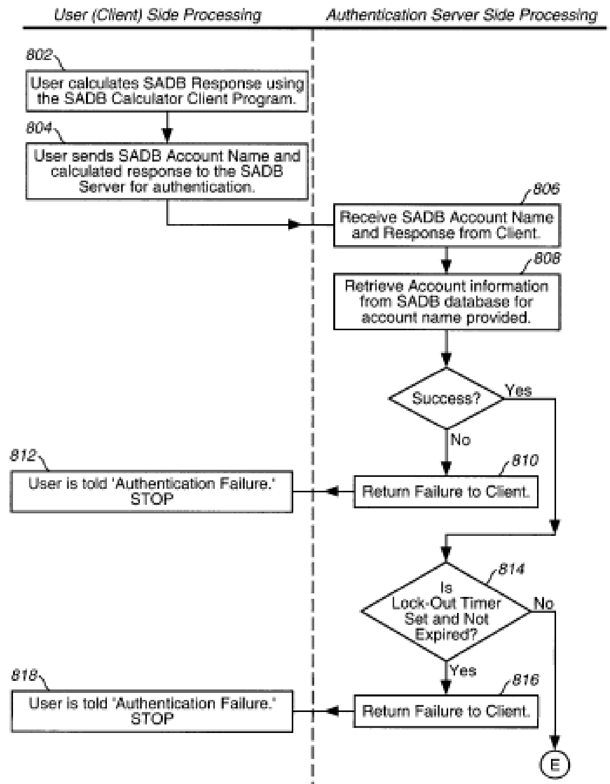

FIG. 8A

150. If, however, either the flag has not been set or the lockout timer has expired, the authorization process continues. *Id.*, 7:64-8:10, 11:42-49, Figs. 6, 7A, 8A.

151. A POSITA would have found it obvious to apply this teaching to Lim's account suspension procedures and issue a new challenge after the user's suspension interval has passed to fully take advantage of the benefits of Guthrie's lockout timer. *See* Section IX.E. This would ensure that users that fail an Internet access request are suspended only for a specified time period, rather than permanently, which would again allow Lim to accomplish its goal of distinguishing humans from bots more effectively and flexibly. *See* Section IX.E.

Moreover, Guthrie's disclosure of redirecting to an error page would advantageously advise human users of the error and allow them to understand why their request was not fulfilled.

152. In view of the above, a POSITA would understand Lim alone or in combination with Guthrie render obvious "if said timer is expired, resetting said logged IP address; and proceeding normally with said new request; and if said timer is not expired, dropping or redirecting said TCP connection."

2. Independent Claim 20

153. In my opinion, Lim in combination with Guthrie renders Claim 20 obvious.

154. [20-PRE] is substantively the same as [1-PRE], and Elements [20-A] through [20-D] are substantively the same as Elements [1-A] through [1-D]. The only difference between these claims is that while Claim 1 recites a "method…comprising [] steps," Claim 20 rewrites the method as a "computer process…comprising computer-executable steps."

155. Lim discloses that its process is computerized and comprises computer-executable steps. Ex. 1004, Fig. 1, 5:5-9:9.

156. Thus, a POSITA would understand Lim in combination with Guthrie discloses Claim 20 for the same reasons discussed above for Claim 1. *See supra* Section X.A.1.

3. Dependent Claims 2 and 21

157. Claim 2 of the ’510 Patent depends from Claim 1. Claim 1 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed above.

158. Claim 21 depends from Claim 20 and recites the same additional limitation as that of Claim 2. Claim 20 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed above.

159. These claims further recite that “said challenge includes prompting said undefined originator to perform a specific action.”

160. In my opinion, Lim discloses this additional limitation.

161. Lim’s system distinguishes human users from robots by way of a challenge, including challenges which can include multiple graphics or images and text that describes one of those graphics (*i.e.*, a prompt directing the user to select one of the plurality of graphical forms—a specific action). Ex. 1004, Abstract, 2:33-39, 9:53-67, 13:15-28, Claim 1. The prompt directing a user to answer the quiz necessarily includes a prompt to perform a specific challenge, *i.e.*, respond to the quiz by selecting the prompted graphic, which is “prompting said undefined originator to perform a specific action.” If the user does not provide the specific expected action in Lim, they can never demonstrate to the system that they are a human, even when they are.

4. Dependent Claims 13, 22, 25-26, and 29

162. Claim 13 of the ’510 Patent depends from Claim 1. Claim 1 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed above.

163. Claim 13 further recites that “said response includes making a choice among a plurality of prompted response options.”

164. Claim 22 of the ’510 Patent depends from Claim 21, and recites the same additional limitation, differing only in terms of non-substantive word choice. Claims 25-26 both depend from Claim 20, and also recite this same additional limitation, differing only in terms of non-substantive word choice. Claim 29 depends from Claim 2, and recites this same additional limitation. Similarly, each of claims 21, 20, and 2 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed throughout this report.

165. Lim discloses this additional limitation.

166. Lim explains that the prompts for any of its quiz questions may be presented as “text that is embedded in graphical representations such as an image,” *i.e.*, as graphical text. Ex. 1004, 13:29-37, *see also* 13:64-65, 14:42-43. Lim also expressly discloses that its quiz questions can be “multiple-choice questions,” in which case the user is prompted to click the described answer graphic “from the image itself, *e.g.*, using an image map, and/or through an HTML form surrounding

the picture." Ex. 1004, 13:54-56.

167. Therefore, a POSITA would understand that Lim, like the '510 Patent, expressly discloses multiple choice questions selected from an image map and thus renders obvious the quiz "response includes making a choice among a plurality of prompted response options."

5. Dependent Claims 7, 14, 17, 27, and 30

168. Claim 7 of the '510 Patent depends from Claim 2. Claim 2 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed above.

169. Claim 7 further recites that "said response includes an answer to a quiz."

170. Claim 14 of the '510 Patent depends from Claim 13, and recites this same additional limitation. Claim 17 of the '510 Patent depends from Claim 1, and recites this same additional limitation. Claim 27 of the '510 Patent depends from Claim 20, and recites this same additional limitation. Claim 30 of the '510 Patent depends from Claim 29, and recites this same additional limitation. Similarly, each of claims 13, 1, 20, and 29 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed throughout this report.

171. Lim discloses this additional limitation.

172. As I described above, Lim's system distinguishes human users from

robots by way of a challenge, including challenges that it calls quizzes. Ex. 1004, 2:32-38, *see also* Abstract. "Quizzes may be used as part of a process to verify that a user is human, as opposed to an automated process (e.g., a bot or robot)." Ex. 1004, 13:15-18. Lim expressly teaches that the user provides a response to these quizzes. Ex. 1004, 13:33-39 ("The pictures can contain a simple question that any user would be expected to be able to answer…. A separate text box or other data entry device rendered in the web page with the quiz question image could then be used by the user to enter his/her answer.").

173. Therefore, a POSITA would understand that Lim discloses quizzes that include a response with an answer to the quiz, as claimed.

6. Dependent Claims 8, 15, 18, and 19

174. Claim 8 of the '510 Patent depends from Claim 2. Claim 2 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed above.

175. Claim 8 further recites that "said response is suggested by textual meaning."

176. Claim 15 of the '510 Patent depends from Claim 13, and recites this same additional limitation. Claim 18 of the '510 Patent depends from Claim 17 and recites this same additional limitation. Claim 19 of the '510 Patent depends from Claim 1 and recites this same additional limitation. Similarly, each of claims

13, 17, and 1 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed throughout this report.

177. Lim discloses this additional limitation.

178. Lim's quizzes include graphical text prompts, which teach a response suggested by textual meaning. Ex. 1004, 13:29-37, *see also* 13:64-65 (prompt presented "in graphical text"), 14:42-43 ("[u]sers are asked simple questions using graphical text"). By presenting the quiz questions "using a display format that cannot be easily recognized or read by a machine or automated process," Lim thus provides an extra level of security by putting the text of the prompt in an image rather than as plain text. *Id.*; *see also* Ex. 1008, 14:8-11 (question "presented in text that is twisted (*i.e.*, displayed in a non-linear fashion) to make optical character recognition (OCR) difficult, while still remaining easily readable to a human").

179. If this claim requires the prompt to include the answer, Lim expressly discloses quiz questions of the same form as the '510 Patent. Ex. 1004 Fig. 4A (prompt is "What color is this yellow box?"). Another example of a quiz prompt is shown in Fig. 17, which shows graphics depicting several shapes in different colors, and a textual expression suggesting what the response should be: "[c]lick on the yellow triangle." Ex. 1004, 14:51-53. Lim discloses additional examples of this concept in its "simple word/object identification/recognition" challenges, which can ask users to "select the correct picture or word matching the object

displayed." Ex. 1004, 13:63-14:5.

180. In sum, a POSITA would understand that Lim provides numerous examples of the challenges of the same type as the '510 patent, in which the "response is suggested by textual meaning," as claimed.

7. Dependent Claim 28

181. Claim 28 of the '510 Patent depends from Claim 20. Claim 20 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed above.

182. Claim 28 further recites "prompting said undefined originator to make a response based upon the knowledge content of said prompt."

183. Lim discloses this additional limitation.

184. Lim explains that its challenges "may be implemented by using a quiz process that requires user interaction." Ex. 1004, 2:33-39 (emphasis added), *see also*, *e.g.*, Abstract, 9:46-67; 13:15-28. Lim explains that the prompts represent simple questions easily answered by a human upon reading the prompt. Ex. 1004, 13:29-37, *see also* 13:64-65 (prompt presented "in graphical text"), 14:42-43 ("[u]sers are asked simple questions using graphical text"). Because Lim discloses challenges intended to distinguish humans from robots, just like the '510 Patent, it presents quizzes that prompt the "undefined originator to make a response based upon the knowledge content of said prompt." That is the fundamental purpose of a

quiz question: providing a prompt that provides the information needed (perhaps with additional personal knowledge) to answer the quiz. *See, e.g.*, Ex. 1004, Fig. 4E (assuming the user to know what a "finger" is to respond to the question), Fig. 4C (assuming the user knows geometric shapes to respond to the quiz). Indeed, as explained in Section X.A.6, above, for all of Lim's quizzes, the prompts contain (or at least point to) the very answer to quiz itself. Ex. 1004, Fig. 4A. Thus, a POSITA would understand that Lim discloses or renders obvious this limitation.

B. Ground 2 - Claims 3-6, 9-12, 16, and 23-24 Are Obvious Over Lim In Combination With Guthrie And Lillibridge

185. Claims 3-6, 9-12, 16 of the '510 Patent directly or indirectly depend from Claim 1. Claims 23-24 directly or indirectly depend from Claim 20. Lim and Guthrie renders obvious independent Claims 1 and 20, for at least the reasons I discussed above for those claims. *See* Section X.A.1 and X.A.2.

186. And for reasons I discuss below, the additional limitations of Claims 3-6, 9-12, 16, and 23-24 are obvious over Lim and Guthrie in further view of Lillibridge.

1. Dependent Claims 3, 9, and 23

187. Claim 3 of the '510 Patent depends from Claim 2. Claim 2 is disclosed and rendered obvious by Lim and Guthrie, for at least the reasons discussed above.

188. Claim 3 further recites: "said prompting is different at each subsequent access of said web site."

189. Claim 9 of the '510 Patent depends from Claim 1 and recites this same additional limitation. Claim 23 of the '510 Patent depends from Claim 20 and recites this same additional limitation, differing only in terms of non-substantive word choice.

190. It is my opinion that Lim in combination with Guthrie as I discussed in Ground 1 above, in further combination with Lillibridge, renders this additional limitation obvious.

191. Lim explains that a user is given subsequent quiz challenges in the form of a "second prompt" or "next prompt" (*i.e.*, a subsequent access of said web site) after a set time interval has passed after the initial challenge (*i.e.*, the initial request). *See* Ex. 1004, Claim 1 ("determining an amount of time or amount of resources that will be accessible by the human operator before a next prompt is transmitted… and providing a second prompt after expiration of the interval"), 14:58-15:2 ("Users may be quizzed with reduced frequency as they respond accurately and with increasing frequency as they fail to respond accurately. For example, FIG. 5 illustrates a process 500 wherein a new user starts (step 502)" and is presented with a series of SmartQuizzes (step 506), with subsequent quizzes presented at an interval determined based on their success or failure (step 504)),

Fig. 5:

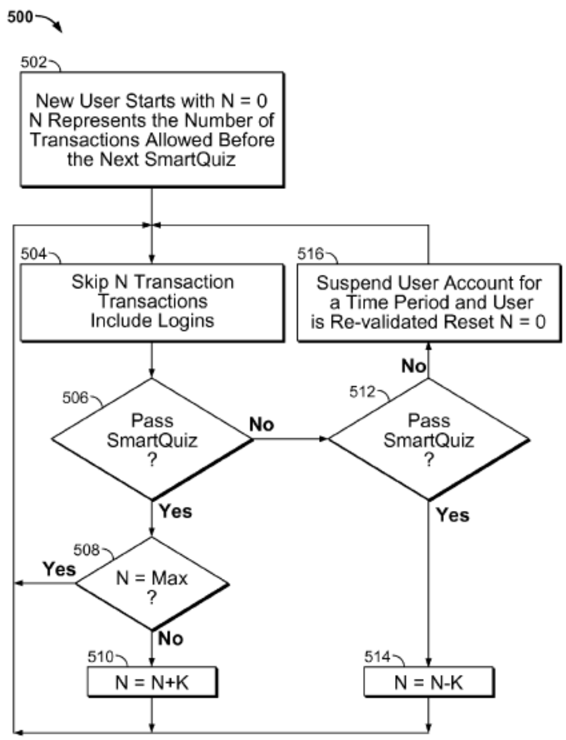

FIG. 5

192. In view of these disclosures, a POSITA would have understood that Lim's second quiz challenges are sent when a user tries to access the same website or resource after the set interval has passed, such that their next (or continued) access would be considered a subsequent access of said web site. Ex. 1004, Claim 1, 14:58-15:2.

193. A POSITA also would have understood that these subsequent quiz challenges would not have included the same questions as the initial challenges (*i.e.*, prompting is different at each subsequent access of said web site). Simply repeating the same challenge over and over again would not adequately test the

user, especially in the context of Lim's multiple choice question, which would be easily solved if the user/bot could try each choice in order.

194. A POSITA would have understood this in view of Lim's express disclosure that one application of its quizzes involves allowing advertisers to effectively present advertisements to users. Ex. 1004, 4:7-35, 7:62-8:17, 8:30-35, 9:20-30, Fig. 1. Indeed, Lim explains that one of the express purposes of its quizzes is to protect against advertising fraud, where bots generate false advertisement "views" rather than the actual human intended to view the advertisements. Ex. 1004, 13:40-51 ("Because automated entities are not able to decipher the question… advertisers are provided with some assurance that their advertising dollars are not being wasted"). This application of Lim would not work if the user was given the same challenge every time, because a bot would be able to simply repeat the correct answer to that quiz every time and use the website freely, driving up false advertising revenue.

195. This concern is reflected in Lim's Fig. 5. Specifically, when a user succeeds at a quiz (step 506), "N," the number of transactions they can engage in before having to take another quiz (step 504), can be increased up to a maximum amount (steps 508, 510). Ex. 1004, 14:58-65, Fig. 5:

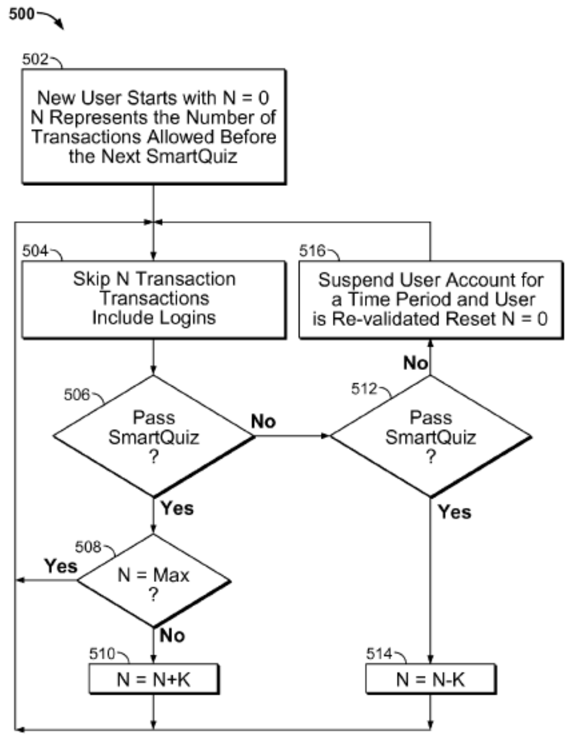

FIG. 5

196. Lim's use of the N variable allows one to flexibly set the cadence the site provider believes will balance the user annoyance at having to answer a quiz against the risk the user has turned the system over to a bot. Moreover, each quiz after N transactions would need to be different to avoid the trivial process of automating a bots answer to the same repeated question. *See also* Ex. 1008, 2:47-59 ("it is easy to write a program that recognizes the American flag…in a random position on the screen…and simulates a click; therefore, this method does not effectively restrict access by electronic agents"). Recall, the Fig. 5 process grants additional transactions, up to N=Max, as a user answers more quizzes correctly. This process would make no sense if the user received the same quiz every time.

There would be no need to reward users for additional correct answers if they were simply answering the same question again because it would not provide additional confidence that the user is a human. Lim's focus on advertising where serving ads to bots could have significant negative financial consequences further supports this notion. Because if the same quiz was shown over and over advertisers would not trust that ads are being shown to human and would be reluctant to pay for additional advertising.

197. This understanding is confirmed by Lim's statement that its subsequent quizzes are a distinct "next prompt" or "second prompt" and explanation that each of its many challenge embodiments may be used in combination with one another or individually, which suggests a readiness to revise and modify its challenges. Ex. 1004, Claim 1 ("next prompt" or "second prompt" provided after set interval passes), 3:23-26 ("FIG. 4 illustrates various types of quizzes, any of which may be used in combination with one another or individually"), 3:64-67 ("FIG. 17 illustrates a further example of a quiz, which may be used in combination with other quizzes or individually"), 13:57-59 (example quizzes "may be used in combination with one another or individually"), 14:58-15:2 ("Users may be quizzed with reduced frequency as they respond accurately and with increasing frequency as they fail to respond accurately. For example, FIG. 5 illustrates a process 500 wherein a new user starts (step 502) and

is ***presented with SmartOuizzes at various intervals*** (step 504). As ***each quiz*** is taken (step 506) a determination is made as to whether the user passed the test. If so (step 508), the interval is adjusted (step 510) until a maximum interval is reached. If the user fails a test, a retest might be offered (step 512)…. Failing the retest (step 516) suspends the user's account for a designated time interval or causes some other penalty"), Figs. 5, 17 (emphasis added).

198. A POSITA would have found it particularly obvious to modify the quiz of Lim in view of Lillibridge.

199. A POSITA would have been motivated to combine Lim and Lillibridge for at least the reasons discussed in Section IX.C above and as follows. And the POSITA would have understood that the similar combination of Lim with Guthrie (discussed in Section IX.E as used in Ground 1 above) could be predictably combined with Lillibridge in a similar manner for at least the reasons discussed in Section IX.F above.

200. Lim provides an extensive list of example quiz types that can be used. This provides a POSITA implementing its system many, varied quizzes and quiz types for the system and supports the obvious notion that many quizzes would be needed.

201. Lillibridge provides a complementary teaching of quizzes that are easily modifiable to satisfy many applications. For example, Lillibridge explains

that its quizzes can be used to fairly conduct lotteries, popularity contests, or polls (Ex. 1008, 1:29-39), limit email spam (*id*., 1:47-57), prevent search engine "page boosting" (*id*., 1:59-2:7), prevent bots from accessing proprietary information (*id*., 2:8-13), and, like Lim, prevent advertising fraud (*id*., 1:40-46). This range of applications demonstrates a need for different prompting at each subsequent access of said web site.

202. Like Lim's, Lillibridge's challenges are riddles used to test if a user is a human or "electronic agent." *See generally*, Ex. 1008, 3:55-6:16.

203. Lillibridge explains that, by default, it "require[s] the user to solve one riddle for each request." Ex. 1008, 8:48-49; *see also* 9:3-9 (discussing a riddle being sent out each time an email is sent). This describes the generation of a modified riddle for every request and notes that relaxed changing could "present a new riddle less frequently," such as every five requests. Ex. 1008, 8:48-52, *see also* Claim 39 (disclosing "rendering an additional riddle" after a predetermined number of access requests).

204. A POSITA would thus understand each of Lillibridge's embodiments to describe generating a random riddle with each request.

205. In sum, a POSITA reading Lim would have would have understood that its riddles should change over time, because otherwise its system would not achieve its goal of protecting against bots. Lillibridge confirms the security

benefits of generating a different riddle for each request and provides specific teachings of how to implement new riddles in response to repeated access requests.

206. A POSITA thus would have considered it obvious to apply these teachings in Lillibridge to Lim's quizzes and would have been motivated to combine Lillibridge's riddle modification teachings with Lim's quizzes in order for Lim to accomplish Lim's security goals more effectively. Legitimate human users would easily adapt to different riddles, while bots would not. In contrast, bots would be able to take advantage of unchanging riddles, undermining Lim's security goals.

207. A POSITA would have further been motivated to form this combination because both Lim and Lillibridge are attempting to achieve the same goal in the same context: effectively distinguishing humans from bots among unknown users attempting to access an Internet resource. Ex. 1004, 9:46-67, 13:15-28; Ex. 1008, 1:20-28, 2:60-63, 4:30-38, 6:11-16, 9:36-40.

2. Dependent Claims 4, 10, and 24

208. Claim 4 of the '510 Patent depends from Claim 3. Claim 3 is disclosed and rendered obvious by Lim and Guthrie with Lillibridge, for at least the reasons discussed above.

209. The additional limitation of Claim 4 is the same as that of Claim 13—"said response includes making a choice among a plurality of prompted response

options"—which is disclosed by Lim as discussed above in Section X.A.4.

210. Claim 10 of the '510 Patent depends from Claim 9 and recites this same additional limitation. Claim 24 of the '510 Patent depends from Claim 23 and recites this same additional limitation, differing only in terms of non-substantive word choice.

211. Thus, Lim in combination with Guthrie, discloses Claims 4, 10, and 24 for the same reasons discussed above for Claim 13. *See supra* Section VIII.A.4.

3. Dependent Claims 5, 6, 11, and 12

212. Claim 5 of the '510 Patent depends from Claim 4. Claim 4 is disclosed and rendered obvious by Lim and Guthrie with Lillibridge, for at least the reasons discussed above.

213. The additional limitation of Claim 5 is the same as that of Claim 7—"said response includes an answer to a quiz"— which is disclosed by Lim as discussed above in Section X.A.5.

214. Claim 6 of the '510 Patent depends from Claim 3 and recites this same additional limitation. Claim 11 of the '510 Patent depends from Claim 10 and recites this same additional limitation. Claim 12 of the '510 Patent depends from Claim 9 and recites this same additional limitation.

215. Thus, Lim in combination with Guthrie, discloses Claims 5, 6, 11, and 12 for the same reasons discussed above for Claim 7. *See supra* Section X.A5.

4. Dependent Claim 16

216. Claim 16 of the ’510 Patent depends from Claim 9. Claim 9 is disclosed and rendered obvious by Lim and Guthrie with Lillibridge, for at least the reasons discussed above.

217. The additional limitation of Claim 16 is the same as that of Claim 8. Thus, Lim discloses Claim 16 for the same reasons discussed above for Claim 8. *See supra* Section X.A.6.

XI. SECONDARY CONSIDERATIONS

218. I am not aware of secondary considerations of non-obviousness that bear on the challenged claims. If I am made aware in the future of arguments of any secondary consideration, I expressly reserve the right to assess those arguments when they arise in order to form opinions regarding their correctness or incorrectness.

XII. CONCLUSION

219. It is my conclusion and opinion that Claims 1-30 of the ’510 Patent are invalid.

I declare under penalty of perjury that the foregoing is true and correct. Executed this 14th day of March, 2025 in Bethlehem, PA.

Dr. Daniel Lopresti

APPENDIX A

Daniel P. Lopresti
Curriculum Vitae
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A. Biographical Information

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Educational History

- A.B. (Bachelor of Arts), Mathematics and Engineering Science, Dartmouth College, Hanover, NH, June 1982.

- M.S.E. (Master of Science in Engineering), Electrical Engineering and Computer Science, Princeton University, Princeton, NJ, June 1983.

- M.A. (Master of Arts), Electrical Engineering and Computer Science, Princeton University, Princeton, NJ, June 1984.

- Ph.D. (Doctor of Philosophy), Computer Science, Princeton University, Princeton, NJ, January 1987.

Professional Experience

- Assistant Professor of Computer Science, Brown University, Providence, RI, September 1986 – May 1991.

- Principal Scientist, Matsushita Information Technology Laboratory, Princeton, NJ, June 1991 – October 1997.

- Member of Technical Staff, Bell Labs, Lucent Technologies, Murray Hill, NJ, October

1997 – December 2002.

- Visiting Research Scientist, Palo Alto Research Center, Palo Alto, CA, December 2002 – June 2003.

- Research Fellow, Information Security Institute, Johns Hopkins University, Baltimore, MD, February 2003 – June 2003.

- Visiting Research Associate Professor, Electrical, Computer & Systems Engineering, Rensselaer Polytechnic Institute, Troy, NY, February 2003 – June 2003.

- Associate Professor, Computer Science & Engineering, Lehigh University, Bethlehem, PA, July 2003 – May 2009. Class of 1961 Professorship, September 2005 – May 2007.

- Professor, Computer Science & Engineering, Lehigh University, Bethlehem, PA, May 2009 – present.

- Department Chair, Computer Science & Engineering, Lehigh University, Bethlehem, PA, July 2009 – June 2012 (first term), July 2012 – June 2014 (second term), July 2015 – June 2019 (third term).

- Interim Dean, P. C. Rossin College of Engineering and Applied Science, Lehigh University, Bethlehem, PA, July 2014 – June 2015.

- Director, Data X Strategic Initiative, Lehigh University, Bethlehem, PA, July 2015 – June 2020.

B. Publications and Creative Activities

Books Edited

E1. *Document Recognition V*, Proceedings of SPIE Vol. 3305, D. Lopresti and J. Zhou (editors), January 1998.

E2. *Document Recognition and Retrieval VI*, Proceedings of SPIE Vol. 3651, D. Lopresti and J. Zhou (editors), January 1999.

E3. *Document Recognition and Retrieval VII*, Proceedings of SPIE Vol. 3967, D. Lopresti and J. Zhou (editors), January 2000.

E4. *Document Recognition and Retrieval VIII*, Proceedings of SPIE Vol. 4307, P. Kantor, D. Lopresti, and J. Zhou (editors), January 2001.

E5. *Document Analysis Systems V*, Lecture Notes in Computer Science Vol. 2423, D.

Lopresti, J. Hu, and R. Kashi (editors), Springer-Verlag, January 2002.

E6. *Human Interactive Proofs*, Lecture Notes in Computer Science Vol. 3517, H. Baird and D. Lopresti (editors), Springer-Verlag, May 2005.

E7. *Proceedings of the Second Workshop on Analytics for Noisy Unstructured Text Data*, ACM International Conference Proceeding Series (ACM Digital Library), D. Lopresti, S. Roy, K. Schulz, and L. V. Subramaniam (editors), July 2008.

E8. *Proceedings of the Third Workshop on Analytics for Noisy Unstructured Text Data*, ACM International Conference Proceeding Series (ACM Digital Library), D. Lopresti, S. Roy, K. Schulz, and L. V. Subramaniam (editors), July 2009.

E9. *Proceedings of the Ninth IAPR International Workshop on Document Analysis Systems*, ACM International Conference Proceeding Series (ACM Digital Library), D. Doermann, V. Govindaraju, D. Lopresti, and P. Natarajan (editors), June 2010.

E10. *Proceedings of the Fourth Workshop on Analytics for Noisy Unstructured Text Data*, ACM International Conference Proceeding Series (ACM Digital Library), R. Basili, D. Lopresti, C. Ringlstetter, S. Roy, K. Schulz, and L. V. Subramaniam (editors), October 2010.

E11. *Proceedings of the Joint Workshop on Multilingual OCR and Analytics for Noisy Unstructured Text Data*, ACM International Conference Proceeding Series (ACM Digital Library), L. Dey, V. Govindaraju, D. Lopresti, P. Natarajan, C. Ringlstetter, and S. Roy (editors), September 2011.

E12. *Proceedings of the Eleventh International Conference on Document Analysis and Recognition*, IEEE Xplore Digital Library, T. Breuel, D. Lopresti, and C. L. Tan (program co-chairs), September 2011.

E13. *Reproducible Research in Pattern Recognition: Second International Workshop*, Lecture Notes in Computer Science Vol. 11455, B. Kerautret, M. Colom, D. Lopresti, P. Monasse, and H. Talbot (editors), Springer Nature, 2019.

E14. *Proceedings of the Fourteenth IAPR International Workshop on Document Analysis Systems*, Vol. 12116, X. Bai, D. Karatzas, and D. Lopresti (editors), Springer Nature, 2020.

E15. *Reproducible Research in Pattern Recognition: Third International Workshop*, Lecture Notes in Computer Science Vol. 12636, B. Kerautret, M. Colom, A. Krähenbühl, D. Lopresti, P. Monasse, and H. Talbot (editors), Springer Nature, 2021.

E16. *Proceedings of the Sixteenth International Conference on Document Analysis and*

Recognition, Lecture Notes in Computer Science Vols. 12821-12824, J. Lladós, D. Lopresti, and S. Uchida (editors), Springer Nature, 2021.

E17. *Reproducible Research in Pattern Recognition: Fourth International Workshop*, Lecture Notes in Computer Science Vol. 14068, B. Kerautret, M. Colom, A. Krähenbühl, D. Lopresti, P. Monasse, and B. Perret (editors), Springer Nature, 2023.

Chapters in Books

B1. "FPGA Implementation of Systolic Sequence Alignment," D. Hoang and D. Lopresti, in *Field-Programmable Gate Arrays: Architectures and Tools for Rapid Prototyping*, H. Grunbacher and R. W. Hartenstein, eds., Berlin: Springer-Verlag, 1992, pp. 183-191.

B2. "Computing in the Ink Domain," D. Lopresti and A. Tomkins, *Advances in Human Factors/Ergonomics: Symbiosis of Human and Artifact*, vol. 20A, Y. Anzai, K. Ogawa, and H. Mori, eds., Amsterdam: Elsevier, 1995, pp. 543-548.

B3. "Using Consensus Sequence Voting to Correct OCR Errors," D. Lopresti and J. Zhou, *Document Analysis Systems*, A. L. Spitz and A. Dengel, eds., Singapore: World Scientific, 1995, pp. 157-168.

B4. "Ink as a First-Class Datatype in Multimedia Databases," W. Aref, D. Barbará, D. Lopresti, and A. Tomkins, *Multimedia Databases: Issues and Research Directions*, S. Jajodia and V. S. Subrahmanian, eds., Berlin: Springer-Verlag, 1996, pp. 113-163.

B5. "Algorithms for Matching Hand-Drawn Sketches," D. Lopresti, A. Tomkins, and J. Zhou, *Progress in Handwriting Recognition*, A. C. Downton and S. Impedovo, eds., Singapore: World Scientific, 1997, pp. 549-556.

B6. "Online Handwriting Recognition," R. Plamondon, D. Lopresti, L. Schomaker, and R. Srihari, *Wiley Encyclopedia of Electrical and Electronics Engineering*, vol. 15, 1999, pp. 123-146.

B7. "A Tabular Survey of Automated Table Processing," D. Lopresti and G. Nagy, *Graphics Recognition: Recent Advances*, A. K. Chhabra and D. Dori, eds., Berlin: Springer-Verlag, 2000, pp. 93-120.

B8. "Applications of Graph Probing to Web Document Analysis," D. Lopresti and G. Wilfong, *Web Document Analysis: Challenges and Opportunities*, A. Antonacopoulos and J. Hu, eds., Singapore: World Scientific, 2003, pp. 19-38.

B9. "Exploiting WWW Resources in Experimental Document Analysis Research," D. Lopresti, *Web Document Analysis: Challenges and Opportunities*, A.

Antonacopoulos and J. Hu, eds., Singapore: World Scientific, 2003, pp. 273-292.

B10. "Multi-character Field Recognition for Arabic and Chinese Handwriting," D. Lopresti, G. Nagy, S. Seth, and X. Zhang, *Arabic and Chinese Handwriting Recognition*, D. Doermann and S. Jaeger, eds., Springer-Verlag, 2008, pp. 218-230.

B11. "The Role of Document Image Analysis in Trustworthy Elections," G. Nagy and D. Lopresti, invited chapter in *Advances in Digital Document Processing and Retrieval*, B. B. Chaudhuri and S. K. Parui, eds., special volume commemorating the Platinum Jubilee of the Indian Statistical Institute, Singapore: World Scientific, 2013, pp. 51-81.

Articles in Refereed Journals

J1. "P–NAC: A Systolic Array for Comparing Nucleic Acid Sequences," D. Lopresti, *Computer*, vol. 20, no. 7, July 1987, pp. 98-99 (also appears in Selected Reprints from Computer Society Magazines).

J2. "SPLASH – Experience Building and Programming a Highly Parallel Programmable Logic Array," M. Gokhale, W. Holmes, A. Kopser, S. Lucas, R. Minnich, D. Sweely, and D. Lopresti, *Computer*, January 1991, pp. 81-89. *Voted into the TCFPGA Hall of Fame Class of 2018.

J3. "I/O Overhead and Parallel VLSI Architectures for Lattice Computations," M. Nodine, D. Lopresti, and J. Vitter, *IEEE Transactions on Computers*, vol. 40, no. 7, July 1991, pp. 843-852.

J4. "Interval Methods for Modeling Uncertainty in RC Timing Analysis," C. Harkness and D. Lopresti, *IEEE Transactions on Computer-Aided Design*, vol. 11, no. 11, November 1992, pp. 1388-1401.

J5. "On Handling Electronic Ink," W. Aref, I. Kamel, and D. Lopresti, *ACM Computing Surveys*, vol. 27, no. 4, December 1995, pp. 564-567.

J6. "Validation of Image Defect Models for Optical Character Recognition," Y. Li, D. Lopresti, G. Nagy, and A. Tomkins, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 18, no. 2, February 1996, pp. 99-108.

J7. "Using Consensus Sequence Voting to Correct OCR Errors," D. Lopresti and J. Zhou, *Computer Vision and Image Understanding*, vol. 67. no. 1, July 1997, pp. 39-47.

J8. "Improving Classifier Performance through Repeated Sampling," J. Zhou and D. Lopresti, *Pattern Recognition*, vol. 30, no. 10, October 1997, pp. 1637-1650.

J9. “Block Edit Models for Approximate String Matching,” D. Lopresti and A. Tomkins, *Theoretical Computer Science*, vol. 181, 1997, pp. 159-179.

J10. “Ink Matching of Cursive Chinese Handwritten Annotations,” D. Lopresti, M. Ma, P. Wang, and J. Crisman, *International Journal of Pattern Recognition and Artificial Intelligence*, vol. 12, no. 1, January 1998, pp. 119-141.

J11. “Spatial Sampling of Printed Patterns,” P. Sarkar, G. Nagy, J. Zhou, and D. Lopresti, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 20, no. 3, March 1998, pp. 344-351.

J12. “Locating and Recognizing Text in WWW Images,” D. Lopresti and J. Zhou, *Information Retrieval*, vol. 2, nos. 2/3, May 2000, pp. 177-206.

J13. “String Techniques for Detecting Duplicates in Document Databases,” D. Lopresti, *International Journal on Document Analysis and Recognition*, vol. 2, no. 4, June 2000, pp. 186-199.

J14. “A Comparison of Text-Based Methods for Detecting Duplication in Scanned Document Databases,” D. Lopresti, *Information Retrieval*, July 2001, vol. 4, no. 2, pp. 153-173.

J15. “Evaluating the Performance of Table Processing Algorithms,” J. Hu, R. Kashi, D. Lopresti, and G. Wilfong, *International Journal on Document Analysis and Recognition*, vol. 4, no. 3, March 2002, pp. 140-153.

J16. “A Text-to-Speech Platform for Variable Length Optimal Unit Searching Using Perceptual Cost Functions,” M. Lee, D. Lopresti, and J. Olive, *International Journal of Speech Technology*, vol. 6, no. 4, October 2003, pp. 347-356.

J17. “A Fast Technique for Comparing Graph Representations with Applications to Performance Evaluation,” D. Lopresti and G. Wilfong, *International Journal on Document Analysis and Recognition*, vol. 6, no. 4, April 2004, pp. 219-229.

J18. “Table Processing Paradigms: A Research Survey,” D. Embley, M. Hurst, D. Lopresti, and G. Nagy, *International Journal on Document Analysis and Recognition*, vol 8, no. 2-3, June 2006, pp. 66-86.

J19. “Forgery Quality and its Implications for Behavioral Biometric Security,” L. Ballard, D. Lopresti, and F. Monrose, *IEEE Transactions on Systems, Man and Cybernetics, Part B*, vol. 37, no. 5, October 2007, pp. 1107-1118.

J20. “Balancing the Role of Priors in Multi-Observer Segmentation Evaluation,” Y. Zhu, X. Huang, W. Wang, D. Lopresti, R. Long, S. Antani, Z. Xue, and G. Thoma, *Journal of Signal Processing Systems*, vol. 55, nos. 1-3, April 2009, pp. 185-207.

J21. “Optical Character Recognition Errors and Their Effects on Natural Language Processing,” D. Lopresti, *International Journal on Document Analysis and Recognition*, vol. 12, no. 3, October 2009, pp. 141-151.

J22. “Handwriting Recognition Research: Twenty Years of Achievement … and Beyond,” M. Cheriet, M. El Yacoubi, H. Fujisawa, D. Lopresti, and G. Lorette, *Pattern Recognition*, vol. 42, no. 12, December 2009, pp. 3131-3135.

J23. “Genome-wide Evaluation and Discovery of Vertebrate A-to-I RNA Editing Sites,” S. Maas, C. P. Godfried Sie, I. Stoev, D. E. Dupuis, J. Latona, A. Porman, B. Evans, P. Rekawek, V. Kluempers, M. A. Mutter, W. M. Gommans, and D. Lopresti, *Biochemical and Biophysical Research Communications*, vol. 412, no. 3, September 2011, pp. 407-412.

J24. “Secure Speech Biometric Templates for User Authentication,” K. Inthavisas and D. Lopresti, *IET Biometrics*, vol. 1, no. 1, pp. 46-54, 2012, DOI: 10.1049/iet-bmt.2011.0008.

J25. “Model-Based Ruling Line Detection in Noisy Handwritten Documents,” J. Chen and D. Lopresti, *Pattern Recognition Letters*, vol. 35, no. 1, January 2014, pp. 34-45.

J26. “Conservative Preprocessing of Document Images,” J. Chen, D. Lopresti, and G. Nagy, *International Journal on Document Analysis and Recognition*, vol. 19, no. 4, December 2016, pp 321-333.

J27. “Arbitrarily-Oriented Text Detection in Low Light Natural Scene Images,” M. Xue, P. Shivakumara, C. Zhang, Y. Xiao, T. Lu, U. Pal and D. Lopresti, *IEEE Transactions on Multimedia,* vol. 23, pp. 2706-2720, early access August 2020, DOI: https://ieeexplore.ieee.org/document/9162503.

J28. “Deep Invariant Texture Features for Water Image Classification,” M. Xue, P. Shivakumara, X. Wu, T. Lu, U. Pal, M. Blumenstein, and D. Lopresti, *SN Applied Sciences*, vol. 2, 19 pages, online access November 2020, DOI: https://doi.org/10.1007/s42452-020-03882-w.

J29. “Graph Attention Network for Detecting License Plates in Crowded Street Scenes,” P. N. Chowdhury, P. Shivakumara, S. Kanchan, R. Raghavendra, U. Pal, T. Lu, and D. Lopresti, *Pattern Recognition Letters*, vol. 140, December 2020, pp. 18-25.

J30. “A New Context-Based Feature for Classification of Emotions in Photographs,” D. Krishnani, P. Shivakumara, T. Lu, U. Pal, D. Lopresti, and G. H. Kumar, *Multimedia Tools and Applications*, 30 pages, online access February 2021, DOI: https://doi.org/10.1007/s11042-020-10404-8.

J31. "Forged Text Detection in Video, Scene, and Document Images," L. Nandanwar, P. Shivakumara, P. Mondal, K. S. Raghunandan, U. Pal, T. Lu, and D. Lopresti, *IET Image Processing*, 12 pages, online access February 2021, DOI: https://doi.org/10.1049/iet-ipr.2020.0590.

J32. "An Episodic Learning Network for Text Detection on Human Bodies in Sports Images," P. N. Chowdhury, P. Shivakumara, R. Raghavendra, S. Nag, U. Pal, T. Lu, and D. Lopresti, *IEEE Transactions on Circuits and Systems for Video Technology*, vol 32, no. 4, April 2022, pp. 2279-2289, online access June 2021, DOI: https://doi.org/10.1109/TCSVT.2021.3092713.

J33. "A Deep Action-Oriented Video Image Classification System for Text Detection and Recognition," A. Chaudhuri, P. Shivakumara, P. N. Chowdhury, U. Pal, T. Lu, D. Lopresti, and G. H. Kumar, *SN Applied Sciences*, vol. 3, 24 pages, October 2021, DOI: https://doi.org/10.1007/s42452-021-04821-z.

J34. "Altered Handwritten Text Detection in Document Images Using Deep Learning," G. Patil, P. Shivakumara, S. S. Gornale, and D. Lopresti, *International Journal of Pattern Recognition and Artificial Intelligence*, vol. 38, no. 3, April 2024, DOI: https://doi.org/10.1142/S0218001424520062.

J35. "A Robust Script Independent Handwriting System for Gender Identification," P. Shivakumara, M. A. Kaljahi, S. Kanchan, T. Lu, U. Pal, and D. Lopresti, accepted to appear in *Expert Systems with Applications*, 15 pages, September 2024, DOI: https://doi.org/10.1016/j.eswa.2024.123576.

J36. "Domain Independent Adaptive Histogram Based Features for Pomegranate Fruit and Leaf Diseases Classification," M. Prajwala, P. P. Kumar, S. M. Gopinath, S. Palaiahnakote, M. Basavanna and D. Lopresti, *CAAI Transactions on Intelligence Technology*, 20 pages, November 2024, DOI: https://doi.org/10.1049/cit2.12390.

Published Reports and Conference Proceedings (all refereed)

C1. "A Systolic Array for Rapid String Comparison," R. Lipton and D. Lopresti, *1985 Chapel Hill Conference on Very Large Scale Integration*, H. Fuchs, ed., Rockville, MD: Computer Science Press, 1985, pp. 363-376.

C2. "Delta Transformations to Simplify VLSI Processor Arrays for Serial Dynamic Programming," R. Lipton and D. Lopresti, *Proceedings of the 1986 International Conference on Parallel Processing*, August 1986, pp. 917-920.

C3. "Comparing Long Strings on a Short Systolic Array," R. Lipton and D. Lopresti, *Systolic Arrays*, W. Moore, A. McCabe, and R. Urquhart, eds., Boston: Adam Hilger, 1987, pp. 181-190.

C4. "Architecture of a Programmable Systolic Array," R. Hughey and D. Lopresti, *International Conference on Systolic Arrays*, K. Bromley, S. Y. Kung, E. Swartzlander, eds., Washington, DC: Computer Society Press, 1988, pp. 41-49.

C5. "The Brown Systolic Array," R. Hughey and D. Lopresti, *Proceedings of the First Annual IEEE Symposium on Parallel and Distributed Processing*, May 1989, pp. 112-113.

C6. "Modeling Uncertainty in RC Timing Analysis," C. L. Harkness and D. Lopresti, *Proceedings of the 1989 International Conference on Computer-Aided Design*, November 1989, pp. 516-519.

C7. "I/O Overhead and Parallel VLSI Architectures for Lattice Computations," M. Nodine, D. Lopresti, and J. Vitter, *International Conference on Computing and Information*, May 1990, pp. 472-476. Also appears in *Advances in Computing and Information*, Lecture Notes in Computer Science Vol. 468, Berlin: Springer-Verlag, 1990, pp. 497-506.

C8. "SPLASH: A Reconfigurable Linear Logic Array," M. Gokhale, W. Holmes, A. Kopser, R. Kunze, D. Lopresti, S. Lucas, R. Minnich, and P. Olsen, *Proceedings of the 1990 International Conference on Parallel Processing*, August 1990, pp. 526-532.

C9. "VLSI Placement Using Uncertain Costs," C. Harkness and D. Lopresti, *Proceedings of the 1990 International Conference on Computer-Aided Design*, November 1990, pp. 340-343.

C10. "A Software Approach to Fault Detection on Programmable Systolic Arrays," R. Hughey and D. Lopresti, *Proceedings of the Second Annual IEEE Symposium on Parallel and Distributed Processing*, December 1990, pp. 523-526.

C11. "Rapid Implementation of a Genetic Sequence Comparator Using Field-Programmable Logic Arrays," D. Lopresti, *Advanced Research in VLSI: Proceedings of the 1991 University of Santa Cruz Conference*, C. H. Sequin, ed., Cambridge: MIT Press, 1991, pp. 138-152 (invited paper).

C12. "B-SYS: A 470 Processor Programmable Systolic Array," R. Hughey and D. Lopresti, *1991 International Conference on Parallel Processing*, August 1991, pp. 580-583.

C13. "FPGA Implementation of Systolic Sequence Alignment," D. Hoang and D. Lopresti, in *Field-Programmable Gate Arrays: Architectures and Tools for Rapid Prototyping*, H. Grunbacher and R. W. Hartenstein, eds., Berlin: Springer- Verlag, 1992, pp. 183-191.

C14. "Pictographic Naming," D. Lopresti and A. Tomkins, *Adjunct Proceedings of the 1993 Conference on Human Factors in Computing Systems (INTERCHI'93)*, April 1993, Amsterdam, The Netherlands, pp. 77-78.

C15. "Approximate Matching of Hand-Drawn Pictograms," D. Lopresti and A. Tomkins, *Proceedings of the Third International Workshop on Frontiers in Handwriting Recognition*, May 1993, Buffalo, NY, pp. 102-111.

C16. "Certifiable Optical Character Recognition," D. Lopresti and J. Sandberg, *Proceedings of the Second International Conference on Document Analysis and Recognition*, October 1993, Tsukuba Science City, Japan, pp. 432-435.

C17. "Classification and Distribution of Optical Character Recognition Errors," J. Esakov, D. Lopresti, and J. Sandberg, *Proceedings of the IS&T/SPIE International Symposium on Electronic Imaging*, February 1994, San Jose, CA, vol. 2181, pp. 204-216.

C18. "Validation of Document Defect Models for Optical Character Recognition" Y. Li, D. Lopresti, and A. Tomkins, *Proceedings of the Third Annual Symposium on Document Analysis and Information Retrieval*, April 1994, Las Vegas, NV, pp. 137-150.

C19. "Issues in Automatic OCR Error Classification," J. Esakov, D. Lopresti, J. Sandberg, and J. Zhou, *Proceedings of the Third Annual Symposium on Document Analysis and Information Retrieval*, April 1994, Las Vegas, NV, pp. 401-412.

C20. "On the Searchability of Electronic Ink," D. Lopresti and A. Tomkins, *Proceedings of the Fourth International Workshop on Frontiers of Handwriting Recognition*, December 1994, Taipei, Taiwan, pp. 156-165.

C21. "The Effects of Document Image Defects on Line Drawing Analysis Algorithms," Y. Chang and D. Lopresti, *Proceedings of the IAPR Workshop on Machine Vision Applications*, December 1994, Kawasaki, Japan, pp. 522-527.

C22. "Repeated Sampling to Improve Classifier Accuracy," J. Zhou and D. Lopresti, *Proceedings of the IAPR Workshop on Machine Vision Applications*, December 1994, Kawasaki, Japan, pp. 346-351.

C23. "Systematic Bias in OCR Experiments," D. Lopresti, A. Tomkins, J. Zhou, and J. Zhou, *Proceedings of the IS&T/SPIE International Symposium on Electronic Imaging*, L. M. Vincent and H. S. Baird, eds., February 1995, San Jose, CA, pp. 196-204.

C24. "Block Edit Models for Approximate String Matching," D. Lopresti and A. Tomkins, *Proceedings of the Second South American Workshop on String Processing*, R. Baeza-Yates and U. Manber, eds., April 1995, Valparaíso, Chile, pp. 11-26.

C25. "The Effects of Sampling Variation on Image Recognition Systems," J. Zhou and D. Lopresti, *Proceedings of the Fifth International Conference on Image Processing and its Applications*, July 1995, Edinburgh, UK, pp. 75-79.

C26. "Spatial Sampling Effects in Optical Character Recognition," D. Lopresti, J. Zhou, G. Nagy, and P. Sarkar, *Proceedings of the Third International Conference on Document Analysis and Recognition*, August 1995, Montréal, Canada, pp. 309-314.

C27. "Temporal-Domain Matching of Hand-Drawn Pictorial Queries," D. Lopresti and A. Tomkins, *Handwriting and Drawing Research: Basic and Applied Issues*, M. L. Simner, C. G. Leedham, and A. J. W. M. Thomassen, eds., Amsterdam: IOS Press, 1996, pp. 387-401.

C28. "A Genetic Approach to the Analysis of Complex Text Formatting," J. Zhou, D. Lopresti, and J. Zhou, *Proceedings of the IS&T/SPIE International Symposium on Electronic Imaging*, L. M. Vincent and J. J. Hull, eds., February 1996, San Jose, CA, pp. 126-137.

C29. "Retrieval Strategies for Noisy Text," D. Lopresti and J. Zhou, *Proceedings of the Fifth Annual Symposium on Document Analysis and Information Retrieval*, April 1996, Las Vegas, NV, pp. 255-269.

C30. "Robust Retrieval of Noisy Text," D. Lopresti, *Proceedings of the Third Forum on Research and Technology Advances in Digital Libraries*, May 1996, Washington, DC, pp. 76-85.

C31. "Algorithms for Matching Hand-Drawn Sketches," D. Lopresti, A. Tomkins, and J. Zhou, *Proceedings of the Fifth International Workshop on Frontiers in Handwriting Recognition*, September 1996, Colchester, England, pp. 233-238.

C32. "Document Analysis and the World Wide Web," D. Lopresti and J. Zhou, *Proceedings of the IAPR Workshop on Document Analysis Systems*, October 1996, Malvern, PA, pp. 651-671.

C33. "OCR for World Wide Web Images," J. Zhou, D. Lopresti, and Z. Lei, *Proceedings of the IS&T/SPIE International Symposium on Electronic Imaging*, L. M. Vincent and J. J. Hull, eds., February 1997, San Jose, CA, pp. 58-66.

C34. "Semantic Matching of Free-Format Chinese Handwriting," M. Ma, P. Wang, D. Lopresti, and J. Crisman, *Proceedings of the Seventeenth International Conference on Computer Processing of Oriental Languages*, April 1997, Hong Kong, pp. 107-112.

C35. "Approximate Matching of Chinese Handwritten Annotations," D. Lopresti, M. Ma, and J. Zhou, *Proceedings of the Seventeenth International Conference on*

Computer Processing of Oriental Languages, April 1997, Hong Kong, pp. 95-100.

C36. "Locating and Recognizing Text in WWW Images," D. Lopresti and J. Zhou, *Proceedings of the Symposium on Document Image Understanding Technology*, April/May 1997, Annapolis, MD, pp. 193-201.

C37. "Spatial Sampling Effects on Scanned 2-D Patterns," J. Zhou, D. Lopresti, P. Sarkar, and G. Nagy, *Advances in Visual Form Analysis*, C. Arcelli, L. P. Cordella, and G. Sanniti di Baja, eds., Singapore: World Scientific, 1997, pp. 666-675.

C38. "Extracting Text from WWW Images," J. Zhou and D. Lopresti, *Proceedings of the Fourth International Conference on Document Analysis and Recognition*, August 1997, Ulm, Germany, pp. 248-252.

C39. "Image Curvelet Feature Extraction and Matching," Z. Lei, Y. Chan, and D. Lopresti, *Proceedings of the IEEE International Conference on Image Processing*, October 1997, Santa Barbara, CA.

C40. "A Feature-Based Approach for Image Retrieval by Sketch," Y. Chan, Z. Lei, D. Lopresti, and S. Y. Kung, *Proceedings of the SPIE International Symposium on Voice, Video and Data Communications*, November 1997, Dallas, TX, pp. 220-231.

C41. "Finding Text in Color Images," J. Zhou, D. Lopresti, and T. Tasdizen, *Proceedings of Document Recognition V (IS&T/SPIE International Symposium on Electronic Imaging)*, February 1998, San Jose, CA, pp. 130-140.

C42. "Ink as Multimedia Data," D. Lopresti, *Proceedings of the Fourth International Conference on Information, Systems, Analysis and Synthesis*, July 1998, Orlando, FL, pp. 122-128.

C43. "String Techniques for Duplicate Document Detection," D. Lopresti, *Proceedings of the Symposium on Document Image Understanding Technology*, April 1999, Annapolis, MD, pp. 101-112.

C44. "Models and Algorithms for Duplicate Document Detection," D. Lopresti, *Proceedings of the Fifth International Conference on Document Analysis and Recognition*, September 1999, Bangalore, India, pp. 297-300.

C45. "Cross-Domain Approximate String Matching," D. Lopresti and G. Wilfong, *Proceedings of the Sixth International Symposium on String Processing and Information Retrieval*, September 1999, Cancún, Mexico, pp. 120-127.

C46. "Automated Table Processing: An (Opinionated) Survey," D. Lopresti and G. Nagy, *Proceedings of the Third IAPR International Workshop on Graphics Recognition*, September 1999, Jaipur, India, pp. 109-134.

C47. “Medium-Independent Table Detection,” J. Hu, R. Kashi, D. Lopresti, and G. Wilfong, *Proceedings of Document Recognition and Retrieval VII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2000, San Jose, CA, pp. 291-302.

C48. “A Comparison of Text-Based Methods for Detecting Duplicates in Document Image Databases,” D. Lopresti, *Proceedings of Document Recognition and Retrieval VII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2000, San Jose, CA, pp. 210-221.

C49. “Cross-Domain Searching Using Handwritten Queries,” D. Lopresti and G. Wilfong, *Proceedings of the Seventh International Workshop on Frontiers in Handwriting Recognition*, September 2000, Amsterdam, The Netherlands, pp. 3-12.

C50. “Comparing the Utility of Optical Character Recognition and Character Shape Coding in Duplicate Document Detection,” D. Lopresti and A. L. Spitz, *Proceedings of the Fourth IAPR International Workshop on Document Analysis Systems*, December 2000, Rio de Janeiro, Brazil, pp. 439-450.

C51. “A System for Understanding and Reformulating Tables,” J. Hu, R. Kashi, D. Lopresti, and G. Wilfong, *Proceedings of the Fourth IAPR International Workshop on Document Analysis Systems*, December 2000, Rio de Janeiro, Brazil, pp. 361-372.

C52. “Table Structure Recognition and Its Evaluation,” J. Hu, R. Kashi, D. Lopresti, and G. Wilfong, *Proceedings of Document Recognition and Retrieval VIII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2001, San Jose, CA, pp. 44-55.

C53. “Evaluating Document Analysis Results via Graph Probing,” D. Lopresti and G. Wilfong, *Proceedings of the Symposium on Document Image Understanding Technology*, April 2001, Columbia, MD, pp. 201-210.

C54. “A Text-to-Speech Platform for Variable Length Optimal Unit Searching Using Perceptual Cost Functions,” M. Lee, D. Lopresti, and J. Olive, *Proceedings of the Fourth ISCA Workshop on Speech Synthesis*, August-September 2001, Perthshire, Scotland, pp. 75-80.

C55. “Issues in Ground-Truthing Graphic Documents,” D. Lopresti and G. Nagy, *Proceedings of the Fourth IAPR International Workshop on Graphics Recognition*, September 2001, Kingston, Ontario, Canada, pp. 59-72.

C56. “Applications of Graph Probing to Web Document Analysis,” D. Lopresti and G. Wilfong, *Proceedings of the First International Workshop on Web Document*

Analysis, September 2001, Seattle, WA, pp. 51-54.

C57. "Why Table Ground-Truthing is Hard," J. Hu, R. Kashi, D. Lopresti, G. Nagy, and G. Wilfong, *Proceedings of the Sixth International Conference on Document Analysis and Recognition*, September 2001, Seattle, WA, pp. 129-133.

C58. "Evaluating Document Analysis Results via Graph Probing," D. Lopresti and G. Wilfong, *Proceedings of the Sixth International Conference on Document Analysis and Recognition*, September 2001, Seattle, WA, pp. 116-120.

C59. "Comparing Semi-Structured Documents via Graph Probing," D. Lopresti and G. Wilfong, *Proceedings of the Seventh Workshop on Multimedia Information Systems*, November 2001, Capri, Italy, pp. 41-50.

C60. "Human Interactive Proofs for Spoken Language Interfaces," D. Lopresti, C. Shih and G. Kochanski, *Proceedings of the Workshop on Human Interactive Proofs*, January 2002, Palo Alto, CA, pp. 30-34.

C61. "Exploiting WWW Resources in Experimental Document Analysis Research," D. Lopresti, *Document Analysis Systems V*, D. Lopresti, J. Hu, and R. Kashi, eds., Berlin: Springer-Verlag, 2002, pp. 532-543.

C62. "Towards Speech-Generated Cryptographic Keys on Resource-Constrained Devices," F. Monrose, M. Reiter, Q. Li, D. Lopresti, and C. Shih, *Proceedings of the Eleventh USENIX Security Symposium*, August 2002, San Francisco, CA, pp. 283-296.

C63. "A Reverse Turing Test Using Speech," G. Kochanski, D. Lopresti, and C. Shih, *Proceedings of the Seventh International Conference on Spoken Language Processing*, September 2002, Denver, CO, pp. 1357-1360.

C64. "Resource-Optimized Delivery of Web Images to Small-Screen Devices," Y. Wu and D. Lopresti, *Proceedings of Document Recognition and Retrieval X (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2003, Santa Clara, CA, pp. 144-156.

C65. "Summarizing Noisy Documents," H. Jing, D. Lopresti, and C. Shih, *Proceedings of the Symposium on Document Image Understanding Technology,* April 2003, Greenbelt, MD, pp. 111-119.

C66. "Assuring High-Accuracy Document Understanding: Retargeting, Scaling-up, and Adapting," H. Baird, K. Popat, T. Breuel, P. Sarkar, and D. Lopresti, *Proceedings of the Symposium on Document Image Understanding Technology*, April 2003, Greenbelt, MD, pp. 17-29.

C67. "A Nonparametric Classifier for Unsegmented Text," G. Nagy, A. Joshi, M.

Krishnamoorthy, Y. Lin, D. Lopresti, S. Mehta, and S. Seth, *Proceedings of Document Recognition and Retrieval XI (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2004, Santa Jose, CA, pp. 102-108.

C68. "Document Analysis Systems for Digital Libraries: Challenges and Opportunities," H. Baird, V. Govindaraju, and D. Lopresti, *Document Analysis Systems VI*, S. Marinai and A. Dengel, eds., Berlin: Springer-Verlag, 2004, pp. 1-16.

C69. "Robust Document Image Understanding Technologies," H. Baird, D. Lopresti, B. Davison, and W. Pottenger, *Proceedings of the First ACM Workshop on Hardcopy Document Processing (in association with Thirteenth Conference on Information and Knowledge Management)*, November 2004, Washington, DC, pp. 9-14.

C70. "Quantifying Information Leakage in Document Redaction," D. Lopresti and A. L. Spitz, *Proceedings of the First ACM Workshop on Hardcopy Document Processing (in association with Thirteenth Conference on Information and Knowledge Management)*, November 2004, Washington, DC, pp. 63-69.

C71. "Information Leakage Through Document Redaction: Attacks and Countermeasures," D. Lopresti and A. L. Spitz, *Proceedings of Document Recognition and Retrieval XII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2005, San Jose, CA, pp. 183-190.

C72. "Chipless ID for Paper Documents," D. Lopresti and G. Nagy, *Proceedings of Document Recognition and Retrieval XII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2005, San Jose, CA, pp. 208-215.

C73. "Performance Evaluation for Text Processing of Noisy Inputs," D. Lopresti, *Proceedings of the 20th Annual ACM Symposium on Applied Computing (Document Engineering Track)*, March 2005, Santa Fe, NM, pp. 759-763.

C74. "Leveraging the CAPTCHA Problem," D. Lopresti, *Proceedings of the Second International Workshop on Human Interactive Proofs*, May 2005, Bethlehem, PA, pp. 97-110.

C75. "The Effectiveness of Generative Attacks on an Online Handwriting Biometric," D. Lopresti and J. Raim, *Proceedings of the International Conference on Audio- and Video-based Biometric Person Authentication*, July 2005, Rye Brook, NY, pp. 1090-1099.

C76. "Mobile Interactive Support System for Time-Critical Document Exploitation," G. Nagy and D. Lopresti, *Symposium on Document Image Understanding Technology,* November 2005, College Park, MD, pp. 111-119.

C77. "Match Graph Generation for Symbolic Indirect Correlation," D. Lopresti, G.

Nagy, and A. Joshi, *Document Recognition and Retrieval XIII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2006, San Jose, CA, pages 606706.1-606706.9.

C78. "Notes on Contemporary Table Recognition," D. Embley, D. Lopresti, and G. Nagy, *Proceedings of the Seventh IAPR International Workshop on Document Analysis Systems*, H. Bunke and A. L. Spitz, eds., Berlin: Springer-Verlag, 2006, pp. 164-175.

C79. "A Bioinformatics Approach to Identify Recoding Events of A-to-I RNA Editing," M. Strohmaier, S. Mass, D. Lopresti, R. Kaushal, W. Scheirer, and S. Hookway, *Proceedings of the IEEE 32nd Annual Northeast Bioengineering Conference*, April 2006, Easton, PA, pp. 209-210.

C80. "Interactive Document Processing and Digital Libraries," G. Nagy and D. Lopresti, *Proceedings of the Second International Conference on Document Image Analysis for Libraries*, April 2006, Lyon, France, pp. 2-11.

C81. "Biometric Authentication Revisited: Understanding the Impact of Wolves in Sheep's Clothing," L. Ballard, F. Monrose, and D. Lopresti, *Proceedings of the Fifteenth USENIX Security Symposium*, July-August 2006, Vancouver, BC, Canada, pp. 29-41.

C82. "A Bioinformatics Approach to Identify Recoding Events of A-to-I RNA Editing," S. Maas, R. Kaushal, D. Lopresti, and M. Strohmaier, *Proceedings of the Computational Systems Bioinformatics Conference*, August 2006, Palo Alto, CA, pages 5 (CD-ROM).

C83. "A Maximum-Likelihood Approach to Symbolic Indirect Correlation," A. Joshi, G. Nagy, D. Lopresti, and S. Seth, *Proceedings of the Eighteenth International Conference on Pattern Recognition*, August 2006, Hong Kong, pp. 99-103.

C84. "Three Computationally Demanding Problems in Search of ASAP Solutions," *Proceedings of the Seventeenth IEEE International Conference on Application-specific Systems, Architectures and Processors*, September 2006, Steamboat Springs, CO, pp. 214-222 (invited paper).

C85. "Multi-Character Field Recognition for Arabic and Chinese Handwriting," D. Lopresti, G. Nagy, S. Seth, and X. Zhang, *Proceedings of the Summit on Arabic and Chinese Handwriting Recognition*, September 2006, College Park, MD, pp. 93-100. An extended version is to appear in Lecture Notes in Computer Science Vol. 4768, Berlin: Springer-Verlag, 2008.

C86. "Evaluating the Security of Handwriting Biometrics," L. Ballard, D. Lopresti, and F. Monrose, *Proceedings of the Tenth International Workshop on Frontiers in Handwriting Recognition*, October 2006, La Baule, France, pp. 461-466.

C87. "Evaluating Biometric Security: Understanding the Impact of Wolves in Sheep's Clothing," D. Lopresti, F. Monrose, and L. Ballard, *Proceedings of the First Korea-Japan Joint Workshop on Pattern Recognition*, November 2006, Jeju, Korea, pp. 15-24 (invited keynote paper).

C88. "Measuring the Impact of Character Recognition Errors on Downstream Text Analysis," D. Lopresti, *Proceedings of Document Recognition and Retrieval XV* (*IS&T/SPIE International Symposium on Electronic Imaging*), January 2008, San Jose, CA, pages 6815.0G.01-6815.0G.11.

C89. "Web-Based Multi-Observer Segmentation Evaluation Tool," Y. Zhu, X. Huang, D. Lopresti, R. Long, S. Antani, Z. Xue, and G. Thoma, *Proceedings of the Twenty-First IEEE International Symposium on Computer-Based Medical Systems*, June 2008, Jyväskylä, Finland, pp. 167-169.

C90. "Optical Character Recognition Errors and Their Effects on Natural Language Processing," D. Lopresti, *Proceedings of the ACM SIGIR Workshop on Analytics for Noisy Unstructured Text Data*, July 2008, Singapore, pp. 9-16.

C91. "Biometric Key Generation Using Pseudo-Signatures," L. Ballard, J. Chen, D. Lopresti, and F. Monrose, *Proceedings of the Eleventh International Conference on Frontiers in Handwriting Recognition*, August 2008, Montréal, Canada, pp. 646-651.

C92. "A Document Analysis System for Supporting Electronic Voting Research," D. Lopresti, G. Nagy, and E. Barney Smith, *Proceedings of the Eighth IAPR International Workshop on Document Analysis Systems*, IEEE Computer Society Press, September 2008, Nara, Japan, pp. 167-174.

C93. "Pseudo-Signatures as a Biometric," J. Chen, D. Lopresti, L. Ballard, and F. Monrose, *Proceedings of the Second IEEE International Conference on Biometrics: Theory, Applications and Systems*, September-October 2008, Arlington, VA, pages 6 (CD-ROM).

C94. "Ballot Mark Detection," E. Barney Smith, D. Lopresti, and G. Nagy, *Proceedings of the Nineteenth International Conference on Pattern Recognition*, December 2008, Tampa, FL, pages 4 (CD-ROM).

C95. "Mark Detection from Scanned Ballots," E. Barney Smith, D. Lopresti, and G. Nagy, *Proceedings of Document Recognition and Retrieval XVI* (*IS&T/SPIE International Symposium on Electronic Imaging*), January 2009, San Jose, CA, pages 7247-26.01-7247-26.10.

C96. "A Classifier Ensemble based on Performance Level Estimation," W. Wang, X. Huang, Y. Zhu, D. Lopresti, Z. Xue, R. Long, S. Antani, and G. Thoma, *Proceedings of the Sixth IEEE International Symposium on Biomedical Imaging*, June-July 2009, Boston, MA, pp. 342-345.

C97. "Interactive Polygons in Region-Based Deformable Contours for Medical Images," Y. Zhu, T. Shen, D. Lopresti, and X. Huang, *Proceedings of the Sixth IEEE International Symposium on Biomedical Imaging*, June-July 2009, Boston, MA, pp. 37-40.

C98. "Tools for Monitoring, Visualizing, and Refining Collections of Noisy Documents," D. Lopresti and G. Nagy, *Proceedings of the Third Workshop on Analytics for Noisy Unstructured Text Data*, July 2009, Barcelona, Spain, pp. 9-16.

C99. "Document Photography in Vitro," G. Nagy, B. Clifford, A. Berg, G. Saunders, E. Barney Smith, and D. Lopresti, *Proceedings of the Third International Workshop on Camera-Based Document Analysis and Recognition*, July 2009, Barcelona, Spain, pp. 26-33.

C100. "Camera-based Ballot Counter," G. Nagy, B. Clifford, A. Berg, G. Saunders, D. Lopresti, and E. Barney Smith, *Proceedings of the Tenth International Conference on Document Analysis and Recognition*, July 2009, Barcelona, Spain, pp. 151-155.

C101. "Toward Resisting Forgery Attacks via Pseudo-Signatures," J. Chen, D. Lopresti, and F. Monrose, *Proceedings of the Tenth International Conference on Document Analysis and Recognition*, July 2009, Barcelona, Spain, pp. 51-55.

C102. "Document Analysis Support for the Manual Auditing of Elections," D. Lopresti, X. Zhou, X. Huang, G. Tan, *Proceedings of the Tenth International Conference on Document Analysis and Recognition*, July 2009, Barcelona, Spain, pp. 733-737.

C103. "Style-Based Ballot Mark Recognition," P. Xiu, D. Lopresti, H. Baird, G. Nagy, and E. Barney Smith, *Proceedings of the Tenth International Conference on Document Analysis and Recognition*, July 2009, Barcelona, Spain, pp. 216-220.

C104. "On the Usability and Security of Pseudo-Signatures," J. Chen and D. Lopresti, *Proceedings of Document Recognition and Retrieval XVII* (*IS&T/SPIE International Symposium on Electronic Imaging*), January 2010, San Jose, CA, pp. 7534-08.01 - 7534-08.10.

C105. "Document Analysis Issues in Reading Optical Scan Ballots," D. Lopresti, G. Nagy, and E. Barney Smith, *Proceedings of the Ninth IAPR International Workshop on Document Analysis Systems*, June 2010, Boston, MA, pp. 105-112.

C106. "Ruling Line Removal in Handwritten Page Images," D. Lopresti and E. Kavallieratou, *Proceedings of the Twentieth International Conference on Pattern Recognition*, August 2010, Istanbul, Turkey, pp. 2704-2707.

C107. "A Platform for Storing, Visualizing, and Interpreting Collections of Noisy Documents," B. Lamiroy and D. Lopresti, *Proceedings of the Fourth Workshop on Analytics for Noisy Unstructured Text Data*, October 2010, Toronto, Canada, pp. 11-18.

C108. "The Impact of Ruling Lines on Writer Identification," J. Chen, D. Lopresti, and E. Kavallieratou, *Proceedings of the Twelfth International Conference on Frontiers in Handwriting Recognition*, November 2010, Kolkata, India, pp. 439-444.

C109. "Characterizing Challenged Minnesota Ballots," G. Nagy, D. Lopresti, E. H. Barney Smith, and Z. Wu, *Document Recognition and Retrieval XVIII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2011, San Francisco, CA, pp. 787413-1 - 787413-10.

C110. "Parameter Calibration for Synthesizing Realistic-Looking Variability in Offline Handwriting," W. Cheng and D. Lopresti, *Document Recognition and Retrieval XVIII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2011, San Francisco, CA, pp. 78740Y-1 - 78740Y-10.

C111. "Using Perturbed Handwriting to Support Writer Identification in the Presence of Severe Data Constraints," J. Chen, W. Cheng, and D. Lopresti, *Document Recognition and Retrieval XVIII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2011, San Francisco, CA, pp. 78740G-1 - 78740G-8.

C112. "Ruling Line Detection and Removal," E. Kavallieratou, D. Lopresti, and J. Chen, *Document Recognition and Retrieval XVIII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2011, San Francisco, CA, pp. 78740V-1 - 78740V-7.

C113. "How Carefully Designed Open Resource Sharing Can Help and Expand Document Analysis Research," B. Lamiroy, D. Lopresti, H. Korth and J. Heflin, *Document Recognition and Retrieval XVIII (IS&T/SPIE International Symposium on Electronic Imaging)*, January 2011, San Francisco, CA, pp. 78740O-1 - 78740O-14.

C114. "Speech Biometric Mapping for Cryptographic Key Generation," K. Inthavisas and D. Lopresti, *Biometric Technology for Human Identification VIII (SPIE Defense, Security, and Sensing)*, April 2011, Orlando, FL, pp. 80291P-1 - 80291P-12.

C115. "Document Analysis Research in the Year 2021," D. Lopresti and B. Lamiroy, in *Modern Approaches in Applied Intelligence: Proceedings of the Twenty-Fourth International Conference on Industrial, Engineering and Other Applications of*

Applied Intelligent Systems, June-July 2011, Syracuse, NY (invited paper), Lecture Notes in Artificial Intelligence Vol. 6703, Heidelberg: Springer, pp. 264-274.

C116. "Attacks on Speech Biometric Authentication," K. Inthavisas and D. Lopresti, *Proceedings of the International Conference on Image Processing, Computer Vision, and Pattern Recognition (IPCV 2011)*, July 2011, Las Vegas, NV, pp. 310-316.

C117. "Biometric Template Protection for Dynamic Time Warping-based User Authentication," K. Inthavisas and D. Lopresti, *Proceedings of the International Conference on Image Processing, Computer Vision, and Pattern Recognition (IPCV 2011)*, July 2011, Las Vegas, NV, pp. 303-309.

C118. "A Real-World Noisy Unstructured Handwritten Notebook Corpus for Document Image Analysis Research," J. Chen, D. Lopresti and B. Lamiroy, *Proceedings of the Joint Workshop on Multilingual OCR and Analytics for Noisy Unstructured Text Data (J-MOCR-AND 2011)*, September 2011, Beijing, China, 8 pages, http://doi.acm.org/10.1145/2034617.2034620.

C119. "When is a Problem Solved?" D. Lopresti and G. Nagy, *Proceedings of the Eleventh International Conference on Document Analysis and Recognition (ICDAR 2011)*, September 2011, Beijing, China, pp. 32-36.

C120. "An Open Architecture for End-to-End Document Analysis Benchmarking," B. Lamiroy and D. Lopresti, *Proceedings of the Eleventh International Conference on Document Analysis and Recognition (ICDAR 2011)*, September 2011, Beijing, China, pp. 42-47.

C121. "Table Detection in Noisy Off-line Handwritten Documents," J. Chen and D. Lopresti, *Proceedings of the Eleventh International Conference on Document Analysis and Recognition (ICDAR 2011)*, September 2011, Beijing, China, pp. 399-403.

C122. "A Model-based Ruling Line Detection Algorithm for Noisy Handwritten Documents," J. Chen and D. Lopresti, *Proceedings of the Eleventh International Conference on Document Analysis and Recognition (ICDAR 2011)*, September 2011, Beijing, China, pp. 404-408.

C123. "Towards Improved Paper-based Election Technology," E. Barney Smith, D. Lopresti, G. Nagy, and Z. Wu, *Proceedings of the Eleventh International Conference on Document Analysis and Recognition (ICDAR 2011)*, September 2011, Beijing, China, pp. 1255-1259.

C124. "Evaluation of Voting with Form Dropout Techniques for Ballot Vote Counting," E. Barney Smith, S. Goyal, R. Scott, and D. Lopresti, *Proceedings of the Eleventh*

International Conference on Document Analysis and Recognition (ICDAR 2011), September 2011, Beijing, China, pp. 473-477.

C125. "Speech Cryptographic Key Regeneration Based on Password," K. Inthavisas and D. Lopresti, *Proceedings of the International Joint Conference on Biometrics (IJCB 2011)*, October 2011, Arlington, VA, 7 pages, DOI: 10.1109/IJCB.2011.6117553.

C126. "The Non-Geek's Guide to the DAE Platform," B. Lamiroy and D. Lopresti, *Proceedings of the Tenth IAPR International Workshop on Document Analysis Systems*, March 2012, Gold Coast, Australia, 6 pages.

C127. "Adapting the Turing Test for Declaring Document Analysis Problems Solved," D. Lopresti and G. Nagy, *Proceedings of the Tenth IAPR International Workshop on Document Analysis Systems (DAS 2012)*, March 2012, Gold Coast, Australia, 5 pages.

C128. "Model-based Tabular Structure Detection and Recognition in Noisy Handwritten Documents," J. Chen and D. Lopresti, *Proceedings of the Thirteenth International Conference on Frontiers in Handwriting Recognition (ICFHR 2012)*, September 2012, Bari, Italy, pp. 75-80.

C129. "Optimal Data Partitioning for Semi-Automated Labeling," D. Lopresti and G. Nagy, *Proceedings of the Twenty-First International Conference on Pattern Recognition (ICPR 2012)*, November 2012, Tsukuba, Japan, pp. 286-289.

C130. "Exploiting Ruling Line Artifacts in Writer Identification," J. Chen and D. Lopresti, *Proceedings of the Twenty-First International Conference on Pattern Recognition (ICPR 2012)*, November 2012, Tsukuba, Japan, pp. 3737-3740.

C131. "Optimal Policy for Labeling Training Samples," L. Lipsky, D. Lopresti, and G. Nagy, *Proceedings of Document Recognition and Retrieval XX (IS&T/SPIE International Symposium on Electronic Imaging)*, February 2013, San Francisco, CA, pp. 865809-1 – 865809-9.

C132. "Boxy, Semi-Structured Document Elements," G. Nagy, D. W. Embley, and D. P. Lopresti, *Proceedings of the Tenth IAPR International Workshop on Graphics Recognition (GREC 2013)*, August 2013, Bethlehem, PA, 7 pages.

C133. "Alternatives for Page Skew Compensation in Writer Identification," J. Chen and D. Lopresti, *Proceedings of the Twelfth International Conference on Document Analysis and Recognition (ICDAR 2013)*, August 2013, Washington, DC, pp. 927-931.

C134. "The Lehigh Steel Collection: A New Open Dataset for Document Recognition Research," B. Bruno and D. Lopresti, *Proceedings of Document Recognition and Retrieval XXI (IS&T/SPIE International Symposium on Electronic Imaging)*, February 2014, San Francisco, CA, pp. 90210O-1 - 90210O-9.

C135. "Form Similarity via Levenshtein Distance Between Ortho-Filtered Logarithmic Ruling-Gap Ratios," G. Nagy and D. Lopresti, *Proceedings of Document Recognition and Retrieval XXI (IS&T/SPIE International Symposium on Electronic Imaging)*, February 2014, San Francisco, CA, pp. 902106-1 - 902106-8.

C136. "The DAE Platform: A Framework for Reproducible Research in Document Image Analysis," B. Lamiroy and D. Lopresti, *Proceedings of the First International Workshop on Reproducible Research in Pattern Recognition*, December 2016, Cancun, Mexico, Springer LNCS Vol. 10214, pp. 17-29.

C137. "A New Common Points Detection-Based Method for Classification of 2D and 3D Texts in Video/Scene Images," L. Nandanwar, P. Shivakumara, A. Kumar, T. Lu, U. Pal, and D. Lopresti, *Proceedings of the Fourteenth International Workshop on Document Analysis Systems (DAS 2020)*, July 2020, Wuhan, China (virtual), Springer LNCS Vol. 12116, pp. 512-528.

C138. "A New Context-Based Method for Restoring Occluded Text in Natural Scene Images," A. Mittal, P. Shivakumara, U. Pal, T. Lu, M. Blumenstein, and D. Lopresti, *Proceedings of the Fourteenth International Workshop on Document Analysis Systems (DAS 2020)*, July 2020, Wuhan, China (virtual), Springer LNCS Vol. 12116, pp. 466-480.

C139. "A New Method for Detecting Altered Text in Document Images," L. Nandanwar, P. Shivakumara, U. Pal, T. Lu, D. Lopresti, B. Seraogi, and B. B. Chaudhuri, *Proceedings of the Second International Conference on Pattern Recognition and Artificial Intelligence (ICPRAI 2020)*, October 2020, Zhongshan City, China (virtual), Springer LNCS Vol. 12068, pp. 93-108.

C140. "Reproducibility: Evaluating the Evaluations," D. Lopresti and G. Nagy, *Reproducible Research in Pattern Recognition: Third International Workshop (RRPR 2020)*, January 2021, Milan, Italy (virtual), Springer LNCS Vol. 12636, pp. 12-23.

C141. "Local Gradient Difference Features for Classification of 2D-3D Natural Scene Text Images," L. Nandanwar, S. Palaiahnakote, R. Ramachandra, T. Lu, U. Pal, D. Lopresti, N. B. Anuar, *Proceedings of the Twenty-Fifth International Conference on Pattern Recognition (ICPR 2020)*, January 2021, Milan, Italy (virtual), IEEE Computer Society Press, pp. 1,112-1,119.

C142. "Chebyshev Harmonic Fourier Moments and Deep CNNs for Detecting Forged Handwriting," L. Nandanwar, S. Palaiahnakote, K. Sayani, U. Pal, T. Lu, D. Lopresti, *Proceedings of the Twenty-Fifth International Conference on Pattern Recognition (ICPR 2020)*, January 2021, Milan, Italy (virtual), IEEE Computer

Society Press, pp. 6,562-6,569.

C143. "Competition and Collaboration in Document Analysis and Recognition," D. Lopresti and G. Nagy*, Proceedings of the Sixteenth International Conference on Document Analysis and Recognition (ICDAR 2021)*, September 2021, Lausanne, Switzerland (hybrid), Springer LNCS Vol. 12821, pp. 176-187.

Edited Publications and Other Articles (including invited and non-refereed)

O1. "Gene Matching Using Microcomputers," D. Lopresti, *Encyclopedia of Microcomputers*, vol. 7, New York: Marcel Dekker, 1991, pp. 419-431.

O2. Special Issue Editor, *SPIE/IS&T International Electronic Imaging Working Group Newsletter*, vol. 8, no. 2, June 1998.

O3. "Electronic Ink as First-Class Computer Data," D. Lopresti, *1999 McGraw-Hill Yearbook of Science and Technology*, pp. 96-98.

O4. "Information Retrieval," D. Lopresti and G. Wilfong, *2001 McGraw-Hill Yearbook of Science and Technology*, pp. 204-206.

O5. Guest Editor (with J. Hu and R. Kashi), Special Issue on Document Analysis Systems, *International Journal of Document Analysis and Recognition*, vol. 6, no. 3, March 2003.

O6. "Human/Machine Differentiation," H. Baird and D. Lopresti, *2005 McGraw-Hill Yearbook of Science and Technology*, pp. 144-147.

O7. "Act Now to Ensure Safe and Secure Elections," D. Lopresti, op-ed piece, *Lehigh Alumni Bulletin*, Fall 2007, pg. 89.

O8. Guest Editor (with C. Knoblock, S. Roy, and L. V. Subramaniam), Special Issue on Noisy Text Analytics, *International Journal of Document Analysis and Recognition*, vol. 10, nos. 3-4, December 2007.

O9. Guest Editor (with S. Roy, K. Schulz, and L. V. Subramaniam), Special Issue on Noisy Text Analytics, *International Journal of Document Analysis and Recognition*, vol. 12, no. 3, October 2009.

O10. Guest Editor (with J. Lladós and S. Uchida), Special Issue on Advanced Topics in Document Analysis and Recognition, *International Journal of Document Analysis and Recognition*, vol. 24, no. 3, September 2021.

Reviews (Book, Film, Software, Exhibit, Performance, etc.) and Notes

R1. Book review of *Image Description and Retrieval*, Enrico Vicario, ed., Plenum

Press, Daniel Lopresti, in *Pattern Analysis & Applications*, vol. 4, no. 1, 2001, pp. 75-76.

Patents

P1. "Certifiable Optical Character Recognition," D. Lopresti, H. Korth, J. Sandberg, and R. Lipton, U.S. Patent No. 5,625,721, issued April 1997.

P2. "Certifiable Optical Character Recognition," D. Lopresti, H. Korth, J. Sandberg, and R. Lipton, U.S. Patent No. 5,703,972, issued December 1997.

P3. "Pictographic Bitmap Naming of Files in Pen-Based Computer Systems," D. Lopresti and A. Tomkins, U.S. Patent No. 5,734,882, issued March 1998.

P4. "A Method and Means for Enhancing Optical Character Recognition of Printed Documents," D. Lopresti and J. Sandberg, U.S. Patent No. 5,748,807, issued May 1998.

P5. "System and Method for Archiving Digital Versions of Documents and for Generating Quality Printed Documents Therefrom," D. Lopresti, J. Esakov, and J. Zhou, U.S. Patent No. 5,754,308, issued May 1998.

P6. "System and Method for Handwriting Matching Using Edit Distance Computation in a Systolic Array Processor," D. Lopresti, U.S. Patent No. 5,757,959, issued May 1998.

P7. "Multimedia Rendering Marker and Method," D. Lopresti and J. Sandberg, U.S. Patent No. 5,793,903, issued August 1998.

P8. "Method of Locating a Penstroke Sequence in a Computer," D. Lopresti and A. Tomkins, U.S. Patent No. 5,809,498, issued September 1998.

P9. "Document Search and Retrieval System with Partial Match Searching of User-Drawn Annotations," D. Lopresti, Y. Ma, and J. Zhou, U.S. Patent No. 5,832,474, issued November 1998.

P10. "Multimedia Rendering Marker and Method," D. Lopresti and J. Sandberg, U.S. Patent No. 5,852,684, issued December 1998.

P11. "A Clock-Free Two-Dimensional Barcode and Method for Printing and Reading the Same," D. Lopresti, J. Esakov, and J. Zhou, U.S. Patent No. 5,862,270, issued January 1999.

P12. "Video User's Environment," D. Lopresti, Y. Ma, A. Tomkins, and J. Zhou, U.S. Patent No. 5,889,506, issued March 1999.

P13. "Title, Caption and Photo Extraction from Scanned Document Images," J. Zhou and D. Lopresti, U.S. Patent No. 5,892,843, issued April 1999.

P14. "Method of Locating a Machine-Readable Two-Dimensional Barcode Within an Image," J. Zhou and D. Lopresti, U.S. Patent No. 5,974,200, issued October 1999.

P15. "Method and Means for Enhancing Optical Character Recognition of Printed Documents," D. Lopresti and J. Sandberg, U.S. Patent No. 6,047,093, issued April 2000.

P16. "A Clock-Free Two-Dimensional Barcode and Method for Printing and Reading the Same," D. Lopresti, J. Esakov, and J. Zhou, U.S. Patent No. 6,115,508, issued September 2000.

P17. "Border-less Clock Free Two-Dimensional Barcode and Method for Printing and Reading the Same," J. Zhou, D. Lopresti, and A. Tomkins, U.S. Patent No. 6,201,901, issued March 2001.

P18. "Storage Management System for Document Image Database," D. Lopresti, U.S. Patent No. 6,298,173, issued October 2001.

P19. "Identification of Logos from Document Images," J. Zhou, D. Lopresti, and P. Sarkar, U.S. Patent No. 6,327,388, issued December 2001.

P20. "Border-less Clock Free Two-Dimensional Barcode and Method for Printing and Reading the Same," J. Zhou, D. Lopresti, and A. Tomkins, U.S. Patent No. 6,418,244, issued July 2002.

P21. "Method for Identifying and Using Table Structures," J. Hu, R. Kashi, D. Lopresti, and G. Wilfong, U.S. Patent No. 7,054,871, issued May 2006.

P22. "Methods and Apparatus for Defending Against Telephone-based Robotic Attacks Using Random Personal Codes," H. Baird, J. Bentley, D. Lopresti, and S.Y. Wang, U.S. Patent No. 7,978,831, issued July 2011.

P23. "Methods and Apparatus for Defending Against Telephone-based Robotic Attacks Using Contextual-based Degradation," H. Baird, J. Bentley, D. Lopresti, and S.Y. Wang, U.S. Patent No. 8,005,197, issued August 2011.

P24. "Methods and Apparatus for Defending Against Telephone-based Robotic Attacks Using Permutation of an IVR Menu," H. Baird, J. Bentley, D. Lopresti, and S.Y. Wang, U.S. Patent No. 8,005,198, issued August 2011.

Patent Publications

PP1. "Method and Apparatus for Filtering E-mail Infected with a Previously

Unidentified Computer Virus," M. R. Andrews, G. P. Kochanski, D. P. Lopresti and C. L. Shih, U.S. Patent Publication No. 20030204569A1, October 2003.

PP2. "Method and Apparatus for Providing Resource-Optimized Delivery of Web Images to Resource-Constrained Devices," D. P. Lopresti and Y. Wu, U.S. Patent Publication No. 20040120589A1, June 2004.

C. Honors and Awards

- A.B. Degree magna cum laude, Dartmouth College, 1982.
- Phi Beta Kappa Honorific Society, Dartmouth College, 1982.
- New Jersey Garden State Graduate Fellowship, Princeton University, 1982 – 1986.
- Gordon Bell Prize Honorable Mention (with W. Holmes), IEEE Software, 1989.
- Sigma Xi Honorific Society, 1991.
- Elected Senior Member of Institute of Electrical and Electronics Engineers, 2003.
- Alumni Council Award for Service to Princeton University, 2005.
- Class of 1961 Professorship, Lehigh University, 2005 – 2007.
- Election Verification Network Award (with A. Appel and D. Jones), 2015.
- TCFPGA Hall of Fame Class of 2018 (ACM/SIGDA Technical Committee on FPGAs): "SPLASH – Experience Building and Programming a Highly Parallel Programmable Logic Array," M. Gokhale, W. Holmes, A. Kopser, S. Lucas, R. Minnich, D. Sweely, and D. Lopresti, *IEEE Computer*, January 1991, pp. 81-89.

D. Research Funding and Training Grants

Competitively Awarded Research Grants

- "Research in Parallel VLSI Architectures," Principal Investigator, AT&T Foundation, $20,283, 1987.
- "Systolic Array Architectures for String Comparisons," Principal Investigator, NSF, $70,000, 1987 – 1989.
- "Multiparadigm Design Environments," Co-Principal Investigator (with J. Savage, E. Charniak, T. Doeppner, T. Dean, P. Kanellakis, L. Morgenstern, S. Reiss, A. van Dam,

J. Vitter, P. Wegner, K. Zadeck, and S. Zdonik), NSF, $3,451,000, 1988 – 1992.

- “High-Performance Design Environments,” Co-Principal Investigator (with J. Savage, E. Charniak, T. Doeppner, J. Hughes, P. Kanellakis, P. Klein, F. Preparata, S. Reiss, R. Tamassia, A. van Dam, P. van Hentenryck, J. Vitter, P. Wegner, K. Zadeck, and S. Zdonik), DARPA, $2,654,835, 1991 – 1994.

- “Investigations in Programmable Systolic Architectures,” Principal Investigator, NSF, $180,882, 1991 – 1993.

- “Using Generative Models to Evaluate and Strengthen Biometrically Enhanced Systems,” Co-Principal Investigator (with F. Monrose and M. Reiter), NSF, $287,950, 2004 – 2008.

- “Keystone Alliance (KA) for Homeland Security – Cyber Security,” Co-Principal Investigator (with H. Korth), The Pennsylvania State University, $25,000, 2004 – 2006.

- “Following the Paper Trail: Reliable Processing of Voting Records for Trustworthy Elections,” Co-Principal Investigator (with C. Borick, E. Barney Smith, Z. Munson, and G. Nagy), NSF, $200,000, 2007 – 2009.

- “PLATO: A System for Taming MADCAT (Multilingual Automatic Document Classification, Analysis, and Translation),” Co-Principal Investigator (with H. Baird) prior to 2011, Principal Investigator from 2011 onward, DARPA (via Raytheon BBN Technologies), $813,046 (requested over multiple years), 2007 – 2013.

- “Structuring, Reasoning, and Querying in a Very Large Medical Image Database,” Co-Principal Investigator (with X. Huang, G. Tan, and G. Nagy), NSF, $392,000, 2008 – 2010.

- “CISE-RV: Computing Community Consortium,” Principal Investigator (with T. Camp and M. L. Maher), National Science Foundation Cooperative Agreement with Computing Research Association, $5,000,000, 2024 – 2027.

Non-competitively Awarded and/or Internal Research Grants

- “Implicit and Multi-Modal CAPTCHAs,” Co-Principal Investigator (with H. Baird), Avaya Labs Research, $30,000, 2005 – 2006.

- “Document Understanding: Survey and Evaluation of the State-of-the-Art,” Co-Principal Investigator (with H. Baird), DARPA (via BBN Technologies), $115,926, 2005 – 2006.
- “National Resource for Document Analysis and Exploitation,” Co-Principal Investigator (with H. Baird), FY2009 Department of Defense Appropriation (Defensewide RDT&E, Information and Communications Technology), $1,600,000,

2009 – 2010.

- “Multidisciplinary & Community Partnership to Develop a Mobile Applications for Enhancing the Provision of Home Visiting to Young Children who Experience Poverty” (with P. Manz, M. C. Chuah, L. Brook Sawyer, S. Woodhouse), Lehigh University Collaborative Research Opportunity Grant, $60,000, 2014 – 2015.

- “Sports and Evolution Lab,” Co-Principal Investigator (with J. Pettegrew and Z. Munson), Lehigh Mountaintop Project, $31,500, Summer 2016.

- “Computing Community Consortium III,” Co-Principal Investigator (with L. Bradley and A. Drobnis), National Science Foundation Cooperative Agreement (subaward beginning 2020 via Computing Research Association), $7,346,277, 2018 – 2023.

- Computing Community Consortium III (Supplement),” Principal Investigator (with A. Schwartz and N. Bliss), National Science Foundation Cooperative Agreement with Computing Research Association, $499,998, 2023.

Competitively Awarded Training Grants

- Grant to support the fabrication of VLSI class projects, Principal Investigator, NSF, $2,925, 1989 – 1990.

- Grant to support the fabrication of VLSI class projects, Principal Investigator, NSF, $3,520, 1990 – 1991.

- “A Facility for the Study of Computational Problems from Molecular and Population Biology,” Co-Principal Investigator (with L. Brooks), Committee on Academic Computing, Brown University, $3,368, 1991.

- “1992 Brown/MIT Conference on Advanced Research in VLSI and Parallel Systems,” Co-Principal Investigator (with C. Leiserson), NSF, $11,000, 1992.

- “The Undergraduate Science Education Program,” Senior Personnel (with N. Simon and V. Ware, Principal Investigators), Howard Hughes Medical Institute, $1,800,000, 2006 – 2010.

- “Integrating Computational and Experimental Methods in the Analysis of Molecular Complexity in Nature,” Co-Principal Investigator (with S. Maas), Lehigh Biosystems Dynamics Summer Institute (funding provided by Howard Hughes Medical Institute), Summer 2006.

- “A Combined Bioinformatics and Molecular Biological Approach for the Identification of Post-transcriptional Recoding Events in the Human Transcriptome,” Co-Principal Investigator (with S. Maas), Lehigh Biosystems Dynamics Summer Institute (funding provided by Howard Hughes Medical Institute), Summer 2008.

- "Bioinformatics, Butterflies, and Penguins," Co-Principal Investigator (with S. Mullen), Lehigh Biosystems Dynamics Summer Institute (funding provided by Howard Hughes Medical Institute), Summer 2009.

- Pennsylvania Governor's School for Engineering and Technology, Team Pennsylvania Foundation, $120,000, 2014.

- "REU Site: The Lehigh Smart Spaces Project," Senior Personnel (with M. Chuah and J. Spletzer, Principal Investigators), NSF, $340,000, 2014 – 2017.

- "Identification of Driver Mutations in Experimental Evolution," Co-Principal Investigator (with G. Lang), Lehigh Biosystems Dynamics Summer Institute (funding provided by Howard Hughes Medical Institute), $44,375, Summer 2014.

Contract/Consulting Work

- KYOS Systems Inc., Canton, MA, research and development in online handwriting recognition, 2004 – 2007.

- Expert witness on behalf of the plaintiffs, Banfield v. Cortes, No. 922 A.2d 36 (Pa. Commw. Ct., 2007), filed August 2006. Deposed in August 2011. At issue: whether the Pennsylvania Secretary of State properly certified electronic voting equipment used throughout the state. Work with law firm Drinker Biddle & Reath as well as independent counsels.

- Expert witness on behalf of the plaintiffs, National Association for the Advancement of Colored People State Conference of Pennsylvania, et al. v. Pedro A. Cortés, Secretary of the Commonwealth of Pennsylvania, et al., No. 08-5048 (US District Court, 2008), filed October 2008. At issue: whether emergency paper ballots can be used when less than all of the electronic voting machines in a precinct have failed on election day.

- Testifying expert witness on behalf of the plaintiffs, Nuance Communications v. Abbyy Software, No. 3:08-cv-02912 (U.S. District Court for the Northern District of California), 2008 – 2013. Work with law firms Wilson Sonsini Goodrich & Rosati and Morrison & Foerster. Deposed in January 2013; testified at jury trial in August 2013. In a separate but related matter, work with law firm Wolf, Greenfield & Sacks regarding US Patent Office actions.

- Designated as testifying expert witness on behalf of the plaintiffs, Secured Mail Solutions v. Advanced Image Direct, et al., No. SA-CV-01090 DOC (U.S. District Court for the Central District of California), 2013 – 2014. Work with law firm O'Melveny & Myers.

- Designated as testifying expert witness on behalf of the defendants, Thermo Fisher

Scientific Inc., et al. v. Yourway Transport, Inc., et al., No. GD 2011-C-4631 (Common Pleas of Lehigh County, PA, Civil Division), 2013 – 2014. Work with law firms Weir & Partners, Karoly Law Firm, and Robert E. Goldman.

- Designated as testifying expert witness on behalf of the plaintiffs, Modevity LLC v. Findaway World (American Arbitration Association, ARBNo. 14 117 Y00633 13), 2014. Deposed in March 2014. Work with law firm Stradley, Ronin, Stevens & Young.

- Expert witness on behalf of the petitioner, Smartmatic v. Avante, Inter Partes Review before the US Patent and Trademark Office, 2019. Work with law firm DLA Piper.

- Designated as testifying expert witness on behalf of the patent owner, Election Systems & Software LLC v. Hart Intercivic Inc., Inter Partes Review before the US Patent and Trademark Office, Case No. PGR2020-00031, 2020 – 2021. Deposed in February 2021. Work with law firm Baker Botts.

- Designated as testifying expert witness on behalf of the petitioner, Google LLC v. Human Differential Intelligence LLC, Inter Partes Review before the US Patent and Trademark Office, 2020. Work with law firm Wolf, Greenfield & Sacks. Settled January 2021.

- Designated as testifying expert witness on behalf of the defendant, Health Discovery Corporation v. Intel Corporation, Civil Action No. 6:20-cv-666, 2021 – 2023. Work with law firms King & Spalding and Perkins Coie.

- Designated as testifying expert witness on behalf of the petitioner, Google LLC v. Defenders of the American Dream, LLC, Inter Partes Review before the US Patent and Trademark Office, Case No. TBD, 2021 – 2022. Work with law firm Wolf, Greenfield & Sacks.

- Designated as testifying expert witness on behalf of the petitioner, Google LLC v. Nobots LLC, Inter Partes Review before the US Patent and Trademark Office, Case No. TBD, 2022 – 2023. Work with law firm Wolf, Greenfield & Sacks.

- Designated as testifying expert witness on behalf of the petitioner, Nike Inc. v. Valmarc Corporation, Inter Partes Review before the US Patent and Trademark Office, Case Nos. IPR2022-01403 and IPR2022-01404, 2022. Work with law firm DLA Piper.

- Designated as testifying expert witness on behalf of the defendants, Planner 5D v. Meta Platforms, Inc.; Facebook Technologies, LLC; The Trustees of Princeton University; et al., Case No. 3:19-cv-03132-WHO (SK), Case No. 3:20-cv-08261-WHO (SK) (U.S. District Court for the Northern District of California), 2021 – present. Deposed in February 2023. Deposed in November 2024. Work with law firms Kirkland & Ellis and Jenner & Block.

- Designated as testifying expert witness on behalf of the plaintiff, Zentian Ltd. v. Apple Inc. and Zentian Ltd. v. Amazon.com Services LLC and Amazon Web Services, Inc., Case Nos. 6:22-cv-00122-ADA and 6:22-cv-00123-ADA (U.S. District Court for the Western District of Texas), 2023 – present. Work with law firm Bartlit Beck LLP.

- Designated as testifying expert witness on behalf of the petitioners, Intuition Machines, Inc. and Cloudflare, Inc. v. Human Differential Intelligence LLC, Inter Partes Review before the US Patent and Trademark Office, Case Nos. IPR2023-00631 and IPR2023-00632, 2023. Work with law firm Finnegan, Henderson, Farabow, Garrett & Dunner, LLP.

- Designated as testifying expert witness on behalf of the petitioners, Aktana, Inc. v. Veeva Systems, Inc., Inter Partes Review before the US Patent and Trademark Office, Case Nos. IPR2024-01443 and IPR2024-01444, 2024. Work with law firm Desmarais, LLP.

- Plus other intellectual property cases not disclosed for reasons of confidentiality.

- Expert witness in several separate academic integrity cases involving alleged programming assignment plagiarism at a large midwestern university, 2020 – 2021.

E. Editor/Editorial Review Board Membership for Scholarly Publications

- Editorial Board, *International Journal of Document Analysis and Recognition*, Springer-Verlag, 1997 – present.

- Co-Editor-in-Chief (with K. Kise, S. Marinai, and J. Lladós), *International Journal of Document Analysis and Recognition*, Springer-Verlag, 2014 – present.

- Associate Editor, *ACM SIGMOD Digital Symposium Collection (DiSC)*, 2004 – 2006.

- Associate Editor, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2005 – 2010.

- Area Editor, *Computer Vision and Image Understanding*, Elsevier, 2011 – present.

- Review Editor, *Frontiers in Digital Humanities: Cultural Heritage Digitization Section*, Open Access, 2015 – 2017.

- Advisory Board, *Artificial Intelligence and Applications*, Bon View Publishing, 2024 – present.

F. Professional Presentations

Invited Presentations / Lectures / Colloquia / Workshops / Performances

- Invited Lectures: although too numerous to list, I estimate I have given 40 to 60 invited talks over my career to date. A recent memorable example surrounds a keynote talk I was invited to give on biometric security at the *First Korea-Japan Joint Workshop on Pattern Recognition* which was held in Jeju, Korea in 2006. While overseas, I gave two more invited technical talks, one at Tokyo University of Agriculture and Technology and another at Hitachi Central Research Laboratory. I was also asked to give an invited talk on the tenure system in the U.S. for high-level administrators, including the president, at Tokyo University of Agriculture and Technology. In June 2013 and May 2014, I delivered invited lectures at the *International Document Image Processing Summer School* in Fourni, Greece. In June 2015, I delivered an invited keynote lecture at the *Seventh Mexican Conference on Pattern Recognition*. In December 2015, I served as an invited panelist at the *Internet of Things World Forum* in Dubai, UAE. In August 2021, I gave an invited talk on "Synergies from Document Analysis" at the *79th Annual General Meeting of the American Society of Questioned Document Examiners*. In December 2021, I will give an invited talk on the societal benefits of AI at the *Forward Research and Innovation Summit* organized by the Puerto Rico Science, Technology and Research Trust.

- Participant in Conference Panel Sessions: I have served on 10 or more conference panel sessions over my career.

Organized or Chaired Sessions / Colloquia / Exhibits / Performances

- Chair of Conference Sessions: I have chaired dozens of conference sessions to date.

- Panel Session Organizer/Moderator, "Meta-Data: What Good is it?" (with F. R. Chen, S. Dennis, D. Doermann, and A. Tomkins), *Document Recognition and Retrieval VI (IS&T/SPIE International Symposium on Electronic Imaging)*, January 1999, San Jose, CA.

- Panel Session Organizer/Moderator, "Synergies Between Document Analysis Research and Digital Libraries" (with H. Baird, A. Downton, Y. LeCun, M. Nakagawa, and M. Worring), *Sixth International Conference on Document Analysis and Recognition*, September 2001, Seattle, WA.

- Panel Session Organizer, "The E-voting Controversy: What are the Risks?" (with H. Stewart-Gambino, C. Borick, B. Freeman, S. Freeman, and M. A. Gould), Lehigh University Department of Computer Science, April 2006, Bethlehem, PA.

- Panel Session Organizer/Moderator, "Noisy Text Analytics: An Exercise in Futility?" (with S. Balakrishnan, H. T. Ng, and R. Srihari), *IJCAI Workshop on Analytics for Noisy Unstructured Text Data*, January 2007, Hyderabad, India.

- Moderator, Congressional briefing on “Intelligent Infrastructure” for the House Committee on Science, Space and Technology, with panelists H. Schulzrinne (Columbia University), M. Wansley (nuTonomy), N. Bliss (Arizona State University), and E. Mynatt (Georgia Tech), Jan. 30, 2018, Washington, DC.
- Moderator, panel session on "“Rethinking Approaches to Disaster Management and Public Safety With Intelligent Infrastructure” at the Annual Meeting of the American Association for the Advancement of Science, with panelists M. Dunaway (University of Louisiana, Lafayette), R. Murphy (Texas A&M University), and N. Venkatasubramanian (University of California, Irvine), Feb. 16, 2018, Austin, TX.

Other

- Invited Debate Participant, “Defect Models are Important to Advance the State-of-the-Art of Optical Character Recognition” (with H. S. Baird, R. Haralick, and G. Nagy), *Fifth Annual Symposium on Document Analysis and Information Retrieval*, April 1996, Las Vegas, NV.

G. Teaching and Advising

Courses Taught (since joining Lehigh)

- CSE 303, *Operating System Design*, Fall 2003, 82 students enrolled in course (co-instructor with Donald Hillman).

- CSE 397-497, *Computational Issues in Molecular Biology*, Spring 2004, 15 students enrolled in course.

- CSE 303, *Operating System Design*, Fall 2004, 85 students enrolled in course (co-instructor with Donald Hillman).

- CSE 397-497, *Bioinformatics: Issues and Algorithms*, Spring 2005, 15 students enrolled in course.

- CSE 303, *Operating System Design*, Fall 2005, 66 students enrolled in course (co-instructor with Donald Hillman).

- CSE 397-497, *Special Topics in Bioinformatics*, Fall 2005, 5 students enrolled in course.

- CSE 398-498, *Bioinformatics: Issues and Algorithms*, Spring 2006, 16 students enrolled in course.

- Engr 005, *Introduction to Engineering Practice* (project supervisor), Fall 2006, 43 students enrolled in project over two sessions.

- CSE 303, *Operating System Design*, Fall 2006, 38 students enrolled in course.

- CSE 450, *Special Topics in Bioinformatics*, Fall 2006, 5 students enrolled in course.

- CSE 097, *Intelligent Machine: The Computer in Popular Culture*, Spring 2007, 33 students enrolled in course.

- CSE 308-408, *Bioinformatics: Issues and Algorithms*, Spring 2007, 19 students enrolled in course.

- Engr 005, *Introduction to Engineering Practice* (project supervisor), Spring 2007, 38 students enrolled in project over two sessions.

- CSE 303, *Operating System Design*, Fall 2007, 24 students enrolled in course.

- CSE 308-408, *Bioinformatics: Issues and Algorithms*, Fall 2007, 8 students enrolled in course.

- CSE 098, *Intelligent Machine: The Computer in Popular Culture*, Spring 2008, 26 students enrolled in course.

- CSE 498, *Computing in My Country*, Spring 2008, 4 students enrolled in course.

- CSE 303, *Operating System Design*, Fall 2008, 35 students enrolled in course.

- CSE 350-450, *Special Topics in Electronic Voting Systems*, Fall 2008, 7 students enrolled in course.

- CSE 098, *Intelligent Machine: The Computer in Popular Culture*, Spring 2009, 24 students enrolled in course.

- CSE 308-408, *Bioinformatics: Issues and Algorithms*, Spring 2009, 9 students enrolled in course.

- CSE 090, *Intelligent Machine: The Computer in Popular Culture*, Fall 2009, 20 students enrolled in course (first-year seminar in College of Arts & Sciences).

- CSE 130, *Technical Presentation*, Spring 2010, 15 students enrolled in course.

- CSE 308-408, *Bioinformatics: Issues and Algorithms*, Spring 2010, 8 students enrolled in course.

- CSE 090 / COGS 90, *Intelligent Machine: The Computer in Popular Culture*, Fall 2010, 23 students enrolled in course (first-year seminar in College of Arts & Sciences).

- CSE 303, *Operating System Design*, Spring 2011, 18 students enrolled in course.

- CSE 497, *Research Methodologies and Tools*, Fall 2011, 8 students enrolled in course.

- CSE 303, *Operating System Design*, Spring 2012, 15 students enrolled in course.
- CSE 347-447, *Data Mining*, Fall 2012, 25 students enrolled in course.

- CSE 252 / STS 252 / EMC 252, *Computers, Internet, and Society*, Spring 2013, 52 students enrolled in course (co-instructor with Ron Crane).

- CSE 406, *Research Methods*, Fall 2013, 6 students enrolled in course.

- CSE 347-447, *Data Mining*, Spring 2014, 46 students enrolled in course.

- CSE 397, *Issues in Cybersecurity*, Fall 2015, 8 students enrolled in course.

- CSE 398-498, *Big Data Analytics*, Spring 2016, 5 students enrolled in course.

- CSE 001, *Breadth of Computing*, Fall 2016, 38 students enrolled in course.

- CSE 098, *Women in Technology*, Spring 2017, 18 students enrolled in course (co-instructor with Samantha Kahoe, Managing Director of Lehigh@NasdaqCenter).

- CSE 350, *Special Topics in Cloud Computing Security*, Spring 2017, 7 students enrolled in course.

- CSE 398-498, *Big Data Analytics*, Spring 2017, 8 students enrolled in course.

- CSE 001, *Breadth of Computing*, Fall 2017, 35 students enrolled in course.

- CSE 098, *Women in Technology*, Spring 2018 (co-instructor with Samantha Dewalt, Managing Director of Lehigh@NasdaqCenter), 14 students enrolled in course.

- CSB 098 / CSE 098, *Software Product Management*, Spring 2018 (co-instructor with Samantha Dewalt, Managing Director of Lehigh@NasdaqCenter), 15 students enrolled in course.

- CSE 398-498, *Big Data Analytics*, Spring 2018, 20 students enrolled in course.

- CSE 001, *Breadth of Computing*, Fall 2018, 34 students enrolled in course.

- CSE 098, *Women in Technology*, Spring 2019 (co-instructor with Samantha Dewalt, Managing Director of Lehigh@NasdaqCenter), 20 students enrolled in course.

- CSE 350-450, *AI for Social Good*, Spring 2019, 14 students enrolled in course.

- CSE 098, *Women in Technology and Innovation*, Spring 2020 (co-instructor with Samantha Walravens, author of *Geek Girl Rising*, and Samantha Dewalt, Managing Director of Lehigh@NasdaqCenter), 10 students enrolled in course.

- CSE 327 / COGS 327, *Artificial Intelligence: Theory and Practice*, Spring 2020, 51 students enrolled in course.

- CSE 398, *Applying AI for Social Good*, Spring 2020, 9 students enrolled in course.

- CSE 398-498, *Big Data Analytics*, Fall 2020, 14 students enrolled in course.

- CSE 098, *Women in Technology and Innovation*, Spring 2021 (co-instructor with Samantha Walravens, author of *Geek Girl Rising*, and Samantha Dewalt, Managing Director of Lehigh@NasdaqCenter), 18 students enrolled in course.

- CSE 327 / COGS 327, *Artificial Intelligence: Theory and Practice*, Spring 2021, 47 students enrolled in course.

- CSE 398-498, *Big Data Analytics*, Fall 2021, 16 students enrolled in course.

- CSE 327 / COGS 327, *Artificial Intelligence: Theory and Practice*, Spring 2022, 47 students enrolled in course.

- CSE 349-449, *Big Data Analytics*, Fall 2022, 11 students enrolled in course.

- CSE 327 / COGS 327, *Artificial Intelligence: Theory and Practice*, Spring 2023, 55 students enrolled in course.

- CSE 349-449, *Big Data Analytics*, Fall 2023, 13 students enrolled in course.

- CSE 327 / COGS 327 / CSE 498, *Artificial Intelligence: Theory and Practice*, Spring 2024, 70 students enrolled in course.

- CSE 349-449, *Big Data Analytics*, Fall 2024, 8 students enrolled in course.

- CSE 406, *Research Methods*, Fall 2024, 13 students enrolled in course.

Course or Curriculum Development (since joining Lehigh)

- When I first arrived at Lehigh, I revamped our teaching of operating systems (CSE 303) and taught the course a number of times before it was taken over by a newer faculty member. I then developed a new course on bioinformatics algorithms and taught it several times on an experimental basis; it is now a regular offering by the department (CSE 308/408), and was taken over by a colleague. This course is also cross-listed as an elective in the undergraduate Bioengineering program. In Spring 2007, I introduced a new course, titled "Intelligent Machine: The Computer in

Popular Culture," which was designed to attract a broad range of students, not just CSE majors. I am also involved as a regular guest lecturer in an innovative survey course in the Life Sciences (BioS 095) as a result of HHMI support Lehigh has received over the years, which was taught for the first time in Fall 2007. In Spring 2008, I introduced another novel course named "Computing in My Country," a seminar that was aimed both at highlighting important advances in the field that are taking place outside of the United States as well as developing communication skills in our graduate students. In Fall 2008, I led a special topics course on electronic voting timed to coincide with the presidential election that year. In Fall 2015, I offered a new seminar course on cybersecurity that integrated technological, business, and policy issues. For Spring 2016, I developed a new course on big data analytics using Apache Spark and the Scala programming language, which has continued each Spring since then. For Spring 2017, I co-developed a new course on Women in Technology working with Samantha Kahoe from Lehigh and Tom Gillis, the co-founder and CEO of Bracket Computing, which was again be repeated in 2018, along with a new course on Software Product Management. Both of these courses made extensive use of a new telepresence room we created during the renovation of Mountaintop Building C, linking us with guest speakers who were experts in their areas in Silicon Valley. I also developed and lead the Software Engineering Track for the highly successful Lehigh Silicon Valley Program (LSV++). For 2018, we visited Lawrence Livermore National Laboratory, OSIsoft, Adobe, Cisco, Google, Plug & Play Tech Center, and Bracket Computing.

Independent Studies Taught (since joining Lehigh)

- Tyler Lund, "Civil War Letter Decryption," Computer Science Senior Project, Fall 2006.

- Joel Reisteter, "Voter Verified Paper Audit Trail: Audit Verification Program," Computer Science Senior Project, Fall 2006.

- Mark Weindling, "Test Procedures for an Electronic Voting System," Computer Science Senior Project, Fall 2006.

- Semih Demribag, "Dissecting a Voting Machine," Computer Science Senior Project, Fall 2007.

- Jeffrey Kleeblatt, "A System for 'Blind' Auditing of Paper Ballot Images," Compuer Science Senior Project, Fall 2007.

- Andrew Plummer, "A Hybrid Voting Machine," Computer Science Senior Project, Fall 2007.

- Arther Loder, "Advanced Readings in Computational Biology," Graduate Independent Study, Spring 2004.

- Kris Molendyke, “Research in Speech-Based Computer Security,” Graduate Independent Study, Summer 2004.

- Deepthi Bollu, “A Web-Based Platform to Support Document Analysis Research,” Graduate Independent Study, Spring 2005.
- Mark Strohmaier, “Algorithms and Architectures to Support Investigations in RNA Editing Effects,” Graduate Independent Study, Fall 2006.

- Wen Cheng, “Issues in Bioinformatics,” Graduate Independent Study, Spring 2007.

- Mark Strohmaier, “Algorithms and Architectures to Support Investigations in RNA Editing Effects,” Graduate Independent Study, Spring 2007.

- Wen Cheng, “Grammar-Based Approaches for Describing 2-D RNA Secondary Structure,” Graduate Independent Study, Fall 2007.

- Keerati Inthavisas, “Generative Attacks on Behavioral Biometric Security,” Graduate Independent Study, Fall 2007.

- Nicholas Hinnerschitz, “A Web-Based Synthetic Ballot Generator,” Independent Spring 2008.

- Joseph Siefers, “Firmware Analysis of the Danaher 1242 Electronic Voting Machine,” Independent Study, Spring 2008.

- Paul Beruti, “Data Mining Applied to the Search for RNA Editing Events,” Eckardt Scholar Project, Fall 2008 – Spring 2009.

- Wen Cheng, “Techniques for Amplifying Offline Handwriting Datasets,” Graduate Independent Study, Fall 2008.

- Young Suk and Rebecca Rovner, “Cracking an Unsolved Civil War Cipher,” Computer Science Senior Project, Fall 2008.

- Michael Kott, “Document Analysis and Exploitation User Experience Enhancement,” Independent Study, Spring 2011.

- Barri Bruno, “The Lehigh Steel Collection,” Independent Study, Fall 2013.

- Zachary Daniels, “Solving Cross-Cut Document Shredder Puzzles,” Independent Study, Fall 2013.

- Connor Tench, “Investigations in Free Space Gesture Recognition,” Independent Study, Fall 2013.

- Daniel Andsager and Marc Greenspan, “Remote Sensing Blimp,” Computer

Engineering Senior Project, Fall 2015 – Spring 2016.

- Hannah St. Lifer, "Data Mining from Social Network Sources," CogSci Honors Thesis, Fall 2015 – Spring 2016.
- Casey Caruso, "Stow Away: A Personal Savings App," Independent Study, Spring 2016.
- Lauren Mentzer, "Anime Tracking Application," Independent Study, Summer 2016.
- Harry Eaton and Cameron Clifton, "Environmental Monitoring System," Computer Engineering Senior Project, Fall 2016 – Spring 2017.
- Victoria Campell, JohnDerek Daniels, and Charles Sengor, "Investigations in Text Analytics," Rapidly Accelerated Research Experience: a focused science immersion program for students from backgrounds underrepresented in STEM fields, funded through Lehigh/HHMI, Summer 2017.
- Robert Salay and Joshua Whitton, "Automatic Music Transcription," Computer Science Senior Project, Fall 2017 (jointly supervised with Tom Collins, Psychology).
- Andrew Borghesani and Collin Messics, "IoT Automated Terrarium," Computer Engineering Senior Project, Fall 2017 – Spring 2018.
- Jasmin Cornejo and Rafia Islam, "Interactive Learning Platform for Nano-Human Interfaces," CSE Department REU, Summer 2020.
- Grant Armstrong, "Stylistic Imitation in First Person Shooter Games using Data Driven Spatial Analytics," CogSci Honors Thesis, Fall 2020 – Spring 2021.
- Jasmin Cornejo, "Interactive Learning Platform for Nano-Human Interfaces (continuation of Summer REU)," Research Intern, California State University Louis Stokes Alliance For Minority Participation Program, Fall 2020 – Spring 2021.
- Jiageng Zheng, "Reinforcement Learning for the Game of Go," Independent Study, Summer 2021, Summer 2022.
- Chloe Moros, Marcon Fellow, Summer 2022.
- Rakene Chowdhury, "Investigations in Machine Learning," Independent Study, Fall 2022.
- Kendra Marable, "Investigations in AI Gaming," Independent Study, Fall 2022.
- AJ Tabarani, "Recognition of Hand-Drawn Hieroglyphics Text," CSE Department REU, Summer 2023.

- Daniella Prado Arroyo, "AI and Music," Independent Study, Fall 2023, Spring 2024.
- Kunj Shah, "AI Ethics," Independent Study, Spring 2024.
- Ethan Feldman, "Issues in Generating and Evaluating Synthetic Data for Sensitive Machine Learning Applications," CSE Department REU, Summer 2024.

Advising, Other than Research Direction (since joining Lehigh): Undergraduate

- Freshman Engineering Advisees: 10 students in 2004 – 2005, 13 students in 2005 – 2006, 13 students in 2006 – 2007, 10 students in 2007 – 2008, 13 students in 2008 – 2009, 12 students in 2009-2010, 11 students in 2010-11.
- CSE Majors (including IBE/CS): 8 students in 2003 – 2004, 8 students in 2004 – 2005, 8 students in 2005 – 2006, 4 students in 2006 – 2007, 11 students in 2007 – 2008, 14 students in 2008 – 2009, 13 students in 2009-2010, 13 students in 2010-11, 14 students in 2013-14.
- Masters in CS: 26 students in 2020 – 2021, 37 students in 2021 – 2022.

Advising, Research Direction (since joining Lehigh): PhD Thesis Committees

- Carolyn Buckley, Lehigh Department of Biological Sciences (advisor J. Schneider), "Metabolic and Hormonal Signals Involved in Food Deprivation Induced Hoarding and Hunger Motivation in Syrian Hamsters," 2004 – 2006.
- Ashutosh Joshi, Department of Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Institute (advisor G. Nagy), "Symbolic Indirect Correlation Classifier," 2004 – 2006.
- Baoning Wu (advisor B. Davison), "Finding and Fighting Search Engine Spam," 2004 – 2007.
- Lucas Ballard, Department of Computer Science, Johns Hopkins University (advisor F. Monrose), "Secure Biometric Cryptographic Key Generators," 2007 – 2008.
- Michael Moll (advisor H. Baird), "Voracious Classifiers," 2006 – 2008.
- Lan Nie (advisor B. Davison), "Mining the Hyperlinks of the Web Graph," 2006 – 2008.
- Erdem Arslan (advisor I. Laurenzi), Lehigh Department of Chemical Engineering, "Stochastic Approach to Engineering and Analysis of DNA-based Microarray Technology," 2006 – 2008.

- Dylan Dupuis, Lehigh Department of Biological Sciences (advisors S. Maas, M. Kuchka), "Alu Repetitive Elements Transcribed by RNA Polymerase III are A-to-I RNA Editing Targets," 2008 – 2012.

- Na Dai (advisor B. Davison), "Mining Web Dynamics for Search," 2011 – 2013.
- Hongsheng Li (advisor X. Huang), "Mathematical Models for Object Matching and Their Application to Computer Vision and Biomedical Imaging" 2011 – 2012.

- Ting Xu (advisor X. Huang), "Model-based Curvilinear Network Segmentation and Tracking toward Quantitative Microscopy," 2013 – 2016.

- Zobeir Raisi, Department of Systems Design Engineering, University of Waterloo (advisor J. Zelek), "Text Detection and Recognition in the Wild," 2022.

Advising, Research Direction: Master's Students Supervised

- James Meyers, "Automating Multi-Locus Viability Analyses for Human Linkage with 'Emilie'," Brown University, Master's Degree completed July 1991, now President and CEO of Framework, Inc.

- Dishant Patel, "Online Handwriting as a Biometric," completed September 2006.

- Ivan Stoev, "A Machine Learning Approach to Prediction of RNA Editing Events," completed May 2010.

Advising, Research Direction: PhD Students Supervised

- Cheryl Harkness, "An Approach to Uncertainty in VLSI Design," Brown University, PhD degree completed June 1990, first position with Hewlett-Packard Design Technology Center, most recently self-employed.

- Richard Hughey, "An Architecture for Programmable Systolic Arrays," Brown University, PhD degree completed June 1991, most recently Professor and Chair of Computer Engineering at UC Santa Cruz.

- Keerati Inthavisas, "Secure Speech Biometric Templates," PhD degree completed November 2011, most recently Lecturer in Computer Engineering at Rajamangala University of Technology Srivijaya, Thailand.

- Yaoyao Zhu, "Towards More Desirable Segmentations via User Interactions," PhD degree completed September 2012, most recently with Checkpoint Systems (co-advised with X. Huang).

- Jin Chen, "Information Preserving Processing of Noisy Handwritten Document Images," PhD degree completed May 2015, first position with Nuance Communications, most recently with Apple.

- Nathan Kern, “Frameworks and Algorithms for Automated Simulation Data Analysis,” Fall 2017 – present (co-advised with W. Im).

Advising, Research Direction: Post-Docs Supervised

- Arti Taneja, “Investigations in Human-in-the-Loop Image Interpretation,” Spring 2019 – Spring 2020 (co-advised with M. Harmer).

H. Service

Service to University

- Accompanied President Greg Farrington and other representatives of Lehigh on *Inside Lehigh* west coast fundraising trip, June 2004.
- Represented Lehigh at University of Pittsburgh's kick-off event for “Center of Excellence First Responder Consortium,” April 2004.
- Participant in panel session at *Campaign for Lehigh* kick-off event: “Worldwide Threats: Converging Dangers in a Post 9/11 World” (with R. Blum, J. Bially Mattern, P. McHale, and A. Romig), October 2004.
- Faculty Steering Committee, RCEAS Representative, 2006 – 2010; Chair 2008 – 2009.
- Rules and Procedures Subcommittee of the Faculty Steering Committee, 2006 – 2010; Chair, 2007 – 2008.
- Barry M. Goldwater Scholarship Nomination Committee, 2006 – 2016.
- Department of Admissions, various undergraduate recruiting activities including serving as a featured speaker at “Lehigh Life Days” events, 2006 – present.
- Presidential Inauguration Committee, 2006 – 2007. University-wide coordinator for *An Exhibition of Student Research and Scholarship at Lehigh*, held April 12, 2007.
- Lehigh Strategic Thinking Initiative, Co-Chair of the Faculty & Staff Working Group (with S. Cady), Spring 2008.
- Provost Search Committee, Fall 2008 – Spring 2009.
- Advisory Committee, *2009 Academic Symposium: A Tradition of Excellence*, held April 16, 2009.

- Advisory Committee, Lehigh Howard Hughes Medical Institute program, 2009 – 2014.

- Department Chairs Executive Committee, 2009 – 2014. 2016 – 2019; Chair, 2011 – 2012.

- Lehigh Strategic Plan Implementation, Co-Chair of the Cluster Development Working Group (with A. Anderson), Spring 2010.

- Lehigh / Universiti Teknologi Petronas (Malaysia) R&D Collaboration Working Committee, 2010 – 2011.

- University Nominations Committee, 2010 – 2013; Chair, 2011 – 2012.

- Lehigh Strategic Plan Implementation, Co-Chair of the Cluster Faculty Hiring Committee (with A. Anderson), Fall 2010 – Spring 2013. Led to the establishment of three faculty-conceived interdisciplinary clusters at Lehigh: Africana Studies, Integrated Networks for Electricity (SmartGrid), and Community Health.

- Accompanied Vice President of International Affairs Mohamed El-Aasser and other representatives of Lehigh on trip to develop research and educational collaborations with Malaysian universities, October 2010.

- Advisory Committee, *2011 Academic Symposium*, held March 29, 2011.

- Board of Trustees Academic Affairs Committee, 2011 – 2012 (faculty representative).

- Advisory Committee, *2013 Academic Symposium*, April 4, 2013.

- Lehigh Mountaintop Development Working Group, 2013 – 2015.

- Lehigh Cyber Governance, Risk Management and Compliance Committee, 2013 – present; Privacy Policy Subcommittee, 2025 – present.

- Lehigh ADVANCE Male Allies for Gender Equity, Fall 2013 – present.

- Lehigh ADVANCE Leadership Team, Spring 2014 – present.

- Academic Infrastructure Working Group, 2016 – 2018.

- Consulting Committee, NEH Next Generation Humanities Ph.D. Planning Grant (awarded to Lehigh Departments of English and History), 2016 – 2017.

- As Director of the Data X Initiative, I provide support to strategic interdisciplinary faculty hiring activities across the university with emphasis on computing and data analytics and particular focus in the areas of data mining, cybersecurity, computer systems, consumer analytics, digital media, and connected health. I am also the primary faculty lead for the large-scale renovation of a massive former industrial building on Lehigh's Mountaintop campus to serve as the new home for Data X.

- Creator and leader of the Software Engineering Track for the highly successful Lehigh Silicon Valley Program (LSV++), 2017 – 2019.

- Steering Committee, IDEAS Program (Integrated Degree in Engineering, Arts, and Sciences), 2020 – present.

- Lehigh Library and Technology Services Faculty Committee, 2023 – present.

- Advisory Board, Marcon Institute, 2024 – present.

- Lehigh Faculty Recruitment Ambassador, 2024 – present.

Service to College and Interdisciplinary Programs

- Bioengineering Graduate Program Committee, 2004 – 2019.

- RCEAS Bio, Environmental, and Molecular Engineering Advisory Council, 2006 – 2019.

- RCEAS Faculty Retreat Planning Committee, 2008 – 2009.

- RCEAS Workshop on Computational Engineering & Science Organizing Committee, October 2009.

- Global Citizenship Faculty Seminar participant, January 2007 – April 2007.

- Diversity Across the Curriculum Faculty Seminar participant, April 2009 – May 2009.

- RCEAS Council of Chairs, 2009 – 2019.

- RCEAS Professorship Appointment Committee, 2013.

- Co-leader of the Nano/Human Interfaces Presidential Engineering Research Initiative (with Martin Harmer, Jeffrey Rickman, Anand Jagota, and Kate Arrington), 2017 – present.

- Co-Chair, Bioengineering Department Chair Search Committee (with Xuanhong Cheng), Spring 2018.

- Bioengineering Department Chair Search Committee, Fall 2019 – Spring 2020.

- Master's Program Incentives Ad Hoc Committee, Fall 2020.

Service to Department

- CSE Department Faculty Recruiting Committee, where I helped to recruit Professor Henry Baird to Lehigh, 2003 – 2004.
- CSE Department Graduate Program Committee, where I helped to craft a major overhaul of our PhD program qualifier requirements designed to strengthen the quality of our pool of graduate students, 2003 – 2004.
- Chair of CSE Department Community Committee, which has instituted a series of successful “study breaks” to bring together faculty and students (especially undergraduates), 2004 – 2005.
- CSE Department Colloquium Committee, where I have invited and served as host for a number of speakers in our department seminar series, 2004 – 2005.
- I established a weekly “brown bag lunch” series that brings together faculty, staff, and students with interests in the area of digital libraries, 2004 – 2006.
- I have participated in Candidates' Day, Parents' Day, and information sessions for high school students considering Lehigh, 2004 – present.
- Chair of CSE Department Colloquium Committee, where I conceived and organized our Distinguished Seminar Series, 2005 – 2006.
- CSE Department Faculty Recruiting Committee, where I helped to recruit Professor Xiaolei Huang to Lehigh, 2005 – 2006.
- Chair of CSE Department Publicity and Undergraduate Recruiting Committee, 2006 – 2007, where I have organized outreach activities to local schools.
- Chair of CSE Department Faculty Recruiting Committee, where I helped to recruit Professor Gang Tan to Lehigh, 2007 – 2008.
- CSE Department Faculty Recruiting Committee, 2008 – 2009.
- CSE Department Graduate Admissions Committee, 2020 – 2023.
- Masters in Computer Science program: Director, 2020 – 2022; Co-Director (with C. Montella), 2023.
- CSE Department Student Honors and Awards Committee, 2022 – present; Chair, 2022 – 2024.
- CSE Department Faculty Recruiting Committee, 2023 – present; Co-Chair (with R. Palmieri), 2024 – present.

Professional: Offices and Committee Memberships Held in Professional Organizations

- Local Arrangements Chair, *Brown/MIT Conference on Advanced Research in VLSI and Parallel Systems*, Providence, RI, March 1992.

- Co-Chair (with J. Zhou), *Document Recognition V (IS&T/SPIE International Symposium on Electronic Imaging)*, San Jose, CA, January 1998.

- Local Arrangements Chair, Document Understanding Working Group Meeting, Murray Hill, NJ, August 1998.

- Co-Chair (with J. Zhou), *Document Recognition and Retrieval VI (IS&T/SPIE International Symposium on Electronic Imaging)*, San Jose, CA, January 1999

- Co-Chair (with J. Zhou), *Document Recognition and Retrieval VII (IS&T/SPIE International Symposium on Electronic Imaging)*, San Jose, CA, January 2000.

- Co-Chair (with P. Kantor and J. Zhou), *Document Recognition and Retrieval VIII (IS&T/SPIE International Symposium on Electronic Imaging)*, San Jose, CA, January 2001.

- Co-Chair (with J. Hu and R. Kashi), *Fifth International Workshop on Document Analysis Systems*, Princeton, NJ, August 2002.

- Co-Chair (with H. Baird), *Second International Workshop on Human Interactive Proofs*, Bethlehem, PA, May 2005.

- Founding Co-Chair (with C. Knoblock, S. Roy, and L. V. Subramaniam), *Workshop on Analytics for Noisy Unstructured Text Data (in association with the Twentieth International Joint Conference on Artificial Intelligence)*, Hyderabad, India, January 2007.

- Co-Chair (with S. Roy, K. Schulz, and L. V. Subramaniam), *Second Workshop on Analytics for Noisy Unstructured Text Data (in association with the Thirty-First International ACM SIGIR Conference)*, Singapore, July 2008.

- Co-Chair (with S. Roy, K. Schulz, and L. V. Subramaniam), *Third Workshop on Analytics for Noisy Unstructured Text Data (in association with the Tenth International Conference on Document Analysis and Recognition)*, Barcelona, Spain, July 2009.

- Program Co-Chair (with S. Chaudhury), *Second International Workshop on Multilingual OCR (in association with the Tenth International Conference on Document Analysis and Recognition)*, Barcelona, Spain, July 2009.

- Co-Chair (with P. Natarajan, V. Govindaraju, and D. Doermann), *Nineth International*

Workshop on Document Analysis Systems, Cambridge, MA, June 2010.

- Co-Chair (with R. Basili, C. Ringlstetter, S. Roy, K. Schulz, and L. V. Subramaniam), *Fourth Workshop on Analytics for Noisy Unstructured Text Data (in association with the Nineteenth ACM International Conference on Information and Knowledge Management)*, Toronto, Canada, October 2010.

- Co-Chair (with S. Chaudhury, L. Day, V. Govindaraju, P. Natarajan, C. Ringlstetter, and S. Roy), *Joint Workshop on Multilingual OCR and Analytics for Noisy Unstructured Text Data (in association with the Eleventh International Conference on Document Analysis and Recognition)*, Beijing, China, September 2011.

- Founding Chair, *IAPR 2011 Doctoral Consortium (in association with the Eleventh International Conference on Document Analysis and Recognition)*, Beijing, China, September 2011.

- Program Co-Chair, *Eleventh International Conference on Document Analysis and Recognition*, Beijing, China, September 2011.

- Track Co-Chair (with K. Kise), *Twenty-First International Conference on Pattern Recognition*, Tsukuba Science City, Japan, November 2012.

- Co-Chair (with C. Ringlstetter, L. Day, S. Roy, and L. V. Subramaniam), *Sixth Workshop on Analytics for Noisy Unstructured Text Data (in association with the Twenty-Fourth International Conference on Computational Linguistics)*, Mumbai, India, December 2012.

- Local Arrangements Chair, *Tenth IAPR International Workshop on Graphics Recognition*, Bethlehem, PA, August 2013.

- Executive Co-Chair, *Twelfth International Conference on Document Analysis and Recognition*, Washington, DC, August 2013.

- Program Co-Chair (with J. LLadós and M. Blumenstein), *Twelfth International Workshop on Document Analysis Systems*, Santorini, Greece, April 2016.

- Area Chair (Document Analysis, Biometrics and Pattern Recognition Applications), *Twenty-Third International Conference on Pattern Recognition*, Cancun, Mexico, December 2016.

- Program Co-Chair (with M. Liwicki, M. Coustaty, and B. Lamiroy), *International Workshop on Open Services and Tools for Document Analysis*, Kyoto, Japan, November 2017.

- Program Co-Chair (with D. Karatzas and C.V. Jawahar), *Fourteenth International Conference on Document Analysis and Recognition*, Kyoto, Japan, November 2017.

- WiDS Ambassador, Lehigh livestream for *Stanford Women in Data Science Conference*, March 2018, March 2019.

- Program Co-Chair (with B. Gatos, J-M Ogier, and K. Kise), *Thirteenth International Workshop on Document Analysis Systems*, Vienna, Austria, April 2018.

- Co-Chair (with B. Kerautret, M. Colom, B. Lamiroy, P. Monasse, J-M Morel, and H. Talbot), *Second Workshop on Reproducible Research in Pattern Recognition*, Beijing, China, August 2018.

- Area Chair (Document Analysis and Recognition), Publications Chair, *Twenty-Fourth International Conference on Pattern Recognition*, Beijing, China, August 2018.

- International Advisory Committee, *Third International Conference on Computer Vision & Image Processing*, Jabalpur, India, September-October 2018.

- Organizing Committee, *Code 8.7 Conference on Using Computational Science and Artificial Intelligence to End Modern Slavery*, UN Headquarters, New York, NY, February 2019.

- Tutorials Co-Chair (with J. Lladós), *Fifteenth International Conference on Document Analysis and Recognition*, Sydney, Australia, September 2019.

- Workshop Co-Chair, *CCC / Code 8.7 Workshop on Applying AI in the Fight Against Modern Slavery*, Washington, DC, March 2020.

- Program Co-Chair (with X. Bai and D. Karatzas), *Fourteenth International Workshop on Document Analysis Systems*, Wuhan, China (virtual), July 2020.

- Tutorials Chair, *Seventeenth International Conference on Frontiers in Handwriting Recognition*, Dortmund, Germany, September 2020.

- International Advisory Committee, *Fifth International Conference on Computer Vision & Image Processing*, Allahabad, India, October 2020.

- Area Chair (Document Analysis and Recognition), *Twenty-Fifth International Conference on Pattern Recognition*, Milan, Italy, January 2021.

- Co-Chair (with B. Kerautret, M. Colom, P. Monasse, J-M Morel, and H. Talbot), *Third Workshop on Reproducible Research in Pattern Recognition*, Milan, Italy, January 2021.

- Program Co-Chair (with J. Lladós and S. Uchida), *Sixteenth International Conference on Document Analysis and Recognition*, Lausanne, Switzerland, September 2021.

- International Advisory Committee, *Sixth International Conference on Computer Vision*

& Image Processing, Punjab, India, December 2021.

- Doctoral Consortium Co-Chair (with V. Elgin), *Third International Conference on Pattern Recognition and Artificial Intelligence*, Paris, France, June 2022.

- International Advisory Committee, *International Conference on Computer Vision & Machine Intelligence*, Allahabad, India, August 2022.

- Co-Chair (with B. Kerautret, M. Colom, P. Monasse, J-M Morel, B. Perret, H. Talbot, and B. Yildiz), *Fourth Workshop on Reproducible Research in Pattern Recognition*, Montréal, Canada, August 2022.

- International Advisory Committee, *Seventh International Conference on Computer Vision & Image Processing*, Nagpur, India, November 2022.

- International Advisory Committee, *Third International Conference on Computer Vision & Machine Intelligence*, Allahabad, India, October 2024.

- Co-Chair (with B. Kerautret, M. Colom, P. Monasse, J-M Morel, B. Perret, H. Talbot, and B. Yildiz), *Fifth Workshop on Reproducible Research in Pattern Recognition*, Kolkata, India, December 2024.

- Doctoral Consortium Co-Chair (with V. Elgin), *Twenty-Seventh International Conference on Pattern Recognition*, Kolkata, India, December 2024.

- Program Co-Chair (with X-C Yin and D. Karatzas), *Nineteenth International Conference on Document Analysis and Recognition*, Wuhan, China, September 2025.

- International Advisory Committee, Tenth International Conference on Computer Vision & Image Processing, Ropar, India, December 2025.

- General Co-Chair (with J-M Ogier, T. K. Ho, and C-L Liu), *Twenty-Eighth International Conference on Pattern Recognition*, Lyon, France, August 2026.

- Program Co-Chair (with G. Fink, A. Fornes, and K. Kise), *Twentieth International Conference on Document Analysis and Recognition*, Vienna, Austria, August-September 2026.

- General Co-Chair (with U. Pal, J-M Ogier, and C-L Liu), *Twenty-First International Conference on Document Analysis and Recognition*, Kuala Lumpur, Malaysia, August 2027.

- Scientific Advisory Board, KYOS Systems Inc., Canton, MA, June 2005 – 2007.

- Lehigh University Chapter of Sigma Xi Honorific Society: Secretary-Elect, 2005 – 2006; Secretary, 2006 – 2007.

- Board of Directors, Manufacturer's Resource Center, Allentown, PA, Sept. 2014 – Sept. 2016.
- Appointed Member, Northampton County Election Commission, First Term Jan. 2020 – Dec. 2021, Second Term Jan. 2022 – Dec. 2023, Third Term Jan. 2024 – Dec. 2025.
- Leadership Team (Seed Fund Steering Committee), Northeast Big Data Innovation Hub, 2020 – 2021.

- International Association for Pattern Recognition (IAPR)*

  Conferences and Meetings Committee, 2003 – 2018, Chair 2014 – 2018; Technical Committee 11 ("Reading Systems") Chair 2009 – 2013; Ad Hoc Committee on IAPR 50th Anniversary Celebration, Chair 2022 – 2024; Technical Committee 22 ("Reproducible Research in Pattern Recognition") Co-Founder 2024 – present; IAPR Executive Committee 2018 – 2024; Treasurer (elected) 2018 – 2021; President (elected) 2021 – 2022; Past-President 2022 – 2024; Nominating Committee, Chair 2022 – 2024; Advisory Committee 2022 – present.

  ** The IAPR is an international association of non-profit, scientific, and professional organizations (national, multi-national, or international in scope) concerned with research in pattern recognition, computer vision, and image processing. IAPR was established in January 1978 and currently consists of 50 national societies, bringing together nearly 10,000 researchers in these fields. The organizational structure of IAPR include 13 Standing Committees and 17 Technical Committees. IAPR sponsors or endorses several dozen conferences and workshops annually for the benefit of the international scientific community.*

- Computing Research Association (CRA)*

  Board of Directors (ex officio), 2022 – 2024; Finance Committee, 2022 – 2024; Working Group on Socially Responsible Computing, 2023 – present, Ethics Education Subcommittee, 2024 – present; CRA-Microsoft Responsible AI Training Network Advisory Committee, 2025 – present.
- "Conference Submission and Review Policies to Foster Responsible Computing Research" (CRA Report), L. Cranor, K. Hazelwood, D. Lopresti, and A. Stent, July 2024.

  ** The Computing Research Association (CRA) has origins dating back to 1972 as the Computer Science Board. CRA counts among its members more than 200 North American organizations active in computing research: academic departments of computer science and computer engineering; laboratories and centers in industry, government, and academia; and affiliated professional societies (AAAI, ACM, CACS/AIC, IEEE Computer Society, SIAM, and USENIX).*

- Computing Research Association's Computing Community Consortium (CCC)*

  CCC Council, 2015 – present; Nominations Committee, 2017, Chair 2020 – 2022; Executive Committee, 2017 – present; Intelligent Infrastructure Task Force, Co-Chair with B. Zorn, 2017 – 2018, Co-Chair with E. Mynatt, 2018 – 2019; Cybersecurity and Cybercrime Task Force, 2018 – 2019, Chair 2019 – 2020; Roadmap for Artificial Intelligence Research Steering Committee, 2018 – 2019; Technology for a Connected and Distributed Life Task Force, 2020 – 2021; Visioning Workshop Ad Hoc Committee, Chair 2020 – 2021; CCC Council Vice Chair, 2020 – 2022; Computing Innovation Fellows Selection Committee, 2021; Security, Integrity, and Trust Task Force, 2021 – 2022; NextGen AI Task Force, 2022 – 2023; Grand Challenges in Computing Task Force, 2023 – present; CCC Council Chair, 2022 – 2024; CCC Council Chair Emeritus, 2024 – present; CCC Visioning Proposal Review Committee, Chair 2024 – present.

- "Systems Computing Challenges in the Internet of Things" (CCC Whitepaper), R. Alur, E. Berger, A. W. Drobnis, L. Fix, K. Fu, G. D. Hager, D. Lopresti, K. Nahrstedt, E. Mynatt, S. Patel, J. Rexford, J. A. Stankovic, and B. Zorn, September 2015.
- "Smart Communities Internet of Things" (CCC Whitepaper), K. Nahrstedt, D. Lopresti, B. Zorn, A. W. Drobnis, E. Mynatt, S. Patel, and H. V. Wright, January 2016.
- "The Future of Computing Research: Industry-Academia Collaborations" (CCC Whitepaper), N. Boules, K. Douglas, S. Feldman, L. Fix, G. Hager, B. Hailpern, M. Hebert, D. Lopresti, B. Mynatt, Chris Rossbach, and Helen Wright, May 2016.
- "Safety, Security, and Privacy Threats Posed by Accelerating Trends in the Internet of Things" (CCC Whitepaper), K. Fu, T. Kohno, D. Lopresti, E. Mynatt, K. Nahrstedt, S. Patel, D. Richardson, and B. Zorn, February 2017.
- "Computing Community Consortium (CCC) Response to NITRD 'Smart Cities and Communities Federal Strategic Plan: Exploring Innovation Together'" (CCC Whitepaper), E. Mynatt, D. Lopresti, K. Nahrstedt, S. Patel, J. Rexford, and B. Zorn, March 2017.
- "A National Research Agenda for Intelligent Infrastructure" (CCC Whitepaper), E. Mynatt, J. Clark, G. Hager, D. Lopresti, G. Morrisett, K. Nahrstedt, G. Pappas, S. Patel, J. Rexford, H. Wright, and B. Zorn, March 2017.
- "Research Agenda in Intelligent Infrastructure to Enhance Disaster Management, Community Resilience and Public Safety" (CCC Whitepaper), M. Dunaway, R. Murphy, N. Venkatasubramanian, L. Palen, and D. Lopresti, March 2017.
- "Rethinking Approaches to Disaster Management and Public Safety with Intelligent Infrastructure" (AAAS Panel Session), M. Dunaway, R. Murphy, and N. Venkatasubramanian, with D. Lopresti moderator, Annual Meeting of the American Association for the Advancement of Science, Austin, TX, February 2018.
- Featured guest on several CCC Catalyzing Computing Podcasts, 2019.
- "Artificial Intelligence Research: A Community Roadmap" (AAAS Panel Session), Y. Gil, B. Selman, and D. Lopresti, with A. Drobnis moderator, Annual Meeting of the American Association for the Advancement of Science, Seattle, WA, February 2020.
- Co-Chair (with N. Bliss, M. Briers, A. Eckstein, J. Goulding, A. Mazumder, and G. Smith), CCC / Code 8.7 Workshop on Applying AI in the Fight Against Modern Slavery, Washington, DC, March 2020.
- "Computing Research Challenges in Next Generation Wireless Networking" (CCC Whitepaper), E. Bertino, D. Bliss, D. Lopresti, L. Peterson, and H. Schulzrinne, October 2020.
- "A Research Ecosystem for Secure Computing" (CCC Whitepaper), N. Bliss, L. A. Gordon, D. Lopresti, F. Schneider, and S. Venkatasubramanian, November 2020.
- "Pandemic Informatics: Preparation, Robustness and Resilience" (CCC Whitepaper), E. Bradley, W. Gropp, D. Lopresti, M. Marathe, and M. Moses, November 2020. Also addenda: "Pandemic Informatics: Vaccine Distribution, Logistics, and Prioritization,"

March 2021; "Pandemic Informatics: Variants of Concern (VOC)," April 2021.

- "Artificial Intelligence and Cooperation" (CCC Whitepaper), E. Bertino, F. Doshi-Velez, M. Gini, D. Lopresti, and D. Parkes, November 2020.
- "Next Wave Artificial Intelligence: Robust, Explainable, Adaptable, Ethical, and Accountable" (CCC Whitepaper), O. C. Jenkins, D. Lopresti, and M. Mitchell, November 2020.
- "A National Research Agenda for Intelligent Infrastructure: 2021 Update" (CCC Whitepaper), D. Lopresti and S. Shekhar, December 2020.
- "A National Discovery Cloud: Preparing the US for Global Competitiveness in the New Era of 21st Century Digital Transformation" (CCC Whitepaper), I. Foster, D. Lopresti, B. Gropp, M. Hill, and K. Schuman, April 2021.
- "CCC / Code 8.7 Applying AI in the Fight Against Modern Slavery" (CCC Whitepaper), D. Lopresti, N. Bliss, M. Briers, A. Eckstein, J. Goulding, A. Mazumder, and G. Smith, June 2021.
- CCC Liaison for Workshop on Artificial Intelligence / Operations Research, co-sponsored by CCC, INFORMS, and SIGAI, Virtual, September 2021.
- Co-Chair (with S. Banerjee, M. Gini, and H. Yanko), CCC Hybrid Workshop on Best Practices for Hybrid Workshops, Multiple Sites and Virtual, October 2021.
- "Response to RFI on Public and Private Sector Uses of Biometric Technologies" (CCC RFI Response), D. Danks, M. Gini, O. C. Jenkins, D. Lopresti, M. Mitchell, and K. Siek, January 2022.
- "Intelligent Infrastructure for All: Challenges and Opportunities" (AAAS Panel Session), M. Ryerson, A. Tomer, and C. Krintz, with S. Shekhar moderator and D. Lopresti co-organizer, Annual Meeting of the American Association for the Advancement of Science, Philadelphia, PA, February 2022.
- "Response to RFI to the Update of the National Artificial Intelligence Research and Development Strategic Plan" (CCC RFI Response), D. Danks, M. Gini, O. C. Jenkins, S. Koenig, D. Lopresti, M. Mitchell, K. Siek, U. Topcu, H. Yanco, and M. Hunter, March 2022.
- "'Meta Hybrid' Visioning Activity Report Out" (CCC Visioning Workshop Report), S. Banerjee, M. Gini, D. Lopresti, and H. Yanco, March 2022.
- "Reboot!" (CCC Panel Session at 2022 CRA Conference at Snowbird), S. Banerjee, N. Bliss, L. Bradley, W. Gropp, and D. Lopresti, July 2022.
- "Response to RFI on the 2023 Federal Cybersecurity Research and Development Strategic Plan" (CCC RFI Response), N. Bliss, E. Bradley, R. Burns, T. M. Conte, D. Danks, N. Evans, K. Fu, H. Griffen, W. D. Gropp, D. Jensen, C. Krintz, B. LaMacchia, D. Lopresti, M. Marathe, M. Moses, A. W. Schwartz, U. Topcu, and P. Wisniewski, March 2023.
- "Response to RFI on AI Accountability Policy" (CCC RFI Response), N. Bliss, D. Danks, M. Gini, J. Gorman, W. Gropp, M. Hunter, O. C. Jenkins, D. Jensen, D. Lopresti, B. Selman, U. Topcu, T. Toscos, and P. Wisniewski, June 2023.
- "Response to RFI on National Priorities for Artificial Intelligence" (CCC RFI Response), J. Biddle, E. Bradley, D. Danks, M. Gini, A.K. Goel, A. Guha, M. Hunter, D. Jensen, S. Koenig, C. Krintz, D. Lopresti, A. McGovern, D. Molzahn, R. Rajaraman, A. Singh, M. Turk, and H. Yanco, July 2023.
- "Response to PCAST Working Group on Generative AI Invites Public Input" (CCC RFI Response), M. Gini, M. Hunter, S. Koenig, D. Lopresti, R. Rajaraman, U. Topcu,

M. Turk, and H. Yanco, July 2023.

- "Response to RFI on Developing a Roadmap for the Directorate for Technology, Innovation, and Partnerships at the National Science Foundation" (CCC and GAC RFI Response), A. Aiken, N. Bliss, E. Bradley, K. Butler, T. Camp, D. Danks, C. Gill, W. Gropp, P. Harsha, C. Krintz, B. LaMacchia, D. Lopresti, B. Mosley, A. Schwartz, K. Siek, M. Taufer, U. Topcu, P. Wisniewski, and H. Yanko, July 2023.
- "Response to White House National Cyber Director Requests Feedback on Open-source Software Security" (CCC RFI Response), K. Butler, D. Danks, D. Lopresti, and M. Hunter, October 2023.
- "Response to the Office of Management and Budget's Request for Comments on Advancing Governance, Innovation, and Risk Management for Agency Use of Artificial Intelligence Draft Memorandum" (CCC RFI Response), D. Danks, H. Griffin, D. Jensen, C. Krintz, D. Lopresti, R. Rajaraman, M. Turk, and H. Yanco, December 2023.
- "Response to the Request for Information (RFI) Related to NIST's Assignments Under Sections 4.1, 4.5 and 11 of the Executive Order Concerning Artificial Intelligence (Sections 4.1, 4.5, and 11)" (CCC RFI Response), D. Danks, C. Gill, D. Lopresti, R. Rajaraman, M. Taufer, U. Topcu, M. Turk, and H. Yanco, February 2024.
- "Response to the National Telecommunications and Information Administration (NTIA) Request for Information: Dual Use Foundation Artificial Intelligence Models With Widely Available Model Weights" (CCC RFI Response), M. Buehler, D. Danks, C. Fiesler, C. Gill, D. Lopresti, and D. Watson-Parris, April 2024.
- "Response to the National Institute of Justice's Request for Input on Section 7.1(b) of Executive Order 14110, "Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence"" (CCC RFI Response), N. Bliss, K. Butler, D. Danks, S. Forrest, C. Gill, D. Lopresti, M. L. Maher, H. Mentis, C. Moore, S. Shekhar, A. Stent, and M. Turk, May 2024.
- CCC Liaison for Workshop on the Future of Information Retrieval Research in the Age of Generative AI, J. Allen, E. Choi, and H. Zamani, co-organizers, Washington, DC, July 2024.
- "Response to the Defense Industrial Base Adoption of Artificial Intelligence for Defense Applications; Notice of Availability" (CCC RFI Response), A. Aiken, N. Bliss, D. Danks, C. Gill, D. Jensen, D. Lopresti, M. L. Maher, C. Moore, W. Regli, and M. Turk, July 2024.
- "Response to the Networking and Information Technology Research and Development Request for Information on Digital Twins Research and Development" (CCC RFI Response), D. Danks, C. Gill, C. Krintz, B. LaMacchia, D. Lopresti, M. L. Maher, and P. Wisniewski, July 2024.
- "Response to the Request for Comments on the U.S. Artificial Intelligence Safety Institute's Draft Document: Managing Misuse Risk for Dual-Use Foundation Models" (CCC RFI Response), D. Danks, C. Gill, M. Lin, D. Lopresti, M. Parashar, W. Regli, and M. Turk, September 2024.
- "Response to the National Science Board–National Science Foundation (NSF) Commission on Merit Review (MRX) Request for Information on Informing the MRX's Review of NSF's Merit Review Criteria, Policy, and Processes" (CCC RFI Response), D. Lopresti, K. Siek, E. Bruce, S. Koenig, M. L. Maher and H. Griffin, September 2024.
- "CCC's Response to the DOE's Request for Information (RFI) on Frontiers in AI for

Science, Security, and Technology (FASST) Initiative" (CCC RFI Response), D. Danks, C. Gill, I. Foster, W. Gropp, D. Lopresti, M. Parashar, M. Turk, and K. Yelick, November 2024.

- "CCC's Response to the Request for Information on the CHIPS and Science Act Section 10343. Research Ethics" (CCC RFI Response), R. Burns, D. Danks, S. Dwarkadas, C. Gill, D. Lopresti, and M. Taufer, November 2024.
- "Future of Information Retrieval Research in the Age of Generative AI CCC Workshop Report," J. Allan, E. Choi, D. Lopresti, and H. Zamani, December 2024.
- "Lessons for Cybersecurity from the American Public Health System" (CRA CCC Quadrennial Paper), A. Shostack, L. J. Camp, Y. T. Chua, J. Dykstra, B. LaMacchia, and D. Lopresti, January 2025.
- "Enabling the AI Revolution in Healthcare" (CRA CCC Quadrennial Paper), M. Singh, K. Siek, D. Danks, R. Ghani, H. Griffin, B. LaMacchia, D. Lopresti, and T. Toscos, February 2025.
- "CCC's Response to the Request for Comments on NSF's Proposed Intellectual Property Options" (CCC RFI Response), D. Danks, C. Gill, D.Lopresti, B. Mosely, P. Wisniewski, and H. Yanco, February 2025.

** CCC was established in 2006 in response to an NSF solicitation indicating a desire to establish a Computing Community Consortium. The CCC proposal received letters of support from 132 Ph.D.-granting academic programs, 16 leading corporations, seven major national laboratories and research centers, and five professional societies in the field. CCC operates through a cooperative agreement between NSF and CRA, the Computing Research Association. Today, the CCC Council has 20 members serving 3-year staggered terms, representing the diverse nature of the computing research field. The mission of the CCC is to enable the pursuit of innovative, high-impact computing research that aligns with pressing national and global challenges. CCC is a major programmatic committee of the CRA.*

- Member of Conference Program Committees for: Second IAPR Workshop on Document Analysis Systems (October 1996), Third IAPR Workshop on Document Analysis Systems, (November 1998), Fifth International Conference on Document Analysis and Recognition (September 1999), IEEE Conference on Computer Vision and Pattern Recognition (June 2000), Seventh International Workshop on Frontiers in Handwriting Recognition (August 2000), Fourth IAPR Workshop on Document Analysis Systems (December 2000), International Workshop on Web Document Analysis (September 2001), Sixth International Conference on Document Analysis and Recognition (September 2001), Seventh International Workshop on Multimedia Information Systems (November 2001), Document Recognition and Retrieval IX (January 2002), Fourth International Workshop on Multimedia Information Retrieval (December 2002), Document Recognition and Retrieval X (January 2003), Workshop on Document Image Analysis and Retrieval (June 2003), Seventh International Conference on Document Analysis and Recognition (August 2003), Second International Workshop on Web Document Analysis (August 2003), Document Recognition and Retrieval XI (January 2004), International Workshop on Document Analysis for Digital Libraries (January 2004), Sixth International Workshop on Document Analysis Systems (September 2004), Document Recognition and Retrieval XII (January 2005), 20th Annual ACM Symposium on Applied Computing (March

2005), Third International Workshop on Web Document Analysis (August 2005), Eighth International Conference on Document Analysis and Recognition (August 2005), Third International Conference on Advances in Pattern Recognition (September 2005), International Conference on Cognition and Recognition (December 2005), Document Recognition and Retrieval XIII (January 2006), Seventh International Workshop on Document Analysis Systems (February 2006), 21st Annual ACM Symposium on Applied Computing (April 2006), 18th International Conference on Pattern Recognition (August 2006), Workshop on Analytics for Noisy Unstructured Text Data (January 2007), Document Recognition and Retrieval XIV (January-February 2007), 22nd Annual ACM Symposium on Applied Computing (March 2007), International Workshop on Advances in Pattern Recognition (July 2007), Ninth International Conference on Document Analysis and Recognition (September 2007), Document Recognition and Retrieval XV (January 2008), 23rd Annual ACM Symposium on Applied Computing (March 2008), 11th International Conference on Frontiers in Handwriting Recognition (August 2008), Eighth International Workshop on Document Analysis Systems (September 2008), 19th International Conference on Pattern Recognition (December 2008), Document Recognition and Retrieval XVI (January 2009), 10th International Conference on Document Analysis and Recognition (July 2009), Document Recognition and Retrieval XVII (January 2010), 25th Annual ACM Symposium on Applied Computing (March 2010), 22nd International Conference on Tools with Artificial Intelligence (October 2010), 12th International Conference on Frontiers in Handwriting Recognition (November 2010), Document Recognition and Retrieval XVIII (January 2011), 26th Annual ACM Symposium on Applied Computing (March 2011), 11th International Conference on Document Analysis and Recognition (September 2011), 23rd International Conference on Tools with Artificial Intelligence (November 2011), Document Recognition and Retrieval XIX (January 2012), 27th Annual ACM Symposium on Applied Computing (March 2012), 10th IAPR International Workshop on Document Analysis Systems (March 2012), LREC Workshop: @NLP can u tag #user_generated_content ?! (May 2012), 13th International Conference on Frontiers in Handwriting Recognition (September 2012), 24th International Conference on Tools with Artificial Intelligence (November 2012), Document Recognition and Retrieval XX (February 2013), Biometric and Surveillance Technology for Human and Activity Identification X (Apr.-May 2013), 25th International Conference on Tools with Artificial Intelligence (November 2013), Document Recognition and Retrieval XXI (February 2014), 11th IAPR International Workshop on Document Analysis Systems (April 2014), Biometric and Surveillance Technology for Human and Activity Identification XI (April 2014), 22nd International Conference on Pattern Recognition (August 2014), 14th International Conference on Frontiers in Handwriting Recognition (September 2014), 26th International Conference on Tools with Artificial Intelligence (November 2014), Document Recognition and Retrieval XXII (February 2015), Biometric and Surveillance Technology for Human and Activity Identification XII (April 2015). 13th International Conference on Document Analysis and Recognition (August 2015), 27th International Conference on Tools with Artificial Intelligence (November 2015), Document Recognition and Retrieval XXIII (February 2016), 15th International Conference on Frontiers of Handwriting Recognition (October 2016), 23rd International Conference on Pattern

Recognition (December 2016), Computing Research: Addressing National Priorities and Societal Needs (October 2017), International Workshop on Open Services and Tools for Document Analysis (November 2017), 14th International Conference on Document Analysis and Recognition (November 2017), 13th International Workshop on Document Analysis Systems (April 2018), 24th International Conference on Pattern Recognition (August 2018), First IEEE International Conference on Artificial Intelligence for Industries (September 2018), 15th International Conference on Document Analysis and Recognition (September 2019), Second IEEE International Conference on Artificial Intelligence for Industries (September 2019), Fifth Asian Conference on Pattern Recognition (November 2019), 17th International Conference on Frontiers in Handwriting Recognition (September 2020), Third IEEE International Conference on Artificial Intelligence for Industries (September 2020), International Symposium on Geometry and Vision (November 2020), 25th International Conference on Pattern Recognition (January 2021), Fourth International Conference on Artificial Intelligence for Industries (September 2021), 15th International Workshop on Document Analysis Systems (May 2022), Third International Conference on Pattern Recognition and Artificial Intelligence (June 2022) 26th International Conference on Pattern Recognition (August 2022), Fifth International Conference on Artificial Intelligence for Industries (September 2022), First International Workshop on Election Infrastructure Security (September 2022), 29th IEEE International Conference on Image Processing (October 2022), 18th International Conference on Frontiers in Handwriting Recognition (December 2022), 17th International Conference on Document Analysis and Recognition (August 2023), Sixth International Conference on Artificial Intelligence for Industries (September 2023), 12th International Conference on Computing and Pattern Recognition (October 2023), 18th International Conference on Document Analysis and Recognition (August-September 2024), 7th International Conference on Artificial Intelligence and Pattern Recognition (September 2024), IEEE International Conference on Artificial Intelligence x Science, Engineering, and Technology (September-October 2024), 13th International Conference on Computing and Pattern Recognition (October 2024).

Other Committees, Commissions, Panels, Societies, etc.

- Department of Electrical and Computer Engineering, University of Miami, Industrial Advisory Committee, 2002.

- Department of Computer Science and Engineering, University of Notre Dame, External Assessment Committee, Fall 2013.

- Invited panelist, "The Benefits of ABET Accreditation to a Quality Computing Program," *ACM Technical Symposium on Computer Science Education (SIGCSE 2014)*, Atlanta, GA, March 2014.

- Invited panelist, "Nuts and Bolts of Managing a Department," *Computing Research Association (CRA) Conference at Snowbird*, Snowbird, UT, July 2014.

- Invited participant, Engineering Deans and Minority Engineering Program Strategic Retention Roundtable, *National Society of Black Engineers (NSBE) 41st Annual*

Convention, Anaheim, CA, March 2015.

- Special Award Judge, *Intel International Science and Engineering Fair*, Pittsburgh, PA, May 2015.

- Panelist, “Perspectives and Practical Skills for Men as Advocates for Gender Equity (with R. Green, E. Holloway, A. Holmes, B. Kirkmeyer, K. Kokini, and Y, A. Minerick),” *122nd ASEE Annual Conference & Exposition*, Seattle, WA, June 2015.

- External Assessor in Image Processing and Artificial Intelligence, University of Malaya, Kuala Lumpur, Malaysia, 2015 – 2018.
- Department of Computer Science & Information Systems, Bradley University, Academic Program Review Committee, Spring 2018.

- Member of Steering Committee for City of Allentown’s Comprehensive and Economic Development Plan, 2018 – 2019.

- Code 8.7 Organizing Committee, Using Computational Science and Artificial Intelligence to End Modern Slavery, 2019 – 2022.

- Advisor to University of Tampa on development of new Department of Computer Science, Fall 2019.

- External Evaluator to SUNY Polytechnic on development of new M.S. in Data Science and Analytics degree program, Spring 2020.

- Department of Computer Science and Engineering, University of Notre Dame, External Assessment Committee, Fall 2020 (postponed due to COVID-19).

- George Mason University, Thematic Hires in Computing Proposal Review Committee, Fall 2020.

- Dartmouth College Harold C. Ripley ’29 Society, 2009 – present; Bartlett Tower Society, 2021 – present.

- Lehigh University South Mountain Society, 2010 – present.

- Association of Princeton Graduate Alumni (APGA)*

  Governing Board, 1997 – 2011; Treasurer, 1998 – 2000; Vice President, 2004 – 2006; President, 2006 – 2008; Departmental Affairs Committee, Chair 2001 – 2003; Nominations and Awards Committee, 2004 – 2011; Executive Committee, 1998 – 2008; Andrew Fleming West Society, 2012 – present.

  ** APGA was founded in 1949 and is focused on building a strong community of Princeton graduate alumni. There are over 30,000 living graduate alumni, representing 30% of Princeton's total alumni body. The APGA connects and supports graduate alumni in scholarship, fellowship, and leadership, in the Nation's service and the service of humanity. The Governing Board of the APGA is responsible for developing, promoting, and executing APGA programs with the help of committee volunteers. To recognize the distinction of Graduate School alumni and parallel the undergraduate alumni presence at Alumni Day, the APGA established the James Madison Medal. First awarded in 1973, the Madison Medal recognizes an alumnus of* *the Graduate School who has had a distinguished career, advanced graduate education, and/or public service. At the same time the APGA continues to serve graduate alumni, it has also increased its support of current graduate students.*

- Princeton University Alumni Council

  Technology Advisory Committee, 1998 – 2017, Vice Chair 1999 – 2001, Chair 2001 – 2003; Alumni Council Executive Committee, 1999 – 2008, 2010 – 2011, 2021 – 2023; Planning & Review Committee, 2001 – 2003; Maclean Society, 2001 – present; Alumni Schools Committee, 2002 – present; Committee to Nominate Alumni Trustees*, 2008 – 2011; Chair 2010 – 2011; Service of Remembrance Committee, 2008 – present; Princetoniana Committee, 2019 – present, Vice Chair 2021 – 2023, Communications and Technology Committee Liaison, 2023 -- present.

  ** First graduate alumnus ever selected to Chair the Committee to Nominate Alumni Trustees.*

- Princeton University Reunions

  P-rade Marshal, 2003 – present; P-rade Grand Marshal*, 2016 – 2018; P-rade FitzRandolph Gate Gatekeeper, 2019, 2022 – present; Society of the Claw, 2016 – present.

  ** First graduate alumnus ever selected as the P-rade Grand Marshal.*

- Princeton University Stewardship Advisory Committee, 2008 – 2013.

- Princeton University Ad Hoc Committee on Leadership Engagement, 2014 – 2015.

- Princeton University Search Committee, Deputy Vice President for Alumni Affairs, 2018.

- Princeton University 1746 Society, 2021 – present.

Review Service Activities Not Listed Above

- Research Grant Review Service: American Association for the Advancement of Science; NSF Trustworthy Computing Panels; NSF CISE Instrumentation Panel; NSF Computing Research Infrastructure Panel; NSF Information and Intelligent Systems Panel; NSF Disrupting Operations of Illicit Supply Networks – Human Trafficking Panel; NSF Microelectronic Systems Architecture; NSF Experimental Systems; NSF Partnerships for Innovation – Cybersecurity Panel; NSF Civic Innovation Challenge; NSF Pathways to Enable Open-Source Ecosystems; Puerto Rico Science, Technology, and Research Trust; United States – Israel Binational Science Foundation; NIH Bridge to Artificial Intelligence (Bridge2AI); United States – Israel Binational Industrial Research and Development (BIRD) Foundation; NSF Partnerships for Innovation – Digital Health Panel; KU Leuven (University of Leuven, Belgium) Interdisciplinary Research Grant Program; NSF Partnerships for Innovation – Data Science and Cybersecurity Panel.

- Journal Article Review Service: ACM Computing Surveys, ACM Transactions on Algorithms, ACM Transactions on Asian Language Information Processing, IEEE Transactions on Computers, IEEE Transactions on Medical Imaging, IEEE

Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on VLSI Systems, International Journal on Document Analysis and Recognition, Journal of the Association for Computing Machinery, Journal of Discrete Algorithms, Journal of Electronic Imaging, Journal of Image and Vision Computing, Journal of Parallel and Distributed Computing, Journal of Supercomputing, Journal of Visual Languages and Computing, Journal of VLSI Signal Processing, Journal of Web Engineering, Machine Vision and Applications Journal, Forensic Science International: Digital Investigation.

- Conference Paper Review Service: ACM Symposium on Applied Computing, American Association for the Advancement of Science Annual Meeting, Design Automation Conference, Document Recognition and Retrieval Conference, IEEE Conference on Computer Vision and Pattern Recognition, IEEE International Conference on Image Processing, IEEE International Symposium on Computer-Based Medical Systems, International Conference on Advances in Computing, International Conference on Computer Engineering & Systems, International Conference on Computer Processing of Oriental Languages, International Conference on Document Analysis and Recognition, International Conference on Parallel Processing, International Conference on Pattern Recognition, International Workshop on Document Analysis Systems, International Workshop on Document Image Analysis for Digital Libraries, International Workshop on Frontiers in Handwriting Recognition, International Workshop on Multimedia Information Retrieval, International Workshop on Multimedia Information Systems, International Workshop on Web Document Analysis, Workshop on Document Image Analysis and Retrieval, Biometric and Surveillance Technology for Human and Activity Identification, ASEE Collaborative Network for Engineering and Computing Diversity Conference, International Conference on Computer Vision & Image Processing.

- Other Review Service: AAAS 2022 Scientific Sessions Panels, AAAS 2023 Scientific Sessions Panels, AAAS 2024 Scientific Sessions Panels.

Professional Society Memberships

- American Association for the Advancement of Science (AAAS).
- Association for the Advancement of Artificial Intelligence (AAAI).
- Association for Computing Machinery (ACM).
- Institute of Electrical and Electronics Engineers (IEEE), Life Member.
- International Association for Pattern Recognition (IAPR).

Honorary Society Memberships

- Phi Beta Kappa.
- Sigma Xi.

Media

- Guest technical expert on electronic voting systems, WNJC's (1360AM) “Voice of the Voters” radio show hosted by Mary Ann Gould, October 25, 2006.

- Guest panelist for a discussion on electronic voting systems (with M. A. Gould and J. Passarella), NBC 10's (Philadelphia) “Live at Issue” hosted by Steve Highsmith, September 23, 2007.

- Guest technical expert on electronic voting systems, WNJC's (1360AM) “Voice of the Voters” radio show hosted by Mary Ann Gould, December 19, 2007.

- Guest panelist for a discussion on electronic voting systems (with S. Sterner, K. Kraft, S. Bannon-Shillea, and A. Brau), WFMZ 69's “Business Matters” hosted by Tony Iannelli, May 12, 2008.

- Radio interview on electronic voting systems, WDHP 1620 AM (Reef Broadcasting, U.S. Virgin Islands) hosted by Mario Moorhead, May 3, 2012.

- Quoted as an expert on document analysis in AP news story “Media Sometimes Try, Fail to Keep NSA's Secrets” by Raphael Satter, February 8, 2014.

- Quoted as an expert on cybersecurity in Morning Call news story “Hackers may have attacked Las Vegas Sands websites through Bethlehem's portal” by Matt Assad, February 18, 2014.

- Quoted as an expert on cybersecurity in Morning Call news story “Data breaches likely as hackers stay a step ahead” by Peter Hall, March 8, 2014.

- Quoted as an expert on cybersecurity in Morning Call column “Heartbleed computer bug shouldn't be dismissed” by Paul Muschick, April 16, 2014.

- Quoted as an expert on curricular development in data science in Information Week column “Universities Expand Curriculum To Meet Data Scientist Demand” by Lisa Morgan, December 16, 2015.

- Quoted as an expert on electronic voting in PCWorld column “If the election is hacked, we may never know” by Patrick Thibodeau, October 5, 2016.

- Quoted as an expert on electronic voting in Network World column “Technology confirms election ballot error is less than .001%” by Steven Max Patterson, October 20, 2016.

- Quoted as an expert on electronic voting in Philadelphia Inquirer online article “Most

Pa. voting machines are old, hackable, and will likely be used to count the 2020 votes" by Katlyn Alo and Jackie Botts, March 30, 2018. See also Peninsula Press article "Amid concerns over election interference, most Pennsylvania counties will continue to use vulnerable voting machines" by the same authors, April 2, 2018.

- Quoted as an expert on AI in the fight against human trafficking in Parentology online article "AI is Turning the Tables on Sex Traffickers" by Carmelo Spatazza, June 3, 2019.

- Quoted as an expert on electronic voting in a widely syndicated AP News story "Reliability of pricey new voting machines questioned" by Frank Bajak, February 23, 2020.

- Quoted as an expert on electronic voting in a Lifewire story "Voting Machines on eBay Could Pose Security Risk" by Sascha Brodsky, October 27, 2020.

- Quoted as an expert on cybersecurity in New England In-House story "Work-from-home creates new cybersecurity risk" by Melinda Rizzo, November 11, 2020.

- Radio interview on the impact of artificial intelligence, WDIY 88.1 FM (Lehigh Valley Public Radio) hosted by Prathysha Kothare, May 7, 2021.

- Quoted as an expert on technology for public safety in State Tech story "Radio Backhaul Could Enhance Police Data-Transfer Capability" by Adam Stone, February 16, 2022.

- Quoted as an expert on technology for public safety in WLVR / WITF / WESA (NPR) story "'COVID Alert PA' will be removed from app stores by end of July" by Megan Frank, July 12, 2022.

- Quoted as an expert on computer security in Wired story "Redacted Documents Are Not as Secure as You Think" by Matt Burgess, November 25, 2022.

- Quoted as an expert on computer security in 69 News (WFMZ-TV) story "LVHN reports cyberattack by Russian ransomware gang" by Rob Manch, February 20, 2023.

- Quoted as an expert on computer security in Morning Call column "Have questions about the LVHN ransomware hack? Here is what you need to know" by Leif Greiss, March 15, 2023.

- Television interview for a four-part series on the impact of AI, 69 News (WFMZ-TV) hosted by Priscilla Liguori, July 25-28, 2023.

- Guest panelist for a discussion on generative AI, WFMZ-Ch. 69 *Business Matters* hosted by Tony Iannelli, September 25, 2023.

- Television interview on generative AI (“AI experts warn about fake images being shared amid Israel - Hamas war”), 69 News (WFMZ-TV) hosted by Priscilla Liguori, October 23, 2023.

- Television interview on cybersecurity (“Water authority in western Pa. hacked by cyber criminals. Local cyber security expert discusses how common such attacks are”), 69 News (WFMZ-TV) hosted by Rob Manch, November 28, 2023.

- Television interview on cybersecurity (“Portions of Pennsylvania court systems website restored following cyberattack”), 69 News (WFMZ-TV) hosted by Bo Koltnow, February 5, 2024.

APPENDIX B

Appendix B

Below I provide two comparison charts.

The first chart, immediately below, compares the claim language of Claim 1 of Lim (Ex. 1004) in the left column and the corresponding disclosures from the Lim 60/144,612 Provisional Application (Ex. 1005) in the right column. As the chart shows, Claim 1 of Lim is fully disclosed by the Lim 60/144,612 Provisional Application. I have endeavored to make this list useful, but it is not exhaustive. Any absences from the chart should not be taken as indicative of any material difference between the references.

Lim Claim 1	Lim 60/144,612 Provisional Application
"1. A method, comprising:"	*See*, *e.g.*, Lim 60/144,612 Provisional Application, Pages 4 ("C. User Systems and Features; Some embodiments of the invention offer a number of different features to support end users of the invention. The customer signup process will be described first, then the ad viewing and searching process will be described… The basic process is as follows:"), 5 ("Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process")
"transmitting, at a first time after the expiration of a first determined interval and from a first computer system to a second computer system, a prompt including one or more graphical images, and a means for a human operator of the second computer system to provide a respective response thereto, the prompt presented in a format sufficient to permit the human operator of the second computer system, but not an automated process executing thereon, to read the prompt and provide a corresponding single correct and distinct response to the respective prompt presented by said graphical image;	"Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or

Lim Claim 1	Lim 60/144,612 Provisional Application
receiving, at the first computer system and from the second computer system, a response related to the prompt, said response (i) purportedly generated by the human operator and (ii) being responsive to the respective prompt set forth in the graphical image; determining, by the first computer system, whether the respective response matches its corresponding single correct and distinct response:”	between transactions using some embodiment of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text ‘123’ and the quiz question might read, ‘What number is shown?’. Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy. The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.) i) Number recognition. A number is presented graphically. The number can be generated randomly or from table i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word ‘Ice Cream’, etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not

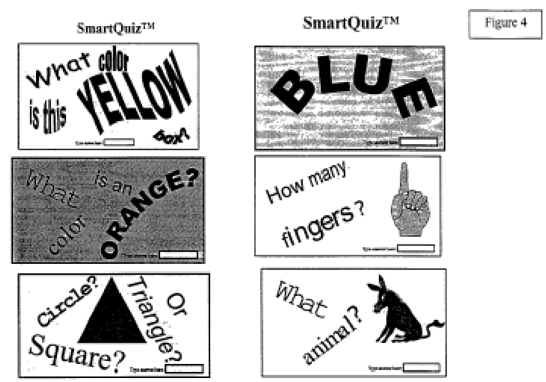
Lim Claim 1	Lim 60/144,612 Provisional Application
	belong in the set of objects displayed. Other recognition examples include: (1) Twisted text recognition. A simple question is presented in text that is twisted to make OCR difficult, but easily readable to a human. (2) Color recognition. A color is presented and the user is asked to identify it. (3) Shape recognition. User is asked to identify the shape presented. (4) Self answering questions. Text questions which contain their answer. (5) One word question, one word answer. The user simply types the word presented in the graphic. ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XXXX minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display '2 cats + 2 dogs' and the correct answer may be '2 cats + 2 dogs'. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?'

<table>
<tr><th>Lim Claim 1</th><th>Lim 60/144,612 Provisional Application</th></tr>
<tr><td></td><td>

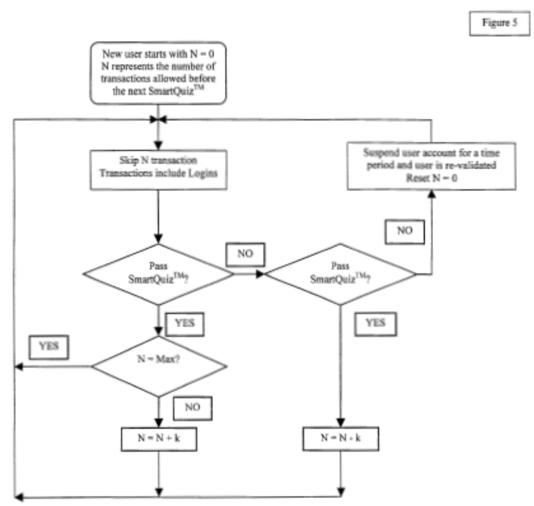
v) Awareness. Users are asked questions about the real world. "What day (month, year) is it?

b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)”

Lim 60/144,612 Provisional Application, Pages 5-7



Lim 60/144,612 Provisional Application, Fig. 4



Lim 60/144,612 Provisional Application, Fig. 5

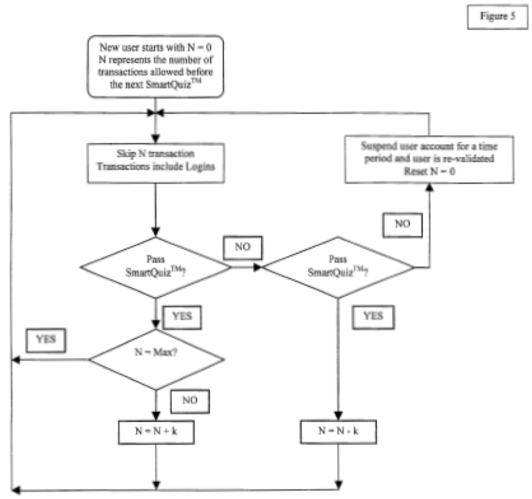
</td></tr>
<tr><td>“when so, inferring that the respective response was provided by the human operator of the second computer system and granting the human operator access to a computer-based resource; otherwise, not</td><td>

“Quizzes

Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system

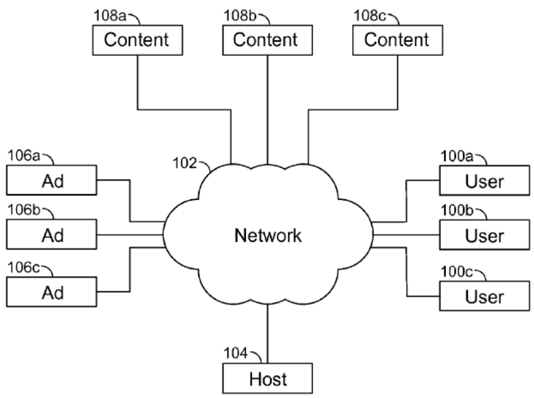
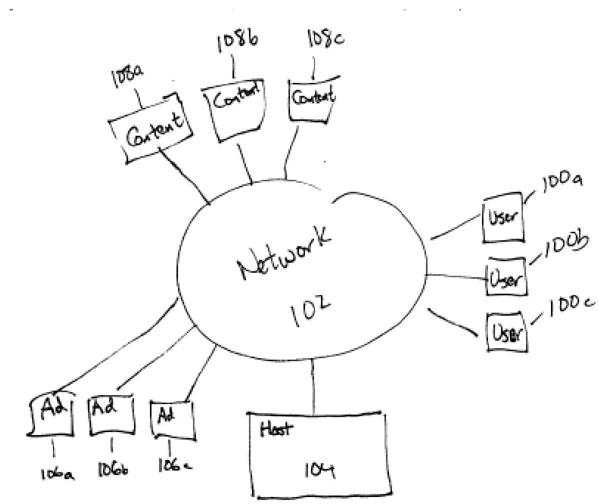
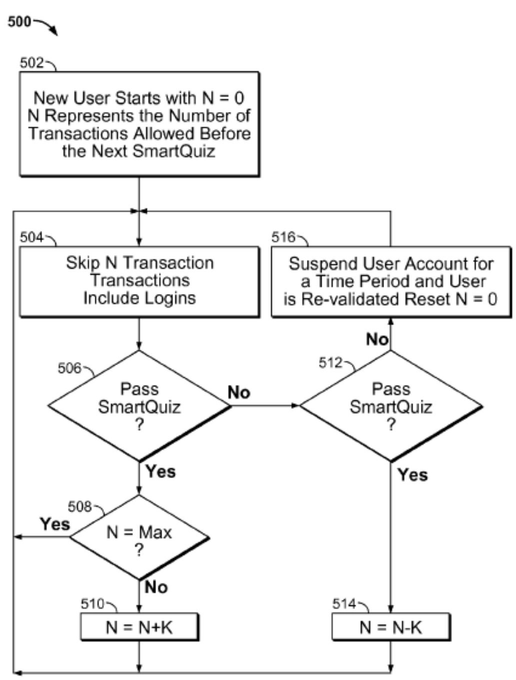
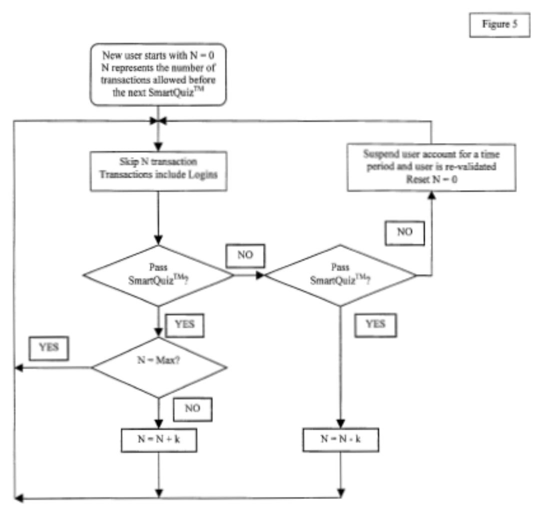
</td></tr>
</table>

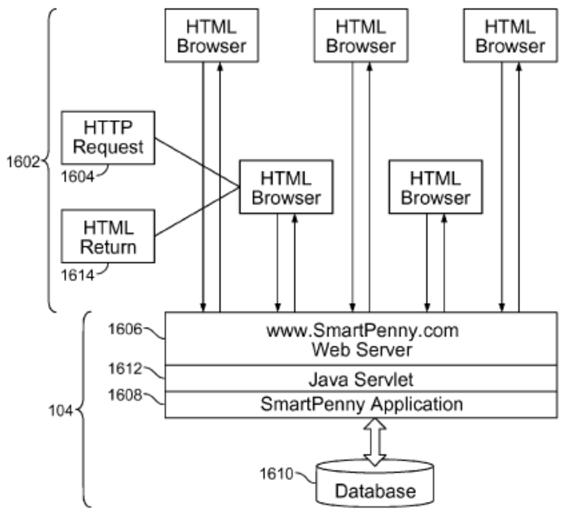
Lim Claim 1	Lim 60/144,612 Provisional Application
granting the human operator access to the computer-based resource;”	would be able to earn the money without the desired human actually viewing the advertising. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiment of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text ‘123’ and the quiz question might read, ‘What number is shown?’. Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy. The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Lim 60/144,612 Provisional Application, Pages 5-6
“determining an amount of time or amount of resources that will be accessible by the human operator before a next prompt is transmitted including adjusting an interval for a next prompt including increasing an	“b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)”

Lim Claim 1	Lim 60/144,612 Provisional Application
amount of time or resources associated with the interval from a baseline amount to an increased amount when the respective response is inferred to have been provided by the human operator, wherein the intervals at which the human operator is quizzed by means of respective prompts set forth in the graphical images are determined by correctness or incorrectness of the human operator's responses to prior ones of the respective prompts, and wherein when the respective response matches its corresponding single correct and distinct response, further increasing a number of accesses or time allowed, before a next graphical image is provided by the first computer system, to the computer-based resource; and "providing a second prompt after expiration of the interval."	Lim 60/144,612 Provisional Application, Page 7  Lim 60/144,612 Provisional Application, Fig. 5

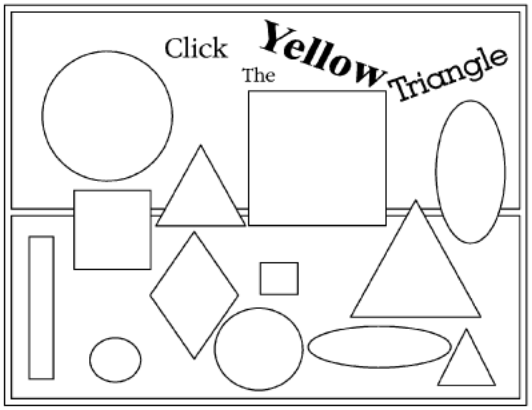
The second chart, immediately below this paragraph, compares the disclosures relied upon in the Petition and in my declaration from Lim (Ex. 1004) in the left column and the corresponding disclosures from the Lim 60/144,612 Provisional Application (Ex. 1005) in the right column. As the chart shows, the Lim 60/144,612 Provisional Application discloses all of the concepts relied on in Lim. I have endeavored to make this list useful, but it is not exhaustive. Any absences from the chart should not be taken as indicative of any material difference between the references.

Lim	Lim 60/144,612 Provisional Application
"A process for verifying whether or not an Internet operation (e.g., sending an e-mail message or accessing a web site) is being attempted by a human being or an automated process may be incorporated with the service	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the

Lim	Lim 60/144,612 Provisional Application
by using a quiz process that requires user interaction." Lim, Abstract	desired human actually viewing the advertising." Lim 60/144,612 Provisional Application, Page 5
 FIG. 1 Lim, Fig. 1	 Lim 60/144,612 Provisional Application, Fig. 1
 FIG. 5 Lim, Fig. 5	 Lim 60/144,612 Provisional Application, Fig. 5

Lim	Lim 60/144,612 Provisional Application
 FIG. 16 Lim, Fig. 16	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/144,612 Provisional Application, Page 2 "B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the

Lim	Lim 60/144,612 Provisional Application
	advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/144,612 Provisional Application, Pages 2-3 "The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next, the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/144,612 Provisional Application, Page 3 *See also* Lim 60/144,612 Provisional Application, Fig. 1

Lim	Lim 60/144,612 Provisional Application
 FIG. 17 Lim, Fig. 17	"The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word "Ice Cream", etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed." "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XX (X minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display '2 cats + 2

Lim	Lim 60/144,612 Provisional Application
	dogs' and the correct answer may be '2 cats + 2 dogs'. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?'" Lim 60/144,612 Provisional Application, Pages 6-7 *See also* Lim 60/144,612 Provisional Application, Pages 5-7
"The term "search engine" is generally meant to refer to a server or a collection of servers dedicated to indexing Internet web pages, storing the results and returning lists of pages that match particular queries (e.g., key word queries). A server is a computer, program or process that responds to requests for information from a client. On the Internet, all web pages are held on servers. This includes those parts of the search engines and directories that are accessible from the Internet. The indexes themselves are normally generated using spiders. A spider is that part of a search engine that surfs the web, storing the universal resource locators (URLs, i.e., the web addresses) and indexing the keywords and text of each page it finds. At present, some of the major search engines are Altavista™, Excite™, Hotbot™, Infoseek™, Lycos™, Northern Light™ and Webcrawler™. Note that the popular site Yahoo is technically a directory (a server or a collection of servers dedicated to indexing Internet web pages and returning lists of pages which match particular queries—directories, also known as indexes, are normally compiled manually, by user submission, and often involve an editorial	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/144,612 Provisional Application, Page 2 "B. System Architecture

Lim	Lim 60/144,612 Provisional Application
selection and/or categorization process), not a search engine. The term search engine is nevertheless often used to describe both directories and search engines. Generally, search engines return results based on key words or search strings that are supplied by users. Results are typically found by matching the key words or search strings with metatags present in the hypertext markup language (HTML) used to encode the web pages of the target web sites. Results are also often ranked according to the quality of the match between the metatags and the search strings. Depending upon the search algorithms employed by the search engine, the more frequently a terms is used as a metatag, the more likely it is to be assigned a high ranking in the returned results. Owners of web sites therefore often repeat metatag terms numerous times (often using common spelling variations and similar terms) so as to ensure that their respective web sites will gain a high ranking when an Internet user executes a search. While this is beneficial for the web site owner (as it is likely an Internet user will tend to select highly ranked results of a search), it is not necessarily beneficial for the user, who may be mislead into selecting a less than desirable web site by such tactics." Lim, 1:35-2:9	The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/144,612 Provisional Application, Pages 2-3 "The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for

Lim	Lim 60/144,612 Provisional Application
	relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next, the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/144,612 Provisional Application, Page 3 *See also* Lim 60/144,612 Provisional Application, Fig. 1
"In another embodiment, a process for verifying whether or not an Internet operation (e.g., sending an e-mail message or accessing a web site) is being attempted by a human being or an automated process may be implemented by using a quiz process that requires user interaction. The quiz process may include causing a graphical image which includes a question contained therein or associated therewith to be transmitted." Lim, 2:32-39	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising." "The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text '123' and the quiz question might read, 'What number is shown?'." Lim 60/144,612 Provisional Application, Pages 5-6
"The quizzes may be used at a frequency according to a past history of successful responses to such quizzes" Lim, 3:1-3	"b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/144,612 Provisional Application, Page 7
"FIG. 4 illustrates various types of quizzes, any of which may be used in combination with one another or individually, which may	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)"

Lim	Lim 60/144,612 Provisional Application
be included in embodiments of the present invention." Lim, 3:23-26	Lim 60/144,612 Provisional Application, Page 6
"FIG. 17 illustrates a further example of a quiz, which may be used in combination with other quizzes or individually, and which may be included in embodiments of the present invention." Lim, 3:64-67	"The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word "Ice Cream", etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed." "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XX (X minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented

Lim	Lim 60/144,612 Provisional Application
	in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display ‘2 cats + 2 dogs’ and the correct answer may be ‘2 cats + 2 dogs’. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are ‘What day was yesterday?’, ‘How old is a 2-year old baby?’, ‘What color is red?’, ‘Is ice-cream hot or cold?’” Lim 60/144,612 Provisional Application, Pages 6-7 *See also* Lim 60/144,612 Provisional Application, Pages 5-7
“A scheme that allows Internet users to take advantage of their individual user profiles in retrieving search results, viewing advertisements and/or performing other Internet-related activities is disclosed herein. Some embodiments of the present invention allow users to earn money, or credits, on-line by visiting certain web sites and/or viewing advertising on particular web sites. Such credits can be redeemed at content sites accessible via the Internet, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used as gratuities for the content providers. Furthermore, the system may allow users to use standard Web browsers such as Netscape's Navigator™, available from Netscape Communications, Inc., Mountain View, Calif., or Microsoft's Internet Explorer™, available from Microsoft Corporation, Redmond, Wash.,	“Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs.

Lim	Lim 60/144,612 Provisional Application
and still access the features provided by the various embodiments of the invention. In accordance with embodiments of the present invention, web site owners and/or advertisers can target their most desired audiences by setting higher rewards for specific demographic characteristics and thus "qualify" visitors to their site and/or viewers of their advertising. Further, advertisers can better control web-based advertising costs as demographically targeted advertising. The architecture of the system also allows content providers to assess micro-payments, e.g., small payments that may be less than $1.00 per item, for their content or provide a means for users of their web sites to leave them gratuities." Lim, 4:7-35	Content providers can assess micropayments, e.g. small payments, typically less than $1.00 per item, for their content or provide a means for users of their web sites to leave them monetary tips." Lim 60/144,612 Provisional Application, Page 2 *See also* Lim 60/144,612 Provisional Application, Pages 2-3, Fig. 1
"Before describing various aspects of the present invention in detail, it is helpful to present some background relating to the Internet in as much as it is expected that several embodiments of the present invention will make use of and be deployed over this ever-expanding network of computer networks. At bottom, the Internet may be regarded as a collection of devices linked together by various telecommunications media, enabling these devices (e.g., computer systems and the like) to exchange and share data, multimedia content and other information. Content sites accessible through the Internet provide information about a myriad of corporations and products, as well as educational, research and entertainment information and services. Literally millions people worldwide use the Internet on a daily or weekly basis. A computer or resource that is attached to the Internet is often referred to as a "host." Examples of such resources include conventional computer systems that are made	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs."

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up of one or more processors, associated memory (typically volatile and non-volatile) and other storage devices and peripherals that allow for connection to the Internet or other networks (e.g., modems, network interfaces and the like). The precise hardware configuration of the hosting resource is generally not critical to the present invention, nor are the precise algorithms used to implement the services and methods described herein. Instead, the focus is on the nature of the services provided by the hosting resource. In most cases, the hosting resource may be embodied as hardware and/or software components of a server or other computer system that includes an interface module, which allows for some dialog with a user, and that may process information through the submission of Web forms completed by the user. Generally, such a server will be accessed through the Internet (e.g., via Web browsers) in the conventional fashion. Operating in conjunction with the interface module may be a communication interface that supports the distribution of electronic mail (e-mail) messages to or from other Web sites or users. In order to facilitate communications between hosts, each host has a numerical Internet protocol (IP) address. The IP address is made up of four groups of numbers separated by decimals. For example, the IP address of a hypothetical host computer might be 123.124.78.91. Each host also has a unique "fully qualified domain name." The "fully qualified domain name" may not be repeated in the Internet. In the case of the hypothetical host 123.456.78.91, the "fully qualified domain name" might be "computer.domain.com". In its most generic form, a fully qualified domain name consists of three elements.	Lim 60/144,612 Provisional Application, Page 2 "B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/144,612 Provisional Application, Pages 2-3

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Taking "computer.host.com" as an example, the three elements are the hostname ("computer"), a domain name ("domain") and a top-level domain ("com"). A given host looks up the IP addresses of other hosts on the Internet through a system known as domain name service. Domain name service is accomplished as follows: The Internet is divided into several "top level" domains. For example, ".edu" is a domain reserved for educational institutions, ".gov" is a domain reserved for government entities and ".net" is generally reserved for enterprises operating within the Internet. Although ".com" is short for "commercial," it is a catchall domain and is today the most popular one generally available to Internet users that have no special attributes, i.e., those that are not a school, a government office or an Internet-based enterprise. Each domain name active in a given top-level domain is registered with the top-level server which contains certain hostname and IP address information. As previously indicated, in order to access the Internet most users rely on computer programs known as "Web browsers." Commercially available Web browsers include such well-known programs as Netscape's Navigator™ and Microsoft's Internet Explorer™. If an Internet user desires to establish a connection with a Web page hosted at computer.domain.com, the Internet user might enter into a Web browser program the uniform resource locator (URL) "http: www.domain.com". The first element of the URL is a transfer protocol (most commonly, "http" standing for hypertext transfer protocol, but others include "mailto" for electronic mail, "ftp" for file transfer protocol, and "nntp" for network news transfer protocol). The remaining elements of this URL (in this case, "www" standing for World Wide Web—the Internet's graphical	"The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next, the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/144,612 Provisional Application, Page 3 *See also* Lim 60/144,612 Provisional Application, Fig. 1

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user interface—and "domain.com") are an alias for the fully qualified domain name of the host computer.domain.com. Once a URL is entered into the browser, the corresponding IP address is looked up in a process facilitated by a top-level server. In other words, all queries for addresses are routed to certain computers, the so-called top-level servers. The top-level server matches the domain name to an IP address of a domain name server capable of directing the inquiry to the computer hosting the Web page. Thus, domain name service ultimately matches an alphanumeric name such as www.domain.com with its numeric IP address 123.456.78.91. Registration of domain names is currently handled by a variety of organizations. A domain name server is a host computer with software capable of responding to domain name inquiries and accessible on a full-time basis to other computers on the Internet. Registering a domain name is the step that allows the top-level servers within the Internet to know where the domain name servers or hosts associated with those domain names are located in the Internet. Domain name service can be operated by the domain name holder or obtained from any entity with the proper computer equipment, including hundreds of Internet service providers (ISPs). One way to establish a presence on the Internet is by placing a Web page, which is, ultimately, a computer data file on a host operating a Web server within a given domain name. When the Web server receives an inquiry from the Internet, it returns the Web page data in the file to the computer making the inquiry. The Web page may be a single line or multiple pages of information and may include any message, name, word, sound or picture, or combination of such elements. Most Web browsers will show somewhere on the screen the domain name	

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of the Web page being shown and will automatically include the domain name in any printout of the Web page. There is no technical connection or relationship between a domain name and the contents of the corresponding Web page. There are a number of ways for an Internet user to find a Web page. Web browsers feature access to various indexes, commonly referred to as search engines. These indexes will allow the user to enter a name or a word or a combination of words, and will return the results of the search as a list of "hyperlinks" to Web pages that have information within or associated with the document making up the page responding to the search. A hyperlink is a link from one site on the Internet to a second site on the Internet. "Clicking" (or, more generally, selecting using a cursor control device such as a mouse, joystick, touch pad, etc.) on a designated space on the initial site which references the subsequent site by a picture, highlighted text or some other indication will direct the user's browser from the initial site to the second site. In addition to their use in indexes, hyperlinks are commonly placed on Web pages, thus allowing Internet users to move from Web page to Web page at the click of a button, without having to type in URLs. Hyperlinks are also used to initiate the transfer of files or other information from the hosting resource to the user's computer in a process commonly known as downloading. Hyperlinks can be and commonly are established without reference to the domain name of the second site. A hyperlink is not technically related to a domain name and therefore it can be identical to an existing domain name without conflicting with that domain name. For example, were the operator of a Web page known as SITE to	

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establish a home page at http: www.xyz.com, any number of indexes could be employed and hyperlinks could be established to bring up the page through use of the word SITE. Some Web pages are referred to as Web forms. In general, a form is a collection of form fields displayed as a Web page by a browser in response to hypertext mark-up language (HTML) tags and other information received from a Web server. An associated form handler resides at the server to collect and process the information submitted by a user via the form. By using such forms, an information collection process performed by a host is made interactive with the users thereof. That is, users can add text to text boxes, select from drop down menus and/or select check boxes and/or radio buttons, etc. Typically, the user submits the form by clicking on a submit button or other appropriately labeled element of the form and, upon such submission, the contents of the form are passed to the form handler. Depending upon the type of information being submitted and the type of form handler being used, the information submitted by a user may be appended to a file maintained by the host, for example a file associated with a temporary account assigned to the user or a larger database. In this way information may be collected, processed and displayed to those who access it. A text box is a standard form field into which a user can type text. When a form containing a text box is submitted in a Web browser, the name and contents of the text box are provided to the form handler running on the server. A check box field is typically arranged in a grid or matrix fashion with one or more cells of the matrix including a check box. Check box fields present a user with choices that can be made by clicking (e.g., selecting or deselecting as appropriate) a check box. Such fields are created and	

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rendered using programming techniques common in the art and any number (including all or none) of individual check boxes may be selected or not. When a user submits a form containing a check box field, the name of each check box along with its value is provided to the form handler at the host. Radio button fields present a user with a choice that can be made by selecting a button. Radio buttons are displayed in a set, only one of which may be selected at a time. When radio button fields are created, they are assigned a group name, and each button in the group is assigned a value and an initial state (selected or not selected). When the user selects one of the buttons in the field, all other buttons in the field take on a value of not selected. Then, when the user submits the form, the group name and value of the buttons is provided to the corresponding form handler at the server for processing." Lim, 5:6-7:61	
"With the above background, aspects of the present invention may now be described. In general, the present invention may be regarded as a service that allows users (preferably registered users) thereof to earn and/or redeem credits on-line in exchange for sharing their personal or demographic information. Thus, users of the system (which may be regarded as a hosted environment embodied as computer readable instructions residing in computer-readable media associated with a computer system attached to/accessible through the Internet) are asked to provide demographic information which may be used to customize advertisements displayed to the user and/or search results from search queries posed by the user. In exchange for this information, the users receive credits which they can later redeem in various fashions as described below. To the users, the process is very	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further,

Lim	Lim 60/144,612 Provisional Application
similar to the customary actions they may be accustomed to in interacting with other search engine sites and/or web portals, with the exception that the use of rich demographic profiles allows for certain customizations that are not provided by other Internet-based services and systems. In addition, the present system offers unique features such as "quizzes" which can be used to validate a third party. These and other features will be discussed below." Lim, 7:62-8:17	advertisers can better control web based advertising costs." Lim 60/144,612 Provisional Application, Page 2 "Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without actually viewing the advertising." Lim 60/144,612 Provisional Application, Page 5 *See also* Lim 60/144,612 Provisional Application, Pages 3-7
"A. System Architecture A basic system architecture within which embodiments of the present invention may operate and be utilized is shown in FIG. 1. Users 100a-care coupled in communication with a network 102. The network 102 might be the Internet, or some other type of computer network (e.g., a local or wide area network or a metropolitan area network) or network of networks. Through the network 102, the users 100a-c can access content sources 108a-c. For example, the content sources 108a-c might include servers and/or proxies hosting Web sites for entertainment, commercial enterprises, research journals, newspapers, and/or some other type of activity, business or interest. Advertisers, such as advertisers 106a-c, are entities that wish to place advertising and/or draw visitors to their sites. Some of the advertisers 106a-c may also be content providers. For example, a company such as NetscapeTM might both	"B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user

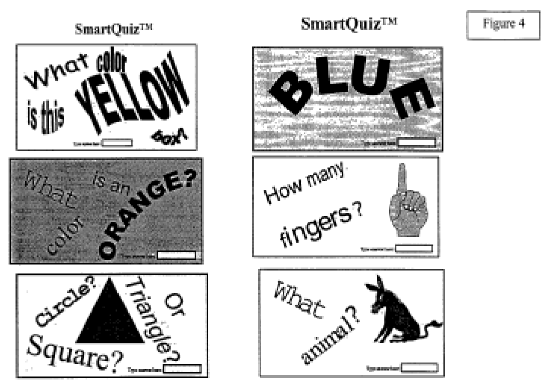
Lim	Lim 60/144,612 Provisional Application
advertise its portal service as well as provide content. Host 104 is configured in accordance with an embodiment of the present invention and may also support the transaction or micro-payment system described below. As part of its operation, host 104 stores information about user accounts, e.g., for the users 100a-c. Host 104 may also provide advertisers 106a-c means to receive payment for qualified viewers, e.g., those meeting certain pre-established demographic criteria. Also, the host 104 may provide content providers means to receive payments for goods and services they offer either through a 'pay-per-view' fee or a tipping (gratuity) scheme. For example, a content provider associated with content source 108a might offer access to a scientific journal hosted at that content source at for $0.50/article (or some other pay per-use fee). Alternatively, the content provider might provide a hyperlink to a Web site (e.g., hosted by host 104) that allows users to provide a gratuity (e.g., so as to express their appreciation for a particular story or column)." Lim, 8:18-52	accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive micropayments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/144,612 Provisional Application, Pages 2-3
"Thus, the host 104 acts as a transaction mediator for this system. The host 104 may be made up of one or more computers, a cluster of computers, a web or server farm, and/or some other configuration of one or more computers. The remainder of the discussion below will assume that the network configuration shown in FIG. 1 is used. Accordingly, embodiments of the invention (which may be computer software, hardware and/or combinations of both) are discussed as being hosted/provided by or from the host 104, although advertising content and hyperlinks to other reward-offering sites may be provided by other sources. In some cases the network 102 may	"Thus, the host 104 acts as the transaction mediator for this system. The host 104 may be multiple computers, a cluster of computers, a web farm, and/or some other sort of configuration of one or more computers. The remainder of the discussion will assume the configuration shown in Figure 1. Accordingly embodiments of the invention discussed are primarily hosted/provided from the host 104 although advertising content and reward offering links may be provided from other sources. Also, the network 102 may have multiple hosts 104 supporting embodiments of the invention. Depending on contractual arrangements between providers, credits earned

Lim	Lim 60/144,612 Provisional Application
be associated with multiple hosts 104 supporting embodiments of the invention.” Lim, 8:52-65	on one system may or may not be valid on another.” Lim 60/144,612 Provisional Application, Page 3
“In some embodiments of the present invention, a search engine returns results according to a ranking that is established according to user-supplied demographic information. In these and/or other cases, advertisements may be presented to users based on such demographic information. Accordingly, embodiments of the present invention offer user registration processes so that users might build rich profiles of themselves, allowing for customized search results to be returned by the search engine each time a search query is executed and/or to provide customized advertisement viewing.” Lim, 9:20-30	“Search Engine Some embodiments of the invention include a search engine that allows the user to search for ads and content relevant to their interests. Search results can be sorted according to relevance, reward value, and popularity, and/or other criteria.” Lim 60/144,612 Provisional Application, Page 7 *See also* Lim 60/144,612 Provisional Application, Pages 3, 5, 8-11
“The basic registration process may be described as follows: A. New users may by referred to a service provider’s Web site (e.g., hosted by host 104) offering a service configured in accordance with the present invention and encouraged to ‘sign up’, e.g., by information displayed at a content provider’s Web site, various advertising for the service, the service provider's home page, and/or some other source. i) Before being allowed to register, these new users may be asked to answer one or more questions of a quiz to test whether they are a human users or not (see the discussion of such Quizzes below). As indicated above, spiders are automated computer processes that are capable of searching the Web and retrieving Web page information. Variations of spiders known as robots or bots have been created that might allow for completion of a	“The basic process is as follows: 1) New users are referred to sign up, e.g. from a content provider, advertising for the service, the service home page, and/or some other source. a) The new user may be asked to answer a quiz to test whether they are a human or not (see Quizzes below).” “Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising.” Lim 60/144,612 Provisional Application, Pages 4-5

Lim	Lim 60/144,612 Provisional Application
simple web form or other registration instrument, and thereby garner any rewards associated therewith, without having to subject a human user to this process. To avoid abuses of the present system, quizzes may be introduced at various levels to thwart such automated processes and allow access only by live, human users." Lim, 9:45-67	
"4. Constraints on Automated Usage Computer systems configured in accordance with the present invention may limit or restrict the number of users which are allowed access from a particular computer or terminal based upon a certain number of cookies or Java applets installed on the user's computer or terminal. such systems may also constrain automated access by allowing a limited number of users access from computers or other web-capable devices associated with certain unique identifiers such as a medium access control (MAC) addresses, IP addresses, or central processing unit (CPU) serial numbers." Lim, 13:4-14	"B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider." Lim 60/144,612 Provisional Application, Page 2 *See also* Lim 60/144,612 Provisional Application, Pages 2-3; Fig. 1
"5. Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process (e.g., a bot or robot). Because users are paid per ad and/or site viewed, an automated system would be able to earn money or credits without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the present invention make use of periodic quizzes, also called a SmartOuiz TM, to verify that a particular user is a human. As noted above, these	"Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human.

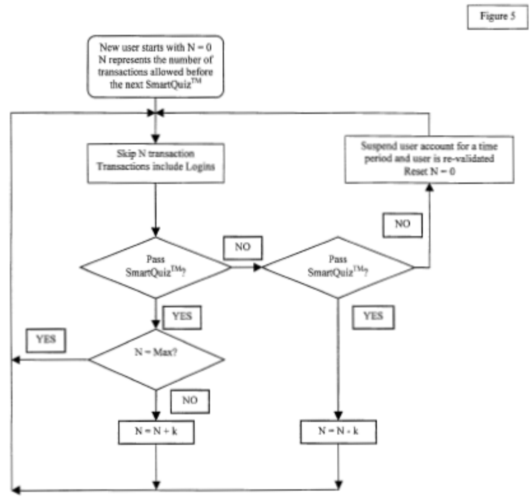
Lim	Lim 60/144,612 Provisional Application
quizzes may be employed during the registration process to verify that a user is a human. Additionally, such quizzes can be used in conjunction with follow up registrations, and/or between transactions using some embodiments of the invention. The basic premise is to design a quiz (or question) using a display format that cannot be easily recognized or read by a machine or automated process. For example, text that is embedded in graphical representations such as an image could be used. The pictures can contain a simple question that any user would be expected to be able to answer. For example, the picture or other image form might have the text '123' drawn therein, and the quiz question might read, 'What number is shown?' A separate text box or other data entry device rendered in the web page with the quiz question image could then be used by the user to enter his/her answer." Lim, 13:15-39	Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiments of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text "123" and the quiz question might read, "What number is shown?". Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy." Lim 60/144,612 Provisional Application, Pages 5-6
"Because automated entities are not able to decipher the question (or more particularly, the answer to the question) from the image, such processes will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could provide the correct answer. The object here is not to test the skill or knowledge of the user per se (although such tests could be used if appropriate to a given situation), but rather to ensure that some human being (and not just another computer system) is actually viewing the pages/ads being rendered. This way, advertisers are provided with some assurance that their advertising dollars are not being wasted." Lim, 13:40-51	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without actually viewing the advertising. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiments of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The

Lim	Lim 60/144,612 Provisional Application
	pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text "123" and the quiz question might read, "What number is shown?". Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy." Lim 60/144,612 Provisional Application, Pages 5-6
"The answers to the quiz questions may be provided using a text-input box located anywhere on the Web page containing the quiz, image. For multiple-choice questions, the answers might be selectable from the image itself, e.g., using an image map, and/or through an HTML form surrounding the picture. FIGS. 4a-4f illustrate various types of quizzes, any of which may be used in combination with one another or individually" Lim, 13:52-59	"The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" Lim 60/144,612 Provisional Application, Page 6
"ii) Simple word/object identification/recognition (e.g., FIGS. 4c and 4f). The name of an object or other word is spelled out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word 'Ice Cream', etc. Users are asked to enter (e.g., in a text box) the name of the object in the space provided, or, are asked to select the correct picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in a set of objects being displayed."	"i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word 'Ice Cream', etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed."

Lim	Lim 60/144,612 Provisional Application
Lim, 13:63-14:5	Lim 60/144,612 Provisional Application, Page 6
"(1) Twisted text recognition (e.g., FIGS. 4 a and 4 b). A simple question is presented in text that is twisted (i.e., displayed in a non-linear fashion) to make optical character recognition (OCR) difficult, while still remaining easily readable to a human. (2) Color recognition (e.g., FIG. 4 d). A color is presented and the user is asked to identify it. (3) Shape recognition (e.g., FIG. 4 c). A user is asked to identify the shape presented (e.g., a triangle, a square, etc.). (4) Self-answering questions (e.g., FIGS. 4a, 4e and 4f). Text or graphical questions that contain their own answer." Lim, 14:7-20	"Other recognition examples include: (1) Twisted text recognition. A simple question is presented in text that is twisted to make OCR difficult, but easily readable to a human. (2) Color recognition. A color is presented and the user is asked to identify it. (3) Shape recognition. User is asked to identify the shape presented. (4) Self answering questions. Text questions which contain their answer." Lim 60/144,612 Provisional Application, Page 6  Lim 60/144,612 Provisional Application, Fig. 4
"iii) Simple counting (e.g., FIG. 4e). A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to enter (e.g., in a text box) the number of objects being displayed, or are asked to select the picture, word or number matching the object displayed. Users may also be asked to select the set of pictures showing the same number of objects." Lim, 14:24-30	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects."

Lim	Lim 60/144,612 Provisional Application
	Lim 60/144,612 Provisional Application, Page 7
"v) Simple queries (e.g., FIGS. 4a-4f). Users are asked simple questions using graphical text. Responses may be entered as text or selected by 'clicking' (e.g., using a cursor control device such as a mouse) on the right area. Examples of questions that might be used are: 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice cream hot or cold?', etc." Lim, 14:42-48	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?'" Lim 60/144,612 Provisional Application, Pages 6-7
"vii) Click on a Designated Object/Space. Users are asked to select a particular image, e.g., 'Click on the yellow triangle.' (See e.g., FIG. 17.): Lim, 14:51-53	"The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word "Ice Cream", etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed." "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space

Lim	Lim 60/144,612 Provisional Application
	provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XX (X minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display '2 cats + 2 dogs' and the correct answer may be '2 cats + 2 dogs'. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?'" Lim 60/144,612 Provisional Application, Pages 6-7 *See also* Lim 60/144,612 Provisional Application, Pages 5-7
"Users may be quizzed with reduced frequency as they respond accurately and with increasing frequency as they fail to respond accurately. For example, FIG. 5 illustrates a process 500 wherein a new user starts (step 502) and is presented with SmartOuizzes at various intervals (step 504). As each quiz is taken (step 506) a determination is made as to whether the user passed the test. If so (step 508), the interval is adjusted (step 510) until a maximum	"b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/144,612 Provisional Application, Page 7

Lim	Lim 60/144,612 Provisional Application
interval is reached. If the user fails a test, a retest might be offered (step 512). Passing the retest also resets the testing interval (step 514). Failing the retest (step 516) suspends the user's account for a designated time interval or causes some other penalty." Lim, 14:58-15:2	 Lim 60/144,612 Provisional Application, Fig. 5
"H. Technical Methods The present system (see FIG. 16) is designed to solve Several technical problems and includes a standard user inter face 1602 that may make use of a conventional web browser, facilities to allow for minimized transactions costs, the ability to serve many users concurrently and secure information transfer without high overhead costs. The interface to the user is conventional HTML and JavaScript, allowing users of the system to rely on conventional web browsers for access and operation. All functions on the present system begin with the user entering information into a conventional HTML form and submitting a conventional HTTP request 1604 to the web host 104. The HTTP request may contain a call to the web server application 1606, which facilitates communication between the HTML interface 1602, application business rules 1608 and any back-end database server 1610. Because the request is to an overlying application 1608 rather than to a database 1610 directly, system efficiency and scalability are enhanced. The application 1608 can securely hold the database	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/144,612 Provisional Application, Page 2 "B. System Architecture

Lim	Lim 60/144,612 Provisional Application
connections open, greatly reducing the overhead on the server 1606 for each database query (alternative solutions require a data base open/close for each query). The application program 1608 (which may or may not be accessed through a middle layer JavaServlet 1612) discussed above may use programmed business rules to determine what queries need to be sent to which databases 1610 and may make database calls in a single block. This low-overhead process coupled with the ability to run multiple copies of the application program 1608 on the web server 1606 allow for many concurrent users. A multithreaded web server 1606 may balance requests to each copy of the application program 1608. The application program 1608 and database schema may be designed such that information about accounts, reward calculations, etc. are stored in the database 1610 and verified from the database 1610. Unauthorized users and automated web bots thus cannot simply make up a URL and send it in to increase their account balances. Once the application program 1608 processes a command, it builds and returns 1614 feedback to the users in HTML to the user's browser." Lim, 23:3-43	The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/144,612 Provisional Application, Pages 2-3 "The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for

Lim	Lim 60/144,612 Provisional Application
	relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next, the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/144,612 Provisional Application, Page 3 *See also* Lim 60/144,612 Provisional Application, Fig. 1

APPENDIX C

Appendix C

Below I provide two comparison charts.

The first chart, immediately below, compares the claim language of Claim 1 of Lim (Ex. 1004) in the left column and the corresponding disclosures from the Lim 60/151,512 Provisional Application (Ex. 1006) in the right column. As the chart shows, Claim 1 of Lim is fully disclosed by the Lim 60/151,512 Provisional Application. I have endeavored to make this list useful, but it is not exhaustive. Any absences from the chart should not be taken as indicative of any material difference between the references.

Lim Claim 1	Lim 60/151,512 Provisional Application
"1. A method, comprising:"	*See, e.g.*, Lim 60/151,512 Provisional Application, Pages 4 ("C. User Systems and Features; Some embodiments of the invention offer a number of different features to support end users of the invention. The customer signup process will be described first, then the ad viewing and searching process will be described… The basic process is as follows:"), 6 ("Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process")
"transmitting, at a first time after the expiration of a first determined interval and from a first computer system to a second computer system, a prompt including one or more graphical images, and a means for a human operator of the second computer system to provide a respective response thereto, the prompt presented in a format sufficient to permit the human operator of the second computer system, but not an automated process executing thereon, to read the prompt and provide a corresponding single correct and distinct response to the respective prompt presented by said graphical image;	"Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in

Lim Claim 1	Lim 60/151,512 Provisional Application
receiving, at the first computer system and from the second computer system, a response related to the prompt, said response (i) purportedly generated by the human operator and (ii) being responsive to the respective prompt set forth in the graphical image; determining, by the first computer system, whether the respective response matches its corresponding single correct and distinct response:"	conjunction with follow up registration, and/or between transactions using some embodiment of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text '123' and the quiz question might read, 'What number is shown?'. Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy. The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.) i) Number recognition. A number is presented graphically. The number can be generated randomly or from table i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word 'Ice Cream', etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also

Lim Claim 1	Lim 60/151,512 Provisional Application
	be asked to identify the one object that does not belong in the set of objects displayed. Other recognition examples include: (1) Twisted text recognition. A simple question is presented in text that is twisted to make OCR difficult, but easily readable to a human. (2) Color recognition. A color is presented and the user is asked to identify it. (3) Shape recognition. User is asked to identify the shape presented. (4) Self answering questions. Text questions which contain their answer. (5) One word question, one word answer. The user simply types the word presented in the graphic. ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XXXX minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display '2 cats + 2 dogs' and the correct answer may be '2 cats + 2 dogs'. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was

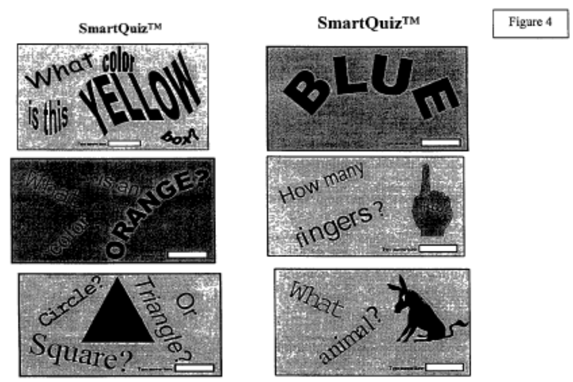
<table>
<tr><th>Lim Claim 1</th><th>Lim 60/151,512 Provisional Application</th></tr>
<tr><td></td><td>

yesterday?’, ‘How old is a 2-year old baby?’, ‘What color is red?’, ‘Is ice-cream hot or cold?’

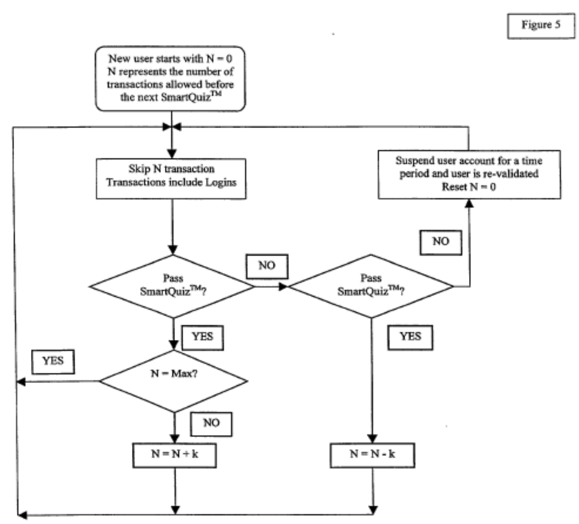
v) Awareness. Users are asked questions about the real world. "What day (month, year) is it?

b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)”

Lim 60/151,512 Provisional Application, Pages 6-8



Lim 60/151,512 Provisional Application, Fig. 4



Lim 60/151,512 Provisional Application, Fig. 5

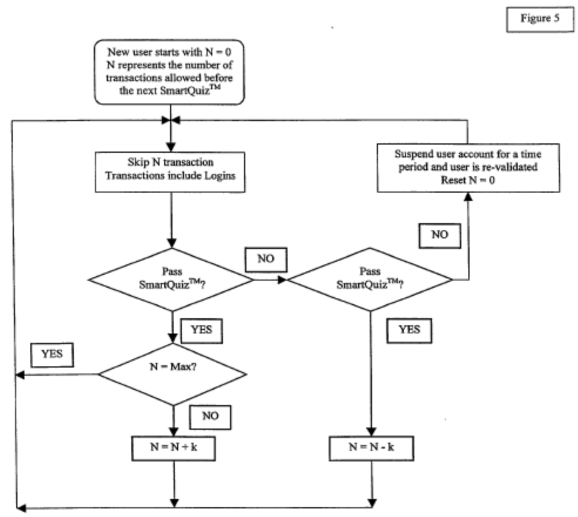
</td></tr>
<tr><td>“when so, inferring that the respective response was provided by the human operator of the second computer system and</td><td>

“Quizzes

Quizzes may be used as part of a process to verify that a user is a human, as opposed to an

</td></tr>
</table>

Lim Claim 1	Lim 60/151,512 Provisional Application
granting the human operator access to a computer-based resource; otherwise, not granting the human operator access to the computer-based resource;”	automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiment of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text ‘123’ and the quiz question might read, ‘What number is shown?’. Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy. The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Lim 60/151,512 Provisional Application, Pages 6-7
“determining an amount of time or amount of resources that will be accessible by the	“b) The user may see the quizzes with reduced frequency as he responds accurately and with

Lim Claim 1	Lim 60/151,512 Provisional Application
human operator before a next prompt is transmitted including adjusting an interval for a next prompt including increasing an amount of time or resources associated with the interval from a baseline amount to an increased amount when the respective response is inferred to have been provided by the human operator, wherein the intervals at which the human operator is quizzed by means of respective prompts set forth in the graphical images are determined by correctness or incorrectness of the human operator's responses to prior ones of the respective prompts, and wherein when the respective response matches its corresponding single correct and distinct response, further increasing a number of accesses or time allowed, before a next graphical image is provided by the first computer system, to the computer-based resource; and "providing a second prompt after expiration of the interval."	increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/151,512 Provisional Application, Page 8  Lim 60/151,512 Provisional Application, Fig. 5

The second chart, immediately below this paragraph, compares the disclosures relied upon in the Petition and in my declaration from Lim (Ex. 1004) in the left column and the corresponding disclosures from the Lim 60/151,512 Provisional Application (Ex. 1006) in the right column. As the chart shows, the Lim 60/151,512 Provisional Application discloses all of the concepts relied on in Lim. I have endeavored to make this list useful, but it is not exhaustive. Any absences from the chart should not be taken as indicative of any material difference between the references.

Lim	Lim 60/151,512 Provisional Application
"A process for verifying whether or not an Internet operation (e.g., sending an e-mail message or accessing a web site) is being	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per

<table>
<tr><th>Lim</th><th>Lim 60/151,512 Provisional Application</th></tr>
<tr><td>attempted by a human being or an automated process may be incorporated with the service by using a quiz process that requires user interaction.”

Lim, Abstract</td><td>ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising.”

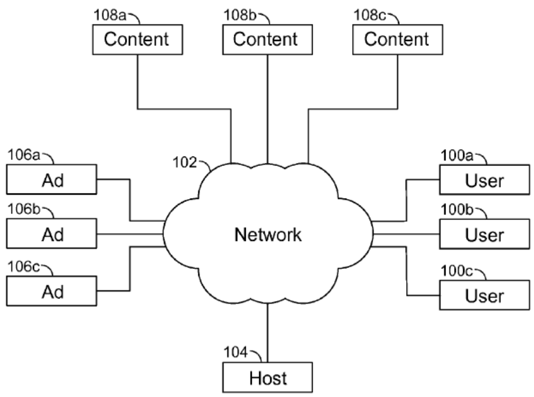
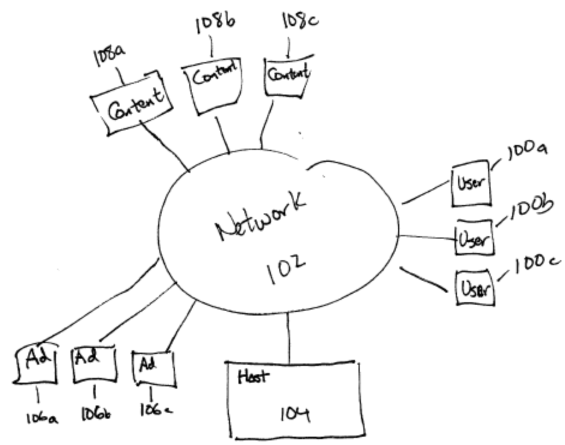
Lim 60/151,512 Provisional Application, Page 6</td></tr>
<tr><td>


FIG. 1

Lim, Fig. 1</td><td>


Lim 60/151,512 Provisional Application, Fig. 1</td></tr>
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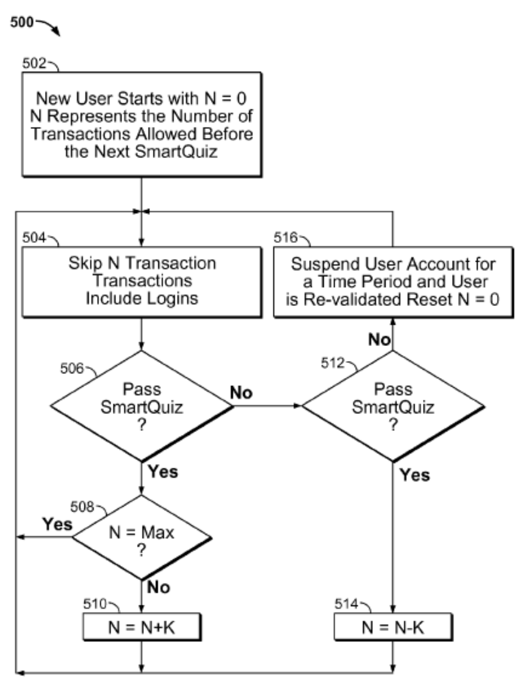
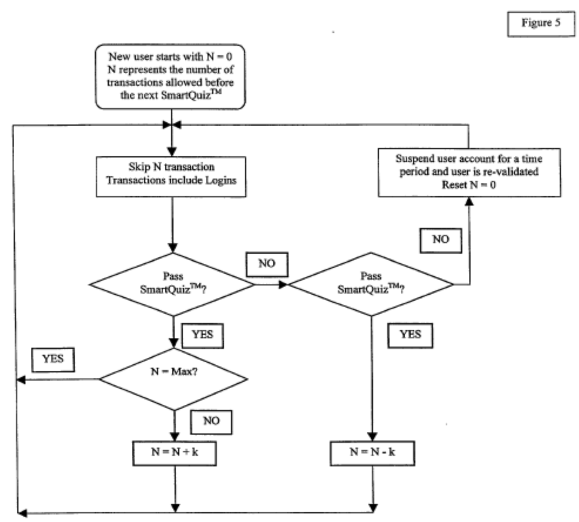


FIG. 5

Lim, Fig. 5</td><td>


Lim 60/151,512 Provisional Application, Fig. 5</td></tr>
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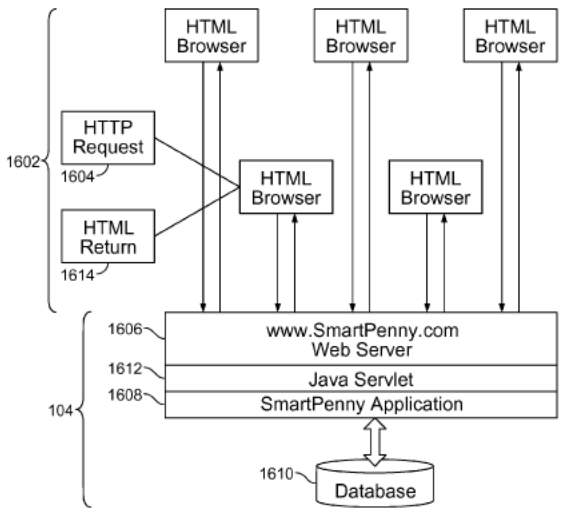
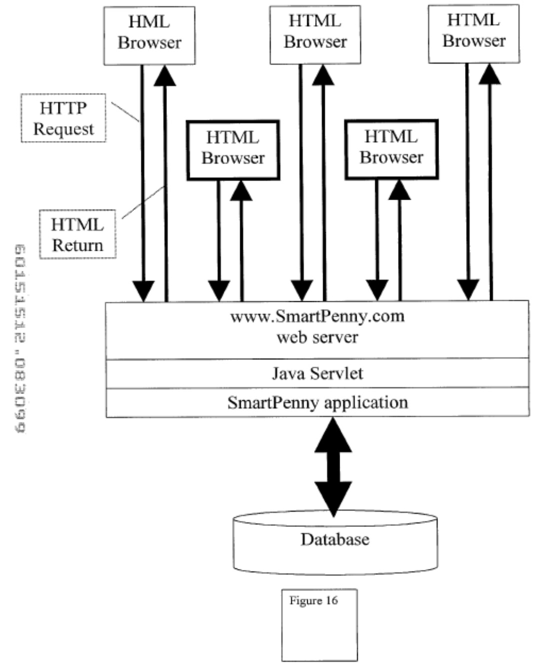


FIG. 16

Lim, Fig. 16
</td><td>


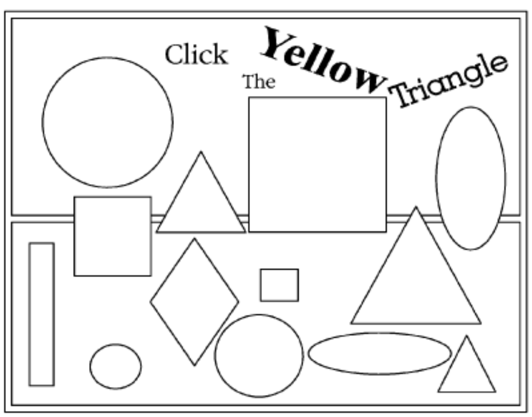
Lim 60/151,512 Provisional Application, Fig. 16
</td></tr>
<tr><td>


FIG. 17

Lim, Fig. 17
</td><td>
“The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture.

Types of quizzes:

a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)”

“i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word "Ice Cream", etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also
</td></tr>
</table>

Lim	Lim 60/151,512 Provisional Application
	be asked to identify the one object that does not belong in the set of objects displayed." "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XX (X minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display '2 cats + 2 dogs' and the correct answer may be '2 cats + 2 dogs'. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?'" Lim 60/151,512 Provisional Application, Page 7 *See also* Lim 60/151,512 Provisional Application, Pages 6-7
"The term "search engine" is generally meant to refer to a server or a collection of servers dedicated to indexing Internet web pages, storing the results and returning lists of pages that match particular queries (e.g.,	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant

Lim	Lim 60/151,512 Provisional Application
key word queries). A server is a computer, program or process that responds to requests for information from a client. On the Internet, all web pages are held on servers. This includes those parts of the search engines and directories that are accessible from the Internet. The indexes themselves are normally generated using spiders. A spider is that part of a search engine that surfs the web, storing the universal resource locators (URLs, i.e., the web addresses) and indexing the keywords and text of each page it finds. At present, some of the major search engines are Altavista™, Excite™, Hotbot™, Infoseek™, Lycos™, Northern Light™ and Webcrawler™. Note that the popular site Yahoo is technically a directory (a server or a collection of servers dedicated to indexing Internet web pages and returning lists of pages which match particular queries—directories, also known as indexes, are normally compiled manually, by user submission, and often involve an editorial selection and/or categorization process), not a search engine. The term search engine is nevertheless often used to describe both directories and search engines. Generally, search engines return results based on key words or search strings that are supplied by users. Results are typically found by matching the key words or search strings with metatags present in the hypertext markup language (HTML) used to encode the web pages of the target web sites. Results are also often ranked according to the quality of the match between the metatags and the search strings. Depending upon the search algorithms employed by the search engine, the more frequently a terms is used as a metatag, the more likely it is to be assigned a high ranking in the returned results. Owners of web sites therefore often repeat metatag terms numerous times (often using common spelling variations and similar terms) so as to	gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/151,512 Provisional Application, Page 2 "B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content.

Lim	Lim 60/151,512 Provisional Application
ensure that their respective web sites will gain a high ranking when an Internet user executes a search. While this is beneficial for the web site owner (as it is likely an Internet user will tend to select highly ranked results of a search), it is not necessarily beneficial for the user, who may be mislead into selecting a less than desirable web site by such tactics." Lim, 1:35-2:9	The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/151,512 Provisional Application, Pages 2-3 "The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next, the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/151,512 Provisional Application, Page 3 "Constraints on automated usage The number of users allowed to access the system from a particular computer or terminal will be limited by a certain number of cookies or Java applets installed on the user's computer or terminal. The system will also constrain automated access by allowing a limited number of users to access from certain unique IDs such as MAC address, IP address, or CPU serial number."

Lim	Lim 60/151,512 Provisional Application
	Lim 60/151,512 Provisional Application, Page 6 "H. Technical Methods The system (Figure 16) provides a standard user interface with low transactions costs and the ability to serve many users concurrently and securely. The interface to the user is HTML and JavaScript. All that users are required to have on their computer system is an industry standard browser like Netscape Navigator and/or Internet Explorer that is JavaTM enabled. The user can enter information into HTML forms submitted through HTTP requests to the web host. The HTTP request may contain a call to the web server application. The web server application facilitates communication between the HTML interface, the application business rules and the back end database server. Because the request is to the application rather than to the database directly, system efficiency and scalability are improved. The application can securely hold database connections open, greatly reducing the overhead on the server for each database query. The application uses business rules to determine what queries need to be sent to the database and makes the calls in a single group. This low overhead coupled with the ability to run multiple copies of the application on the web server allow for many concurrent users. The multithreaded web server balances the requests to each copy of the application. The application and database schema are designed such that information about accounts, reward calculations, etc., are stored in and verified from the database. The application is designed to make it difficult for a hacker, or an automated system, to create a URL that will increase their balance, etc. Once the application processes a command, it builds and returns

Lim	Lim 60/151,512 Provisional Application
	feedback to the users in HTML and/or in a JavaTM applet via their browsers." Lim 60/151,512 Provisional Application, Pages 14-15 *See also* Lim 60/151,512 Provisional Application, Figs. 1, 16
"In another embodiment, a process for verifying whether or not an Internet operation (e.g., sending an e-mail message or accessing a web site) is being attempted by a human being or an automated process may be implemented by using a quiz process that requires user interaction. The quiz process may include causing a graphical image which includes a question contained therein or associated therewith to be transmitted." Lim, 2:32-39	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site." "The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text '123' and the quiz question might read, 'What number is shown?'." Lim 60/151,512 Provisional Application, Page 6
"The quizzes may be used at a frequency according to a past history of successful responses to such quizzes" Lim, 3:1-3	"b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/151,512 Provisional Application, Page 8
"FIG. 4 illustrates various types of quizzes, any of which may be used in combination with one another or individually, which may be included in embodiments of the present invention." Lim, 3:23-26	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" Lim 60/151,512 Provisional Application, Page 7

Lim	Lim 60/151,512 Provisional Application
"FIG. 17 illustrates a further example of a quiz, which may be used in combination with other quizzes or individually, and which may be included in embodiments of the present invention." Lim, 3:64-67	"The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word "Ice Cream", etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed." "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XX (X minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display '2 cats + 2

Lim	Lim 60/151,512 Provisional Application
	dogs' and the correct answer may be '2 cats + 2 dogs'. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?'" Lim 60/151,512 Provisional Application, Page 7 *See also* Lim 60/151,512 Provisional Application, Pages 6-7
"A scheme that allows Internet users to take advantage of their individual user profiles in retrieving search results, viewing advertisements and/or performing other Internet-related activities is disclosed herein. Some embodiments of the present invention allow users to earn money, or credits, on-line by visiting certain web sites and/or viewing advertising on particular web sites. Such credits can be redeemed at content sites accessible via the Internet, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used as gratuities for the content providers. Furthermore, the system may allow users to use standard Web browsers such as Netscape's Navigator™, available from Netscape Communications, Inc., Mountain View, Calif., or Microsoft's Internet Explorer™, available from Microsoft Corporation, Redmond, Wash., and still access the features provided by the various embodiments of the invention. In accordance with embodiments of the present invention, web site owners and/or advertisers can target their most desired	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs. Content providers can assess micropayments, e.g. small payments, typically less than $1.00 per item, for their content or provide a means for users of their web sites to leave them monetary tips."

Lim	Lim 60/151,512 Provisional Application
audiences by setting higher rewards for specific demographic characteristics and thus "qualify" visitors to their site and/or viewers of their advertising. Further, advertisers can better control web-based advertising costs as demographically targeted advertising. The architecture of the system also allows content providers to assess micro-payments, e.g., small payments that may be less than $1.00 per item, for their content or provide a means for users of their web sites to leave them gratuities." Lim, 4:7-35	Lim 60/151,512 Provisional Application, Page 2 *See also* Lim 60/151,512 Provisional Application, Pages 2-3, 6, 14-15, Figs. 1, 16
"Before describing various aspects of the present invention in detail, it is helpful to present some background relating to the Internet in as much as it is expected that several embodiments of the present invention will make use of and be deployed over this ever-expanding network of computer networks. At bottom, the Internet may be regarded as a collection of devices linked together by various telecommunications media, enabling these devices (e.g., computer systems and the like) to exchange and share data, multimedia content and other information. Content sites accessible through the Internet provide information about a myriad of corporations and products, as well as educational, research and entertainment information and services. Literally millions people worldwide use the Internet on a daily or weekly basis. A computer or resource that is attached to the Internet is often referred to as a "host." Examples of such resources include conventional computer systems that are made up of one or more processors, associated memory (typically volatile and non-volatile) and other storage devices and peripherals that allow for connection to the Internet or other networks (e.g., modems, network	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/151,512 Provisional Application, Page 2 "B. System Architecture The basic system architecture according to some embodiments of the invention is shown in

Lim	Lim 60/151,512 Provisional Application
interfaces and the like). The precise hardware configuration of the hosting resource is generally not critical to the present invention, nor are the precise algorithms used to implement the services and methods described herein. Instead, the focus is on the nature of the services provided by the hosting resource. In most cases, the hosting resource may be embodied as hardware and/or software components of a server or other computer system that includes an interface module, which allows for some dialog with a user, and that may process information through the submission of Web forms completed by the user. Generally, such a server will be accessed through the Internet (e.g., via Web browsers) in the conventional fashion. Operating in conjunction with the interface module may be a communication interface that supports the distribution of electronic mail (e-mail) messages to or from other Web sites or users. In order to facilitate communications between hosts, each host has a numerical Internet protocol (IP) address. The IP address is made up of four groups of numbers separated by decimals. For example, the IP address of a hypothetical host computer might be 123.124.78.91. Each host also has a unique “fully qualified domain name.” The “fully qualified domain name” may not be repeated in the Internet. In the case of the hypothetical host 123.456.78.91, the “fully qualified domain name” might be “computer.domain.com”. In its most generic form, a fully qualified domain name consists of three elements. Taking “computer.host.com” as an example, the three elements are the hostname (“computer”), a domain name (“domain”) and a top-level domain (“com”). A given host looks up the IP addresses of other hosts	Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column.” Lim 60/151,512 Provisional Application, Pages 2-3 “The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next,

Lim	Lim 60/151,512 Provisional Application
on the Internet through a system known as domain name service. Domain name service is accomplished as follows: The Internet is divided into several "top level" domains. For example, ".edu" is a domain reserved for educational institutions, ".gov" is a domain reserved for government entities and ".net" is generally reserved for enterprises operating within the Internet. Although ".com" is short for "commercial," it is a catchall domain and is today the most popular one generally available to Internet users that have no special attributes, i.e., those that are not a school, a government office or an Internet-based enterprise. Each domain name active in a given top-level domain is registered with the top-level server which contains certain hostname and IP address information. As previously indicated, in order to access the Internet most users rely on computer programs known as "Web browsers." Commercially available Web browsers include such well-known programs as Netscape's Navigator™ and Microsoft's Internet Explorer™. If an Internet user desires to establish a connection with a Web page hosted at computer.domain.com, the Internet user might enter into a Web browser program the uniform resource locator (URL) "http: www.domain.com". The first element of the URL is a transfer protocol (most commonly, "http" standing for hypertext transfer protocol, but others include "mailto" for electronic mail, "ftp" for file transfer protocol, and "nntp" for network news transfer protocol). The remaining elements of this URL (in this case, "www" standing for World Wide Web—the Internet's graphical user interface—and "domain.com") are an alias for the fully qualified domain name of the host computer.domain.com. Once a URL is entered into the browser, the corresponding IP address is looked up in a	the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/151,512 Provisional Application, Page 3 "Constraints on automated usage The number of users allowed to access the system from a particular computer or terminal will be limited by a certain number of cookies or Java applets installed on the user's computer or terminal. The system will also constrain automated access by allowing a limited number of users to access from certain unique IDs such as MAC address, IP address, or CPU serial number." Lim 60/151,512 Provisional Application, Page 6 "H. Technical Methods The system (Figure 16) provides a standard user interface with low transactions costs and the ability to serve many users concurrently and securely. The interface to the user is HTML and JavaScript. All that users are required to have on their computer system is an industry standard browser like Netscape Navigator and/or Internet Explorer that is JavaTM enabled. The user can enter information into HTML forms submitted through HTTP requests to the web host. The HTTP request may contain a call to the web server application. The web server application facilitates communication between the HTML interface, the application business rules and the back end database server. Because the request is to the application rather than to the database directly, system efficiency and scalability are improved. The application can securely hold database

Lim	Lim 60/151,512 Provisional Application
process facilitated by a top-level server. In other words, all queries for addresses are routed to certain computers, the so-called top-level servers. The top-level server matches the domain name to an IP address of a domain name server capable of directing the inquiry to the computer hosting the Web page. Thus, domain name service ultimately matches an alphanumeric name such as www.domain.com with its numeric IP address 123.456.78.91. Registration of domain names is currently handled by a variety of organizations. A domain name server is a host computer with software capable of responding to domain name inquiries and accessible on a full-time basis to other computers on the Internet. Registering a domain name is the step that allows the top-level servers within the Internet to know where the domain name servers or hosts associated with those domain names are located in the Internet. Domain name service can be operated by the domain name holder or obtained from any entity with the proper computer equipment, including hundreds of Internet service providers (ISPs). One way to establish a presence on the Internet is by placing a Web page, which is, ultimately, a computer data file on a host operating a Web server within a given domain name. When the Web server receives an inquiry from the Internet, it returns the Web page data in the file to the computer making the inquiry. The Web page may be a single line or multiple pages of information and may include any message, name, word, sound or picture, or combination of such elements. Most Web browsers will show somewhere on the screen the domain name of the Web page being shown and will automatically include the domain name in any printout of the Web page. There is no technical connection or relationship between	connections open, greatly reducing the overhead on the server for each database query. The application uses business rules to determine what queries need to be sent to the database and makes the calls in a single group. This low overhead coupled with the ability to run multiple copies of the application on the web server allow for many concurrent users. The multithreaded web server balances the requests to each copy of the application. The application and database schema are designed such that information about accounts, reward calculations, etc., are stored in and verified from the database. The application is designed to make it difficult for a hacker, or an automated system, to create a URL that will increase their balance, etc. Once the application processes a command, it builds and returns feedback to the users in HTML and/or in a JavaTM applet via their browsers." Lim 60/151,512 Provisional Application, Pages 14-15 *See also* Lim 60/151,512 Provisional Application, Figs. 1, 16

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a domain name and the contents of the corresponding Web page. There are a number of ways for an Internet user to find a Web page. Web browsers feature access to various indexes, commonly referred to as search engines. These indexes will allow the user to enter a name or a word or a combination of words, and will return the results of the search as a list of “hyperlinks” to Web pages that have information within or associated with the document making up the page responding to the search. A hyperlink is a link from one site on the Internet to a second site on the Internet. “Clicking” (or, more generally, selecting using a cursor control device such as a mouse, joystick, touch pad, etc.) on a designated space on the initial site which references the subsequent site by a picture, highlighted text or some other indication will direct the user's browser from the initial site to the second site. In addition to their use in indexes, hyperlinks are commonly placed on Web pages, thus allowing Internet users to move from Web page to Web page at the click of a button, without having to type in URLs. Hyperlinks are also used to initiate the transfer of files or other information from the hosting resource to the user's computer in a process commonly known as downloading. Hyperlinks can be and commonly are established without reference to the domain name of the second site. A hyperlink is not technically related to a domain name and therefore it can be identical to an existing domain name without conflicting with that domain name. For example, were the operator of a Web page known as SITE to establish a home page at http: www.xyz.com, any number of indexes could be employed and hyperlinks could be established to bring up the page through use of the word SITE.	

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Some Web pages are referred to as Web forms. In general, a form is a collection of form fields displayed as a Web page by a browser in response to hypertext mark-up language (HTML) tags and other information received from a Web server. An associated form handler resides at the server to collect and process the information submitted by a user via the form. By using such forms, an information collection process performed by a host is made interactive with the users thereof. That is, users can add text to text boxes, select from drop down menus and/or select check boxes and/or radio buttons, etc. Typically, the user submits the form by clicking on a submit button or other appropriately labeled element of the form and, upon such submission, the contents of the form are passed to the form handler. Depending upon the type of information being submitted and the type of form handler being used, the information submitted by a user may be appended to a file maintained by the host, for example a file associated with a temporary account assigned to the user or a larger database. In this way information may be collected, processed and displayed to those who access it. A text box is a standard form field into which a user can type text. When a form containing a text box is submitted in a Web browser, the name and contents of the text box are provided to the form handler running on the server. A check box field is typically arranged in a grid or matrix fashion with one or more cells of the matrix including a check box. Check box fields present a user with choices that can be made by clicking (e.g., selecting or deselecting as appropriate) a check box. Such fields are created and rendered using programming techniques common in the art and any number (including all or none) of individual check boxes may be selected or not. When a user	

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submits a form containing a check box field, the name of each check box along with its value is provided to the form handler at the host. Radio button fields present a user with a choice that can be made by selecting a button. Radio buttons are displayed in a set, only one of which may be selected at a time. When radio button fields are created, they are assigned a group name, and each button in the group is assigned a value and an initial state (selected or not selected). When the user selects one of the buttons in the field, all other buttons in the field take on a value of not selected. Then, when the user submits the form, the group name and value of the buttons is provided to the corresponding form handler at the server for processing." Lim, 5:6-7:61	
"With the above background, aspects of the present invention may now be described. In general, the present invention may be regarded as a service that allows users (preferably registered users) thereof to earn and/or redeem credits on-line in exchange for sharing their personal or demographic information. Thus, users of the system (which may be regarded as a hosted environment embodied as computer readable instructions residing in computer-readable media associated with a computer system attached to/accessible through the Internet) are asked to provide demographic information which may be used to customize advertisements displayed to the user and/or search results from search queries posed by the user. In exchange for this information, the users receive credits which they can later redeem in various fashions as described below. To the users, the process is very similar to the customary actions they may be accustomed to in interacting with other search engine sites and/or web portals, with the exception that the use of rich	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, withdrawn as cash, and/or used to tip content providers. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft Corporation, Seattle, Washington, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/151,512 Provisional Application, Page 2

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demographic profiles allows for certain customizations that are not provided by other Internet-based services and systems. In addition, the present system offers unique features such as "quizzes" which can be used to validate a third party. These and other features will be discussed below." Lim, 7:62-8:17	"Quizzes may be used as part of a process to Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without a human actually viewing the advertising or visiting the site." Lim 60/151,512 Provisional Application, Page 6 *See also* Lim 60/151,512 Provisional Application, Pages 3-8
"A. System Architecture A basic system architecture within which embodiments of the present invention may operate and be utilized is shown in FIG. 1. Users 100a-care coupled in communication with a network 102. The network 102 might be the Internet, or some other type of computer network (e.g., a local or wide area network or a metropolitan area network) or network of networks. Through the network 102, the users 100a-c can access content sources 108a-c. For example, the content sources 108a-c might include servers and/or proxies hosting Web sites for entertainment, commercial enterprises, research journals, newspapers, and/or some other type of activity, business or interest. Advertisers, such as advertisers 106a-c, are entities that wish to place advertising and/or draw visitors to their sites. Some of the advertisers 106a-c may also be content providers. For example, a company such as NetscapeTM might both advertise its portal service as well as provide content. Host 104 is configured in accordance with an embodiment of the present invention and may also support the transaction or micro-payment system described below. As part of	"B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive micropayments for goods and services they

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its operation, host 104 stores information about user accounts, e.g., for the users 100a-c. Host 104 may also provide advertisers 106a-c means to receive payment for qualified viewers, e.g., those meeting certain pre-established demographic criteria. Also, the host 104 may provide content providers means to receive payments for goods and services they offer either through a 'pay-per-view' fee or a tipping (gratuity) scheme. For example, a content provider associated with content source 108a might offer access to a scientific journal hosted at that content source at for $0.50/article (or some other pay per-use fee). Alternatively, the content provider might provide a hyperlink to a Web site (e.g., hosted by host 104) that allows users to provide a gratuity (e.g., so as to express their appreciation for a particular story or column)." Lim, 8:18-52	offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/151,512 Provisional Application, Pages 2-3
"Thus, the host 104 acts as a transaction mediator for this system. The host 104 may be made up of one or more computers, a cluster of computers, a web or server farm, and/or some other configuration of one or more computers. The remainder of the discussion below will assume that the network configuration shown in FIG. 1 is used. Accordingly, embodiments of the invention (which may be computer software, hardware and/or combinations of both) are discussed as being hosted/provided by or from the host 104, although advertising content and hyperlinks to other reward-offering sites may be provided by other sources. In some cases the network 102 may be associated with multiple hosts 104 supporting embodiments of the invention." Lim, 8:52-65	"Thus, the host 104 acts as the transaction mediator for this system. The host 104 may be multiple computers, a cluster of computers, a web farm, and/or some other sort of configuration of one or more computers. The remainder of the discussion will assume the configuration shown in Figure 1. Accordingly embodiments of the invention discussed are primarily hosted/provided from the host 104 although advertising content and reward offering links may be provided from other sources. Also, the network 102 may have multiple hosts 104 supporting embodiments of the invention. Depending on contractual arrangements between providers, credits earned on one system may or may not be valid on another." Lim 60/151,512 Provisional Application, Page 3
"In some embodiments of the present invention, a search engine returns results	"Search Engine

Lim	Lim 60/151,512 Provisional Application
according to a ranking that is established according to user-supplied demographic information. In these and/or other cases, advertisements may be presented to users based on such demographic information. Accordingly, embodiments of the present invention offer user registration processes so that users might build rich profiles of themselves, allowing for customized search results to be returned by the search engine each time a search query is executed and/or to provide customized advertisement viewing." Lim, 9:20-30	Some embodiments of the invention include a search engine that allows the user to search for ads and content relevant to their interests. Search results can be sorted according to relevance, reward value, and popularity, and/or other criteria. The following describes the search process: 1) Selects the search engine from a web site including an embodiment of the invention and enters or selects the search keyword(s). a) If the user is not logged in, they will be directed to the login/sign up pages, but in some embodiments, users can use the system without logging in. b) If a user is not logged in, they will be able to do searches without the benefit of the demographic reward and corresponding sorting. (Figure 10) c) Once registered (Figure 11) and logged in, the user's username, balance and/or demographic profile will appear either in the window and/or in a pop up window brought up by a mouse click from the user on a button. (Figure 12) d) The user types or selects the desired category to search for. e) The user is returned a list of links relevant to the user's search criteria. (Figure 13). Sites offering highest reward will be listed first, their reward indicating their heightened interest in the users demographic. This matchmaker function merges information about both parties, making a more efficient match for both, allowing destination sites to only pay lead rewards to targeted users and users to easily identify sites who desire them (as well as those who do not). For example, in Figure 13, Zoom travel, which targets young males appears at the top of the list, rather than the bottom, in contrast to alphabetic order. AAAAA Travel, on the other hand, is not targeting young males

Lim	Lim 60/151,512 Provisional Application
	and correspondingly appears towards the bottom." Lim 60/151,512 Provisional Application, Page 8 *See also* Lim 60/151,512 Provisional Application, Pages 3-6, 10-13
"The basic registration process may be described as follows: A. New users may by referred to a service provider's Web site (e.g., hosted by host 104) offering a service configured in accordance with the present invention and encouraged to 'sign up', e.g., by information displayed at a content provider's Web site, various advertising for the service, the service provider's home page, and/or some other source. i) Before being allowed to register, these new users may be asked to answer one or more questions of a quiz to test whether they are a human users or not (see the discussion of such Quizzes below). As indicated above, spiders are automated computer processes that are capable of searching the Web and retrieving Web page information. Variations of spiders known as robots or bots have been created that might allow for completion of a simple web form or other registration instrument, and thereby garner any rewards associated therewith, without having to subject a human user to this process. To avoid abuses of the present system, quizzes may be introduced at various levels to thwart such automated processes and allow access only by live, human users." Lim, 9:45-67	"The basic process is as follows: 1) New users are referred to sign up, e.g. from a content provider, advertising for the service, the service home page, and/or some other source. a) The new user may be asked to answer a quiz to test whether they are a human or not (see Quizzes below)." "Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site." Lim 60/151,512 Provisional Application, Pages 4, 6
"4. Constraints on Automated Usage Computer systems configured in accordance	"Constraints on automated usage

Lim	Lim 60/151,512 Provisional Application
with the present invention may limit or restrict the number of users which are allowed access from a particular computer or terminal based upon a certain number of cookies or Java applets installed on the user's computer or terminal. such systems may also constrain automated access by allowing a limited number of users access from computers or other web-capable devices associated with certain unique identifiers such as a medium access control (MAC) addresses, IP addresses, or central processing unit (CPU) serial numbers." Lim, 13:4-14	The number of users allowed to access the system from a particular computer or terminal may be limited by the number of cookies and/or Java applets installed on the user's computer or terminal. The system will also constrain automated access by allowing a limited amount of access from a single unique identifier, e.g. medium access control (MAC) address, Internet Protocol (IP) address, and/or CPU serial number." Lim 60/151,512 Provisional Application, Page 6 *See also* Lim 60/151,512 Provisional Application, Pages 2-3, 14-15; Figs. 1, 16
"5. Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process (e.g., a bot or robot). Because users are paid per ad and/or site viewed, an automated system would be able to earn money or credits without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the present invention make use of periodic quizzes, also called a SmartOuiz TM, to verify that a particular user is a human. As noted above, these quizzes may be employed during the registration process to verify that a user is a human. Additionally, such quizzes can be used in conjunction with follow up registrations, and/or between transactions using some embodiments of the invention. The basic premise is to design a quiz (or question) using a display format that cannot be easily recognized or read by a machine or automated process. For example, text that is embedded in graphical representations such as an image could be used. The pictures can contain a simple question that any user	"Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiments of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text "123" and the quiz question might read, "What number is shown?".

Lim	Lim 60/151,512 Provisional Application
would be expected to be able to answer. For example, the picture or other image form might have the text ‘123’ drawn therein, and the quiz question might read, ‘What number is shown?’ A separate text box or other data entry device rendered in the web page with the quiz question image could then be used by the user to enter his/her answer.” Lim, 13:15-39	Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy.” Lim 60/151,512 Provisional Application, Pages 6-7
“Because automated entities are not able to decipher the question (or more particularly, the answer to the question) from the image, such processes will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could provide the correct answer. The object here is not to test the skill or knowledge of the user per se (although such tests could be used if appropriate to a given situation), but rather to ensure that some human being (and not just another computer system) is actually viewing the pages/ads being rendered. This way, advertisers are provided with some assurance that their advertising dollars are not being wasted.” Lim, 13:40-51	“Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without a human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiments of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text "123" and the quiz question might read, "What number is shown?". Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy.”

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	Lim 60/151,512 Provisional Application, Pages 6-7
"The answers to the quiz questions may be provided using a text-input box located anywhere on the Web page containing the quiz, image. For multiple-choice questions, the answers might be selectable from the image itself, e.g., using an image map, and/or through an HTML form surrounding the picture. FIGS. 4a-4f illustrate various types of quizzes, any of which may be used in combination with one another or individually" Lim, 13:52-59	"The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" Lim 60/151,512 Provisional Application, Page 7
"ii) Simple word/object identification/recognition (e.g., FIGS. 4c and 4f). The name of an object or other word is spelled out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word 'Ice Cream', etc. Users are asked to enter (e.g., in a text box) the name of the object in the space provided, or, are asked to select the correct picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in a set of objects being displayed." Lim, 13:63-14:5	"i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word 'Ice Cream', etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed." Lim 60/151,512 Provisional Application, Page 7
"(1) Twisted text recognition (e.g., FIGS. 4 a and 4 b). A simple question is presented in text that is twisted (i.e., displayed in a non-linear fashion) to make optical character recognition (OCR) difficult, while still remaining easily readable to a human. (2) Color recognition (e.g., FIG. 4 d). A color is presented and the user is asked to identify it.	"Other recognition examples include: (1) Twisted text recognition. A simple question is presented in text that is twisted to make OCR difficult, but easily readable to a human. (2) Color recognition. A color is presented and the user is asked to identify it. (3) Shape recognition. User is asked to identify the shape presented.

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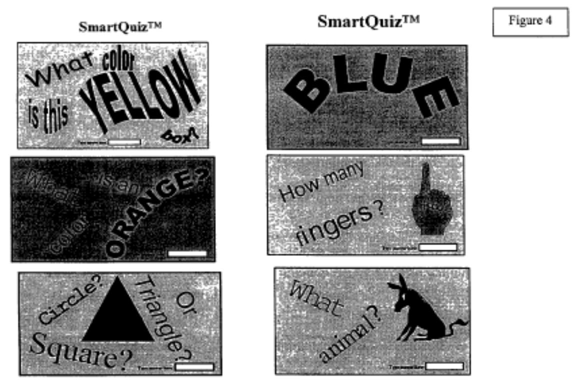
(3) Shape recognition (e.g., FIG. 4 c). A user is asked to identify the shape presented (e.g., a triangle, a square, etc.). (4) Self-answering questions (e.g., FIGS. 4a, 4e and 4f). Text or graphical questions that contain their own answer." Lim, 14:7-20	(4) Self answering questions. Text questions which contain their answer." Lim 60/151,512 Provisional Application, Page 7  Lim 60/151,512 Provisional Application, Fig. 4
"iii) Simple counting (e.g., FIG. 4e). A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to enter (e.g., in a text box) the number of objects being displayed, or are asked to select the picture, word or number matching the object displayed. Users may also be asked to select the set of pictures showing the same number of objects." Lim, 14:24-30	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects." Lim 60/151,512 Provisional Application, Page 7
"v) Simple queries (e.g., FIGS. 4a-4f). Users are asked simple questions using graphical text. Responses may be entered as text or selected by 'clicking' (e.g., using a cursor control device such as a mouse) on the right area. Examples of questions that might be used are: 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice cream hot or cold?', etc."	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?',

Lim	Lim 60/151,512 Provisional Application
Lim, 14:42-48	‘What color is red?’, ‘Is ice-cream hot or cold?’” Lim 60/151,512 Provisional Application, Page 7
“vii) Click on a Designated Object/Space. Users are asked to select a particular image, e.g., ‘Click on the yellow triangle.’ (See e.g., FIG. 17.): Lim, 14:51-53	“The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)” “i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word "Ice Cream", etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed.” “ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, ‘4 divided by two’, ‘XX (X minus XX (where X is an object)’. Users are asked to type in the correct number in the space provided, or, they

<table>
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<tr><td></td><td>have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display ‘2 cats + 2 dogs’ and the correct answer may be ‘2 cats + 2 dogs’.

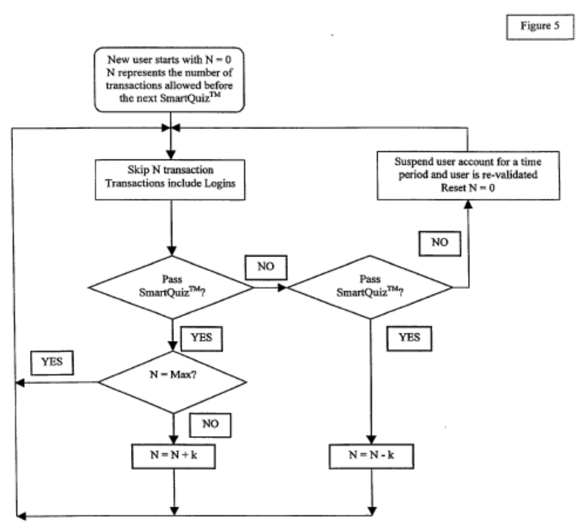
iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are ‘What day was yesterday?’, ‘How old is a 2-year old baby?’, ‘What color is red?’, ‘Is ice-cream hot or cold?’”

Lim 60/151,512 Provisional Application, Page 7

See also Lim 60/151,512 Provisional Application, Pages 6-7</td></tr>
<tr><td>“Users may be quizzed with reduced frequency as they respond accurately and with increasing frequency as they fail to respond accurately. For example, FIG. 5 illustrates a process 500 wherein a new user starts (step 502) and is presented with SmartOuizzes at various intervals (step 504). As each quiz is taken (step 506) a determination is made as to whether the user passed the test. If so (step 508), the interval is adjusted (step 510) until a maximum interval is reached. If the user fails a test, a retest might be offered (step 512). Passing the retest also resets the testing interval (step 514). Failing the retest (step 516) suspends the user's account for a designated time interval or causes some other penalty.”

Lim, 14:58-15:2</td><td>“b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)”

Lim 60/151,512 Provisional Application, Page 8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</table>

Lim	Lim 60/151,512 Provisional Application
	Lim 60/151,512 Provisional Application, Fig. 5
"H. Technical Methods The present system (see FIG. 16) is designed to solve Several technical problems and includes a standard user inter face 1602 that may make use of a conventional web browser, facilities to allow for minimized transactions costs, the ability to serve many users concurrently and secure information transfer without high overhead costs. The interface to the user is conventional HTML and JavaScript, allowing users of the system to rely on conventional web browsers for access and operation. All functions on the present system begin with the user entering information into a conventional HTML form and submitting a conventional HTTP request 1604 to the web host 104. The HTTP request may contain a call to the web server application 1606, which facilitates communication between the HTML interface 1602, application business rules 1608 and any back-end database server 1610. Because the request is to an overlying application 1608 rather than to a database 1610 directly, system efficiency and scalability are enhanced. The application 1608 can securely hold the database connections open, greatly reducing the overhead on the server 1606 for each database query (alternative solutions require a data base open/close for each query). The application program 1608 (which may or may not be accessed through a middle layer JavaServlet 1612) discussed above may use programmed business rules to determine what queries need to be sent to which databases 1610 and may make database calls in a single block. This low-overhead process coupled with the ability to run multiple copies of the application program 1608 on the web server 1606 allow for many	"H. Technical Methods The system (Figure 16) provides a standard user interface with low transactions costs and the ability to serve many users concurrently and securely. The interface to the user is HTML and JavaScript. All that users are required to have on their computer system is an industry standard browser like Netscape Navigator and/or Internet Explorer that is JavaTM enabled. The user can enter information into HTML forms submitted through HTTP requests to the web host. The HTTP request may contain a call to the web server application. The web server application facilitates communication between the HTML interface, the application business rules and the back end database server. Because the request is to the application rather than to the database directly, system efficiency and scalability are improved. The application can securely hold database connections open, greatly reducing the overhead on the server for each database query. The application uses business rules to determine what queries need to be sent to the database and makes the calls in a single group. This low overhead coupled with the ability to run multiple copies of the application on the web server allow for many concurrent users. The multithreaded web server balances the requests to each copy of the application. The application and database schema are designed such that information about accounts, reward calculations, etc., are stored in and verified from the database. The application is designed to make it difficult for a hacker, or an automated system, to create a URL that will increase their balance, etc. Once the application processes a command, it builds and returns

Lim	Lim 60/151,512 Provisional Application
concurrent users. A multithreaded web server 1606 may balance requests to each copy of the application program 1608. The application program 1608 and database schema may be designed such that information about accounts, reward calculations, etc. are stored in the database 1610 and verified from the database 1610. Unauthorized users and automated web bots thus cannot simply make up a URL and send it in to increase their account balances. Once the application program 1608 processes a command, it builds and returns 1614 feedback to the users in HTML to the user's browser." Lim, 23:3-43	feedback to the users in HTML and/or in a JavaTM applet via their browsers. Lim 60/151,512 Provisional Application, Pages 14-15

APPENDIX D

<u>**Appendix D**</u>

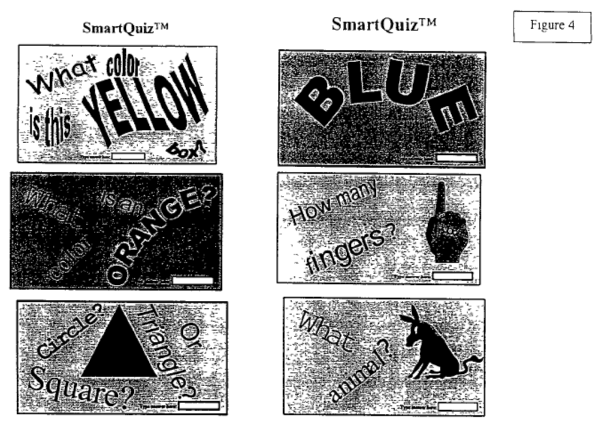
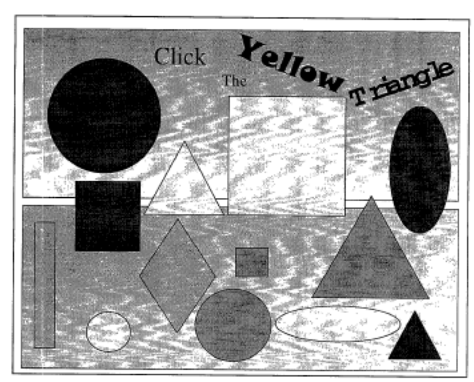
Below I provide two comparison charts.

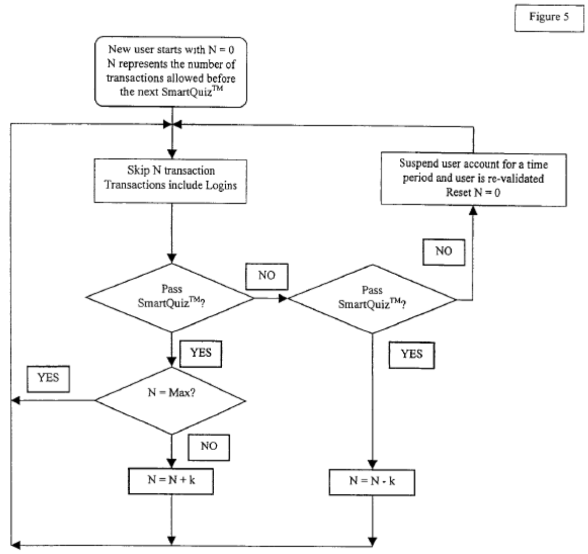
The first chart, immediately below, compares the claim language of Claim 1 of Lim (Ex. 1004) in the left column and the corresponding disclosures from the Lim 60/201,539 Provisional Application (Ex. 1007) in the right column. As the chart shows, Claim 1 of Lim is fully disclosed by the Lim 60/201,539 Provisional Application. I have endeavored to make this list useful, but it is not exhaustive. Any absences from the chart should not be taken as indicative of any material difference between the references.

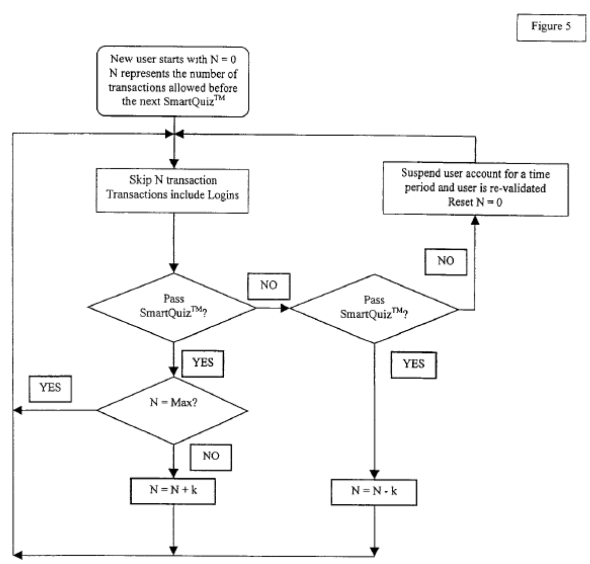
Lim Claim 1	Lim 60/201,539 Provisional Application
"1. A method, comprising:"	*See, e.g.*, Lim 60/201,539 Provisional Application, Pages 4 ("C. User Systems and Features; Some embodiments of the invention offer a number of different features to support end users of the invention. The customer signup process will be described first, then the ad viewing and searching process will be described… The basic process is as follows:"), 6 ("Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process")
"transmitting, at a first time after the expiration of a first determined interval and from a first computer system to a second computer system, a prompt including one or more graphical images, and a means for a human operator of the second computer system to provide a respective response thereto, the prompt presented in a format sufficient to permit the human operator of the second computer system, but not an automated process executing thereon, to read the prompt and provide a corresponding single correct and distinct response to the respective prompt presented by said graphical image;	"Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in

Lim Claim 1	Lim 60/201,539 Provisional Application
receiving, at the first computer system and from the second computer system, a response related to the prompt, said response (i) purportedly generated by the human operator and (ii) being responsive to the respective prompt set forth in the graphical image; determining, by the first computer system, whether the respective response matches its corresponding single correct and distinct response:”	conjunction with follow up registration, and/or between transactions using some embodiment of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text ‘123’ and the quiz question might read, ‘What number is shown?’. Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy. The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.) i) Number recognition. A number is presented graphically. The number can be generated randomly or from table i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word ‘Ice Cream’, etc. Users are asked to type in the name of the object in the space provided, or, they have to click on the right picture or word matching the object displayed. Users may also

Lim Claim 1	Lim 60/201,539 Provisional Application
	be asked to identify the one object that does not belong in the set of objects displayed. Other recognition examples include: (1) Twisted text recognition. A simple question is presented in text that is twisted to make OCR difficult, but easily readable to a human. (2) Color recognition. A color is presented and the user is asked to identify it. (3) Shape recognition. User is asked to identify the shape presented. (4) Self answering questions. Text questions which contain their answer. (5) One word question, one word answer. The user simply types the word presented in the graphic. ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects. iii) Simple math. Using numbers or objects or a text description, users have to perform simple math calculations such as 1 + 1, 2 * 2, '4 divided by two', 'XXXX minus XX (where X is an object)'. Users are asked to type in the correct number in the space provided, or, they have to click on the correct answer represented in picture, word or number. Users may also be asked to click on the right set of pictures showing the same mathematical results. For example, the question may display '2 cats + 2 dogs' and the correct answer may be '2 cats + 2 dogs'. iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was

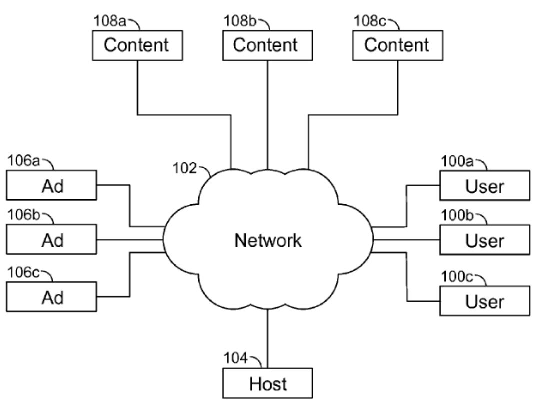
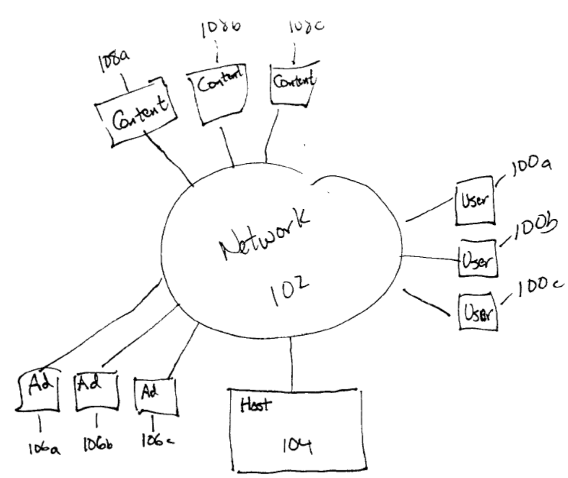
Lim Claim 1	Lim 60/201,539 Provisional Application
	yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?' v) Awareness. Users are asked questions about the real world. "What day (month, year) is it? vi) Click on Space. Users are asked to click on a graphic space. 'Click on the red box.' (See also Figure 17) b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/201,539 Provisional Application, Pages 6-8  Lim 60/201,539 Provisional Application, Fig. 4 Figure 17  Lim 60/201,539 Provisional Application, Fig. 17

Lim Claim 1	Lim 60/201,539 Provisional Application
	 Lim 60/201,539 Provisional Application, Fig. 5
“when so, inferring that the respective response was provided by the human operator of the second computer system and granting the human operator access to a computer-based resource; otherwise, not granting the human operator access to the computer-based resource;”	“Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiment of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the

Lim Claim 1	Lim 60/201,539 Provisional Application
	picture might have the text '123' and the quiz question might read, 'What number is shown?'. Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy. The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Lim 60/201,539 Provisional Application, Pages 6-7
"determining an amount of time or amount of resources that will be accessible by the human operator before a next prompt is transmitted including adjusting an interval for a next prompt including increasing an amount of time or resources associated with the interval from a baseline amount to an increased amount when the respective response is inferred to have been provided by the human operator, wherein the intervals at which the human operator is quizzed by means of respective prompts set forth in the graphical images are determined by correctness or incorrectness of the human operator's responses to prior ones of the respective prompts, and wherein when the respective response matches its corresponding single correct and distinct response, further increasing a number of accesses or time allowed, before a next graphical image is provided by the first computer system, to the computer-based resource; and	"b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/201,539 Provisional Application, Page 8  Lim 60/201,539 Provisional Application, Fig. 5

Lim Claim 1	Lim 60/201,539 Provisional Application
"providing a second prompt after expiration of the interval."	

The second chart, immediately below this paragraph, compares the disclosures relied upon in the Petition and in my declaration from Lim (Ex. 1004) in the left column and the corresponding disclosures from the Lim 60/201,539 Provisional Application (Ex. 1007) in the right column. As the chart shows, the Lim 60/201,539 Provisional Application discloses all of the concepts relied on in Lim. I have endeavored to make this list useful, but it is not exhaustive. Any absences from the chart should not be taken as indicative of any material difference between the references.

Lim	Lim 60/201,539 Provisional Application
"A process for verifying whether or not an Internet operation (e.g., sending an e-mail message or accessing a web site) is being attempted by a human being or an automated process may be incorporated with the service by using a quiz process that requires user interaction." Lim, Abstract	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site." Lim 60/201,539 Provisional Application, Page 6
 FIG. 1 Lim, Fig. 1	 Lim 60/201,539 Provisional Application, Fig. 1

<table>
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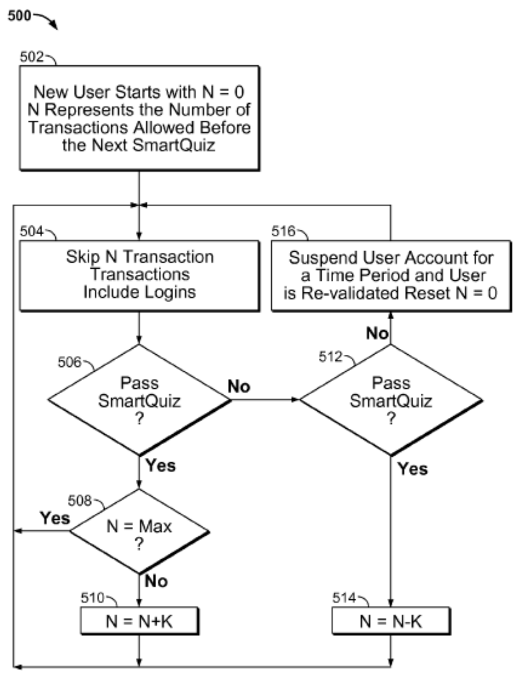
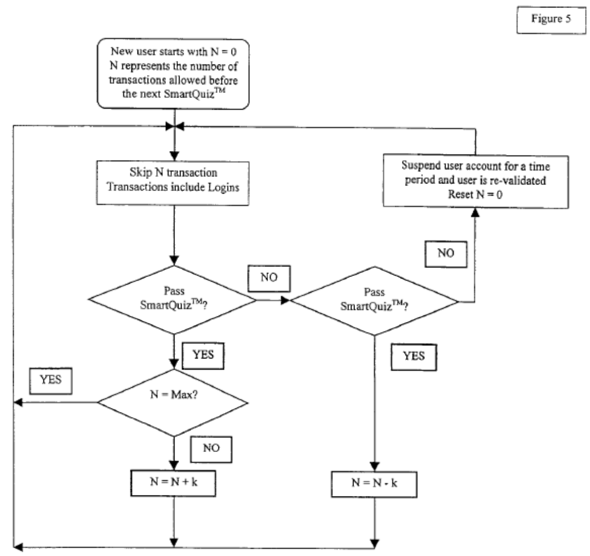
<tr><td>


FIG. 5

Lim, Fig. 5
</td><td>


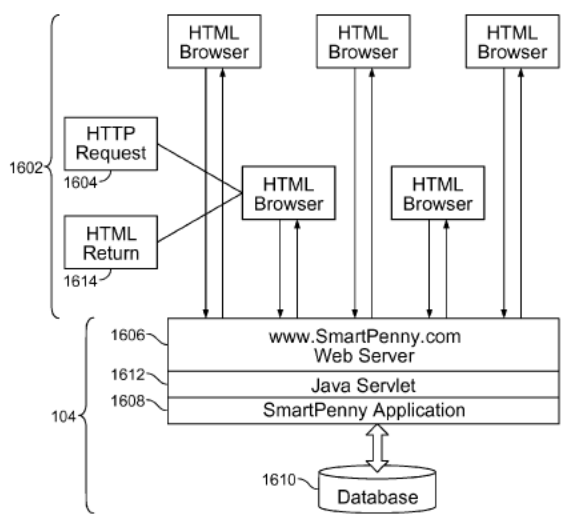
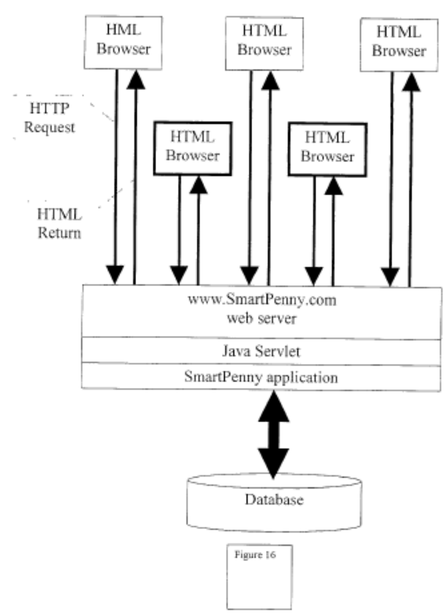
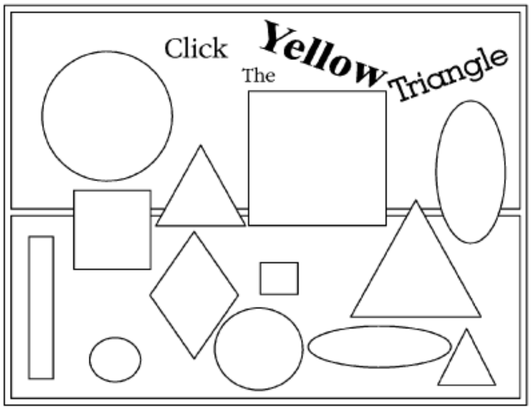
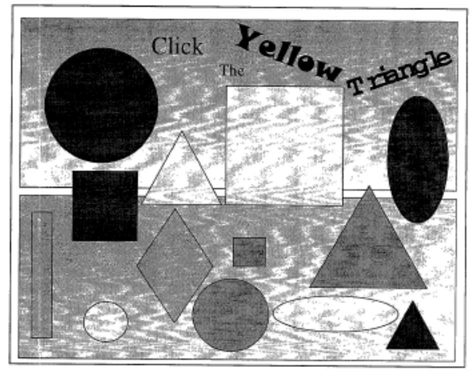
Lim 60/201,539 Provisional Application, Fig. 5
</td></tr>
<tr><td>


FIG. 16

Lim, Fig. 16
</td><td>


Lim 60/201,539 Provisional Application, Fig. 16
</td></tr>
</table>

Lim	Lim 60/201,539 Provisional Application
 FIG. 17 Lim, Fig. 17	Figure 17  Lim 60/201,539 Provisional Application, Fig. 17
"The term "search engine" is generally meant to refer to a server or a collection of servers dedicated to indexing Internet web pages, storing the results and returning lists of pages that match particular queries (e.g., key word queries). A server is a computer, program or process that responds to requests for information from a client. On the Internet, all web pages are held on servers. This includes those parts of the search engines and directories that are accessible from the Internet. The indexes themselves are normally generated using spiders. A spider is that part of a search engine that surfs the web, storing the universal resource locators (URLs, i.e., the web addresses) and indexing the keywords and text of each page it finds. At present, some of the major search engines are Altavista™, Excite™, Hotbot™, Infoseek™, Lycos™, Northern Light™ and Webcrawler™. Note that the popular site Yahoo is technically a directory (a server or a collection of servers dedicated to indexing Internet web pages and returning lists of pages which match particular queries—directories, also known as indexes, are normally compiled manually, by user submission, and often involve an editorial selection and/or categorization process), not	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/201,539 Provisional Application, Page 2 "B. System Architecture

Lim	Lim 60/201,539 Provisional Application
a search engine. The term search engine is nevertheless often used to describe both directories and search engines. Generally, search engines return results based on key words or search strings that are supplied by users. Results are typically found by matching the key words or search strings with metatags present in the hypertext markup language (HTML) used to encode the web pages of the target web sites. Results are also often ranked according to the quality of the match between the metatags and the search strings. Depending upon the search algorithms employed by the search engine, the more frequently a terms is used as a metatag, the more likely it is to be assigned a high ranking in the returned results. Owners of web sites therefore often repeat metatag terms numerous times (often using common spelling variations and similar terms) so as to ensure that their respective web sites will gain a high ranking when an Internet user executes a search. While this is beneficial for the web site owner (as it is likely an Internet user will tend to select highly ranked results of a search), it is not necessarily beneficial for the user, who may be mislead into selecting a less than desirable web site by such tactics." Lim, 1:35-2:9	The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/201,539 Provisional Application, Pages 2-3 "The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for

Lim	Lim 60/201,539 Provisional Application
	relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next, the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/201,539 Provisional Application, Pages 3-4 "Constraints on automated usage The number of users allowed to access the system from a particular computer or terminal will be limited by a certain number of cookies or Java applets installed on the user's computer or terminal. The system will also constrain automated access by allowing a limited number of users to access from certain unique IDs such as MAC address, IP address, or CPU serial number." Lim 60/201,539 Provisional Application, Page 6 "Technical Methods The SmartPenny.com system (Figure 16) is designed to solve several technical problems: a standard user interface, minimize transactions costs, the ability to serve many users concurrently and secure information transfer without high overhead costs. The interface to the user is HTML and JavaScript. All that users are required to have on their computer system is an industry standard Java enabled browser like Netscape Navigator or Internet Explorer. All functions on the SmartPenny.com system begin with the user entering information into an HTML form and submitting a HTTP request to the SmartPenny.com web host. The HTTP request may contain a call to the SmartPenny.com web server application. The SmartPenny.com web server application facilitates communication

Lim	Lim 60/201,539 Provisional Application
	between the HTML interface, the SmartPenny.com application business rules and the back end database server. Because the request is to the SmartPenny.com application rather than to the database directly, system efficiency and scalability are possible. The application can securely hold the database connections open, greatly reducing the overhead on the server for each database query (alternative solutions require a database open/close for each query). The SmartPenny.com application uses its programmed business rules to determine what queries need to be sent to the database and makes the calls in a single block. This low overhead coupled with the ability to run multiple copies of the application on the web server allow for many concurrent users. The multithreaded web server balances the requests to each copy of the application. The SmartPenny.com application and database schema are designed such that information about accounts, reward calculations etc. are stored in the database and verified from the database. Hackers and automated web bots cannot simply make up a URL and send it in to increase their account balances. Once the application processes a command, it builds and returns feedback to the users in HTML to their standard browser." Lim 60/201,539 Provisional Application, Page 16 *See also* Lim 60/201,539 Provisional Application, Figs. 1, 16
"In another embodiment, a process for verifying whether or not an Internet operation (e.g., sending an e-mail message or accessing a web site) is being attempted by a human being or an automated process may be implemented by using a quiz process that requires user interaction. The quiz process	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site."

Lim	Lim 60/201,539 Provisional Application
may include causing a graphical image which includes a question contained therein or associated therewith to be transmitted." Lim, 2:32-39	"The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text '123' and the quiz question might read, 'What number is shown?'." Lim 60/201,539 Provisional Application, Pages 6-7
"The quizzes may be used at a frequency according to a past history of successful responses to such quizzes" Lim, 3:1-3	"b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/201,539 Provisional Application, Page 8
"FIG. 4 illustrates various types of quizzes, any of which may be used in combination with one another or individually, which may be included in embodiments of the present invention." Lim, 3:23-26	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" Lim 60/201,539 Provisional Application, Page 7
"FIG. 17 illustrates a further example of a quiz, which may be used in combination with other quizzes or individually, and which may be included in embodiments of the present invention." Lim, 3:64-67	"vi) Click on Space. Users are asked to click on a graphic space. 'Click on the red box.' (See also Figure 17)" Lim 60/201,539 Provisional Application, Page 8
"A scheme that allows Internet users to take advantage of their individual user profiles in retrieving search results, viewing advertisements and/or performing other Internet-related activities is disclosed herein. Some embodiments of the present invention allow users to earn money, or credits, on-line by visiting certain web sites and/or viewing advertising on particular web sites. Such	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other

Lim	Lim 60/201,539 Provisional Application
credits can be redeemed at content sites accessible via the Internet, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used as gratuities for the content providers. Furthermore, the system may allow users to use standard Web browsers such as Netscape's Navigator™, available from Netscape Communications, Inc., Mountain View, Calif., or Microsoft's Internet Explorer™, available from Microsoft Corporation, Redmond, Wash., and still access the features provided by the various embodiments of the invention. In accordance with embodiments of the present invention, web site owners and/or advertisers can target their most desired audiences by setting higher rewards for specific demographic characteristics and thus "qualify" visitors to their site and/or viewers of their advertising. Further, advertisers can better control web-based advertising costs as demographically targeted advertising. The architecture of the system also allows content providers to assess micro-payments, e.g., small payments that may be less than $1.00 per item, for their content or provide a means for users of their web sites to leave them gratuities." Lim, 4:7-35	tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs. The architecture of the system also allows content providers to assess micropayments, e.g. small payments that may be less than $1.00 per item, for their content or provide a means for users of their web sites to leave them monetary tips." Lim 60/201,539 Provisional Application, Page 2 *See also* Lim 60/201,539 Provisional Application, Pages 2-4, 6, 16, Figs. 1, 16
"Before describing various aspects of the present invention in detail, it is helpful to present some background relating to the Internet in as much as it is expected that several embodiments of the present invention will make use of and be deployed over this ever-expanding network of computer networks. At bottom, the Internet may be regarded as a collection of devices linked together by various telecommunications media, enabling	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape

Lim	Lim 60/201,539 Provisional Application
these devices (e.g., computer systems and the like) to exchange and share data, multimedia content and other information. Content sites accessible through the Internet provide information about a myriad of corporations and products, as well as educational, research and entertainment information and services. Literally millions people worldwide use the Internet on a daily or weekly basis. A computer or resource that is attached to the Internet is often referred to as a "host." Examples of such resources include conventional computer systems that are made up of one or more processors, associated memory (typically volatile and non-volatile) and other storage devices and peripherals that allow for connection to the Internet or other networks (e.g., modems, network interfaces and the like). The precise hardware configuration of the hosting resource is generally not critical to the present invention, nor are the precise algorithms used to implement the services and methods described herein. Instead, the focus is on the nature of the services provided by the hosting resource. In most cases, the hosting resource may be embodied as hardware and/or software components of a server or other computer system that includes an interface module, which allows for some dialog with a user, and that may process information through the submission of Web forms completed by the user. Generally, such a server will be accessed through the Internet (e.g., via Web browsers) in the conventional fashion. Operating in conjunction with the interface module may be a communication interface that supports the distribution of electronic mail (e-mail) messages to or from other Web sites or users. In order to facilitate communications between hosts, each host has a numerical	Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/201,539 Provisional Application, Page 2 "B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive

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Internet protocol (IP) address. The IP address is made up of four groups of numbers separated by decimals. For example, the IP address of a hypothetical host computer might be 123.124.78.91. Each host also has a unique "fully qualified domain name." The "fully qualified domain name" may not be repeated in the Internet. In the case of the hypothetical host 123.456.78.91, the "fully qualified domain name" might be "computer.domain.com". In its most generic form, a fully qualified domain name consists of three elements. Taking "computer.host.com" as an example, the three elements are the hostname ("computer"), a domain name ("domain") and a top-level domain ("com"). A given host looks up the IP addresses of other hosts on the Internet through a system known as domain name service. Domain name service is accomplished as follows: The Internet is divided into several "top level" domains. For example, ".edu" is a domain reserved for educational institutions, ".gov" is a domain reserved for government entities and ".net" is generally reserved for enterprises operating within the Internet. Although ".com" is short for "commercial," it is a catchall domain and is today the most popular one generally available to Internet users that have no special attributes, i.e., those that are not a school, a government office or an Internet-based enterprise. Each domain name active in a given top-level domain is registered with the top-level server which contains certain hostname and IP address information. As previously indicated, in order to access the Internet most users rely on computer programs known as "Web browsers." Commercially available Web browsers include such well-known programs as Netscape's Navigator™ and Microsoft's	payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/201,539 Provisional Application, Pages 2-3 "The invention will be described according to several systems and features as follows. First the user facing portions of the system will be described including sign up, searching for relevant web-sites, URLs or links, reading ads, tipping, bonuses, and other user portions. Next, the advertiser systems and features will be described followed by the content provider systems and features." Lim 60/201,539 Provisional Application, Pages 3-4 "Constraints on automated usage The number of users allowed to access the system from a particular computer or terminal will be limited by a certain number of cookies or Java applets installed on the user's computer or terminal. The system will also constrain automated access by allowing a limited number of users to access from certain unique IDs such as MAC address, IP address, or CPU serial number." Lim 60/201,539 Provisional Application, Page 6 "Technical Methods The SmartPenny.com system (Figure 16) is designed to solve several technical problems: a

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Internet Explorer™. If an Internet user desires to establish a connection with a Web page hosted at computer.domain.com, the Internet user might enter into a Web browser program the uniform resource locator (URL) “http: www.domain.com”. The first element of the URL is a transfer protocol (most commonly, “http” standing for hypertext transfer protocol, but others include “mailto” for electronic mail, “ftp” for file transfer protocol, and “nntp” for network news transfer protocol). The remaining elements of this URL (in this case, “www” standing for World Wide Web—the Internet's graphical user interface—and “domain.com”) are an alias for the fully qualified domain name of the host computer.domain.com. Once a URL is entered into the browser, the corresponding IP address is looked up in a process facilitated by a top-level server. In other words, all queries for addresses are routed to certain computers, the so-called top-level servers. The top-level server matches the domain name to an IP address of a domain name server capable of directing the inquiry to the computer hosting the Web page. Thus, domain name service ultimately matches an alphanumeric name such as www.domain.com with its numeric IP address 123.456.78.91. Registration of domain names is currently handled by a variety of organizations. A domain name server is a host computer with software capable of responding to domain name inquiries and accessible on a full-time basis to other computers on the Internet. Registering a domain name is the step that allows the top-level servers within the Internet to know where the domain name servers or hosts associated with those domain names are located in the Internet. Domain name service can be operated by the domain name holder or obtained from any entity with	standard user interface, minimize transactions costs, the ability to serve many users concurrently and secure information transfer without high overhead costs. The interface to the user is HTML and JavaScript. All that users are required to have on their computer system is an industry standard Java enabled browser like Netscape Navigator or Internet Explorer. All functions on the SmartPenny.com system begin with the user entering information into an HTML form and submitting a HTTP request to the SmartPenny.com web host. The HTTP request may contain a call to the SmartPenny.com web server application. The SmartPenny.com web server application facilitates communication between the HTML interface, the SmartPenny.com application business rules and the back end database server. Because the request is to the SmartPenny.com application rather than to the database directly, system efficiency and scalability are possible. The application can securely hold the database connections open, greatly reducing the overhead on the server for each database query (alternative solutions require a database open/close for each query). The SmartPenny.com application uses its programmed business rules to determine what queries need to be sent to the database and makes the calls in a single block. This low overhead coupled with the ability to run multiple copies of the application on the web server allow for many concurrent users. The multithreaded web server balances the requests to each copy of the application. The SmartPenny.com application and database schema are designed such that information about accounts, reward calculations etc. are stored in the database and verified from the database. Hackers and automated web bots cannot simply make up a URL and send it in to increase their account balances. Once the application processes a command, it builds and

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the proper computer equipment, including hundreds of Internet service providers (ISPs). One way to establish a presence on the Internet is by placing a Web page, which is, ultimately, a computer data file on a host operating a Web server within a given domain name. When the Web server receives an inquiry from the Internet, it returns the Web page data in the file to the computer making the inquiry. The Web page may be a single line or multiple pages of information and may include any message, name, word, sound or picture, or combination of such elements. Most Web browsers will show somewhere on the screen the domain name of the Web page being shown and will automatically include the domain name in any printout of the Web page. There is no technical connection or relationship between a domain name and the contents of the corresponding Web page. There are a number of ways for an Internet user to find a Web page. Web browsers feature access to various indexes, commonly referred to as search engines. These indexes will allow the user to enter a name or a word or a combination of words, and will return the results of the search as a list of "hyperlinks" to Web pages that have information within or associated with the document making up the page responding to the search. A hyperlink is a link from one site on the Internet to a second site on the Internet. "Clicking" (or, more generally, selecting using a cursor control device such as a mouse, joystick, touch pad, etc.) on a designated space on the initial site which references the subsequent site by a picture, highlighted text or some other indication will direct the user's browser from the initial site to the second site. In addition to their use in indexes, hyperlinks are commonly placed on	returns feedback to the users in HTML to their standard browser." Lim 60/201,539 Provisional Application, Page 16 *See also* Lim 60/201,539 Provisional Application, Figs. 1, 16

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Web pages, thus allowing Internet users to move from Web page to Web page at the click of a button, without having to type in URLs. Hyperlinks are also used to initiate the transfer of files or other information from the hosting resource to the user's computer in a process commonly known as downloading. Hyperlinks can be and commonly are established without reference to the domain name of the second site. A hyperlink is not technically related to a domain name and therefore it can be identical to an existing domain name without conflicting with that domain name. For example, were the operator of a Web page known as SITE to establish a home page at http: www.xyz.com, any number of indexes could be employed and hyperlinks could be established to bring up the page through use of the word SITE. Some Web pages are referred to as Web forms. In general, a form is a collection of form fields displayed as a Web page by a browser in response to hypertext mark-up language (HTML) tags and other information received from a Web server. An associated form handler resides at the server to collect and process the information submitted by a user via the form. By using such forms, an information collection process performed by a host is made interactive with the users thereof. That is, users can add text to text boxes, select from drop down menus and/or select check boxes and/or radio buttons, etc. Typically, the user submits the form by clicking on a submit button or other appropriately labeled element of the form and, upon such submission, the contents of the form are passed to the form handler. Depending upon the type of information being submitted and the type of form handler being used, the information submitted by a user may be appended to a file maintained by the host, for example a file associated with a temporary account assigned to the user or a	

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larger database. In this way information may be collected, processed and displayed to those who access it. A text box is a standard form field into which a user can type text. When a form containing a text box is submitted in a Web browser, the name and contents of the text box are provided to the form handler running on the server. A check box field is typically arranged in a grid or matrix fashion with one or more cells of the matrix including a check box. Check box fields present a user with choices that can be made by clicking (e.g., selecting or deselecting as appropriate) a check box. Such fields are created and rendered using programming techniques common in the art and any number (including all or none) of individual check boxes may be selected or not. When a user submits a form containing a check box field, the name of each check box along with its value is provided to the form handler at the host. Radio button fields present a user with a choice that can be made by selecting a button. Radio buttons are displayed in a set, only one of which may be selected at a time. When radio button fields are created, they are assigned a group name, and each button in the group is assigned a value and an initial state (selected or not selected). When the user selects one of the buttons in the field, all other buttons in the field take on a value of not selected. Then, when the user submits the form, the group name and value of the buttons is provided to the corresponding form handler at the server for processing." Lim, 5:6-7:61	
"With the above background, aspects of the present invention may now be described. In general, the present invention may be regarded as a service that allows users (preferably registered users) thereof to earn and/or redeem credits on-line in exchange for	"Some embodiments of the invention allow users to earn money, or credits, online by visiting sites and/or viewing advertising on a web site. The credits can be spent at content sites around the web, exchanged for merchant gift certificates or airline miles, used as entries

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sharing their personal or demographic information. Thus, users of the system (which may be regarded as a hosted environment embodied as computer readable instructions residing in computer-readable media associated with a computer system attached to/accessible through the Internet) are asked to provide demographic information which may be used to customize advertisements displayed to the user and/or search results from search queries posed by the user. In exchange for this information, the users receive credits which they can later redeem in various fashions as described below. To the users, the process is very similar to the customary actions they may be accustomed to in interacting with other search engine sites and/or web portals, with the exception that the use of rich demographic profiles allows for certain customizations that are not provided by other Internet-based services and systems. In addition, the present system offers unique features such as "quizzes" which can be used to validate a third party. These and other features will be discussed below." Lim, 7:62-8:17	in sweepstakes and contests, used as payment for credit card balances, withdrawn as cash, and/or used to tip content providers and other tokens of exchange. Furthermore, the system can allow users to use standard web browsers such as Netscape NavigatorTM, for Netscape Communications, Inc., Mountain View, California, or Microsoft Internet Explorer, from Microsoft, and access the features provided by the various embodiments of the invention. Site advertisers can target their most desired audiences by setting higher rewards for specific characteristics and thus qualify visitors to their site and/or viewers of their advertising. Further, advertisers can better control web based advertising costs." Lim 60/201,539 Provisional Application, Page 2 "Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site." Lim 60/201,539 Provisional Application, Page 6 *See also* Lim 60/201,539 Provisional Application, Pages 3-8
"A. System Architecture A basic system architecture within which embodiments of the present invention may operate and be utilized is shown in FIG. 1. Users 100a-care coupled in communication with a network 102. The network 102 might be the Internet, or some other type of computer network (e.g., a local or wide area network or a metropolitan area network) or	"B. System Architecture The basic system architecture according to some embodiments of the invention is shown in Figure 1. Users 100a-c are coupled in communication with a network 102. The network 102 might be the Internet, or some other type of network. Through the network 102, the users 100a-c can access content providers 108a-c. For example, the content

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network of networks. Through the network 102, the users 100a-c can access content sources 108a-c. For example, the content sources 108a-c might include servers and/or proxies hosting Web sites for entertainment, commercial enterprises, research journals, newspapers, and/or some other type of activity, business or interest. Advertisers, such as advertisers 106a-c, are entities that wish to place advertising and/or draw visitors to their sites. Some of the advertisers 106a-c may also be content providers. For example, a company such as NetscapeTM might both advertise its portal service as well as provide content. Host 104 is configured in accordance with an embodiment of the present invention and may also support the transaction or micro-payment system described below. As part of its operation, host 104 stores information about user accounts, e.g., for the users 100a-c. Host 104 may also provide advertisers 106a-c means to receive payment for qualified viewers, e.g., those meeting certain pre-established demographic criteria. Also, the host 104 may provide content providers means to receive payments for goods and services they offer either through a 'pay-per-view' fee or a tipping (gratuity) scheme. For example, a content provider associated with content source 108a might offer access to a scientific journal hosted at that content source at for $0.50/article (or some other pay per-use fee). Alternatively, the content provider might provide a hyperlink to a Web site (e.g., hosted by host 104) that allows users to provide a gratuity (e.g., so as to express their appreciation for a particular story or column)." Lim, 8:18-52	providers 108a-c might include web sites for entertainment, companies, research journals, newspapers, and/or some other type of content provider. Advertisers such as the advertisers 106a-c are entities that wish to place advertising and/or draw visitors to their site. Some of the advertisers 106a-c may also be content providers. For example, a company such as Netscape might both advertise its portal service as well as provide content. The host 104 includes an embodiment of the invention and supports the transaction system. The host 104 stores information about user accounts, e.g. for the users 100a-c. The host 104 provides advertisers 106a-c a means to receive payment for qualified viewers, e.g. meeting a certain demographic. Also, the host 104 provides content providers a way to receive payments for goods and services they offer either through a fee or a tipping system. For example, the content provider 108a might offer access to a scientific journal for $0.50/article. Alternatively, the content provider 108b might provide a tipping link next to their articles to allow users to express their appreciation for a particular story or column." Lim 60/201,539 Provisional Application, Page 2
"Thus, the host 104 acts as a transaction mediator for this system. The host 104 may be made up of one or more computers, a	"Thus, the host 104 acts as the transaction mediator for this system. The host 104 may be multiple computers, a cluster of computers, a

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cluster of computers, a web or server farm, and/or some other configuration of one or more computers. The remainder of the discussion below will assume that the network configuration shown in FIG. 1 is used. Accordingly, embodiments of the invention (which may be computer software, hardware and/or combinations of both) are discussed as being hosted/provided by or from the host 104, although advertising content and hyperlinks to other reward-offering sites may be provided by other sources. In some cases the network 102 may be associated with multiple hosts 104 supporting embodiments of the invention." Lim, 8:52-65	web farm, and/or some other sort of configuration of one or more computers. The remainder of the discussion will assume the configuration shown in Figure 1. Accordingly embodiments of the invention discussed are primarily hosted/provided from the host 104 although advertising content and reward offering links may be provided from other sources. Also, the network 102 may have multiple hosts 104 supporting embodiments of the invention. Depending on contractual arrangements between providers, credits earned on one system may or may not be valid on another." Lim 60/201,539 Provisional Application, Page 3
"In some embodiments of the present invention, a search engine returns results according to a ranking that is established according to user-supplied demographic information. In these and/or other cases, advertisements may be presented to users based on such demographic information. Accordingly, embodiments of the present invention offer user registration processes so that users might build rich profiles of themselves, allowing for customized search results to be returned by the search engine each time a search query is executed and/or to provide customized advertisement viewing." Lim, 9:20-30	"Search Engine Some embodiments of the invention include a search engine that allows the user to search for merchant sites, links, ads and content relevant to their interests. Search results can be sorted according to relevance, reward value, and popularity, and/or other criteria. The following describes the search process: 1) Selects the search engine from a web site including an embodiment of the invention and enters or select the search keyword(s). a) If the user is not logged in, they will be directed to the login/sign up pages, but can still use the system without logging in. b) If a user is not logged in, they will be able to do searches without the benefit of the demographic reward and corresponding sorting. (Figure 10) c) Once registered (Figure 11) and logged in, the users username and/or balance and/or demographic profile will appear either in a constant position of the window or by clicking a button to give a pop up window. (Figure 12)

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	d) The user types or selects the desired category to search for. e) The user is returned a list of links relevant to the user's search criteria. (Figure 13). Sites offering highest reward will be listed first, their reward indicating their heightened interest in the users demographic. This matchmaker function merges information about both parties, making a more efficient match for both, allowing destination sites to only pay lead rewards to targeted users and users to easily identify sites who desire them (as well as those who do not). For example, in Figure 13, Zoom travel, who targets young males appears at the top of the list, rather than the bottom which would be the tyranny of a mere alphabetical listing. AAAAA Travel, on the other hand, is not interested in young males and correspondingly appears with no reward where an alphabetical listing would have placed it at the top of the list, presenting a poor search result for a for a young male." Lim 60/201,539 Provisional Application, Pages 8-9 *See also* Lim 60/201,539 Provisional Application, Pages 3-6, 9, 11-13
"The basic registration process may be described as follows: A. New users may by referred to a service provider's Web site (e.g., hosted by host 104) offering a service configured in accordance with the present invention and encouraged to 'sign up', e.g., by information displayed at a content provider's Web site, various advertising for the service, the service provider's home page, and/or some other source. i) Before being allowed to register, these new users may be asked to answer one or more questions of a quiz to test whether they are a	"The basic process is as follows: 1) New users are referred to sign up, e.g. from a content provider, advertising for the service, the service home page, and/or some other source. a) The new user may be asked to answer a quiz to test whether they are a human or not (see Quizzes below)." "Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the

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human users or not (see the discussion of such Quizzes below). As indicated above, spiders are automated computer processes that are capable of searching the Web and retrieving Web page information. Variations of spiders known as robots or bots have been created that might allow for completion of a simple web form or other registration instrument, and thereby garner any rewards associated therewith, without having to subject a human user to this process. To avoid abuses of the present system, quizzes may be introduced at various levels to thwart such automated processes and allow access only by live, human users." Lim, 9:45-67	desired human actually viewing the advertising or visiting the site." Lim 60/201,539 Provisional Application, Pages 4, 6
"4. Constraints on Automated Usage Computer systems configured in accordance with the present invention may limit or restrict the number of users which are allowed access from a particular computer or terminal based upon a certain number of cookies or Java applets installed on the user's computer or terminal. such systems may also constrain automated access by allowing a limited number of users access from computers or other web-capable devices associated with certain unique identifiers such as a medium access control (MAC) addresses, IP addresses, or central processing unit (CPU) serial numbers." Lim, 13:4-14	"Constraints on automated usage The number of users allowed to access the system from a particular computer or terminal will be limited by a certain number of cookies or Java applets installed on the user's computer or terminal. The system will also constrain automated access by allowing a limited number of users to access from certain unique IDs such as MAC address, IP address, or CPU serial number." Lim 60/201,539 Provisional Application, Page 6
"5. Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process (e.g., a bot or robot). Because users are paid per ad and/or site viewed, an automated system would be able to earn money or credits without the desired human actually viewing the advertising or visiting the site. Accordingly, some	"Quizzes Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site.

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embodiments of the present invention make use of periodic quizzes, also called a SmartOuiz TM, to verify that a particular user is a human. As noted above, these quizzes may be employed during the registration process to verify that a user is a human. Additionally, such quizzes can be used in conjunction with follow up registrations, and/or between transactions using some embodiments of the invention. The basic premise is to design a quiz (or question) using a display format that cannot be easily recognized or read by a machine or automated process. For example, text that is embedded in graphical representations such as an image could be used. The pictures can contain a simple question that any user would be expected to be able to answer. For example, the picture or other image form might have the text '123' drawn therein, and the quiz question might read, 'What number is shown?' A separate text box or other data entry device rendered in the web page with the quiz question image could then be used by the user to enter his/her answer." Lim, 13:15-39	Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or between transactions using some embodiments of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text "123" and the quiz question might read, "What number is shown?". Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy." Lim 60/201,539 Provisional Application, Pages 6-7
"Because automated entities are not able to decipher the question (or more particularly, the answer to the question) from the image, such processes will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could provide the correct answer. The object here is not to test the skill or knowledge of the user per se (although such tests could be used if appropriate to a given situation), but rather to ensure that some human being (and not just another computer system) is actually viewing the pages/ads being rendered. This way, advertisers are provided with some assurance	"Quizzes may be used as part of a process to verify that a user is a human, as opposed to an automated process. Because users are paid per ad and/or site viewed, an automated system would be able to earn the money without the desired human actually viewing the advertising or visiting the site. Accordingly, some embodiments of the invention make use of periodic quizzes, also called a SmartQuizTM, to verify that a particular user is a human. As noted above, the quizzes may be employed during the registration process to verify a user is a human. Additionally, quizzes can be used in conjunction with follow up registration, and/or

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that their advertising dollars are not being wasted." Lim, 13:40-51	between transactions using some embodiments of the invention. The basic premise is to use a display format that cannot be easily recognized or read by a machine. For example, text that is embedded in graphical representations such as an image. The pictures can contain a simple question that any user is expected to be able to answer, e.g. the picture might have the text "123" and the quiz question might read, "What number is shown?". Because automated entities are not able to decipher the question from the graphic, they will not be able to respond correctly to the question. In contrast, because of the intentionally simple nature of the questions, almost any human could perform at 100% accuracy." Lim 60/201,539 Provisional Application, Pages 6-7
"The answers to the quiz questions may be provided using a text-input box located anywhere on the Web page containing the quiz, image. For multiple-choice questions, the answers might be selectable from the image itself, e.g., using an image map, and/or through an HTML form surrounding the picture. FIGS. 4a-4f illustrate various types of quizzes, any of which may be used in combination with one another or individually" Lim, 13:52-59	"The answers to the quiz questions may be provided using a text-input box located anywhere on the picture, or around it. For multiple choice questions, the answers might be selectable from the image itself, e.g. using an image map, and/or through an HTML form surrounding the picture. Types of quizzes: a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" Lim 60/201,539 Provisional Application, Page 7
"ii) Simple word/object identification/recognition (e.g., FIGS. 4c and 4f). The name of an object or other word is spelled out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word 'Ice Cream', etc. Users are asked to enter (e.g., in	"i) Simple word/object identification/recognition. The name of an object is typed out in graphical text or a picture of an easily recognizable object is displayed, for example a dog, a book, a car, the word 'Ice Cream', etc. Users are asked to type in the name of the object in the space provided, or,

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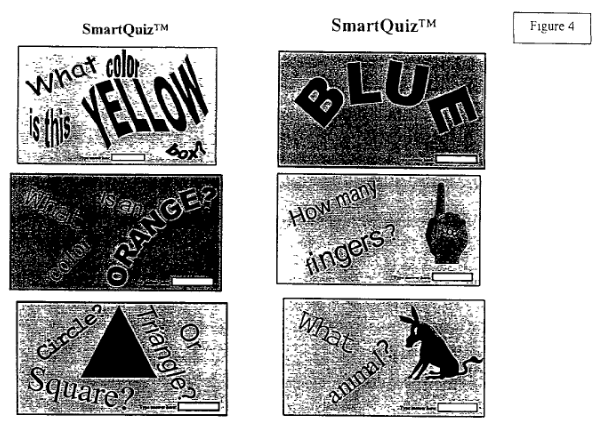
a text box) the name of the object in the space provided, or, are asked to select the correct picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in a set of objects being displayed." Lim, 13:63-14:5	they have to click on the right picture or word matching the object displayed. Users may also be asked to identify the one object that does not belong in the set of objects displayed." Lim 60/201,539 Provisional Application, Page 7
"(1) Twisted text recognition (e.g., FIGS. 4 a and 4 b). A simple question is presented in text that is twisted (i.e., displayed in a non-linear fashion) to make optical character recognition (OCR) difficult, while still remaining easily readable to a human. (2) Color recognition (e.g., FIG. 4 d). A color is presented and the user is asked to identify it. (3) Shape recognition (e.g., FIG. 4 c). A user is asked to identify the shape presented (e.g., a triangle, a square, etc.). (4) Self-answering questions (e.g., FIGS. 4a, 4e and 4f). Text or graphical questions that contain their own answer." Lim, 14:7-20	"Other recognition examples include: (1) Twisted text recognition. A simple question is presented in text that is twisted to make OCR difficult, but easily readable to a human. (2) Color recognition. A color is presented and the user is asked to identify it. (3) Shape recognition. User is asked to identify the shape presented. (4) Self answering questions. Text questions which contain their answer." Lim 60/201,539 Provisional Application, Page 7  Lim 60/201,539 Provisional Application, Fig. 4
"iii) Simple counting (e.g., FIG. 4e). A number of similar object are displayed, such as 2 balls, 4 birds, 1 finger, etc. Users are asked to enter (e.g., in a text box) the number of objects being displayed, or are asked to select the picture, word or number matching	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "ii) Simple counting. A number of similar object are displayed, such as 2 balls, 4 birds, 1

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the object displayed. Users may also be asked to select the set of pictures showing the same number of objects." Lim, 14:24-30	finger, etc. Users are asked to type in the number of objects displayed in the space provided, or, they have to click on the right picture, word or number matching the object displayed. Users may also be asked to click on the right set of pictures showing the same number of objects." Lim 60/201,539 Provisional Application, Page 7
"v) Simple queries (e.g., FIGS. 4a-4f). Users are asked simple questions using graphical text. Responses may be entered as text or selected by 'clicking' (e.g., using a cursor control device such as a mouse) on the right area. Examples of questions that might be used are: 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice cream hot or cold?', etc." Lim, 14:42-48	"a) There are several types of quizzes, all of which can be combined. Some examples follow: (See also Figure 4 for examples.)" "iv) Simple queries. Users are asked simple questions using graphical text. Responses may be typed in or selected by clicking on the right area. Examples of questions are 'What day was yesterday?', 'How old is a 2-year old baby?', 'What color is red?', 'Is ice-cream hot or cold?'" Lim 60/201,539 Provisional Application, Pages 7-8
"vii) Click on a Designated Object/Space. Users are asked to select a particular image, e.g., 'Click on the yellow triangle.' (See e.g., FIG. 17.): Lim, 14:51-53	"a) There are several types of quizzes, all of which can be combined. Some examples follow:" "vi) Click on Space. Users are asked to click on a graphic space. 'Click on the red box.' (See also Figure 17)" Lim 60/201,539 Provisional Application, Pages 7-8
"Users may be quizzed with reduced frequency as they respond accurately and with increasing frequency as they fail to respond accurately. For example, FIG. 5 illustrates a process 500 wherein a new user starts (step 502) and is presented with SmartOuizzes at various intervals (step 504). As each quiz is taken (step 506) a determination is made as to whether the user passed the test. If so (step 508), the interval is adjusted (step 510) until a maximum	"b) The user may see the quizzes with reduced frequency as he responds accurately and with increasing frequency as he fails to respond accurately. (See also Figure 5)" Lim 60/201,539 Provisional Application, Page 8

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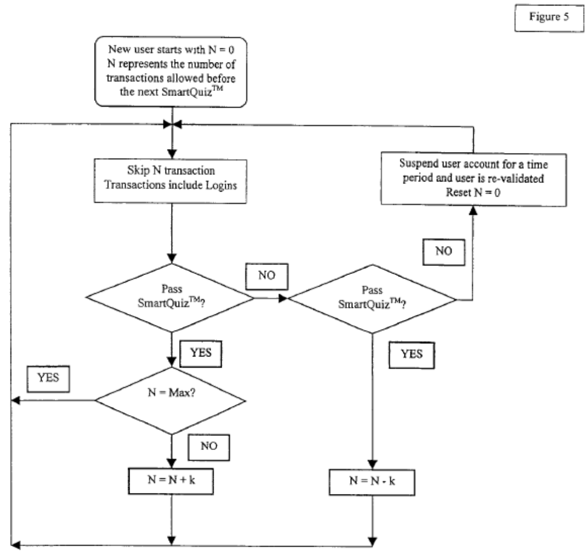
interval is reached. If the user fails a test, a retest might be offered (step 512). Passing the retest also resets the testing interval (step 514). Failing the retest (step 516) suspends the user's account for a designated time interval or causes some other penalty." Lim, 14:58-15:2	 Lim 60/201,539 Provisional Application, Fig. 5
"H. Technical Methods The present system (see FIG. 16) is designed to solve Several technical problems and includes a standard user inter face 1602 that may make use of a conventional web browser, facilities to allow for minimized transactions costs, the ability to serve many users concurrently and secure information transfer without high overhead costs. The interface to the user is conventional HTML and JavaScript, allowing users of the system to rely on conventional web browsers for access and operation. All functions on the present system begin with the user entering information into a conventional HTML form and submitting a conventional HTTP request 1604 to the web host 104. The HTTP request may contain a call to the web server application 1606, which facilitates communication between the HTML interface 1602, application business rules 1608 and any back-end database server 1610. Because the request is to an overlying application 1608 rather than to a database 1610 directly, system efficiency and scalability are enhanced. The application	"Technical Methods The SmartPenny.com system (Figure 16) is designed to solve several technical problems: a standard user interface, minimize transactions costs, the ability to serve many users concurrently and secure information transfer without high overhead costs. The interface to the user is HTML and JavaScript. All that users are required to have on their computer system is an industry standard Java enabled browser like Netscape Navigator or Internet Explorer. All functions on the SmartPenny.com system begin with the user entering information into an HTML form and submitting a HTTP request to the SmartPenny.com web host. The HTTP request may contain a call to the SmartPenny.com web server application. The SmartPenny.com web server application facilitates communication between the HTML interface, the SmartPenny.com application business rules and the back end database server. Because the request is to the SmartPenny.com application rather than to the database directly, system efficiency and scalability are possible. The application can securely hold the database

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1608 can securely hold the database connections open, greatly reducing the overhead on the server 1606 for each database query (alternative solutions require a data base open/close for each query). The application program 1608 (which may or may not be accessed through a middle layer JavaServlet 1612) discussed above may use programmed business rules to determine what queries need to be sent to which databases 1610 and may make database calls in a single block. This low-overhead process coupled with the ability to run multiple copies of the application program 1608 on the web server 1606 allow for many concurrent users. A multithreaded web server 1606 may balance requests to each copy of the application program 1608. The application program 1608 and database schema may be designed such that information about accounts, reward calculations, etc. are stored in the database 1610 and verified from the database 1610. Unauthorized users and automated web bots thus cannot simply make up a URL and send it in to increase their account balances. Once the application program 1608 processes a command, it builds and returns 1614 feedback to the users in HTML to the user's browser." Lim, 23:3-43	connections open, greatly reducing the overhead on the server for each database query (alternative solutions require a database open/close for each query). The SmartPenny.com application uses its programmed business rules to determine what queries need to be sent to the database and makes the calls in a single block. This low overhead coupled with the ability to run multiple copies of the application on the web server allow for many concurrent users. The multithreaded web server balances the requests to each copy of the application. The SmartPenny.com application and database schema are designed such that information about accounts, reward calculations etc. are stored in the database and verified from the database. Hackers and automated web bots cannot simply make up a URL and send it in to increase their account balances. Once the application processes a command, it builds and returns feedback to the users in HTML to their standard browser." Lim 60/201,539 Provisional Application, Page 16