UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
61/134,646	07/11/2008		105	08-002P		

CONFIRMATION NO. 2762

JEFFREY AMBROZIAK
563 LAKE DRIVE
GUILFORD, CT 06437

FILING RECEIPT

OC000000031331000

Date Mailed: 08/04/2008

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Jeffrey R. Ambrozizk, Guilford, CT;
Carson C.K. Fincham, Ridgefield, CT;
Jose A. Suarez, Fairfield, CT;

Power of Attorney:
Jeffrey Ambroziak--47387

If Required, Foreign Filing License Granted: 08/01/2008
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 61/134,646**
Projected Publication Date: None, application is not eligible for pre-grant publication
Non-Publication Request: No
Early Publication Request: No
**** SMALL ENTITY ****
Title

System and method of distribution for charging electric vehicles

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of

State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

Doc Code:

U.S. PTO
61/134646
07/11/2008

071108

PROVISIONAL APPLICATION FOR PATENT COVER SHEET - Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EH059246785US

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
JEFFREY R.	AMBROZIAK	GUILFORD, CT US
CARSON C. K.	FINCHAM	RIDGEFIELD, CT US
JOSE A.	SUAREZ	FAIRFIELD, CT US

☐ *Additional inventors are being named on* ______ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

SYSTEM AND METHOD OF DISTRIBUTION FOR CHARGING ELECTRIC VEHICLES

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ The address corresponding to Customer

OR

☒ Firm *or*	JEFFREY AMBROZIAK				
Address	563 LAKE DRIVE				
City	GUILFORD	State	CONNECTICUT	ZIP	06437
Country	USA	Telephone	203.535.3879	Emai	jambroziak@a3dt.com

ENCLOSED APPLICATION PARTS ***(check all that apply)***

☐ Application Data Sheet. See 37 CFR 1.76

☐ CD(s), Number of CDs ______

☒ Specification *Number of Pages* 24

☐ Other (specify) ______

☐ Drawing(s) *Number of Sheets* ______

Total # of sheets 24 = Application Size Fee $0.00

Fees Due: Filing Fee of $210 ($105 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is $260 ($130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR

METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT

☒ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fee and application size fee (if applicable).

☒ Payment by credit card. Form PTO-2038 is attached.

$105.00
TOTAL FEE AMOUNT ($)

☐ The Director is hereby authorized to charge the filing fee and application size fee (if applicable) or credit any overpayment to Account Number: ______. A duplicative copy of this form is enclosed for fee processing.

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

Doc Code:

PROVISIONAL APPLICATION COVER SHEET

The invention was made by an agency of the United States Government or under a contract with an agency of the United States

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ______

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

SIGNATURE		Date	**July 11, 2008**
TYPED or PRINTED NAME	**Jeffrey R. Ambroziak**	REGISTRATION NO. *(if appropriate)*	**47,387**
TELEPHONE	**203.535.3879**	Docket Number:	**08-002P**

Doc Code:

PROVISIONAL APPLICATION FOR PATENT COVER SHEET - Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EH059246785US

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
JEFFREY R.	AMBROZIAK	GUILFORD, CT US
CARSON C. K.	FINCHAM	RIDGEFIELD, CT US
JOSE A.	SUAREZ	FAIRFIELD, CT US

☐ *Additional inventors are being named on* ______ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

SYSTEM AND METHOD OF DISTRIBUTION FOR CHARGING ELECTRIC VEHICLES

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ The address corresponding to Customer [ ]

OR

☒ Firm *or*	**JEFFREY AMBROZIAK**				
Address	**563 LAKE DRIVE**				
City	**GUILFORD**	State	**CONNECTICUT**	ZIP	**06437**
Country	**USA**	Telephone	**203.535.3879**	Emai	**jambroziak@a3dt.com**

ENCLOSED APPLICATION PARTS ***(check all that apply)***

☐ Application Data Sheet. See 37 CFR 1.76

☐ CD(s), Number of CDs ______

☒ Specification *Number of Pages* **24**

☐ Other (specify) ______

☐ Drawing(s) *Number of Sheets* ______

Total # of sheets **24** = Application Size Fee **$0.00**

Fees Due: Filing Fee of $210 ($105 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is $260 ($130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR

METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT

☒ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fee and application size fee (if applicable). **$105.00**

☒ Payment by credit card. Form PTO-2038 is attached. TOTAL FEE AMOUNT ($)

☐ The Director is hereby authorized to charge the filing fee and application size fee (if applicable) or credit any overpayment to Account Number: ______ . A duplicative copy of this form is enclosed for fee processing.

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

Doc Code:

PROVISIONAL APPLICATION COVER SHEET

The invention was made by an agency of the United States Government or under a contract with an agency of the United States

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ______

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

SIGNATURE	[signature]	Date	**July 11, 2008**
TYPED or PRINTED NAME	**Jeffrey R. Ambroziak**	REGISTRATION NO. *(if appropriate)*	**47,387**
TELEPHONE	**203.535.3879**	Docket Number:	**08-002P**

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s): **AMBROZIAK et al.**			Docket No. **08-002P**	
Application No. **Not Yet Assigned**	Filing Date **July 11, 2008**	Examiner **Not Yet Assigned**	Customer No. —	Group Art Unit **Not Yet Assigned**
Invention: **SYSTEM AND METHOD OF DISTRIBUTION FOR CHARGING ELECTRIC VEHICLES**				

I hereby certify that the following correspondence:

Provisional Patent Application

(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

July 11, 2008
(Date)

Jeffrey R. Ambroziak
(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

EH059246785US
("Express Mail" Mailing Label Number)

Note: Each paper must have its own certificate of mailing.

P06A/REV04

SYSTEM AND METHOD OF DISTRIBUTION FOR CHARGING ELECTRIC VEHICLES

Background:

Improvements in battery technology provide the potential of economically viable modes of transportation including, but not limited to, automobiles, motorcycles, etc. One oft cited drawback of such electrical vehicles is the need to plug them in regularly to replenish their electrical charge. First, such charging will likely require more time than is typically required to fill up an automobile with a petroleum based product. As a result, the owner of an electrical automobile must often times adhere to a schedule of charging that renders the automobile unusable for protracted stretches of time. In addition, there exists a resistance to performing the act of plugging in an automobile and subsequently unplugging the vehicle in order to maintain a charged vehicle.

[Can move electrical receiver. Can broadcast availability of/need for electricity. Apparatus at home. Get away from dedicated gas stations.]

Overview:

Exemplary and non-limiting embodiments of the some embodiments described herein provide a method and apparatus for charging electrical vehicles that eliminates the need to plug and unplug the vehicle while providing for load balancing at the generator of electricity. In addition to balancing the need for electrical charge by a plurality of vehicles, an embodiment allows for each automobile to serve as a node in an electrical grid for the generation of electricity.

Exemplary and non-limiting embodiments:

<u>Wireless Charging Nodes</u>

- A parking space or other expanse suitable for maintaining an automobile in a generally stationary fashion is equipped with a means for wirelessly charging an automobile. Various methods for wirelessly transmitting an electrical charge are known including, but not limited to, resonant inductive coupling, and wireless microwave transmission. In addition, a company referred to as Powercast has demonstrated power transmission for quite a distance using RF (Radio Frequency) technology to beam EM waves in a direction to a transreceiver which then converts the EM waves back to electricity. While described with reference to various technologies for enabling the wireless transmission of electrical energy, the exemplary embodiments described are not limited to any particular mode or process of such wireless transmission. Rather, the invention is broadly drawn to encompass any and all technologies that facilitate or otherwise enable the provision of electricity, electrical energy, and/or electrical power from a source to a receiver without a physical connection (i.e., a wire or other physical electricity conducting medium) between the source and receiver. While many embodiments described herein are directed to wireless charging and/or energy transmission between vehicles and a power grid, some embodiments herein may be practiced utilizing plug-in and/or physical coupling to provide energy transmission. Load distribution, balancing, and/or pricing embodiments may, for example, be practiced in conjunction with any electrical transmission apparatus that is or becomes known or practicable (*e.g.*, not limited to wireless charging and/or transmissions).

- When an automobile is positioned within a distance suitable for the provision of wireless electrical power, the provision of electrical power is enabled.
    - In one embodiment, electrical power is wirelessly transmitted from a transmitter positioned underground or flush with the surface of the ground or pavement. In another embodiment, a transmitter is configured around the periphery of a space such that it is in sufficient proximity to a parked or stationary automobile to enable the transmission of electrical power.
    - The presence of an automobile may be sensed, as by a pressure sensor or via short range electronic communication such as Bluetooth or the like. In the latter instance, data may be transmitted between the automobile and a transceiver associated with the electrical transmitter. Such data may include, for example, a unique automobile identifier (*e.g.*, a Vehicle Identification Number (VIN)), an account identifier (e.g., a credit card account, bank account, EZ-Pass® Account, Pay-Pal® Account, and/or electrical supplier account), and user selected parameters defining user charging preferences.
        - For example, upon pulling up to a space enabled/operable to provide electricity in a wireless fashion from one or more transmitters embedded flush with the surface of the pavement, a sensor receives an interrogation signal sent via Bluetooth® from the automobile sent as function of the automobile being put into park (and/or put into neutral, the parking brake being engaged, the engine being shut off, and/or the key being turned to a specific position – e.g., position "IV" may comprise a position dedicated to indicating that the driver descires to activate one or more charging and/or power transmission sequences). The sensor receives an identifier of the automobile and interfaces with a central server to retrieve account information of an owner of the automobile. Likewise, such information can be stored in a memory device associated with the automobile and sent to the sensor. In addition, either sent from the automobile or retrieved from a server using the identifier, the sensor receives information regarding parameters defining how the automobile is to be charged. For example, such information might define a maximum rate willing to be paid for electricity. In addition, such information might specify a time by which the car is to be a certain percent charged. For example, a user may have specified that the car is not to be charged if the cost of electricity is over $.10/kWh. The user may also have specified

that the automobile needs to be 80% charged at the end of eight hours. In some embodiemtns, the user may idnciate a desired charging level (and/or a desired charging level may be automatically calculated) based on a desired distance of travel. In the case that the vehicle/charging facility is located 20 miles from the driver's home, for example, the driver (and/or the vehicle or charging station) may determine that the vehicle should be charged to have enough power to travel the 20 miles home (with or without a factor of safety and/or reserve travel capacity).

- In the above example, the information may be entered into a central server for retrieval by the electrical charging system (ECS)(comprising the sensor and means for electrical charging), such as via a web page configuration page accessible by the driver or entered into the automobile such as via a dashboard based interface. Any other well known method incorporating a graphical user interface (GUI) may be employed to enter data into the automobile based memory or server. For example, an iPhone® interface may communicate via Bluetooth® with a memory device and processor resident in the automobile to make and/or change parameter selections. [Microsoft Sync...]
- Once the information is received, the ECS operates to determine an appropriate charging schedule. For example, a driver parks his car in a space having an ECS. The driver knows that his car will sit in the space all work day, hence the chosen charging duration of eight hours. The ECS, perhaps relying on other retrieved information specifying the charging characteristics of the automobile, computes that it will take approximately three hours of charging to charge the automobile to a minimum of 80% charged. The ECS, via communication with the power supplier, determines that the present cost of electricity is $.12/kWh but will fall to $.09/kWh in two hours. The system therefore waits for two hours before charging the automobile for approximately three hours.
- In addition to computing and implementing a charging regimen to meet the user specified parameters, the ECS can communicate with the user/driver to alert the driver to potential problems. For example, with reference to the example above, the ECS may determine that the cost of electricity will be below $.10/kWh for only two of the next eight hours. The ECS may send a message to this effect to the user via a user specified node, such as a message on a dashboard display device, a message sent to a cell phone, an email account or the like. The user may be enabled to reply so as to modify or override a predetermined parameter selection. For example, the user may relax the maximum price for electricity attribute. In addition, the predefined parameter selections may include directions for actions to be taken when the predetermined charging regime cannot be met.

- When charging is enabled, the system stores and makes accessible information regarding the operation of the ECS. For example, the user/driver can access real time (or near real time) charging information via a web page interface. For example, the user may enter a userid and password to view charging/account information. The viewable information may be maintained by the entity supplying the electrical power and/or by the proprietor of the ECS (which may be the same entity). The user may see that, at present, the ECS has scheduled charging to begin in two hours and proceed for the next three hours at a rate of $.085/kWh at which time the automobile will be 80% charged. At such time, the user may change selected parameters, such as the degree of desired charging and request an updated charging profile. For example, the user may change the requested charge percentage to be 100%. In response, ECS recomputes a charging regimen for display to the user/driver.
- In the above described manner, the driver predefines a charging profile that is read and acted upon the ECS without required further input from the user/driver. By employing a central server, the charging regimen can be maintained as the user/driver leaves one ECS and parks at another ECS.

<u>Load Balancing</u>

- As noted briefly above, when computing a charging regimen to match the user defined charging parameters, the ECS may communicate with a system or systems operated by the power supplying entity (PSE). In this manner, load balancing can be affected. For example, by communicating with the power supplier, the ECS may be able to obtain/"lock in" a desirable price for electricity at present or at a time in the future. For example, at peak times when electricity is most expensive, the PSE may inform the ECS that it will commit to providing three hours of electricity at $.085/kWh in two hours provided that it not provide any electricity for the next two hours. If thousands of cars are in communication with a PSE via an ECS and are somewhere within a charging regimen at any one time, such a shifting of the provision of electricity to a future time operates to balance the load at the PSE so as better obtain maximally efficient electricity generation.
- Such load balancing may be implemented in real time. For example, if the PSE experiences an unexpected peak consumption requiring the inefficient firing up of additional electricity providing elements, the PSE can communicate with the ECSs to request a delay in providing electricity to automobiles. With reference to the above example, the ECS has determined that the automobile requires only three hours over the course of the next eight hours to

charge the automobile to the requested level. As a result, the ECS can delay providing electricity to the automobile for up to five hours as load balancing requires.

- In one embodiment, electric cars are power generating entities. For example, the top and sides of an automobile may be fitted with solar panels. A typical automobile so outfitted may comprise approximately $60ft^2$ of solar panels. In addition, solar panels can be extended to incorporate more surface area, for example, when the automobile is substantially stationary. When parked outside, as in an outdoor parking lot with individual spaces configured to contain ECSs, a modest sized parking lot full of automobiles fitted with solar panels can generate a relatively large amount of electricity.
  - When fitted with solar panels, the ECS can operate to receive electricity from an automobile. For example, a user/driver may store amongst the preselected charging attributes that he will sell electricity generated by his automobile at a minimum price of $.11/kWh or at any price when the automobile does not need to be charged. For example, to shed some load, a PSE, currently charging $.14/kWh requests the ECSs to delay the charging of five hundred cars. The ECSs reply that five hundred cars can be delayed and, in addition, two hundred cars (perhaps some of which are included in the five hundred) have the capacity to sell electricity at various prices because they are either already charged or have specified a preference to sell electricity when possible (for the sake of simplicity, in the present example, they all agree to sell at $.11/kWh). The PSE instructs the ECSs to receive electricity from the two hundred automobiles while crediting the accounts of the users/drivers providing electricity.
  - In another embodiment, the automobiles using the ECS are not electric cars but have likewise been fitted with solar panels and equipments required to transmit electricity to an ECS. One problem with encouraging the widespread use of solar panels, such as on the roofs of existing houses, is the large cost of installation and maintenance. By installing solar panels at an automobile factory, economies of scale are introduced. In addition, the surfaces of an automobile are readily accessible for maintenance purposes. In addition, most automobiles spend extended periods of time exposed to sunlight during the daylight hours. If exposed while connected to an ECS, such automobiles provide a large, at present untapped, source of electricity. Furthermore,

if such automobiles are provided with a battery to store power when away from an ECS, the stored power can be transferred to a PSE via an ECS when possible.

[Providers compete for business
Charge here/parking $1.00 off
Consult weather maps
Incorporate electrical grid requirements
Load balancing
Can discontinue charging, if possible.]

Energy Costs

- Electrical energy costs are typically comprised of two components: (i) an electrical energy generation charge, and (ii) an electrical energy transmission charge. While electrical energy generation charges vary depending upon the supplier of electrical energy (*e.g.*, customers choosing to be supplied solely by renewable sources may pay more than customers receiving a mix of electrical energy), transmission charges are generally fixed. In some embodiments, electrical energy transmission costs may vary depending upon various factors such as a distance of an electrical load from one or more electrical sources. Electric vehicles provided with electrical charging energy from an ECS, for example, may be charged one transmission rate for electrical energy that comes from the PSE (*e.g.*, "the grid"), while they may be charged a second (and likely lower) transmission rate for electrical energy supplied by other vehicles coupled to the ECS (*e.g.*, since there is a very short transmission distance and/or very small transmission losses). Similarly, an office building receiving energy from an ECS in an adjacent parking lot may pay little or no transmission costs while it may pay standard transmission costs when purchasing power from the grid/PSE.
- In some embodiments, the actual distance between loads and sources may be utilized to calculate an appropriate transmission charge and/or to look-up an appropriate transmission charge in a pre-stored table and/or other data store. According to some embodiments, other factors such as total expected transmission losses, installation and/or maintenance costs of utilized transmission components, etc., may be utilized to determine an appropriate transmission rate or cost. While a load may pull energy from a nearby source, for example, a transmission means such as an undersea cable or microwave transmission tower may comprise relatively expensive infrastructure that causes the transmission rate to be higher than if the source pulled power from a further source from which power could be delivered via a much less expensive means (*e.g.*, a standard utility pole and power line configuration). In some embodiments, the cheapest available electrical transmission rate may be determined and/or the associated source(s) may be selected as the most appropriate source from which power should be supplied. According to some embodiments, the transmission route via which the smallest expected losses will occur may be determined and/or selected. In such a

manner, for example, the power grid may be most efficiently managed to reduce transmission losses and maximize availability and usage of available power.

- In some embodiments, the 'quality' of available electricity/energy from various sources may be compared and/or analyzed to determine from which available power source the power should be supplied. Some power sources and/or transmission means may provide power that is more consistent (*e.g.*, with respect to supplied frequency, voltage, and/or amperage) than power/energy provided from other sources. For critical loads such as power supply to hospitals, for example, the closest power source may comprise an ECS from an adjacent parking lot/parking garage, but that source may provide intermittent and/or otherwise lower-quality energy than, say, a large hydropower facility several miles (or more) away, that is estimated to be capable of consistently providing steady and/or high quality power for longer periods of time (*e.g.*, at night and/or during inclement weather). According to some embodiments, the 'quality' may also or alternatively be determined based on various externalities such as perceived environmental benefits and/or "greenness" of available power and/or power choices perceived to benefit the locality/local economy (*e.g.*, coal power may be preferred and/or selected for a source in a small town in western Pennsylvania, even though other sources may be cheaper, higher quality, closer, and/or "greener", because the local and/or state or regional economy may be determined to be best served by purchasing relatively "local" products).
- In some instances, electricity generated by solar panels attached to one or more automobiles in communication with one or more ECS may provide enough electricity to fully charge all of the automobiles in communication with the ECS. For example, the parking lot of a single office building may install an ECS that enables charging at a plurality of parking spaces. The automobiles utilizing the ECS may provide enough electricity, via solar panels, to meet all of the charging needs of the automobiles and may then divert additional electricity to the building.

<u>Advantages</u>

Various exemplary embodiments described above allow for a multi-tiered approach to utilizing an ECS wherein additional benefits are realized with each additional tier of functionality. Such benefits include, but are not limited to, the following:

- First, enabling the charging of automobiles (EVS) and other vehicles in a variety of environments allows for the charging of vehicles in an efficient manner. For example, vehicles typically remain parked in a single place for long periods of time each day. The ECS and described methods for using the ECS permit a vehicle to recharge, generally, throughout the day at times most convenient to the owner/operator of the vehicle. In the instance that the charging is enabled via wireless charging, the additional effort required by the operator of the vehicle is negligible.
- Second, when the ECS is capable of communicating with the automobile, data may be exchanged to control the charging process. User defined preferences, stored at the automobile, on a server, or at any location accessible by the ECS can direct the charging process. In addition to

enabling charging according to user defined preferences, the ECS may enable access by the user, such as via a web page, to view the charging status of the automobile in real time. By accessing profile information indicative of the individual performance of the automobile (such as prior charging times, battery life, battery performance, etc.), the ECS can customize the charging process as desired.

- Third, when the ECS is enabled to communicate with a power generating entity, load balancing is enabled. In the scenario where millions of automobiles utilize an ECS, thus substantially shifting energy consumption from petroleum based products in the form of gasoline, diesel fuel and the like to nuclear or coal generated electricity, exemplary embodiments enable load balancing to, for example, permit the efficient operation of such electricity generating facilities.
- Fourth, when automobiles incorporate solar panels, electricity can be generated and added to the grid, or otherwise utilized to power entities in communication with the ECS, via the ECS.

SYSTEM AND METHOD OF DISTRIBUTION FOR GEOSPATIAL DATA

Background:

While GIS systems have failed to capture a sizeable share of the market of personal computer users, the benefit of accessing geospatial data continues to increase. Stovepipe applications of geospatial technology, like Google Earth ™, provide individuals access to worldwide coverage of the earth consisting of geo-referenced imagery, course digital elevation data, and various other data. One limitation of Google Earth™ is that the Google provided data must always be used as a base map when attempting to combine personal geospatial data. This is not always desirable.

Another problem when attempting to utilize geospatial data is that of data formats. Image and elevation data is typically stored in a variety of incompatible data types including, but not limited to SDTS, .IMG, shape files, .DEM, geotiff, .LBL, .LBM, .DAT, etc. As a result, when a person obtains some data of interest, it is likely to be in a format that is difficult or impossible to read and utilize.

Despite these barriers, large volumes of geospatial data are being created every day by persons as diverse as scientists, students, professors, geologists, architects, sociologists, outdoors enthusiasts, etc. Unfortunately, while websites such as gisdatadepot.com provide government GIS data for sale, there exists no central place for individuals to post their geospatial data sets so that interested parties can easily find the data, download it, and use it.

Definitions:

DEM: Digital Elevation Model. An array of values corresponding to elevations arranged in a grid pattern. Also referred to as a "digital terrain model" or "terrain model".

Overview:

Exemplary and non-limiting embodiments of the invention provide an end to end solution for the creation, distribution, and utilization of geospatial data.

Exemplary embodiments:

<u>The System</u>

- As described in detail in the exemplary and non-limiting embodiments below, the system comprises a server or servers on which is stored geospatial data in a standard format. Users of the system can upload datasets comprising, at a minimum, image and terrain data. Once uploaded, the datasets can be searched or otherwise accessed by users of the system and downloaded for viewing and exploration of the dataset or datasets. The software for viewing the datasets may reside on a server of the system or may be downloaded to a computer of a user.

Uploading, searching and downloading datasets by a user may be accomplished via the internet by employing, for example, a web page interface.

Data Sets

- Data sets comprising, at least, a surface texture and an associated terrain model are stored on one or more servers with a visual representation of the data. Although one or more servers can be utilized to store the data sets, one or more servers operate to provide a unitary access point to purveyors and users of the data sets. As described more fully below, data may be browsed and accessed via the internet. Subsets of the data, such as the visual representations of the data sets and other descriptive information (such as available data sets and information used to search the datasets) may be stored on a server hosting one or more web pages while the image and DEM files are stored on one or more additional servers. In this way, if a user decides to access a data set via a selection entered on a web page, the actual download will occur from a server selected by the system. For example, the data sets can be mirrored on more than one server and the system may instruct the download to commence from a server with the lowest utilization. Conversely, the user may be provided with a list of available servers from which the user selects a desired server.
    - The surface texture is a georeferenced image depicting a terrain surface. Examples include, but are not limited to, aerial photographs, satellite images, maps (comprising both vector and raster data), etc.
    - Terrain model is a DEM.
        - Both the image and DEM are stored as comprised of one or more subfiles wherein each DEM subfile is comprised of an equal number of rows and columns. Each DEM subfile corresponds to an image file covering the same geographic area. In one embodiment, each DEM is a binary number of rows by a binary number of columns (e.g., 1024 X 1024). By dividing the data in this manner algorithms commonly utilized to interface with graphics cards are optimized. Example formats for the image and DEM include .pgm and .ppm. In addition to the standard format of .pgm and .ppm files, additional data may be embedded in the files for use by the system. One example of embedded data might comprise a value formed from a hash of the image and/or DEM data. When a user attempts to view a data set with such embedded information, the hash is retrieved by the viewing software application and sent to the system, a comparison is performed. If the hash value does not match the stored hash value maintained by the system, use of the data set by the user is prevented. In this manner, the user must maintain a connection to the server in order to view a downloaded data set.
            - In one exemplary embodiment, all downloads are free. Once downloaded, data sets may be sent or given to others via any desired means. However, to view the data sets

using the viewing software, a connection must be maintained between the user and the system, such as via the internet, in order to view the data sets as described above.

- In one exemplary embodiment, a data set may be purchased for a nominal sum. By so doing, a hash is created using data from the data set and an attribute of the user/purchaser (such as a registration code of the viewing software), with the resulting hash embedded in the data set. As a result, when the user attempts to view the data set, the hash is recomputed locally on the users machine, such as by the viewing software, and viewing is enabled without a connection to the system.

- The visual representation is a video depicting, at least, the image and DEM data. For example, the visual representation may be a mpeg video of a fly-through of the data set. When made available to a user via the internet, a still shot from the mpeg can be displayed on a web page with accompanying additional data, such as text data.
  - o In one embodiment, the snapshot serves as a hyper link to the mpeg video. When a user clicks on the snapshot from a web browser, the mpeg video plays. Watching the mpeg video provides a feel for the resolution of the image and DEM data as well as the geographic extent of the data set.
- Additional data for use with the image and DEM data may include point, line, area, and audio data, and other geospatial models and textures.
  - o For example, a 3D model of a building, temple, or other physical structure may be included for download. A snapshot or a flythrough of the model may be included to aid in making a decision whether or not to download the model. In addition, a reduced resolution model may be displayed and manipulated, as through a flash interface.
    - ▪ For example, image and DEM data for a portion of New York City are downloaded. Likewise, a snapshot of a high resolution model of the temple of Dendur at the Metropolitan Museum of Art is displayed. Once downloaded, the model of the temple can be displayed. In one embodiment, the temple model is displayed with the DEM and image data in seamless fashion. In another embodiment, an icon is displayed with the DEM and image data indicating that a model exists at a defined point or area. For example, a sphere is positioned at the position of the museum. Clicking on or otherwise selecting the sphere displays information about the temple model and/or opens the model for viewing. Such viewing may utilize system software or may invoke third party viewing software, such as 3D Studio Max ™.

        - In another example, a model may be available of the outdoor intersection of 51st street and fifth avenue. A sphere may be displayed with a radius of a size sufficient to bound or encompass the model data. In addition to the model, audio data may be associated with the model or individual points in the model. As a result, as one moves around the model street sounds are played to enhance the realism of the experience.
- In one embodiment, the system computes a shaded relief image from the terrain model (possibly color coded by elevation), applies political boundary data (optional) and optional place names and displays the derived image to give a user a sense of geographic context of the data set.
- In addition to the data available for download, additional information may be stored for use by the system to, for example, facilitate searching of the data sets. Examples of such additional data include, but are not limited to, geographic extents of a data set, key words, a unique identifier for the data set, a record of other data sets that are congruent with a data set.
    - For example, a data set corresponding, at least in part, to a 1:24,000 quadrangle of New Orleans may be assigned a unique identifier of "2909007ne" and may be comprised of an image and a DEM such as 2909007ne.ppm and 2909007ne.pgm, respectively. Each of 2909007ne.pgm and 2909007ne.ppm are individual tiles that may be seamlessly combined with another data set, for example, "2909007se". As a result, a user can download a file of interest, such as 2909007ne, that is of a desired size and expanse. When selecting the data set for download, an indication, such as a displayed map, may show the user other data sets available for download that are adjacent to the desired file so that the user may choose to additionally download the other indicated files such as, for example, 2909007se.
        - In one embodiment, data may be embedded in a data set that indicates that it is a replacement for an individual tile in another data set. For example, a first data set, 2902007se, may be comprised of a 4X4 matrix of .pgm and .ppm files. A second data, 29092007se_afterflood, set may be identical to the first data set with the exception of the tile at row 2, column 2 that depicts flood damage. In such an instance, the second data set need only be comprised of the substitute tile. When a user downloads the second data set, a check is performed, or an option is extended to the user, to download 2902007se and the substitute tile of 29092007se_afterflood or, if 2902007se is resident on the user's computer, just 29092007se_afterflood. In this manner duplicative information is not downloaded

from, or stored upon, the system server. In a similar manner, it is more likely that data sets comprised of different images will be packaged with the same DEM. In such an instance, only the image information is downloaded if the user already has the appropriate DEM from another download.

- In another example, a user may search for "Yosemite" and one or more data sets that have the keyword "Yosemite" associated with them are displayed, such as via an mpeg snapshot. In addition to stored keywords, the system may operate to derive keywords and other indicia of the data sets upon which to search. For example, based upon latitudinal and longitudinal expanse of a data set of Yosemite national park, the system may operate to generate one or more parameters indicative of the data set, such as "California" and "U.S". Other keywords associated with a data set may be generally descriptive such as "canyon", "coastal", "mountainous", etc.
- Additional data may further include an identifier of the creator and poster of a data set, such as an Email address. If the creator of a data set gives permission, individuals downloading or browsing the data set can contact the creator. Such permission can take several forms. On one end of a spectrum, the creator's Email is made available to any user of the system. On the other end of the spectrum, no one can obtain an identifier of the creator of a data set. In between, a creator may allow Emails to be forwarded to him, via the system, without the sender knowing the identifier.
  - As described more fully below, communities, comprising users with interest in similar data sets, may be established and maintained. In this way, users, such as hikers, professors, etc. with a specific interest in a particular area can establish and maintain correspondence regarding the data sets.
  - In addition to an identifier of the creator of the dataset, images and text affecting a branding of the dataset may be uploaded for display to users of the system and the datasets. In this manner, organizations and individuals can obtain recognition for the quality of their datasets.
- Stored data corresponding to data sets can be used to direct advertising to users. For example, users accessing data related to Yosemite national park may be provided with web links to outfitters in the Yosemite area.

<u>Interface:</u>

- In an exemplary and non-limiting embodiment, users access a web page (such as www.you-vista.com) to search for data sets, to download desired data sets, to post data sets, and to interface with the system, as well as with other users via the system, as described herein.
- Data sets may be created using, for example, CartaVista™ by A3Dt, inc. In one embodiment, at a minimum, each data set includes an image and a corresponding DEM in a standard format. An example of standard formats are the .pgm and .ppm formats described above. Advantages of so doing include optimized integration with graphics cards. More specifically, square DEMs (particularly those having binary dimensions) are optimal for implementing quad trees to optimize the number of triangles that must be plotted to produce a single perspective image of the image and terrain using, for example OGL.
    - Using software, such as CartaVista™, datasets for use with the system can be created and uploaded. For example, CartaVista™ allows a wide variety disparate GIS data formats to be inputted and seamlessly combined regardless of scale, projection, etc. CartaVista™ further enables outputting data in the standard formats established for download via the system. Data sets so created may be uploaded to a data server forming a part of or in communication with the system via CartaVista™ operating as a stand alone executable on a PC (such as via an FTP transfer) or through, for example, a web based interface such as a web page hosted by the system. Checks of the data to ensure their integrity and compatibility with the system can be performed on a client machine, such as a PC running CartaVista™, prior to uploading. Conversely, the system may perform checks to make sure that the data is free from corruption at any time from the receipt of the uploaded dataset to the time at which the dataset becomes available to users.
    - CartaVista™ can also be utilized to create sample fly-throughs or other visual representations of the dataset such as perspective snapshots.
    - In one embodiment, the system produces a visual representation such as a snapshot or fly-through of the dataset. For example, the system may produce a default movie comprising the terrain and image data rotating beneath a fixed point. Alternatively, the system may compute a perspective rendering from a default point or one selected by a user of the system.
    - In addition to the required image, terrain, and visual representation data, other geospatial data associated with a dataset may be uploaded and accessed by other users.
        - Examples of static data include point and line data comprised, in part of textual data. Such data might contain points of interest or trail paths.
        - In addition, dynamic data can uploaded and made available. For example a dataset may be dynamically uploaded with

location information of individuals. For example, the system may be configured to store, such as in a relational database, location information of individuals captured by a mobile device, such as an iphone, a mobile telephone with GPS capability, a blackberry, and the like. In such an instance, the individuals permitted to view such data may be password protected. Users of the system can download an appropriate dataset, such as of a city or Yosemite National Park and also access point data of family members and fellow hikers for display with the dataset.

- In addition, users viewing a dataset may be enabled to query additional data in such dynamic datasets to which the individual has access. For example, users may download a dataset of New Orleans and query to see what data sets encompassing, in whole or in part, the extent of the dataset are available. Continuing with the example, a dataset of point data indicating the location of red cross emergency personnel may be indicated as being available to all users. The user may access this data and overlay it on the New Orleans dataset. The downloaded data may additionally include an object file (such as a .obj) or a bit map associated with the point data. For example, a red cross may be plotted at each point location overlayed on the dataset or the bitmap may be displayed, such as on a floating billboard. Standard symbols may be defined by the system for fire, police, rescue and the like.
    - In one embodiment, hot links may be displayed so that a user in communication with the system and viewing a dataset may instantly access police, fire, and rescue personnel location information.
    - In an embodiment, location data may be restricted based upon a security access code associated with a user session. For example, in the preceding example, the location of military personnel may not be available to most users of the system but may be made available to users with a registration id that indicates an appropriate security clearance.
  - In one embodiment, the upload of data may be dynamic and enabled by a user of the system. For example, a person may execute an application on an iphone (or n vifone or the like) to upload the person's location every five minutes on a server or other database associated with the system. The person may define one or more users of the system permitted to view this information. In the instance that the person chooses not to execute the location application, a user of the system, who has

permission to view the person's location may issue a query, via the system, to activate the executable on the person's iphone. An indication that the person's location is now being viewed by an allowed person may be displayed on the iphone. In such an instance, the person may have displayed an option to upload his location or not. The response to the option may be kept secret so that the user seeking to gain location information does not know if the person was unavailable or declined to allow access.

- In all instances, the system may enable communication amongst persons in communication with the system. For example, a user may be viewing a portion of New Orleans with spheres plotted at points corresponding to rescue personnel. Touching on a sphere causes textual information related to the point, such as a phone number, to be displayed. Touching on the displayed phone number causes a phone call to be placed, such as by Skype™ to the person associated with the sphere and point data. In addition to voice communication, text and video data, for example, may likewise be exchanged.
- In one embodiment, the system or a person using the system may request location information of a person operating a mobile platform in communication with the system. Such a request may take the form of a text message sent to the iPhone of a person. In addition to containing information sufficient to request location information (such as data instructing a location executable to execute on the person's mobile platform), the message may contain additional information. For example, the message may contain information telling the mobile platform where (server id, IP address, SQL server info, etc.) to send the requested location information. Additional information includes an instruction to take a photo with the iPhone as well as an email address where the photo is to be sent.
    - For example, a user of the system is viewing a dataset of New Orleans with dynamic point data showing persons in distress. In addition, there is displayed dynamic point data corresponding to rescue volunteers dispersed about New Orleans. By touching (if the viewing software is displayed on a touch screen) or clicking on a displayed point corresponding to a rescue volunteer,

attribute information associated with the volunteer is displayed, including the phone number of the volunteer. By touching or otherwise selecting the phone number, the computer on which the visualization software is running places a call, such as via Skype, to the volunteer. In addition, a text message can be sent to the volunteer's phone requesting a photo be taken of the surrounding environment and sent to an email account managed by the system or other account.

- Searching for and downloading data sets.
  - In an exemplary embodiment, a user accesses information regarding available data sets via the internet in web page format. The web page may display snapshots (each a hyperlink to additional data, including a download link) from mpegs of fly-throughs of one or more data sets. For example, the home page of the system may show the top five most downloaded datasets in the form of snapshots. Alternatively, the system might show one or more snapshots associated with data sets (perhaps newly added) that may be of interest to the user, based upon, for example past downloads of the user or on stored preferences of the user.
  - In one embodiment, the user searches using keywords.
  - In one embodiment, Suggestions of data sets are presented to the user. For example, the home web page of youvista.com may have a section, such as "MyVista", where there are presented selections of data sets. The selection may be based upon a search of data sets resident in the system with a geographic expanse that is at least partially coincident with the geographic expanse of other datasets that the user has downloaded or in which the user has expressed an interest.
  - In one embodiment, the user searches by clicking on a dynamic map that visually displays selectable geographic areas. Once an area is selected, data sets that cover an area in proximity to the selected area are displayed for download.
  - Once a hyperlink is selected by a user, additional information associated with the selected data set is displayed. For example, an Email address associated with the creator of the data set may be presented. Ratings of the data set by other users may be presented. Textual descriptors of the data set may be stored by the creator and displayed. For example, there might be displayed "Yosemite aerial photography of half-dome (24 bit color, 1m resolution) overlayed on DEM created from USGS 1:24,000 DLG. Yosemite falls region also available as separate download."

- The user is provided with links to the image and terrain data to enable downloading. The links may be individual or a single link may download the matching image and DEM data. Other data comprising the data set may be stored by the creator. For example, point, line, area, and audio data may be stored for download by the user. For example, points representing spots of interest or a line created by a GPS device recording a preferred trail hike may be offered for download. The points and lines may be attributed with additional information (other than latitude and longitude information) such as text information. In addition, a configuration file may be included that specifies how the point, line, area, and audio data is to be displayed and/or presented. For example, points representing trail outfitters may appear as a preferred icon overlayed on the image and terrain data (as specified in the configuration file). When the user nears a point so displayed, in a virtual manner, via the visual interface, the name of the outfitter and an internet link may appear. By clicking on the link, if the user is internet enabled, the website may be presented. Likewise, an audio file of running water may be specified to play when the user is near a river (defined in a downloadable line or area file) in the virtual environment (as specified in the configuration file).
- Once downloaded, the visualization software allows a user to modify the configuration file, such as, for example, to turn off the playing of audio files or to change the font in which textual information is displayed.
- In addition to data sets, users may download visualization software from the system, such as via a web page. In one embodiment, the downloaded visualization software is free. In some embodiments, the software must be registered and a registration id provided from the system and stored on the user machine running the software. As described above, in such an instance, some aspects of a users activities can be controlled by the system. In some instances, this control is required to produce advertising revenue to support the creation and maintenance of the system.
    - In addition to viewing the data, the visualization software can enable measurement and analysis of the dataset. For example, while viewing a fly-over of the dataset, a user can touch two points in the perspective rendering and the visualization software determines the latitude and longitude of the two points, computes a distance between the points and displays the distance to the user. Likewise, a shortest path can be computed between the points and a 3D line computed and displayed within the perspective rendering.
- In one embodiment, a dedicated web address or other accessible address may be provided to any user in need of emergency response data. Presently, dialing 911 anywhere in the U.S. routes a call to police and fire personnel. Similarly, executing

an application, such as on an iPhone, would immediately route the user of the application to a repository of applicable information.

- For example, a hurricane survivor enables a dedicated application. Data is downloaded for viewing, as described herein, allowing the user to fly over and around his surroundings in a virtual manner. Pressing on the icon for emergency services, causes icons representing red cross stations to be displayed on the iPhone. Pressing on one such icon causes the display of an RFID updated list of the inventory at that red cross station. Pressing another button passes the users GPS determined present location to a Google earth™ application on the iPhone and displays directions to the red cross station.
- Access to certain data may be limited based upon location to guarantee access by the most needy individuals. For example, weather and other data may be made available (or the user may be granted priority) for viewing to a user only if the user is within a predefined emergency area.

- In one embodiment, visualization software may be resident upon a mobile platform, such as an iphone or the n vifone by Garmin International Inc., a unit of Garmin Ltd. (Nasdaq: GRMN).
  - In such an embodiment, the perspective renderings of the fly-throughs of a data set may be computed by the system, compressed (such as into mpeg video), sent to the iphone and displayed. Control icons can be displayed and utilized on the iphone with the control information sent to the system so as to control the flight path and other fly-through parameters.
  - In one embodiment, the orientation of the mobile platform may be utilized to control visualizations. For example, accelerometers and the like within an iPhone used to determine the orientation and motion of the iPhone. This information can be used to control the visualization of geospatial data such as by controlling flight parameters associated with a fly-through eg, tilting forward produces forward movement, tilting to the right produces a turning motion to the right, etc.
  - In another embodiment, a dedicated client computer, such as the user's computer running visualization software (described

above), can communicate with an iphone, such as via wi-fi, Bluetooth, or phone link, to provide snapshots (such as jpegs) of a fly-through controlled by the user. When data throughput is sufficient, these snapshots form a real time, or near real time, visualization experience.

- In one embodiment, the system may be configured to keep a specific data set resident in memory so as provide multiple users with near real time data streams as described above. In another embodiment, a user's computers may be set up as a server. For example, a user may load a data set of Yosemite park on a home computer and establish communication between an iPhone and the home computer. As long as the home computer remains on and in communication with the iPhone, the user can use the processing power of the home computer to generate images which are sent to the iPhone.
- One advantage of the above embodiments is that mobile platforms lacking sufficient processing and graphics capabilities to make full use of the system can work in partnership with the system or another computer by offloading the computationally intense activities to another computer. In one embodiment, a hybrid architecture is envisioned whereby a subset of a dataset is utilized on an iPhone for manipulation with a full rendering being computed on another computer and sent to the iPhone when requested. For example, the points forming a wire frame model of New York City are downloaded to an iPhone along with point data specifying the location of the temple model. The iPhone is capable of rendering the wireframe and point data. When requested, the parameters of view angle, height, etc. are sent from the iPhone to another computer running system software and a full resolution image matching the sent parameters is generated and sent to the iPhone for display. Such an approach maximizes the processing capabilities of each platform and minimizes communication and data traffic between platforms.

Mobile device architecture

- In one embodiment, the system, at least one client, and at least one mobile device may be in communication with one another. The client may be, for example, a pc or pc compatible device running visualization software. The mobile device may be a cell phone, such as an iPhone. The system, the at least one client, and at least one mobile device form a mobile device architecture. As described more fully below, whether via direct bi-directional communication or via the system, the client and the mobile device may exchange data.
  - In an exemplary embodiment, an application executable on the mobile device determines a location of the mobile device and sends the location information to the client. For example, an iPhone application determines

location information, such as a longitude, a latitude, and a confidence level radius. The location information may be sent directly to a client via a communication protocol such as, for example, Hypertext transfer protocol (HTTP) or Short message service (SMS) protocol. By "directly" it is meant that the communication of location information between the client and the mobile device does not involve storage or transfer of location information via the server component of the system. Alternatively, the location information may be sent to the server portion of the system for access by other clients and mobile platforms.

- *Client to mobile device communication.* For example, an iPhone determines location information and sends the information via a communication protocol to an ftp address to which the client has access. The ftp address may be stored on the iPhone and accessible to a location application operable on the iPhone. Conversely, the application may be activated, such as by the receipt of a message (such as an SMS message) via a communication from the client in which is embedded the address and password of the ftp site where the location information is to be stored. In this manner, access to the location information is limited to clients with access to the ftp site. The location information, as well as messages used to invoke the execution of the application, may be further protected through any known encryption method. Once stored, a client, using visualization software, can overlay the location information on a viewable dataset using the system. For example, a long running application on a client platform may periodically check to see if additional location information has been received from a mobile platform and stored for retrieval by the client. The check may be performed on a site accessible to the client, such as an ftp site. Conversely, an application resident on a platform in communication with a server hosting the location data may affirmatively alert clients of updated location information.
    - Reformatting of the data to enable visualization with the visualization software may be performed by the client or by an application resident on a server hosting the location data.
    - In another example, the communication between the mobile platform and the client does not require an external server. For example, the mobile device may communicate the location information via a SMS message. In another example, the client device may be set up with a unique address to enable http communication between the mobile device and the client.
- *Client to system communication.* For example, an iPhone determines location information and sends the information via a communication protocol to the system. The system may store the location information in any desirable format to facilitate access by users of the system, for example, as a flat

file capable of being downloaded or in a data server, such as an SQL server.

- For example, a user may view a dataset of New Orleans during a disaster, such as hurricane Katrina. In addition to the terrain model and imagery forming a dataset, one or more color coded surfaces corresponding to radar generated images of weather phenomenon may be displayed over the terrain, perhaps at varying degrees of opacity/translucence. The user periodically downloads a point file comprising the locations of emergency workers who have previously sent location information to the system for access by users/clients. Such access may be password protected, encrypted, or otherwise restricted. This point file can be viewed using the visualization software using, for example, one or more of the methods described below.
- In the above example, the location information may be augmented with additional data. For example, the location information may contain the phone number or other identifier of the mobile device. An operation, such as an SQL join or a logical equivalent, may be performed to add additional information, such as a name of the individual operating the mobile device. As a result, when the data is viewed by a user of the system, this additional information is available. Continuing with the present example, a user downloads location information of emergency workers and plots them as spheres surrounded by translucent spheres corresponding in radius to a confidence radius (such as a 95% confidence radius). When the user touches, clicks, or otherwise selects a portion of a viewing screen corresponding to one of the spheres, the visualization software determines which sphere has been selected and displays information associated with the sphere. For example, the latitude and longitude is displayed as well as the phone number and name associated with the sphere. For example, the phone number "203.535.3897" and the name "Jeff Ray" are displayed in text fields. These fields may be tied to user specified actions. For example, touching on the phone number may cause a call to be placed to the mobile platform, such as via Skype™.
- Whether querying or performing a geospatial query from the system, on the client platform, or on any platform in communication with the client or the system, the location information may be formatted in

response to a request and made available for viewing. For example, a user may request point data corresponding to all emergency workers within a ten mile radius of a specified point that have an attribute of being "online". A response to the query is performed and the data forwarded to a user for visualization by the user.

- It is understood that in all instances described above, the mobile device may act as a client device/user of the system.

Visualization Conventions

- As noted above, point, line and area data may be downloaded to be viewed with a dataset. Various conventions may be employed to display multi-dimensional data associated with a vector data component. For example, a point, displayed as a sphere, may be assigned a hue, saturation, intensity or size corresponding to an attribute. For example, a point set comprising the location of people in distress may be displayed as spheres where the saturation varies according to how old location data is. In this manner, older point data looks more washed out and accords with the human perception that it is older and less likely to be accurate.
- In addition to spheres, OGL provides support for the display of numerous geometric shapes including, but not limited to, cones and tori (plural of torus). The hue, saturation, intensity, size and orientation of such shapes may be utilized to display multidimensional data. For example, each point corresponding to a person in distress may be augmented with data fields corresponding to the direction to the nearest first aid station and evacuation center. When the points are plotted as spheres, two cones extending from the sphere may be color coded (red = first aid station, blue = evacuation center) may point, perhaps parallel to the ground, to the first aid station and the evacuation center. When a user of the system touches or otherwise accesses data corresponding to a displayed sphere and facilitates communication (via telephone or other method, such as text messaging) with the corresponding mobile device represented by the sphere, the user can give directions and aid based upon the perceived orientation of the displayed cones. For example, the user may communicate, "There is an aid station north of you and an evacuation center to the north west."
  - In another example, a cone may extend from a sphere plotted above the terrain and extend down to the ground. This configuration may be used to represent that the point data is "tied" to a place on the ground above which another point is plotted, for example a point representing a plane 10,000 feet above the ground. In such an instance, a sphere representing the plane may be plotted 10,000 feet above the surface or text may be plotted over the sphere from which the cone extends indicating the height of the associated point. For example the text "10,000 feet" may be plotted over the sphere. As such

points are continually and repeatedly plotted, one can observe both the location of persons in need of assistance on the ground while simultaneously viewing the location of rescue planes and helicopters in the air.

- In addition to geometric shapes, non-geometric shapes may be defined, such as in a .obj format, textured, and displayed. In addition, floating billboards may be employed. For example, rescue workers may be represented by a floating billboard displaying a photo of the worker for easy identification.

<u>Security</u>

- In an exemplary embodiment, multiple passwords may be employed to provide security on a mobile device. There may be defined a first password to enable normal operation of the aforementioned application and an alternate password. Use of the alternate password will enable operation of the mobile platform, perhaps in a protected mode, while indicating that something is wrong. For example, a mobile device receiving and transmitting location information corresponding to secured assets is forcibly taken by nefarious characters. The password to operate the mobile device may be extracted from the owner of the mobile device using unsavory techniques. Upon providing the alternate password, an application on the mobile platform immediately informs the system of the location of the compromised mobile device. This information may be displayed via visualization software to indicate the location of the compromised mobile device.
- In addition to the ability of a user of the system to instruct a mobile device to execute the application for reporting location information, the user may require a predefined password to be entered in order to activate the application.

Notes:

Miscellaneous: Path of where I've been in viewer. Spheres, line, linked list of past 10 location measurements, points indicating changes in direction with lines in between, etc.

Uploads – may offer bitmap logos of organizations, e.g. UVista certified.

PATENT APPLICATION SERIAL NO.______________________

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

07/14/2008 NNGUYEN1 00000116 61134646

01 FC:2005 105.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002- 489-267/69033