

# POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

03624

**OR**

I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

Name	Registration Number	Name	Registration Number

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

The address associated with the above-mentioned Customer Number.

**OR**

The address associated with Customer Number:

**OR**

Firm or Individual Name

**Volpe and Koenig, P.C.**

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant:

Inventor or Joint Inventor

Legal Representative of a Deceased or Legally Incapacitated Inventor

Assignee or Person to Whom the Inventor is Under an Obligation to Assign

Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

**SIGNATURE of Applicant for Patent**

Signature

*Fatih M. Ozluturk*

Date

10/18/12

Name

Fatih M. Ozluturk

Telephone

516 603 8383

Title and Company

**NOTE:** Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below \*.

\*Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS**

**NOTE:** This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	Not Yet Known
Filing Date	February 13, 2017
First Named Inventor	Fatih M. Ozluturk
Title	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
Art Unit	Not Yet Known
Examiner Name	Not Yet Known
Attorney Docket Number	OZL-PT001.17

**SIGNATURE of Applicant or Patent Practitioner**

Signature	/Thomas A. Mattioli/	Date	February 13, 2017
Name	Thomas A. Mattioli	Telephone	(215) 568-6400
Registration Number	56,773		

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.

\*Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION  
 UNDER 37 CFR 1.102(e)** (Page 1 of 1)

First Named Inventor:	Fatih M. Ozluturk	Nonprovisional Application Number (if known):	
Title of Invention:	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		

**APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.**

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

**I.  Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.  
 ---OR---  
 (b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

**II.  Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Thomas A. Mattioli/	Date February 13, 2017
Name (Print/Typed) Thomas A. Mattioli	Practitioner Registration Number 56773

**Note:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.\*

\*Total of 1 forms are submitted.

## Privacy Act Statement

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	
<b>Filing Date:</b>	
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Attorney Docket Number:</b>	OZL-PT001.17

Filed as Small Entity

### Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Basic Filing:</b>				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	70	70
UTILITY SEARCH FEE	2111	1	300	300
UTILITY EXAMINATION FEE	2311	1	360	360
REQUEST FOR PRIORITIZED EXAMINATION	2817	1	2000	2000
<b>Pages:</b>				
<b>Claims:</b>				
CLAIMS IN EXCESS OF 20	2202	9	40	360

**Miscellaneous-Filing:**

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	2830	1	70	70
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				
<b>Miscellaneous:</b>				
<b>Total in USD (\$)</b>				<b>3160</b>

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	28340733
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	13-FEB-2017
<b>Filing Date:</b>	
<b>Time Stamp:</b>	17:05:14
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$3160
RAM confirmation Number	021417INTEFSW17062700
Deposit Account	220493
Authorized User	Angel Wolf

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	WebADS.pdf	138750 7a934f60bfb3be433799322d0bd9193543e45a6b	no	8
<b>Warnings:</b>					
<b>Information:</b>					
2		OZL-PT001_17_Application_EFS.PDF	175462 271f8a3b5d7acc1d5b194fed1ca3858700837fa	yes	28
	<b>Multipart Description/PDF files in .zip description</b>				
	<b>Document Description</b>		<b>Start</b>	<b>End</b>	
	Abstract		28	28	
	Claims		22	27	
	Specification		1	21	
<b>Warnings:</b>					
<b>Information:</b>					
3	Drawings-only black and white line drawings	OZL-PT001_17_Drawings_EFS.PDF	225563 55b43ccb8e3a651b93b7237c10fca010cfa1ee1	no	9
<b>Warnings:</b>					
<b>Information:</b>					
4	Oath or Declaration filed	OZL-PT001_17_Declaration_EFS.PDF	1259548 2eea273442b79cdeb4a8f4304f42f02648e75e1f1	no	1
<b>Warnings:</b>					
<b>Information:</b>					
5	Power of Attorney	OZL-PT001_17_POA_Transmittal_EFS.PDF	225452 823f5c41596dea7bb29fc467eeb1160c8be64434	no	1

<b>Warnings:</b>					
<b>Information:</b>					
6	Power of Attorney	OZL-PT001_17_POA_EFS.PDF	187133 f9ea9f505bbc28aa2fa11dd8d2b200993491514e	no	2
<b>Warnings:</b>					
<b>Information:</b>					
7	TrackOne Request	OZL-PT001_17_Track_One_Request_EFS.PDF	125001 944a8d5e78ca996416f58be5d8ee1832a3573354	no	2
<b>Warnings:</b>					
<b>Information:</b>					
8	Fee Worksheet (SB06)	fee-info.pdf	42064 7fbba489dbd70309d5208e33b374cc3aa060547a	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>				2378973	
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p>					

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	OZL-PT001.17
		Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

**Secrecy Order 37 CFR 5.2:**

<input type="checkbox"/>	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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**Inventor Information:**

<b>Inventor 1</b>					
<b>Legal Name</b>					
<b>Prefix</b>	<b>Given Name</b>	<b>Middle Name</b>	<b>Family Name</b>	<b>Suffix</b>	
	Fatih	M.	Ozluturk		
<b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service					
<b>City</b>	Port Washington	<b>State/Province</b>	NY	<b>Country of Residence</b> <sup>i</sup>	US
<b>Mailing Address of Inventor:</b>					
<b>Address 1</b>	5 Hilldale Lane				
<b>Address 2</b>					
<b>City</b>	Sands Point	<b>State/Province</b>	NY		
<b>Postal Code</b>	11050	<b>Country</b> <sup>i</sup>	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button. <span style="float: right;"><input type="button" value="Add"/></span>					

**Correspondence Information:**

<b>Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).</b>			
<input type="checkbox"/> <b>An Address is being provided for the correspondence information of this application.</b>			
<b>Customer Number</b>	3624		
<b>Email Address</b>	eoffice@vklaw.com	<input type="button" value="Add Email"/>	<input type="button" value="Remove Email"/>

**Application Information:**

<b>Title of the Invention</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		
<b>Attorney Docket Number</b>	OZL-PT001.17	<b>Small Entity Status Claimed</b>	<input type="checkbox"/>
<b>Application Type</b>	Nonprovisional		
<b>Subject Matter</b>	Utility		
<b>Total Number of Drawing Sheets (if any)</b>	9	<b>Suggested Figure for Publication (if any)</b>	4

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

### Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

### Publication Information:

Request Early Publication (Fee required at time of Request 37 CFR 1.219)

**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

### Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	<input checked="" type="radio"/> Customer Number	<input type="radio"/> US Patent Practitioner	<input type="radio"/> Limited Recognition (37 CFR 11.9)		
Customer Number	3624				
Prefix	Given Name	Middle Name	Family Name	Suffix	Remove
Registration Number					
Prefix	Given Name	Middle Name	Family Name	Suffix	Remove
Registration Number					
Additional Representative Information blocks may be generated within this form by selecting the <b>Add</b> button.					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	OZL-PT001.17
		Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		

### Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

Prior Application Status		Pending		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
	Continuation of	15149481	2016-05-09		
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15149481	Continuation of	14690818	2015-04-20	9338356	2016-05-10
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14690818	Continuation of	14532654	2014-11-04	9013587	2015-04-21
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14532654	Continuation of	13442370	2012-04-09	8922663	2014-12-30
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13442370	Continuation of	12274032	2008-11-19	8154607	2012-04-10
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12274032	Continuation of	11089081	2005-03-24	8331723	2012-12-11
Prior Application Status		Expired		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11089081	Claims benefit of provisional	60556230	2004-03-25		

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

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This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country <sup>i</sup>	Filing Date (YYYY-MM-DD)	Access Code <sup>i</sup> (if applicable)

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### Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

### Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

- |   |  |                                      |
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| <input type="radio"/> Assignee  | <input type="radio"/> Legal Representative under 35 U.S.C. 117         | <input type="radio"/> Joint Inventor |
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### Mailing Address Information For Applicant:

Address 1			
Address 2			
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Country <sup>i</sup>		Postal Code	
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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
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### Assignee Information including Non-Applicant Assignee Information:

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<b>Assignee 1</b>				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
If the Assignee or Non-Applicant Assignee is an Organization check here. <input type="checkbox"/>				
Prefix	Given Name	Middle Name	Family Name	Suffix
<b>Mailing Address Information For Assignee including Non-Applicant Assignee:</b>				
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Address 2				
City		State/Province		
Country <sup>i</sup>	Postal Code			
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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
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**Signature:**

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This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

<b>Signature</b>	/Thomas A. Mattioli/			Date (YYYY-MM-DD)	
First Name	Thomas A.	Last Name	Mattioli	Registration Number	56773
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### ABSTRACT

The effect of camera shake in digital video is corrected using signal processing techniques. The digital video is a sequence of digital images. When the sequence of digital images are being captured, movement of the imaging device causes the images to shift on the image sensor of the imaging device and affects the quality of the eventual video. Movement of the imaging device is detected while the video is being captured, and a motion information representing the motion is recorded. A processor determines a correcting filter based on the motion information and user input. The processor modifies the sequence of images captured according to the correcting filter and obtains a final corrected video. Corrected video is displayed in a viewfinder.

## CLAIMS

What is claimed is:

1. A method for use in an imaging device comprising an image sensor, a processor, a memory, and one or more motion sensors, the method comprising:

capturing a sequence of images with the image sensor, wherein the sequence of images comprise a video;

detecting, by the one or more motion sensors, motion information for one or more images of the sequence of images, wherein the motion information represents motion of the device during capturing of the one or more images of the sequence of images;

determining, by the processor, a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modifying, by the processor, one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values;

combining, by the processor, the modified images to obtain a final video; and  
storing the final video in the memory.

2. The method of claim 1, wherein the processor determines the vertical and horizontal shift values for one or more images for which the motion information is detected.

3. The method of claim 1, wherein the processor modifies one or more images for which the vertical and horizontal shift values are determined.

4. The method of claim 1, wherein the processor modifies one or more images of the sequence of images such that effect of motion of the device during capturing of the one or more images of the sequence of images is reduced in the final

video.

5. The method of claim 1, wherein the processor determines a vertical shift value and a horizontal shift value for each image of the sequence of images.

6. The method of claim 1, wherein the motion information represents motion of the device at time of capturing of one or more images of the sequence of images.

7. The method of claim 1, wherein the one or more images of the sequence of images is at least two images, and wherein the motion information represents motion of the device between capturing of consecutive images.

8. The method of claim 1, wherein the vertical and horizontal shift values for an image indicate how much the image is displaced due to motion of the device during capturing of the image.

9. The method of claim 1, wherein the modifying by the processor of the one or more images of the sequence of images comprises shifting a reference point in each image according to the vertical shift value and the horizontal shift value for the image in a direction that reduces the effect of motion of the device in the final video.

10. The method of claim 1, wherein the method further comprises displaying the final video in a user interface.

11. The method of claim 1, wherein the method further comprises modifying the sequence of images using a video compression technique.

12. The method of claim 1, wherein the one or more images of the sequence of images for which the motion information is detected are stored in the memory, and wherein the motion information is stored in the memory synchronously with the storing of the images.

13. The method of claim 1, wherein determining a vertical shift value and a horizontal shift value for one or more images of the sequence of images is based at least in part on the focal distance of a lens of the imaging device.

14. The method of claim 1, wherein the method further comprises receiving user input in a user interface, and at least one of modifying one or more images of the sequential images or combining the modified images to obtain a final video is based at least in part on the user input.

15. An imaging device, comprising:

an image sensor configured to capture a sequence of images, wherein the sequence of images comprise a video;

one or more motion sensors configured to detect motion information for one or more images of the sequence of images, wherein the motion information represents motion of the imaging device during capturing of the one or more images of the sequence of images;

a processor configured to:

determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modify one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values; and

combine the modified images to obtain a final video; and

a memory configured to store the final video.

16. The imaging device of claim 15, wherein the processor is configured to determine the vertical and horizontal shift values for one or more images of the sequence of images for which the motion information is detected.

17. The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images for which the vertical and horizontal shift values are determined.

18. The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images such that effect of motion of the device during capturing of the one or more images of the sequence of images is reduced in the final video.

19. The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for each of the images of the sequence of images.

20. The imaging device of claim 15, wherein the motion information detected by the one or more motion sensors represents motion of the device at time of capturing of one or more images of the sequence of images.

21. The imaging device of claim 15, wherein the one or more images of the sequence of images is at least two images, and wherein the motion information detected by the one or more motion sensors represents motion of the device between capturing of consecutive images.

22. The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for an image such that

the vertical shift value and the horizontal shift value indicate how much the image is displaced due to motion of the device during capturing of the image.

23. The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images by shifting a reference point in each image according to the vertical shift value and the horizontal shift value for the image in a direction that reduces the effect of motion of the device in the final video.

24. The imaging device of claim 15, wherein the device further comprises a display configured to display the final video.

25. The imaging device of claim 15, wherein the processor is further configured to modify the sequence of images using a video compression technique.

26. The imaging device of claim 15, wherein the device is configured to store the one or more images of the sequence of images for which the motion information is detected in the memory, and wherein the device is configured to store the motion information in the memory synchronously with the storing of the images.

27. The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the focal distance of a lens of the imaging device.

28. The imaging device of claim 15, wherein the device further comprises a display configured to receive user input, and the device is configured to modify one or more images of the sequential images and to obtain a final video based at least in

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part on the user input.

29. The imaging device of claim 15, wherein the processor is two or more processors.

**METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO  
COUNTERACT EFFECT OF CAMERA SHAKE**

**CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] This application is a continuation of 15/149,481, filed May 9, 2016, which is a continuation of U.S. Patent Application No. 14/690,818, filed on April 20, 2015, which issued as U.S. Patent No. 9,338,356 on May 10, 2016, which is a continuation of U.S. Patent Application No. 14/532,654, filed on November 4, 2014, which issued as U.S. Patent No. 9,013,587 on April 21, 2015, which is a continuation of U.S. Patent Application No. 13/442,370, filed on April 9, 2012, which issued as U.S. Patent No. 8,922,663 on December 30, 2014, which is a continuation of U.S. Patent Application Serial No. 12/274,032, filed on November 19, 2008, which issued as U.S. Patent No. 8,154,607 on April 10, 2012, which is a continuation of U.S. Patent Application Serial No. 11/089,081, filed on March 24, 2005, which issued as U.S. Patent No. 8,331,723 on December 11, 2012, which claims the benefit of U.S. Provisional Application Serial No. 60/556,230, filed on March 25, 2004, the contents of each of which are incorporated by reference herein.

**FIELD OF INVENTION**

[0002] The present invention generally relates to digital image processing. More specifically, this invention relates to processing of digitized image data in order to correct for image distortion caused by relative motion between the imaging device and the subject at the time of image capture, or by optical distortion from other sources.

**BACKGROUND**

[0003] When capturing images, as with a camera, it is desirable to capture images without unwanted distortion. In general, sources of unwanted distortion can be characterized as equipment errors and user errors. Examples of common equipment errors include inadequate or flawed optical equipment, and undesirable

characteristics of the film or other recording media. Using equipment and media of a quality that is suitable for a particular photograph can help mitigate the problems associated with the equipment and the recording medium, but in spite of this, image distortion due to equipment errors can still appear.

[0004] Another source of image distortion is user error. Examples of common user errors include poor image processing, and relative motion between the imaging device and the subject of the image. For example, one common problem that significantly degrades the quality of a photograph is the blur that results from camera movement (i.e. shaking) at the time the photograph is taken. This can be difficult to avoid, especially when a slow shutter speed is used, such as in low light conditions, or when a large depth of field is needed and the lens aperture is small. Similarly, if the subject being photographed is moving, use of a slow shutter speed can also result in image blur.

[0005] There are currently many image processing techniques that are used to improve the quality, or “correctness,” of a photograph. These techniques are applied to the image either at the time it is captured by a camera, or later when it is post-processed. This is true for both traditional “hardcopy” photographs that are chemically recorded on film, and for digital photographs that are captured as digital data, for example using a charged couple device (CCD) or a CMOS sensor. Also, hardcopy photographs can be scanned and converted into digital data, and are thereby able to benefit from the same digital signal processing techniques as digital photographs.

[0006] Commonly used post-processing techniques for digitally correcting blurred images typically involve techniques that seek to increase the sharpness or contrast of the image. This can give the mistaken impression that the blur is remedied. However, in reality, this process causes loss of data from the original image, and also alters the nature of the photograph. Thus, current techniques for increasing the sharpness of an image do not really “correct” the blur that results from relative motion between a camera and a subject being photographed. In fact,

the data loss from increasing the sharpness can result in a less accurate image than the original. Therefore, a different method that actually corrects the blur is desirable.

[0007] In the prior art, electro-mechanical devices for correcting image blur due to camera motion are built into some high quality lenses, variously called “image stabilization”, “vibration reduction”, or similar names by camera/lens manufacturers. These devices seek to compensate for the camera/lens movement by moving one or more of the lens elements; hence countering the effect of the motion. Adding such a device to a lens typically makes the lens much more expensive, heavier and less sturdy, and can also compromise image quality.

[0008] Accordingly, it is desirable to have a technique that corrects for distortion in photographs without adding excessively to the price, robustness or weight of a camera or other imaging device, or adversely affecting image quality.

### SUMMARY

[0009] The present invention processes image data in order to correct an image for distortion caused by imager movement or by movement of the subject being imaged. In another embodiment, the present invention can prevent image distortion due to motion of the imaging device or subject at relatively slow shutter speeds, resulting in a substantially undistorted image.

[0010] In another embodiment, the present invention measures relative motion between the imaging device and the subject by using sensors that detect the motion. When an image is initially captured, the effect of relative motion between the imaging device and the subject is that it transforms the “true image” into a blurred image, according to a 2-dimensional transfer function defined by the motion. The invention determines a transfer function that represents the motion and corrects the blur.

[0011] In yet another embodiment, the transfer function is estimated using blind detection techniques. The transfer function is then inverted, and the inverted

function is implemented in an image correcting filter that essentially reverses the blurring effect of the motion on the image. The image is processed through the filter, wherein blur due to the motion is reversed, and the true image is recovered.

[0012] In yet another embodiment, the invention uses the transfer function to combine consecutive images taken at a fast shutter speed to avoid blur due to motion between camera and subject that could result from using a slow shutter speed. In still another embodiment, the image sensor is moved to counter camera motion while the image is being captured.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 is a portion of memory having memory locations wherein elements of a recorded image are stored.

[0014] Figure 2 is a portion of memory having memory locations wherein elements of a deconvolution filter are stored.

[0015] Figure 3 is a portion of memory having memory locations wherein the recorded image is stored for calculating the next value of a corrected image.

[0016] Figure 4 is a functional block diagram of a system for correcting an image for distortion using a transfer function representing the distortion, wherein the transfer function is derived from measurements of the motion that caused the distortion.

[0017] Figure 5 is a functional block diagram of a system for correcting an image for distortion using a transfer function representing the distortion, wherein the transfer function is derived using blind estimation techniques.

[0018] Figure 6 shows a unit for iterative calculation of the corrective filter coefficients and estimation of the correct image data.

[0019] Figure 7 illustrates support regions of an image  $r(n,m)$  and of a transfer function  $h(n,m)$ , and the transfer function  $h(n,m)$  being applied to different parts of the image  $r(n,m)$ .

[0020] Figure 8 shows a unit for blind deconvolution to calculate the correct image data.

[0021] Figure 9 is an image of an object being captured on an image sensor wherein pixel values represent points of the image.

[0022] Figure 10 illustrates the effect of moving an imager while capturing an image, resulting in multiple copies of the image being recorded over each other, causing blur.

[0023] Figure 11 illustrates combining images taken at fast shutter speeds to result in the equivalent of a final image taken at a slower shutter speed, but with reduced blur.

[0024] Figure 12 illustrates image blur correction where an image sensor is moved to compensate for imager movement.

[0025] Figure 13 is an example of an image distorted by movement of the imager when the image was captured.

[0026] Figure 14 is represents the image of Figure 13 corrected according to the present invention.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0027] The present invention will be described with reference to the figures wherein like numerals represent like elements throughout. Although the invention is explained hereinafter as a method of correcting for image distortion due to the shaking of a camera when a picture is taken, similar distortions can also be caused by other types of imaging equipment and by imperfections in photo processing equipment, movement of the subject being photographed, and other sources. The present invention can be applied to correct for these types of distortions as well. Additionally, although reference is made throughout the specification to a camera as the exemplary imaging device, the present invention is not limited to such a

device. As aforementioned, the teachings of the present invention may be applied to any type of imaging device, as well as image post-processing techniques.

[0028] Capturing and recording a photograph, for example by a camera, involves gathering the light reflected or emanating from a subject, passing it through an optical system, such as a series of lenses, and directing it onto a light sensitive recording medium. A typical recording medium in traditional analog photography is a film that is coated with light sensitive material. During processing of the exposed film, the image is fixed and recorded. In digital cameras, the recording medium is typically a dense arrangement of light sensors, such as a Charge-Coupled Device (CCD) or a CMOS sensor.

[0029] The recording medium continuously captures the impression of the light that falls upon it as long as the camera shutter is open. Therefore, if the camera and the subject are moving with respect to each other (such as in the case when the user is unsteady and is shaking the camera, or when the subject is moving), the recorded image becomes blurred. To reduce this effect, a fast shutter speed can be used, thereby reducing the amount of motion occurring while the shutter is open. However, this reduces the amount of light from the subject captured on the recording medium, which can adversely affect image quality. In addition, increasing the shutter speed beyond a certain point is not always practical. Therefore, undesired motion blur occurs in many pictures taken by both amateur and professional photographers.

[0030] The nature of the blur is that the light reflected from a reference point on the subject does not fall on a single point on the recording medium, but rather it 'travels' across the recording medium. Thus a spread-out, or smudged, representation of the reference point is recorded.

[0031] Generally, all points of the subject move together, and the optics of the camera and the recording medium also move together. For example, in the case of a photograph of a moving car, wherein an image of the car is blurred due to uniform motion of all parts of the car. In other words, the image falling on the recording

medium ‘travels’ uniformly across the recording medium, and all points of the subject blur in the same manner.

[0032] The nature of the blur resulting from uniform relative motion can be expressed mathematically. In a 2-dimensional space with discrete coordinate indices ‘ $n$ ’ and ‘ $m$ ’, the undistorted image of the subject can be represented by  $s(n,m)$ , and a transfer function  $h(n,m)$  can be used to represent the blur. Note that  $h(n,m)$  describes the way the image ‘travels’ on the recording medium while it is captured. The resulting image that is recorded,  $r(n,m)$ , is given by:

$$r(n,m) = s(n,m) ** h(n,m); \quad \text{Equation (1)}$$

where  $**$  represents 2-dimensional convolution. The mathematical operation of convolution is well known to those skilled in the art and describes the operation:

$$r(n,m) = \sum_{i=-\infty}^{\infty} \sum_{j=-\infty}^{\infty} h(i,j) s(n-i, m-j). \quad \text{Equation (2)}$$

[0033] In the sum operations in Equation (2), the summation limits are infinite. In practice, the summations are not infinite, since the support region of the transfer function is finite. In other words, the region where the function is non-zero is limited by the time the camera shutter is open and the amount of motion. Therefore, the summation is calculated for only the indices of the transfer function where the function itself is non-zero, for example, from  $i = -N \dots N$  and  $j = -M \dots M$ .

[0034] If the transfer function  $h(n,m)$  is known, or its estimate is available, the blur that it represents can be “undone” or compensated for in a processor or in a computer program, and a corrected image can be obtained, as follows. Represent the “reverse” of the transfer function  $h(n,m)$  as  $h^{-1}(n,m)$  such that:

$$h(n,m) ** h^{-1}(n,m) = \delta(n,m); \quad \text{Equation (3)}$$

where  $\delta(n,m)$  is the 2-dimensional Dirac delta function, which is:

$$\delta(n,m) = \begin{cases} 1 & \text{if } n = m = 0 \\ 0 & \text{otherwise} \end{cases} . \quad \text{Equation (4)}$$

[0035] The delta function has the property that when convolved with another function, it does not change the nature of that function. Therefore, once  $h(n,m)$  and hence  $h^{-1}(n,m)$  are known, an image  $r(n,m)$  can be put through a correcting filter, called a “deconvolution filter”, which implements the inverse transfer function  $w(n,m) = h^{-1}(n,m)$  and undoes the effect of blur. Then:

$$\begin{aligned} r(n,m) ** w(n,m) &= r(n,m) ** h^{-1}(n,m) \\ &= s(n,m) ** h(n,m) ** h^{-1}(n,m) \\ &= s(n,m) ** \delta(n,m) \\ &= s(n,m); \end{aligned} \quad \text{Equation (5)}$$

and the correct image data  $s(n,m)$  is recovered.

[0036] The deconvolution filter in this example is such that:

$$\sum_{i=-N}^N \sum_{j=-M}^M w(i,j) h(n-i, m-j) = \begin{cases} 1 & \text{if } n = m = 0 \\ 0 & \text{otherwise} \end{cases} . \quad \text{Equation (6)}$$

Because of the property that the deconvolution operation forces the output of the convolution to be zero for all but one index, this method is called the “zero-forcing algorithm”. The zero-forcing algorithm itself is but one method that can be used, but there are others possible also, such as the least mean-square algorithm described in more detail below.

[0037] In order to define a deconvolution filter, the transfer function  $h(n,m)$  representing the relative motion between the imager and the subject must be derived from measuring the motion, or alternatively by using blind estimation techniques. The inverse function  $h^{-1}(n,m)$  must then be calculated and incorporated in a filter to recover a corrected image  $s(n,m)$ . It is possible to determine  $h(n,m)$  using sensors that detect motion, and record it at the time the image is captured.

[0038] One embodiment of the present invention includes one or more motion sensors, attached to or included within the imager body, the lens, or otherwise configured to sense any motion of the imager while an image is being captured, and to record this information. Such sensors are currently commercially available which are able to capture movement in a single dimension, and progress is being made to improve their accuracy, cost, and characteristics. To capture motion in two dimensions, two sensors may be used, each capable of detecting motion in a single direction. Alternatively, a sensor able to detect motion in more than one dimension can be used.

[0039] The convolution in Equation (5) can be performed using memory elements, by performing an element-by-element multiplication and summation over the support region of the transfer function. The recorded image is stored, at least temporarily, in memory elements forming a matrix of values such as shown in Figure 1. Similarly, the deconvolution filter  $w(n,m)$  is stored in another memory location as shown in Figure 2. The deconvolution operation is then performed by multiplying the values in the appropriate memory locations on an element-by-element basis, such as multiplying  $r(n,m)$  and  $w(0,0)$ ;  $r(n-1,m)$  and  $w(1,0)$ , and so on, and summing them all up.

[0040] Element-by-element multiplication and summing results in the convolution:

$$y(n,m) = \sum_{i=-N}^N \sum_{j=-M}^M w(i,j)r(n-i,m-j). \quad \text{Equation (7)}$$

To calculate the next element,  $y(n+1,m)$  for example, the deconvolution filter  $w(n,m)$  multiplies the shifted memory locations, such as shown in Figure 3, followed by the summation. Note that the memory locations do not need to be shifted in practice; rather, the pointers indicating the memory locations would move. In Figure 1 and Figure 3 portions of  $r(n,m)$  are shown that would be included in the element-by-element multiplication and summation, and this portion is the same size as  $w(n,m)$ . However, it should be understood that  $r(n,m)$ , that is the whole image, is typically much larger than the support region of  $w(n,m)$ . To determine value of the convolution for different points, an appropriate portion of  $r(n,m)$  would be included in the calculations.

[0041] The filter defined by Equation (5) is ideal in the sense that it reconstructs the corrected image from the blurred image with no data loss. A first embodiment calculates the inverse of  $h(n,m)$  where  $h(n,m)$  is known. As explained above, by making use of motion detecting devices, such as accelerometers, the motion of the imager (such as a camera and/or the associated lens) can be recorded while the picture is being captured, and the motion defines the transfer function describing this motion.

[0042] A functional block diagram of this embodiment in accordance with the present invention is illustrated in Figure 4, wherein a method 40 for correcting image distortion is shown. An image  $r(n,m)$  from camera optics is captured by an imager (step 41) and recorded in memory (step 42). Simultaneously, motion sensors detect and record camera motion (step 43) that occurs while the shutter of the camera is open. The transfer function representing the motion  $h(n,m)$  is derived (step 44), and the inverse transfer function  $h^{-1}(n,m)$  is determined (step 46). The inverse transfer function is applied in a corrective filter (step 48) to the image, which outputs a corrected image  $s(n,m)$  (step 49).

[0043] In this and other embodiments that make use of motion sensors to represent the imager's movement, derivation of the transfer function from motion

information (step 44) takes into account the configuration of the imager and the lens also. For an imager that is a digital camera, for example, the focal length of the lens factors into the way the motion of the imager affects the final image. Therefore the configuration of the imager is part of the derivation of  $h(n,m)$ . This is important especially for imagers with varying configurations, such as digital cameras with interchangeable lenses.

[0044] In this first embodiment of the invention, an iterative procedure is used to compute the inverse transfer function from  $h(n,m)$ . The approximate inverse transfer function at iteration  $k$  is denoted as  $\hat{h}_k^{-1}(n,m)$ . At this iteration, output of the deconvolution filter is:

$$\begin{aligned} y_k(n,m) &= \hat{h}_k^{-1}(n,m) ** r(n,m) \\ &= \sum_i \sum_j \hat{h}_k^{-1}(i,j) r(n-i, m-j). \end{aligned} \quad \text{Equation (8)}$$

[0045] The filter output can be written as the sum of the ideal term and the estimation noise as:

$$\begin{aligned} y_k(n,m) &= h^{-1}(n,m) ** r(n,m) + (\hat{h}_k^{-1}(n,m) - h^{-1}(n,m)) ** r(n,m) \\ &= s(n,m) + v_k(n,m); \end{aligned} \quad \text{Equation (9)}$$

where  $v(n,m)$  is the estimation noise which is desirable to eliminate. An initial estimate of the correct image can be written as:

$$\hat{s}_k(n,m) = \hat{h}_k^{-1}(n,m) ** r(n,m). \quad \text{Equation (10)}$$

[0046] However, this estimate can in general be iteratively improved. There are a number of currently known techniques described in estimation theory to achieve this. A preferable option is the Least Mean-Square (LMS) algorithm. A

block diagram of a calculation unit 60 which implements this method is shown in Figure 6.

[0047] As an initial state,  $\hat{h}^{-1}_0(n, m)$  is set to equal  $\mu r(n, m)$ . Then, the following steps are iteratively repeated:

[0048] Step 1, an estimate of the correct image is calculated in a first 2-dimensional finite impulse response (2D FIR) filter 62:

$$\hat{s}_k(n, m) = \hat{h}_k^{-1}(n, m) ** r(n, m).$$

[0049] Step 2, a received signal based on the estimated correct image is calculated in a second 2D FIR filter 64:

$$\tilde{r}_k(n, m) = \hat{s}_k(n, m) ** h(n, m);$$

and the estimation error is calculated using an adder 66:

$$e_k(n, m) = r_k(n, m) - \tilde{r}_k(n, m).$$

[0050] Step 3, the inverse transfer function coefficients are then updated in the LMS algorithm unit 68:

$$\hat{h}_{k+1}^{-1}(n, m) = \hat{h}_k^{-1}(n, m) + \mu r(n, m) e_k(n, m);$$

where  $\mu$  is the step-size parameter.

[0051] These steps are repeated until the estimation error becomes small enough to be acceptable; which value can be predetermined or may be set by a user. As the iterative algorithm converges, the estimated inverse transfer function approaches the correct inverse transfer function  $h^{-1}(n, m)$ . The inverse transfer function coefficients are the coefficients of the deconvolution filter, and the estimate  $\hat{s}(n, m)$  converges to  $s(n, m)$ , the correct image, at the same time.

[0052] This process can be repeated for the entire image, but it is less complex, and therefore preferable, to find the inverse filter first over a single transfer function support region, then apply it to the entire image  $r(n, m)$ .

[0053] While the above Steps 1-3 are being repeated, a different portion of the recorded image  $r(n, m)$  can be used in each iteration. As in Figure 7, it should be noted that the recorded image  $r(n, m)$  typically has a much larger support region

than the transfer function  $h(n,m)$  that represents the camera motion. Therefore, the above steps are preferably performed over a support region of  $h(n,m)$ , and not over the entire image  $r(n,m)$ , for each iteration.

[0054] Although the present invention has been explained with reference to the LMS algorithm, this is by way of example and not by way of limitation. It should be clear to those skilled in the art that there are other iterative algorithms beside the LMS algorithm that can be used to achieve acceptable results, and also that there are equivalent frequency domain derivations of these algorithms. For example, it is possible to write Equation (1) in frequency domain as:

$$R(\omega_1, \omega_2) = S(\omega_1, \omega_2)H(\omega_1, \omega_2); \quad \text{Equation (11)}$$

where  $R(\omega_1, \omega_2)$ ,  $S(\omega_1, \omega_2)$ , and  $H(\omega_1, \omega_2)$  are the frequency domain representations (Fourier Transforms) of the captured image, the correct image, and the transfer function, respectively, and therefore:

$$S(\omega_1, \omega_2) = \frac{R(\omega_1, \omega_2)}{H(\omega_1, \omega_2)}. \quad \text{Equation (12)}$$

[0055] To obtain  $s(n,m)$  one would calculate  $S(\omega_1, \omega_2)$  as above and take the Inverse Fourier Transform, which should be known to those skilled in the art. However, this method does not always lead to well behaved solutions, especially when numerical precision is limited.

[0056] In a second embodiment of the present invention,  $h(n,m)$  is not known. This second embodiment uses so-called blind deconvolution, whereby the transfer function  $h(n,m)$  is estimated using signal processing techniques. A functional block diagram of this embodiment is illustrated in Figure 5, wherein a method 50 for correcting image distortion according to this embodiment is shown. An image  $r(n,m)$  from the optics from a camera is captured (step 51) and recorded in memory

(step 52). Unlike the first embodiment, there are no motion sensors to detect and record camera motion that occurs while the shutter of the camera is open. Instead, the transfer function representing the motion  $h(n,m)$  is derived using blind estimation techniques (step 54), and the inverse transfer function  $h^{-1}(n,m)$  is determined (step 56). The inverse transfer function is applied in a corrective filter to the image (step 58), which outputs a corrected image  $s(n,m)$  (step 59).

[0057] Blind equalization techniques are used to obtain the deconvolution filter coefficients. This is also an iterative LMS algorithm, similar to that used in the first embodiment. In this second embodiment, an iterative procedure is also used to compute an approximate deconvolution filter, and the approximation is improved at each iteration until it substantially converges to the ideal solution. As aforementioned with respect to the first embodiment, the level of convergence may be predetermined or may be set by a user. The approximate deconvolution filter is denoted at iteration  $k$  as  $\hat{w}_k(n,m)$ . At this iteration, the output of the deconvolution filter is:

$$\begin{aligned} y_k(n,m) &= \hat{w}_k(n,m) ** r(n,m) \\ &= \sum \sum \hat{w}_k(i,j) r(n-i,m-j); \end{aligned} \quad \text{Equation (13)}$$

[0058] The filter output can be written as the sum of the ideal term and the estimation noise as:

$$\begin{aligned} y_k(n,m) &= w(n,m) ** r(n,m) + [\hat{w}_k(n,m) - w(n,m)] ** r(n,m) \\ &= s(n,m) + v_k(n,m); \end{aligned} \quad \text{Equation (14)}$$

where  $v(n,m)$  is the estimation noise, which is desirable to eliminate. An initial estimate of the correct image can be written as:

$$\hat{s}_k(n, m) = \hat{w}_k(n, m) ** r(n, m). \quad \text{Equation (15)}$$

[0059] However, this estimate can be iteratively improved. There are a number of currently known techniques described in estimation theory to achieve this. A preferable option is the LMS algorithm. A block diagram of a calculation unit 80 which implements this method is shown in Figure 8.

[0060] As an initial state,  $\hat{h}^{-1}_0(n, m)$  is set equal to  $\mu r(n, m)$ . Then, the following steps are iteratively repeated:

[0061] Step 1, an estimate of the correct image is calculated in a first 2D FIR filter 82:

$$\hat{s}_k(n, m) = \hat{h}_k^{-1}(n, m) ** r(n, m).$$

[0062] Step 2, a received signal based on the estimated correct image is calculated in a non-linear estimator 84:

$$\tilde{r}_k(n, m) = g(\hat{s}_k(n, m));$$

and the estimation error is calculated using an adder 86:

$$e_k(n, m) = r_k(n, m) - \tilde{r}_k(n, m).$$

[0063] Step 3, the inverse transfer function coefficients are then updated in the LMS algorithm unit 88:

$$\hat{h}_{k+1}^{-1}(n, m) = \hat{h}_k^{-1}(n, m) + \mu r(n, m) e_k(n, m),$$

where  $\mu$  is the step-size parameter.

[0064] The function  $g(\cdot)$  calculated in step 2 is a non-linear function chosen to yield a Bayes estimate of the image data. Since this function is not central to the present invention and is well known to those of skill in the art, it will not be described in detail hereinafter.

[0065] There are known blind detection algorithms for calculating  $s(n, m)$  by looking at higher order statistics of the image data  $r(n, m)$ . A group of algorithms under this category are called Bussgang algorithms. There are also variations called Sato algorithms, and Godard algorithms. Another class of blind estimation

algorithms use spectral properties (polyspectra) of the image data to deduce information about  $h(n,m)$ . Any appropriate blind estimation algorithm can be used to determine  $h(n,m)$ , and to construct a correcting filter.

[0066] The first two embodiments of the present invention described hereinbefore correct blur in an image based on determining a transfer function that represents the motion of an imager while an image is being captured, and then correcting for the blur by making use of the “inverse” transfer function. One method determines the transfer function at the time the photograph is being captured by using devices that can detect camera motion directly. The other method generates a transfer function after the image is captured by using blind estimation techniques. Both methods then post-process the digital image to correct for blur. In both cases, the captured image is originally blurred by motion, and the blur is then removed.

[0067] In accordance with a third embodiment of the present invention the blurring of an image is prevented as it's being captured, as described below. When an imager is moved while an image is being captured, multiple copies of the same image are, in effect, recorded over each other. For example, when an image is captured digitally it is represented as pixel values in the sensor points of the image sensor. This is pictorially represented in Figure 9, in which the imager (for example, a camera and its associated lens) are not shown in order to simplify the depiction.

[0068] If the imager is shaken or moved while the image is being captured, the situation is equivalent to copies of the same image being captured multiple times in an overlapping fashion with an offset. The result is a blurred image. This is particularly true if the shutter speed is relatively slow compared to the motion of the camera. This is graphically illustrated in Figure 10.

[0069] When the shutter speed is sufficiently fast compared to the motion of the imager, blur does not occur or is very limited because the displacement of the imager is not large enough to cause the light reflected from a point on the image to fall onto more than one point on the image sensor. This third embodiment of the invention takes advantage of the ability of an imager to record multiple images

using fast shutter speeds. When an image is being captured using a setting of a relatively slow shutter speed, the imager actually operates at a higher shutter speed (for instance at the fastest shutter speed at which the imager is designed to operate), and captures multiple images “back to back.” For example, if the photograph is being taken with a shutter speed setting of 1/125 sec and the fastest shutter speed of the camera is 1/1000 sec, the camera actually captures 8 consecutive images, each taken with a shutter speed setting of 1/1000 sec. Then, the camera combines the images into a single image by aligning them such that each pixel corresponding to the same image point in each image is combined pixel-by-pixel into one pixel value by adding pixel values, averaging them, or using any other appropriate operation to combine them. The multiple images can all be stored and aligned once all of them are captured, or alternatively, each image can be aligned and combined with the first image in “real time” without the need to store all images individually. The blur of the resulting image is substantially reduced, as depicted in Figure 11.

[0070] The quality of an image can be measured in terms of signal-to-noise power ratio (SNR). When a fast shutter speed is used, the SNR of the image is degraded because the image sensor operates less effectively when the amount of light falling on it is reduced. However, since multiple images are being added, this degradation is overcome. Indeed, an SNR improvement can be expected using this embodiment, because the image data is being added coherently while the noise is being added non-coherently. This phenomenon is the basis for such concepts as maximal ratio combining (MRC).

[0071] To determine how to align the pixel values, a device that can detect motion, such as an accelerometer or other motion sensor, is attached to or incorporated within the imager, and it records the motion of the imager while the photograph is being taken. The detected motion indicates how much the imager moved while each of the series of images was captured, each image having been captured back-to-back with a high shutter speed as explained in the example above.

The imager moves each of the images in the series by an amount which is preferably measured in pixels, in the direction opposite the motion of the imager that occurred during the interval between the capture of the first image and each respective image in the series. Thus, the shift of each image is compensated for, and the correct pixels are aligned in each of the images. This is illustrated in Figure 11. The combined image will not be blurred since there is no spilling of image points into more than one pixel in the combined final image.

[0072] As an alternative to the third embodiment, the reference point for aligning the higher speed images is not the imager location, but the subject itself. In other words, higher shutter speed images can be aligned and combined such that a designated subject in a field of view is clear and sharp whereas other parts of the image may be blurred. For example, a moving subject such as a car in motion can be the designated subject. If high shutter speed images are combined such that the points of the image of the moving car are aligned, the image of the car will be clear and sharp, while the background is blurred. As a way to align a designated subject, such as the car in this example, pattern recognition and segmentation algorithms may be used that are well known to those skilled in the art, and defined in current literature. Alternatively, a tracking signal that is transmitted from the subject can be used to convey its position. Alternatively, the user can indicate, such as by an indicator in a viewfinder, which object in the field of view is the designated subject to be kept blur-free.

[0073] A fourth embodiment of the invention compensates for movement of the imager or the subject by adjusting the position of the image sensor during image capture, according to the inverse of the transfer function describing the imager or subject motion, or both. This embodiment is illustrated in Figure 12. This embodiment is preferably used in digital cameras wherein the image sensor 108 is a relatively small component and can be moved independently of the camera, but can also be used with film. Accordingly, this embodiment makes use of motion sensors, and detects the movement of the camera and/or the subject while the image is being

captured. The signals from the motion sensors are used to control devices that adjust the position of the image sensor. In Figure 12, horizontal motion sensor 102 and vertical motion sensor 104 measure movement of the camera while its shutter (not shown) is open and an image is being captured. The motion information is conveyed to a controller 106, which determines and sends signals to devices 110a, 110b, 110c, and 110d, which adjust the position of the image sensor 108. The control mechanism is such that the devices 110a-d, for example electromagnets or servos, move the image sensor 108 in the opposite direction of the camera motion to prevent motion blur. Additional sensors (not shown) can be used to detect motion of the subject, and the control mechanism configured to correct for that motion as well.

[0074] Figure 13 shows an example of a photographic image that is blurred due to user movement of the imager while taking the picture. Figure 14 shows the same image, corrected according to the present invention. The invention substantially recovers the correct image from the blurred image.

[0075] Those skilled in the art will recognize that all embodiments of the invention are applicable to digitized images which are blurred by uniform motion, regardless of the source of the image or the source of the motion blur. It is applicable to digital images blurred due to motion of the imager, of the subject, or both. In some cases, it is also applicable to images captured on film and then scanned into digital files. In the latter case, however, motion sensor information typically may not be available, and therefore only the blind estimation embodiment can be used. Also, where appropriate, the different embodiments of the invention can be combined. For example, the superposition embodiment can be used to avoid most blur, and the correcting filter using blind estimation embodiment can then be applied to correct the combined image for any remaining blur.

[0076] In describing the invention, no distinction has been made between an imager that captures images one at a time, such as a digital camera, and one that captures sequence of images, such as digital or analog video recorders. A digital video recorder or similar device operates substantially the same way as a digital

camera, with the addition of video compression techniques to reduce the amount of image data being stored, and various filtering operations used to improve image quality. The invention is also applicable to digital and analog video capture and processing, being applied to each image in the sequence of images, and can be used in conjunction with compression and other filtering.

[0077] The implementation of the apparatus that performs the restoration of the images to their correct form can be done as part of the imager capturing the image, or it can be done as a post-process. When done as part of the imager, the image correcting apparatus can be implemented in an integrated circuit, or in software to run on a processor, or a combination of the two. When done as a post process, a preferred embodiment is that the image data is input into a post processing device such as a computer, and the blind estimation algorithm is performed by a computer program. In this embodiment, the implementation could be a dedicated computer program, or an add-on function to an existing computer program.

[0078] Where a computer program performs the image restoration, a blind estimation algorithm can be executed by the program to calculate the estimated transfer function  $h(n,m)$ . Alternatively, motion information can be recorded by the camera at the time the image is captured, and can be downloaded into the program to be used as an input to calculate  $h(n,m)$ . In either case, the program then derives the correcting filter and applies the filter to correct the image.

[0079] It should also be noted that if there are multiple blurred objects in an image, and the blur is caused by the objects moving in different directions, the image of each object will be blurred differently, each blurred object having a different transfer function describing its motion. The present invention can allow the user to individually select independently blurred parts of the image and individually correct only the selected parts, or alternatively, to correct a selected part of the image at the expense of the rest of the image, resulting in a blur-corrected subject and a blurred background.

[0080] When increased accuracy is needed in obtaining  $h(n,m)$ , those skilled in the art will recognize that, in some cases, the motion information from sensors can be used to calculate  $h(n,m)$ , and an estimate of  $h(n,m)$  can also be calculated by blind estimation and the two transfer functions can be advantageously combined for more accurate results.

[0081] There are other signal processing algorithms and digital filters which can be applied to digital images in order to improve their color saturation, reduce noise, adjust contrast and sharpness, etc. These can be incorporated as part of an imager, such as a digital camera, or as part of a post-processing application, such as a photo editing software running on a computer. It should be clear to those skilled in the art that those techniques can be applied in addition to the distortion correction of this invention.

\* \* \*



$r(n+N, m+M)$	...		$r(n, m+M)$		...	$r(n-N, m+M)$
			...			
			$r(n, m+1)$			
$r(n+N, m)$	...	$r(n+1, m)$	<b><math>r(n, m)</math></b>	$r(n-1, m)$	...	$r(n-N, m)$
			$r(n, m-1)$			
			...			
$r(n+N, m)$	...		$r(n, m-M)$		...	$r(n-N, m-M)$

**Figure 1**

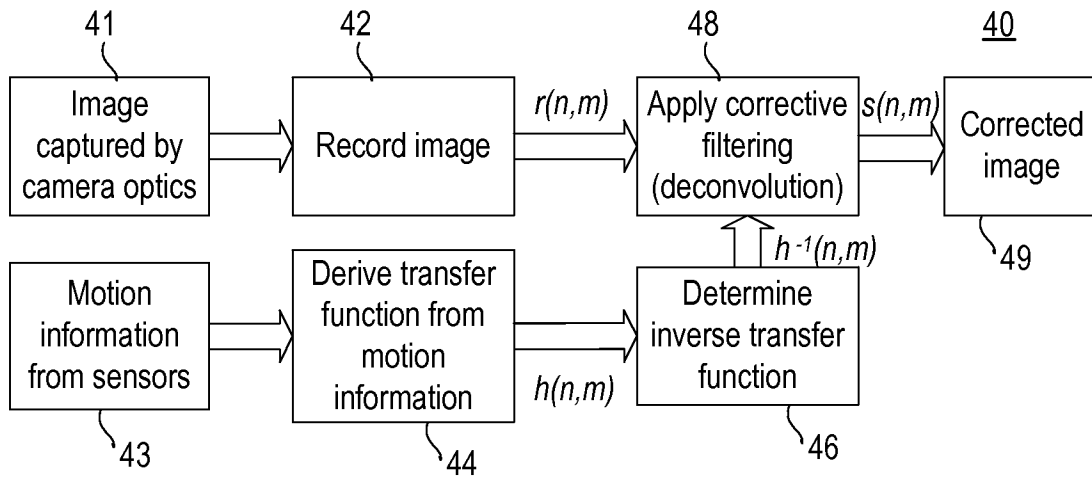
$w(N, M)$	...		$w(0, M)$		...	$w(-N, M)$
			...			
			$w(0, 1)$			
$w(N, 0)$	...	$w(1, 0)$	<b><math>w(0, 0)</math></b>	$w(-1, 0)$	...	$w(-N, 0)$
			$w(0, -1)$			
			...			
$w(N, 0)$	...		$w(0, -M)$		...	$w(-N, -M)$

**Figure 2**

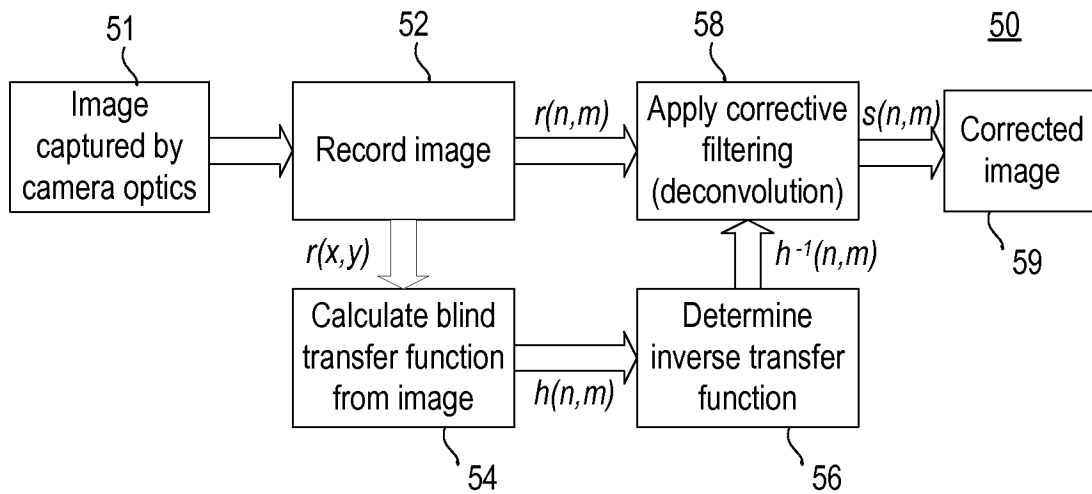
$r(n+N+1, m+M)$	...		$r(n+1, m+M)$		...	$r(n-N+1, m+M)$
			...			
			$r(n+1, m+1)$			
$r(n+N+1, m)$	...	$r(n+2, m)$	<b><math>r(n+1, m)</math></b>	$r(n, m)$	...	$r(n-N+1, m)$
			$r(n+1, m-1)$			
			...			
$r(n+N+1, m)$	...		$r(n+1, m-M)$		...	$r(n-N+1, m-M)$

**Figure 3**

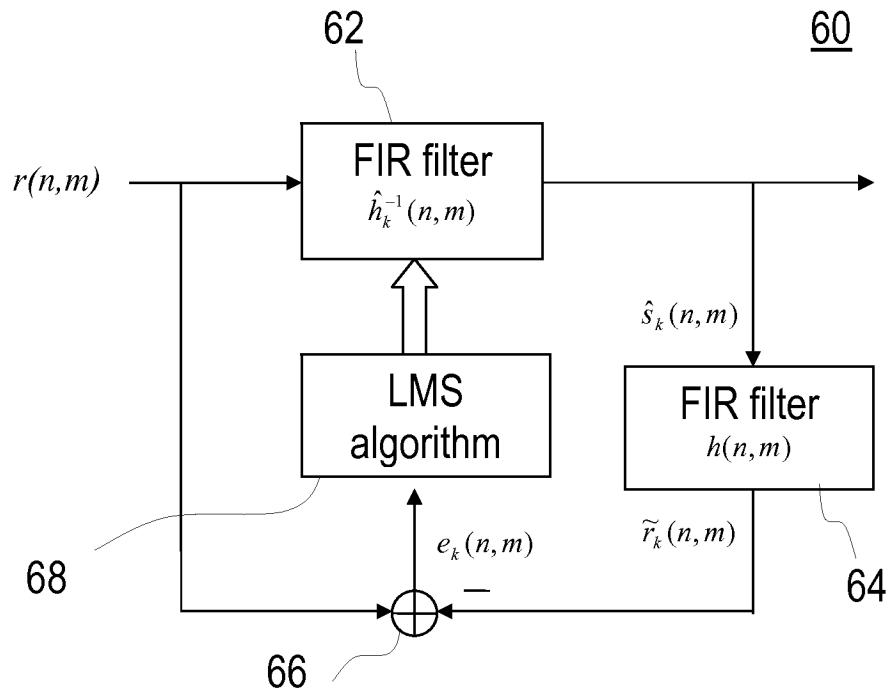




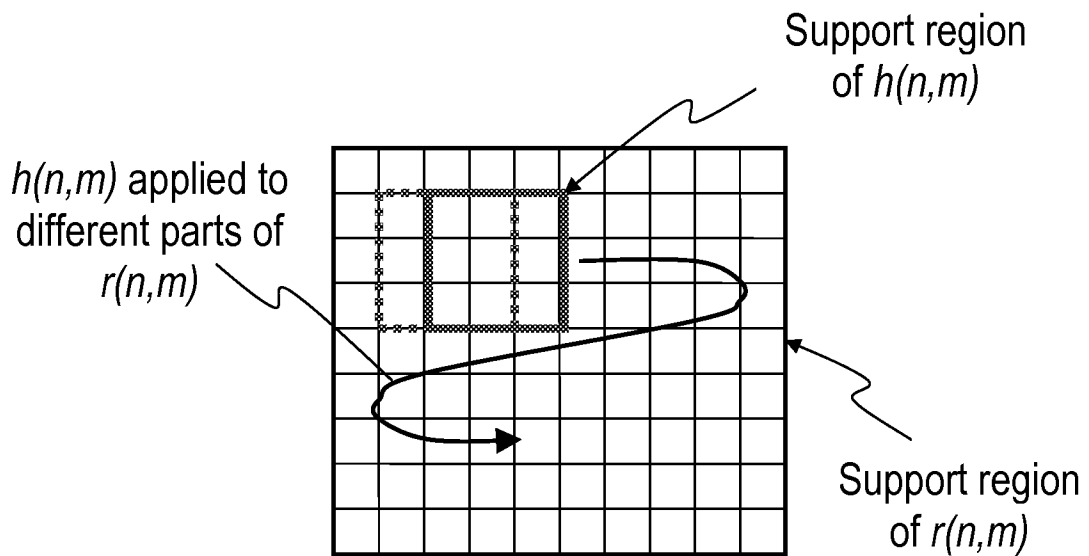
**Figure 4**



**Figure 5**

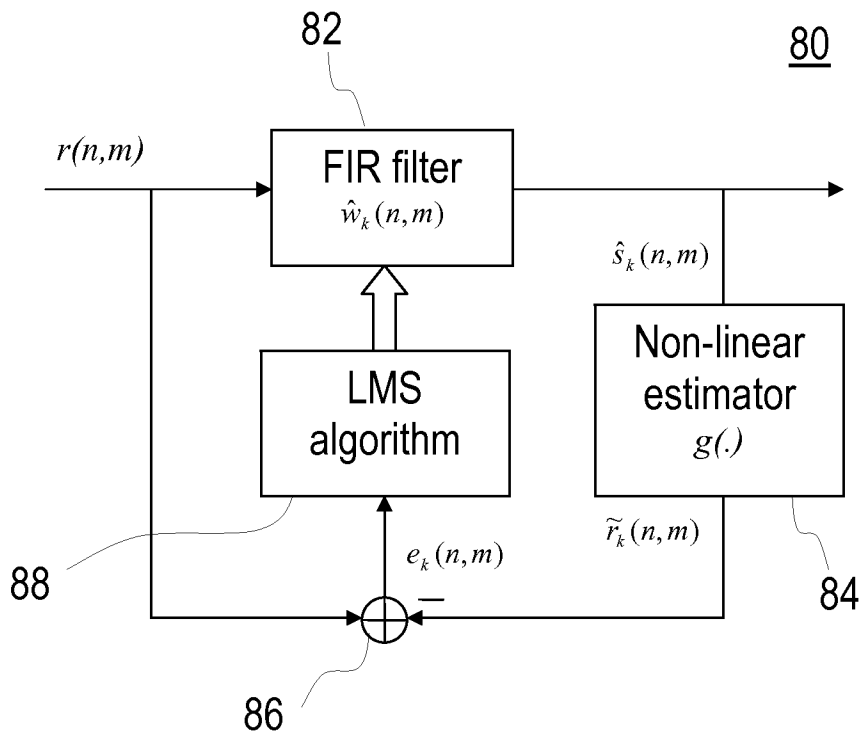


**Figure 6**

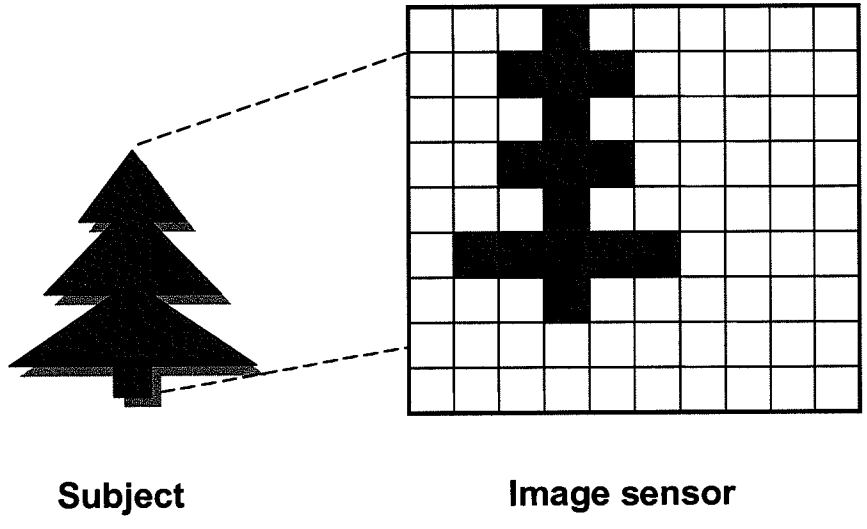


**Figure 7**



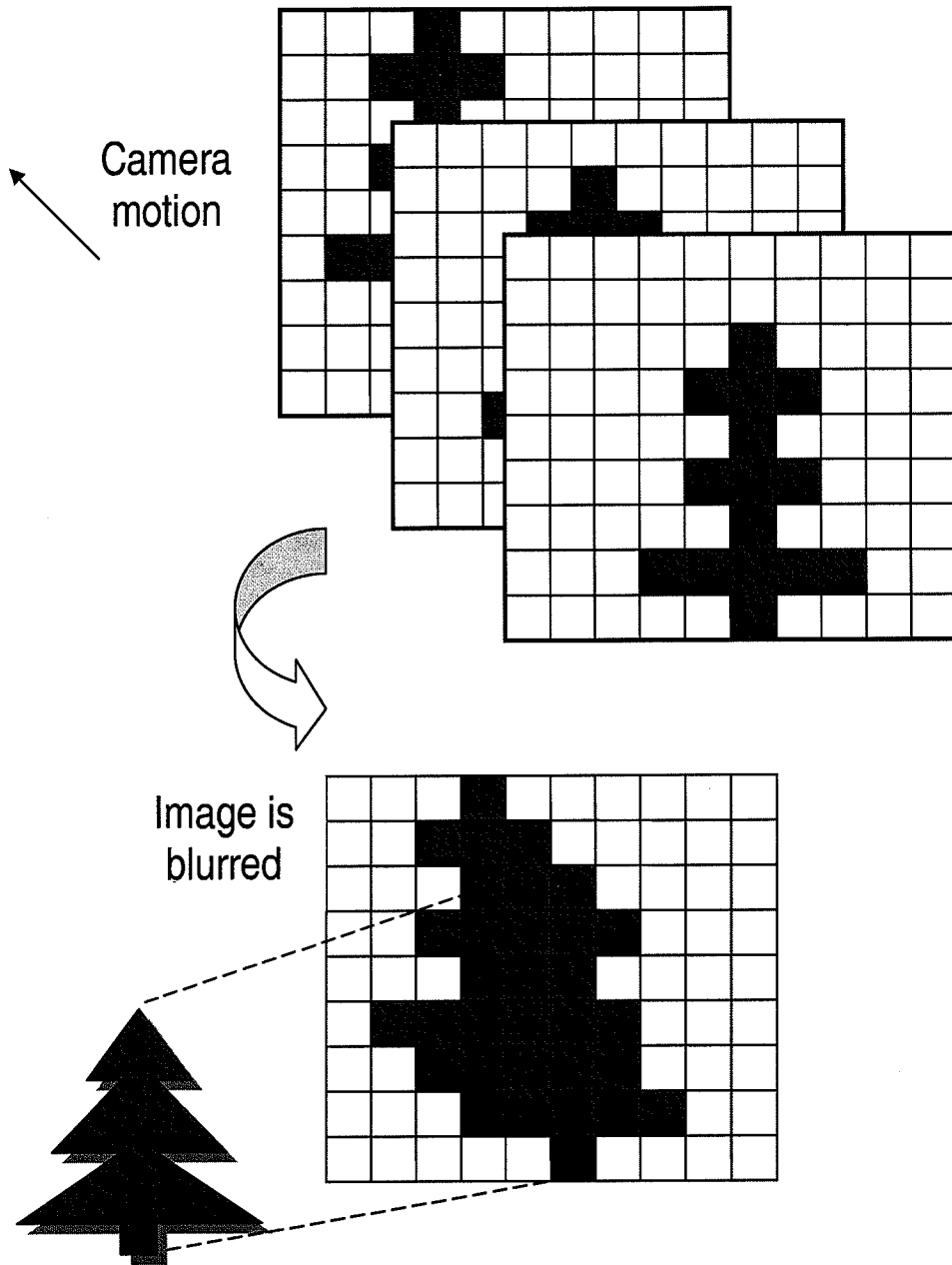


**Figure 8**



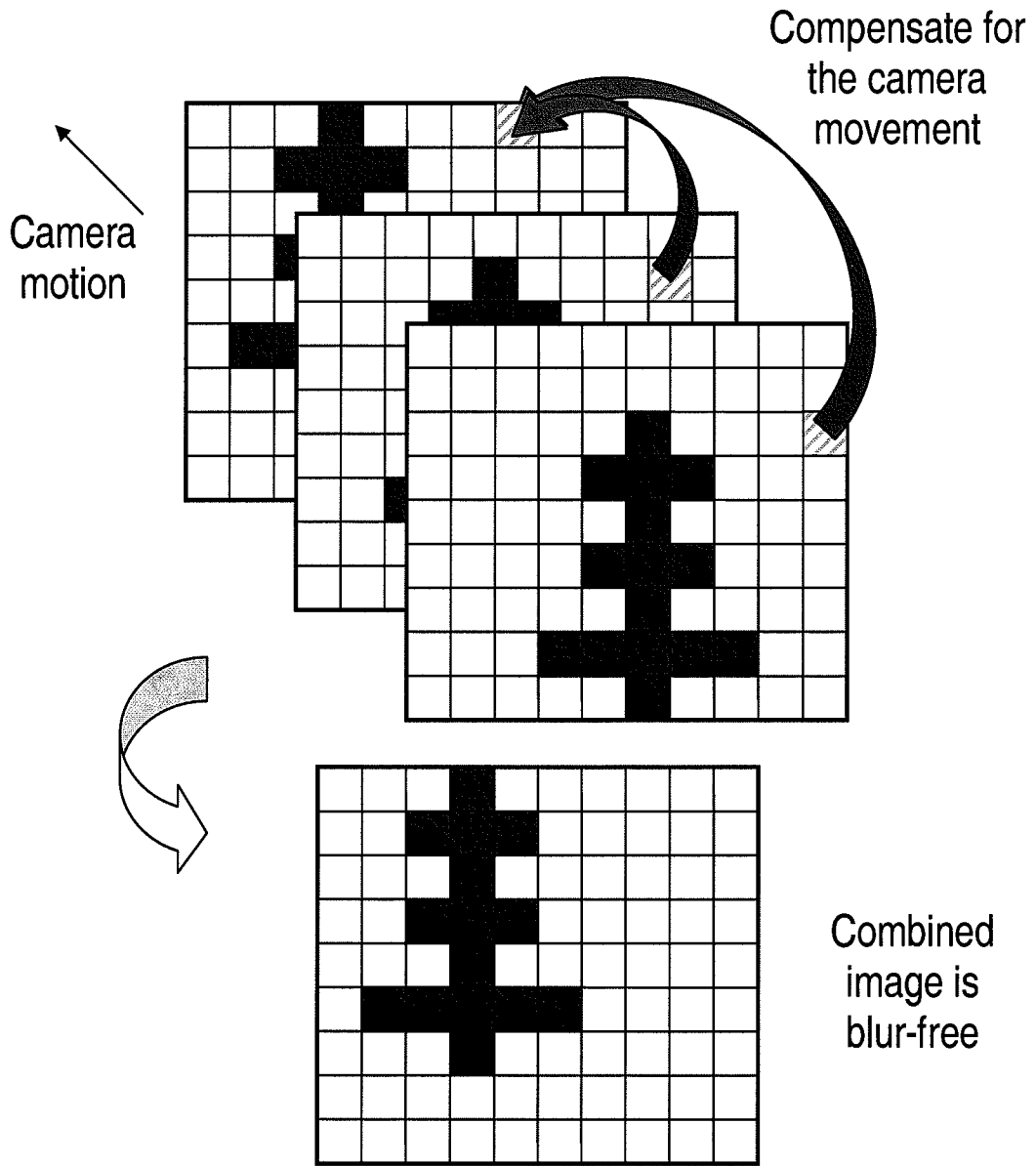
**Figure 9**





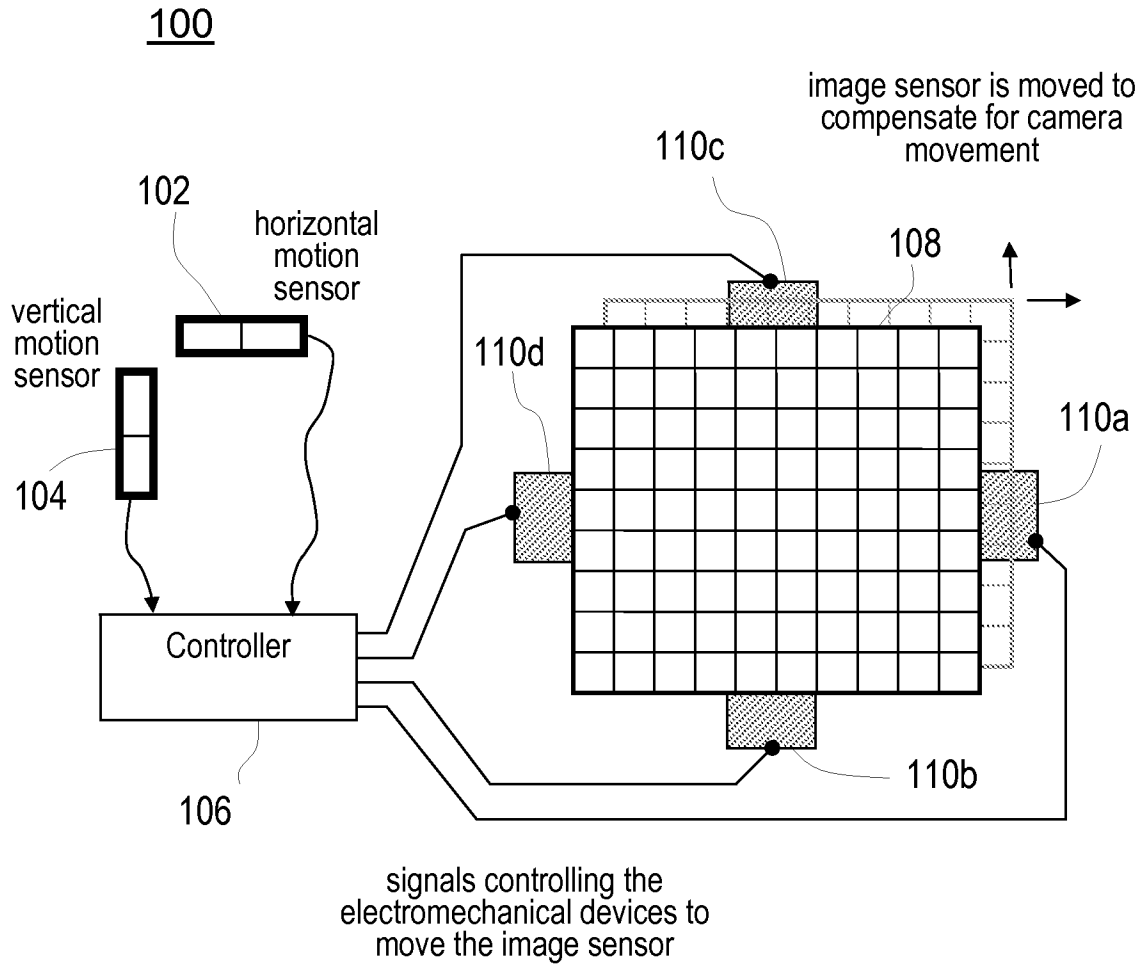
**Figure 10**





**Figure 11**





**Figure 12**





**Figure 13**

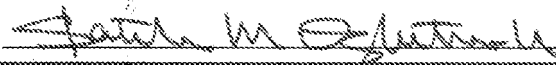


**Figure 14**



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**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)**

<b>Title of Invention</b>	<b>METHOD AND APPARATUS TO CORRECT DIGITAL IMAGE BLUR DUE TO MOTION OF SUBJECT OR IMAGING DEVICE</b>
As the below named inventor, I hereby declare that:	
This declaration is directed to:	<input type="checkbox"/> The attached application, or <input checked="" type="checkbox"/> United States application or PCT international application number <u>14/532,654</u> filed on <u>November 5, 2014</u>
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
<b>WARNING:</b>	
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.	
<b>LEGAL NAME OF INVENTOR</b>	
Inventor: <u>Fatih M. Ozluturk</u>	Date (Optional): _____
Signature: <u></u>	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	28340733
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	13-FEB-2017
<b>Filing Date:</b>	
<b>Time Stamp:</b>	17:05:14
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$3160
RAM confirmation Number	021417INTEFSW17062700
Deposit Account	220493
Authorized User	Angel Wolf

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	WebADS.pdf	138750 7a934f60bfb3be433799322d0bd9193543e45a6b	no	8
<b>Warnings:</b>					
<b>Information:</b>					
2		OZL-PT001_17_Application_EFS.PDF	175462 271f8a3b5d7acc1d5b194fed1ca3858700837fa	yes	28
	<b>Multipart Description/PDF files in .zip description</b>				
	<b>Document Description</b>		<b>Start</b>	<b>End</b>	
	Abstract		28	28	
	Claims		22	27	
	Specification		1	21	
<b>Warnings:</b>					
<b>Information:</b>					
3	Drawings-only black and white line drawings	OZL-PT001_17_Drawings_EFS.PDF	225563 55b43ccb8e3a651b93b7237c10fca010cfa1ee1	no	9
<b>Warnings:</b>					
<b>Information:</b>					
4	Oath or Declaration filed	OZL-PT001_17_Declaration_EFS.PDF	1259548 2eea273442b79cdeb4a8f4304f42f02648e75e1f1	no	1
<b>Warnings:</b>					
<b>Information:</b>					
5	Power of Attorney	OZL-PT001_17_POA_Transmittal_EFS.PDF	225452 823f5c41596dea7bb29fc467eeb1160c8be64434	no	1

<b>Warnings:</b>					
<b>Information:</b>					
6	Power of Attorney	OZL-PT001_17_POA_EFS.PDF	187133 f9ea9f505bbc28aa2fa11dd8d2b200993491514e	no	2
<b>Warnings:</b>					
<b>Information:</b>					
7	TrackOne Request	OZL-PT001_17_Track_One_Request_EFS.PDF	125001 944a8d5e78ca996416f58be5d8ee1832a3573354	no	2
<b>Warnings:</b>					
<b>Information:</b>					
8	Fee Worksheet (SB06)	fee-info.pdf	42064 7fbba489dbd70309d5208e33b374cc3aa060547a	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>				2378973	
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p>					

# POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

03624

OR

I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

Name	Registration Number	Name	Registration Number

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

The address associated with the above-mentioned Customer Number.

OR

The address associated with Customer Number:

OR

Firm or Individual Name

Volpe and Koenig, P.C.

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant:

Inventor or Joint Inventor

Legal Representative of a Deceased or Legally Incapacitated Inventor

Assignee or Person to Whom the Inventor is Under an Obligation to Assign

Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

### SIGNATURE of Applicant for Patent

Signature

*Fatih M. Ozluturk*

Date

10/18/12

Name

Fatih M. Ozluturk

Telephone

516 603 8383

Title and Company

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below \*.

\*Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION  
 UNDER 37 CFR 1.102(e)** (Page 1 of 1)

First Named Inventor:	Fatih M. Ozluturk	Nonprovisional Application Number (if known):	
Title of Invention:	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		

**APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.**

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:
  - I.  **Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**
    - i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.  
 ---OR---
    - (b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
    - ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.
  - II.  **Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**
    - i. A request for continued examination has been filed with, or prior to, this form.
    - ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
    - iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
    - iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
    - v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Thomas A. Mattioli/	Date February 13, 2017
Name (Print/Typed) Thomas A. Mattioli	Practitioner Registration Number 56773

**Note:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.\*

\*Total of 1 forms are submitted.

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	
<b>Filing Date:</b>	
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Attorney Docket Number:</b>	OZL-PT001.17

Filed as Small Entity

### Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Basic Filing:</b>				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	70	70
UTILITY SEARCH FEE	2111	1	300	300
UTILITY EXAMINATION FEE	2311	1	360	360
REQUEST FOR PRIORITIZED EXAMINATION	2817	1	2000	2000

**Pages:**

**Claims:**

CLAIMS IN EXCESS OF 20	2202	9	40	360
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**Miscellaneous-Filing:**

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	2830	1	70	70
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				
<b>Miscellaneous:</b>				
<b>Total in USD (\$)</b>				<b>3160</b>

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	28340733
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	13-FEB-2017
<b>Filing Date:</b>	
<b>Time Stamp:</b>	17:05:14
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$3160
RAM confirmation Number	021417INTEFSW17062700
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Authorized User	Angel Wolf

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	WebADS.pdf	138750 7a934f60bfb3be433799322d0bd9193543e45a6b	no	8
<b>Warnings:</b>					
<b>Information:</b>					
2		OZL-PT001_17_Application_EFS.PDF	175462 271f8a3b5d7acc1d5b194fed1ca3858700837fa	yes	28
	<b>Multipart Description/PDF files in .zip description</b>				
	<b>Document Description</b>		<b>Start</b>	<b>End</b>	
	Abstract		28	28	
	Claims		22	27	
	Specification		1	21	
<b>Warnings:</b>					
<b>Information:</b>					
3	Drawings-only black and white line drawings	OZL-PT001_17_Drawings_EFS.PDF	225563 55b43ccb8e3a651b93b7237c10fca010cfa1ee1	no	9
<b>Warnings:</b>					
<b>Information:</b>					
4	Oath or Declaration filed	OZL-PT001_17_Declaration_EFS.PDF	1259548 2eea273442b79c4a8f4304f42f02648e75e1f1	no	1
<b>Warnings:</b>					
<b>Information:</b>					
5	Power of Attorney	OZL-PT001_17_POA_Transmittal_EFS.PDF	225452 823f5c41596dea7bb29fc467eeb1160c8be64434	no	1

<b>Warnings:</b>					
<b>Information:</b>					
6	Power of Attorney	OZL-PT001_17_POA_EFS.PDF	187133 f9ea9f505bbc28aa2fa11dd8d2b200993491514e	no	2
<b>Warnings:</b>					
<b>Information:</b>					
7	TrackOne Request	OZL-PT001_17_Track_One_Request_EFS.PDF	125001 944a8d5e78ca996416f58be5d8ee1832a3573354	no	2
<b>Warnings:</b>					
<b>Information:</b>					
8	Fee Worksheet (SB06)	fee-info.pdf	42064 7fbba489dbd70309d5208e33b374cc3aa060547a	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>				2378973	
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p>					

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	OZL-PT001.17
		Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

**Secrecy Order 37 CFR 5.2:**

<input type="checkbox"/>	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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**Inventor Information:**

<b>Inventor 1</b>					
<b>Legal Name</b>					
<b>Prefix</b>	<b>Given Name</b>	<b>Middle Name</b>	<b>Family Name</b>	<b>Suffix</b>	
	Fatih	M.	Ozluturk		
<b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service					
<b>City</b>	Port Washington	<b>State/Province</b>	NY	<b>Country of Residence <sup>i</sup></b>	US
<b>Mailing Address of Inventor:</b>					
<b>Address 1</b>	5 Hilldale Lane				
<b>Address 2</b>					
<b>City</b>	Sands Point	<b>State/Province</b>	NY		
<b>Postal Code</b>	11050	<b>Country <sup>i</sup></b>	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button. <span style="float: right;"><input type="button" value="Add"/></span>					

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<b>Customer Number</b>	3624		
<b>Email Address</b>	eoffice@vklaw.com	<input type="button" value="Add Email"/>	<input type="button" value="Remove Email"/>

**Application Information:**

<b>Title of the Invention</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		
<b>Attorney Docket Number</b>	OZL-PT001.17	<b>Small Entity Status Claimed</b>	<input type="checkbox"/>
<b>Application Type</b>	Nonprovisional		
<b>Subject Matter</b>	Utility		
<b>Total Number of Drawing Sheets (if any)</b>	9	<b>Suggested Figure for Publication (if any)</b>	4

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

### Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

### Publication Information:

Request Early Publication (Fee required at time of Request 37 CFR 1.219)

**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

### Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

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<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	OZL-PT001.17
		Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE		

### Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

Prior Application Status		Pending		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
	Continuation of	15149481	2016-05-09		
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15149481	Continuation of	14690818	2015-04-20	9338356	2016-05-10
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14690818	Continuation of	14532654	2014-11-04	9013587	2015-04-21
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14532654	Continuation of	13442370	2012-04-09	8922663	2014-12-30
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13442370	Continuation of	12274032	2008-11-19	8154607	2012-04-10
Prior Application Status		Patented		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12274032	Continuation of	11089081	2005-03-24	8331723	2012-12-11
Prior Application Status		Expired		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11089081	Claims benefit of provisional	60556230	2004-03-25		

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

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### Foreign Priority Information:

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Application Number	Country <sup>i</sup>	Filing Date (YYYY-MM-DD)	Access Code <sup>i</sup> (if applicable)

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### Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE:** This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

### 1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

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**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

### 2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

### Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

- |   |  |                                      |
|---|--|--------------------------------------|
| <input type="radio"/> Assignee  | <input type="radio"/> Legal Representative under 35 U.S.C. 117         | <input type="radio"/> Joint Inventor |
| <input type="radio"/> Person to whom the inventor is obligated to assign. | <input type="radio"/> Person who shows sufficient proprietary interest |                                      |

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

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### Mailing Address Information For Applicant:

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Address 2			
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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

### Assignee Information including Non-Applicant Assignee Information:

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<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	OZL-PT001.17
	Application Number	
Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE	

**Signature:**

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

<b>Signature</b>	/Thomas A. Mattioli/			Date (YYYY-MM-DD)	
First Name	Thomas A.	Last Name	Mattioli	Registration Number	56773
Additional Signature may be generated within this form by selecting the Add button.					

### ABSTRACT

The effect of camera shake in digital video is corrected using signal processing techniques. The digital video is a sequence of digital images. When the sequence of digital images are being captured, movement of the imaging device causes the images to shift on the image sensor of the imaging device and affects the quality of the eventual video. Movement of the imaging device is detected while the video is being captured, and a motion information representing the motion is recorded. A processor determines a correcting filter based on the motion information and user input. The processor modifies the sequence of images captured according to the correcting filter and obtains a final corrected video. Corrected video is displayed in a viewfinder.

## CLAIMS

What is claimed is:

1. A method for use in an imaging device comprising an image sensor, a processor, a memory, and one or more motion sensors, the method comprising:

capturing a sequence of images with the image sensor, wherein the sequence of images comprise a video;

detecting, by the one or more motion sensors, motion information for one or more images of the sequence of images, wherein the motion information represents motion of the device during capturing of the one or more images of the sequence of images;

determining, by the processor, a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modifying, by the processor, one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values;

combining, by the processor, the modified images to obtain a final video; and  
storing the final video in the memory.

2. The method of claim 1, wherein the processor determines the vertical and horizontal shift values for one or more images for which the motion information is detected.

3. The method of claim 1, wherein the processor modifies one or more images for which the vertical and horizontal shift values are determined.

4. The method of claim 1, wherein the processor modifies one or more images of the sequence of images such that effect of motion of the device during capturing of the one or more images of the sequence of images is reduced in the final

video.

5. The method of claim 1, wherein the processor determines a vertical shift value and a horizontal shift value for each image of the sequence of images.

6. The method of claim 1, wherein the motion information represents motion of the device at time of capturing of one or more images of the sequence of images.

7. The method of claim 1, wherein the one or more images of the sequence of images is at least two images, and wherein the motion information represents motion of the device between capturing of consecutive images.

8. The method of claim 1, wherein the vertical and horizontal shift values for an image indicate how much the image is displaced due to motion of the device during capturing of the image.

9. The method of claim 1, wherein the modifying by the processor of the one or more images of the sequence of images comprises shifting a reference point in each image according to the vertical shift value and the horizontal shift value for the image in a direction that reduces the effect of motion of the device in the final video.

10. The method of claim 1, wherein the method further comprises displaying the final video in a user interface.

11. The method of claim 1, wherein the method further comprises modifying the sequence of images using a video compression technique.

12. The method of claim 1, wherein the one or more images of the sequence of images for which the motion information is detected are stored in the memory, and wherein the motion information is stored in the memory synchronously with the storing of the images.

13. The method of claim 1, wherein determining a vertical shift value and a horizontal shift value for one or more images of the sequence of images is based at least in part on the focal distance of a lens of the imaging device.

14. The method of claim 1, wherein the method further comprises receiving user input in a user interface, and at least one of modifying one or more images of the sequential images or combining the modified images to obtain a final video is based at least in part on the user input.

15. An imaging device, comprising:

an image sensor configured to capture a sequence of images, wherein the sequence of images comprise a video;

one or more motion sensors configured to detect motion information for one or more images of the sequence of images, wherein the motion information represents motion of the imaging device during capturing of the one or more images of the sequence of images;

a processor configured to:

determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modify one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values; and

combine the modified images to obtain a final video; and

a memory configured to store the final video.

16. The imaging device of claim 15, wherein the processor is configured to determine the vertical and horizontal shift values for one or more images of the sequence of images for which the motion information is detected.

17. The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images for which the vertical and horizontal shift values are determined.

18. The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images such that effect of motion of the device during capturing of the one or more images of the sequence of images is reduced in the final video.

19. The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for each of the images of the sequence of images.

20. The imaging device of claim 15, wherein the motion information detected by the one or more motion sensors represents motion of the device at time of capturing of one or more images of the sequence of images.

21. The imaging device of claim 15, wherein the one or more images of the sequence of images is at least two images, and wherein the motion information detected by the one or more motion sensors represents motion of the device between capturing of consecutive images.

22. The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for an image such that

the vertical shift value and the horizontal shift value indicate how much the image is displaced due to motion of the device during capturing of the image.

23. The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images by shifting a reference point in each image according to the vertical shift value and the horizontal shift value for the image in a direction that reduces the effect of motion of the device in the final video.

24. The imaging device of claim 15, wherein the device further comprises a display configured to display the final video.

25. The imaging device of claim 15, wherein the processor is further configured to modify the sequence of images using a video compression technique.

26. The imaging device of claim 15, wherein the device is configured to store the one or more images of the sequence of images for which the motion information is detected in the memory, and wherein the device is configured to store the motion information in the memory synchronously with the storing of the images.

27. The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the focal distance of a lens of the imaging device.

28. The imaging device of claim 15, wherein the device further comprises a display configured to receive user input, and the device is configured to modify one or more images of the sequential images and to obtain a final video based at least in

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part on the user input.

29. The imaging device of claim 15, wherein the processor is two or more processors.

**METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO  
COUNTERACT EFFECT OF CAMERA SHAKE**

**CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] This application is a continuation of 15/149,481, filed May 9, 2016, which is a continuation of U.S. Patent Application No. 14/690,818, filed on April 20, 2015, which issued as U.S. Patent No. 9,338,356 on May 10, 2016, which is a continuation of U.S. Patent Application No. 14/532,654, filed on November 4, 2014, which issued as U.S. Patent No. 9,013,587 on April 21, 2015, which is a continuation of U.S. Patent Application No. 13/442,370, filed on April 9, 2012, which issued as U.S. Patent No. 8,922,663 on December 30, 2014, which is a continuation of U.S. Patent Application Serial No. 12/274,032, filed on November 19, 2008, which issued as U.S. Patent No. 8,154,607 on April 10, 2012, which is a continuation of U.S. Patent Application Serial No. 11/089,081, filed on March 24, 2005, which issued as U.S. Patent No. 8,331,723 on December 11, 2012, which claims the benefit of U.S. Provisional Application Serial No. 60/556,230, filed on March 25, 2004, the contents of each of which are incorporated by reference herein.

**FIELD OF INVENTION**

[0002] The present invention generally relates to digital image processing. More specifically, this invention relates to processing of digitized image data in order to correct for image distortion caused by relative motion between the imaging device and the subject at the time of image capture, or by optical distortion from other sources.

**BACKGROUND**

[0003] When capturing images, as with a camera, it is desirable to capture images without unwanted distortion. In general, sources of unwanted distortion can be characterized as equipment errors and user errors. Examples of common equipment errors include inadequate or flawed optical equipment, and undesirable

characteristics of the film or other recording media. Using equipment and media of a quality that is suitable for a particular photograph can help mitigate the problems associated with the equipment and the recording medium, but in spite of this, image distortion due to equipment errors can still appear.

[0004] Another source of image distortion is user error. Examples of common user errors include poor image processing, and relative motion between the imaging device and the subject of the image. For example, one common problem that significantly degrades the quality of a photograph is the blur that results from camera movement (i.e. shaking) at the time the photograph is taken. This can be difficult to avoid, especially when a slow shutter speed is used, such as in low light conditions, or when a large depth of field is needed and the lens aperture is small. Similarly, if the subject being photographed is moving, use of a slow shutter speed can also result in image blur.

[0005] There are currently many image processing techniques that are used to improve the quality, or “correctness,” of a photograph. These techniques are applied to the image either at the time it is captured by a camera, or later when it is post-processed. This is true for both traditional “hardcopy” photographs that are chemically recorded on film, and for digital photographs that are captured as digital data, for example using a charged couple device (CCD) or a CMOS sensor. Also, hardcopy photographs can be scanned and converted into digital data, and are thereby able to benefit from the same digital signal processing techniques as digital photographs.

[0006] Commonly used post-processing techniques for digitally correcting blurred images typically involve techniques that seek to increase the sharpness or contrast of the image. This can give the mistaken impression that the blur is remedied. However, in reality, this process causes loss of data from the original image, and also alters the nature of the photograph. Thus, current techniques for increasing the sharpness of an image do not really “correct” the blur that results from relative motion between a camera and a subject being photographed. In fact,

the data loss from increasing the sharpness can result in a less accurate image than the original. Therefore, a different method that actually corrects the blur is desirable.

[0007] In the prior art, electro-mechanical devices for correcting image blur due to camera motion are built into some high quality lenses, variously called “image stabilization”, “vibration reduction”, or similar names by camera/lens manufacturers. These devices seek to compensate for the camera/lens movement by moving one or more of the lens elements; hence countering the effect of the motion. Adding such a device to a lens typically makes the lens much more expensive, heavier and less sturdy, and can also compromise image quality.

[0008] Accordingly, it is desirable to have a technique that corrects for distortion in photographs without adding excessively to the price, robustness or weight of a camera or other imaging device, or adversely affecting image quality.

### SUMMARY

[0009] The present invention processes image data in order to correct an image for distortion caused by imager movement or by movement of the subject being imaged. In another embodiment, the present invention can prevent image distortion due to motion of the imaging device or subject at relatively slow shutter speeds, resulting in a substantially undistorted image.

[0010] In another embodiment, the present invention measures relative motion between the imaging device and the subject by using sensors that detect the motion. When an image is initially captured, the effect of relative motion between the imaging device and the subject is that it transforms the “true image” into a blurred image, according to a 2-dimensional transfer function defined by the motion. The invention determines a transfer function that represents the motion and corrects the blur.

[0011] In yet another embodiment, the transfer function is estimated using blind detection techniques. The transfer function is then inverted, and the inverted

function is implemented in an image correcting filter that essentially reverses the blurring effect of the motion on the image. The image is processed through the filter, wherein blur due to the motion is reversed, and the true image is recovered.

[0012] In yet another embodiment, the invention uses the transfer function to combine consecutive images taken at a fast shutter speed to avoid blur due to motion between camera and subject that could result from using a slow shutter speed. In still another embodiment, the image sensor is moved to counter camera motion while the image is being captured.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 is a portion of memory having memory locations wherein elements of a recorded image are stored.

[0014] Figure 2 is a portion of memory having memory locations wherein elements of a deconvolution filter are stored.

[0015] Figure 3 is a portion of memory having memory locations wherein the recorded image is stored for calculating the next value of a corrected image.

[0016] Figure 4 is a functional block diagram of a system for correcting an image for distortion using a transfer function representing the distortion, wherein the transfer function is derived from measurements of the motion that caused the distortion.

[0017] Figure 5 is a functional block diagram of a system for correcting an image for distortion using a transfer function representing the distortion, wherein the transfer function is derived using blind estimation techniques.

[0018] Figure 6 shows a unit for iterative calculation of the corrective filter coefficients and estimation of the correct image data.

[0019] Figure 7 illustrates support regions of an image  $r(n,m)$  and of a transfer function  $h(n,m)$ , and the transfer function  $h(n,m)$  being applied to different parts of the image  $r(n,m)$ .

[0020] Figure 8 shows a unit for blind deconvolution to calculate the correct image data.

[0021] Figure 9 is an image of an object being captured on an image sensor wherein pixel values represent points of the image.

[0022] Figure 10 illustrates the effect of moving an imager while capturing an image, resulting in multiple copies of the image being recorded over each other, causing blur.

[0023] Figure 11 illustrates combining images taken at fast shutter speeds to result in the equivalent of a final image taken at a slower shutter speed, but with reduced blur.

[0024] Figure 12 illustrates image blur correction where an image sensor is moved to compensate for imager movement.

[0025] Figure 13 is an example of an image distorted by movement of the imager when the image was captured.

[0026] Figure 14 is represents the image of Figure 13 corrected according to the present invention.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0027] The present invention will be described with reference to the figures wherein like numerals represent like elements throughout. Although the invention is explained hereinafter as a method of correcting for image distortion due to the shaking of a camera when a picture is taken, similar distortions can also be caused by other types of imaging equipment and by imperfections in photo processing equipment, movement of the subject being photographed, and other sources. The present invention can be applied to correct for these types of distortions as well. Additionally, although reference is made throughout the specification to a camera as the exemplary imaging device, the present invention is not limited to such a

device. As aforementioned, the teachings of the present invention may be applied to any type of imaging device, as well as image post-processing techniques.

[0028] Capturing and recording a photograph, for example by a camera, involves gathering the light reflected or emanating from a subject, passing it through an optical system, such as a series of lenses, and directing it onto a light sensitive recording medium. A typical recording medium in traditional analog photography is a film that is coated with light sensitive material. During processing of the exposed film, the image is fixed and recorded. In digital cameras, the recording medium is typically a dense arrangement of light sensors, such as a Charge-Coupled Device (CCD) or a CMOS sensor.

[0029] The recording medium continuously captures the impression of the light that falls upon it as long as the camera shutter is open. Therefore, if the camera and the subject are moving with respect to each other (such as in the case when the user is unsteady and is shaking the camera, or when the subject is moving), the recorded image becomes blurred. To reduce this effect, a fast shutter speed can be used, thereby reducing the amount of motion occurring while the shutter is open. However, this reduces the amount of light from the subject captured on the recording medium, which can adversely affect image quality. In addition, increasing the shutter speed beyond a certain point is not always practical. Therefore, undesired motion blur occurs in many pictures taken by both amateur and professional photographers.

[0030] The nature of the blur is that the light reflected from a reference point on the subject does not fall on a single point on the recording medium, but rather it 'travels' across the recording medium. Thus a spread-out, or smudged, representation of the reference point is recorded.

[0031] Generally, all points of the subject move together, and the optics of the camera and the recording medium also move together. For example, in the case of a photograph of a moving car, wherein an image of the car is blurred due to uniform motion of all parts of the car. In other words, the image falling on the recording

medium ‘travels’ uniformly across the recording medium, and all points of the subject blur in the same manner.

[0032] The nature of the blur resulting from uniform relative motion can be expressed mathematically. In a 2-dimensional space with discrete coordinate indices ‘ $n$ ’ and ‘ $m$ ’, the undistorted image of the subject can be represented by  $s(n,m)$ , and a transfer function  $h(n,m)$  can be used to represent the blur. Note that  $h(n,m)$  describes the way the image ‘travels’ on the recording medium while it is captured. The resulting image that is recorded,  $r(n,m)$ , is given by:

$$r(n,m) = s(n,m) ** h(n,m); \quad \text{Equation (1)}$$

where  $**$  represents 2-dimensional convolution. The mathematical operation of convolution is well known to those skilled in the art and describes the operation:

$$r(n,m) = \sum_{i=-\infty}^{\infty} \sum_{j=-\infty}^{\infty} h(i,j) s(n-i, m-j). \quad \text{Equation (2)}$$

[0033] In the sum operations in Equation (2), the summation limits are infinite. In practice, the summations are not infinite, since the support region of the transfer function is finite. In other words, the region where the function is non-zero is limited by the time the camera shutter is open and the amount of motion. Therefore, the summation is calculated for only the indices of the transfer function where the function itself is non-zero, for example, from  $i = -N \dots N$  and  $j = -M \dots M$ .

[0034] If the transfer function  $h(n,m)$  is known, or its estimate is available, the blur that it represents can be “undone” or compensated for in a processor or in a computer program, and a corrected image can be obtained, as follows. Represent the “reverse” of the transfer function  $h(n,m)$  as  $h^{-1}(n,m)$  such that:

$$h(n,m) ** h^{-1}(n,m) = \delta(n,m); \quad \text{Equation (3)}$$

where  $\delta(n,m)$  is the 2-dimensional Dirac delta function, which is:

$$\delta(n,m) = \begin{cases} 1 & \text{if } n = m = 0 \\ 0 & \text{otherwise} \end{cases} . \quad \text{Equation (4)}$$

[0035] The delta function has the property that when convolved with another function, it does not change the nature of that function. Therefore, once  $h(n,m)$  and hence  $h^{-1}(n,m)$  are known, an image  $r(n,m)$  can be put through a correcting filter, called a “deconvolution filter”, which implements the inverse transfer function  $w(n,m) = h^{-1}(n,m)$  and undoes the effect of blur. Then:

$$\begin{aligned} r(n,m) ** w(n,m) &= r(n,m) ** h^{-1}(n,m) \\ &= s(n,m) ** h(n,m) ** h^{-1}(n,m) \\ &= s(n,m) ** \delta(n,m) \\ &= s(n,m); \end{aligned} \quad \text{Equation (5)}$$

and the correct image data  $s(n,m)$  is recovered.

[0036] The deconvolution filter in this example is such that:

$$\sum_{i=-N}^N \sum_{j=-M}^M w(i,j) h(n-i, m-j) = \begin{cases} 1 & \text{if } n = m = 0 \\ 0 & \text{otherwise} \end{cases} . \quad \text{Equation (6)}$$

Because of the property that the deconvolution operation forces the output of the convolution to be zero for all but one index, this method is called the “zero-forcing algorithm”. The zero-forcing algorithm itself is but one method that can be used, but there are others possible also, such as the least mean-square algorithm described in more detail below.

[0037] In order to define a deconvolution filter, the transfer function  $h(n,m)$  representing the relative motion between the imager and the subject must be derived from measuring the motion, or alternatively by using blind estimation techniques. The inverse function  $h^{-1}(n,m)$  must then be calculated and incorporated in a filter to recover a corrected image  $s(n,m)$ . It is possible to determine  $h(n,m)$  using sensors that detect motion, and record it at the time the image is captured.

[0038] One embodiment of the present invention includes one or more motion sensors, attached to or included within the imager body, the lens, or otherwise configured to sense any motion of the imager while an image is being captured, and to record this information. Such sensors are currently commercially available which are able to capture movement in a single dimension, and progress is being made to improve their accuracy, cost, and characteristics. To capture motion in two dimensions, two sensors may be used, each capable of detecting motion in a single direction. Alternatively, a sensor able to detect motion in more than one dimension can be used.

[0039] The convolution in Equation (5) can be performed using memory elements, by performing an element-by-element multiplication and summation over the support region of the transfer function. The recorded image is stored, at least temporarily, in memory elements forming a matrix of values such as shown in Figure 1. Similarly, the deconvolution filter  $w(n,m)$  is stored in another memory location as shown in Figure 2. The deconvolution operation is then performed by multiplying the values in the appropriate memory locations on an element-by-element basis, such as multiplying  $r(n,m)$  and  $w(0,0)$ ;  $r(n-1,m)$  and  $w(1,0)$ , and so on, and summing them all up.

[0040] Element-by-element multiplication and summing results in the convolution:

$$y(n,m) = \sum_{i=-N}^N \sum_{j=-M}^M w(i,j)r(n-i,m-j). \quad \text{Equation (7)}$$

To calculate the next element,  $y(n+1,m)$  for example, the deconvolution filter  $w(n,m)$  multiplies the shifted memory locations, such as shown in Figure 3, followed by the summation. Note that the memory locations do not need to be shifted in practice; rather, the pointers indicating the memory locations would move. In Figure 1 and Figure 3 portions of  $r(n,m)$  are shown that would be included in the element-by-element multiplication and summation, and this portion is the same size as  $w(n,m)$ . However, it should be understood that  $r(n,m)$ , that is the whole image, is typically much larger than the support region of  $w(n,m)$ . To determine value of the convolution for different points, an appropriate portion of  $r(n,m)$  would be included in the calculations.

[0041] The filter defined by Equation (5) is ideal in the sense that it reconstructs the corrected image from the blurred image with no data loss. A first embodiment calculates the inverse of  $h(n,m)$  where  $h(n,m)$  is known. As explained above, by making use of motion detecting devices, such as accelerometers, the motion of the imager (such as a camera and/or the associated lens) can be recorded while the picture is being captured, and the motion defines the transfer function describing this motion.

[0042] A functional block diagram of this embodiment in accordance with the present invention is illustrated in Figure 4, wherein a method 40 for correcting image distortion is shown. An image  $r(n,m)$  from camera optics is captured by an imager (step 41) and recorded in memory (step 42). Simultaneously, motion sensors detect and record camera motion (step 43) that occurs while the shutter of the camera is open. The transfer function representing the motion  $h(n,m)$  is derived (step 44), and the inverse transfer function  $h^{-1}(n,m)$  is determined (step 46). The inverse transfer function is applied in a corrective filter (step 48) to the image, which outputs a corrected image  $s(n,m)$  (step 49).

[0043] In this and other embodiments that make use of motion sensors to represent the imager's movement, derivation of the transfer function from motion

information (step 44) takes into account the configuration of the imager and the lens also. For an imager that is a digital camera, for example, the focal length of the lens factors into the way the motion of the imager affects the final image. Therefore the configuration of the imager is part of the derivation of  $h(n,m)$ . This is important especially for imagers with varying configurations, such as digital cameras with interchangeable lenses.

[0044] In this first embodiment of the invention, an iterative procedure is used to compute the inverse transfer function from  $h(n,m)$ . The approximate inverse transfer function at iteration  $k$  is denoted as  $\hat{h}_k^{-1}(n,m)$ . At this iteration, output of the deconvolution filter is:

$$\begin{aligned} y_k(n,m) &= \hat{h}_k^{-1}(n,m) ** r(n,m) \\ &= \sum_i \sum_j \hat{h}_k^{-1}(i,j) r(n-i, m-j). \end{aligned} \quad \text{Equation (8)}$$

[0045] The filter output can be written as the sum of the ideal term and the estimation noise as:

$$\begin{aligned} y_k(n,m) &= h^{-1}(n,m) ** r(n,m) + (\hat{h}_k^{-1}(n,m) - h^{-1}(n,m)) ** r(n,m) \\ &= s(n,m) + v_k(n,m); \end{aligned} \quad \text{Equation (9)}$$

where  $v(n,m)$  is the estimation noise which is desirable to eliminate. An initial estimate of the correct image can be written as:

$$\hat{s}_k(n,m) = \hat{h}_k^{-1}(n,m) ** r(n,m). \quad \text{Equation (10)}$$

[0046] However, this estimate can in general be iteratively improved. There are a number of currently known techniques described in estimation theory to achieve this. A preferable option is the Least Mean-Square (LMS) algorithm. A

block diagram of a calculation unit 60 which implements this method is shown in Figure 6.

[0047] As an initial state,  $\hat{h}^{-1}_0(n, m)$  is set to equal  $\mu r(n, m)$ . Then, the following steps are iteratively repeated:

[0048] Step 1, an estimate of the correct image is calculated in a first 2-dimensional finite impulse response (2D FIR) filter 62:

$$\hat{s}_k(n, m) = \hat{h}_k^{-1}(n, m) ** r(n, m).$$

[0049] Step 2, a received signal based on the estimated correct image is calculated in a second 2D FIR filter 64:

$$\tilde{r}_k(n, m) = \hat{s}_k(n, m) ** h(n, m);$$

and the estimation error is calculated using an adder 66:

$$e_k(n, m) = r_k(n, m) - \tilde{r}_k(n, m).$$

[0050] Step 3, the inverse transfer function coefficients are then updated in the LMS algorithm unit 68:

$$\hat{h}_{k+1}^{-1}(n, m) = \hat{h}_k^{-1}(n, m) + \mu r(n, m) e_k(n, m);$$

where  $\mu$  is the step-size parameter.

[0051] These steps are repeated until the estimation error becomes small enough to be acceptable; which value can be predetermined or may be set by a user. As the iterative algorithm converges, the estimated inverse transfer function approaches the correct inverse transfer function  $h^{-1}(n, m)$ . The inverse transfer function coefficients are the coefficients of the deconvolution filter, and the estimate  $\hat{s}(n, m)$  converges to  $s(n, m)$ , the correct image, at the same time.

[0052] This process can be repeated for the entire image, but it is less complex, and therefore preferable, to find the inverse filter first over a single transfer function support region, then apply it to the entire image  $r(n, m)$ .

[0053] While the above Steps 1-3 are being repeated, a different portion of the recorded image  $r(n, m)$  can be used in each iteration. As in Figure 7, it should be noted that the recorded image  $r(n, m)$  typically has a much larger support region

than the transfer function  $h(n,m)$  that represents the camera motion. Therefore, the above steps are preferably performed over a support region of  $h(n,m)$ , and not over the entire image  $r(n,m)$ , for each iteration.

[0054] Although the present invention has been explained with reference to the LMS algorithm, this is by way of example and not by way of limitation. It should be clear to those skilled in the art that there are other iterative algorithms beside the LMS algorithm that can be used to achieve acceptable results, and also that there are equivalent frequency domain derivations of these algorithms. For example, it is possible to write Equation (1) in frequency domain as:

$$R(\omega_1, \omega_2) = S(\omega_1, \omega_2)H(\omega_1, \omega_2); \quad \text{Equation (11)}$$

where  $R(\omega_1, \omega_2)$ ,  $S(\omega_1, \omega_2)$ , and  $H(\omega_1, \omega_2)$  are the frequency domain representations (Fourier Transforms) of the captured image, the correct image, and the transfer function, respectively, and therefore:

$$S(\omega_1, \omega_2) = \frac{R(\omega_1, \omega_2)}{H(\omega_1, \omega_2)}. \quad \text{Equation (12)}$$

[0055] To obtain  $s(n,m)$  one would calculate  $S(\omega_1, \omega_2)$  as above and take the Inverse Fourier Transform, which should be known to those skilled in the art. However, this method does not always lead to well behaved solutions, especially when numerical precision is limited.

[0056] In a second embodiment of the present invention,  $h(n,m)$  is not known. This second embodiment uses so-called blind deconvolution, whereby the transfer function  $h(n,m)$  is estimated using signal processing techniques. A functional block diagram of this embodiment is illustrated in Figure 5, wherein a method 50 for correcting image distortion according to this embodiment is shown. An image  $r(n,m)$  from the optics from a camera is captured (step 51) and recorded in memory

(step 52). Unlike the first embodiment, there are no motion sensors to detect and record camera motion that occurs while the shutter of the camera is open. Instead, the transfer function representing the motion  $h(n,m)$  is derived using blind estimation techniques (step 54), and the inverse transfer function  $h^{-1}(n,m)$  is determined (step 56). The inverse transfer function is applied in a corrective filter to the image (step 58), which outputs a corrected image  $s(n,m)$  (step 59).

[0057] Blind equalization techniques are used to obtain the deconvolution filter coefficients. This is also an iterative LMS algorithm, similar to that used in the first embodiment. In this second embodiment, an iterative procedure is also used to compute an approximate deconvolution filter, and the approximation is improved at each iteration until it substantially converges to the ideal solution. As aforementioned with respect to the first embodiment, the level of convergence may be predetermined or may be set by a user. The approximate deconvolution filter is denoted at iteration  $k$  as  $\hat{w}_k(n,m)$ . At this iteration, the output of the deconvolution filter is:

$$\begin{aligned} y_k(n,m) &= \hat{w}_k(n,m) ** r(n,m) \\ &= \sum \sum \hat{w}_k(i,j) r(n-i,m-j); \end{aligned} \quad \text{Equation (13)}$$

[0058] The filter output can be written as the sum of the ideal term and the estimation noise as:

$$\begin{aligned} y_k(n,m) &= w(n,m) ** r(n,m) + [\hat{w}_k(n,m) - w(n,m)] ** r(n,m) \\ &= s(n,m) + v_k(n,m); \end{aligned} \quad \text{Equation (14)}$$

where  $v(n,m)$  is the estimation noise, which is desirable to eliminate. An initial estimate of the correct image can be written as:

$$\hat{s}_k(n, m) = \hat{w}_k(n, m) ** r(n, m). \quad \text{Equation (15)}$$

[0059] However, this estimate can be iteratively improved. There are a number of currently known techniques described in estimation theory to achieve this. A preferable option is the LMS algorithm. A block diagram of a calculation unit 80 which implements this method is shown in Figure 8.

[0060] As an initial state,  $\hat{h}^{-1}_0(n, m)$  is set equal to  $\mu r(n, m)$ . Then, the following steps are iteratively repeated:

[0061] Step 1, an estimate of the correct image is calculated in a first 2D FIR filter 82:

$$\hat{s}_k(n, m) = \hat{h}_k^{-1}(n, m) ** r(n, m).$$

[0062] Step 2, a received signal based on the estimated correct image is calculated in a non-linear estimator 84:

$$\tilde{r}_k(n, m) = g(\hat{s}_k(n, m));$$

and the estimation error is calculated using an adder 86:

$$e_k(n, m) = r_k(n, m) - \tilde{r}_k(n, m).$$

[0063] Step 3, the inverse transfer function coefficients are then updated in the LMS algorithm unit 88:

$$\hat{h}_{k+1}^{-1}(n, m) = \hat{h}_k^{-1}(n, m) + \mu r(n, m) e_k(n, m),$$

where  $\mu$  is the step-size parameter.

[0064] The function  $g(\cdot)$  calculated in step 2 is a non-linear function chosen to yield a Bayes estimate of the image data. Since this function is not central to the present invention and is well known to those of skill in the art, it will not be described in detail hereinafter.

[0065] There are known blind detection algorithms for calculating  $s(n, m)$  by looking at higher order statistics of the image data  $r(n, m)$ . A group of algorithms under this category are called Bussgang algorithms. There are also variations called Sato algorithms, and Godard algorithms. Another class of blind estimation

algorithms use spectral properties (polyspectra) of the image data to deduce information about  $h(n,m)$ . Any appropriate blind estimation algorithm can be used to determine  $h(n,m)$ , and to construct a correcting filter.

[0066] The first two embodiments of the present invention described hereinbefore correct blur in an image based on determining a transfer function that represents the motion of an imager while an image is being captured, and then correcting for the blur by making use of the “inverse” transfer function. One method determines the transfer function at the time the photograph is being captured by using devices that can detect camera motion directly. The other method generates a transfer function after the image is captured by using blind estimation techniques. Both methods then post-process the digital image to correct for blur. In both cases, the captured image is originally blurred by motion, and the blur is then removed.

[0067] In accordance with a third embodiment of the present invention the blurring of an image is prevented as it's being captured, as described below. When an imager is moved while an image is being captured, multiple copies of the same image are, in effect, recorded over each other. For example, when an image is captured digitally it is represented as pixel values in the sensor points of the image sensor. This is pictorially represented in Figure 9, in which the imager (for example, a camera and its associated lens) are not shown in order to simplify the depiction.

[0068] If the imager is shaken or moved while the image is being captured, the situation is equivalent to copies of the same image being captured multiple times in an overlapping fashion with an offset. The result is a blurred image. This is particularly true if the shutter speed is relatively slow compared to the motion of the camera. This is graphically illustrated in Figure 10.

[0069] When the shutter speed is sufficiently fast compared to the motion of the imager, blur does not occur or is very limited because the displacement of the imager is not large enough to cause the light reflected from a point on the image to fall onto more than one point on the image sensor. This third embodiment of the invention takes advantage of the ability of an imager to record multiple images

using fast shutter speeds. When an image is being captured using a setting of a relatively slow shutter speed, the imager actually operates at a higher shutter speed (for instance at the fastest shutter speed at which the imager is designed to operate), and captures multiple images “back to back.” For example, if the photograph is being taken with a shutter speed setting of 1/125 sec and the fastest shutter speed of the camera is 1/1000 sec, the camera actually captures 8 consecutive images, each taken with a shutter speed setting of 1/1000 sec. Then, the camera combines the images into a single image by aligning them such that each pixel corresponding to the same image point in each image is combined pixel-by-pixel into one pixel value by adding pixel values, averaging them, or using any other appropriate operation to combine them. The multiple images can all be stored and aligned once all of them are captured, or alternatively, each image can be aligned and combined with the first image in “real time” without the need to store all images individually. The blur of the resulting image is substantially reduced, as depicted in Figure 11.

[0070] The quality of an image can be measured in terms of signal-to-noise power ratio (SNR). When a fast shutter speed is used, the SNR of the image is degraded because the image sensor operates less effectively when the amount of light falling on it is reduced. However, since multiple images are being added, this degradation is overcome. Indeed, an SNR improvement can be expected using this embodiment, because the image data is being added coherently while the noise is being added non-coherently. This phenomenon is the basis for such concepts as maximal ratio combining (MRC).

[0071] To determine how to align the pixel values, a device that can detect motion, such as an accelerometer or other motion sensor, is attached to or incorporated within the imager, and it records the motion of the imager while the photograph is being taken. The detected motion indicates how much the imager moved while each of the series of images was captured, each image having been captured back-to-back with a high shutter speed as explained in the example above.

The imager moves each of the images in the series by an amount which is preferably measured in pixels, in the direction opposite the motion of the imager that occurred during the interval between the capture of the first image and each respective image in the series. Thus, the shift of each image is compensated for, and the correct pixels are aligned in each of the images. This is illustrated in Figure 11. The combined image will not be blurred since there is no spilling of image points into more than one pixel in the combined final image.

[0072] As an alternative to the third embodiment, the reference point for aligning the higher speed images is not the imager location, but the subject itself. In other words, higher shutter speed images can be aligned and combined such that a designated subject in a field of view is clear and sharp whereas other parts of the image may be blurred. For example, a moving subject such as a car in motion can be the designated subject. If high shutter speed images are combined such that the points of the image of the moving car are aligned, the image of the car will be clear and sharp, while the background is blurred. As a way to align a designated subject, such as the car in this example, pattern recognition and segmentation algorithms may be used that are well known to those skilled in the art, and defined in current literature. Alternatively, a tracking signal that is transmitted from the subject can be used to convey its position. Alternatively, the user can indicate, such as by an indicator in a viewfinder, which object in the field of view is the designated subject to be kept blur-free.

[0073] A fourth embodiment of the invention compensates for movement of the imager or the subject by adjusting the position of the image sensor during image capture, according to the inverse of the transfer function describing the imager or subject motion, or both. This embodiment is illustrated in Figure 12. This embodiment is preferably used in digital cameras wherein the image sensor 108 is a relatively small component and can be moved independently of the camera, but can also be used with film. Accordingly, this embodiment makes use of motion sensors, and detects the movement of the camera and/or the subject while the image is being

captured. The signals from the motion sensors are used to control devices that adjust the position of the image sensor. In Figure 12, horizontal motion sensor 102 and vertical motion sensor 104 measure movement of the camera while its shutter (not shown) is open and an image is being captured. The motion information is conveyed to a controller 106, which determines and sends signals to devices 110a, 110b, 110c, and 110d, which adjust the position of the image sensor 108. The control mechanism is such that the devices 110a-d, for example electromagnets or servos, move the image sensor 108 in the opposite direction of the camera motion to prevent motion blur. Additional sensors (not shown) can be used to detect motion of the subject, and the control mechanism configured to correct for that motion as well.

[0074] Figure 13 shows an example of a photographic image that is blurred due to user movement of the imager while taking the picture. Figure 14 shows the same image, corrected according to the present invention. The invention substantially recovers the correct image from the blurred image.

[0075] Those skilled in the art will recognize that all embodiments of the invention are applicable to digitized images which are blurred by uniform motion, regardless of the source of the image or the source of the motion blur. It is applicable to digital images blurred due to motion of the imager, of the subject, or both. In some cases, it is also applicable to images captured on film and then scanned into digital files. In the latter case, however, motion sensor information typically may not be available, and therefore only the blind estimation embodiment can be used. Also, where appropriate, the different embodiments of the invention can be combined. For example, the superposition embodiment can be used to avoid most blur, and the correcting filter using blind estimation embodiment can then be applied to correct the combined image for any remaining blur.

[0076] In describing the invention, no distinction has been made between an imager that captures images one at a time, such as a digital camera, and one that captures sequence of images, such as digital or analog video recorders. A digital video recorder or similar device operates substantially the same way as a digital

camera, with the addition of video compression techniques to reduce the amount of image data being stored, and various filtering operations used to improve image quality. The invention is also applicable to digital and analog video capture and processing, being applied to each image in the sequence of images, and can be used in conjunction with compression and other filtering.

[0077] The implementation of the apparatus that performs the restoration of the images to their correct form can be done as part of the imager capturing the image, or it can be done as a post-process. When done as part of the imager, the image correcting apparatus can be implemented in an integrated circuit, or in software to run on a processor, or a combination of the two. When done as a post process, a preferred embodiment is that the image data is input into a post processing device such as a computer, and the blind estimation algorithm is performed by a computer program. In this embodiment, the implementation could be a dedicated computer program, or an add-on function to an existing computer program.

[0078] Where a computer program performs the image restoration, a blind estimation algorithm can be executed by the program to calculate the estimated transfer function  $h(n,m)$ . Alternatively, motion information can be recorded by the camera at the time the image is captured, and can be downloaded into the program to be used as an input to calculate  $h(n,m)$ . In either case, the program then derives the correcting filter and applies the filter to correct the image.

[0079] It should also be noted that if there are multiple blurred objects in an image, and the blur is caused by the objects moving in different directions, the image of each object will be blurred differently, each blurred object having a different transfer function describing its motion. The present invention can allow the user to individually select independently blurred parts of the image and individually correct only the selected parts, or alternatively, to correct a selected part of the image at the expense of the rest of the image, resulting in a blur-corrected subject and a blurred background.

[0080] When increased accuracy is needed in obtaining  $h(n,m)$ , those skilled in the art will recognize that, in some cases, the motion information from sensors can be used to calculate  $h(n,m)$ , and an estimate of  $h(n,m)$  can also be calculated by blind estimation and the two transfer functions can be advantageously combined for more accurate results.

[0081] There are other signal processing algorithms and digital filters which can be applied to digital images in order to improve their color saturation, reduce noise, adjust contrast and sharpness, etc. These can be incorporated as part of an imager, such as a digital camera, or as part of a post-processing application, such as a photo editing software running on a computer. It should be clear to those skilled in the art that those techniques can be applied in addition to the distortion correction of this invention.

\* \* \*



$r(n+N, m+M)$	...		$r(n, m+M)$		...	$r(n-N, m+M)$
			...			
			$r(n, m+1)$			
$r(n+N, m)$	...	$r(n+1, m)$	<b><math>r(n, m)</math></b>	$r(n-1, m)$	...	$r(n-N, m)$
			$r(n, m-1)$			
			...			
$r(n+N, m)$	...		$r(n, m-M)$		...	$r(n-N, m-M)$

**Figure 1**

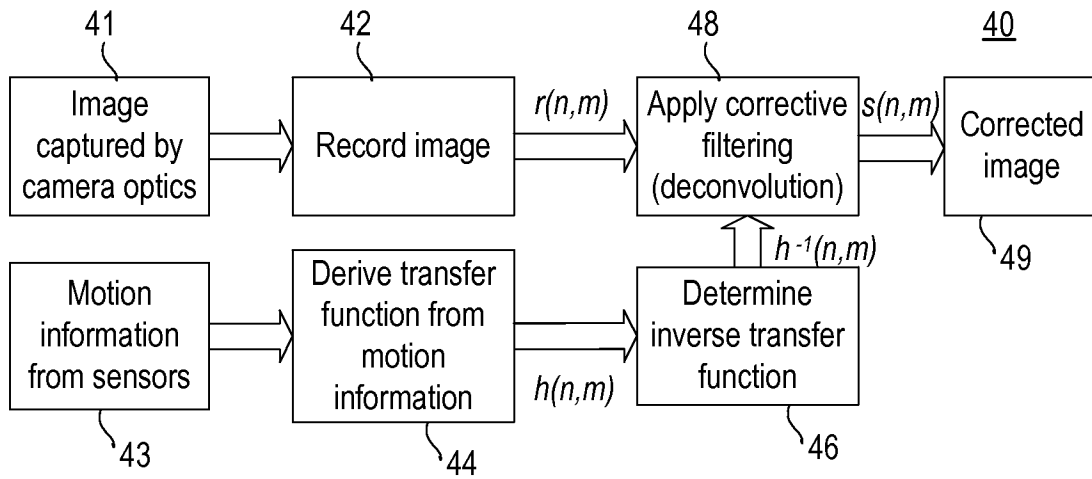
$w(N, M)$	...		$w(0, M)$		...	$w(-N, M)$
			...			
			$w(0, 1)$			
$w(N, 0)$	...	$w(1, 0)$	<b><math>w(0, 0)</math></b>	$w(-1, 0)$	...	$w(-N, 0)$
			$w(0, -1)$			
			...			
$w(N, 0)$	...		$w(0, -M)$		...	$w(-N, -M)$

**Figure 2**

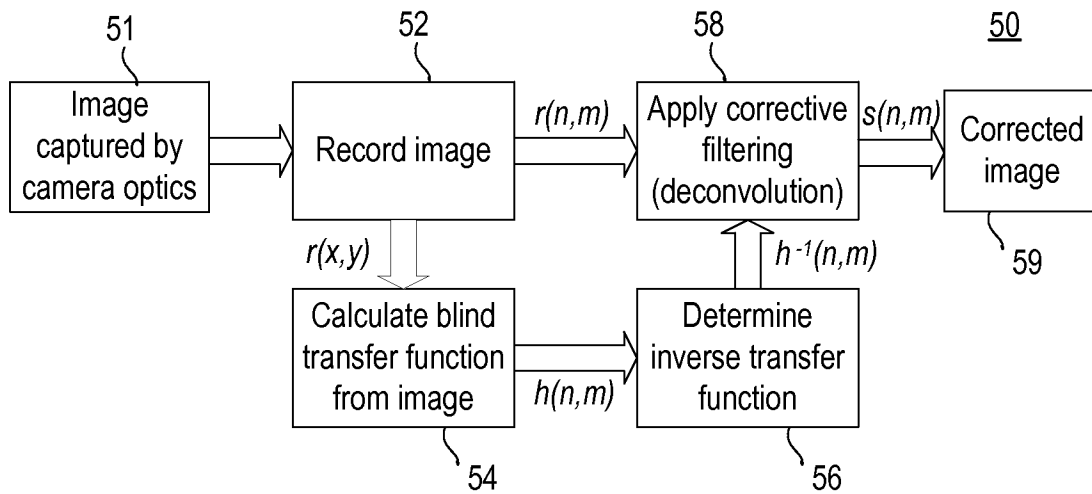
$r(n+N+1, m+M)$	...		$r(n+1, m+M)$		...	$r(n-N+1, m+M)$
			...			
			$r(n+1, m+1)$			
$r(n+N+1, m)$	...	$r(n+2, m)$	<b><math>r(n+1, m)</math></b>	$r(n, m)$	...	$r(n-N+1, m)$
			$r(n+1, m-1)$			
			...			
$r(n+N+1, m)$	...		$r(n+1, m-M)$		...	$r(n-N+1, m-M)$

**Figure 3**

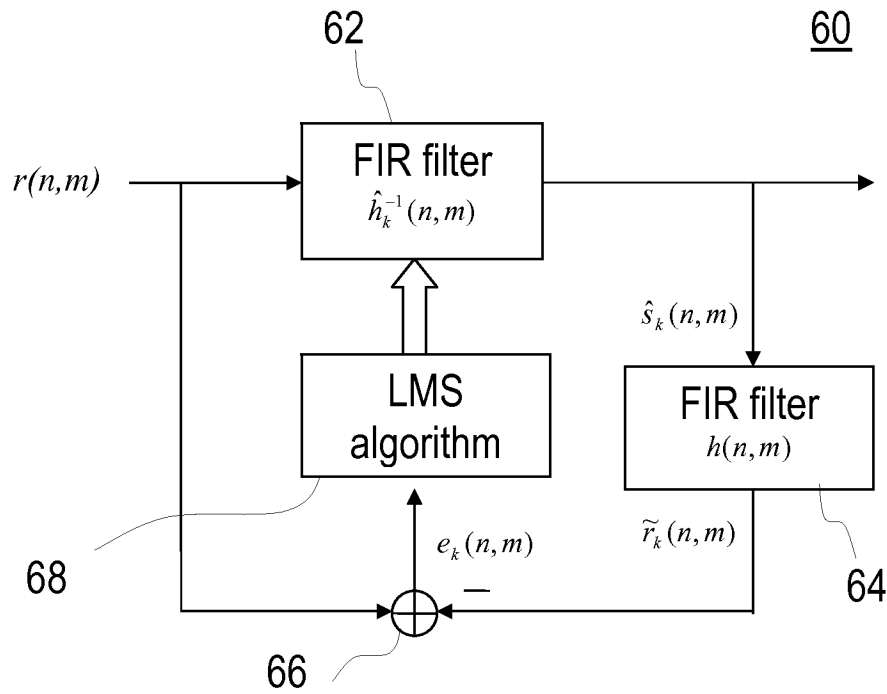




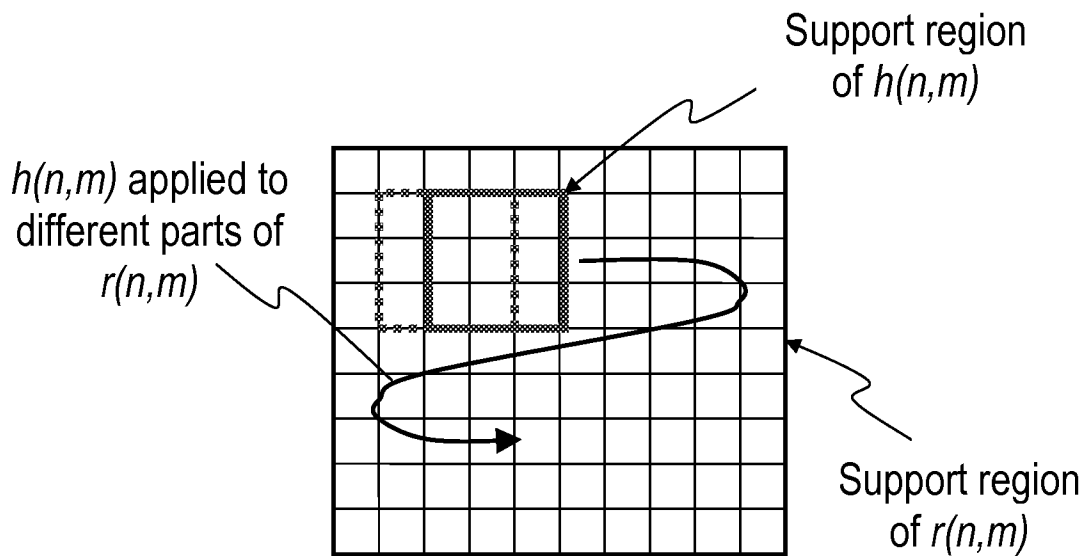
**Figure 4**



**Figure 5**

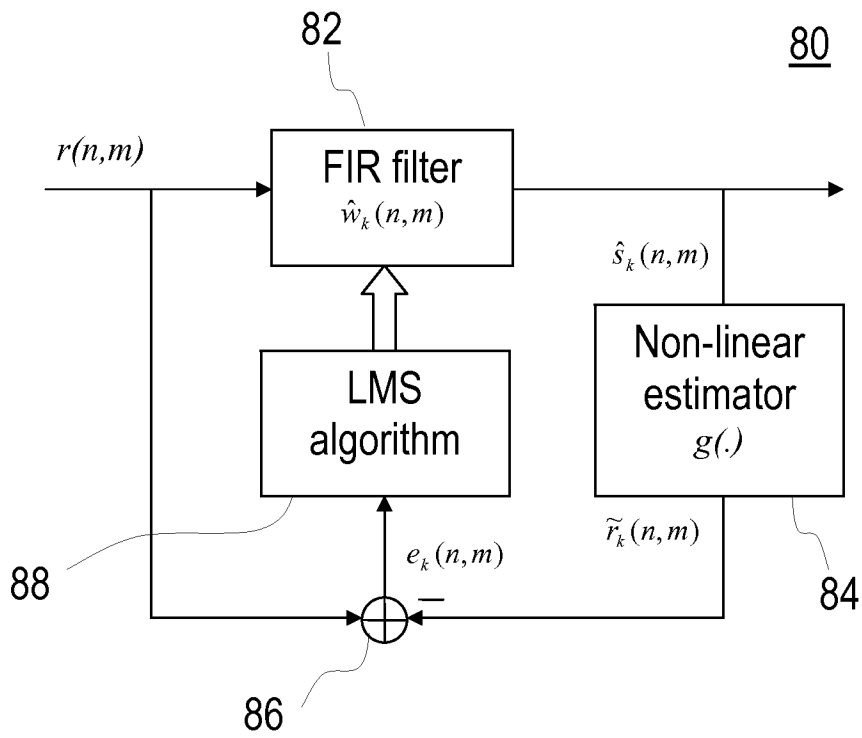


**Figure 6**

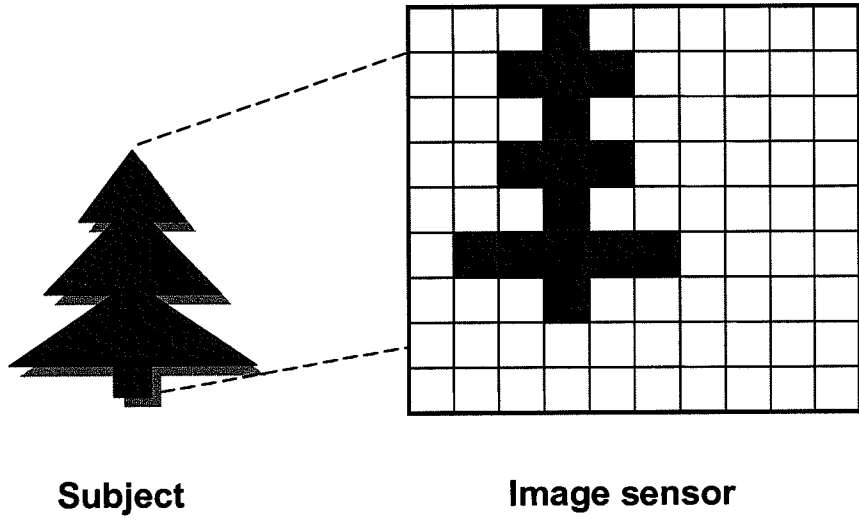


**Figure 7**



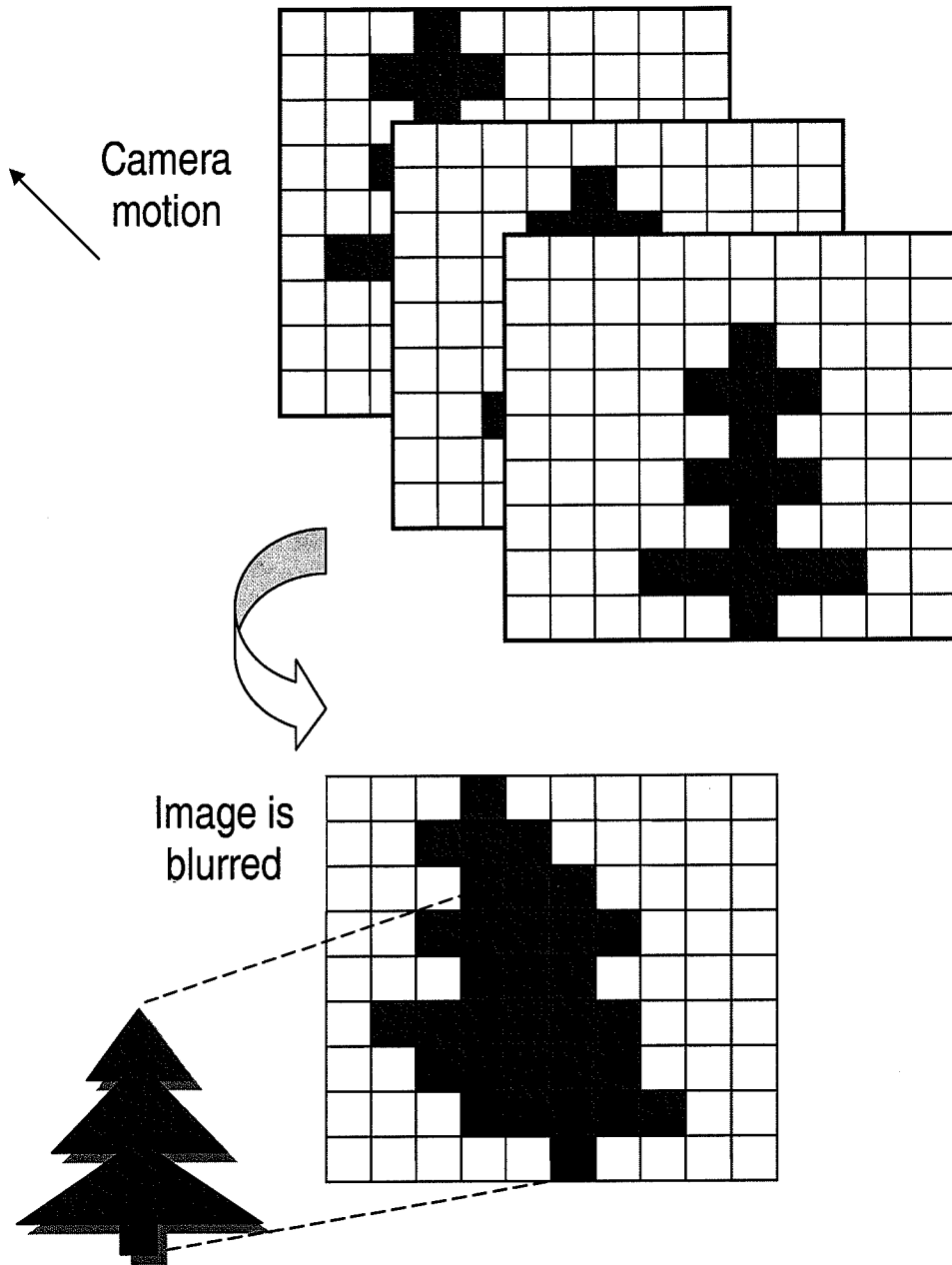


**Figure 8**



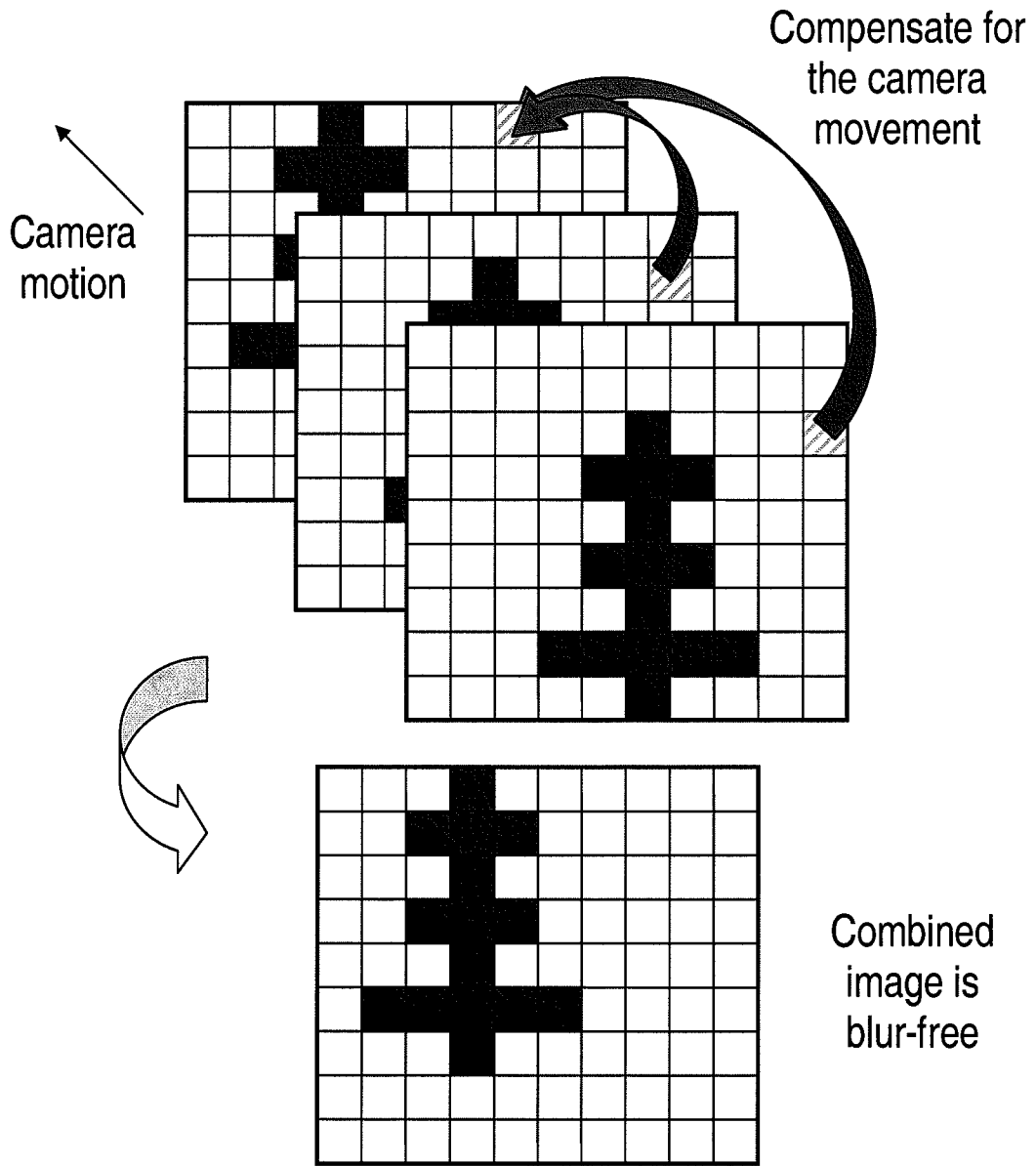
**Figure 9**





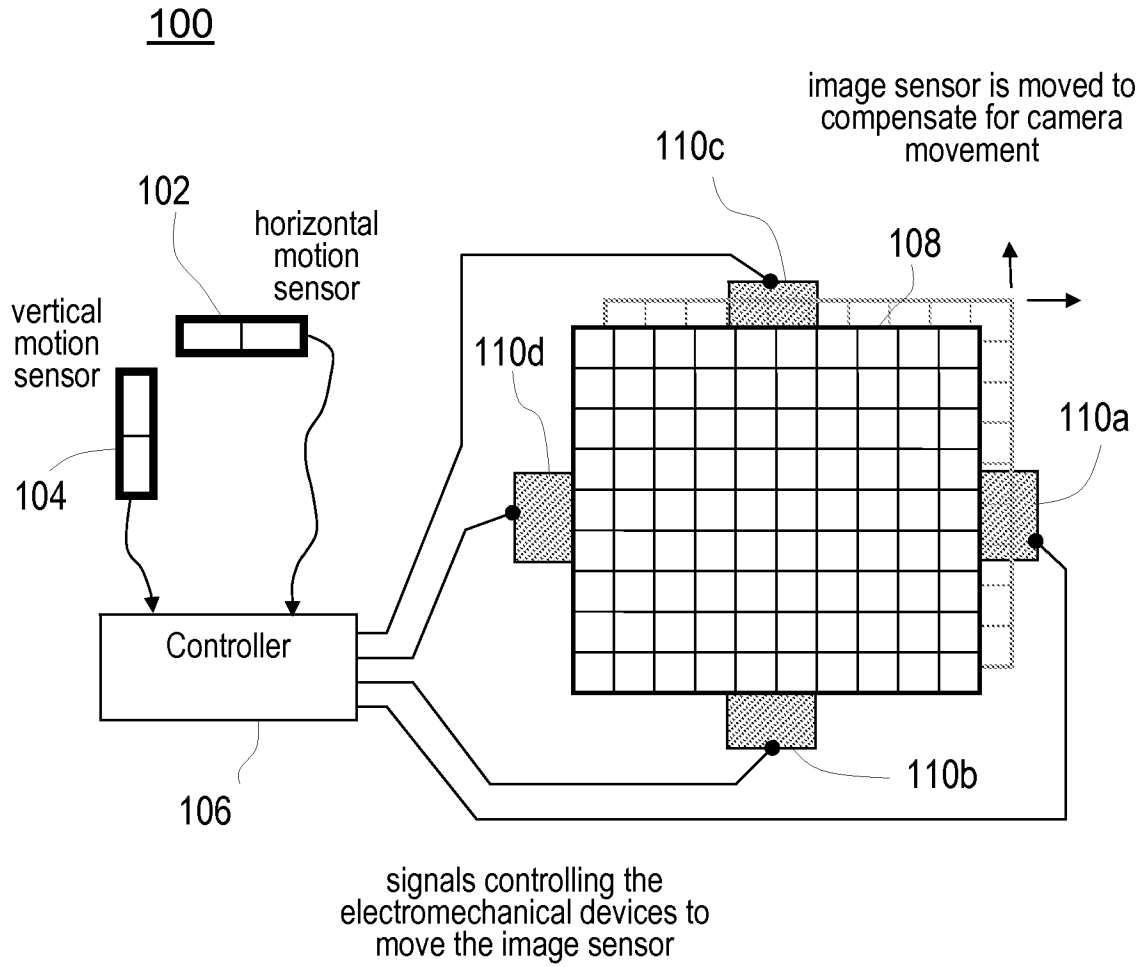
**Figure 10**





**Figure 11**





**Figure 12**





**Figure 13**

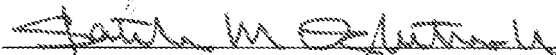


**Figure 14**



Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	METHOD AND APPARATUS TO CORRECT DIGITAL IMAGE BLUR DUE TO MOTION OF SUBJECT OR IMAGING DEVICE
As the below named inventor, I hereby declare that:	
This declaration is directed to:	<input type="checkbox"/> The attached application, or <input checked="" type="checkbox"/> United States application or PCT international application number <u>14/532,654</u> filed on <u>November 5, 2014</u>
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
<b>WARNING:</b>	
<p>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.</p>	
LEGAL NAME OF INVENTOR	
Inventor: <u>Fatih M. Ozluturk</u>	Date (Optional): _____
Signature: <u></u>	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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**TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS**

**NOTE:** This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	Not Yet Known
Filing Date	February 13, 2017
First Named Inventor	Fatih M. Ozluturk
Title	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
Art Unit	Not Yet Known
Examiner Name	Not Yet Known
Attorney Docket Number	OZL-PT001.17

**SIGNATURE of Applicant or Patent Practitioner**

Signature	/Thomas A. Mattioli/	Date	February 13, 2017
Name	Thomas A. Mattioli	Telephone	(215) 568-6400
Registration Number	56,773		

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.

\*Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

**PATENT APPLICATION FEE DETERMINATION RECORD**

Substitute for Form PTO-875

Application or Docket Number  
15/431,332

**APPLICATION AS FILED - PART I**

	(Column 1)	(Column 2)
FOR	NUMBER FILED	NUMBER EXTRA
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A
TOTAL CLAIMS (37 CFR 1.16(j))	29 minus 20 = *	9
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 = *	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))		

\* If the difference in column 1 is less than zero, enter "0" in column 2.

SMALL ENTITY	
RATE(\$)	FEE(\$)
N/A	70
N/A	300
N/A	360
x 40 =	360
x 210 =	0.00
	0.00
	0.00
TOTAL	1090

OTHER THAN SMALL ENTITY	
RATE(\$)	FEE(\$)
N/A	
N/A	
N/A	
TOTAL	

**APPLICATION AS AMENDED - PART II**

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(i))	* Minus	**	=
Independent (37 CFR 1.16(h))	* Minus	***	=
Application Size Fee (37 CFR 1.16(s))			
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))			

SMALL ENTITY	
RATE(\$)	ADDITIONAL FEE(\$)
x =	
x =	
TOTAL ADD'L FEE	

OTHER THAN SMALL ENTITY	
RATE(\$)	ADDITIONAL FEE(\$)
x =	
x =	
TOTAL ADD'L FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(i))	* Minus	**	=
Independent (37 CFR 1.16(h))	* Minus	***	=
Application Size Fee (37 CFR 1.16(s))			
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))			

SMALL ENTITY	
RATE(\$)	ADDITIONAL FEE(\$)
x =	
x =	
TOTAL ADD'L FEE	

OTHER THAN SMALL ENTITY	
RATE(\$)	ADDITIONAL FEE(\$)
x =	
x =	
TOTAL ADD'L FEE	

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.  
 \*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".  
 \*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".  
 The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.



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Table with 7 columns: APPLICATION NUMBER, FILING or 371(c) DATE, GRP ART UNIT, FIL FEE REC'D, ATTY.DOCKET.NO, TOT CLAIMS, IND CLAIMS. Row 1: 15/431,332, 02/13/2017, 2673, 1090, OZL-PT001.17, 29, 2

CONFIRMATION NO. 4930

FILING RECEIPT

3624
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103



Date Mailed: 02/27/2017

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. 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

Inventor(s)
Fatih M. Ozluturk, Port Washington, NY;

Applicant(s)
Fatih M. Ozluturk, Port Washington, NY;

Power of Attorney: The patent practitioners associated with Customer Number 03624

Domestic Priority data as claimed by applicant

This application is a CON of 15/149,481 05/09/2016
which is a CON of 14/690,818 04/20/2015 PAT 9338356
which is a CON of 14/532,654 11/04/2014 PAT 9013587
which is a CON of 13/442,370 04/09/2012 PAT 8922663
which is a CON of 12/274,032 11/19/2008 PAT 8154607
which is a CON of 11/089,081 03/24/2005 PAT 8331723
which claims benefit of 60/556,230 03/25/2004

Foreign Applications for which priority is claimed (You may be eligible to benefit from the Patent Prosecution Highway program at the USPTO. Please see http://www.uspto.gov for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 02/23/2017

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/431,332**

**Projected Publication Date:** 06/08/2017

**Non-Publication Request:** No

**Early Publication Request:** No

**\*\* SMALL ENTITY \*\***

**Title**

METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE

**Preliminary Class**

358

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## **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 (1-866-999-4258).

**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 Assets Control, 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).

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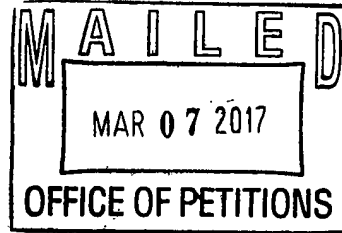
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technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



VOLPE AND KOENIG, P.C.  
UNITED PLAZA  
30 SOUTH 17TH STREET, 18<sup>TH</sup> FLOOR  
PHILADELPHIA PA 19103



Doc Code: TRACK1.GRANT

<p><b>Decision Granting Request for Prioritized Examination (Track I or After RCE)</b></p>	<p>Application No.: 15/431,332</p>
<p>1. THE REQUEST FILED <u>2/13/17</u> IS <u>GRANTED</u>.</p> <p>The above-identified application has met the requirements for prioritized examination</p> <p>A. <input checked="" type="checkbox"/> for an original nonprovisional application (Track I).  B. <input type="checkbox"/> for an application undergoing continued examination (RCE).</p> <p>2. <b>The above-identified application will undergo prioritized examination.</b> The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:</p> <p>A. filing a <b><u>petition for extension of time</u></b> to extend the time period for filing a reply;  B. filing an <b><u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u></b>, or a multiple dependent claim;  C. filing a <b><u>request for continued examination</u></b>;  D. filing a notice of appeal;  E. filing a request for suspension of action;  F. mailing of a notice of allowance;  G. mailing of a final Office action;  H. completion of examination as defined in 37 CFR 41.102; or  I. abandonment of the application.</p> <p>Telephone inquiries with regard to this decision should be directed to Cheryl Gibson-Baylor at (571)272-3213, Office of Petitions. In his/her absence, calls may be directed to Brian W. Brown, (571)272-5338.</p> <p>Cheryl Gibson-Baylor <u>/Cheryl Gibson-Baylor/</u> [Signature]</p> <p><u>Petitions Paralegal Specialist</u> (Title)</p>	



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Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
15/431,332 02/13/2017 Fatih M. Ozluturk OZL-PT001.17 4930

3624 7590 03/23/2017
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

Table with 1 column: EXAMINER

HO, TUAN V

Table with 2 columns: ART UNIT, PAPER NUMBER

2661

Table with 2 columns: NOTIFICATION DATE, DELIVERY MODE

03/23/2017

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

eoffice@volpe-koenig.com



1. The present application is being examined under the pre-AIA first to invent provisions.
2. This application contains claims directed to the following patentably distinct species of Figs. 4 and 5. The species are independent or distinct because the species of Figs. 4 and 5 are different due to motion sensor 43. In addition, these species are not obvious variants of each other based on the current record.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species, or a single grouping of patentably indistinct species, for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, claim 1 appears to be generic.

There is a search and/or examination burden for the patentably distinct species as set forth above because at least the following reason(s) apply: the different structures of the species.

**Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species to be examined even though the requirement may be traversed (37 CFR 1.143) and (ii)**

**identification of the claims encompassing the elected species or grouping of patentably indistinct species**, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

The election may be made with or without traverse. To preserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the election of species requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected species or grouping of patentably indistinct species.

Should applicant traverse on the ground that the species, or groupings of patentably indistinct species from which election is required, are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing them to be obvious variants or clearly admit on the record that this is the case. In either instance, if the

examiner finds one of the species unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103 or pre-AIA 35 U.S.C. 103(a) of the other species.

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan Ho whose telephone number is (571) 272-7365. The examiner can normally be reached on Mon-Fri 7:00AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sinh Tran can be reached on (571) 272-7564. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

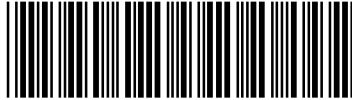
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on

access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-21 7-9197 (toll-free).

If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan V Ho/

Primary Examiner, Art Unit 2622

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b> 15431332	<b>Applicant(s)/Patent Under Reexamination</b> OZLUTURK, FATIH M.
	<b>Examiner</b> TUAN HO	<b>Art Unit</b> 2661

✓	<b>Rejected</b>
=	<b>Allowed</b>

-	<b>Cancelled</b>
÷	<b>Restricted</b>

N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

Claims renumbered in the same order as presented by applicant
  CPA
  T.D.
  R.1.47

CLAIM		DATE							
Final	Original	03/20/2017							
	1	÷							
	2	÷							
	3	÷							
	4	÷							
	5	÷							
	6	÷							
	7	÷							
	8	÷							
	9	÷							
	10	÷							
	11	÷							
	12	÷							
	13	÷							
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**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
Filing Date	2017-02-13
First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

U.S. PATENT DOCUMENTS							
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
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**INFORMATION DISCLOSURE  
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(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
Filing Date	2017-02-13
First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
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1 Corresponds to EP 1004983 and JP 2000-207538  
2 Corresponds to EP 0884897

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
Filing Date	2017-02-13
First Named Inventor	Fatih M. Ozluturk
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Attorney Docket Number	OZL-PT001.17

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
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**INFORMATION DISCLOSURE  
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(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
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Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
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EXAMINER INITIAL	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO
	1004983	05/2000	EP				
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**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
Filing Date	2017-02-13
First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

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EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
		Banham, et al., Digital Image Restoration, IEEE Signal Processing Magazine, March 1997, Pgs. 24-41.
		Biemond et al., "Iterative Methods for Image Deblurring," Proceedings of the IEEE, May 1990, vol 78, no. 5.
		Kundur, et al., Blind Image Deconvolution, IEEE Signal Processing Magazine, May 1996, Pgs. 43-64.
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## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	29037554
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Carey Kulp
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	26-APR-2017
<b>Filing Date:</b>	13-FEB-2017
<b>Time Stamp:</b>	16:26:51
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDS.pdf	60250  918b89a3ca6816aa70a1a58430911b06bd8bafbd	no	3

### Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	MasterList.pdf	95758	no	5
			d9c2cf3fd5463120b901527dff1a498144ae9b7c		
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
<b>Total Files Size (in bytes):</b>				156008	
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p>					

**PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the PATENT APPLICATION of:

Fatih M. Ozluturk

Application No.: 15/431,332

Confirmation No.: 4930

Filed: February 13, 2017

For: METHOD AND APPARATUS TO  
CORRECT DIGITAL VIDEO TO  
COUNTERACT EFFECT OF CAMERA  
SHAKE

Group: 2661

Examiner: Tuan V. Ho

Our File: OZL-PT001.17

Date: April 26, 2017

**INFORMATION DISCLOSURE STATEMENT**

Mail Stop Amendment (via EFS)  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Further to Applicant's Duty of Disclosure pursuant to 37 C.F.R. § 1.56, Applicant wishes to bring to the Examiner's attention the material cited on the enclosed Information Disclosure Statement Form.

This Application is a continuation of U.S. Patent Application No. 15/149,481, filed May 9, 2016, which is a continuation of U.S. Patent Application No. 14/690,818, filed April 20, 2015, which issued May 10, 2016 as U.S. Patent No. 9,338,356, which is a continuation of U.S. Patent Application No. 14/532,654, filed November 4, 2014, which issued April 21, 2015 as U.S. Patent No. 9,013,587, which

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is a continuation of U.S. Patent Application No. 13/442,370, filed April 9, 2012, which issued December 30, 2014 as U.S. Patent No. 8,922,663, which is a continuation of U.S. Patent Application No. 12/274,032, filed November 19, 2008, which issued April 10, 2012 as U.S. Patent No. 8,154,607, which is a continuation of U.S. Patent Application No. 11/089,081, filed March 24, 2005, which issued December 11, 2012 as U.S. Patent No. 8,331,723, which claims priority from Provisional Application No. 60/556,230, which was filed March 25, 2004.

Applicant would like to bring the following Applications to the Examiner's attention: U.S. Patent Application No. 14/584,891, filed December 29, 2014, which issued October 20, 2015 as U.S. Patent No. 9,167,162; U.S. Patent Application No. 14/586,297, filed December 30, 2014, which issued October 6, 2015 as U.S. Patent No. 9,154,699; U.S. Patent Application No. 14/875,204, filed October 5, 2015; U.S. Patent Application No. 12/274,057, filed November 19, 2008, which issued January 14, 2014 as U.S. Patent No. 8,630,484; U.S. Patent Application No. 12/274,074, filed November 19, 2008, which issued November 22, 2011 as U.S. Patent No. 8,064,719; U.S. Patent Application No. 12/274,084, filed November 19, 2008, which issued March 22, 2016 as U.S. Patent No. 9,294,674; U.S. Patent Application No. 12/274,096, filed November 19, 2008, which issued November 22, 2011 as U.S. Patent No. 8,064,720; U.S. Patent Application No. 14/861,731, filed September 22, 2015; U.S. Patent Application No. 15/207,057, filed July 11, 2016; U.S. Patent Application No. 14/679,551, filed April 6, 2015, which issued July 12, 2016 as U.S.

Patent No. 9,392,175; and U.S. Patent Application No. 13/653,144, filed October 16, 2012, which issued April 7, 2015 as U.S. Patent No. 9,001,221.

Pursuant to 37 C.F.R. §1.98(d) copies of documents cited in the parent application are not enclosed, but copies will be provided upon request. Documents that were not cited in the parent application are indicated by an asterisk (\*) on the enclosed Information Disclosure Statement Form. Pursuant to 37 C.F.R. §1.98(a)(2)(ii), copies of the cited U.S. publications and/or patent documents have not been included.

It is respectfully requested that the Examiner consider these documents and return an initialed copy of the Information Disclosure Statement Form indicating consideration of the cited materials.

Respectfully submitted,

Fatih M. Ozluturk

By Thomas A. Mattioli  
Thomas A. Mattioli  
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Volpe and Koenig, P.C.  
United Plaza  
30 South 17th Street  
Philadelphia, PA 19103

TAM/PCK  
Enclosure

**PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:

**FATIH M. OZLUTURK**

**Application No.:** 15/431,332

**Filed:** February 13, 2017

**Confirmation No.:** 4930

**For:** METHOD AND APPARATUS TO  
CORRECT DIGITAL VIDEO TO  
COUNTERACT EFFECT OF CAMERA  
SHAKE

**Group:** 2661

**Examiner:** Tuan V. Ho

Our File: OZL-PT001.17

Date: April 28, 2017

**REPLY UNDER 37 C.F.R. § 1.111**

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

This Reply is being filed in response to the March 23, 2017 Restriction Requirement.

**REMARKS/ARGUMENTS**

In response to the Restriction Requirement, the Applicant elects Figure 4 in the present Reply, and submits claims 1-29 for prosecution on the merits in this application. This election is being made without traverse.

If anything further is required in order to fully respond to this Action, the Examiner is invited to contact the undersigned by telephone at the Examiner's convenience, so that any such matters can be expeditiously addressed.

Prompt examination and allowance of this Application is respectfully requested.

Respectfully submitted,

FATIH M. OZLUTURK

BY Thomas A. Mattioli  
Thomas A. Mattioli  
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30 South 17th Street  
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TAM/amw

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	29066057
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	28-APR-2017
<b>Filing Date:</b>	13-FEB-2017
<b>Time Stamp:</b>	16:16:51
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		OZL-PT001_17_Reply_EFS.PDF	56067  fbd11fa948e6e3aa72c572688661c1f54c13 a877	yes	2

<b>Multipart Description/PDF files in .zip description</b>			
<b>Document Description</b>		<b>Start</b>	<b>End</b>
Response to Election / Restriction Filed		1	1
Applicant Arguments/Remarks Made in an Amendment		2	2

**Warnings:**

**Information:**

<b>Total Files Size (in bytes):</b>	56067
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**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**



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

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
15/431,332 02/13/2017 Fatih M. Ozluturk OZL-PT001.17 4930

3624 7590 06/02/2017
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

Table with 1 column: EXAMINER

HO, TUAN V

Table with 2 columns: ART UNIT, PAPER NUMBER

2661

Table with 2 columns: NOTIFICATION DATE, DELIVERY MODE

06/02/2017

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

eoffice@volpe-koenig.com



1. The present application is being examined under the pre-AIA first to invent provisions.
  
2. Applicant's election of the species of Fig. 4, claims 1-29 without traverse is acknowledged. Claims 1-29 are now examined on the merits.
  
3. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.
  
4. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-10, 13-24 and 17-29 are is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Dutta (2003/0076408) cited by Applicant.

With regard to claim 15, Dutta discloses in Figs. 1-4, a camera system that comprises the imaging device (device 100, [0015]), comprising: an image sensor configured to capture a sequence of images (image sensor 310, [0015]), wherein the sequence of images comprise a video (video images, [0015]); one or more motion sensors configured to detect motion information for one or more images of the sequence of images, wherein the motion information represents motion of the imaging device during capturing of the one or more images of the sequence of images (motion sensor assembly 302, [0017 and 0020]); a processor configured to: determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information (processing engine 304, [0021]); modify one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values ([0023]); and combine the modified images to obtain a final video; and a memory configured to store the final video (entire image is reconstructed, [0023]).

With regard to claim 16, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is configured to determine the vertical and horizontal shift values for one or more images of the sequence of images for which the motion information is detected (processing engine 304, [0021]).

With regard to claim 17, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is configured to modify one or more images of the sequence of images for which the vertical and horizontal shift values are determined (an entire image is reconstructed with at least two images, [0023]).

With regard to claim 18, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is configured to modify one or more images of the sequence of images such that effect of motion of the device during capturing of the one or more images of the sequence of images is reduced in the final video (reconstructed entire image, [0023]).

With regard to claim 19, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is configured to determine a vertical shift value and a horizontal shift value for each of the images of the sequence of images (processing engine 304, [0021]).

With regard to claim 20, Dutta discloses in Figs. 1-4, a camera system that comprises the motion information detected by the one or more motion sensors represents motion of the device at time of capturing of one or more images of the sequence of images (X and Y shifting motion value are obtained during shooting images, [0020]).

With regard to claim 21, Dutta discloses in Figs. 1-4, a camera system that comprises the one or more images of the sequence of images is at least two images, and wherein the motion information detected by the one or more motion sensors represents motion of the device between capturing of consecutive images (reconstructed image is processed based at least two images, [0023]).

With regard to claim 22, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is configured to determine a vertical shift value and a horizontal shift value for an image such that the vertical shift value and the horizontal shift value indicate how much the image is displaced due to motion of the device during capturing of the image (X and Y shifting direction value, [0020]).

With regard to claim 23, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is configured to modify one or more

images of the sequence of images by shifting a reference point in each image according to the vertical shift value and the horizontal shift value for the image in a direction that reduces the effect of motion of the device in the final video (reconstruction of an image is inherently shifting a reference point so as to obtain a new one with reducing effect of motions, [0023]).

With regard to claim 24, Dutta discloses in Figs. 1-4, a camera system that comprises the device further comprises a display configured to display the final video (display 104 as shown in Fig. 2).

With regard to claim 27, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is configured to determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the focal distance of a lens of the imaging device (focal distance of a lens, [0017]).

With regard to claim 28, Dutta discloses in Figs. 1-4, a camera system that comprises the device further comprises a display configured to receive user input, and the device is configured to modify one or more images of the sequential images and to obtain a final video based at least in part on the user input (display operation panel is inherently included in the device so as a user can control display 104, [0023, 0024 and 0026]).

With regard to claim 29, Dutta discloses in Figs. 1-4, a camera system that comprises the processor is two or more processors (processing engine 304 works in conjunction with camera DSP 312, [0017-0018]).

Method claims 1-10 and 13-14 correspond to apparatus claims 15-24 and 27-29 and are analyzed the same as discussed with respect to apparatus claims 15-18, 21-23, 28, 27-28.

It should be noted that claimed user interface is met by a camera display operation panel since the panel is used to control display 104.

5. Claims 11,12 and 25, 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kojima et al (US 2005/0140793) discloses an electronic camera that comprises a shaking compensation mechanism.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan Ho whose telephone number is (571) 272-7365. The examiner can normally be reached on Mon-Fri 7:00AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sinh Tran can be reached on (571) 272-7564. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-21 7-9197 (toll-free).

Application/Control Number: 15/431,332  
Art Unit: 2661

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If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan V Ho/

Primary Examiner, Art Unit 2622

<b>Notice of References Cited</b>	Application/Control No. 15/431,332	Applicant(s)/Patent Under Reexamination OZLUTURK, FATIH M.	
	Examiner TUAN HO	Art Unit 2661	Page 1 of 1

**U.S. PATENT DOCUMENTS**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A US-2005/0140793 A1	06-2005	Kojima, Kazuhiko	H04N5/23287	348/208.99
B	US-				
C	US-				
D	US-				
E	US-				
F	US-				
G	US-				
H	US-				
I	US-				
J	US-				
K	US-				
L	US-				
M	US-				


**FOREIGN PATENT DOCUMENTS**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
N					
O					
P					
Q					
R					
S					
T					

**NON-PATENT DOCUMENTS**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)				
U					
V					
W					
X					

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<b>Search Notes</b>  	<b>Application/Control No.</b>  15431332	<b>Applicant(s)/Patent Under Reexamination</b>  OZLUTURK, FATIH M.
	<b>Examiner</b>  TUAN HO	<b>Art Unit</b>  2661

CPC- SEARCHED		
Symbol	Date	Examiner
H04N 5/23287, 5/23258, 5/23267	3/9/17	TH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
	Class 348	3/9/17	TH
	Class 382	3/9/17	EAST

SEARCH NOTES		
Search Notes	Date	Examiner
EAST and Invnetorship Search	3/9/17	TH

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	See Search History	3/9/17	TH

	/TUAN HO/ Primary Examiner, Art Unit 2661
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**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
Filing Date	2017-02-13
First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

U.S. PATENT DOCUMENTS							
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		4,612,575	09/1986	Ishman et al.			
		4,646,274	02/1987	Martinez			
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05/30/2017

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**INFORMATION DISCLOSURE  
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First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
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/TUAN V HO/

05/30/2017

1 Corresponds to EP 1004983 and JP 2000-207538

2 Corresponds to EP 0884897

**INFORMATION DISCLOSURE  
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Application Number	15/431,332
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First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
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05/30/2017

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**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
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First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
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EXAMINER INITIAL	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO
	1004983	05/2000	EP				
	11-024122	01/1999	JP				
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	2004-056581	02/2004	JP				
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<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> (Not for submission under 37 CFR 1.99)	Application Number	15/431,332
	Filing Date	2017-02-13
	First Named Inventor	Fatih M. Ozluturk
	Art Unit	2661
	Examiner Name	Tuan V. Ho
	Attorney Docket Number	OZL-PT001.17

OTHER DOCUMENTS		
EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
		Banham, et al., Digital Image Restoration, IEEE Signal Processing Magazine, March 1997, Pgs. 24-41.
		Biemond et al., "Iterative Methods for Image Deblurring," Proceedings of the IEEE, May 1990, vol 78, no. 5.
		Kundur, et al., Blind Image Deconvolution, IEEE Signal Processing Magazine, May 1996, Pgs. 43-64.
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/TUAN V HO/

05/30/2017

## EAST Search History

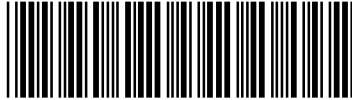
## EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	14	"1514481".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 05:47
L2	2	"9338356".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 05:49
L3	9312	348/\$.ccls. and (vertical and horizontal and (shift or movement or shake) and motion and sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 06:50
L4	6156	348/\$.ccls. and (vertical and horizontal and (shift or movement or shake) and motion and sensor and combin\$3 and image)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 06:50
L5	5060	348/\$.ccls. and (vertical and horizontal and (shift or movement or shake) and motion and sensor and combin\$3 and image and value)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 06:52
L6	4628	348/\$.ccls. and (vertical and horizontal and (shift or movement or shake) and motion and sensor and combin\$3 and image and value and camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 06:52
L7	482	348/208.99-208.16.ccls. and (vertical and horizontal and (shift or movement or shake) and motion and sensor and combin\$3 and image and value and camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 06:54
L8	333812	H04N5/23287,23258,23267.cpc. or 348/\$.ccls. or "382".ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 07:09
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		motion same sensor and (combin\$3 and image and value and camera))	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L13	0	8 and (fatih near3 ozlutuk)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/09 07:17
L14	32	8 and (fatih near3 ozluturk)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/09 07:18
L15	0	14 and (vertical same horizontal same (shift or movement or shake) same motion same sensor and (combin\$3 and image and value and camera)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/03/09 07:18

**3/ 9/ 2017 7:19:30 AM**

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<b>Index of Claims</b> 	<b>Application/Control No.</b> 15431332	<b>Applicant(s)/Patent Under Reexamination</b> OZLUTURK, FATIH M.
	<b>Examiner</b> TUAN HO	<b>Art Unit</b> 2661

✓	<b>Rejected</b>
=	<b>Allowed</b>

-	<b>Cancelled</b>
÷	<b>Restricted</b>

N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

Claims renumbered in the same order as presented by applicant
  CPA
  T.D.
  R.1.47

CLAIM		DATE							
Final	Original	03/20/2017	05/30/2017						
	1	÷	✓						
	2	÷	✓						
	3	÷	✓						
	4	÷	✓						
	5	÷	✓						
	6	÷	✓						
	7	÷	✓						
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	10	÷	✓						
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	25	÷	○						
	26	÷	○						
	27	÷	✓						
	28	÷	✓						
	29	÷	✓						





UNITED STATES PATENT AND TRADEMARK OFFICE

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Table with 4 columns: APPLICATION NUMBER (15/431,332), FILING OR 371(C) DATE (02/13/2017), FIRST NAMED APPLICANT (Fatih M. Ozluturk), ATTY. DOCKET NO./TITLE (OZL-PT001.17)

CONFIRMATION NO. 4930

PUBLICATION NOTICE



3624
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

Title:METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE

Publication No.US-2017-0163897-A1

Publication Date:06/08/2017

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
15/431,332 02/13/2017 Fatih M. Ozluturk OZL-PT001.17 4930

3624 7590 07/21/2017
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

Table with 1 column: EXAMINER

HO, TUAN V

Table with 2 columns: ART UNIT, PAPER NUMBER

2661

Table with 2 columns: NOTIFICATION DATE, DELIVERY MODE

07/21/2017

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

eoffice@volpe-koenig.com

<b>Applicant-Initiated Interview Summary</b>	<b>Application No.</b> 15/431,332	<b>Applicant(s)</b> OZLUTURK, FATIH M.	
	<b>Examiner</b> TUAN HO	<b>Art Unit</b> 2661	

All participants (applicant, applicant's representative, PTO personnel):

(1) TUAN HO. (3)\_\_\_\_\_.

(2) Mr. Mattioli. (4)\_\_\_\_\_.

Date of Interview: 19 July 2017.

Type:  Telephonic  Video Conference  
 Personal [copy given to:  applicant  applicant's representative]

Exhibit shown or demonstration conducted:  Yes  No.  
If Yes, brief description: \_\_\_\_\_.

Issues Discussed 101 112 102 103 Others  
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1.

Identification of prior art discussed: Dutta Reference.

**Substance of Interview**

(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Upon a telephone interview, the examiner agreed with Mr. Mattioli that the proposed claim 1 would overcome the rejections.

**Applicant recordation instructions:** The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

**Examiner recordation instructions:** Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Attachment

/TUAN HO/  
Primary Examiner, Art Unit 2661

## Summary of Record of Interview Requirements

### Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

### Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,  
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

### Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

<b>PATENT ASSIGNMENT COVER SHEET</b>
--------------------------------------

Electronic Version v1.1  
 Stylesheet Version v1.2

EPAS ID: PAT4520055

<b>SUBMISSION TYPE:</b>	NEW ASSIGNMENT
<b>NATURE OF CONVEYANCE:</b>	ASSIGNMENT
<b>CONVEYING PARTY DATA</b>	
<b>Name</b>	<b>Execution Date</b>
FATIH M OZLUTURK	07/25/2017
<b>RECEIVING PARTY DATA</b>	
<b>Name:</b>	CLEAR IMAGING RESEARCH, LLC
<b>Street Address:</b>	5 HILLDALE LN
<b>City:</b>	SANDS POINT
<b>State/Country:</b>	NEW YORK
<b>Postal Code:</b>	11050
<b>PROPERTY NUMBERS Total: 6</b>	
<b>Property Type</b>	<b>Number</b>
Application Number:	14875204
Application Number:	15149481
Application Number:	15207057
Application Number:	15431332
Application Number:	14861731
Application Number:	60556230
<b>CORRESPONDENCE DATA</b>	
<b>Fax Number:</b>	
<i>Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.</i>	
<b>Phone:</b>	516 603 8383
<b>Email:</b>	ozluturk@hotmail.com
<b>Correspondent Name:</b>	FATIH M OZLUTURK
<b>Address Line 1:</b>	5 HILLDALE LN
<b>Address Line 4:</b>	SANDS POINT, NEW YORK 11050
<b>NAME OF SUBMITTER:</b>	FATIH M OZLUTURK
<b>SIGNATURE:</b>	/FatihOzluturk/
<b>DATE SIGNED:</b>	07/25/2017
This document serves as an Oath/Declaration (37 CFR 1.63).	
<b>Total Attachments: 1</b>	



## ASSIGNMENT OF PATENT RIGHTS

Fatih Ozluturk ("Assignor") is owner of the following U.S. Patent Applications (the "Patent Applications"):

Application no 14/875,204 filed on 10/5/2015  
Application no 15/149,481 filed on 5/9/2016  
Application no 15/207,057 filed on 7/11/2016  
Application no 15/431,332 filed on 2/13/2017  
Application no 14/861,731 filed on 9/22/2015  
Provisional application no 60/556,230 filed on 3/25/2004

Clear Imaging Research, LLC, a Limited Liability Company registered in Delaware, with offices in 5 Hilldale Ln, Sands Point, NY ("Assignee") desires to acquire rights in and to the Patent.

Therefore, for valuable consideration, the receipt of which is acknowledged, Assignor sells, assigns and transfers his entire right, title and interest in the Patents to Assignee. The right, title and interest conveyed in this Assignment is to be held and enjoyed by Assignee and Assignee's successors, legal representatives and assigns, to the full end of the term for which the Patent is granted, as fully and exclusively as it would have been held and enjoyed by Assignor had this assignment not been made.

Date: 7/25/2017



Fatih Ozluturk

On this 25 day of July 2017, before me, Lynn J Moessner, the undersigned Notary Public, personally appeared Fatih Ozluturk, proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument, and acknowledged to me that he executed the same. Witness my hand and official seal in Port Washington County of Nassau on the date set forth in this certificate.



Notary Public

LYNN J MOESSNER  
Notary Public, State of New York  
No. 01M04970982  
Qualified in Nassau County  
My Commission Expires 8/20/2018

**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**  
( Not for submission under 37 CFR 1.99)

Application Number	15431332
Filing Date	2017-02-13
First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

**U.S.PATENTS** Remove

Examiner Initial*	Cite No	Patent Number	Kind Code <sup>1</sup>	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

**U.S.PATENT APPLICATION PUBLICATIONS** Remove

Examiner Initial*	Cite No	Publication Number	Kind Code <sup>1</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010010546	A1	2001-08-02	Chen	
	2	20020097324	A1	2002-07-25	Onuki	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

**FOREIGN PATENT DOCUMENTS** Remove

Examiner Initial*	Cite No	Foreign Document Number <sup>3</sup>	Country Code <sup>2</sup> i	Kind Code <sup>4</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T <sup>5</sup>
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

**NON-PATENT LITERATURE DOCUMENTS** Remove

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number	15431332
	Filing Date	2017-02-13
	First Named Inventor	Fatih M. Ozluturk
	Art Unit	2661
	Examiner Name	Tuan V. Ho
	Attorney Docket Number	OZL-PT001.17

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>5</sup>
	1		

If you wish to add additional non-patent literature document citation information please click the Add button

**EXAMINER SIGNATURE**

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number	15431332
	Filing Date	2017-02-13
	First Named Inventor	Fatih M. Ozluturk
	Art Unit	2661
	Examiner Name	Tuan V. Ho
	Attorney Docket Number	OZL-PT001.17

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

- The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas A. Mattioli/	Date (YYYY-MM-DD)	2017-07-28
Name/Print	Thomas A. Mattioli	Registration Number	56,773

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	15431332
<b>Filing Date:</b>	13-Feb-2017
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Filer:</b>	Thomas A Mattioli/Carey Kulp
<b>Attorney Docket Number:</b>	OZL-PT001.17

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Miscellaneous:</b>				
Submission- Information Disclosure Stmt	1806	1	180	180
<b>Total in USD (\$)</b>				<b>180</b>

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	29923032
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Carey Kulp
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	28-JUL-2017
<b>Filing Date:</b>	13-FEB-2017
<b>Time Stamp:</b>	17:21:32
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$180
RAM confirmation Number	073117INTEFSW17240600
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

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**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDS.pdf	59780	no	3
			0ead9b411011197264b15939b8f860390b8ff026		

**Warnings:**

**Information:**

2	Information Disclosure Statement (IDS) Form (SB08)	SB08.pdf	1080109	no	4
			ea0a7d8de9a80f058b226a9c902afeacc532977f		

**Warnings:**

**Information:**

3	Fee Worksheet (SB06)	fee-info.pdf	30790	no	2
			4bb7e1998e1233d74c8e91f16740c7fc09587310		

**Warnings:**

**Information:**

<b>Total Files Size (in bytes):</b>	1170679
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**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In the PATENT APPLICATION of:

Fatih M. Ozluturk

Application No.: 15/431,332

Confirmation No.: 4930

Filed: February 13, 2017

For: METHOD AND APPARATUS TO  
CORRECT DIGITAL VIDEO TO  
COUNTERACT EFFECT OF CAMERA  
SHAKE

Group: 2661

Examiner: Tuan V. Ho

Our File: OZL-PT001.17

Date: July 28, 2017

**INFORMATION DISCLOSURE STATEMENT**

Mail Stop Amendment (via EFS)  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Further to Applicant's Duty of Disclosure pursuant to 37 C.F.R. § 1.56, Applicant wishes to bring to the Examiner's attention the material cited on the enclosed PTO Form SB-08. Pursuant to 37 C.F.R. §1.98(a)(2)(ii), copies of the newly cited U.S. publications and/or patent documents have not been included.

This Application is a continuation of U.S. Patent Application No. 15/149,481, filed May 9, 2016, which is a continuation of U.S. Patent Application No. 14/690,818, filed April 20, 2015, which issued May 10, 2016 as U.S. Patent No. 9,338,356, which is a continuation of U.S. Patent Application No. 14/532,654, filed  
4796721-1

November 4, 2014, which issued April 21, 2015 as U.S. Patent No. 9,013,587, which is a continuation of U.S. Patent Application No. 13/442,370, filed April 9, 2012, which issued December 30, 2014 as U.S. Patent No. 8,922,663, which is a continuation of U.S. Patent Application No. 12/274,032, filed November 19, 2008, which issued April 10, 2012 as U.S. Patent No. 8,154,607, which is a continuation of U.S. Patent Application No. 11/089,081, filed March 24, 2005, which issued December 11, 2012 as U.S. Patent No. 8,331,723, which claims priority from Provisional Application No. 60/556,230, which was filed March 25, 2004.

Applicant would like to bring the following Applications to the Examiner's attention: U.S. Patent Application No. 14/584,891, filed December 29, 2014, which issued October 20, 2015 as U.S. Patent No. 9,167,162; U.S. Patent Application No. 14/586,297, filed December 30, 2014, which issued October 6, 2015 as U.S. Patent No. 9,154,699; U.S. Patent Application No. 14/875,204, filed October 5, 2015; U.S. Patent Application No. 12/274,057, filed November 19, 2008, which issued January 14, 2014 as U.S. Patent No. 8,630,484; U.S. Patent Application No. 12/274,074, filed November 19, 2008, which issued November 22, 2011 as U.S. Patent No. 8,064,719; U.S. Patent Application No. 12/274,084, filed November 19, 2008, which issued March 22, 2016 as U.S. Patent No. 9,294,674; U.S. Patent Application No. 12/274,096, filed November 19, 2008, which issued November 22, 2011 as U.S. Patent No. 8,064,720; U.S. Patent Application No. 14/861,731, filed September 22, 2015; U.S. Patent Application No. 15/207,057, filed July 11, 2016; U.S. Patent

**Applicant: Fatih M. Ozluturk**  
**Application No.: 15/431,332**

Application No. 14/679,551, filed April 6, 2015, which issued July 12, 2016 as U.S. Patent No. 9,392,175; and U.S. Patent Application No. 13/653,144, filed October 16, 2012, which issued April 7, 2015 as U.S. Patent No. 9,001,221.

It is respectfully requested that the Examiner consider these documents and return an initialed copy of the PTO Form SB-08 indicating consideration of the cited materials.

Respectfully submitted,

Fatih M. Ozluturk

By Thomas A. Mattioli  
Thomas A. Mattioli  
Registration No. 56,773  
(215) 568-6400

Volpe and Koenig, P.C.  
United Plaza  
30 South 17th Street  
Philadelphia, PA 19103

TAM/PCK  
Enclosure

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:

Fatih M. Ozluturk

**Application No.:** 15/431,332

**Confirmation No.:** 4930

**Filed:** February 13, 2017

**For:** METHOD AND APPARATUS TO  
CORRECT DIGITAL VIDEO TO  
COUNTERACT EFFECT OF CAMERA  
SHAKE

**Group:** 2661

**Examiner:** Tuan V. Ho

**Our File:** OZL-PT001.17

**Date:** September 1, 2017

**RESPONSE PURSUANT TO 37 C.F.R. §1.111**

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

This Response is being timely filed in response to the Office Action dated June 2, 2017.

Please amend the application without prejudice or disclaimer as follows:

**Amendments to the Claims:**

This listing of the claims will replace all prior versions of the claims in the application:

1. (Currently Amended) A method for use in an imaging device comprising an image sensor, a processor, a memory, and one or more motion sensors, the method comprising:

capturing a sequence of images with the image sensor, wherein the sequence of images comprise a video, and storing the images in the memory;

detecting, by the one or more motion sensors, motion information for one or more images of the sequence of images, wherein the motion information represents motion of the device during capturing of the one or more images of the sequence of images, and storing the motion information in the memory synchronously with the storing of the one or more images;

determining, by the processor, a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modifying, by the processor, one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values;

combining, by the processor, the modified images to obtain a final video; and

storing the final video in the memory.

2. (Original) The method of claim 1, wherein the processor determines the vertical and horizontal shift values for one or more images for which the motion information is detected.

3. (Original) The method of claim 1, wherein the processor modifies one or more images for which the vertical and horizontal shift values are determined.

4. (Original) The method of claim 1, wherein the processor modifies one or more images of the sequence of images such that effect of motion of the device during capturing of the one or more images of the sequence of images is reduced in the final video.

5. (Original) The method of claim 1, wherein the processor determines a vertical shift value and a horizontal shift value for each image of the sequence of images.

6. (Original) The method of claim 1, wherein the motion information represents motion of the device at time of capturing of one or more images of the sequence of images.

7. (Original) The method of claim 1, wherein the one or more images of the sequence of images is at least two images, and wherein the motion information represents motion of the device between capturing of consecutive images.

8. (Original) The method of claim 1, wherein the vertical and horizontal shift values for an image indicate how much the image is displaced due to motion of the device during capturing of the image.

9. (Original) The method of claim 1, wherein the modifying by the processor of the one or more images of the sequence of images comprises shifting a reference point in each image according to the vertical shift value and the horizontal shift value for the image in a direction that reduces the effect of motion of the device in the final video.

10. (Original) The method of claim 1, wherein the method further comprises displaying the final video in a user interface.

11. (Original) The method of claim 1, wherein the method further comprises modifying the sequence of images using a video compression technique.

12. (Canceled).

13. (Original) The method of claim 1, wherein determining a vertical shift value and a horizontal shift value for one or more images of the sequence of images is based at least in part on the focal distance of a lens of the imaging device.

14. (Original) The method of claim 1, wherein the method further comprises receiving user input in a user interface, and at least one of modifying one or more images of the sequential images or combining the modified images to obtain a final video is based at least in part on the user input.

15. (Currently Amended) An imaging device, comprising:

an image sensor configured to capture a sequence of images, wherein the sequence of images comprise a video, and store the images in a memory;

one or more motion sensors configured to detect motion information for one or more images of the sequence of images, wherein the motion information represents motion of the imaging device during capturing of the one or more images of the sequence of images, and store the motion

information in the memory synchronously with the storing of the one or more images; and

a processor configured to:

determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modify one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values; and

combine the modified images to obtain a final video; and

[[a]] wherein the memory is further configured to store the final video.

16. (Original) The imaging device of claim 15, wherein the processor is configured to determine the vertical and horizontal shift values for one or more images of the sequence of images for which the motion information is detected.

17. (Original) The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images for which the vertical and horizontal shift values are determined.

18. (Original) The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images such

that effect of motion of the device during capturing of the one or more images of the sequence of images is reduced in the final video.

19. (Original) The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for each of the images of the sequence of images.

20. (Original) The imaging device of claim 15, wherein the motion information detected by the one or more motion sensors represents motion of the device at time of capturing of one or more images of the sequence of images.

21. (Original) The imaging device of claim 15, wherein the one or more images of the sequence of images is at least two images, and wherein the motion information detected by the one or more motion sensors represents motion of the device between capturing of consecutive images.

22. (Original) The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for an image such that the vertical shift value and the horizontal shift value indicate how much the image is displaced due to motion of the device during capturing of the image.

23. (Original) The imaging device of claim 15, wherein the processor is configured to modify one or more images of the sequence of images by shifting a reference point in each image according to the vertical shift value and the horizontal shift value for the image in a direction that reduces the effect of motion of the device in the final video.

24. (Original) The imaging device of claim 15, wherein the device further comprises a display configured to display the final video.

25. (Original) The imaging device of claim 15, wherein the processor is further configured to modify the sequence of images using a video compression technique.

26. (Canceled).

27. (Original) The imaging device of claim 15, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the focal distance of a lens of the imaging device.

28. (Original) The imaging device of claim 15, wherein the device further comprises a display configured to receive user input, and the device is configured to modify one or more images of the sequential images and to obtain a final video based at least in part on the user input.

29. (Original) The imaging device of claim 15, wherein the processor is two or more processors.

30. (New) A method for use in an imaging device comprising an image sensor, a processor, a memory, and one or more motion sensors, the method comprising:

capturing a sequence of images with the image sensor, wherein the sequence of images comprise a video;

detecting, by the one or more motion sensors, motion information for one or more images of the sequence of images, wherein the motion information represents motion of the device during capturing of the one or more images of the sequence of images;

determining, by the processor, a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modifying, by the processor, one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values;

combining, by the processor, the modified images, and applying a video compression technique to obtain a final video; and

storing the final video in the memory.

31. (New) An imaging device, comprising:

an image sensor configured to capture a sequence of images, wherein the sequence of images comprise a video;

one or more motion sensors configured to detect motion information for one or more images of the sequence of images, wherein the motion information represents motion of the imaging device during capturing of the one or more images of the sequence of images;

a processor configured to:

determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the motion information;

modify one or more images of the sequence of images based at least in part on the vertical and the horizontal shift values; and

combine the modified images, and apply a video compression technique to obtain a final video; and

a memory configured to store the final video.

32. (New) The imaging device of claim 31, wherein the one or more images of the sequence of images is at least two images, and wherein the motion information detected by the one or more motion sensors represents motion of the device between capturing of consecutive images.

33. (New) The imaging device of claim 31, wherein the processor is configured to determine a vertical shift value and a horizontal shift value for one or more images of the sequence of images based at least in part on the focal distance of a lens of the imaging device.

34. (New) The imaging device of claim 31, wherein the device further comprises a display configured to receive user input, and the device is configured to modify one or more images of the sequential images and to obtain a final video based at least in part on the user input.

**REMARKS**

Claims 1-11, 13-25, and 27-34 are currently pending in this application. Claims 12 and 26 are canceled in the present Reply. Claims 1 and 15 are amended. Claims 30-34 are newly added.

**Examiner Interview**

The Examiner and Applicant's representative Thomas A. Mattioli conducted a telephone interview on July 19, 2017, where potential claim amendments and the Dutta reference were discussed.

**Claim Objections**

The Examiner objected to claims 11, 12, 25 and 26 as being dependent upon a rejected base claims, but indicated they would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The Applicant thanks the Examiner for the indication of allowability and has amended independent claims 1 and 15 to incorporate the allowable subject matter of claims 12 and 26, respectively. In addition, the Applicant has added new independent claims 30 and 31 which include the subject matter indicated to be allowable in claims 11 and 25, respectively.

The Applicant therefore respectfully requests withdrawal of the claim objections.

**Claim Rejections – 35 U.S.C. §102**

Claims 1-10, 13-24 and 17-29 are rejected under pre-AIA 35 U.S.C. §102(b) as being anticipated by Dutta (US Publication No. 2003/0076408). The Applicant has amended claims 1 and 15 to incorporate the allowable subject matter of claims 12 and 26, respectively. The Applicant therefore asserts that the pre-AIA 35 U.S.C. §102(b) rejections are rendered moot and respectfully requests their withdrawal.

**CONCLUSION**

If the Examiner believes that any additional minor formal matters need to be addressed in order to place this application in condition for allowance, or that a telephonic interview will help to materially advance the prosecution of this application, the Examiner is invited to contact the undersigned by telephone at the Examiner's convenience.

In view of the foregoing, Applicant submits that the present application, including claims 1-11, 13-25, and 27-34, is in condition for allowance and a notice to that effect is requested.

Respectfully submitted,

Fatih M. Ozluturk

By /Thomas A. Mattioli/  
Thomas A. Mattioli  
Registration No. 56,773  
(215) 568-6400

Volpe and Koenig, P.C.  
United Plaza  
30 South 17th Street  
Philadelphia, PA 19103-4009

TAM/amw

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	15431332			
<b>Filing Date:</b>	13-Feb-2017			
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE			
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk			
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf			
<b>Attorney Docket Number:</b>	OZL-PT001.17			
Filed as Small Entity				
<b>Filing Fees for Utility under 35 USC 111(a)</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
CLAIMS IN EXCESS OF 20	2202	3	40	120
INDEPENDENT CLAIMS IN EXCESS OF 3	2201	2	210	420
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				
<b>Miscellaneous:</b>				
<b>Total in USD (\$)</b>				<b>540</b>

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	30255011
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	01-SEP-2017
<b>Filing Date:</b>	13-FEB-2017
<b>Time Stamp:</b>	15:39:03
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$540
RAM confirmation Number	090517INTEFSW15412500
Deposit Account	220493
Authorized User	Angel Wolf

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

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**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		OZL-PT001_17_Reply_EFS.PDF	80851 e01cdc83d36ae0211afc1d79914e2c52e8c20cf3	yes	14
<b>Multipart Description/PDF files in .zip description</b>					
<b>Document Description</b>			<b>Start</b>	<b>End</b>	
Amendment/Req. Reconsideration-After Non-Final Reject			1	1	
Claims			2	11	
Applicant Arguments/Remarks Made in an Amendment			12	14	
<b>Warnings:</b>					
<b>Information:</b>					
2	Fee Worksheet (SB06)	fee-info.pdf	31984 e187291baef72a052892339b5b9dddf68db0eac9f	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			112835		

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

<b>PATENT APPLICATION FEE DETERMINATION RECORD</b> Substitute for Form PTO-875	Application or Docket Number <b>15/431,332</b>	Filing Date <b>02/13/2017</b>	<input type="checkbox"/> To be Mailed
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ENTITY:  LARGE  SMALL  MICRO

**APPLICATION AS FILED – PART I**

FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	
<input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =	
<input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

**APPLICATION AS AMENDED – PART II**

	(Column 1)	(Column 2)	(Column 3)	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
<b>AMENDMENT</b>	<b>09/01/2017</b>	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR			
	Total (37 CFR 1.16(i))	* 32	Minus	** 29	= 3	X \$40 = 120
	Independent (37 CFR 1.16(h))	* 4	Minus	***3	= 1	X \$210 = 210
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))					
<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	<b>330</b>

	(Column 1)	(Column 2)	(Column 3)	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
<b>AMENDMENT</b>		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR			
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))					
<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.  
 \*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".  
 \*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE  
SHARON HARRIS

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



NOTICE OF ALLOWANCE AND FEE(S) DUE

3624 7590 09/26/2017
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

Table with 2 columns: EXAMINER (HO, TUAN V), ART UNIT (2661), PAPER NUMBER (4930)

DATE MAILED: 09/26/2017

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.

15/431,332 02/13/2017 Fatih M. Ozluturk OZL-PT001.17 4930
TITLE OF INVENTION: METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE

Table with 7 columns: APPLN. TYPE, ENTITY STATUS, ISSUE FEE DUE, PUBLICATION FEE DUE, PREV. PAID ISSUE FEE, TOTAL FEE(S) DUE, DATE DUE

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.
If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.
If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".
For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

**PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 or Fax (571)-273-2885**

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

3624 7590 09/26/2017  
**VOLPE AND KOENIG, P.C.**  
 UNITED PLAZA  
 30 SOUTH 17TH STREET, 18th Floor  
 PHILADELPHIA, PA 19103

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/431,332	02/13/2017	Fatih M. Ozluturk	OZL-PT001.17	4930

TITLE OF INVENTION: METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	12/26/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
HO, TUAN V	2661	348-208200

<p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p><input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p><input type="checkbox"/> "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. <b>Use of a Customer Number is required.</b></p>	<p>2. For printing on the patent front page, list</p> <p>(1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____</p> <p>(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____</p> <p>3 _____</p>
---	---

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE \_\_\_\_\_ (B) RESIDENCE: (CITY and STATE OR COUNTRY) \_\_\_\_\_

Please check the appropriate assignee category or categories (will not be printed on the patent) :  Individual  Corporation or other private group entity  Government

<p>4a. The following fee(s) are submitted:</p> <p><input type="checkbox"/> Issue Fee</p> <p><input type="checkbox"/> Publication Fee (No small entity discount permitted)</p> <p><input type="checkbox"/> Advance Order - # of Copies _____</p>	<p>4b. Payment of Fee(s): (<b>Please first reapply any previously paid issue fee shown above</b>)</p> <p><input type="checkbox"/> A check is enclosed.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input type="checkbox"/> The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).</p>
---	--

5. **Change in Entity Status** (from status indicated above)

Applicant certifying micro entity status. See 37 CFR 1.29

Applicant asserting small entity status. See 37 CFR 1.27

Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_ Registration No. \_\_\_\_\_



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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.

3624 7590 09/26/2017
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

EXAMINER

HO, TUAN V

ART UNIT PAPER NUMBER

2661

DATE MAILED: 09/26/2017

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

<b>Notice of Allowability</b>	<b>Application No.</b> 15/431,332	<b>Applicant(s)</b> OZLUTURK, FATIH M.	
	<b>Examiner</b> TUAN HO	<b>Art Unit</b> 2661	<b>AIA (First Inventor to File) Status</b> No

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1.  This communication is responsive to Papers filed on 9/1/17.  
 A declaration(s)/affidavit(s) under 37 CFR 1.130(b) was/were filed on \_\_\_\_\_.
2.  An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.
3.  The allowed claim(s) is/are 1-11, 13-25, 27-34 (renumbered as 1-32). As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to PPHfeedback@uspto.gov.
4.  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a)  All    b)  Some    \*c)  None of the:
1.  Certified copies of the priority documents have been received.
  2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3.  Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- \* Certified copies not received: \_\_\_\_\_.

Applicant has **THREE MONTHS FROM THE "MAILING DATE"** of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5.  CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
 including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.  
**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6.  DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |  |  |
|--|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)   | 5. <input type="checkbox"/> Examiner's Amendment/Comment                             |
| 2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date _____ | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material         | 7. <input type="checkbox"/> Other _____.   |
| 4. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____.                             |  |

/TUAN HO/  
Primary Examiner, Art Unit 2661

1. The present application is being examined under the pre-AIA first to invent provisions.
2. Claims 1-11, 13-25 and 27-34 are allowed.
3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan Ho whose telephone number is (571) 272-7365. The examiner can normally be reached on Mon-Fri 7:00AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sinh Tran can be reached on (571) 272-7564. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on

Application/Control Number: 15/431,332  
Art Unit: 2661

Page 3

access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-21 7-9197 (toll-free).


If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan V Ho/

Primary Examiner, Art Unit 2622






<b>Issue Classification</b> 	<b>Application/Control No.</b> 15431332	<b>Applicant(s)/Patent Under Reexamination</b> OZLUTURK, FATIH M.
	<b>Examiner</b> TUAN HO	<b>Art Unit</b> 2661

<input checked="" type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b> <input type="checkbox"/> <b>CPA</b> <input type="checkbox"/> <b>T.D.</b> <input type="checkbox"/> <b>R.1.47</b>															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17		33										
	2		18		34										
	3		19												
	4		20												
	5		21												
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	7		23												
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	12		28												
	13		29												
	14		30												
	15		31												
	16		32												

NONE  (Assistant Examiner) _____ (Date) _____		<b>Total Claims Allowed:</b> 32	
/TUAN HO/ Primary Examiner. Art Unit 2661  (Primary Examiner) _____ (Date) _____		O.G. Print Claim(s) 2	O.G. Print Figure 4

<b>Search Notes</b>  	<b>Application/Control No.</b>  15431332	<b>Applicant(s)/Patent Under Reexamination</b>  OZLUTURK, FATIH M.
	<b>Examiner</b>  TUAN HO	<b>Art Unit</b>  2661

CPC- SEARCHED		
Symbol	Date	Examiner
H04N 5/23287, 5/23258, 5/23267	3/9/17	TH
Updated	9/17/17	TH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
	Class 348	3/9/17	TH
	Class 382	3/9/17	TH
	Updated	9/17/17	TH

\* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

SEARCH NOTES		
Search Notes	Date	Examiner
EAST and Invnetorship Search	3/9/17	TH

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	See Search History	3/9/17	TH

	/TUAN HO/ Primary Examiner, Art Unit 2661
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**EAST Search History****EAST Search History (Prior Art)**

<b>Ref #</b>	<b>Hits</b>	<b>Search Query</b>	<b>DBs</b>	<b>Default Operator</b>	<b>Plurals</b>	<b>Time Stamp</b>
L1	349470	H04N5/23287,23258,23267.cpc. or 348/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/17 14:49
L2	520514	H04N5/23287,23258,23267.cpc. or 348/\$.ccls. or 382/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/17 14:51

**9/ 17/ 2017 2:51:44 PM****C:\ Users\ THO\ Documents\ EAST\ Workspaces\ default.1.wsp**



<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number	15431332
	Filing Date	2017-02-13
	First Named Inventor	Fatih M. Ozluturk
	Art Unit	2661
	Examiner Name	Tuan V. Ho
	Attorney Docket Number	OZL-PT001.17

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code <sup>1</sup>	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code <sup>1</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010010546	A1	2001-08-02	Chen	
	2	20020097324	A1	2002-07-25	Onuki	

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS							Remove	
Examiner Initial*	Cite No	Foreign Document Number <sup>3</sup>	Country Code <sup>2</sup> i	Kind Code <sup>4</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T <sup>5</sup>
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS							Remove
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<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number		15431332
	Filing Date		2017-02-13
	First Named Inventor	Fatih M. Ozluturk	
	Art Unit		2661
	Examiner Name	Tuan V. Ho	
	Attorney Docket Number		OZL-PT001.17

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>5</sup>
	1		

If you wish to add additional non-patent literature document citation information please click the Add button

**EXAMINER SIGNATURE**

Examiner Signature	/TUAN V HO/	Date Considered	09/17/2017
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\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number	15431332
	Filing Date	2017-02-13
	First Named Inventor	Fatih M. Ozluturk
	Art Unit	2661
	Examiner Name	Tuan V. Ho
	Attorney Docket Number	OZL-PT001.17

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

- The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas A. Mattioli/	Date (YYYY-MM-DD)	2017-07-28
Name/Print	Thomas A. Mattioli	Registration Number	56,773

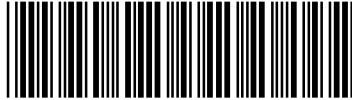
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b> 15431332	<b>Applicant(s)/Patent Under Reexamination</b> OZLUTURK, FATIH M.
	<b>Examiner</b> TUAN HO	<b>Art Unit</b> 2661

✓	<b>Rejected</b>
=	<b>Allowed</b>

-	<b>Cancelled</b>
÷	<b>Restricted</b>

N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

**Claims renumbered in the same order as presented by applicant**
                 
  **CPA**
                 
  **T.D.**
                 
  **R.1.47**

CLAIM		DATE							
Final	Original	03/20/2017	05/30/2017	09/17/2017					
	1	÷	✓	=					
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	33			=					
	34			=					

**PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 or Fax (571)-273-2885**

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

3624 7590 09/26/2017  
**VOLPE AND KOENIG, P.C.**  
 UNITED PLAZA  
 30 SOUTH 17TH STREET, 18th Floor  
 PHILADELPHIA, PA 19103

**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
SUBMITTED VIA EFS
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/431,332	02/13/2017	Fatih M. Ozluturk	OZL-PT001.17	4930

TITLE OF INVENTION: METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	12/26/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
HO, TUAN V	2661	348-208200

<p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p><input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p><input type="checkbox"/> "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. <b>Use of a Customer Number is required.</b></p>	<p>2. For printing on the patent front page, list</p> <p>(1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 <u>Volpe and Koenig, P.C.</u></p> <p>(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____</p> <p>3 _____</p>
---	---

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Clear Imaging Research, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY) Sands Point, New York

Please check the appropriate assignee category or categories (will not be printed on the patent) :  Individual  Corporation or other private group entity  Government

<p>4a. The following fee(s) are submitted:</p> <p><input checked="" type="checkbox"/> Issue Fee</p> <p><input checked="" type="checkbox"/> Publication Fee (No small entity discount permitted)</p> <p><input type="checkbox"/> Advance Order - # of Copies _____</p>	<p>4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)</p> <p><input type="checkbox"/> A check is enclosed.</p> <p><input checked="" type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input checked="" type="checkbox"/> The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number <u>220493</u> (enclose an extra copy of this form).</p>
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5. Change in Entity Status (from status indicated above)

Applicant certifying micro entity status. See 37 CFR 1.29

Applicant asserting small entity status. See 37 CFR 1.27

Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature <u>/Thomas A. Mattioli/</u>	Date <u>November 22, 2017</u>
Typed or printed name <u>Thomas A. Mattioli</u>	Registration No. <u>56,773</u>

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	15431332			
<b>Filing Date:</b>	13-Feb-2017			
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE			
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk			
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf			
<b>Attorney Docket Number:</b>	OZL-PT001.17			
Filed as Small Entity				
<b>Filing Fees for Utility under 35 USC 111(a)</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
UTILITY APPL ISSUE FEE	2501	1	480	480
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
<b>Extension-of-Time:</b>				
<b>Miscellaneous:</b>				
<b>Total in USD (\$)</b>				<b>480</b>

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	31031040
<b>Application Number:</b>	15431332
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4930
<b>Title of Invention:</b>	METHOD AND APPARATUS TO CORRECT DIGITAL VIDEO TO COUNTERACT EFFECT OF CAMERA SHAKE
<b>First Named Inventor/Applicant Name:</b>	Fatih M. Ozluturk
<b>Customer Number:</b>	3624
<b>Filer:</b>	Thomas A Mattioli/Angel Wolf
<b>Filer Authorized By:</b>	Thomas A Mattioli
<b>Attorney Docket Number:</b>	OZL-PT001.17
<b>Receipt Date:</b>	22-NOV-2017
<b>Filing Date:</b>	13-FEB-2017
<b>Time Stamp:</b>	15:13:35
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$480
RAM confirmation Number	112417INTEFSW15145300
Deposit Account	220493
Authorized User	Angel Wolf

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	OZL-PT001_17_ISSUE_FEE_EFS. PDF	107073  f935753c7433ebaa8f41a75b7ed3af725e6e97c2	no	1

**Warnings:****Information:**

2	Fee Worksheet (SB06)	fee-info.pdf	32445  f164c1f2cd6e38f667c7fff505c7eb33fb1e31d9	no	2
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**Warnings:****Information:**

<b>Total Files Size (in bytes):</b>	139518
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**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
(Not for submission under 37 CFR 1.99)

Application Number	15/431,332
Filing Date	2017-02-13
First Named Inventor	Fatih M. Ozluturk
Art Unit	2661
Examiner Name	Tuan V. Ho
Attorney Docket Number	OZL-PT001.17

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	6,067,367	05/2000	Nakajima et al.			
	6,079,862	06/2000	Kawashima et al.			
	6,097,854	08/2000	Szeliski et al.			
	6,101,238	08/2000	Murthy et al.			
	6,124,864	09/2000	Madden et al.			
*	6,157,733	12/2000	Swain			
	6,166,384	12/2000	Dentinger et al. <sup>1</sup>			
	6,166,853	12/2000	Sapia et al.			
	6,195,460	02/2001	Kobayashi et al.			
	6,198,283	03/2001	Foo et al.			
	6,208,765	03/2001	Bergen			
	6,249,616	06/2001	Hashimoto			
	6,278,460	08/2001	Myers et al.			
	6,292,593	09/2001	Nako et al.			
	6,342,918	01/2002	Inou et al.			
	6,349,114	02/2002	Mory			
	6,353,689	03/2002	Kanamaru et al.			
	6,353,823	<del>06/2003</del> 03/2002	<del>Shimada et al.</del> Kumar			
	6,466,262	10/2002	Miyatake et al. <sup>2</sup>			
	6,470,100	10/2002	Horiuchi et al.			
	6,512,807	01/2003	Pohlman et al.			
	6,583,823	06/2003	Shimada et al.			
	6,687,458	02/2004	Masuda			
	6,745,066	06/2004	Lin et al.			
	6,757,434	06/2004	Miled et al.			
	6,759,979	07/2004	Vashisth et al.			
	6,781,623	08/2004	Thomas			
	6,909,914	06/2005	Pedrizetti et al.			

Change(s) applied  
to document,  
/P.H./  
10/9/2017

/TUAN V HO/

05/30/2017

1 Corresponds to EP 1004983 and JP 2000-207538  
2 Corresponds to EP 0884897



APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/431,332	01/02/2018	9860450	OZL-PT001.17	4930

3624 7590 12/13/2017  
VOLPE AND KOENIG, P.C.  
UNITED PLAZA  
30 SOUTH 17TH STREET, 18th Floor  
PHILADELPHIA, PA 19103

### ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

#### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Fatih M. Ozluturk, Port Washington, NY;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit [SelectUSA.gov](http://SelectUSA.gov).

TO: <b>Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> P.O. Box 1450 Alexandria, VA 22313-1450	<b>REPORT ON THE                  FILING OR DETERMINATION OF AN                  ACTION REGARDING A PATENT OR                  TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court EASTERN DISTRICT OF TEXAS on the following

Trademarks or  Patents. (  the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 2:19-CV-326	DATE FILED 10/1/2019	U.S. DISTRICT COURT EASTERN DISTRICT OF TEXAS
PLAINTIFF Clear Imaging Research, LLC		DEFENDANT SAMSUNG ELECTRONICS CO. LTD. and SAMSUNG ELECTRONICS AMERICA, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached		
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
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5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
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CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

PATENT OR Trademark No.	Date of Patent or Trademark	Holder of Patent or Trademark
1. 8,630,484	1/14/2014	Clear Imaging Research LLC
2. 9,154,699	10/6/2015	Clear Imaging Research LLC
3. 9,392,175	7/12/2016	Clear Imaging Research LLC
4. 9,860,450	1/2/2018	Clear Imaging Research LLC
5. 10,171,740	1/1/2019	Clear Imaging Research LLC
6. 10,389,944	8/2/2019	Clear Imaging Research LLC

AO 120 (Rev. 08/10)

<b>TO:</b> Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	<b>REPORT ON THE                  FILING OR DETERMINATION OF AN                  ACTION REGARDING A PATENT OR                  TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court EASTERN DISTRICT OF TEXAS on the following

Trademarks or  Patents. (  the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 2:19-CV-326	DATE FILED 10/1/2019	U.S. DISTRICT COURT EASTERN DISTRICT OF TEXAS
PLAINTIFF Clear Imaging Research, LLC		DEFENDANT SAMSUNG ELECTRONICS CO. LTD. and SAMSUNG ELECTRONICS AMERICA, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached		
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1			
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5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
--------------------

CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

PATENT OR Trademark No.	Date of Patent or Trademark	Holder of Patent or Trademark
<b>1. 8,630,484</b>	1/14/2014	Clear Imaging Research LLC
<b>2. 9,154,699</b>	10/6/2015	Clear Imaging Research LLC
<b>3. 9,392,175</b>	7/12/2016	Clear Imaging Research LLC
<b>4. 9,860,450</b>	1/2/2018	Clear Imaging Research LLC
<b>5. 10,171,740</b>	1/1/2019	Clear Imaging Research LLC
<b>6. 10,389,944</b>	8/2/2019	Clear Imaging Research LLC

<b>PATENT ASSIGNMENT COVER SHEET</b>
--------------------------------------

Electronic Version v1.1  
 Stylesheet Version v1.2

EPAS ID: PAT6663561

<b>SUBMISSION TYPE:</b>	NEW ASSIGNMENT
<b>NATURE OF CONVEYANCE:</b>	ASSIGNMENT

**CONVEYING PARTY DATA**

Name	Execution Date
FATIH OZLUTURK	04/19/2021
OZLUTURK & CO, LLC	04/19/2021
CLEAR IMAGING, LLC	04/19/2021

**RECEIVING PARTY DATA**

<b>Name:</b>	CLEAR IMAGING RESEARCH, LLC
<b>Street Address:</b>	5 HILLDALE LANE
<b>City:</b>	SANDS POINT
<b>State/Country:</b>	NEW YORK
<b>Postal Code:</b>	11050

**PROPERTY NUMBERS Total: 30**

Property Type	Number
<b>Application Number:</b>	60556230
<b>Patent Number:</b>	8331723
<b>Patent Number:</b>	8064719
<b>Patent Number:</b>	8064720
<b>Patent Number:</b>	8154607
<b>Patent Number:</b>	8630484
<b>Patent Number:</b>	9294674
<b>Patent Number:</b>	8922663
<b>Patent Number:</b>	9001221
<b>Patent Number:</b>	9013587
<b>Patent Number:</b>	9167162
<b>Patent Number:</b>	9154699
<b>Patent Number:</b>	9392175
<b>Patent Number:</b>	9338356
<b>Patent Number:</b>	9826159
<b>Patent Number:</b>	9774785
<b>Patent Number:</b>	9800787
<b>Patent Number:</b>	9800788

Property Type	Number
Patent Number:	9860450
Patent Number:	10171740
Application Number:	15790430
Patent Number:	10341566
Patent Number:	10389944
Patent Number:	10382689
Patent Number:	10721405
Application Number:	16538066
Patent Number:	10880483
Application Number:	16933557
Application Number:	17066882
PCT Number:	WO2005093654

**CORRESPONDENCE DATA**

**Fax Number:**

*Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.*

**Phone:** 516 603 8383

**Email:** fatih@clear-imaging.com

**Correspondent Name:** FATIH M OZLUTURK

**Address Line 1:** 5 HILLDALE LN

**Address Line 4:** SANDS POINT, NEW YORK 11050

<b>NAME OF SUBMITTER:</b>	FATIH OZLUTURK
<b>SIGNATURE:</b>	/FatihOzluturk/
<b>DATE SIGNED:</b>	04/19/2021
	This document serves as an Oath/Declaration (37 CFR 1.63).

**Total Attachments: 3**  
source=CIR Re-assignment#page1.tif  
source=CIR Re-assignment#page2.tif  
source=CIR Re-assignment#page3.tif

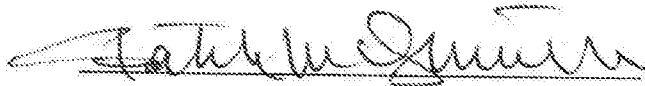
## ASSIGNMENT OF PATENT RIGHTS

I, Fatih Ozluturk ("Assignor"), have assigned my right, title and interest in the inventions, patents, and patent applications listed in Exhibit A, as well as, any reissues, continuations, continuation-in-parts, divisionals, substitute applications, re-examinations claiming the benefit of any patent or patent application listed in Exhibit A ("Patents"), for the entire life of Patents, including the right to sue for past, current, or future patent infringement, to Clear Imaging Research, LLC with offices in 5 Hilldale Lane, Sands Point, NY ("Assignee").

To the extent that any clarification is sought or necessary, for any reason, I ("Assignor") on behalf of myself in my personal capacity, and as the Principal and Owner of any legal entity that I own, control, and/or manage as of this date and any time in the past (including but not limited to Clear Imaging LLC), for valuable consideration, the receipt of which I acknowledge, hereby sell, assign and transfer the entire right, title and interest in the inventions, patents, and patent applications listed in Exhibit A, as well as, any reissues, continuations, continuation-in-parts, divisionals, substitute applications, re-examinations claiming the benefit of any patent or patent application listed in Exhibit A ("Patents"), for the entire life of Patents, including the right to sue for past, current, or future patent infringement, to Clear Imaging Research, LLC with offices in 5 Hilldale Lane, Sands Point, NY ("Assignee"). For the avoidance of doubt, this assignment includes all rights to sue and collect for past damages.

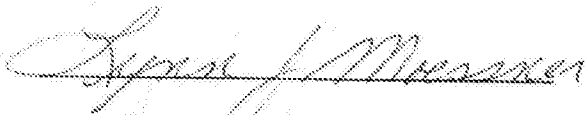
For the avoidance of doubt, there remains no rights, past, current, or future, related or associated with Patents that remain outside the Assignee. For the avoidance of doubt, no rights to sue or collect for past damages remain outside the Assignee. The right, title and interest conveyed in this Assignment is to be held and enjoyed by Assignee and Assignee's successors, legal representatives and assigns, to the full end of the term of Patents past, current, and future, is granted, as fully and exclusively as it would have been held and enjoyed by Assignor had this assignment not been made.

Date: 4/19/21



Assignor

On this 19<sup>th</sup> day of April, before me, Lynn J. Moessner, the undersigned Notary Public, personally appeared Fatih Ozluturk, proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument, and acknowledged to me that he executed the same. Witness my hand and official seal in Port Washington County of Nassau on the date set forth in this certificate.



Notary Public

LYNN J. MOESSNER  
Notary Public, State of New York  
No. 01M04978882  
Qualified in Nassau County  
My Commission Expires 6/20/2022

## EXHIBIT A

The Patents include the patents and patent applications listed below, as well as, any reissues, continuations, continuation-in-parts, divisionals, substitute applications, re-examinations claiming the benefit of any patent or patent application listed below.

Patent Number	Publication Number	Application Number	Title
		US60/556230	Processing to restore photographs affected due to camera shake or moving subject
US8331723		US11/089081	Method and apparatus to correct digital image blur due to motion of subject or imaging device
US8064719		US12/274074	Method and apparatus to correct digital image blur due to motion of subject or imaging device
US8064720		US12/274096	Method and apparatus to correct digital image blur due to motion of subject or imaging device
US8154607		US12/274032	Method and apparatus to correct digital image blur due to motion of subject or imaging device
US8630484		US12/274057	Method and apparatus to correct digital image blur due to motion of subject or imaging device
US9294674		US12/274084	Method and apparatus to correct digital image blur due to motion of subject or imaging device
US8922663		US13/442370	Method and apparatus to correct digital image blur due to motion of subject or imaging device
US9001221		US13/653144	Method and apparatus for using motion information and image data to correct blurred images
US9013587		US14/532654	Method and apparatus to correct digital image blur by combining multiple images
US9167162		US14/584891	Method and apparatus to correct digital image blur due to motion of subject or imaging device by adjusting image sensor
US9154699		US14/586297	Method and apparatus to correct blur in all or part of a digital image by combining plurality of images
US9392175		US14/679551	Method and apparatus for using motion information and image data to correct blurred images
US9338356		US14/690818	Method and apparatus to correct digital video to counteract effect of camera shake
US9826159		US14/861731	Method and apparatus for implementing a digital graduated filter for an imaging apparatus
US9774785		US14/875204	Method and apparatus to correct blur in all or part of a digital image by combining plurality of images
US9800787		US15/149481	Method and apparatus to correct digital video to counteract effect of camera shake
US9800788		US15/207057	Method and apparatus for using motion information and image data to correct blurred images
US9860450		US15/431332	Method and apparatus to correct digital video to counteract effect of camera shake
US10171740		US15/714558	Method and apparatus to correct blur in all or part of a digital image by combining plurality of

			images
	US20180048822	US15/790430	Method and apparatus for using motion information and image data to correct blurred images
US10341566		US15/811171	Method and apparatus for implementing a digital graduated filter for an imaging apparatus
US10389944		US15/858339	Method and apparatus to correct blur in all or part of an image
US10382689		US16/233914	Method and apparatus for capturing stabilized video in an imaging device
US10721405		US16/459157	Method and apparatus for implementing a digital graduated filter for an imaging apparatus
	US20190364213	US16/538066	Method and apparatus for capturing stabilized video in an imaging device
US10880483		US16/544426	Method and apparatus to correct blur in all or part of an image
	US20200351445	US16/933557	Method and apparatus for implementing a digital graduated filter for an imaging apparatus
	US20210044752	US17/066882	Method and apparatus to correct blur in all or part of an image
	WO2005093654	US2005009766W	Method and apparatus to correct digital image blur due to motion of subject or imaging device

AO 120 (Rev. 08/10)

<b>TO:</b> Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	<b>REPORT ON THE                  FILING OR DETERMINATION OF AN                  ACTION REGARDING A PATENT OR                  TRADEMARK</b>
---	--

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court EASTERN DISTRICT OF TEXAS on the following

Trademarks or  Patents. (  the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 2:19-CV-326	DATE FILED 10/1/2019	U.S. DISTRICT COURT EASTERN DISTRICT OF TEXAS
PLAINTIFF Clear Imaging Research, LLC		DEFENDANT SAMSUNG ELECTRONICS CO. LTD. and SAMSUNG ELECTRONICS AMERICA, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached		
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1			
2			
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

<b>DECISION/JUDGEMENT</b> All claims asserted by and between all parties as part of the above-captioned case are hereby DISMISSED WITH PREJUDICE with all attorneys' fees, expenses, and costs of court to be borne by the party incurring the same
--

CLERK <i>David A. O'Toole</i>	(BY) DEPUTY CLERK nkl	DATE 5/18/21
----------------------------------	--------------------------	-----------------

Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

<b>PATENT OR Trademark No.</b>	<b>Date of Patent or Trademark</b>	<b>Holder of Patent or Trademark</b>
<b>1. 8,630,484</b>	1/14/2014	Clear Imaging Research LLC
<b>2. 9,154,699</b>	10/6/2015	Clear Imaging Research LLC
<b>3. 9,392,175</b>	7/12/2016	Clear Imaging Research LLC
<b>4. 9,860,450</b>	1/2/2018	Clear Imaging Research LLC
<b>5. 10,171,740</b>	1/1/2019	Clear Imaging Research LLC
<b>6. 10,389,944</b>	8/2/2019	Clear Imaging Research LLC



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Table with 5 columns: APPLICATION NUMBER, FILING OR 371(C) DATE, FIRST NAMED APPLICANT, ATTY.DOCKET NO./TITLE, REQUEST ID. Values: 15/431,332, 02/13/2017, Fatih M. Ozluturk, OZL-PT001.17, 141433

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 06/17/2021 has been accepted.

CERTIFICATIONS:

Change of Entity Status:
X Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Table with 2 columns: Label, Value. Rows: Signature: /Thomas A. Mattioli/, Name: Thomas A. Mattioli, Registration Number: 56773

<b>TO: Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Southern District of California on the following

Trademarks or  Patents. (  the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 3:23 cv 673	DATE FILED 4/14/2023	U.S. DISTRICT COURT Southern District of California
PLAINTIFF Clear Imaging Research, LLC		DEFENDANT Apple Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached		
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1			
2			
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
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CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

PATENT OR Trademark No.	Date of Patent or Trademark	Holder of Patent or Trademark
1. 9,860,450	1/2/2018	Clear Imaging Research, LLC
2. 10,171,740	1/1/2019	Clear Imaging Research, LLC
3. 10,382,689	8/13/2019	Clear Imaging Research, LLC
4. 11,457,149	9/27/2022	Clear Imaging Research, LLC
5. 11,490,015	11/1/2022	Clear Imaging Research, LLC
6. 11,627,254	4/11/2023	Clear Imaging Research, LLC
7. 11,627,391	4/11/2023	Clear Imaging Research, LLC

To:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	<b>REPORT ON THE                  FILING OR DETERMINATION OF AN                  ACTION REGARDING A PATENT OR                  TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Southern District of California on the following:   X   Patents or      Trademarks:

<b>DOCKET NO.</b>	<b>DATE FILED</b>	US District Court Southern District of California
3:23-cv-00673-GPC-DEB	4/14/23	San Diego, CA
<b>PLAINTIFF</b>		<b>DEFENDANT</b>
Clear Imaging Reasearch, LLC		Apple Inc.
<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>
1. 9,860,450	6. 11,627,254	11.
2. 10,171,740	7. 11,627,391	12.
3. 10,382,689	8.	13.
4. 11,457,149	9.	14.
5. 11,490,015	10.	15.

In the above-entitled case, the following patents(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY	
	<input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>	<b>PATENT OR TRADEMARK NO.</b>
1.	6.	11.
2.	7.	12.
3.	8.	13.
4.	9.	14.
5.	10.	15.

In the above-entitled case, the following decision has been rendered or judgment issued:

DECISION/JUDGMENT
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CLERK	(BY) DEPUTY CLERK	DATE
John Morrill		