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This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)					
Inventor(s)					
Inventor 1					Remove
Given Name	Middle Name	Family Name	City	State	Country
Ishay		Sivan	Tel-Aviv		IL
All Inventors Must Be Listed – Additional Inventor information blocks may be generated within this form by selecting the Add button.					Add
Title of Invention		System and method for real time assessment of a picture quality			
Attorney Docket Number (if applicable)					
Correspondence Address					
Direct all correspondence to (select one):					
<input type="radio"/> The address corresponding to Customer Number			<input checked="" type="radio"/> Firm or Individual Name		
Firm or Individual Name 1			Ishay Sivan		
Firm or Individual Name 2					
Mailing Address of Applicant:					
Address 1		Dissentchik 12			
Address 2					
City	Tel-Aviv	State/Province			
Postal Code	69353	Country		IL	
Phone	972-54-6549030				

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.	
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<input type="radio"/> Yes, the name of the U.S. Government agency and the Government contract number are:	

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Entity Status

Applicant claims small entity status under 37 CFR 1.27

Yes, applicant qualifies for small entity status under 37 CFR 1.27

No

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Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	Ishay Sivan		Date (YYYY-MM-DD)	2012-10-23
First Name	Ishay	Last Name	SIVAN	Registration Number (if appropriate)

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PROVISIONAL APPLICATION FOR PATENT

System and method for real time assessment of a picture quality

Inventor: Ishay Sivan

Date: October 23, 2012

ABSTRACT

A system and method for real time assessment of a picture quality produced on multiple sensor device as a smartphone, including data from device sensors like image sensor, accelerometer and gyroscope. This data will be used to produced multiple quality indicators. These values are combined to form a total image quality. The way the combing is done can be configured by the user or be done automatically to give emphasis on certain values. The indication can given before the user has taken the image, and may be given again when the picture is taken, depending on configuration. These quality indicators, including the total indicator, are save along with the final image to be used by other software.

BACKGROUND OF THE INVENTION

Image quality has been assessed by various methods. For example measuring the details and acutance of an image (full reference, no reference, partial reference) via various methods like DCT measurements. Other methods included using gyroscope to measure is the image is leveled or not, or even an accelerometer to hint of device shake. Few are done in real time, like the image level. There are methods to evaluate image blur or evaluate image details like:

1. "A No-Reference Objective Image Sharpness Metric Based on the Notion of Just Noticeable Blur (JNB)" (IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 18, NO. 4, APRIL 2009)
2. "Blur determination in the compressed domain using DCT information" 1999 International Conference on Image Processing, 386 - 390 vol.2

There are methods and programs that use motion detection to tell the user when it is best to press the shutter button, but they don't give a quality evaluation after the user pressed the shutter button. This invention is about combining data from multiple sensors and multiple quality indicators, using today available GPU and CPU to calculate in real time each quality indicator, and about forming a combined total indicator to be shown to the user before and after he has pressed the shutter button.

SUMMARY OF THE INVENTION

In general, each available sensor send its data to another component that process this raw data and outputs a related processed data. From that data (and perhaps some configuration or other sensor input) a quality indicator is formed.

This can be seen in drawing 1 which form a part of this specification.

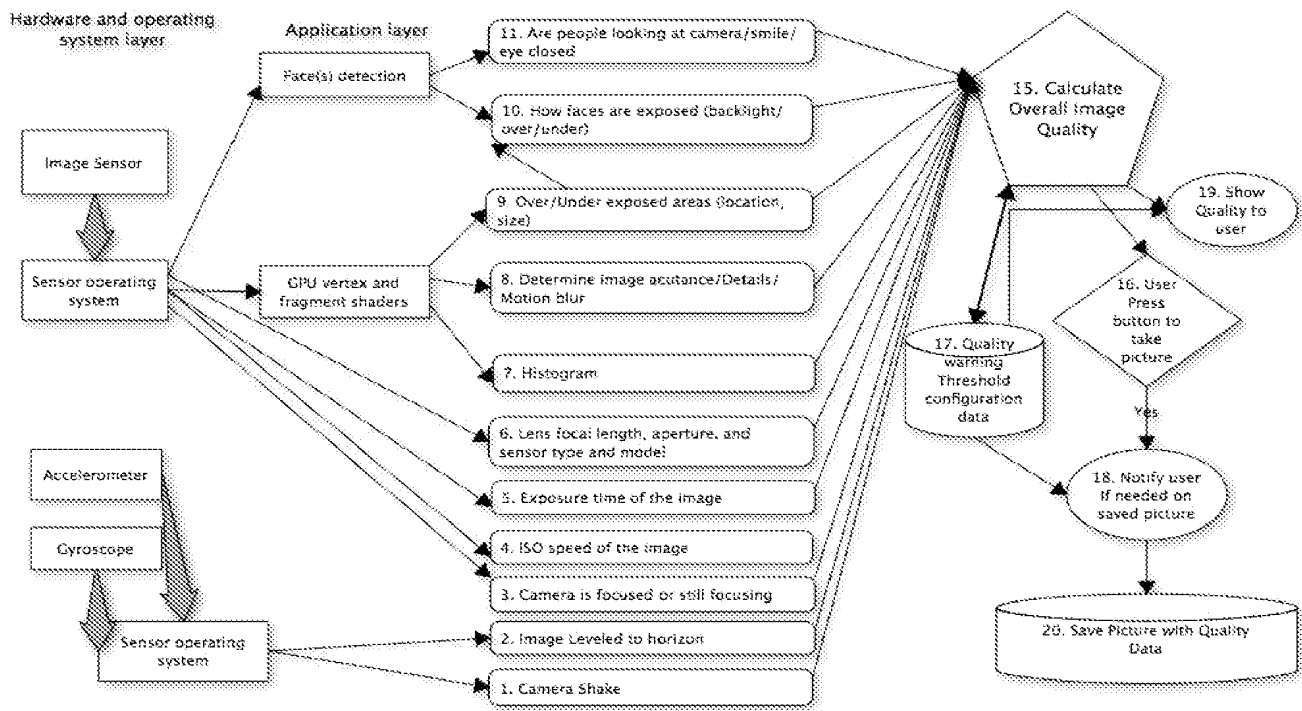
There are many qualities indicators, depending on device capabilities and implementation:

1. Image leveled to the horizon
2. motion detection
3. camera is focused or still focusing
4. ISO level and how it is related to the specific sensor
5. Exposure time and how is it related to the scene taken if data available
6. Lens focal length, aperture, focus distance and sensor type and model.
7. Histogram evaluation
8. Image details (acutance, corners detected, DCT coefficient for high details, image sharpness)
9. Under and over exposure area
10. Face detection and over or under exposed area near faces.

11. Face detection and is face is smiling and/or looking at camera
 These indicators are passed to a component (item 15) that analyzes the relevance of each of them, and with some configuration data (item 17) spills out a “total” quality value.
 The quality indicator can be shown to the user if configured to (item 19).
 Also, given an optional configurable “minimum” quality, a further indication to the user can be made if the image is bellow this quality.
 When the user presses the “shutter” button o take the picture (item 16) another indication to the user may be shown (item 18), dependent on configuration.
 After the user presses the shutter button the image will be saved (item 20) along the quality indication including the total quality. This can be inside the image exif extension or another file.
 In another embodiment it can also be that the image will not be saved or deleted after taken if it is bellow some quality indicator threshold including the total quality indicator.

BRIEF EXPLANATION OF DIAGRAM 1

On the left side of the diagram are the hardware sensor. The bulk arrows indicate raw data transfer to the operating system operating these sensors. As we go from left to right we go into the application layer that uses the input provided from these sensors as the image frame, full image when taken, image parameters and data from raw gyroscope and accelerometer. In another embodiment the application layer can take whatever raw data available from these sensor and bypass the most convenient operating system API that provide the sensor data.
 Face detection can be made in the operating system or application layer.
 The GPU is is programed with vertex and fragment shaders to facilitate real time data input to the application like histogram, image details and over/under exposed areas.
 As we go further to the right of the diagram the quality indicators are created following the logic described herein. These parameters are passed to the application logic as to calculate overall image quality, user warnings and saving of the final image.



DETAILED DESCRIPTION OF THE INVENTION

The invention described herein consists of a system and method for real time assessment of picture quality produced on multiple sensors device as a smartphone. In one embodiment, all of the sensors like image sensor, accelerometer, and gyroscope and so on are embedded in one device. It can be that they are divided in different devices, but send their data to one device where the total indicator is calculated.

Typically, today's smartphone include all these sensor and hardware inside the smartphone. But it is possible that the image will be sent to the device from an external camera via a cable or Wi-Fi.

Image sensor sends its data to the device operating system that may send the whole image or a preview of it to the GPU at a rate of X frame per second.

This image data is passed to various programmed GPU vertex and fragment shaders. This will be used for fast calculation of some of the quality indicators.

The following are each quality indicator and how it is calculated:

1. Image leveled to horizon

The device gyroscope (and accelerometer if available) is used to calculate device angle to the horizon, or how the device is leveled. Using this data a quality indicator for device leveled according to its orientation is calculated. For example, zero to 3 degrees is quality "excellent", 3 to 5 degrees is quality "good" and so on. Take notice that the device may be held horizontally or vertically by the user.

2. Motion detection

Device accelerometer data (and gyroscope if available) can be used to determine if the device is accelerating related to the ground reference frame. This calculation can be done via the software embedded in the sensors, the device operating system or manually calculated by software running on the device. Acceleration related to the ground is given as pitch yaw and roll or any other method, to indicated acceleration in 3 axis. These values are used to give a quality indicator on camera shake in real time.

3. Camera is focus or still focusing

The device image sensor may send a signal to the application software component (via the operating system) that the image sensor is focused or still focusing. This will be used to form an "excellent" quality for focused and "bad" quality indicator for still focusing.

4. ISO level and camera hardware exposure data

Data as ISO level, exposure time, focal length, and aperture and focus area is sent from the image sensor to the device operating system to the application software component.

Depending on the device capabilities, like max and minimum ISO, a quality indicator is produced. High ISO gives bad quality vs low ISO that gives high quality indicator.

An optional exposure time quality indicator may be created, if a minimum exposure time is configured.

5. Exposure time

Depending on the scene, the exposure time could give another quality indicator.

For example if we are taking a picture of a dog, we need a fast exposure, so the dog will not be blurred. This could be in conjunction with the detail indicator.

6. Lens focal length, aperture, focus distance, sensor type and model and depth of field

Depending on the device capabilities to change focal length and aperture, and given a known configured scene, a quality indicator can be given to how these parameters confront to the given

scene. For example, a scene with a baby taken 50 cm from him, with a Nikon D300, 50mm focal length lens, aperture of 1.8, means the depth of field will be 2.7 cm. This means that the baby face will not be fully in focus, and a bad quality can be given. For a same configuration with f/8 aperture, an excellent quality can be given.

7. Image Histogram

Using the image frame and some GPU shaders, a histogram can be calculated in real time. In Photography it is well known how a “good” and “bad” histogram looks.

For “typical” images, those with an average range of light and dark areas, a good histogram will basically look like a bell curve that’s centered around the center of the graph. A full explanation will be out of the scope of this document, but a bad histogram means that the colors of the image are mostly pushed to right or to the left.

This data can also be used as a quality indicator, given a threshold configuration.

8. Image details

There are many known algorithms to extract image quality. There are full reference, no reference or partial reference.

For example blur can be detected via “A No-Reference Objective Image Sharpness Metric Based on the Notion of Just Noticeable Blur (JNB)” (IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 18, NO. 4, APRIL 2009)

Most algorithms will take too long on current CPU and if can be implemented, may be slow on a GPU as well, but as the technology progresses, these algorithms can be implemented to for a real time, or near real time image quality indicator.

Still, algorithms like Harris corner detection or its variants like Shi Tomasi corners detection can be used to determine if the image frame we have now has more or less details than the previous frame. Combine that with data from the gyroscope and accelerometer, we can know if the device has moved and with this partial reference know if the quality has severely deteriorated or got better.

These algorithms may have parameters like sensitivity and threshold for Harris corner detection.

The preferred input for these parameters can come from the image sensor like ISO used.

Other algorithms can be to calculate the image acutance, or calculating the image DCT coefficient and look for a high sum of high coefficient (“Blur determination in the compressed domain using DCT information” 1999 International Conference on Image Processing, 386 - 390 vol.2)

from each of these algorithms one can determine a quality indicator.

9. Under and over exposure areas

Given a configurable under and over threshold (say 5% from pure white and 3% from pure black) the image frame given to the GPU is processed to calculate areas that are under exposed and areas that are over exposed. The image frame is divided to a configurable number of areas, say 256 areas or 1024 areas. If over a configurable number of percentage of pixels in the area (say 95%) are under or over exposed, the area is marked as under or over exposed.

10. Face detection and over or under exposed area near faces

Face detection can be provided in the application layer or as a service provided by the operating system API or even image sensor raw output data.

This data can be used in combination with the under/over exposure area calculated before, to determine if the faces are under or over exposed, or more likely if there is a particular over exposed area near the face.

If so, the average luminance of the face is calculated. If it is below a threshold, this may indicate the face is underexposed (backlight). This will give a low quality indicator for this “face underexposed” indicator.

11. Face detection and is face is smiling and/or looking at camera

Using the face location, one can determine if the person in each face is smiling and/or looking at the camera. This data can be used for another quality indicator.

Say over 90% of the faces are looking at the camera and 80% are smiling equals an “Excellent” quality, while none are looking and none are smiling indicating a “bad” quality.

Combining the separate quality indicator to a total quality indicator

Each device may have different hardware capabilities, thereby will not include all the possible quality indicators or will not be able to process details indicators due to a slow hardware. Some indicators may be ignored if configured so by the user. We are now left with a set of indicators to work with.

To come out with a total quality indicator, we will use a weight function, giving each indicator a configured weight.

$$\sum_{a \in A} f(a)w(a).$$

In this formula $f(a)$ is the quality indicator for indicator a out of A possible.

$w(a)$ is the related weight function. Each weight function may be configured by the user, take into account the device capabilities or mix the two. It is also possible that the formula a weight function of one indicator will take into account the data from other quality indicator of quality indicators weight functions.

For example a quality indicator indicating the device has not yet reach focus (item 4) will be given a high weight relative to other quality indicator as “person not looking to camera” (item 5.4)

The sum of $f(a)*w(a)$ will give an un-normalized total quality indicator. It will need to be normalized to fit a quality spectrum shown to the user (for example a spectrum shown to user can be an integer between 1 to 5) or saved alongside the image file.

From that we will get the total quality indicator.

Using the total quality indicator

The total quality indicator can be shown to the user in real time. Also, given a configurable “minimum” quality, an indication to the user can be made if the image total quality indicator is below this minimum.

The indication can show just the total quality or the all the quality indicators below a certain threshold. The indication can be a number of even an icon representing the quality.

For example 5 smiles, each represent a quality indicator.

Smiling face – Good, crying face – bad and so on.

In one embodiment, the picture will be saved without the user having to press a “shutter” button.

If the user needs to press a “shutter” button to actually save the picture, then after the picture is taken, the user can be warned of low quality if needed and configured so.

After in image is taken, the user may have an option to see some or all the quality indicators, and from that get a details sense of what he can do to get a better picture from that specific scene.

It can also be that the image will not be saved or deleted if it is bellow some quality indicator threshold including the total quality indicator.

After the image is saved, the qualities indicators will be saved along with the image so it can be used afterwards.

The user may choose to get suggestions from the application on how to improve the next shot. The application will use the quality indicators and their correlation to answer that.

Claims:

What is claimed is:

1. A system and method for real time calculations of image quality indicators explained herein.
2. A system and method according to claim 1 where the quality indicators are shown to the user before he actually takes the picture.
3. A system and method according to claim 1 where the total quality indicator is shown to the user before he actually takes the picture.
4. A system and method according to claim 1 where the total quality indicator is shown to the user after he took the picture.
5. A system and method according to claim 1 where the quality indicators are saved along with the image, for example inside the exif data
6. A system and method according to claim 1 where the quality indicators are used to decide if to save the image taken.
7. A system and method according to claim 1 where the quality indicators are used suggest to the user how to improve the picture he is taking.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	System and method for real time assessment of a picture quality
First Named Inventor/Applicant Name:	Ishay Sivan
Filer:	Ishay Sivan
Attorney Docket Number:	

Filed as Small Entity

Provisional Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Provisional Application filing fee	2005	1	125	125

Pages:

Claims:

Miscellaneous-Filing:

Petition:

Patent-Appeals-and-Interference:

Post-Allowance-and-Post-Issuance:

Extension-of-Time:

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				125

Electronic Acknowledgement Receipt

EFS ID:	14052091
Application Number:	61717216
International Application Number:	
Confirmation Number:	3674
Title of Invention:	System and method for real time assessment of a picture quality
First Named Inventor/Applicant Name:	Ishay Sivan
Correspondence Address:	Ishay Sivan - Dissentchik 12 - Tel-Aviv - 69353 IL - ishay@ishaysivan.com
Filer:	Ishay Sivan
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	23-OCT-2012
Filing Date:	
Time Stamp:	13:17:53
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$125

RAM confirmation Number	10973
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Provisional Cover Sheet (SB16)	ProvisionalCoverForm2.pdf	3567377 50d87cb9a59b2a3a307b69996f815043ac6078e4	no	2

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Information:

2	Specification	Patent.pdf	222928 9764c1a8efa2d9c96bf75aced6730091ba311a71	no	6
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Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	28351 87b24999736cd8baa2406e03d38e46c468119ed3	no	2
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New International Application Filed with the USPTO as a Receiving Office

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CONFIRMATION NO. 3674

FILING RECEIPT



Ishay Sivan
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Tel-Aviv, 69353
ISRAEL

Date Mailed: 11/20/2012

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

Inventor(s)
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Applicant(s)
Ishay Sivan, Tel-Aviv, ISRAEL;

Power of Attorney: None

If Required, Foreign Filing License Granted: 11/16/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is US 61/717,216

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **

Title

System and method for real time assessment of a picture quality

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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Doc Code: PD.TO.AUTH

Document Description: Authorization to access Appl. by Trilateral Office

PTO/SB/39 (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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AUTHORIZATION TO PERMIT ACCESS TO APPLICATION BY PARTICIPATING OFFICES	<small>COMPLETE IF KNOWN</small>	
	Application Number	61/717,218
	Filing Date	23 Oct 2012
	First Named Inventor	SIVAN, Ishay
	Attorney Docket Number	2247936
Send completed form to: Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450	Title (Required)	SYSTEM AND METHOD FOR REAL TIME ASSESSMENT OF...

The undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h).

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This written authorization should be submitted prior to the filing of a subsequent foreign application, in which priority is claimed to the above-identified patent application, with any intellectual property office (e.g., the EPO, JPO, KIPO, or DAS Accessing Office). However, if applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application, this written authorization should not be filed.

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Ishay Sivan
Signature

Ishay SIVAN
Printed or Typed Name

Inventor
Title

12 Feb 14
Date

Telephone Number

Registration Number, if applicable

This collection of information is required by 37 CFR 1.14(h). 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 6 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.

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Table with 6 columns: APPLICATION NUMBER, FILING or 371(c) DATE, GRP ART UNIT, FIL FEE REC'D, ATTY.DOCKET.NO, TOT CLAIMS, IND CLAIMS. Row 1: 61/717,216, 10/23/2012, 125, (blank), (blank), (blank)

Ishay Sivan
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ISRAEL

CONFIRMATION NO. 3674
REPLACEMENT FILING RECEIPT



Date Mailed: 02/24/2014

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

Inventor(s)
Ishay Sivan, Tel-Aviv, ISRAEL;

Applicant(s)
Ishay Sivan, Tel-Aviv, ISRAEL;

Power of Attorney: None

Permission to Access - A proper Authorization to Permit Access to Application by Participating Offices (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 11/16/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is US 61/717,216

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **

Title

System and method for real time assessment of a picture quality

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

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Title 35, United States Code, Section 184

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