

(12) Indian Patent Application

(21) Application Number: 201741034258

(22) Filing Date: 27/09/2017 (43) Publication Date: 13/12/2019

(71) Applicant(s): L&T TECHNOLOGY SERVICES LIMITED

(72) Inventor(s): BABU, RAMESH D
GOPINATH, C
NALLAMILLI, ASHOK
YERUNKAR, AKSHAY ANKUSH

(51) International Classifications: G02B 15/24

(54) Title: WIDE-ANGLE LENS DISTORTION CORRECTION

(57) Abstract: The disclosure relates to a system 100 and method 200 for correcting a radial distortion in an image 104. The radial distortion in the image 104 may form while capturing the image by a first wide-angle lens camera 102. The system 100 for correcting the image distortion may include a projector 110. The projector 110 may project the distorted image 104 captured by the first wide-angle lens camera 102 on a predefined shaped screen 108. The system 100 may further include a second wide-angle lens camera 112. The second wide-angle lens camera 112 may recapture the image 104 from the predefined shaped screen 108, such that the recaptured image 104 may be free from the distortion. The specifications of the second wide-angle lens camera 112 and the first wide-angle lens camera 102 may be substantially same.

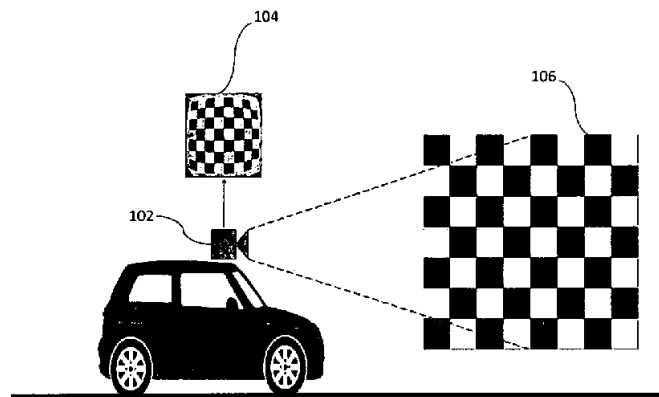


Figure 1



ABSTRACT

Wide-angle lens distortion correction

The disclosure relates to a system 100 and method 200 for correcting a radial distortion in an image 104. The radial distortion in the image 104 may form while capturing the image by a first wide-angle lens camera 102. The system 100 for correcting the image distortion may include a projector 110. The projector 110 may project the distorted image 104 captured by the first wide-angle lens camera 102 on a predefined shaped screen 108. The system 100 may further include a second wide-angle lens camera 112. The second wide-angle lens camera 112 may recapture the image 104 from the predefined shaped screen 108, such that the recaptured image 104 may be free from the distortion. The specifications of the second wide-angle lens camera 112 and the first wide-angle lens camera 102 may be substantially same.

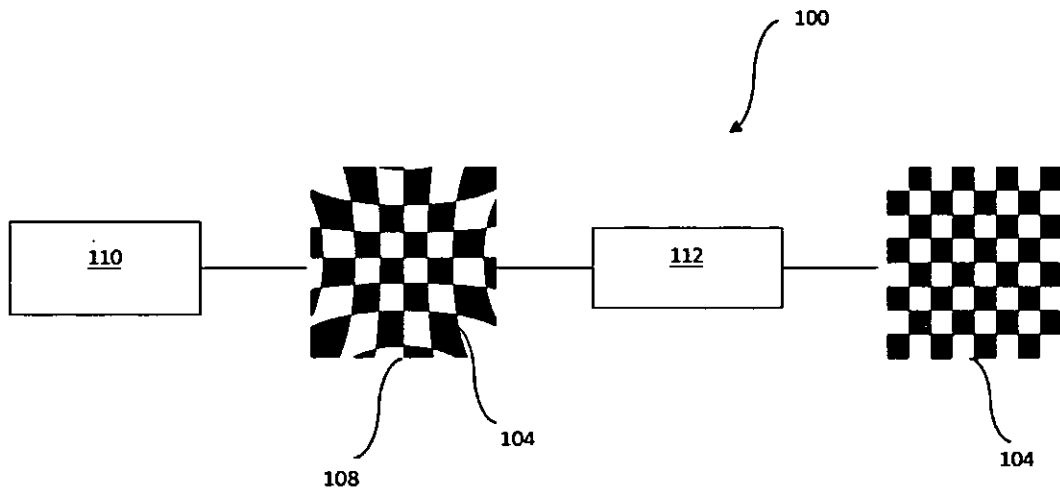


Figure 3

27-Sep-2018/70249/201741034258/Abstract


We claim:



1. A system 100 for correcting a radial distortion in an image 104 captured by a first wide-angle lens camera 102 comprising:
 - a projector 110 to project the image 104 captured by the first wide-angle lens camera 102 on a predefined shaped screen 108; and
 - a second wide-angle lens camera 112 to recapture the image 104 from the predefined shaped screen 108, such that the specifications of the first wide-angle lens camera 102 and the second wide-angle lens camera 112 are substantially same.
2. The system 100 for correcting the radial distortion in the image 104 captured by the first wide-angle lens camera 102 as claimed in claim 1, wherein the shape of the screen 108 depends on one or more specifications of the first wide-angle camera 102.
3. The system 100 for correcting the radial distortion 104 in the image captured by the first wide-angle lens camera 102 as claimed in claim 1, wherein the shape of the screen 108 depends on at least one parameters of the distorted image 104.
4. The system 100 for correcting the radial distortion in the image 104 captured by the first wide-angle lens camera 102 as claimed in claim 1, wherein the images 104 played in a sequence forms a video.
5. The system 100 for correcting the radial distortion in the image 104 captured by the first wide-angle lens camera 102 as claimed in claim 1, wherein the shape of the screen 108 is parabolic, ellipsoidal or spherical.

6. The system 100 for correcting the radial distortion in the image 104 captured by the first wide-angle lens camera 102 as claimed in claim 1, wherein the second wide-angle camera 112 is placed at the focal point of the screen 108.
7. A method 200 for correcting a radial distortion in an image 104 captured by a first wide-angle lens camera 102 comprising:
- projecting the distorted image 104 on a predefined shaped screen 108; and
- recapturing the image 104 on the predefined shaped screen 108 by a second wide-angle lens camera 112, the second wide-angle lens camera 112 having substantially same specifications as the first wide-angle lens camera 102, such that recaptured image 104 is free from the distortion.

Dated this 27th day of September 2017,


Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089

FIELD OF INVENTION



The invention generally relates to a field of image correction and more particularly to correction of image captured by a wide-angle lens camera.

BACKGROUND

A conventional wide-angle lens camera has a substantially smaller focal length compared to the focal length of a normal lens camera. The smaller focal length allows the wide-angle lens camera to capture a greater field of view but also causes some distortion in the image. The distortion may be of various types such as radial distortion, barrel distortion, pincushion distortion, fisheye distortion etc. These distortions affect the quality of the image and makes the image appear non-uniform. Although the distortion in the image is undesirable, the wide-angle lens camera may be useful in applications requiring more visual information than a normal lens camera is capable of capturing. Some of the applications where the wide-angle lens camera is required includes capturing architectural, interior and landscape view. Wide-angle lens cameras are further used in applications such as Advanced Drive Assistance Systems and security cameras. These applications often require correction of distortions in the images captured by the wide-angle lens. The conventional image distortion correction methods use camera calibration algorithms for correcting the distorted image.

Hence there is a need for an improved image distortion correction system and method.

SUMMARY OF THE INVENTION

According to an exemplary embodiment of the invention, a system for correcting a radial distortion in an image is disclosed. The radial distortion may form while capturing the image by a first wide-angle lens camera. The system for correcting the image distortion may include a projector. The projector may project the distorted image captured by the first wide-angle lens camera on a predefined shaped screen. The system may further include a second wide-angle lens camera. The second wide-angle lens camera may recapture the image from the predefined shaped screen. The system for correcting the radial distortion may be such that the specifications of the second wide-angle lens camera and the first wide-angle lens camera may be substantially same.

According to another exemplary embodiment of the invention, a method for correcting a radial distortion in an image captured by a first wide-angle lens camera is disclosed. The method may include projecting the distorted image captured by the first wide-angle lens on a predefined shaped screen. The method may further include recapturing the image projected on the predefined shaped screen by a second wide-angle lens camera. The specifications of the second wide-angle lens camera and the first wide-angle lens camera may be substantially same. The image recaptured by the second wide-angle lens may be free from the distortion.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings, wherein like reference numerals denote corresponding parts throughout the several views:

Figure 1 illustrates a first wide-angle lens camera capturing an image of a real-world in a wide-angle lens distortion correction system according to an exemplary embodiment of the invention;

Figure 2 illustrates a perspective view of a screen according to an exemplary embodiment of the invention;

Figure 3 illustrates a schematic diagram of the wide-angle lens distortion correction system according to an exemplary embodiment of the invention; and

Figure 4 illustrates a flowchart diagram of a method for correcting a distortion in an image according to an exemplary embodiment of the invention.

DETAILED DESCRIPTION OF DRAWINGS

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

Referring now to Figure 1, a first wide-angle lens camera 102 capturing an image 104 of a real-world 106 in a wide-angle lens distortion correction system 100 is illustrated according to an exemplary embodiment of the invention. The wide-angle lens distortion correction system 100 may be employed in applications such as, but not limited to, photography, videography, Advanced Driver Assistance Systems (ADAS), security systems etc. for correcting the distorted images and videos. The distortions corrected by the wide-angle lens distortion correction system 100 may include distortions such as radial distortion, barrel distortion, pincushion distortion, fisheye distortion etc. The distortion may deform the image 104 and makes it appear slightly curved which affects the visibility of the image 104. The first wide-angle lens camera 102 as illustrated in figure 1 may be a camera 102 having a wide-angle lens. According to an embodiment, the first wide-angle lens camera 102 may be a still image capturing device. According to another embodiment, the first wide-angle lens camera 102 may be a video recording device. It will be apparent to a person skilled in the art that the first wide-angle lens camera 102 may be any camera such as, but not limited to, a Single-Lens Reflex (SLR) camera, a Digital Single-Lens Reflex (DSLR) camera, a camcorder, a mirrorless camera etc. The lens of the first wide-angle lens camera 102 may have a substantially smaller focal length in comparison to the lens of a normal lens camera. By way of an example, the focal length of the lens of the first wide-angle lens camera 102 may be 35 mm or less. The first wide-angle lens camera 102 may be used for capturing a greater field of view. It should be noted that the image 104 captured by the first wide-angle lens camera 102 may include more visual information due to the greater field of view.

Figure 2 illustrates an isometric view of a screen 108 according to an exemplary embodiment of the invention. The screen 108 may display the image 104 captured by the first wide-angle lens camera 102. The screen 108 may be of type such as, but not limited to, Cathode ray tube

display (CRT), Light-emitting diode display (LED), Liquid crystal display (LCD), Organic light-emitting diode display (OLED) etc. The shape of the screen 108 may be predefined. According to an embodiment, the shape of the screen 108 may be defined depending on one or more specifications of the first wide-angle lens camera 102. The specifications of the first wide-angle lens camera 102 may include image sensor, scanning frequency, shutter speed, resolution, wide dynamic range etc. According to another embodiment, the shape of the screen 108 may be defined depending on at least one parameter of the distorted image 104 captured by the first wide angle lens camera 102. The parameters of the distorted image 104 may include angle of incidence with respect to a three-dimensional space. The shape of the screen 108 may in any shape such as a parabolic, ellipsoidal or spherical shape. It should be noted that the shape of the screen 108 may be substantially similar to the shape of the distorted image 104. By way of an example, if the distortion in the image 104 is a barrel distortion, the shape of the screen 108 may be substantially similar to a parabolic shape.

Figure 3 illustrates a schematic diagram of the wide-angle lens distortion correction system 100 for correcting the distortion in the image 104 according to an exemplary embodiment of the invention. The system 100 for correcting the distortion in the image 104 may include a projector 110. The projector 110 may project the distorted image 104 captured by the first wide angle lens camera 102 on the predefined shaped screen 108. The system 100 for correcting the distortion in the image 104 may further include a second wide-angle lens camera 112. The second wide-angle lens camera 112 may recapture the image 104 from the predefined shape screen 108. The recaptured image 104 by the second-wide angle lens camera 112 may be free of image distortion. According to an embodiment, the specifications of the second wide-angle lens camera 112 may be substantially same to the specifications of the first wide angle lens

camera 102. According to another embodiment, the second wide-angle lens camera 112 and the first wide angle lens camera 102 are same.

Figure 4 illustrates a block diagram of a method 200 for correcting a distortion in an image 104 captured by a first wide-angle lens camera 102 according to another exemplary embodiment of the invention. In step 202, the first wide-angle lens camera 102 may capture an image 104 of a real-world 106. According to an embodiment, the image 104 captured by the first wide-angle lens camera 102 may be a still image. According to another embodiment, the image 104 captured by the first wide-angle lens camera 102 may be a video. According to an embodiment, the first wide-angle lens camera 102 may be mounted at a fixed position. According to another embodiment, the first wide-angle lens camera 102 may be mounted on a moving object. By way of an example, for security applications like surveillance in ATMs, banks, homes etc. the first wide angle lens camera 102 may be mounted on a fixed wall and for ADAS applications, the first wide-angle lens camera 102 may be mounted on a moving vehicle. The vehicle with the first wide-angle lens camera 102 may travel from one place to another. During the travel, the first wide angle lens camera 102 may capture the video that includes roads, pedestrians, sky etc. It will be apparent to a person skilled in the art, the video is a set of still images that is being run continuously. The image 104 captured by the first wide angle lens camera 102 may include distortion. The distorted image 104 captured by the first wide-angle lens camera 102 may be send to a projector 110.

In step 204, the shape of a screen 108 for projecting the distorted image recorded by the first wide-angle lens camera 102 may be determined. According to an embodiment, the shape of the screen 108 may be determined based on the specifications of the first wide angle lens camera 102. According to another embodiment, the shape of the screen 108 may be determined based

on the parameters of the distorted image 104. It should be noted that the shape of the screen 108 may be such that the screen 108 may properly accommodate the distorted image 104.

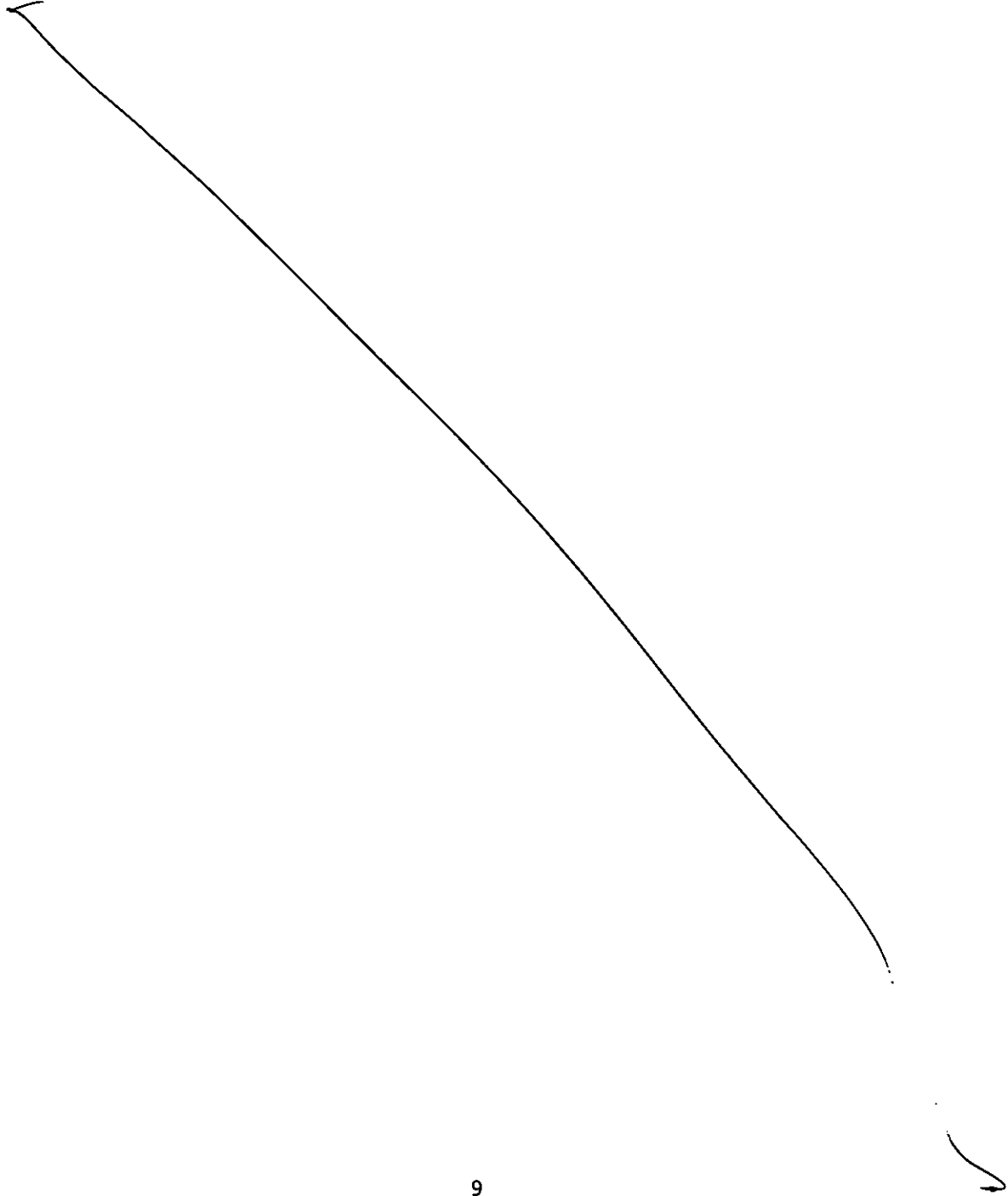
In step 206, the projector 110 may project the distorted image 104 captured by the first wide-angle lens camera 102 on the predefined screen 108. The distorted image 104 projected on the screen 108 may cover the entire area of the screen 108. According to an embodiment, the process of capturing the distorted image 104 from the first wide-angle lens camera 102 and projecting the distorted image 104 on the screen 108 may take place simultaneously. According to another embodiment, the projection of the distorted image 104 on the screen 108 may be performed later.

In step 208, a second wide-angle lens camera 112 may recapture the image 104 projected on the screen 108. According to an embodiment, the specifications of the second wide angle lens camera 112 may be same as the specifications of the first wide-angle lens camera 102. According to another embodiment, the second wide-angle lens camera 112 and the first wide-angle lens camera 102 may be same. It should be noted that the second wide-angle lens camera 112 may be placed at the focal point of the screen 108 while recapturing the image 104 from the screen 108.

The step 210 shows that the image 104 recaptured by the second wide-angle lens camera 112 may be free of the distortion. The image 104 recaptured by the second wide-angle lens camera 112 may further cover all the details included in the real world 106 image 104.

It is understood that the above description is intended to be illustrative, and not restrictive. It is intended to cover all alternatives, modifications and equivalents as may be included within

the spirit and scope of the invention as defined in the appended claims. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein," respectively.





L&T Technology Services Limited
201741034258

Total number of Sheets: 4
Sheet No. 1 of 4

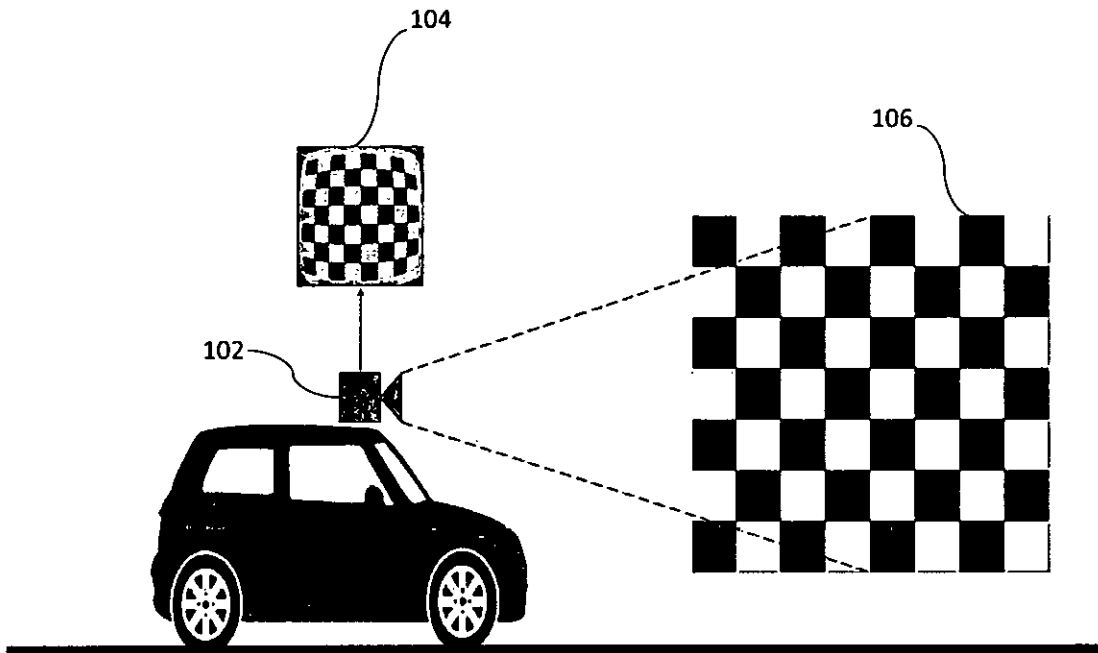


Figure 1

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089

27-Sep-2018/70249/201741034258/Drawing

PATENT OFFICE CHENNAI 28/09/2018 10:21

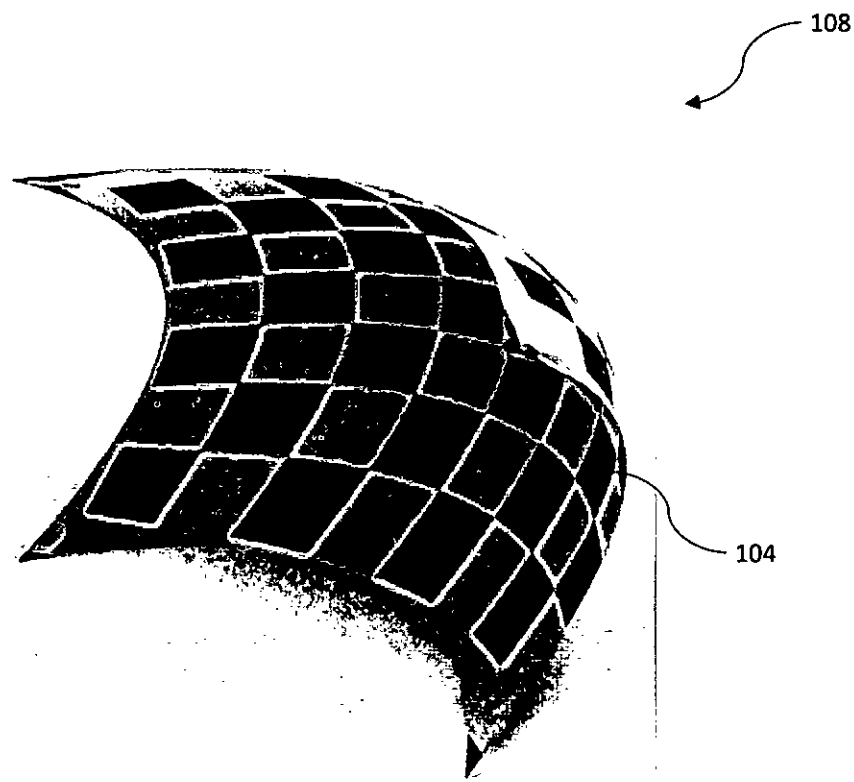



Figure 2


Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089

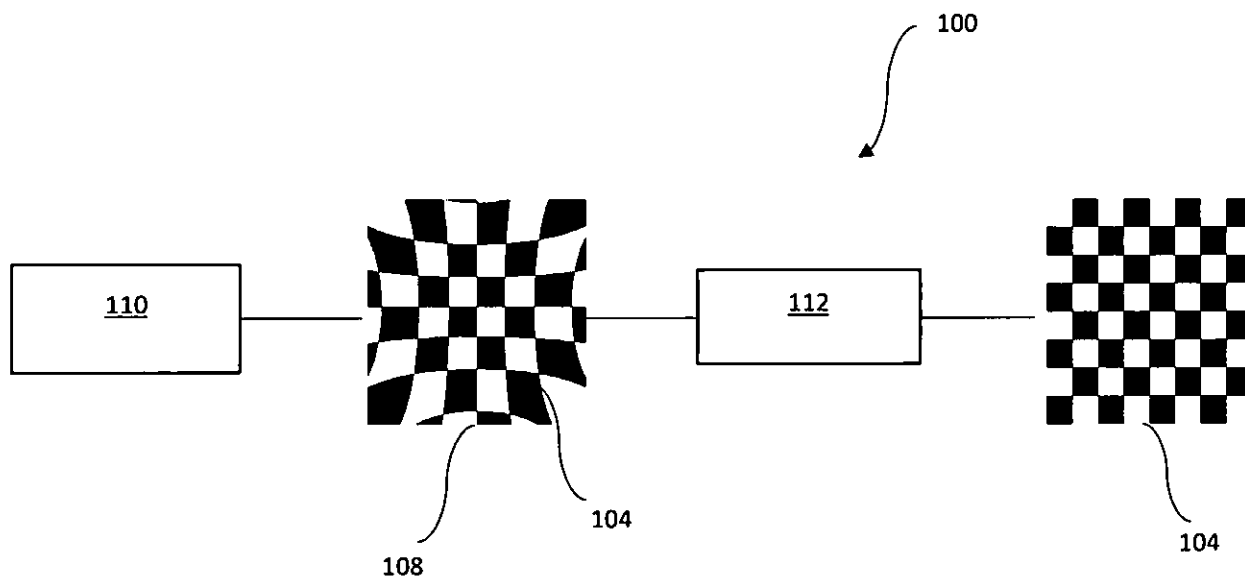


Figure 3

Faisal
Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089

27-Sep-2018/70249/201741034258/Drawing

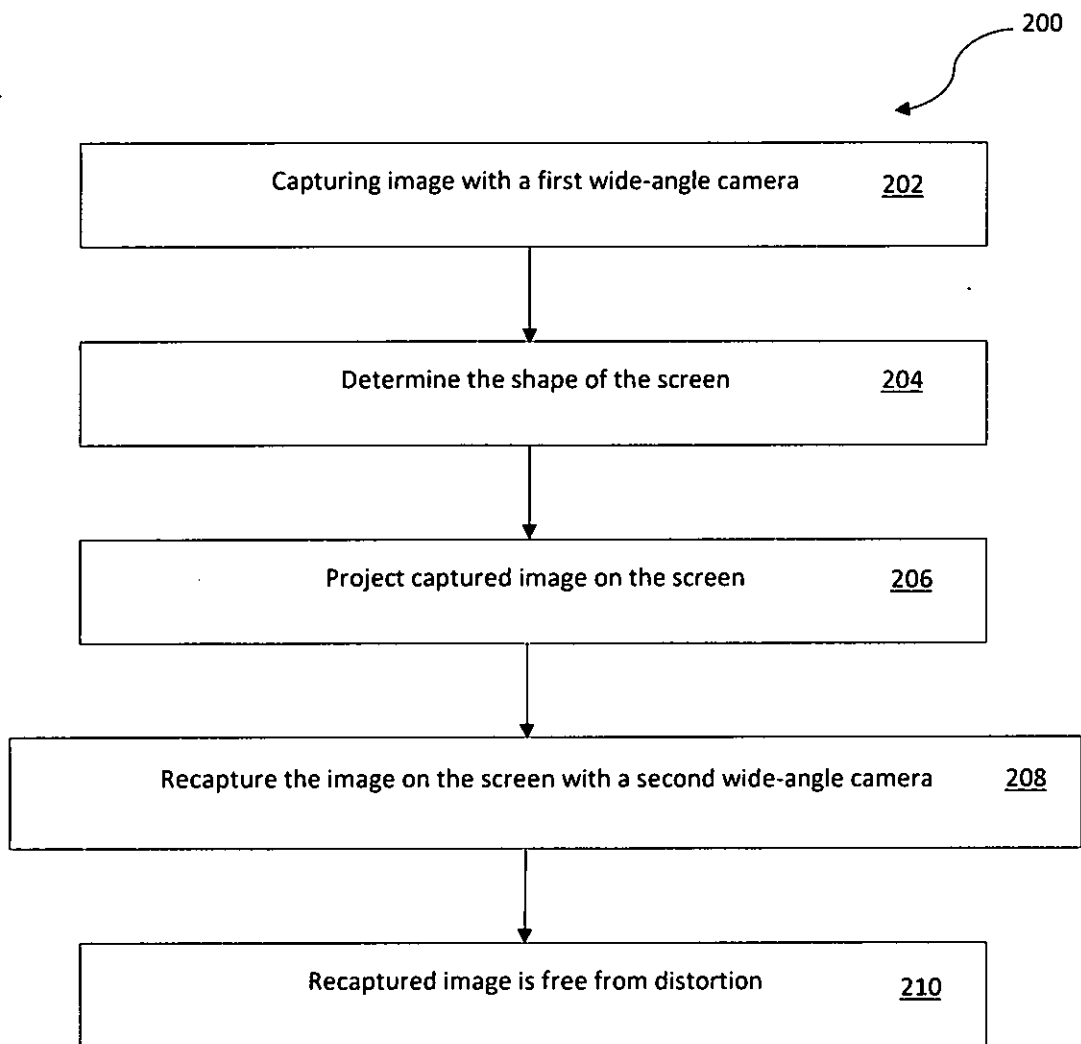


Figure 4

Faisal
Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089