

Methods and Camera Systems for Recording and Creation of 3-Dimension (3-D) Capable Videos and 3-Dimension (3-D) Still Photos.

Background

1) Technical field

Embodiments of the invention relate to camera systems and methods for recording 2-Dimension video and still images using a single image sensor and an optical lens module, but which can be converted to high quality 3-D video movies and still photos.

2) Description of related art.

The cameras having the standard auto focus is only capable of focusing only a given area which is within its range of view. The standard auto focus camera is not able to simultaneously focus all the objects which are near (eg. 5cm distance from camera) and far (eg. up to infinity or a few tens of meters) onto the imaging plane of the image sensor or photographic film of the camera. This makes it impossible or very difficult for software to create a good quality 3- Dimensional video from a 2-D video, captured using a standard auto focus camera. The software is capable of creating 3D video from 2D video. Also software and hardware combinations are available to create 3D video from 2D video. Key to achieving good 3D is to have all objects in the area of view focused on to the sensor of the camera, to achieve a video which is fully focused everywhere within the view. A common practice is to use two or more cameras to record video of a single scene and then later combine the two individual video recordings done by the two or more cameras, into one video in order to produce the 3 Dimensional video movies and still photographs.

Drawback of this method is the increase in the number of camera components required and there by the increase in the price of the video/still camera capable of capturing 3 Dimensional capable video and still images.

In addition the requirement of post processing to create the 3D video from the individual video recordings makes it time consuming and requires additional equipment to create a 3d movie or video. The above requirements make it impossible for the fabrication of low cost 3D capable video or still cameras. With increasing demand for low cost 3-Dimension miniaturized video and still capture capable cameras, a low cost camera system which is capable of capturing 3-Dimension video movies and still photos with and optical system incorporated to an imaging sensor is desired.

Summary of embodiments of the invention

Embodiments of the invention relate to methods and systems of making a low cost video camera and imaging (still capture) camera which is capable of recording video and still images, which can be converted to high quality 3 Dimensional videos and 3-D still photos.

Various arrangements may be envisaged to achieve focusing of the whole area, which is visible through the optical system of the camera onto the image sensor or film, used to capture the video movie or still photograph.

Embodiments of the invention are particularly advantages when providing an optical imaging lens system which is capable of simultaneously focusing light rays originating from objects disposed at various distances on to a first focal plane which is maintained at a fixed distance from the lens assembly. Hence,

embodiments of the invention enable imaging devices in small and compact form factor to produce quality 3-Dimension capable video and still images.

Here, what is meant (intended) by the term 3-Dimension capable to generate 3-Dimension video movie or 3-D still photographs using a combination of software and hardware, from the original 2-Dimension video movie or still photograph. The application areas are in the mobile communications such as mobile phones, laptops, smart phones, mobile multimedia devices, web cams, camcorders, cameras, digital cameras, photographic film camera, medical camera and compact camera modules.

The key to converting a 2-Dimension video or still image to a high quality 3-D video or still image should have all the objects which are near and far in the field of view should be fully focused and should not have blur regions in the 2-D video or 2-D still photo. The camera system disclosed herein provide 2-Dimension videos and still images which fulfills the requirement of having all the objects in the field of view to be fully focused and have no blur areas, in order to obtain high quality converted 3-Dimension video and still images.

Brief description of the drawings.

Fig (1) illustrates an optical camera system assembly having a lens assembly with the capability of focusing both far and near objects simultaneously and the image capture sensor placed at the focal plane. Here the optical lens system has multiple components.

Fig (2) illustrates an optical camera system assembly having a lens assembly with the capability of focusing both far and near objects simultaneously and the image capture sensor placed at the focal plane. Here the optical lens system has multiple components.

Fig (3) illustrates flow chart showing the process flow for viewing 2-D video movies and 2-D still photographs in 3-Dimensions directly from mobile phone, after conversion to 3-Dimensions.

Detailed description of illustrative embodiments

In the following description, numerous specific details are set forth in order to provide a thorough understanding of various illustrative embodiments of the invention. It will be understood, however, to one skilled in the art, that embodiments of the present invention may be practiced without some or all of these specific details. In other instances, well known process operations have not been described in detail in order not to unnecessarily obscure pertinent aspects of embodiments being described.

In one embodiment, a camera system having a special optical system and image sensor for capturing video and still images which are fully focused is disclosed. The special optical system consists of a lens assembly which is operable to simultaneously focus light rays originating from various distances onto a first focal plane. More particularly, parallel, convergent or divergent light rays from objects at near distances (eg. at least a few millimeters), and parallel or near parallel light rays from far object or objects at near infinity distances may be simultaneously focused onto a first focal plane while maintaining quality focus of a formed image within an acceptable tolerance limit.

The imaging surface of the image sensor or photographic film is placed at the first focal plane. In certain embodiments, a separation distance between a second focal plane where an image of a near object may be formed and a third focal plane where an image of a far object may be formed should have an acceptable tolerance limit. The first focal plane may be suitably maintained at a fixed distance from the

lens assembly whether the optical system is focusing on objects at near distances, or objects at near infinity distances, or both. Thus, when focusing objects at various distances, the optical system does not require varying a relative distance between the lens assembly and a first focal plane or an image plane on which images of the objects are focused onto be captured by an image sensor or photographic film. In other words, the first focal plane, where images are formed for capturing of objects disposed at various distances, including near distances and near-infinity distance, is fixed relative to the lens assembly. Since a relative movement between lenses is not necessary when performing a focus function, the optical system would require less space and less power. The image plane may be provided as part of an image sensor, such as but not limited to, a charged couple device (CCD) sensor, a complementary metal oxide semiconductor (CMOS) sensor and a photographic film.

The video and still image captured by the camera system disclosed here in will have all the objects in its field of view to be fully focused. The feature of this camera being able to provide fully focused video and still images of all objects in its field of view enables the creation of high quality 3-D videos and still images by conversion of the video and still images using software, hardware or a combination of both.

Fig. 1 and fig. 2 show cross sectional views of the devices explained.

Fig. 1 illustrates an optical system according to one embodiment of the invention. The optical system 100 includes a lens 110. A retainer structure 120 as illustrated, but not limited as such, may be provided to support the lens 110. Threads may be provided on the retainer structure 120 to facilitate installation or mounting of the optical system 100 to an external body or device.

As illustrated, parallel, convergent or divergent light rays from near objects, and parallel or near parallel light rays from objects at near infinity distances may be simultaneously focused onto a first focal plane or image plane or image sensor 130 which may be maintained at a fixed distance from the lens assembly 110.

Fig. 2 illustrates the embodiment of fig. 1 in cooperation with an array of optical elements within the lens assembly 200.

The lens assembly 200 includes an array of optical elements, 210 (a), 210 (b), 210 (c), 210 (d), 210 (e), but not limited to the illustration.

The number of optical elements, dimensions and orientation of each element is not limited to illustration.

Fig. 3 illustrates an example flow chart for using the mobile phone to directly playback video movies and still images which can be viewed as 3-D video movies and 3-D still photos through a suitable display 330. The high quality 2-D video or 2-D still photo captured by the camera system disclosed herein is converted to 3-D video or 3-D still photo by the converter 320. The mobile phone 310 is equipped with a 2-D video and still camera with the optics capable of focusing near and far objects simultaneously onto the image capture sensor or image capture plane, illustrated in fig. 1 and fig. 2, but not limited to these illustrations.

Claims

What is claimed is:

1. An optical camera system comprising:

a lens assembly, wherein the lens assembly is operable to simultaneously focus a plurality of light rays originating from a plurality of distances, onto a first focal plane which is maintained at a fixed distance from the lens assembly.

Thereby enabling the video or still images obtained by the camera system can be easily converted to high quality 3-Dimensional video and still images using a combination of software and hardware.
2. The system of claim 1, where in a separation distance between a second focal plane where an image of a near object is formed and a third focal plane where an image of a far object is formed has a tolerance of about +/- 300 micrometers.
3. The system of claim 1, where in the first focal plane is at a position in between the positions of second focal plane and the third focal plane.
4. The system of claim 1, where in an image capturing sensor device is placed at the first focal plane.
5. The system of claim 1, where in an image capturing film is placed at the first focal plane.
6. The camera system of claim 1, produces fully focused images of objects which are at near and far distances to the camera.
7. The camera system of claim 1, produces fully focused movies of objects which are at near and far distances to the camera.

8. The camera system of claim 1, is capable of producing video movies and still photographs.
9. The system of claim 1, where in the objects in the captured still photographs and video movies have very sharp edges, creating very sharp and high resolution photos and videos.
10. The video movie recorded using the system of claim 1 is converted from 2-Dimensional video to 3-Dimensional video using software.
11. The video movie recorded using the system of claim 1 is converted from 2-Dimensional video to 3-Dimensional video using hardware.
12. The video movie recorded using the system of claim 1 is converted from 2-Dimensional video to 3-Dimensional video using a combination of hardware and software.
13. The still photographs captured using the system of claim 1 is converted from 2-Dimensional still photograph to 3-Dimensional still photographs using hardware.
14. The still photographs captured using the system of claim 1 is converted from 2-Dimensional still photograph to 3-Dimensional still photographs using software.
15. The still photographs captured using the system of claim 1 is converted from 2-Dimensional still photograph to 3-Dimensional still photographs using a combination of software and hardware.
16. A method for fabricating the camera system which can record high quality video movies and still photos which can be converted to high quality 3-Dimensional videos and 3-Dimensional still photos.

17. The video movies and still photographs obtained using the system of claim 1 have very sharp and clear images of the objects which are at a far distance.
18. The video movies and still photographs obtained using the system of claim 1 have very sharp and clear images of the objects which are at near distance.
19. The video movies and still photographs obtained using the system of claim 1 have very sharp and clear images of the objects which are at both near distance and far distance.
20. The 2-D video movies and 2-D still photographs obtained using the system of claim 1 is converted to 3-D video movies and 3-D still photographs.
21. The converted 3-D video movies and 3-D still photographs of claim 20 can be viewed using a 3-D enabled television.
22. The converted 3-D video movies and 3-D still photographs of claim 20 can be viewed on a computer monitor, laptop, mobile phone, smart phone, portable media player, or any other device capable of displaying video movies and still photographs.
23. The converted 3-D video movies and 3-D still photographs of claim 20 can be viewed with the dedicated eye glasses.
24. The converted 3-D video movies and 3-D still photographs of claim 20 can be viewed on a computer monitor, laptop, mobile phone, smart phone, portable media player, or any other device capable of displaying video movies and still photographs without the dedicated eye glasses.

25. A method for fabricating a system to view 3-Dimensional video and 3-Dimensional still photographs without using the dedicated spectacles comprising:
- An image display device such as television, computer monitor, mobile phone display, LCD (liquid crystal display), plasma display, TFT display, or other suitable display devices, but not limited to these, with or without a grating structure or a polarizer or a combination of both placed on top or in contact with the image display device.
26. The method of claim 25, wherein a second polarizer is placed on top or in contact with the image display device (eg. television, computer monitor, mobile phone display, LCD (liquid crystal display), plasma display, TFT display, or other suitable display device).
27. An optical lens system capable of generating the energy required for focusing by the lens system itself with the use of light energy.
28. An optical lens system capable of reacting to the reflected light energy in order to focus all light rays onto one plane or onto the image sensor.
29. An optical lens system capable of changing it's optical properties in various regions of the lens system in order to focus all light rays onto one plane, depending on the light incident on various regions of the lens system.
30. An optical lens system capable of changing it's optical properties in various regions of the lens system in order to focus all light rays onto one plane depending on the electrical energy provided to lens assembly.
31. The 2-Dimensional video recording or still photo is directly viewed in 3-Dimensions on mobile phone or television after conversion to appropriate

format using software or hardware or a combination of both software and hardware.

32. With a combination of software and hardware, a television may convert the 2-Dimension video content and 2-Dimension still content captured in real time by the camera system of claim1, to 3-Dimension video and 3-Dimension still images.
33. With a combination of software and hardware, a television may convert the 2-Dimension video content and 2-Dimension still content captured in real time by the camera system of claim1, to a format which are translated by the glasses as a 3-Dimension image.
34. The glasses of claim 33, are the glasses provided with 3-D enabled television sets, for viewing 3-Dimensional content.
35. The system of claim 1, wherein a ZOOM function is incorporated to the camera system.