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(54) RETRACTABLE ROTATABLE CAMERA MODULE FOR MOBILE COMMUNICATION DEVICE AND METHOD OF OPERATION THEREOF

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(57) **ABSTRACT**

A mobile communication device having a camera module and a method of operating a mobile communication device having a camera module. In one embodiment, the mobile communication device includes: (1) a main body and (2) a camera module, coupled to the main body and configured for movement with respect thereto between a retracted position and an exposed position and rotatable in the exposed position about at least one axis of rotation.

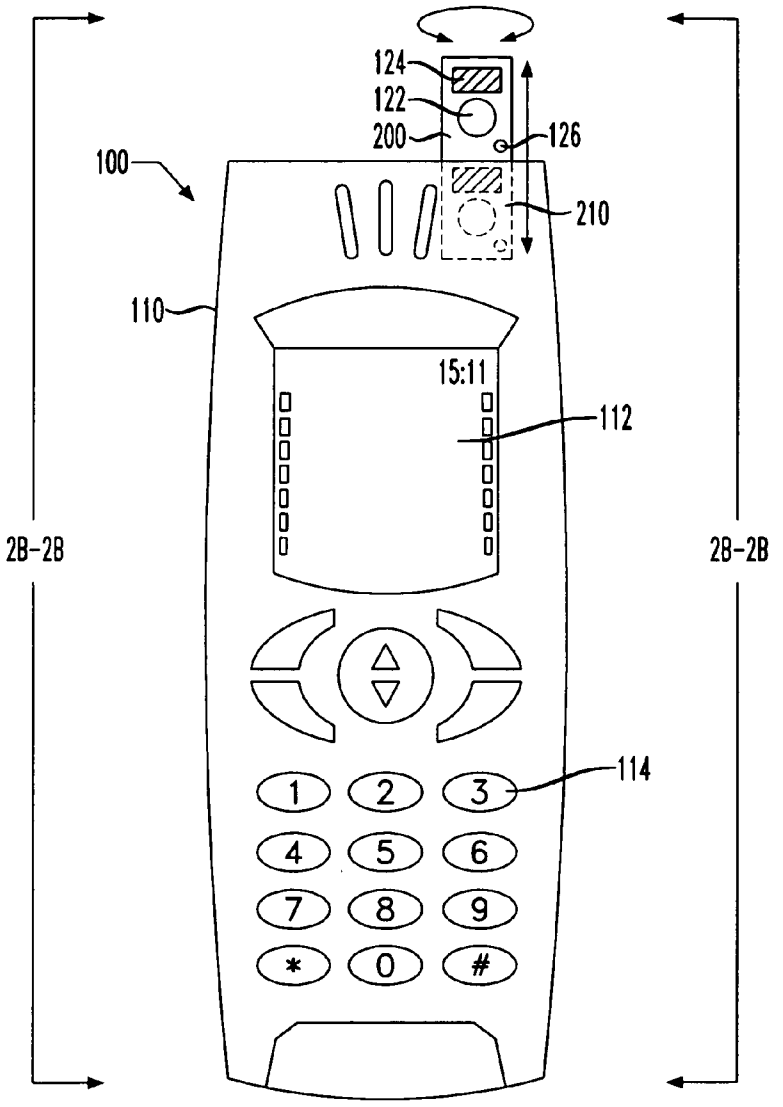


FIG. 1

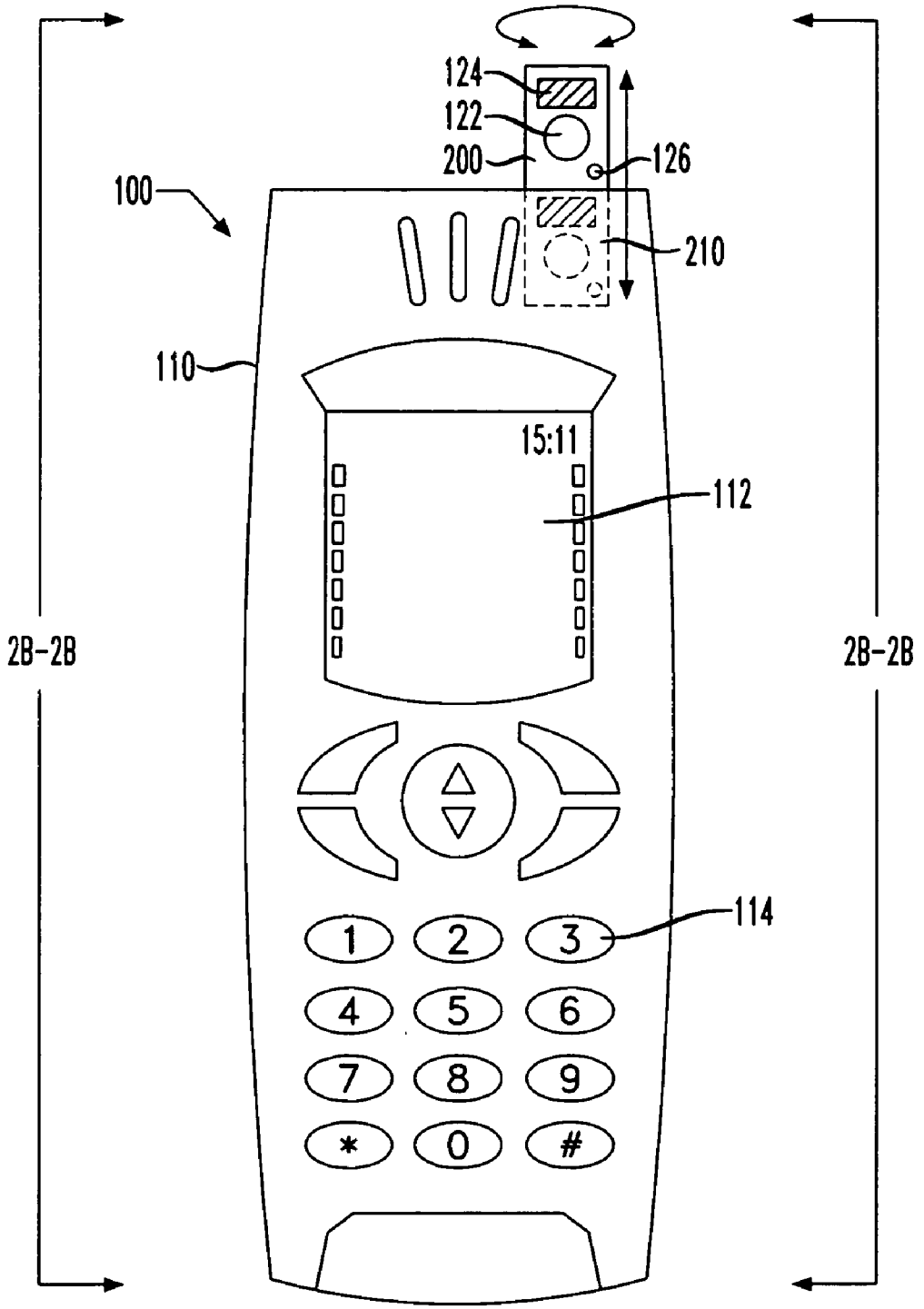


FIG. 2A

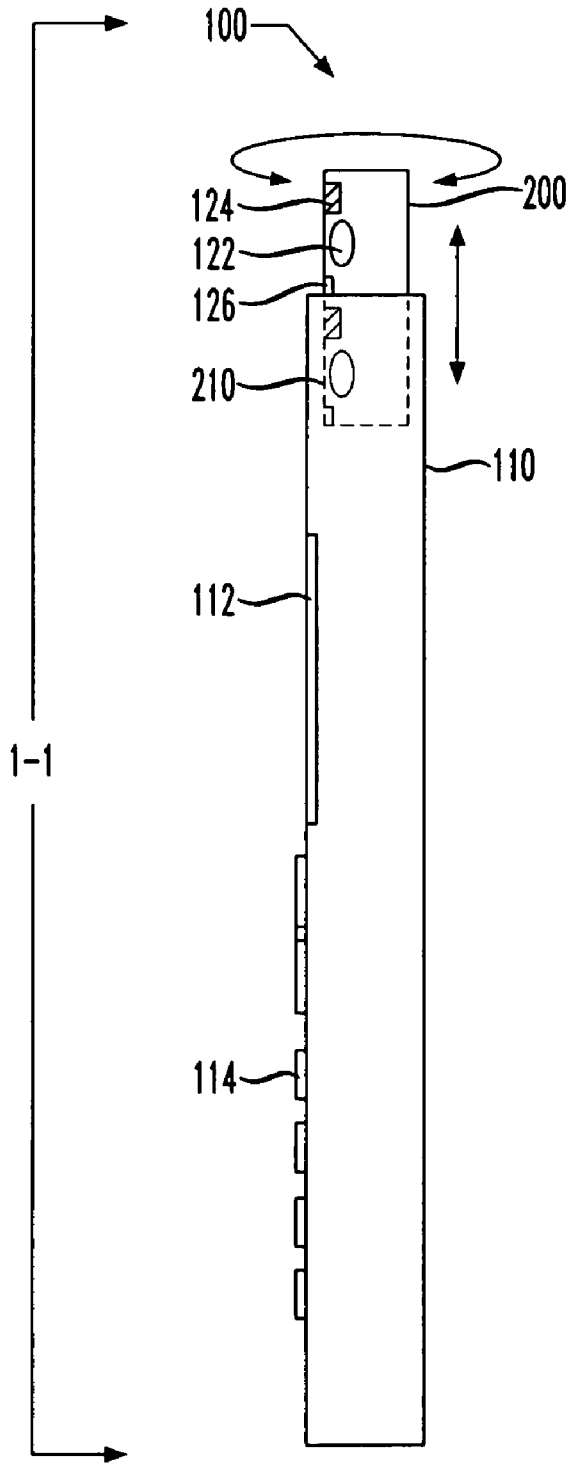

100
124
122
126
200
210
110
112
114
1-1

FIG. 2B

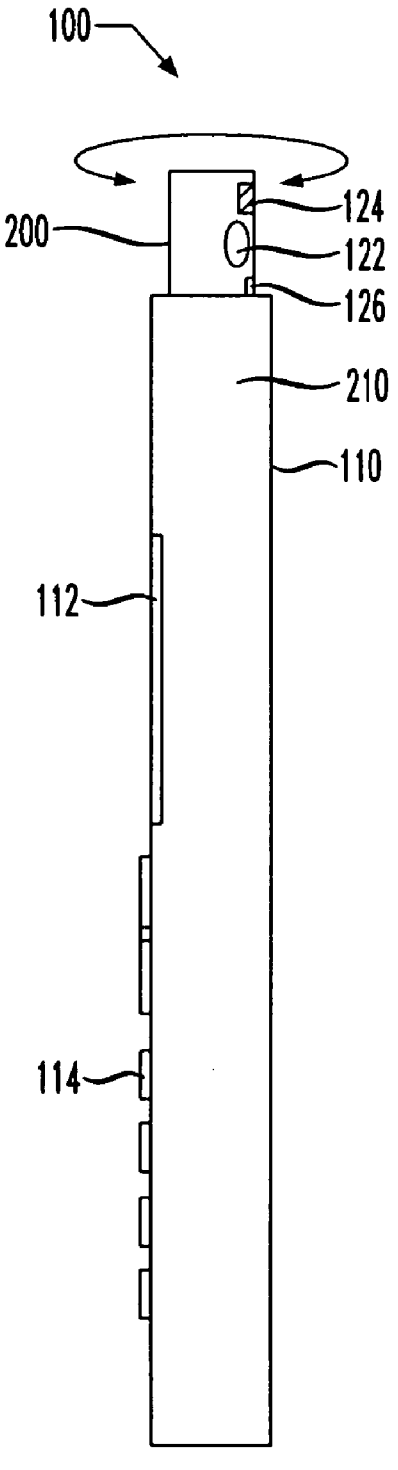

100
200
124
122
126
210
110
112
114

FIG. 3

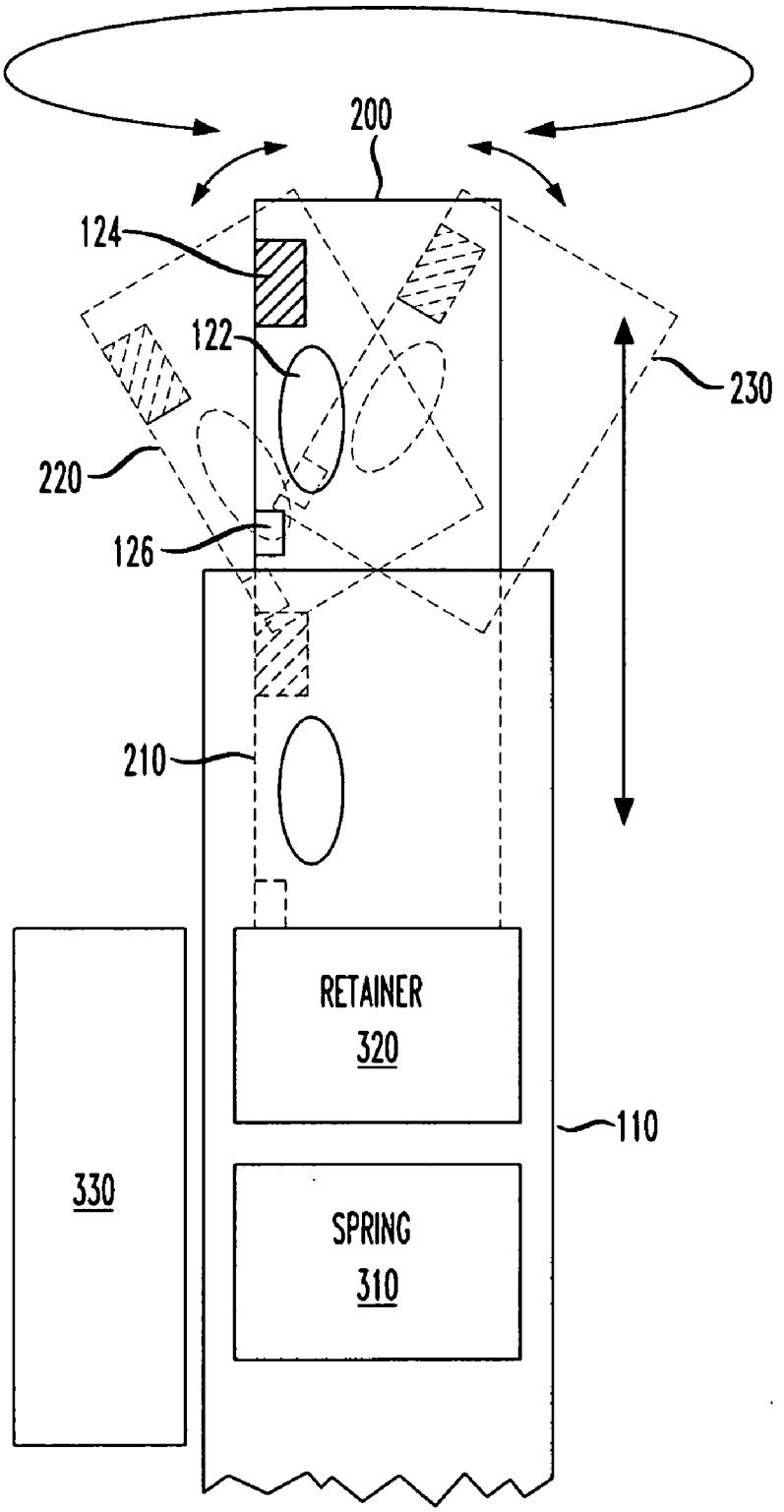
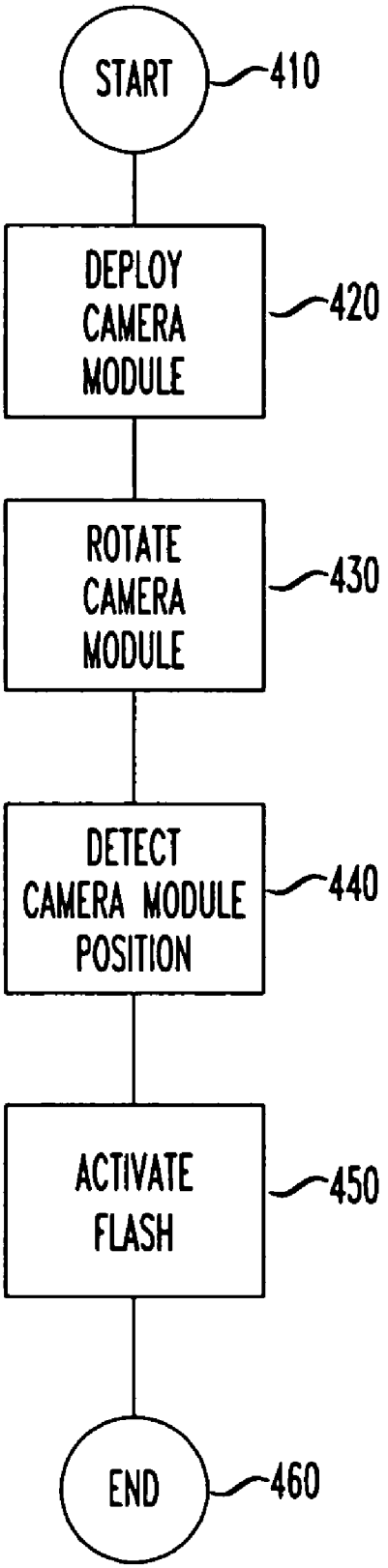


FIG. 4


START
410
DEPLOY CAMERA MODULE
420
ROTATE CAMERA MODULE
430
DETECT CAMERA MODULE POSITION
440
ACTIVATE FLASH
450
END
460

RETRACTABLE ROTATABLE CAMERA MODULE FOR MOBILE COMMUNICATION DEVICE AND METHOD OF OPERATION THEREOF

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention is directed, in general, to wireless telecommunications and, more specifically, to a retractable rotatable camera module for a mobile communication device and method of operating the same.

BACKGROUND OF THE INVENTION

[0002] Mobile communication devices, such as mobile telephones, are increasingly used for more than just speech communication. A variety of applications like messaging services, data communication, e-mail or fax services have become available to the users of mobile communication devices.

[0003] The ongoing development in digital imaging devices makes it possible today to equip mobile communication devices with digital cameras at affordable prices, which gives rise to a host of new multimedia services. Such digital cameras allow one party to take digital photographs and send them to another by means of the well known multimedia message system (MMS) standard. Even video telephony can be established between two mobile communication devices, provided they are each equipped with a camera. The display is integral part of such applications, for viewing functions in the case of digital photography or so each party can see the other in the case of video telephony.

[0004] A problem, which consequently arises is that a different arrangement of display in relation to camera is required to support services such as digital photography and video telephony in the same device. More specifically, they have to face in opposite directions in digital photography, whereas the display and camera have to face in the same direction in video telephony.

[0005] This problem can be solved by equipping the mobile communication device with two cameras, one facing in the same and another facing in the opposite direction of the display. The use of two cameras in a single mobile communication device is taught in, for instance, United States patent application publication US 2003/0036365 to Kuroda, entitled "Portable Communications Terminal with Camera Capable of Taking Pictures." However, using two cameras leads to a significantly more expensive and complex mobile communication device.

[0006] Accordingly, what is needed in the art is a less expensive way to bring both digital photography and video telephony functionality to a mobile communication device.

SUMMARY OF THE INVENTION

[0007] The present invention addresses the above-described shortcomings of the prior art by introducing a mobile communication device with imaging means, which can be flexibly used for different applications or services, such as digital photography or video telephony.

[0008] To address the above-discussed deficiencies of the prior art, in one aspect, the present invention provides a mobile communication device having a camera module and a method of operating a mobile communication device having a camera module. In one embodiment, the mobile communication device includes: (1) a main body and (2) a camera module, coupled to the main body and configured for movement with respect thereto between a retracted position and an exposed position and rotatable in the exposed position about at least one axis of rotation.

[0009] In another aspect, the present invention provides a mobile communication device. In one embodiment, the mobile communication device includes: (1) a main body having attaching means for attaching a camera module and (2) a camera module having complementary attaching means to the main body, such that the camera module is movable with respect to the main body from a retracted position to an exposed position and is rotatable in the exposed position about at least one axis of rotation.

[0010] In yet another aspect, the present invention provides a camera module. In one embodiment, the camera module includes: (1) attaching means for attaching the camera module to complementary attaching means of a mobile communication device and (2) a camera, coupled to the attaching means, the camera movable with respect to a main body of the mobile communication device from a retracted position to an exposed position and rotatable in the exposed position about at least one axis of rotation.

[0011] In still another aspect, the present invention provides a method of operating a retractable rotatable camera module. In one embodiment, the method includes: (1) deploying the camera module by releasing a user-releasable retainer, the camera module to move from a retracted position to an exposed position with respect to a main body of an associated mobile communication device and (2) rotating the camera module about at least one axis of rotation.

[0012] The foregoing has outlined, rather broadly, preferred and alternative features of the present invention so that those skilled in the art may better understand the detailed description of the invention that follows. Additional features of the invention will be described hereinafter that form the subject of the claims of the invention. Those skilled in the art should appreciate that they can readily use the disclosed conception and specific embodiment as a basis for designing or modifying other structures for carrying out the same purposes of the present invention. Those skilled in the art should also realize that such equivalent constructions do not depart from the spirit and scope of the invention in its broadest form.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] For a more complete understanding of the present invention, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

[0014] **FIG. 1** illustrates a schematic front view of one embodiment of a mobile communication device with a retractable camera module rotatable about one axis of rotation and constructed according to the principles of the present invention;

[0015] **FIGS. 2A and 2B** illustrate schematic right-hand side views of the mobile communication device of **FIG. 1** with the camera module in a front side (**FIG. 2A**) and a back side (**FIG. 2B**) position;

[0016] **FIG. 3** illustrates an enlarged schematic side view of a second embodiment of a camera module rotatable about two axes of rotation and constructed according to the principles of the present invention; and

[0017] **FIG. 4** illustrates a flow diagram of one embodiment of a method of operating a retractable rotatable camera module for a mobile communication device carried out according to the principles of the present invention

DETAILED DESCRIPTION

[0018] Referring initially to **FIG. 1**, illustrated is a mobile telephone **100**, which is equipped with a retractable and rotatable camera module **200**. When in use the camera module **200** is in the exposed position shown in **FIG. 1**. When the camera associated with the camera module **200** is not in use, the camera module **200** is retractable into a main body **110** of the mobile telephone **100**. This retracted position is indicated by reference number **210**.

[0019] In this embodiment the camera module **200** comprises a flash **124** and a self-timer (not shown), which is connected to a light-emitting diode (LED) **126** for indicating the elapsing of the delay time of the self-timer.

[0020] The camera module **200** is shown with a lens **122** thereof facing to the front side of the mobile telephone **100**, the front side being defined as the side of the mobile telephone **100** on which a display **112** and a keypad **114** are arranged. This is the typical position suitable for an application such as video conferencing. By rotating the camera module **200** by about 180°, the camera module **200** now faces to the back side of the mobile telephone **100**, which is a suitable position for taking digital photographs.

[0021] The camera module **200** is shown in **FIG. 1** as being mounted at the top side of the mobile telephone **100**. Of course, the camera module **200** could be mounted at the side of the mobile telephone **100** or at any position, in which it can be rotated to face to the front or the back side of the mobile telephone **100** as described above.

[0022] Certainly, the invention is not limited to mobile telephones, but can also be used for personal digital assistants (PDAs) or mobile digital assistants (MDAs) or any other conventional or later-developed mobile communication device.

[0023] Turning now to **FIGS. 2A and 2B**, the mobile telephone **100** of **FIG. 1** is shown from the left-hand side to demonstrate further the rotating movement of the camera module **200**. In **FIG. 2A**, the camera module **200** is in the front side position. In **FIG. 2B**, the camera module **200** is rotated by about 180°, which causes the camera module **200** to face the back side of the mobile telephone **100**.

[0024] Turning now to **FIG. 3**, illustrated is another embodiment of the camera module **200**. In this embodiment, the camera module **200** is rotatable about two axes of rotation, which are essentially perpendicular to one another. That way the camera module **200** can not only be rotated about a vertical axis as shown in **FIGS. 1, 2A** and 2B, but can also be tilted and thus rotated about a horizontal axis of rotation. Positions, in which the camera module is tilted forward and backward are indicated by reference numbers **220** and **230** respectively.

[0025] **FIG. 3** also shows, in highly schematic form, an optional spring **310**, by which the camera module **200** can be automatically ejected and brought into the exposed position. For this purpose, an optional user-releasable retainer **320** may be provided to retain the spring in a compressed position until the user releases it. In the alternative, the camera module **200** could be automatically ejected by means of an electromagnet or motor or manually pulled out by the user. Finally, if the camera module **200** is wholly detachable from the mobile telephone **100** of **FIG. 1**, an attaching means **330** is associated with the camera module **200**. The attaching means **330** releasably engages a corresponding attaching means located on or in the mobile telephone **100**.

[0026] Turning now to **FIG. 4**, illustrated is a flow diagram of one embodiment of a method of operating a retractable rotatable camera module for a mobile communication device carried out according to the principles of the present invention. The method begins in a start step **410** when a user wishes to deploy a camera either to take a digital photograph or engage in video telephony.

[0027] The method proceeds to a step **420** in which a user deploys a camera module containing the camera by releasing a user-releasable retainer. In response, a spring extends, causing a camera module to move from a retracted position to an exposed position with respect to the main body of the mobile communication device.

[0028] Next, in a step **430**, the user rotates the camera module about at least one axis of rotation. Then, in an optional step **440**, a detector, in particular an electronic detector, may detect the position of the camera module relative to the main body of the mobile communication device, including perhaps the rotational orientation of the camera module. The power supply of the camera module may then be automatically switched on. Also, the display of the mobile communication device may be configured for a particular application, such as digital photography or video telephony.

[0029] Next, in an optional step **450**, a flash may be activated if the user intends to take a digital photograph. A self-timer may be used to measure a delay time before automatically taking a photograph. The elapsing of the delay time can be indicated by appropriate indicator, such as an LED, which may flash with an ascending frequency during the delay time. The method ends in an end step **460**, when the user ostensibly urges the camera module back into a retracted position within the main body.

[0030] Although the present invention has been described in detail, those skilled in the art should understand that they can make various changes, substitutions and alterations herein without departing from the spirit and scope of the invention in its broadest form.

What is claimed is:

1. A mobile communication device, comprising:

a main body; and

a camera module, coupled to said main body and configured for movement with respect thereto between a retracted position and an exposed position and rotatable in said exposed position about at least one axis of rotation.

2. The mobile communication device as recited in claim 1 wherein said camera module translates to move between said retracted position and said exposed position.

3. The mobile communication device as recited in claim 1 wherein said at least one axis of rotation is essentially perpendicular to a direction of said movement.

4. The mobile communication device as recited in claim 1 wherein said camera module is rotatable at least from a front side position to a back side position in said exposed position.

5. The mobile communication device as recited in claim 1 wherein said camera module is rotatable about at least two axes of rotation in said exposed position.

6. The mobile communication device as recited in claim 5 wherein said two axes of rotation are essentially perpendicular.

7. The mobile communication device as recited in claim 1 further comprising a user-releasable retainer for retaining said camera module in said retracted position.

8. The mobile communication device as recited in claim 1 further comprising a spring mechanism that automatically ejects said camera module from said retracted position to said exposed position.

9. The mobile communication device as recited in claim 1, comprising detection means for detecting a position of said camera module relative to said main body.

10. The mobile communication device as recited in claim 9, comprising a memory with at least one stored program and a microprocessor by which said program can be executed, said program being started automatically when said detection means detects a certain position of said camera module.

11. The mobile communication device as recited in claim 1 further comprising a flash coupled to said camera module.

12. The mobile communication device as recited in claim 1 further comprising a user-activatable self-timer that automatically takes a photograph after a certain delay time and an indicator that indicates an elapsing of said delay time.

13. The mobile communication device as recited in claim 12 wherein said indicator is a light-emitting diode (LED).

14. A mobile communication device, comprising:

a main body having attaching means for attaching a camera module; and

a camera module having complementary attaching means to said main body, such that said camera module is movable with respect to said main body from a retracted position to an exposed position and is rotatable in said exposed position about at least one axis of rotation.

15. The mobile communication device as recited in claim 14 wherein said attaching means of said main body comprises means for moving the camera module from the retracted position to said exposed position and means for rotating said camera module in said exposed position about at least one axis of rotation.

16. A camera module, comprising:

attaching means for attaching said camera module to complementary attaching means of a mobile communication device; and

a camera, coupled to said attaching means, said camera movable with respect to a main body of said mobile communication device from a retracted position to an exposed position and rotatable in said exposed position about at least one axis of rotation.

17. A method of operating a retractable rotatable camera module, comprising:

deploying said camera module by releasing a user-releasable retainer, said camera module to move from a retracted position to an exposed position with respect to a main body of an associated mobile communication device; and

rotating said camera module about at least one axis of rotation.

18. The method as recited in claim 17 further comprising detecting a position of said camera module relative to said main body.

19. The method as recited in claim 18 wherein said detecting comprises detecting a rotational orientation of said camera module.

20. The method as recited in claim 18 further comprising automatically configuring a display of said mobile communication device for a particular application.

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