# IMAGING METHOD FOR IMAGE SENSOR, IMAGING APPARATUS, AND ELECTRONIC DEVICE

## CROSS REFERENCE TO RELATED APPLICATION

This application is a SG national application of an International Application No. PCT/CN2016/100649, filed on September 28, 2016, which claims a priority to Chinese Patent Application Serial No. 201510963341.3, filed with the State Intellectual Property Office of P. R. China on December 18, 2015 by GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP., LTD., and titled with "imaging method for image sensor, imaging apparatus and electronic device", the entire contents of which are incorporated herein by reference.

## TECHNICAL FIELD

The present disclosure relates to the imaging technology field, and more particularly, to an imaging method for an image sensor, an imaging apparatus and an electronic device.

## BACKGROUND

At present, diversification of camera functions of mobile phones has earned trust of users. Multi-frame synthesis technology is applied in many mobile phones when photographing, i.e. an image sensor of the mobile phone continuously captures a plurality of images, and then the images are synthesized by software so as to achieve different photography effects (such as a High Dynamic Range (HDR for short) effect, a night effect, etc.) to enrich use experience.

However, in the multi-frame synthesis technology used in related art, due to a need of acquiring the multi-frame data, long time is required for the multi-frame data. In addition, if an object to be photographed is moving when capturing the multi-frame data, ghosting effect occurs easily after synthesis.

## SUMMARY

The present disclosure aims to solve at least one of the problems in related art to some extent. Accordingly, a first objective of the present disclosure is to provide an imaging method for an image sensor.

A second objective of the present disclosure is to provide an imaging apparatus.

A third objective of the present disclosure is to provide an electronic device.

A fourth objective of the present disclosure is to provide a mobile terminal.

A fifth objective of the present disclosure is to provide a non-transitory computer-readable storage medium.

In order to achieve the above objectives, a first aspect of embodiments of the present disclosure provides an imaging method for an image sensor. The image sensor includes a photosensitive pixel array and a filter arranged on the photosensitive pixel array. The filter includes an array of filter units. Each filter unit and a plurality of adjacent photosensitive pixels covered by the filter unit in the photosensitive pixel array form a synthesized pixel. The imaging method includes: reading an output of the photosensitive pixel array, and extracting pixel values of photosensitive pixels within different synthesized pixels from a read-out single-frame high-resolution image, and combining the pixel values so as to obtain a plurality of multiple-frame low-resolution images; and synthesizing the plurality of multiple-frame low-resolution images.

A second aspect of embodiments of the present disclosure provides an imaging apparatus including an image sensor and an imaging processing module. The image sensor includes a photosensitive pixel array; a filter arranged on the photosensitive pixel array, the filter includes an array of filter units, each filter unit and a plurality of adjacent photosensitive pixels covered by the filter unit in the photosensitive pixel array form a synthesized pixel. The image processing module is connected to the image sensor, the imaging processing module is configured to read an output of the photosensitive pixel array, and is configured to extract pixel values of photosensitive pixels within different synthesized pixels from a read-out single-frame high-resolution image, and is configured to combine the pixel values so as to obtain a plurality of multi-frame low-resolution images, and is configured to synthesize the plurality of multi-frame low-resolution images.

A third aspect of embodiments of the present disclosure provides an electronic device. The electronic device includes the imaging apparatus according to the second aspect of embodiments of the present disclosure.

A fourth aspect of embodiments of the present disclosure provides a mobile terminal. The mobile terminal includes a housing; a processor; a memory; a circuit board; a power supply circuit and an image sensor. The circuit board is located in a space defined by the housing. The processor, the memory and the image sensor are arranged on the circuit board. The power supply circuit is configured to supply power for each circuit or component in the mobile terminal. The image sensor includes a photosensitive pixel array and a filter arranged on the photosensitive pixel array. The filter includes an array of filter units. Each filter unit and a plurality of adjacent photosensitive

indicate colors of the filter units 1315 respectively. The numerals 1, 2, 3, 4 are configured to indicate positions of the four adjacent photosensitive pixels 111 beneath the filter unit 1315. In detail, R is configured for indicating the red filter unit 1315. B is configured for indicating the blue filter unit 1315. Gr and Gb are configured for indicating the green filter unit 1315 respectively.

The filter unit 1315 shared by the four adjacent photosensitive pixels 111 may be integrally formed, or assembled from four individual filters. Preferably, the filter unit 1315 in this embodiment of the present disclosure is integrally formed.

Referring again to Fig. 1A, an imaging method for an image sensor according to an embodiment of the present disclosure may include followings.

S1, output of the photosensitive pixel array is read, and pixel values of photosensitive pixels within different synthesized pixels are extracted from a read-out single-frame high-resolution image and are combined so as to obtain a plurality of multiple-frame low-resolution images.

In an embodiment of the present disclosure, extracting pixel values of photosensitive pixels within different synthesized pixels from a read-out single-frame high-resolution image, and combining the pixel values so as to obtain a plurality of multiple-frame low-resolution images includes: extracting the pixel values of the photosensitive pixels located at same positions in the different synthesized pixels from the read-out single-frame high-resolution image, and combining the pixel values so as to obtain the plurality of multiple-frame low-resolution images.

It is to be understood that, the position where the pixel is extracted from the single-frame high-resolution image in an embodiment of the present disclosure can also be adjusted according to actual requirements for synthesizing images, such as extracting the pixel values of the photosensitive pixels located at different positions relative to their respective synthesized pixels from the read-out single-frame high-resolution image, and combining the pixel values so as to obtain the plurality of multiple-frame low-resolution images.

Referring to Figs. 2 and 4B, the pixel values of the photosensitive pixels 111 located at same positions in the different synthesized pixels 14 (four different synthesized pixels) are extracted from the single-frame high-resolution image and then are synthesized so as to obtain four frames of low-resolution images. For example, the four photosensitive pixels 111 in the first frame of the obtained low-resolution images are extracted from the pixel values of the photosensitive pixels 111 located at the same positions Gr1, R1, B1 and Gb1 relative to four respective filter units 1315 included in the four adjacent synthesized pixels 14.

S2, the plurality of multiple-frame low-resolution images are synthesized.

In an embodiment, the plurality of multiple-frame low-resolution images acquired are synthesized to generate an HDR (High dynamic range) image.

pixels within different synthesized pixels from a read-out single-frame high-resolution image, and combining the pixel values so as to obtain a plurality of multiple-frame low-resolution images ; and

synthesizing the plurality of multiple-frame low-resolution images .

14. The mobile terminal according to claim 13, wherein the processor is further configured to:

from the read-out single-frame high-resolution image, extract the pixel values of the photosensitive pixels located at same positions in the different synthesized pixels, and combine the pixel values so as to obtain the plurality of multiple-frame low-resolution images .

15. The mobile terminal according to claim 13, wherein each filter unit and n*n adjacent photosensitive pixels covered by the filter unit in the photosensitive pixel array form a synthesized pixel, and the processor is configured to:

read the output of the photosensitive pixel array, extract the pixel values of the photosensitive pixels within adjacent synthesized pixels from the read-out single-frame high-resolution image, and combine the pixel values so as to obtain at least m frames of low-resolution images; and

synthesize the at least m frames of low-resolution images, wherein n is a natural number greater than 1, m is a natural number greater than 1 and less than or equal to n*n.

16. The mobile terminal according to claim 15, wherein each filter unit and 2*2 adjacent photosensitive pixels covered by the filter unit in the photosensitive pixel array form a synthesized pixel, and the processor is configured to:

read the output of the photosensitive pixel array, and extract the pixel values of the photosensitive pixels within different synthesized pixels from the read-out single-frame high-resolution image, and combine the pixel values so as to obtain four frames of low-resolution images; and

synthesize the four frames of low-resolution images.

17. The mobile terminal according to claim 13, wherein four adjacent synthesized pixels form a synthesized pixel unit, and four filter units arranged adjacently within each synthesized pixel unit comprise a red filter unit, a blue filter unit and two green filter units.

18. The mobile terminal according to claim 13, wherein each synthesized pixel further comprises a lens array arranged above the filter unit, and the lens array is configured to converge light onto the photosensitive pixels beneath the filter.

19. The mobile terminal according to claim 18, wherein the lens array comprises a plurality of micro-lenses and each micro-lens is arranged corresponding to one photosensitive pixel.

20. A non-transitory computer-readable storage medium having stored therein one or more programs, wherein the programs are configured to perform the imaging method for an image sensor according to any one of claims 1 to 5.