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### Image resolution enhancing carrying frame, camera module and electronic device

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#### Abstract

A carrying frame includes a main body, a first rotating part, a second rotating part, and a driving part. The main body includes a first inner surface which defines a first through hole. The first rotating part is mounted on the first inner surface and comprises a second inner surface which defines a second through hole. The second rotating part is mounted on the second inner surface and comprises a third through hole. The driving part is configured to drive at least one of the first rotating part to rotate in a first direction and the second rotating part to rotate in a second direction. The first direction and the second direction are perpendicular to each other, and both the first direction and the second direction are parallel to a plane where the main body is located. A camera module and an electronic device are also provided.

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Background/Summary

FIELD

(1) The subject matter herein generally relates to fields of electronics and optical components, and in particular, to a carrying frame, a camera module having the carrying frame and an electronic device having the camera module.

BACKGROUND

(2) With the development of image processing technology, the resolution of cameras has become higher and higher. In order to increase the pixels of the camera, a photosensitive chip with more photosensitive units can be used. However, as the number of photosensitive units increases, the production process of the photosensitive chip becomes more complicated, which results in a higher production cost.

Description

## BRIEF DESCRIPTION OF THE DRAWINGS

- (1) Implementations of the present disclosure will now be described, by way of embodiments, with reference to the attached figures.
- (2) FIG. 1A is a schematic front view of an embodiment of a carrying frame according to the present disclosure.
- (3) FIG. 1B is a schematic back view of an embodiment of a carrying frame according to the present disclosure.
- (4) FIG. 2A is a diagram of an embodiment of a first deflection formed between a first frame of a carrying frame and a main body of carrying frame according to the present disclosure.
- (5) FIG. 2B is a diagram of an embodiment of a second deflection formed between a first frame of a carrying frame and a main body of carrying frame according to the present disclosure.
- (6) FIG. 3 is an exploded, diagrammatic view of an embodiment of an optical component according to the present disclosure.
- (7) FIG. 4 is an exploded, diagrammatic view of an embodiment of a camera module according to the present disclosure.
- (8) FIG. 5 is a diagram of an embodiment of an use state of a camera module according to the present disclosure.
- (9) FIG. 6A is a diagram of an embodiment of light incident on a photosensitive chip according to the present disclosure.
- (10) FIG. 6B is a diagram of an embodiment of light incident on a photosensitive chip according to the present disclosure.
- (11) FIG. 6C is a diagram of an embodiment of light incident on a photosensitive chip according to the present disclosure.
- (12) FIG. 6D is a diagram of an embodiment of light incident on a photosensitive chip according to the present disclosure.
- (13) FIG. 7 is a diagram of an embodiment of an electronic device according to the present disclosure.

## DETAILED DESCRIPTION

- (14) It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures, and components have not been described in detail so as not to obscure the related relevant feature being described. Also, the description is not to be considered as limiting the scope of the embodiments described herein. The drawings are not necessarily to scale, and the proportions of certain parts may be exaggerated to better illustrate details and features of the present disclosure.
- (15) The disclosure is illustrated by way of example and not by way of limitation in the figures of the accompanying drawings, in which like references indicate similar elements. It should be noted that references to “an” or “one” embodiment in this disclosure are not necessarily to the same embodiment, and such references mean “at least one.”
- (16) The term “comprising,” when utilized, means “including, but not necessarily limited to”; it specifically indicates open-ended inclusion or membership in the so-described combination, group, series, and the like.
- (17) Resolution refers to the number of maximum pixels (i.e., photosensitive units) of the photosensitive chip in the camera module that can be used for imaging. It is usually measured by the product of the number of horizontal pixels and the number of vertical pixels, that is, resolution=the number of horizontal pixels×the number of vertical pixels.

(18) Pixel refers to the smallest unit that constitutes the imaging area of the photosensitive chip. Wherein, the pixel size refers to the physical size of the pixel, that is, the distance between the centers of adjacent pixels.

(19) The photosensitive chip includes a plurality of photosensitive units, and each photosensitive unit corresponds to a pixel. The more pixels, the more details of the object that the photosensitive chip can sense, and the clearer the image. It should be noted that under the same photosensitive area, the resolution and the pixel size are trade-offs. Increasing the resolution requires adding more pixels in the same photosensitive area. As in the background art, under the same photosensitive area, the more photosensitive units there are in the photosensitive chip, the more complicated the production process and the higher the required production cost.

(20) Therefore, the embodiments of the present disclosure provide a carrying frame, an optical assembly, a camera module, and an electronic device. The carrying frame, the optical assembly, the camera module, and the electronic device may improve the resolution and save costs without using more photosensitive units.

(21) FIG. 1A is a schematic front view of an embodiment of a carrying frame. FIG. 1B is a schematic back view of an embodiment of a carrying frame. Referring to FIGS. 1A and 1B, the carrying frame **100** may be used to carry an optical component **201** (shown in FIG. 3), and may be applied in a camera module **300** (shown in FIG. 4). A front side of the carrying frame **100** faces the optical component **201**, and a back side of the carrying frame **100** facing away from the front side faces a photosensitive chip **302** (shown in FIG. 4).

(22) In at least one embodiment, the carrying frame **100** includes a main body **10**, a first rotating part **20**, a second rotating part **30**, and a driving part **40**. The first rotating part **20**, the second rotating part **30**, and the driving part **40** are arranged on the main body **10**. The first rotating part **20** can rotate in a first direction, the second rotating part **30** can rotate in a second direction. The driving part **40** drives the first rotating part **20** to rotate in the first direction, so that the first rotating part **20** is offset with respect to a plane where the main body **10** is located. The driving part **40** drives the second rotating part **30** to rotate in the second direction, so that the second rotating part **30** is offset with respect to the plane where the main body **10** is located. The first direction and the second direction are perpendicular to each other, and both the first direction and the second direction are parallel to the plane where the main body **10** is located.

(23) In FIGS. 1A and 1B, the first direction is defined as X, the second direction is defined as Y. The first direction and the second direction in the FIGS. 1A and 1B are only examples, which are not limited in the present disclosure. For example, in at least one embodiment, the first direction may be a direction as Y, the second direction may be a direction as X.

(24) In at least one embodiment, the carrying frame may further include a first through hole **11**. The first through hole **11** penetrates the main body **10** in a third direction. The camera module **300** finds a view and captures light through the first through hole **11**. A shape of the first through hole **11** may be circular, rectangular, or determined according to a shape of the optical component **201**.

(25) In at least one embodiment, the main body **10** may be in a square, rectangular, circular, or oval shape or be in other shapes matching the camera module **300**. The main body **10** may be a metal sheet, such as pure metal, stainless steel, alloy, or the like.

(26) In at least one embodiment, the first rotating part **20** includes a first rotating shaft **21**, a second rotating shaft **22**, and a first frame **23**. The first rotating shaft **21**, the second rotating shaft **22**, and the first frame **23** are all located in the first through hole **11**.

(27) The first rotating shaft **21** and the second rotating shaft **22** are mounted on an inner surface defining the first through hole **11**, and the first rotating shaft **21** and the second rotating shaft **22** are oppositely arranged. The first rotating shaft **21** is connected between the main body **10** and the first frame **23**, the second rotating shaft **22** is connected between the main body **10** and the first frame **23**.

(28) In at least one embodiment, the first rotating shaft **21** and the second rotating shaft **22** are

mounted on the inner surface defining the first through hole **11** along the first direction, that is, the first rotating shaft **21** and the second rotating shaft **22** are on a straight line, and the straight line is parallel to the first direction. So that the first frame **23** can rotate around the first rotating shaft **21** and the second rotating shaft **22**, that is, the first frame **23** can rotate around the first direction.

(29) A second through hole **24** is formed in the middle of the first frame **23**. The camera module **300** can use the second through hole **24** for finding a view and capturing light. A shape of the second through hole **24** may be circular, rectangular or determined according to the shape of the optical component **201**.

(30) In at least one embodiment, the first frame **23** includes a first portion **231**, a second portion **232**, a third portion **233**, and a fourth portion **234**. The first portion **231** and the second portion **232** are arranged opposite to each other along the second direction. The third portion **233** and the fourth portion **234** are arranged opposite to each other along the first direction. Specifically, the second through hole **24** is surrounded by the first portion **231**, the third portion **233**, the second portion **232**, and the fourth portion **234** which are connected in sequence.

(31) Referring to FIG. **1A**, the third portion **233** is connected to the main body **10** through the first rotating shaft **21**, the fourth portion **234** is connected to the main body **10** through the second rotating shaft **22**.

(32) In at least one embodiment, the second rotating part **30** includes a third rotating shaft **31**, a fourth rotating shaft **32**, and a second frame **33**. The third rotating shaft **31**, the fourth rotating shaft **32**, and the second frame **33** are all located in the second through hole **24**.

(33) The third rotating shaft **31** and the fourth rotating shaft **32** are mounted on an inner surface defining the second through hole **24**, and the third rotating shaft **31** and the fourth rotating shaft **32** are oppositely arranged. The third rotating shaft **31** is connected between the first frame **23** and the second frame **33**, the fourth rotating shaft **32** is connected between the first frame **23** and the second frame **33**.

(34) In at least one embodiment, the third rotating shaft **31** and the fourth rotating shaft **32** are mounted on the inner surface defining the second through hole **24** along the second direction, that is, the third rotating shaft **31** and the fourth rotating shaft **32** are on a straight line, and the straight line is parallel to the second direction. So that the second frame **33** can rotate around the third rotating shaft **31** and the fourth rotating shaft **32**, that is, the second frame **33** can rotate around the second direction.

(35) A third through hole **34** is formed in the middle of the second frame **33**. The camera module **300** can use the third through hole **34** for finding a view and capturing light. A shape of the third through hole **34** may be circular, rectangular or determined according to the shape of the optical component **201**.

(36) In at least one embodiment, the second frame **33** includes a fifth portion **331**, a sixth portion **332**, a seventh portion **333**, and an eighth portion **334**. The fifth portion **331** and the sixth portion **332** are arranged opposite to each other along the second direction. The seventh portion **333** and the eighth portion **334** are arranged opposite to each other along the first direction. Specifically, the third through hole **34** is surrounded by the fifth portion **331**, the seventh portion **333**, the sixth portion **332**, and the eighth portion **334** which are connected in sequence.

(37) Referring to FIG. **1A**, the fifth portion **331** is connected to the first portion **231** of the first frame **23** through the third rotating shaft **31**, the sixth portion **332** is connected to the second portion **232** of the first frame **23** through the fourth rotating shaft **32**.

(38) In at least one embodiment, the second frame **33** is used to carry the optical component **201**, and the second frame **33** can drive the optical component **201** to rotate in the second direction. Further, since the second frame **33** is connected to the first frame **23** through the third rotating shaft **31** and the fourth rotating shaft **32**, when the first frame **23** rotates in the first direction, the first frame **23** drives the second frame **33** to rotate in the first direction, and then the second frame **33** drives the optical component **201** to rotate in the first direction.

(39) In at least one embodiment, the first rotating shaft **21**, the second rotating shaft **22**, the third rotating shaft **31**, and the fourth rotating shaft **32** may be internally inlaid with shrapnel, for example, the shrapnel may be embedded inside by nano-injection, to restrict the position of the first rotating part **20** and the second rotating part **30** when the driving part **40** drives the first rotating part **20** and the second rotating part **30** to rotate, and restore the position of the first rotating part **20** and the second rotating part **30** when the driving part **40** stops driving the first rotating part **20** and the second rotating part **30** to rotate.

(40) In at least one embodiment, the main body **10**, the first rotating part **20**, and the second rotating part **30** may be integrally formed by nano-injection.

(41) In at least one embodiment, referring to FIGS. **1A** and **1B**, the first through hole **11**, the first frame **23**, the second through hole **24**, the second frame **33**, and the third through hole **34** are all rectangular. It can be understood that the first through hole **11**, the first frame **23**, the second through hole **24**, the second frame **33**, and the third through hole **34** may have other shapes, and the shapes of the first through hole **11**, the first frame **23**, the second through hole **24**, the second frame **33**, and the third through hole **34** may be different.

(42) The driving part **40** includes a rotating assembly **41** and a driving assembly **42**. Referring to FIG. **1B**, the driving part **40** is arranged on a reverse side of the carrying frame **100**. The driving assembly **42** may be arranged on the main body **10**. The rotating assembly **41** may be arranged on the first rotating part **20** and the second rotating part **30**. The driving assembly **42** is disposed correspondingly to the rotating assembly **41**, the rotating assembly **41** drives the first rotating part **20** and the second rotating part **30** to rotate under the driving the driving assembly **42**.

(43) In at least one embodiment, the driving assembly **42** drives the rotating assembly **41** by electromagnetic, and the driving assembly **42** cooperates with the rotating assembly **41** to drive the first rotating part **20** and the second rotating part **30** to shake and tilt in a preset direction and reach a preset angle.

(44) The rotating assembly **41** includes a first rotating component **411** and a second rotating component **412**. The first rotating component **411** is arranged on the first rotating part **20** for driving the first rotating part **20** to rotate in the first direction. The second rotating component **412** is arranged on the second rotating part **30** for driving the second rotating part **30** to rotate in the second direction. For example, the first rotating component **411** is arranged on the first frame **23**, and the second rotating component **412** is arranged on the second frame **33**.

(45) In at least one embodiment, the first rotating component **411** and the second rotating component **412** may be magnetic components respectively, and the magnetic components can respond to the magnetic field, for example, the magnetic components may be subjected to force in the magnetic field to drive the first rotating part **20** and the second rotating part **30** to rotate. The magnetic components may be magnetics.

(46) In at least one embodiment, the first rotating component **411** includes a first magnet **4111**, and the first magnet **4111** may be arranged on the first portion **231** or the second portion **232**. The first rotating component **411** may further include a second magnet **4112**. If the first magnet **4111** is arranged on the first portion **231**, the second magnet **4112** is arranged on the second portion **232**. If the first magnet **4111** is arranged on the second portion **232**, the second magnet **4112** is arranged on the first portion **231**.

(47) In at least one embodiment, the second rotating component **412** includes a third magnet **4121**, and the third magnet **4121** may be arranged on the seventh portion **333** or the eighth portion **334**. The second rotating component **412** may further include a fourth magnet **4122**. If the third magnet **4121** is arranged on the seventh portion **333**, the fourth magnet **4122** is arranged on the eighth portion **334**. If the third magnet **4121** is arranged on the eighth portion **334**, the fourth magnet **4122** is arranged on the seventh portion **333**.

(48) The driving assembly **42** includes a coil (not shown) on the main body **10**. Based on the magnetic effect of the current, the coil generates a magnetic field when energized. For example,

when a current is passed through a straight metal wiring line, a circular magnetic field will be created in the space around the straight metal wiring line. The greater the current flowing through the wiring line, the stronger the magnetic field produced. The magnetic field forms a circle around the wiring line. It can be understood that the magnetic component may respond to the magnetic field, for example, the magnetic component may be subjected to force in the magnetic field and then displaced.

(49) In at least one embodiment, the driving assembly **42** includes a first coil **421**, a second coil **422**, a third coil **423**, and a fourth coil **424**. The first coil **421** corresponds to and is adjacent to the first magnet **4111**, the second coil **422** corresponds to and is adjacent to the second magnet **4112**, the third coil **423** corresponds to and is adjacent to the third magnet **4121**, the fourth coil **424** corresponds to and is adjacent to the fourth magnet **4122**.

(50) Referring to FIG. **1B**, the first coil **421** corresponding to the first magnet **4111** is arranged on the main body **10**, the second coil **422** corresponding to the second magnet **4112** is arranged on the main body **10**. The first coil **421** and the second coil **422** correspond to each other and are spaced along the second direction Y. The third coil **423** corresponding to the third magnet **4121** is arranged on the main body **10**, the fourth coil **424** corresponding to the fourth magnet **4122** is arranged on the main body **10**. The third coil **423** and the fourth coil **424** correspond to each other and are spaced along the first direction X. When the first coil **421** is energized, the first magnet **4111** is subjected to force in the magnetic field generated by the first coil **421** to drive the first frame **23** to tilt. When the second coil **422** is energized, the second magnet **4112** is subjected to force in the magnetic field generated by the second coil **422** to drive the first frame **23** to tilt. When the third coil **423** is energized, the third magnet **4121** is subjected to force in the magnetic field generated by the third coil **423** to drive the second frame **33** to tilt. When the fourth coil **424** is energized, the fourth magnet **4122** is subjected to force in the magnetic field generated by the fourth coil **424** to drive the second frame **33** to tilt.

(51) In at least one embodiment, the driving assembly **42** may further include pins (not shown) and a logic gate (not shown), the logic gate is connected to the coil through the pins to control whether the coil is energized or not, so as to control the coil to generate a magnetic field. In at least one embodiment, the logic gate may be arranged on a circuit board **301** (shown in FIG. **3**) of the camera module **300**.

(52) In at least one embodiment, the driving assembly **42** may further include a first pin **425**, a second pin **426**, a third pin **427**, and a fourth pin **428**. The first pin **425**, the second pin **426**, the third pin **427**, and the fourth pin **428** are respectively connected to the logic gate. Referring to FIG. **1B**, the first pin **425** is connected to the first coil **421**, the second pin **426** is connected to the second coil **422**, the third pin **427** is connected to the third coil **423**, and the fourth pin **428** is connected to the fourth coil **424**.

(53) In at least one embodiment, the logic gate may control the first rotating component **411** to drive the first rotating part **20** to perform a first action and a second action in the first direction X. For example, the first action may be that the first rotating part **20** shakes and tilts to the left, and a first deflection angle is formed between the first rotating part **20** and the main body **10**. The second action may be that the first rotating part **20** shakes and tilts to the right, and a second deflection angle is formed between the first rotating part **20** and the main body **10**. An optical path of the optical component **201** on the first rotating part **20** may be changed to move to the left by the leftward shaking and tilting of the first rotating part **20**. Correspondingly, when the first rotating part **20** shakes and tilts to the right, the optical path of the optical component **201** may move to the right.

(54) In at least one embodiment, when the first rotating part **20** performs the first action, the second portion **232** of the first frame **23** may move upward, and the first portion **231** of the first frame **23** may move downward. In at least one embodiment, when the first rotating part **20** performs the second action, the second portion **232** of the first frame **23** may move downward, and the first

portion **231** of the first frame **23** may move upward. The first action and the second action may be adjusted according to the refraction and the reflection of the light by the optical component **201**.

(55) In at least one embodiment, to control the first rotating part **20** to perform the first action, the logic gate may control the first coil **421** to be electrified, the second coil **422** to be electrified, or the first coil **421** and the second coil **422** to be electrified at the same time.

(56) In at least one embodiment, to control the first rotating part **20** to perform the second action, the logic gate may control the first coil **421** to be electrified, the second coil **422** to be electrified, or the first coil **421** and the second coil **422** to be electrified at the same time.

(57) In at least one embodiment, the logic gate may control the second rotating component **412** to drive the second rotating part **30** to perform a third action and a fourth action in the second direction Y. For example, the third action may be that the second rotating part **30** shakes and tilts upward, and a third deflection angle is formed between the second rotating part **30** and the main body **10**. The fourth action may be that the second rotating part **30** shakes and tilts downward, and a fourth deflection angle is formed between the second rotating part **30** and the main body **10**. The optical path of the optical component **201** on the first rotating part **20** may be changed to move upward by the upward shaking and tilting of the second rotating part **30**. Correspondingly, when the second rotating part **30** shakes and tilts downward, the optical path of the optical component **201** may move downward.

(58) In at least one embodiment, when the second rotating part **30** performs the third action, the seventh portion **333** of the second frame **33** may move downward, and the eighth portion **334** of the second frame **33** may move upward. In at least one embodiment, when the second rotating part **30** performs the fourth action, the seventh portion **333** of the second frame **33** may move upward, and the eighth portion **334** of the second frame **33** may move downward. The third action and the fourth action may be adjusted according to the refraction and the reflection of the light by the optical component **201**.

(59) In at least one embodiment, to control the second rotating part **30** to perform the third action, the logic gate may control the third coil **423** to be electrified, the fourth coil **424** to be electrified, or the third coil **423** and the fourth coil **424** to be electrified at the same time.

(60) In at least one embodiment, to control the second rotating part **30** to perform the fourth action, the logic gate may control the third coil **423** to be electrified, the fourth coil **424** to be electrified, or the third coil **423** and the fourth coil **424** to be electrified at the same time.

(61) In at least one embodiment, the logic gate may pre-store driving waveforms corresponding to the first action, the second action, the third action, and the fourth action, and may drive the coil by outputting the driving waveform to the pins corresponding to the coil. The logic gate outputs the driving waveforms to the driving assembly **42** to control the operation of the driving assembly **42**, and then the first rotating part **20** and the second rotating part **30** are controlled by the driving assembly **42** to perform actions corresponding to the driving waveforms.

(62) In at least one embodiment, the corresponding driving waveforms may be set according to the driving situation of the driving assembly **42** to the rotating assembly **41**, so that the logic gate may change the optical path of the light passing through the optical component **201**, the light passing through the optical component **201** may move up, right, down, or left, or may move in the order of up.fwdarw.right.fwdarw.down.fwdarw.left.

(63) In at least one embodiment, to control the light passing through the optical component **201** to move in the order of up.fwdarw.right.fwdarw.down.fwdarw.left, the logic gate may control the energization of the first coil **421**, the second coil **422**, the third coil **423**, and the fourth coil **424** at the same time. How to realize the movement of the light is not specifically limited in the present disclosure.

(64) The working principle of the carrying frame **100** will be specifically described below.

(65) The logic gate outputs the driving waveform corresponding to the first action to tilt the first frame **23** to the left, as shown in FIG. 2A, so that a first deflection a is formed between a plane



where the first frame **23** is located and a plane where the main body **10** is located. The logic gate outputs the driving waveform corresponding to the second action to tilt the first frame **23** to the right, as shown in FIG. **2B**, so that a second deflection is formed between the plane where the first frame **23** is located and the plane where the main body **10** is located. Correspondingly, the logic gate outputs the driving waveform corresponding to the third action to tilt the second frame **33** upward, and a deflection angle is formed between a plane where the second frame **33** is located and a plane where the main body **10** is located. The logic gate outputs the driving waveform corresponding to the fourth action to tilt the second frame **33** downward, and a deflection angle is formed between the plane where the second frame **33** is located and the plane where the main body **10** is located.

(66) In at least one embodiment, the deflection of the optical component **201** can be controlled by the carrying frame **100**, the deflected optical component **201** can change the optical path, so that the light passing through the optical component **201** can be adjusted according to the deflection angle of the optical component **201**, thereby adjusting the light incident on the photosensitive chip **302**. By controlling the rotation of the first rotating part **20** and the second rotating part **30**, the light can move, so that the photosensitive chip **302** can obtain different images. After moving for many times, multiple images can be obtained, the desired high-resolution image can be obtained from the multiple images.

(67) FIG. **3** is an exploded diagrammatic view of an embodiment of an optical assembly **200**. Referring to FIG. **3**, the optical assembly **200** includes an optical component **201** and the above carrying frame **100**. The optical component **201** is arranged on a first surface of the carrying frame **100**.

(68) In at least one embodiment, the optical component **201** is used for passing light in a specific wavelength range.

(69) In at least one embodiment, the optical component **201** may be made of glass. In at least one embodiment, the optical component **201** may be a galvanometer to filter reflected light and eliminate polarized light. In at least one embodiment, the optical component **201** may be a filter, and the filter may be an infrared filter. Specifically, the infrared filter may be a white glass infrared filter, a blue glass infrared filter, or a blue resin infrared filter.

(70) In at least one embodiment, the optical component **201** may further includes a first adhesive layer **202**, the first adhesive layer **202** is arranged on a side of the second frame **33** facing away from the photosensitive chip **302** (that is, the side of the second frame **33** is the front side of the carrying frame **100**), the optical component **201** is adhered to the second frame **33** through the first adhesive layer **202**.

(71) In at least one embodiment, the second frame **33** includes a third through hole **34**, the light passing through the optical component **201** can incident on the photosensitive chip **302** through the third through hole **34**.

(72) FIG. **4** illustrates an embodiment of a camera module **300**. The camera module **300** includes a circuit board **301**, a photosensitive chip **302**, the above carrying frame **100**, an optical component **201**, a lens holder **303**, and a lens **304** arranged in sequence. The photosensitive chip **302** and the carrying frame **100** are mounted on the circuit board **301**, the photosensitive chip **302** is surrounded by the circuit board **301** and the carrying frame **100**. The optical component **201** is mounted on the carrying frame **100**. The lens holder **303** is mounted on the carrying frame **100** provided with the optical component **201**. The lens **304** is mounted on the lens holder **303**. The circuit board **301**, the photosensitive chip **302**, the optical component **201**, the lens holder **303**, and the lens **304** are conventional structures of the existing camera module and will not be described in detail.

(73) In at least one embodiment, the camera module **300** may further include a first adhesive layer **202**, a second adhesive layer **305**, and a third adhesive layer **306**. The second adhesive layer **305** is arranged on the circuit board **301**, the carrying frame **100** is adhered to the circuit board **301** through the second adhesive layer **305**. The optical component **201** is adhered to the second frame

33 through the first adhesive layer 202. The third adhesive layer 306 is arranged on the carrying frame 100, the lens holder 303 is adhered to the carrying frame 100 through the third adhesive layer 306.

(74) In at least one embodiment, the light reflected by the photographed object enters the lens 304 to be captured by the lens 304. The optical component 201 filters the light captured by the lens 304. The light passing through the optical component 201 passes through the third through hole 34 and is incident on the photosensitive chip 302. The photosensitive chip 302 includes a plurality of photosensitive units (not shown), the photosensitive units receive light and then process imaging.

(75) The working principle of the above carrying frame 100 in the camera module 300 will be described in detail with reference to FIGS. 5 and 6. It can be understood that the connection relationship between the lens 304, the optical component 201, the carrying frame 100, and the photosensitive chip 302 in FIG. 5 is only an example.

(76) For example, the light passing through the lens 304 is vertically incident on the optical component 201. As shown in FIG. 5, the light reflected by the photographed object is incident on the lens 304, when the optical component 201 is not tilted by the carrying frame 100, the optical component 201 is parallel to a plane where the carrying frame 100 is located, the light passing through the lens 304 is vertically incident on the optical component 201, the light passing through the optical component 201 is vertically incident on the photosensitive chip 302. When the optical component 201 is tilted by the carrying frame 100, the light passing through the lens 304 is vertically incident on the optical component 201, and the light is incident on the photosensitive chip 302 at an oblique angle by the optical component 201, that is, the light passing through the optical component 201 is incident on the photosensitive chip 302 at the oblique angle. In this way, the rotation of the optical component 201 is controlled by the carrying frame 100, so that a deflection angle is formed between the optical component 201 and the plane where the carrying frame 100 is located. By controlling the deflection angle of the optical component 201, an exposure timing corresponds to the deflection angle of the optical component 201. Different deflection angles correspond to different images, in other words, multiple images may be obtained by deflecting the optical component 201, and a desired high-resolution image can be obtained based on the multiple images.

(77) Specifically, referring to FIG. 6A, when the optical component 201 is not controlled to be tilted by the carrying frame 100, the deflection angle between the optical component 201 and the plane where the carrying frame 100 is located is zero. The light a reflected by a photographed point P passes through the lens 304 and is incident on the optical component 201, the light a is incident on an area A (the area enclosed by the dotted line in FIG. 6A) of the photosensitive chip 302 by the optical component 201, the corresponding pixel in the area A receives the light a reflected by the photographed point P, and a first image P1 is generated by the photosensitive chip 302. Referring to FIG. 6B, when the optical component 201 is controlled to be tilted by the carrying frame 100, and a first deflection angle between the optical component 201 and the plane where the carrying frame 100 is located is formed. The light a reflected by the photographed point P passes through the lens 304 and is incident on the optical component 201, the light a is incident on an area B (the area enclosed by the dotted line in FIG. 6B) of the photosensitive chip 302 by the optical component 201, the corresponding pixel in the area B receives the light a reflected by the photographed point P, and the area B is located above the area A, that is, the light a is shifted to an upper area of the photosensitive chip 302 by the optical component 201, and a second image P2 is generated by the photosensitive chip 302. Referring to FIG. 6C, when the optical component 201 is controlled to be tilted by the carrying frame 100, and a second deflection angle between the optical component 201 and the plane where the carrying frame 100 is located is formed. The light a reflected by the photographed point P passes through the lens 304 and is incident on the optical component 201, the light a is incident on an area C (the area enclosed by the dotted line in FIG. 6C) of the photosensitive chip 302 by the optical component 201, the corresponding pixel in the area C

receives the light a reflected by the photographed point P, and the area C is located at the upper right of the area A, that is, the light a is shifted to an upper right area of the photosensitive chip **302** by the optical component **201**, and a third image P3 is generated by the photosensitive chip **302**. Referring to FIG. 6D, when the optical component **201** is controlled to be tilted by the carrying frame **100**, and a third deflection angle between the optical component **201** and the plane where the carrying frame **100** is located is formed. The light a reflected by the photographed point P passes through the lens **304** and is incident on the optical component **201**, the light a is incident on an area D (the area enclosed by the dotted line in FIG. 6D) of the photosensitive chip **302** by the optical component **201**, the corresponding pixel in the area D receives the light a reflected by the photographed point P, and the area D is located at the lower right of the area A, that is, the light a is shifted to a lower right area of the photosensitive chip **302** by the optical component **201**, and a fourth image P4 is generated by the photosensitive chip **302**.

(78) A desired high-resolution image can be obtained according to the first image P1, the second image P2, the third image P3, and the fourth image P4. That is, by moving the optical component **201**, more pixels of the photosensitive chip **302** can receive more details of the photographed point. Its technical principle refers to the XPR pixel displacement technology, the light incident on the photosensitive chip **302** is changed by changing the optical component **201**, so that one frame of picture is divided into multiple projections, and the multiple projections are superimposed by the phenomenon of persistence of vision. When the image is projected on the screen, and the image moves quickly by half a pixel at a time in the order of up.fwdarw.right.fwdarw.down.fwdarw.left.

(79) FIG. 7 illustrates an embodiment of an electronic device. The electronic device includes the above camera module **300**. The electronic device may be, but not limited to, a mobile phone, a wearable device, a computer, a vehicle, or a monitoring device. In at least one embodiment, the electronic device is a mobile phone.

(80) It is to be understood, even though information and advantages of the present embodiments have been set forth in the foregoing description, together with details of the structures and functions of the present embodiments, the disclosure is illustrative only; changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the present embodiments to the full extent indicated by the plain meaning of the terms in which the appended claims are expressed.

## Claims

1. A carrying frame comprising: a main body comprising a first inner surface which defines a first through hole; a first rotating part mounted on the first inner surface, the first rotating part comprising a second inner surface which defines a second through hole; a second rotating part mounted on the second inner surface, the second rotating part comprising a third through hole; and a driving part configured to drive at least one of the first rotating part to rotate in a first direction and the second rotating part to rotate in a second direction, wherein the first direction and the second direction are perpendicular to each other, and both the first direction and the second direction are parallel to a plane where the main body is located.
2. The carrying frame of claim 1, wherein the first rotating part comprises a first rotating shaft, a second rotating shaft, and a first frame; the first rotating shaft and the second rotating shaft are mounted on the first inner surface, and the first rotating shaft and the second rotating shaft are oppositely arranged; the first rotating shaft is connected between the first inner surface and the first frame, and the second rotating shaft is connected between the first inner surface and the first frame.
3. The carrying frame of claim 2, wherein the second rotating part comprises a third rotating shaft, a fourth rotating shaft, and a second frame; the third rotating shaft and the fourth rotating shaft are mounted on the second inner surface, and the third rotating shaft and the fourth rotating shaft are oppositely arranged; the third rotating shaft is connected between the second inner surface and the

second frame, and the fourth rotating shaft is connected between the second inner surface and the second frame.

4. The carrying frame of claim 3, wherein the driving part comprises a rotating assembly and a driving assembly; the rotating assembly is arranged on the first rotating part and the second rotating part, the driving assembly is arranged on the main body.

5. The carrying frame of claim 4, wherein the rotating assembly comprises a first rotating component and a second rotating component, the first rotating component is arranged on the first rotating part, the second rotating component is arranged on the second rotating part.

6. The carrying frame of claim 5, wherein the first rotating component comprises a first magnet and a second magnet, the first magnet and the second magnet are respectively arranged on both sides of the first rotating part in the second direction; the second rotating component comprises a third magnet and a fourth magnet, the third magnet and the fourth magnet are respectively arranged on both sides of the second rotating part in the first direction.

7. The carrying frame of claim 6, wherein the driving assembly comprises a first coil, a second coil, a third coil, and a fourth coil, the first coil corresponds to and is adjacent to the first magnet, the second coil corresponds to and is adjacent to the second magnet, the third coil corresponds to and is adjacent to the third magnet, the fourth coil corresponds to and is adjacent to the fourth magnet.

8. A camera module comprising: a circuit board; a photosensitive chip on the circuit board; an optical component; a lens holder; a lens on the lens holder; and a carrying frame on the circuit board, the carrying frame comprising: a main body comprising a first inner surface to define a first through hole; a first rotating part mounted on the first inner surface, the first rotating part comprising a second inner surface which defines a second through hole; a second rotating part mounted on the second inner surface, the second rotating part comprising a third through hole; and a driving part configured to drive at least one of the first rotating part to rotate in a first direction and the second rotating part to rotate in a second direction, wherein the first direction and the second direction are perpendicular to each other, and both the first direction and the second direction are parallel to a plane where the main body is located; wherein the optical component is arranged on the carrying frame and corresponds to the third through hole, the photosensitive chip corresponds to the third through hole, and the optical component and the photosensitive chip are respectively arranged on both sides of the carrying frame; the lens holder is mounted on the side of the carrying frame with the optical component.

9. The camera module of claim 8, wherein the first rotating part comprises a first rotating shaft, a second rotating shaft, and a first frame; the first rotating shaft and the second rotating shaft are mounted on the first inner surface, and the first rotating shaft and the second rotating shaft are oppositely arranged; the first rotating shaft is connected between the first inner surface and the first frame, and the second rotating shaft is connected between the first inner surface and the first frame.

10. The camera module of claim 9, wherein the second rotating part comprises a third rotating shaft, a fourth rotating shaft, and a second frame; the third rotating shaft and the fourth rotating shaft are mounted on the second inner surface, and the third rotating shaft and the fourth rotating shaft are oppositely arranged; the third rotating shaft is connected between the second inner surface and the second frame, and the fourth rotating shaft is connected between the second inner surface and the second frame.

11. The camera module of claim 10, wherein the driving part comprises a rotating assembly and a driving assembly; the rotating assembly is arranged on the first rotating part and the second rotating part, the driving assembly is arranged on the main body.

12. The camera module of claim 11, wherein the rotating assembly comprises a first rotating component and a second rotating component, the first rotating component is arranged on the first rotating part, the second rotating component is arranged on the second rotating part.

13. The camera module of claim 12, wherein the first rotating component comprises a first magnet and a second magnet, the first magnet and the second magnet are respectively arranged on both

sides of the first rotating part in the second direction; the second rotating component comprises a third magnet and a fourth magnet, the third magnet and the fourth magnet are respectively arranged on both sides of the second rotating part in the first direction.

14. The camera module of claim 13, wherein the driving assembly comprises a first coil, a second coil, a third coil, and a fourth coil, the first coil corresponds to and is adjacent to the first magnet, the second coil corresponds to and is adjacent to the second magnet, the third coil corresponds to and is adjacent to the third magnet, the fourth coil corresponds to and is adjacent to the fourth magnet.

15. An electronic device comprising: a camera module comprising: a circuit board; a photosensitive chip on the circuit board; an optical component; a lens holder; a lens on the lens holder; and a carrying frame on the circuit board, the carrying frame comprising: a main body comprising a first inner surface which defines a first through hole; a first rotating part mounted on the first inner surface, the first rotating part comprising a second inner surface which defines a second through hole; a second rotating part mounted on the second inner surface, the second rotating part comprising a third through hole; and a driving part configured to drive at least one of the first rotating part to rotate in a first direction and the second rotating part to rotate in a second direction, wherein the first direction and the second direction are perpendicular to each other, and both the first direction and the second direction are parallel to a plane where the main body is located; wherein the optical component is arranged on the carrying frame and corresponds to the third through hole, the photosensitive chip corresponds to the third through hole, and the optical component and the photosensitive chip are respectively arranged on both sides of the carrying frame; the lens holder is mounted on the side of the carrying frame with the optical component.

16. The electronic device of claim 15, wherein the first rotating part comprises a first rotating shaft, a second rotating shaft, and a first frame; the first rotating shaft and the second rotating shaft are mounted on the first inner surface, and the first rotating shaft and the second rotating shaft are oppositely arranged; the first rotating shaft is connected between the first inner surface and the first frame, and the second rotating shaft is connected between the first inner surface and the first frame.

17. The electronic device of claim 16, wherein the second rotating part comprises a third rotating shaft, a fourth rotating shaft, and a second frame; the third rotating shaft and the fourth rotating shaft are mounted on the second inner surface, and the third rotating shaft and the fourth rotating shaft are oppositely arranged; the third rotating shaft is connected between the second inner surface and the second frame, and the fourth rotating shaft is connected between the second inner surface and the second frame.

18. The electronic device of claim 17, wherein the driving part comprises a rotating assembly and a driving assembly; the rotating assembly is arranged on the first rotating part and the second rotating part, the driving assembly is arranged on the main body.

19. The electronic device of claim 18, wherein the rotating assembly comprises a first rotating component and a second rotating component, the first rotating component is arranged on the first rotating part, the second rotating component is arranged on the second rotating part.

20. The electronic device of claim 19, wherein the first rotating component comprises a first magnet and a second magnet, the first magnet and the second magnet are respectively arranged on both sides of the first rotating part in the second direction; the second rotating component comprises a third magnet and a fourth magnet, the third magnet and the fourth magnet are respectively arranged on both sides of the second rotating part in the first direction; the driving assembly comprises a first coil, a second coil, a third coil, and a fourth coil, the first coil corresponds to and is adjacent to the first magnet, the second coil corresponds to and is adjacent to the second magnet, the third coil corresponds to and is adjacent to the third magnet, the fourth coil corresponds to and is adjacent to the fourth magnet.

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