

DESCRIPTION

TITLE OF INVENTION: IMAGING DEVICE AND WINDOW GLASS EQUIPPED WITH IMAGING DEVICE

5 TECHNICAL FIELD

[0001]

The present disclosure relates to an imaging device and a window glass equipped with an imaging device.

10 BACKGROUND ART

[0002]

Conventionally known is a window camera, including: an imaging unit that captures an image of outdoors from an indoor surface of a window glass; a housing having a rectangular attachment surface to face in parallel with the indoor surface so that the imaging unit is attached to the attachment surface in a recessed manner with an optical axis of the imaging unit being aligned with an intersection of a pair of diagonal lines of the attachment surface; and a light shielding member made of an elastic material and protruding from the attachment surface toward the indoor surface in a rectangular frame shape according to the outer shape of the attachment surface so as to close a gap between the indoor surface and the attachment surface by elastic deformation under pressure from the housing. This window camera is fixed to the indoor surface of the window glass by a suction cup piece of a suction cup mechanism of the housing. The suction cup piece is formed of an elastic material (see, for example, Patent Document 1).

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PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0003]

Patent Document 1: JP-A-2021-111812

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DISCLOSURE OF INVENTION

TECHNICAL PROBLEM

[0004]

The suction cup piece, which sticks to the indoor surface (indoor-side main surface) of the window glass, is formed of an elastic material and is exposed to ultraviolet radiation through the window glass. Since the elastic material such as
5 silicone rubber is degraded by ultraviolet radiation, there is a risk of fall-off of the window camera due to the difficulty in holding the window camera stably over a long term.

[0005]

In view of the foregoing, it is an object of the present invention to provide an
10 imaging device capable of being stably fixed to a structural part around a window glass over a long term and to provide a window glass equipped with an imaging device.

SOLUTION TO PROBLEM

[0006]

15 An imaging device according to an aspect of the present disclosure comprises: a housing configured to be installed on an indoor side of a window glass of a building structure, the housing having a first surface to face a main surface on the indoor side of the window glass and a side surface oriented at an angle relative to the first surface; a fixing part configured to attach or adhere the side surface to a structural part around the
20 window glass; a lens disposed on the first surface; and an imaging unit placed in the housing and configured to capture an image of an outdoor scene outside the window glass through the lens.

ADVANTAGEOUS EFFECTS OF INVENTION

25 [0007]

According to the present disclosure, it is possible to provide an imaging device capable of being stably fixed to a structural part around a window glass over a long term and to provide a window glass equipped with an imaging device.

30 BRIEF DESCRIPTION OF DRAWINGS

[0008]

Fig. 1A is a schematic view illustrating an example of the arrangement of an

imaging device according to an embodiment.

Fig. 1B is an enlarged view illustrating a configuration example of the imaging device of Fig. 1A and its surroundings.

Fig. 2A is a schematic view illustrating the configuration example of the imaging device according to the embodiment.

Fig. 2B is a schematic view illustrating the configuration example of the imaging device according to the embodiment.

Fig. 2C is a cross-sectional view taken along line IIC-IIC of Fig. 2B.

Fig. 3A is a schematic view illustrating a configuration example of an imaging device according to a modification of the embodiment.

Fig. 3B is a schematic view illustrating the configuration example of the imaging device according to the modification of the embodiment.

Fig. 3C is a schematic view illustrating the configuration example of the imaging device according to the modification of the embodiment.

DESCRIPTION OF EMBODIMENTS

[0009]

Hereinafter, an embodiment of an imaging device and an imaging device-equipped window glass according to the present disclosure will be described below. In the following, the same elements are designated by the same reference numerals, and duplicate descriptions thereof may be omitted.

[0010]

In the respective drawings, the scales of members may sometimes be different from the actual scales for ease of understanding. In the present embodiment, a three-dimensional orthogonal coordinate system constituted by three axis directions (X axis direction, Y axis direction and Z axis direction) is employed, where the width direction (lateral direction) of the window glass is taken as the X axis direction; the height direction of the window glass is taken as the Y axis direction; and the thickness direction of the window glass is taken as the Z axis direction. As an example, the direction from the bottom to the top of the window glass is defined as a +Y axis direction; and the direction opposite to the +Y axis direction is defined as a -Y axis direction. Further, the direction toward the interior side of the window glass is defined as a +Z axis

direction; and the direction toward the exterior side of the window glass is defined as a -Z axis direction. In the following description, the +Y axis direction may be referred to as the top side; the -Y axis direction may be referred to as the bottom. Furthermore, the term "in plan view" means viewing in the XY plane. As an example, the X axis direction and the Z axis direction are substantially in parallel with a direction (horizontal direction) parallel to the horizontal plane; and the Y axis direction is substantially in parallel with a direction vertical to the horizontal plane.

[0011]

The X axis direction, the Y axis direction and the Z axis direction represent a direction parallel to the X axis, a direction parallel to the Y axis and a direction parallel to the Z axis, respectively. The X axis direction, the Y axis direction and the Z axis direction are orthogonal to one another. The XY plane, the YZ plane and the ZX plane represent an imaginary plane parallel to the X and Y axis directions, an imaginary plane parallel to the Y and Z axis directions and an imaginary plane parallel to the Z and X axis directions, respectively.

[0012]

<Embodiment>

Fig. 1A is a schematic view illustrating an example of the arrangement of an imaging device 100 as viewed from outside a window 10 of a building 1. Fig. 1B is an enlarged view illustrating a configuration example of the imaging device of Fig. 1A and its surroundings. In Figs. 1A and 1B, the window 10 is illustrated as being attached to a wall 1W of the building 1. The building 1 is an example of a building structure.

[0013]

The window 10 has a window glass 11 and a window frame 12. The window frame 12 is an example of a structural part around the window glass 11. The window glass 11 is, for example, a so-called FIX window, but may be a horizontal sliding window or the like. In Fig. 1B, only parts of the window glass 11 and the window frame 12 are shown. In the present embodiment, the window frame 12 is described as being made of a magnetic metal as an example.

[0014]

The imaging device 100 is used in a state of being installed to face an indoor-side main surface 11A (see Fig. 1B) of the window glass 11 of the window 10 of the building

1. The imaging device 100 is, for example, triangular box-shaped in plan view and is positioned at +X+Y-side corner portions of the window glass 11 and the window frame 12.

[0015]

5 In the present embodiment, the window glass 11, the window frame 12 and the imaging device 100 constitute an imaging device-equipped window glass 200. However, the imaging device-equipped window glass 200 may be provided with the window glass 11 and the imaging device 100 but without the window frame 12.

[0016]

10 The imaging device 100 is a device that images an outdoor scene through the window glass 11 and, as an example, is connected via a cable 101 (see Fig. 1B) to a processing device for image processing or the like. The imaging device 100 transmits image data to the processing device through the cable 101. Further, the imaging device 100 receives a control signal for e.g. ON/OFF switching of an imaging unit 140,
15 as well as a power supply, from the processing device through the cable 101.

[0017]

 The processing device is disposed inside the building 1, but is omitted from the illustrations in Figs. 1A and 1B. As an example, the processing device may be connected to an outdoor information processing device such as server via a wireless
20 communication device inside the building 1 or a cable. The processing device may be, as an example, connected to a PC (personal computer) or an information processing device such as server inside the building 1 via a cable or a wireless communication device, and the PC, the server or the like may be connected to an outdoor upper server or the like via a cable or a wireless communication device.

25 [0018]

 Although the window glass 11 is attached to the building 1 in the present embodiment, the window glass 11 may be attached to any building structure other than the building 1. Examples of the building structure other than the building 1 include civil engineering structures such as a bridge pier, a bridge and a dam, historical structures
30 and artistic structures.

[0019]

 The window glass 11 is a glass plate for windows of building structures such as

the building 1. The window glass 11 may be a glass facade e.g. at the entrance of the building 1. The window glass 11 is, for example, rectangular-shaped in plan view, having a surface on the outside of the building 1 and a surface on the inside of the building 1. The inside of the building 1 refers to an indoor side of the building 1. The thickness of the window glass 11 is set according to the specifications of the building 1. Here, the term “rectangular shape” is meant to include not only the shape of a rectangle or square but also the shape of a rounded rectangle or rounded square. The shape of the window glass in plan view is not limited to a rectangular shape, and may be any other shape such as a circular shape.

10 [0020]

The window glass 11 is not limited to a single panel, and may be a laminated glass or an insulated glazing. Further, the window glass 11 may be a Low-E glass, a light control glass or a glass with linear member.

[0021]

15 Examples of the material for the window glass 11 include soda-lime silica glass, borosilicate glass, aluminosilicate glass and alkali-free glass.

[0022]

The thickness of the window glass 11 is preferably from 1.0 to 20 mm. When the thickness of the window glass 11 is 1.0 mm or larger, the window 10 has sufficient strength for attachment of the imaging device 100. When the thickness of the window glass is 20 mm or smaller, the window has sufficient electromagnetic wave transmission performance for stable wireless communication connection of a wireless communication device with an outdoor information processing device such as server. The thickness of the window glass is more preferably from 3.0 to 15 mm, still more preferably from 9.0 to 13 mm.

25

[0023]

The reflectance on the outdoor-side surface of the window glass 11 is, for example, 3% or higher. Further, the visible light transmittance (TVA) of the window glass 11 based on standard illuminant A as specified in JIS R3106: 1998 is, for example, from 30% to 98%. When the TVA of the window glass 11 is 30% or higher, the imaging device 100 achieves sufficient image quality at the time of imaging the outdoor scene through the window glass 11. When the TVA of the window glass 11 is

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98% or lower, excellent solar shading performance can be obtained. The TVA of the window glass 11 is preferably 50% or higher, more preferably 70% or higher, still more preferably 75% or higher, particularly preferably 80% or higher. Further, the TVA of the window glass 11 is preferably 95% or lower, more preferably 92% or lower, still
5 more preferably 90% or lower, particularly preferably 85% or lower.

[0024]

The imaging device 100 is used as attached to the indoor side of the window glass 11 of the building 1, and is capable of capturing video images and still images. Here, the general configuration and functions of the imaging device 100 will be described
10 below with reference to Figs. 1A and 1B, and the detailed configuration of the imaging device 100 will be described later with reference to Figs. 2A to 2C in addition to Figs. 1A and 1B.

[0025]

The imaging device 100 has a lens 130 arranged to face the indoor-side main
15 surface 11A of the window glass 11, and captures images of the outdoor subject through the lens 130 and the window glass 11. The subject is a scene viewed through the window glass 11 (everything visible through the window glass 11). The scene may, for example, be a road, a sidewalk, a walkway, an intersection, an entrance/exit of the building 1, a station ticket gate, a station entrance/exit or the like, and may include
20 people, vehicles and the like. The imaging device 100, when having an infrared imaging function, may capture infrared images. The information captured by the imaging device 100 may be used for digital twin computing.

[0026]

Such an imaging device 100 can be used for various applications and is not
25 limited to any particular use. Images of the subject outside the window glass 11 of the building 1, captured by the imaging device 100, can be used for various purposes. As an example, the use of the imaging device 100 as a surveillance camera for security will be described hereinafter. The imaging device 100 is arranged facing the indoor-side main surface 11A of the window glass 11 and thus is difficult to see from outside the
30 window glass 11 due to reflection. Accordingly, the use of the imaging device 100 as a surveillance camera is an example of suitable application of the device.

[0027]

It is preferable that the height of attachment of the imaging device 100 to the window glass 11 is higher than the average human height from the viewpoint of ensuring a clear view of monitoring area. The height of attachment of the imaging device 100 to the window glass 11 is, for example, preferably 2 m or more. The
 5 imaging device 100 may be attached to the window glass 11 on the second or higher floor of the building 1. When the height of attachment of the imaging device 100 to the window glass 11 is 2 m or more, it is less likely that the imaging device will be visibly recognized by a person being monitored.

[0028]

10 The height of attachment of the imaging device 100 to the window glass 11 may be set, such that appropriate images can be captured, in consideration of the angle of view of the imaging device 100, the distance from the imaging device 100 to the subject, and the like. The upper limit of the height of attachment of the imaging device 100 to the window glass 11 is the height of the top edge of the window glass 11 located at the
 15 highest position among window glasses 11 of the building 1. The height of the imaging device 100 is defined as the height from a standard surface in parallel with the horizontal plane (for example, the ground, the floor level or imaginary plane). The height of the imaging device 100 may be the height of the lens 130.

[0029]

20 <Detailed Configuration of Imaging Device 100>

The detailed configuration of the imaging device 100 will be now described below with reference to Figs. 2A to 2C in addition to Figs. 1A and 1B. Figs. 2A and 2B are schematic views illustrating a configuration example of the imaging device 100. Fig. 2C is a cross-sectional view taken along line IIC-IIC of Fig. 2B.

25 [0030]

The imaging device 100 includes a case 110, a magnetic part 120, a lens 130 and an imaging unit 140.

[0031]

<Case 110>

30 The case 110 is a housing of the imaging device 100 having a box shape that is triangular in plan view. In other words, the case 110 is a triangular prism-shaped housing that is triangular in plan view and has a low height in the Z axis direction.

[0032]

The case 110 can be made of, for example, a resin material or a metal material.

Examples of the resin material include thermoplastic resins such as PC

(polycarbonate)/ASA (acrylate styrene acrylonitrile), ASA, AES (acrylonitrile ethylene

5 styrene) and the like. Examples of the metal material include aluminum, iron, stainless steel and the like.

[0033]

The case 110 has, as surfaces exposed outside, a first surface 111, a second

surface 112 (see, in particular, Fig. 2C) and a side surface 113. As shown in Fig. 2C,

10 the case 110 includes an outer case 110A, inner cases 110B and 110C and a holder 110D.

[0034]

In the following description of the positional relationship between the first surface

111, the second surface 112 and the side surface 113 (113A, 113B and 113C), the

15 expressions such as “the first surface 111 and the side surface 113A are connected to each other” may be used. For example, the expression “the first surface 111 and the

side surface 113A are connected to each other” is meant to include the case where the first surface 111 and the side surface 113A are in a positional relationship that appears to be connected as a part of the appearance of the case 110 even without physical

20 connection between the first surface 111 and the side surface 113A due to the presence of a boundary of the outer case 110A and the inner case 110C therebetween. The

same applies to the connection of any two of the first surface 111, the second surface 112 and the side surface 113 (113A, 113B and 113C) other than the combination of the first surface 111 and the side surface 113A.

25 [0035]

<First Surface 111>

The first surface 111 is a surface situated on the -Z axis direction side and

oriented in parallel with the XY plane. The first surface 111 is, among the outer

surfaces of the case 110, a surface to face the indoor-side main surface 11A of the

30 window glass 11. As an example, the case 110 is placed such that the first surface

111 is in direct contact with the indoor-side main surface 11A of the window glass 11.

This is to, when the imaging unit 140 captures images through the lens 130, reduce

reflections of the window glass 11 in the captured images. The first surface 111 may however be spaced away from the main surface 11A.

[0036]

As an example, the first surface 111 is in the shape of an isosceles right triangle in plan view and has, in a center portion thereof, a recess 111A that is recessed in the +Z axis direction. A surface of the recess 111A is conically concave and is annular in plan view. Although the first surface 11 is described as having an isosceles right triangular shape in plan view in the present embodiment, the first surface 111 may have a right triangular shape in which the lengths of two sides other than the hypotenuse are different in plan view or may have a shape other than the right triangular shape. Further, the recess 111A may be provided at a position offset from the center portion of the first surface 111.

[0037]

The recess 111A has an opening 111A1 e.g. in a center region thereof in plan view. Portions of the lens 130 and the holder 110D are exposed through the opening 111A1. As an example, the recess 111A has a depth recessed relative to the first surface 111 such that the lens 130 and the holder 110D do not protrude from the first surface 111 in the Z axis direction toward the -Z axis direction side. In other words, the recess 111A has a depth recessed relative to the first surface 111A such that the lens 130 and the holder 110D are set back from the first surface 111 in the Z axis direction toward the +Z axis direction side (the second surface 112 side). This is to, when the imaging device 100 is attached to the main surface 11A of the window glass 11 with the first surface 111 brought into direct contact with the main surface 11A, keep the lens 130 and the holder 110D from contact with the main surface 11A.

[0038]

Furthermore, the recess 111A is tapered, such that the recess diameter in plan view increases with distance from the opening 111A1, so as to remain outside the field of view defined by the lens 130 and the imaging unit 140. This is to, when the imaging device 100 captures images, prevent the recess 111A from being reflected in the captured images. The orientation of the lens 130 relative to the case 110 is variable. The recess 111A has a widely tapered shape so as to, even when the orientation of the lens 130 is varied such that the angle of the lens 130 relative to the Z axis becomes

maximum, be prevented from being reflected in the captured images.

[0039]

As an example, the recess 111A may have a depth such that the lens 130 and the holder 110D are in flush with the first surface 111 in the Z axis direction or may have a depth such that the lens 130 and the holder 110D protrude from the first surface 111 in the Z axis direction toward the -Z axis direction side. Such a configuration is applicable, for example, in the case where the imaging device 100 is installed facing the main surface 11A of the window glass 11 with the first surface 111 spaced apart from the main surface 11A.

[0040]

The opening 111A1 may be provided at a position offset from the center of the recess 111A in plan view.

[0041]

<Second Surface 112>

As specifically shown in Fig. 2C, the second surface 112 is a surface opposite the first surface 111 and, as an example, has the same isosceles right triangle shape and size as the first surface 111. The second surface 112 is in parallel with the XY plane. The second surface 112 is aligned with the first surface 111 such that the hypotenuse and two sides adjacent to the right angle of the second surface 112 respectively overlap the hypotenuse and two sides adjacent to the right angle of the first surface 111 in plan view. The expression "two adjacent sides" of a right triangle is used to mean two sides that form the right angle of the right triangle, that is, two sides of the right triangle other than the hypotenuse. Thus, two adjacent sides of the right triangular shape will hereinafter refer to two sides of the right triangular shape other than the hypotenuse. Although the second surface 112 is not shown in Figs. 1B, 2A and 2B, the position of the second surface is indicated by the reference symbol.

[0042]

<Side Surface 113>

The side surface 113 is composed of three side surfaces 113A, 113B and 113C. These three side surfaces 113A, 113B and 113C are hereinafter simply referred to as the side surface 113 when not specifically distinguished. The side surfaces 113A, 113B and 113C connect the first surface 111 and the second surface 112 among the

outer surfaces of the case 110.

[0043]

<Side Surface 113A>

The side surface 113A is a surface oriented in parallel with the XZ plane and
 5 connecting one of the two adjacent sides of the first surface 111 extending in the X axis
 direction to one of the two adjacent sides of the second surface 112 extending in the X
 axis direction. The side surface 113B is connected to a +X axis direction side of the
 side surface 113A, whereas the side surface 113C is connected to a -X axis direction
 side of the side surface 113A.

10 [0044]

The side surface 113A has, as an example, an opening 113A1 in a center region
 thereof when viewed in the XZ plane. One of two magnetic parts 120 is embedded in
 the side surface 113A with a portion of the magnetic part 120 exposed through the
 opening 113A1. The side surface 113A is, as an example, in flush with the portion of
 15 the magnetic part 120 exposed through the opening 113A1.

[0045]

Here, the expression "the magnetic part 120 is embedded in the side surface
 113A" means that the magnetic part 120 may be partially exposed through the opening
 113A1 of the side surface 113A as shown in Fig. 2B, or may be located inside the case
 20 110 by being covered by the side surface 113 with no opening 113A1 formed in the side
 surface 113A.

[0046]

Although the magnetic part 120 is as an example embedded in the center region
 of the side surface 113A when viewed in the XZ plane, the position of the magnetic part
 25 120 may be offset from the center region of the side surface 113A in either direction
 along the XZ plane.

[0047]

Furthermore, as an example, a cutout 113A2 is formed in a -X-Z axis direction-
 side end region of the side surface 113A so as to feed therethrough the cable 101 (see
 30 Fig. 1A). The position of the cutout 113A2 is not limited to that shown in Fig. 2B. No
 cutout 113A2 may be formed in the side surface 113A.

[0048]

<Side Surface 113B>

The side surface 113B is a surface oriented at an angle of 90 degrees to the side surface 113A and in parallel with the YZ plane. The side surface 113B connects one of the two adjacent sides of the first surface 111 extending in the Y axis direction to one of the two adjacent sides of the second surface 112 extending in the Y axis direction. The side surface 113A is connected to a +Y axis direction side of the side surface 113B, whereas the side surface 113C is connected to a -Y axis direction side of the side surface 113B.

[0049]

The side surface 113B has, as an example, an opening 113B1 in a center region thereof when viewed in the YZ plane. The other of the two magnetic parts 120 is embedded in the side surface 113B with a portion of the magnetic part 120 exposed through the opening 113B1. The side surface 113B is, as an example, in flush with the portion of the magnetic part 120 exposed through the opening 113B1.

[0050]

Here, the expression "the magnetic part 120 is embedded in the side surface 113B" means that the magnetic part 120 may be partially exposed through the opening 113B1 of the side surface 113B as shown in Fig. 2B, or may be located inside the case 110 by being covered by the side surface 113B with no opening 113B1 formed in the side surface 113B.

[0051]

Although the magnetic part 120 is as an example embedded in the center region of the side surface 113B when viewed in the YZ plane, the position of the magnetic part 120 may be offset from the center region of the side surface 113B in either direction along the YZ plane.

[0052]

Furthermore, as an example, a cutout 113B2 is formed in a -Y-Z axis direction-side end region of the side surface 113B so as to feed therethrough the cable 101 (see Fig. 1A). The position of the cutout 113B2 is not limited to that shown in Fig. 2B. No cutout 113B2 may be formed in the side surface 113B.

[0053]

In the case where the imaging device 100 is connected to the processing device

via the cable 101, the case 110 may be provided with either one of the cutouts 113A2 and 113B2. However, the case 110 with both of the cutouts 113A2 and 113B2 facilitates selection of the direction of routing of the cable 101 at the attached position of the imaging device 100.

5 [0054]

<Side Surface 113C>

The side surface 113C is a surface connecting the hypotenuse of the first surface 111 to the hypotenuse of the second surface 112. The side surface 113C is oriented at an angle of 45 degrees to the XZ and YZ planes. The side surfaces 113A and 113B
10 are connected to the side surface 113C. The cutouts 113A2 and 113B2 are also positioned in end regions of the side surface 113C abutting the side surfaces 113A and 113B, respectively.

[0055]

<Outer Case 110A>

15 The outer case 110A is provided with the second surface 112, the side surfaces 113A, 113B and 113C as well as an opening 110A1. The outer case 110A is a case constituted by, among walls of the triangular prism-shaped case 110 with a low height in the Z axis direction, thin walls that respectively extend along the second surface 112 and the side surfaces 113A, 113B and 113C. In other words, the outer case 110A is a
20 triangular prism-shaped case having a hollow space therein and an opening 110A1 in a -Z axis direction side thereof where the first surface 111 is located. The inner case 110B, the inner case 110C and the holder 110D are placed in the outer case 110A.

[0056]

<Inner Case 110B>

25 The inner case 110B is a case located at the farthest back position within the outer case 100A when viewed from the opening 110A1. The inner case 110B is triangular-shaped in plan view, and has a through hole 110B1 formed in the Z axis direction through a center portion thereof in plan view. An inner side surface 110B2 of the inner case surrounding the through hole 110B1 has, as an example, a shape
30 corresponding to the inner surface of a hemispherical shell except its vertex portion.

[0057]

<Inner Case 110C>

The inner case 110C is a case located, at a position in front of the inner case 110B when viewed from the opening 110A1, within the outer casing 110A. The inner case 110C is placed inside the outer case 110A in a state of being stacked on the inner case 110B. A surface of the inner case 110C on the -Z axis direction side is the first surface 111.

[0058]

The inner case 110C is triangular-shaped in plan view, and has a through hole 110C1 formed in the Z axis direction through a center portion thereof in plan view. The opening 111A1 is defined midway of the through hole 110C1 in the Z axis direction.

The opening 111A1 is a region located between both end regions of the through hole 110C in the Z axis direction and having the smallest opening diameter in plan view. In other words, the opening 111A1 is defined as the most inwardly narrowed region between both end regions of the through hole 110C1 in the Z axis direction. The opening 111A1 is an opening through which the holder 110D is exposed when the imaging device 100 is viewed from the -Z axis direction side (front side).

[0059]

A region of the through hole 110C1 located on the -Z axis direction side with respect to the opening 111A1 corresponds to an inner space of the recess 111A. An inner side surface 110C2 of the inner case 110C, surrounding the region of the through hole 110C1 located on the +Z axis direction side with respect to the opening 111A1, has a shape corresponding to the inner surface of a hemispherical shell except its vertex portion. The opening 111A1 is located at a position corresponding to the vertex portion of this hemispherical shell. The inner side surface 110C2 communicates with the inner side surface 110B2 of the inner case 110B, forming a shape corresponding to the inner surface of a spherical shell except its two vertex portions on the Z axis.

[0060]

The magnetic parts 120 are embedded in the side surfaces 113A and 113B of the case 110, respectively. In Fig. 2C, the magnetic part 120 embedded in the opening 113B1 of the side surface 113B of the outer case 110A is shown. In actual, the magnetic part 120 is embedded as an example across the outer case 110A and the inner cases 110B and 110C. Hence, openings are formed in the inner cases 110B and 110C to be in communication with the opening 113B1 of the outer case 110A. The

magnetic part 120 is embedded in the opening 113B1 of the outer case 110A and the
opens of the inner cases 110B and 110C. The same configuration applies to the
opening 113A1 of the side surface 113A of the outer case 110A, and openings are
formed in the inner cases 110B and 110C to be in communication with the opening
5 113A1.

[0061]

<Holder 110D>

The holder 110D is a semi-spherical member and is disposed in a space defined
by the inner side surface 110C2 of the inner case 110C and the inner side surface
10 110B2 of the inner case 110B. A recess 110D1 is formed in a -Z axis direction side of
the holder 110D to install therein the lens 130. An opening is formed in a region of the
recess 110D1 overlapping the lens 130. The recess 110D1 is tapered, such that the
recess diameter in plan view increases with distance from the lens 130, so as to remain
outside the field of view defined by the lens 130 and the imaging unit 140. This is to,
15 when the imaging device 100 captures images, prevent the recess 110D1 from being
reflected in the captured images.

[0062]

A portion of the holder 110D surrounding the recess 110D1 is exposed inside the
recess 111A through the opening 111A1. Further, the holder 110D has a recessed
20 installation portion 110D2 to install therein the imaging unit 140 in back (on the +Z side
in Fig. 2C) of the lens 130. The installation portion 110D2 is in communication with the
recess 110D1 through the opening of the recess 110D1.

[0063]

Such a holder 110D is rotatable relative to the inner cases 110B and 110C along
25 the inner side surfaces 110B2 and 110C2, and thus is capable of varying the orientation
of the lens 130. Here, the case 110 is not necessarily configured to vary the
orientation of the lens 130, and the orientation of the lens 130 may be fixed.

[0064]

<Magnetic Part 120>

30 The magnetic part 120 is, as an example, a member having a permanent magnet
covered by a magnetic metal, a resin material or the like. Preferred examples of the
permanent magnet are those having strong magnetic attraction, such as neodymium

magnet. Examples of the magnetic metal to cover the permanent magnet are iron, nickel and the like. Examples of the resin material to cover the permanent magnet are thermoplastic resins such as PC (polycarbonate)/ASA (acrylate styrene acrylonitrile), ASA and AES (acrylonitrile ethylene styrene).

5 [0065]

Here, the imaging device 100 has two magnetic parts 120. As shown in Fig. 2B, one of the magnetic parts 120 is embedded in the center region of the side surface 113A; and the other of the magnetic parts 120 is embedded in the side surface 113B.

By these magnetic parts 120 (see Fig. 2B), the imaging device 100 is magnetically

10 attracted to and fixed to the window frame 12 as shown in Fig. 1B. In the case where the window frame 12 is not made of a magnetic metal, the imaging device 100 may be fixed to the window frame 12 by, for example, applying a magnetic metal sheet to the window frame 12 and causing magnetic attraction of the magnetic parts 120 to the magnetic metal sheet on the window frame. The imaging device 100 may be fixed to
15 the window frame 12 by applying a paint containing a magnetic material (for example, MAGNET PAINT (trademark) manufactured by Turner Colour Works Ltd.) to the window frame 12 and causing magnetic attraction of the magnetic parts 120 to the paint on the window frame.

[0066]

20 In the present embodiment, the imaging device 100 is as an example described as being provided with the magnetic parts 120 and attached by magnetic attraction to the window frame 12 of magnetic metal. However, the imaging device 100 may alternatively be fixed to the window frame 12 by forming the case 110 of a magnetic metal, applying a sheet-shaped magnetic part 120 onto the window frame 12 and
25 causing magnetic attraction of the case 110 to the sheet-shaped magnetic part 120 on the window frame 12.

[0067]

The imaging device 100 may be adhered to the window frame 12 using an adhesive such as a double-sided tape instead of the magnetic parts 120. In this case,
30 the adhesive such as double-sided tape is applied to a portion of the case 110 of the imaging device 100 which is located between the side surface 113A or 113B and the window frame 12 and is not directly exposed to ultraviolet radiation. Even in the case

where the imaging device 100 is adhered to the window frame 12 using the adhesive such as double-sided tape, the adhesive can be suppressed from degradation by ultraviolet radiation unless directly exposed to ultraviolet radiation so that it is possible to stably fix the imaging device 100 to the window frame 12. Examples of the double-

5 sided tape include acrylic foam double-sided high-adhesive tapes (such as VHB Tape (registered trademark) manufactured by Sumitomo 3M Limited and HYPERJOINT (registered trademark) manufactured by Nitto Denko Corporation) and so-called butyl tapes having butyl rubber-based adhesives applied to both sides of base materials.

[0068]

10 Although the imaging device 100 is described as being fixed to the window frame 12 as an example in the present embodiment, the imaging device 100 may alternatively be fixed to any structural part around the window glass 11, other than the window frame 12, such as a ceiling or wall around the window glass 11. In the case where the ceiling, wall or the like is not made of a magnetic metal, the imaging device 100 may be

15 fixed to the ceiling, wall or the like by applying a magnetic metal sheet to the ceiling, wall or the like. The imaging device 100 may be fixed to the ceiling or wall by forming the case 110 of a magnetic metal and applying a sheet-shaped magnetic part 120 to the ceiling, wall or the like. The imaging device 100 may be fixed to the ceiling, wall or the like by applying an adhesive such as a double-sided tape to the area located between

20 the case 110 and the ceiling, wall or the like and not directly exposed to ultraviolet radiation.

[0069]

<Lens 130>

The lens 130 is disposed in the opening of the recess 110D1 of the holder 110D of

25 the case 110. Since the opening of the recess 110D1 is in communication with the installation portion 110D2 in back of the recess 110D1, the imaging unit 140 installed in the installation portion 110D2 is able to capture images of outdoor scenes outside the window glass 11 through the opening of the recess 110D1 and the lens 130. A lens 130 may also be provided on the second surface 112 to image both of outdoor and

30 indoor scenes. The lens 130 may only be provided on the second surface 112 to image only indoor scenes.

[0070]

<Imaging Unit 140>

The imaging unit 140 is a camera body capable of capturing digital images such as video images and still images and may have, for example, an image sensor using an imaging element such as CMOS (complementary metal oxide semiconductor) or CCD (charge coupled device). The camera body refers to any part of a camera other than lens 130. In other words, the imaging unit 140 and the lens 130 constitute a digital camera.

[0071]

The imaging unit 140 is fixed inside the installation portion 110D2 of the holder 110D. This is to capture images of the subject outside the window glass 11 through the lens 130. The imaging unit 140 may have, or may not have, a telephoto function. The imaging unit 140 without a telephoto function is low in cost, which leads to low-cost production of the imaging device 100. The imaging unit 140 is connected to the processing device via the cable 101 (see Fig. 1A).

[0072]

<Attachment of Imaging Device 100 to Window Frame 12>

Next, the attachment of the imaging device 100 to the window frame 12 will be described below with reference to mainly Fig. 1B. As an example, the +X+Y-side corner portion of the window frame 12 is assumed to be that a frame part 12X of the window frame 12 extending in the X axis direction along the top edge of the window glass 11 and a frame part 12Y of the window frame 12 extending in the Y axis direction along the +X axis direction-side edge of the window glass 11 meet at an angle of 90 degrees.

[0073]

As shown in Fig. 1B, the imaging device 100 may preferably be positioned, as an example, at the top corner portions of the window glass 11 and the window frame 12. It is because: the top corner portion of the window frame 12 is difficult to see and is less conspicuous when viewed from outside by a large number of unspecified people; and the attachment of the imaging device 100 at a certain height enables image capturing over a wider area. The attachment position of the imaging device 100 is however not limited to the top corner portion of the window frame 12.

[0074]

The main surface 11A of the window glass 11 has a side 11AX extending in the X axis direction on the top edge and a side 11AY extending in the Y axis direction on the +X axis direction-side edge. The sides 11AX and 11AY are connected to each other at the +X+Y-side corner of the main surface 11A, with an angle of 90 degrees formed
5 between the sides 11AX and 11AY. In other words, the sides 11AX and 11AY are adjacent sides. Since the sides 11AX and 11AY are connected perpendicularly to each other, the angle between the frame parts 12X and 12Y of the window frame 12, which hold the window glass 11, is 90 degrees.

[0075]

10 The imaging device 100 is fixed to the top corner portion of the window frame 12 by bringing the side surfaces 113A and 113B (see Fig. 2B) of the case 110 into direct contact with the top corner portion of the window frame 12 and magnetically attracting the magnetic parts 120 to the window frame 12. The side surfaces 113A and 113B extend along the edges 11AX and 11AY, respectively. More specifically, the side
15 surface 113A extends along the edge 11AX in the X-axis direction; and the side surface 113B extends along the edge 11AY in the Y-axis direction.

[0076]

Since the case 110 of the imaging device 100 has a corner angle of 90 degrees between the side surfaces 113A and 113B, the side surfaces 113A and 113B can be
20 brought into direct contact with the inner corner portion between the frame parts 12X and 12Y of the window frame 12. Thus, the two magnetic parts 120 on the side surfaces 113A and 113B of the imaging device 100 are magnetically attracted to the frame parts 12X and 12Y of the window frame 12 just by pressing the side surfaces 113A and 113B against the inner corner portion between the frame parts 12X and 12Y.
25 In this way, it is possible to easily attach the imaging device 100 to the window frame 12.

[0077]

Furthermore, the imaging device 100 has a triangular shape in plan view and fits right into the inner corner portion between the frame parts 12X and 12Y of the window
30 frame 12. The imaging device 100 thus appears to be integrated with the window frame 12, which results in good design property.

[0078]

<Surface Color of Recesses 110D1 and 111A of Case 110>

It is preferable that the surfaces of the recesses 110D1 and 111A, which are positioned around the lens 130, are lower in light reflectance. The color of the surfaces of the recesses 110D1 and 111A is preferably black, which absorbs light most effectively, but may be any color other than black. The surfaces of the recesses 110D1 and 111A can be colored in any appropriate color by, for example, applying a paint. Preferred examples of the paint are those capable of suppressing degradation by ultraviolet radiation, such as a radical-control paint.

[0079]

The color of the surfaces of the recesses 110D1 and 111A is, as an example, a color with a lightness of 5 or lower. The lightness refers to e.g. a lightness value as specified in JIS Z8721: 1993.

[0080]

There is a correlation between the reflectance and the lightness, and a lightness of 5 or lower corresponds to a reflectance of 20% or lower. The reflectance refers to a total light reflectance as specified in JIS K7375: 2008. When the surfaces of the recesses 110D1 and 111A have a reflectance of 20% or lower, it is possible to prevent quality deterioration of the captured images caused by strong incident light such as sunlight unnecessarily reflected from the recesses 110D1 and 111A to the lens 130.

[0081]

Therefore, one example of suitable application of the imaging device 100 is as a surveillance camera. The imaging device 100, when used as a surveillance camera to image the outdoor area, may be in such a position as to be backlit by the sun depending on the time of day or the location of installation. Even in such a case, it is possible for the imaging device to easily capture high-quality images of the outdoor monitoring area including the target subject.

[0082]

The hue and chroma of the surface color of the recesses 110D1 and 111A are not particularly limited so far as the lightness is 5 or lower. As the color with a lightness of 5 or lower, not only black but also dark gray and the like may be mentioned.

[0083]

When the surfaces of the recesses 110D1 and 111A are sufficiently low in

reflectance as described above, the imaging device 100 can capture sufficiently clear images even without the use of a reflection suppression member such as a lens hood. Since the lens hood is often made of a material susceptible to degradation by ultraviolet radiation, such as silicone rubber, the imaging device 100 with no lens hood is
5 advantageous in terms of degradation by ultraviolet radiation.

[0084]

<Color of Case 110>

Parts of the surfaces of the case 110, other than the recesses 110D1 and 111A of the first surface 111, are visible from outside through the window glass 11 and thus may
10 preferably have an inconspicuous color as in the case of the recesses 110D1 and 111A. It is because, when the imaging device 100 is used as a surveillance camera as an example, the monitoring target is less wary of the imaging device in the case where the first surface 111 in front of the imaging device 100 is invisible from outside the window glass 111.

15 [0085]

In a state that the imaging device 100 is fixed to the window frame 12, the side surface 113C of the case 110 is exposed outside. When the side surface 113C is made the same color or a similar color as the window frame 12, the case 110 becomes less conspicuous, which is effective particularly for use of the imaging device as a
20 surveillance camera. The side surfaces 113A and 113B are invisible in a state that the imaging device 100 is fixed to the window frame 12. Thus, the color of the side surfaces 113A and 113B is not particularly limited. When the side surfaces 113A and 113B are painted in the same color as the side surface 113C, however, the imaging device 100 itself can achieve good design property and the painting process of the side
25 surfaces 113A to 113C can be simplified.

The color of the parts of the surfaces of the case 110, other than the recesses 110D1 and 111A of the first surface 111, may also be preferably black, which absorbs light more efficiently, but may be any color other than black.

The total light reflectance on the surface of the case 110 is preferably from 10% to
30 40% as specified in JIS K7375: 2008. When the total light reflectance is 10% or higher, heat is less likely to be built up in the case 110 so that the window glass 11 is less susceptible to temperature rise and is less likely to break. When the total light

reflectance is 40% or lower, it is less likely that an image of the case 110 will be reflected in the window glass 11. The total light reflectance is more preferably 15% or higher, still more preferably 20% or higher. The total light reflectance is more preferably 35% or lower, still more preferably 30% or lower.

5 [0086]

<Modifications>

Figs. 3A to 3C are schematic views illustrating a configuration example of an imaging device 100M according to a modification of the above-described embodiment.

Fig. 3A shows an example where the imaging device 100M is installed inside the
10 building 1. In Fig. 3A, a ceiling 1C and two walls 1WA and 1WB of the building 1 are shown in which the two walls 1WA and 1WB are adjacent to the ceiling 1C and are adjacent to each other. The two walls 1WA and 1WB are perpendicular to each other. The wall 1WA and the ceiling 1C are perpendicular to each other. The wall 1WB and the ceiling 1C are perpendicular to each other. Further, a window glass 11 is provided
15 in the wall 1WB. The window glass 11 is held by a window frame 12 that is attached to the wall 1WB.

[0087]

As shown in Fig. 3A, the imaging device 100M is positioned at a top corner portion of a room defined by the two walls 1WA and 1WB and the ceiling 1C, with the lens 130
20 directed toward the inside of the room. The window glass 11 and the window frame 12 shown on the wall 1WB in Fig. 3A do not need to be provided.

[0088]

Fig. 3B shows an example of the configuration of the imaging device 100M as viewed from the front side where the lens 130 is located; and Fig. 3C is an example of
25 the configuration of the imaging device 100M as viewed from the back side opposite the front side where the lens 130 is located.

[0089]

The imaging device 100M is provided with a case 110M, magnetic parts 120, a lens 130 and an imaging unit 140. In Figs. 3A to 3C, the imaging unit 140 is omitted
30 from illustration. Here, the imaging device 100M features the configuration of the case 110M, which is different from that of the case 110 of the imaging device 100 shown in Figs. 1A to 2C.

[0090]

The case 110M has a triangular pyramid shape with a first surface 111 and three side surfaces 113AA, 113AB and 113AC. The first surface 111 is the same as the first surface 111 of the case 110 of the imaging device 100 shown in Figs 1A to 2C. The case 110M has no second surface 112. The case 110 of the imaging device 100 shown in Figs. 1A to 2C may be formed in a triangular pyramid shape with the first surface 111 and three side surfaces 113A to 113C but without the second surface 112.

[0091]

As an example, the three side surfaces 113AA, 113AB and 113AC are oriented such that the side surfaces 113AA and 113AB are perpendicular each other, the side surfaces 113AA and 113AC are perpendicular to each other, and the side surfaces 113AB and 113AC are perpendicular to each other.

[0092]

The two magnetic parts 120 are embedded in the side surfaces 113AA and 113AB, respectively. Thus, by, for example, applying magnetic metal sheets to the respective two walls 1WA and 1WB, the imaging device 100M can be attached by magnetic attraction to the top corner portion of the room and fixed to the two walls 1WA and 1WB as shown in Fig. 3A.

[0093]

The imaging device 100M may have three magnetic parts 120 respectively embedded in the side surface 113AC as well as the other side surfaces. In this case, a magnetic metal sheet may also be applied to the ceiling 1C. Alternatively, the two magnetic parts 120 may be provided, one embedded in the side surface 113AC and the other embedded in either the side surface 113AA or 113AB. The imaging device 100M may have a single magnetic part 120 embedded in either one of the side surfaces 113AA, 113AB and 113AC.

[0094]

As in the case of the imaging device 100 described above with reference to Figs. 1A to 2C, the case 110M may be made of a metal; and a sheet-shaped magnetic part 120 may be applied to any one of the ceiling 1C and the two walls 1WA and 1WB. Any one of the first surface 111, the second surface 112 and the side surfaces 113AA, 113AB and 113AC may be adhered to the corresponding one of the ceiling 1C and the

two walls 1WA and 1WB using an adhesive such as a double-sided tape.

[0095]

The imaging device 100M is herein described as being configured to image indoor scenes, but may be configured to image outdoor scenes by providing the lens 130 on the surface 113AA or 113AB. The imaging device 100M may be configured to image both of indoor and outdoor scenes by providing lenses 130 on the first surface 111 and the side surface 113AA or 113AB.

[0096]

<Effects>

The above-embodied imaging device 100 includes: the case 110 to configured be installed on the indoor side of the window glass 11 of the building structure and having the first surface 111 to face the main surface 11A on the indoor side of the window glass 11 and the side surface 113 oriented at an angle relative to the first surface 111; the fixing part (magnetic part 120) that attaches or adheres the side surface 113 to the structural part around the window glass 11; the lens 130 disposed on the first surface 111; and the imaging unit 140 placed in the case 110 and configured to capture an image of an outdoor scene outside the window glass 11 through the lens 130. The fixing part (magnetic part 120), which is configured to attach or adhere the side surface 113 to the structural part around the window glass 11 as mentioned above, can avoid direct exposure to ultraviolet radiation. It is thus possible to suppress degradation of the fixing part (magnetic part 120) by ultraviolet radiation.

[0097]

Therefore, the imaging device 100 is provided, which can be stably fixed to the structural part around the window glass 11 over a long term. It is possible to suppress fall-off of the imaging device 100 and stably fix the imaging device 100 to the structural part around the window glass 11 over a long term.

[0098]

The fixing part of the imaging device 100 may be a magnetic part 120 having a magnet configured to magnetically attach the side surface 113 to the structural part.

Since the magnetic force of the magnetic part 120 is semi-permanent, it is possible to stably fix the imaging device 100 to the structural part around the window glass 11 over a longer term.

[0099]

The magnetic part 120 may be embedded in the side surface 113 of the case 110. By the magnetic part 120 embedded in the side surface 113, it is possible to easily and stably fix the imaging device 100 to the structural part around the window glass 11.

5 [0100]

Further, the imaging device may be configured such that: the side surface 113 of the case 110 includes two side surface 113A and 113B respectively extending along two sides 11AX and 11AY of the main surface 11A of the window glass 11; and two magnetic parts 120 are respectively embedded in the two side surfaces 113A and 113B of the case 110. By the two magnetic parts 120 embedded in the two side surfaces 113A and 113B that respectively extend along the two sides 11AX and 11AY of the indoor-side main surface 11A of the window glass 11, it is possible to stably fix the imaging device 100 to the structural part around the window glass 11 that extends along the two sides 11AX and 11AY.

15 [0101]

The imaging device may be configured such that: the two sides 11AX and 11AY of the indoor-side main surface 11A of the window glass 11 are adjacent to each other; and the two side surfaces 113A and 113B of the case 110 respectively extend along the adjacent two sides 11AX and 11AY of the main surface 11A. By the two magnetic parts 120 embedded in the adjacent two side surfaces 113A and 113B of the case 110 that respectively extend along the adjacent two sides 11AX and 11AY of the indoor-side main surface 11A of the window glass 11, it is possible to stably fix the imaging device 100 to the structural part around the window glass 11 that extends along the adjacent two sides 11AX and 11AY.

25 [0102]

The imaging device may be configured such that: the case 110 has the second surface 112 located opposite the first surface 111; the first surface 111 and the second surface 112 have the same right triangular shape and size; the side surface 113 includes three side surface 113A to 113C connecting three sides of the right triangular shape of the first surface 111 to three sides of the right triangular shape of the second surface 112, respectively; and the magnetic parts 120 are respectively embedded in the two side surfaces 113A and 113B, among the three side surfaces 113A to 113C,

connecting the two adjacent sides forming the right angle of the right triangular shape of the first surface 111 to the two adjacent sides forming the right angle of the triangular shape of the second surface 112. By the two magnetic parts 120 embedded in the two mutually adjacent and perpendicular side surfaces 113A and 113B, it is possible to easily and stably fix the imaging device 100 to the right-angled corner portion of the structural part such as the window frame 12 around the window glass 11.

[0103]

The imaging device may be configured such that: the case 110 is made of a metal material; and the magnetic part 120 is fixed to the structural part. Even in such a configuration that the magnetic part 120 is provided on the structural part rather than on the case 110, the imaging device 100 can be stably fixed to the structural part around the window glass 11 over a long term. It is possible to suppress fall-off of the imaging device 100 and stably fix the imaging device 100 to the structural part around the window glass 11 over a long term.

[0104]

The imaging device may be configured such that: the case 110 has the recess 111A recessed relative to the first surface 111; and the lens 130 is disposed in the recess 111A. It is possible to, in a state that the first surface 111 is arranged facing the indoor-side main surface 11A of the window glass 11, keep the lens 130 from contact with the main surface 11A.

[0105]

The color of the surface of the recess 111A may be black. In this case, the recess 111A absorbs light to achieve a lower reflectance. It is thus possible to provide the imaging device 100 in which the lens 130 is made less conspicuous.

[0106]

The reflectance of the recess 111A may be 20% or less. When the reflectance of the recess 111A is 20% or less, it is possible to prevent quality deterioration of the captured images caused by strong incident light such as sunlight unnecessarily reflected from the recess 111A to the lens 130.

[0107]

The first surface 111 may be in direct contact with the main surface 11A of the window glass 11. By the first surface 111 being in direct contact with the main surface

11A, it is possible to reduce reflections of the window glass 11 in the images captured by the imaging unit 140 through the lens 130.

[0108]

The imaging device may be configured such that: the case 110 has the second
5 surface 112 located opposite the first surface 111; the first surface 111 and the second surface 112 have the same right triangular shape and size; the side surface includes three side surfaces 113A to 113C connecting three sides of the right triangular shape of the first surface 111 to the three sides of the right triangular shape of the second surface 112, respectively; the magnetic parts 120 are embedded in the two side
10 surfaces 113A and 113B connecting the two adjacent sides forming the right angle of the right triangular shape of the first surface 111 to the two adjacent sides forming the right angle of the right triangular shape of the second surface 112; the case has the recess 111A recessed relative to the first surface 111; the lens 130 is disposed in the recess 111A; the surface of the recess 111A is black in color and has a reflectance of
15 20% or lower; and the first surface 111 is in direct contact with the main surface of the window glass. By the two magnetic parts 120 embedded in the mutually adjacent and perpendicular side surfaces 113A and 113B, it is possible to easily and stably fix the imaging device 100 to the right-angled corner portion of the structural part such as the window frame 12 around the window glass 11. It is further possible to, in a state that
20 the first surface 111 is arranged facing the indoor-side main surface 11A of the window glass 11, keep the lens 130 from contact with the main surface 11A. By the recess 111A absorbing light, it is possible to achieve a lower reflectance and provide the imaging device 100 in which the lens 130 is less conspicuous. By the recess 111A having a reflectance of 20% or lower, it is possible to prevent quality deterioration of the
25 captured images caused by strong incident light such as sunlight unnecessarily reflected from the recess 111A to the lens 130.

[0109]

Furthermore, the imaging device-equipped window glass 200 is provided including: the window glass 11 for the building structure; and the imaging device 100
30 installed on the indoor side of the window glass 11, wherein the imaging device 100 includes: the case 110 installed on the indoor side of the window glass 11 and having the first surface 111 facing the main surface 11A on the indoor side of the window glass

11 and the side surface 113 oriented at an angle relative to the first surface 111; the fixing part that attaches or adheres the side surface 113 to the structural part around the window glass 11; the lens 130 disposed on the first surface 111; and the imaging unit 140 placed in the case 110 and configured to capture an image of an outdoor scene outside the window glass 11 through the lens 130. The fixing part (magnetic part 120), which is configured to attach or adhere the side surface 113 to the structural part around the window glass 11 as mentioned above, can avoid direct exposure to ultraviolet radiation. It is thus possible to suppress degradation of the fixing part (magnetic part 120) by ultraviolet radiation.

10 [0110]

Therefore, the image device-equipped window glass 200 is provided, which enables stable fixing of the imaging device 100 to the structural part around the window glass 11 over a long term. It is possible to suppress fall-off of the imaging device 100 and stably fix the imaging device 100 to the structural part around the window glass 11 over a long term.

[0111]

The image device-equipped window glass 200 may further include the window frame 12 that holds the window glass 11. The imaging device-equipped window glass 200 with the window frame 12 enables stable fixing of the imaging device 100 to the structural part around the window glass 11 over a long period of time.

20 [0112]

The structural part may be the frame parts 12X and 12Y of the window frame 12. Since the imaging device 100 has a triangular shape in plan view and fits right into the inner corner portion between the frame parts 12X and 12Y of the window frame 12 in the above embodiment, the imaging device 100 appears to be integrated with the window frame 12 and thus achieves good design property.

25 [0113]

Although the embodiments of the imaging device and the image device-equipped window glass according to the present disclosure have been described above, the present disclosure is not limited to the above-described embodiments; and various changes, modifications and replacements can be made to the above-described embodiments without departing from the claimed scope of the present invention.

30

[0114]

The following notes are disclosed in relation to the above-described embodiments.

(Note 1)

An imaging device comprising:

- 5 a housing configured to be installed on an indoor side of a window glass of a building structure and having a first surface to face a main surface on the indoor side of the window glass and a side surface oriented at an angle relative to the first surface;
- a fixing part configured to attach or adhere the side surface to a structural part around the window glass;
- 10 a lens disposed on the first surface; and
- an imaging unit placed in the housing and configured to capture an image of an outdoor scene outside the window glass through the lens.

(Note 2)

- 15 The imaging device according to Note 1, wherein the fixing part is a magnetic part having a magnet configured to magnetically attach the side surface to the structural part.

(Note 3)

The imaging device according to Note 2, wherein the magnetic part is embedded in the side surface of the housing.

20 (Note 4)

The imaging device according to Note 3, wherein:

- the side surface includes two side surfaces extending respectively along two sides of the main surface; and
- the magnetic part is embedded in each of the two side surfaces.

25 (Note 5)

The imaging device according to Note 4, wherein:

- the two sides of the main surface are adjacent to each other; and
- the two side surfaces extend along the adjacent two sides of the main surface, respectively.

30 (Note 6)

The imaging device according to any one of Notes 2 to 5, wherein:

- the housing has a second surface located opposite to the first surface;

the first surface and the second surface have the same right triangular shape and size,

the side surface includes three side surfaces connecting three sides of the right triangular shape of the first surface to three sides of the right triangular shape of the

5 second surface, respectively, and

the magnetic part is embedded in two of the three side surfaces connecting two adjacent sides forming the right angle of the right triangular shape of the first surface to two adjacent sides forming the right angle of the triangular shape of the second surface.

(Note 7)

10 The imaging device according to Note 2, wherein:

the housing is made of a metal; and

the magnetic part is configured to be fixed to the structural part.

(Note 8)

The imaging device according to any one of Notes 1 to 7, wherein:

15 the housing has a recess that is recessed relative to the first surface; and

the lens is disposed in the recess.

(Note 9)

The imaging device according to Note 8, wherein a surface of the recess is black in color.

20 (Note 10)

The imaging device according to Note 8 or 9, wherein the reflectance of the recess is 20% or less.

(Note 11)

25 The imaging device according to any one of Notes 1 to 10, wherein the first surface is configured to be brought into direct contact with the main surface of the window glass.

(Note 12)

The imaging device according to Note 5, wherein:

the housing has a second surface located opposite to the first surface;

30 the first surface and the second surface have the same right triangular shape and size;

the side surface includes three side surfaces connecting three sides of the right

triangular shape of the first surface to three sides of the right triangular shape of the second surface, respectively;

the magnetic part is embedded in two of the three side surfaces connecting two adjacent sides forming the right angle among the three sides of the right triangular

5 shape of the first surface to two adjacent sides forming the right angle among the three sides of the right triangular shape of the second surface;

the housing has a recess that is recessed relative to the first surface;

the lens is disposed in the recess;

a surface of the recess is black in color;

10 the reflectance of the recess is 20% or less; and

the first surface is configured to be brought into direct contact with the main surface of the window glass.

(Note 13)

An imaging device-equipped window glass comprising:

15 a window glass for a building structure; and

an imaging device installed on an indoor side of the window glass,

the imaging device comprising:

a housing installed on the indoor side of the window glass and having a first surface facing a main surface on the indoor side of the window glass and a side surface

20 oriented at an angle relative to the first surface;

a fixing part configured to attach or adhere the side surface to a structural part around the window glass;

a lens disposed on the first surface; and

an imaging unit placed in the housing and configured to capture an image of an outdoor scene outside the window glass through the lens.

25

(Note 14)

The imaging device-equipped window glass according to Note 13, further comprising a window frame part that holds the window glass.

(Note 15)

30 The imaging device-equipped window glass according to Note 14, wherein the structural part is the window frame part.

The entire disclosure of Japanese Patent Application No. 2023-132855 filed on August 17, 2023, including specification, claims, drawings and summary, is incorporated herein by reference in its entirety.

5 REFERENCE SYMBOLS

[0115]

11: Window glass

11A: Main surface

11AX, 11AY: Sides (examples of two sides)

10 12: Window frame

100: Imaging device

110, 110M: Case

111: First surface

110D1: Recess

15 111A: Recess

112: Second surface

113, 113A, 113B, 113C, 113AA, 113AB, 113AC: Side surface

120: Magnetic part

130: Lens

20 140: Imaging unit

CLAIMS

[Claim 1]

An imaging device comprising:

- 5 a housing configured to be installed on an indoor side of a window glass of a building structure and having a first surface to face a main surface on the indoor side of the window glass and a side surface oriented at an angle relative to the first surface;
- a fixing part configured to attach or adhere the side surface to a structural part around the window glass;
- a lens disposed on the first surface; and
- 10 an imaging unit placed in the housing and configured to capture an image of an outdoor scene outside the window glass through the lens.

[Claim 2]

- The imaging device according to Claim 1, wherein the fixing part is a magnetic part having a magnet configured to magnetically attach the side surface to the structural
- 15 part.

[Claim 3]

The imaging device according to Claim 2, wherein the magnetic part is embedded in the side surface of the housing.

[Claim 4]

- 20 The imaging device according to Claim 3, wherein:
 - the side surface includes two side surfaces extending respectively along two sides of the main surface; and
 - the magnetic part is embedded in each of the two side surfaces.

[Claim 5]

- 25 The imaging device according to Claim 4, wherein:
 - the two sides of the main surface are adjacent to each other; and
 - the two side surfaces extend along the adjacent two sides of the main surface, respectively.

[Claim 6]

- 30 The imaging device according to Claim 2, wherein:
 - the housing further includes a second surface located opposite to the first surface;
 - the first surface and the second surface have the same right triangular shape and

size,

the side surface includes three side surfaces connecting three sides of the right triangular shape of the first surface to three sides of the right triangular shape of the second surface, respectively, and

- 5 the magnetic part is embedded in two of the three side surfaces connecting two adjacent sides forming the right angle of the right triangular shape of the first surface to two adjacent sides forming the right angle of the right triangular shape of the second surface.

[Claim 7]

- 10 The imaging device according to Claim 2, wherein:
the housing is made of a metal; and
the magnetic part is configured to be fixed to the structural part.

[Claim 8]

- 15 The imaging device according to Claim 1, wherein:
the housing has a recess that is recessed relative to the first surface; and
the lens is disposed in the recess.

[Claim 9]

The imaging device according to Claim 8, wherein a surface of the recess is black in color.

- 20 [Claim 10]

The imaging device according to Claim 8, wherein the reflectance of the recess is 20% or less.

[Claim 11]

- 25 The imaging device according to Claim 1, wherein the first surface is configured to be brought into direct contact with the main surface of the window glass.

[Claim 12]

- 30 The imaging device according to Claim 5, wherein:
the housing further includes a second surface located opposite the first surface;
the first surface and the second surface have the same right triangular shape and size;

the side surface includes three side surfaces connecting three sides of the right triangular shape of the first surface to three sides of the right triangular shape of the

second surface, respectively;

the magnetic part is embedded in two of the three side surfaces connecting two adjacent sides forming the right angle of the right triangular shape of the first surface to two adjacent sides forming the right angle of the right triangular shape of the second

5 surface;

the housing has a recess that is recessed relative to the first surface;

the lens is disposed in the recess;

a surface of the recess is black in color;

the reflectance of the recess is 20% or less; and

10 the first surface is configured to be brought into direct contact with the main surface of the window glass.

[Claim 13]

An imaging device-equipped window glass comprising:

a window glass for a building structure; and

15 an imaging device installed on an indoor side of the window glass,

the imaging device comprising:

a housing installed on the indoor side of the window glass and having a first surface facing a main surface on the indoor side of the window glass and a side surface oriented at an angle relative to the first surface;

20 a fixing part configured to attach or adhere the side surface to a structural part around the window glass;

a lens disposed on the first surface; and

an imaging unit placed in the housing and configured to capture an image of an outdoor scene outside the window glass through the lens.

25 [Claim 14]

The imaging device-equipped window glass according to Claim 13, further comprising a frame part that holds the window glass.

[Claim 15]

30 The imaging device-equipped window glass according to Claim 14, wherein the structural part is the frame part.