used. However, in the method of the direct visual inspection by the inspector, there are various problems such as a risk of a toxic gas being produced in the sewage pipeline to affect a human body and a risk from immersion at the time of sudden rainfall. In the method of arranging the television camera in the pipe, there are also problems that a sufficient inspection speed is not obtained and a vehicle is difficult to control when a water level in the sewage pipeline rises.

[0004]

In flying an unmanned aerial vehicle in not only the sewage pipeline but also an environment where a collision with any boundary surface such as a wall surface or a ceiling may occur, controllability of the unmanned aerial vehicle may be deteriorated by the collision with the boundary surface, or an vehicle body may be damaged in some cases.

Citation List

Patent Literature

[0005]

Patent Literature 1: Japanese Patent Laid-Open No. 2017-087917
Patent Literature 2: Japanese Patent Laid-Open No. 2017-226259
Patent Literature 3: Japanese Patent Laid-Open No. 2018-001967
Patent Literature 4: Japanese Patent Laid-Open No. 2014-239665
Patent Literature 5: Japanese Patent Laid-Open No. 2014-236728
Patent Literature 6: Japanese Patent Laid-Open No. 2013-000059

Summary

[0005a]

In an aspect, the present disclosure refers to a shooting inspection system comprising:

a flight start stage on which an unmanned flying object can be placed;

the unmanned flying object that is connected to a line-type member, comprises an inspection camera, a traveling direction shooting camera, and an unmanned flying object-side communication unit, and starts to fly from a state where the unmanned flying object is placed on the flight start stage in an inspection space, shoots in a traveling direction in the inspection space using the traveling direction shooting camera, and flies in the inspection space while transmitting traveling direction shooting data obtained by shooting in the traveling direction from the unmanned flying object-side communication unit;

an external control device that comprises a display unit and an external control device-side communication unit, receives the traveling direction shooting data by the external control device-side communication unit, accepts an input of a control instruction to the unmanned flying object while displaying a moving image or a still image obtained based on the traveling direction shooting data on the display unit, and transmits a signal representing the control instruction from the external control device-side communication unit; and

a draw device that is connected to the line-type member and draws the unmanned flying object,

wherein the unmanned flying object comprises:

a frame having a shape elongated along a forward direction;

four rotary wings, wherein a first pair of the four rotary wings is positioned on a front-half side of the frame and a second pair of the four rotary wings is positioned on a back-half side of the frame, and wherein the four rotary wings are positioned inside the frame;

a driver that drives the four rotary wings;

a control signal generation unit that is configured to generate a control signal for causing the driver to drive the four rotary wings, wherein the control signal generation unit is positioned between the first pair of the four rotary wings and the second pair of the four rotary wings,

wherein the first pair of the four rotary wings and the second pair of the four rotary wings are arranged apart from each other in the forward direction inside the frame and the control signal generation unit is positioned in an area between the first pair of the four rotary wings and the second pair of the four rotary wings, the area resulting from the apart arrangement, so that the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings are arranged apart from each other in the forward direction in the order of the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings,

wherein the traveling direction shooting camera is placed at a position on the vehicle body of the unmanned flying object, the position being between the first pair of the four rotary wings and the second pair of the four rotary wings.

[0005b]

In an aspect, the present disclosure refers to a shooting inspection method comprising:

putting an unmanned flying object that is connected to a line-type member and comprises an inspection camera, a traveling direction shooting camera, and an unmanned flying object-side communication unit into an inspection space with the unmanned flying object placed on a flight start stage;

by the unmanned flying object, starting to fly from a state where the unmanned flying object is placed on the flight start stage in the inspection space, shooting in a traveling direction in the inspection space using the traveling direction shooting camera, and flying in the inspection space while transmitting traveling direction shooting data obtained by shooting in the traveling direction from the unmanned flying object-side communication unit;

by an external control device which includes a display unit and an external control device-side communication unit, receiving the traveling direction shooting data using the external control device-side communication unit, accepting an input of a control instruction to the unmanned flying object while displaying a moving image or a still image obtained based on the traveling direction shooting data on the display unit, and transmitting a signal representing the control instruction from the external control device-side communication unit; and

by a draw device, connected to the line-type member, drawing the unmanned flying object,

wherein the unmanned flying object comprises:

a frame having a shape elongated along a forward direction;

four rotary wings, wherein a first pair of the four rotary wings is

positioned on a front-half side of the frame and a second pair of the four rotary wings is positioned on a back-half side of the frame, and wherein the four rotary wings are positioned inside the frame;

a driver that drives the four rotary wings;

a control signal generation unit that is configured to generate a control signal for causing the driver to drive the four rotary wings, wherein the control signal generation unit is positioned between the first pair of the four rotary wings and the second pair of the four rotary wings,

wherein the first pair of the four rotary wings and the second pair of the four rotary wings are arranged apart from each other in the forward direction inside the frame and the control signal generation unit is positioned in an area between the first pair of the four rotary wings and the second pair of the four rotary wings, the area resulting from the apart arrangement, so that the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings are arranged apart from each other in the forward direction in the order of the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings,

wherein the traveling direction shooting camera is placed at a position on the vehicle body of the unmanned flying object, the position being between the first pair of the four rotary wings and the second pair of the four rotary wings.

[0006]

The present disclosure is to provide an apparatus configuration, a method, and the like for performing shooting inspection in an inspection space including the inside of a sewage pipeline using

an unmanned flying object.

[0007]

To solve the above-described problems, the present disclosure provides, in an example, a shooting inspection system including a flight start stage (flight start platform) on which an unmanned flying object can be placed, the unmanned flying object that is connected to a line-type member, includes an inspection camera, a traveling direction shooting camera, and an unmanned flying object-side communication unit, and starts to fly from a state where the unmanned flying object is placed on the flight start stage in an inspection space, shoots a traveling direction in the inspection space using the traveling direction shooting camera, and flies in the inspection space while transmitting traveling direction shooting data obtained by shooting the traveling direction from the unmanned flying object-side communication unit, an external control device that includes a display unit and an external control device-side communication unit, receives the traveling direction shooting data by the external control device-side communication unit, accepts an input of a control instruction to the unmanned flying object while displaying a moving image (movie) or a still image obtained based on the traveling direction shooting data on the display unit, and transmits a signal representing the control instruction from the external control device-side communication unit, and a draw device that is connected to the line-type member and draws the unmanned flying object.

[0008]

The present disclosure provides, in an example, a shooting inspection method including putting an unmanned flying object that is connected to a line-type member and includes an inspection camera, a traveling direction shooting camera, and an unmanned flying object-side communication unit into an inspection space with the unmanned flying object placed on a flight start

Claims

[Claim 1]

A shooting inspection system comprising:

a flight start stage on which an unmanned flying object can be placed;

the unmanned flying object that is connected to a line-type member, comprises an inspection camera, a traveling direction shooting camera, and an unmanned flying object-side communication unit, and starts to fly from a state where the unmanned flying object is placed on the flight start stage in an inspection space, shoots in a traveling direction in the inspection space using the traveling direction shooting camera, and flies in the inspection space while transmitting traveling direction shooting data obtained by shooting in the traveling direction from the unmanned flying object-side communication unit;

an external control device that comprises a display unit and an external control device-side communication unit, receives the traveling direction shooting data by the external control device-side communication unit, accepts an input of a control instruction to the unmanned flying object while displaying a moving image or a still image obtained based on the traveling direction shooting data on the display unit, and transmits a signal representing the control instruction from the external control device-side communication unit; and

a draw device that is connected to the line-type member and draws the unmanned flying object,

wherein the unmanned flying object comprises:

a frame having a shape elongated along a forward direction;

four rotary wings, wherein a first pair of the four rotary wings is positioned on a front-half side of the frame and a second pair of the four rotary wings is positioned on a back-half side of the frame, and wherein the

four rotary wings are positioned inside the frame;

a driver that drives the four rotary wings;

a control signal generation unit that is configured to generate a control signal for causing the driver to drive the four rotary wings, wherein the control signal generation unit is positioned between the first pair of the four rotary wings and the second pair of the four rotary wings,

wherein the first pair of the four rotary wings and the second pair of the four rotary wings are arranged apart from each other in the forward direction inside the frame and the control signal generation unit is positioned in an area between the first pair of the four rotary wings and the second pair of the four rotary wings, the area resulting from the apart arrangement, so that the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings are arranged apart from each other in the forward direction in the order of the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings,

wherein the traveling direction shooting camera is placed at a position on the vehicle body of the unmanned flying object, the position being between the first pair of the four rotary wings and the second pair of the four rotary wings.

[Claim 2]

A shooting inspection method comprising:

putting an unmanned flying object that is connected to a line-type member and comprises an inspection camera, a traveling direction shooting camera, and an unmanned flying object-side communication unit into an inspection space with the unmanned flying object placed on a flight start stage;

by the unmanned flying object, starting to fly from a state where the unmanned flying object is placed on the flight start stage in the inspection space, shooting in a traveling direction in the inspection space using the

traveling direction shooting camera, and flying in the inspection space while transmitting traveling direction shooting data obtained by shooting in the traveling direction from the unmanned flying object-side communication unit;

by an external control device which includes a display unit and an external control device-side communication unit, receiving the traveling direction shooting data using the external control device-side communication unit, accepting an input of a control instruction to the unmanned flying object while displaying a moving image or a still image obtained based on the traveling direction shooting data on the display unit, and transmitting a signal representing the control instruction from the external control device-side communication unit; and

by a draw device, connected to the line-type member, drawing the unmanned flying object,

wherein the unmanned flying object comprises:

a frame having a shape elongated along a forward direction;

four rotary wings, wherein a first pair of the four rotary wings is positioned on a front-half side of the frame and a second pair of the four rotary wings is positioned on a back-half side of the frame, and wherein the four rotary wings are positioned inside the frame;

a driver that drives the four rotary wings;

a control signal generation unit that is configured to generate a control signal for causing the driver to drive the four rotary wings, wherein the control signal generation unit is positioned between the first pair of the four rotary wings and the second pair of the four rotary wings,

wherein the first pair of the four rotary wings and the second pair of the four rotary wings are arranged apart from each other in the forward direction inside the frame and the control signal generation unit is positioned in an area between the first pair of the four rotary wings and the second pair of the four rotary wings, the area resulting from the apart arrangement, so

that the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings are arranged apart from each other in the forward direction in the order of the first pair of the four rotary wings, the control signal generation unit, and the second pair of the four rotary wings,

wherein the traveling direction shooting camera is placed at a position on the vehicle body of the unmanned flying object, the position being between the first pair of the four rotary wings and the second pair of the four rotary wings.

[Claim 3]

The method according to claim 2, wherein the draw device is an automatic winding device that winds the line-type member to draw the unmanned flying object.

[Claim 4]

The method according to claim 2 or 3, wherein the draw device draws the unmanned flying object with the unmanned flying object stopping traveling in the traveling direction and floating.

[Claim 5]

The method according to any one of claims 2 to 4, wherein the inspection camera performs shooting in the inspection space while the unmanned flying object is being drawn by the draw device.

[Claim 6]

The method according to any one of claims 2 to 5, further comprising generating a developed view or expanded image data corresponding to a boundary surface of the inspection space from inspection camera shooting data obtained by the shooting using the inspection camera, and displaying the developed view or the expanded image data as an image.

[Claim 7]

The method according to any one of claims 2 to 6, wherein an antenna is attached to the flight start stage, and communication between the

unmanned flying object-side communication unit and the external control device-side communication unit is performed according to a wireless LAN (local area network) communication standard using the antenna.

[Claim 8]

The method according to any one of claims 2 to 7, wherein resolution of the moving image or the still image obtained based on the traveling direction shooting data is lower than resolution of a moving image or a still image obtained based on shooting data obtained by the shooting using the inspection camera.

[Claim 9]

The method according to any one of claims 2 to 8, wherein the flight start stage is attached to a distal end portion of a rod-shaped body, and the rod-shaped body is inserted into the inspection space from the flight start stage on which the unmanned flying object is placed to put the unmanned flying object into the inspection space.

[Claim 10]

The method according to claim 9, wherein the unmanned flying object is put into the inspection space by placing the flight start stage that is attached to the distal end portion of the rod-shaped body and on which the unmanned flying object is placed on a carriage and inserting the rod-shaped body into the inspection space from an opening provided in the carriage.