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IMAGE DISPLAY DEVICE, METHOD FOR OPERATING IMAGE DISPLAY DEVICE, AND PROGRAM FOR OPERATING IMAGE DISPLAY DEVICE

Abstract

Provided is an image display device including a processor, in which the processor is configured to perform control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation application of International Application No. PCT/JP2023/036436, filed Oct. 5, 2023, the disclosure of which is incorporated herein by reference in its entirety. Further, this application claims priority from Japanese Patent Application No. 2022-180167, filed on Nov. 10, 2022, and Japanese Patent Application No. 2023-001824, filed on Jan. 10, 2023, the disclosures of which are incorporated herein by reference in their entirety.

BACKGROUND
1. Technical Field
[0002] The technology of the present disclosure relates to an image display device, a method for operating an image display device, and a program for operating an image display device.
2. Description of the Related Art
[0003] For example, as described in JP2022-056085A, JP2022-139903A, and JP2017-168077A, a technique has been proposed which extracts deformation occurring in a structure from an image obtained by imaging the structure with an imaging device. The structure is, for example, a so-called infrastructure such as a dam, a bridge, or a tunnel. The deformation is, for example, a crack, peeling, rust, water leakage, or exposure of reinforcing bars.
SUMMARY
[0004] In the technique described in JP2022-056085A, JP2022-139903A, and the like, in a case of a relatively large structure, such as a dam, a bridge, or a tunnel, for example, an image covering the entire structure is obtained by imaging the structure a plurality of times with an imaging device while moving the imaging device, for example, from an entrance to an exit of the tunnel. The image covering the entire structure is a very long image, for example, an image from the entrance to the exit of the tunnel having a total length of 5 km.
[0005] In addition, in the technique described in JP2022-056085A, JP2022-139903A, and the like, the image is displayed on a display together with extraction results of the deformation and the like to be viewed by the user. The image displayed in this case is a portion of the image covering the entire structure such as an image in a distance range of 50 m from 2 km to 2.05 km in the tunnel having a total length of 5 km.
[0006] In the case of the above-described display form of the image, the user often does not know which portion of the structure the displayed captured image corresponds to. As a result, there is a problem in that it is not possible to specify the position of the structure where the deformation has occurred.
[0007] JP2017-168077A discloses an aspect in which an image (referred to as a panoramic image in JP2017-168077A) covering the entire structure and a partial image (referred to as an inspection

image in JP2017-168077A) of the image covering the entire structure are displayed on the same screen. Then, as a solution to the above problem, in JP2017-168077A, a frame of the inspection image is displayed on the panoramic image such that a user recognizes which portion of the structure the captured inspection image corresponds to.

[0008] However, in JP2017-168077A, since the panoramic image and the inspection image are displayed on the same screen and the frame of the inspection image is displayed on the panoramic image, a screen configuration is cluttered.

[0009] An embodiment according to the technology of the present disclosure provides an image display device, a method for operating an image display device, and a program for operating an image display device that enable a user to recognize which portion of a structure a displayed captured image corresponds to with a simple screen configuration.

[0010] According to an aspect of the present disclosure, there is provided an image display device including a processor, in which the processor is configured to perform control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.

[0011] Preferably, the processor is configured to: receive a designation of any position of the first index bar; and display the partial image, whose capture position corresponds to the designated position, in the display region.

[0012] Preferably, a second index bar that indicates a second distance range wider than the first distance range and indicates which position in the second distance range the first index bar being displayed corresponds to is capable of being displayed.

[0013] Preferably, the second distance range is an entire distance range of the structure in the first direction.

[0014] Preferably, the partial image is capable of being displayed to be enlarged in the display region, and an auxiliary window indicating which position of the partial image the portion displayed to be enlarged corresponds to is capable of being displayed.

[0015] Preferably, an operation portion for inputting an instruction to switch the partial image being displayed in the display region to a partial image adjacent to the partial image being displayed in the display region is provided on the display screen.

[0016] Preferably, a portion-of-interest mark indicating a portion of interest in the long image is capable of being displayed on the first index bar.

[0017] Preferably, the portion of interest includes at least one of a portion designated by a user or a portion in which a specific object is present.

[0018] Preferably, a text memo or a voice memo input by the user is displayed in association with the portion of interest.

[0019] Preferably, the portion designated by the user is at least one of a portion designated by an imaging person of the long image during capture of the long image or a portion designated by an inspector of the long image during inspection of the long image.

[0020] Preferably, a portion whose partial image is displayed and a portion whose partial image is not displayed are capable of being displayed to be distinguished from each other on the first index bar.

[0021] Preferably, a display completion mark indicating the portion whose partial image is displayed is displayed on the first index bar such that the portion whose partial image is displayed and the portion whose partial image is not displayed are displayed to be distinguished from each other.

[0022] Preferably, at least one of a brightness, color, or pattern of the first index bar is changed such that the portion whose partial image is displayed and the portion whose partial image is not displayed are displayed to be distinguished from each other.
[0023] Preferably, the processor is configured to: receive a designation of an object to be measured in the partial image; and display at least one of a position of the object to be measured in the structure or an actual size of the object to be measured in response to the designation.
[0024] Preferably, the long image is an image obtained by combining a plurality of captured images obtained by imaging different portions of the structure with the imaging device a plurality of times along at least the first direction of the first direction and a second direction intersecting the first direction.
[0025] Preferably, the plurality of captured images are images obtained by imaging the structure at a plurality of different positions in the first direction while moving the imaging device in the first direction.
[0026] Preferably, the imaging device has a plurality of cameras that are arranged along the second direction, and the plurality of captured images are images obtained by imaging the structure with the plurality of cameras. In addition, preferably, the imaging device has a plurality of cameras that are arranged along the first direction, and the plurality of captured images are images obtained by imaging the structure with the plurality of cameras.
[0027] Preferably, the imaging device has a plurality of cameras that are arranged along the second direction, the plurality of captured images are images obtained by imaging the structure with the plurality of cameras while moving the imaging device along the first direction, and the long image is an image obtained by combining the plurality of captured images along the first direction and the second direction.
[0028] Preferably, the structure is a tunnel, the first direction is a length direction connecting an entrance and an exit of the tunnel, and the second direction is a circumferential direction of the tunnel.
[0029] According to another aspect of the present disclosure, there is provided a method for operating an image display device, the method including: performing control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.
[0030] According to still another aspect of the present disclosure, there is provided a program for operating an image display device, the program causing a computer to execute a process including: performing control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.
[0031] According to the technology of the present disclosure, it is possible to provide an image display device, a method for operating an image display device, and a program for operating an image display device that enable a user to recognize which portion of a structure a displayed captured image corresponds to with a simple screen configuration.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] Exemplary embodiments according to the technique of the present disclosure will be described in detail based on the following figures, wherein:

[0033] FIG. **1** is a diagram showing an aspect in which an inner wall surface of a tunnel is imaged with an imaging device;

[0034] FIG. **2** is a side view showing the imaging device;

[0035] FIG. **3** is a perspective view showing an imaging device main body;

[0036] FIG. **4** is a side view showing the imaging device main body;

[0037] FIG. **5** is a diagram showing imaging regions of a first imaging unit and a second imaging unit;

[0038] FIG. **6** is a diagram showing a structure of a long image;

[0039] FIG. **7** is a diagram showing captured image information;

[0040] FIG. **8** is a diagram showing an operation screen;

[0041] FIG. **9** is a diagram illustrating an operation screen in a case where a portion designation button is selected;

[0042] FIG. **10** is a diagram showing during-imaging designated portion information;

[0043] FIG. **11** is a diagram showing the imaging device, an information management server, an inspector terminal, and information transmitted from the imaging device to the information management server;

[0044] FIG. **12** is a block diagram showing a computer constituting each of the information management server and the inspector terminal;

[0045] FIG. **13** is a block diagram showing a processing unit of a CPU of the information management server;

[0046] FIG. **14** is a diagram showing during-inspection designated portion information;

[0047] FIG. **15** is a diagram showing a process of an extraction unit;

[0048] FIG. **16** is a diagram showing extracted image information;

[0049] FIG. **17** is a block diagram showing a processing unit of a CPU of the inspector terminal;

[0050] FIG. **18** is a diagram showing a bird's-eye view screen;

[0051] FIG. **19** is a diagram showing the bird's-eye view screen;

[0052] FIG. **20** is a diagram showing a partial index bar of the bird's-eye view screen;

[0053] FIG. **21** is a diagram showing an aspect in which a text memo is displayed in association with a during-imaging designated portion mark;

[0054] FIG. **22** is a diagram showing an aspect in which the text memo is displayed in association with a during-inspection designated portion mark;

[0055] FIG. **23** is a diagram illustrating a partial image display screen;

[0056] FIG. **24** is a diagram showing the partial index bar of the partial image display screen;

[0057] FIG. **25** is a diagram showing a process of receiving designation of any position of the partial index bar and displaying a partial image whose capture position corresponds to the designated position in a display region;

[0058] FIG. **26** is a diagram showing an operation button group;

[0059] FIG. **27** is a diagram showing a case where the partial image is displayed to be enlarged;

[0060] FIG. **28** is a diagram showing a case where an extracted image is displayed to be superimposed on the partial image;

[0061] FIG. **29** is a diagram showing an aspect in which the position and actual size of an object to be measured designated in the partial image are displayed;

[0062] FIG. **30** is a diagram showing an aspect in which the position and actual size of the object to be measured designated in the partial image are displayed;

[0063] FIG. **31** is a diagram showing a process of switching a partial image being displayed in the display region to a partial image adjacent to the partial image being displayed in the display region;
[0064] FIG. **32** is a diagram showing a process of switching the partial image being displayed in the display region to a partial image adjacent to the partial image being displayed in the display region;
[0065] FIG. **33** is a flowchart showing a processing procedure of the information management server and the inspector terminal;
[0066] FIG. **34** is a diagram showing another example in which a portion in which the partial image is displayed and a portion in which the partial image is not displayed are displayed to be distinguished from each other;
[0067] FIG. **35** is a diagram showing an example in which the during-imaging designated portion mark and the like are displayed on a whole index bar; and
[0068] FIG. **36** is a diagram showing another example of the during-imaging designated portion information.

DETAILED DESCRIPTION

[0069] FIG. **1** shows an aspect in which an imaging person UP images an inner wall surface **11** of a tunnel **10** along a circumferential direction CD using an imaging device **12**. The tunnel **10** has an entrance **13** and an exit **14** and extends in a length direction LD connecting the entrance **13** and the exit **14**. A length from the entrance **13** to the exit **14**, that is, a total length of the tunnel **10** is, for example, 10000 m. The imaging person UP moves the imaging device **12** from the entrance **13** to the exit **14**, for example, along a center line of a road surface **15** to move the imaging device **12** along the length direction LD. The tunnel **10** is an example of a "structure" according to the technology of the present disclosure. The length direction LD is an example of a "first direction" according to the technology of the present disclosure. The circumferential direction CD is an example of a "second direction" according to the technology of the present disclosure. The imaging person UP is an example of a "user" according to the technology of the present disclosure.
[0070] As shown in FIG. **2** as an example, the imaging device **12** includes an imaging device main body **20** and a carriage **21** on which the imaging device main body **20** is mounted. As shown in FIGS. **3** and **4**, the imaging device main body **20** includes a base **22**, a first support **231**, a second support **232**, a first attachment plate **241**, a second attachment plate **242**, a first imaging unit **251**, and a second imaging unit **252**.
[0071] The base **22** has a rectangular plate shape and is attached to the carriage **21** by screwing or the like. The first support **231** and the second support **232** are rectangular prisms that extend from the base **22** in a vertical direction. The first attachment plate **241** and the second attachment plate **242** have a disk shape, and the centers thereof are fixed to end portions of the first support **231** and the second support **232** that are opposite to the base **22**.
[0072] Four first imaging units **251** are attached to the first attachment plate **241** through first attachment tools **261**. In addition, five second imaging units **252** are attached to the second attachment plate **242** through second attachment tools **262**. That is, the imaging device main body **20** includes a total of nine imaging units **25**.
[0073] In a case where the angle of a lower portion of each of the first attachment plate **241** and the second attachment plate **242** is 0° and the angles of left, upper, and right portions of each of the first attachment plate **241** and the second attachment plate **242** in a clockwise direction from the lower portion are 90°, 180°, and 270°, respectively (see FIG. **4**), the first imaging units **251** are disposed at positions of 90°, 150°, 210°, and 270°. In addition, the second imaging units **252** are disposed at positions of 60°, 120°, 180°, 240°, and 300°. That is, both the first imaging units **251** and the second imaging units **252** are disposed at angular intervals of 60°. In addition, a total of nine imaging units **25** including the first imaging units **251** and the second imaging units **252** are disposed at angular intervals of 30°. The number of imaging units **25** is not limited to nine shown in the example. The number of imaging units **25** may be one or more than nine.

[0074] Each of the first imaging unit **251** and the second imaging unit **252** includes one camera **27** and two illumination lamps **28** that are disposed at symmetrical positions with the camera **27** interposed therebetween. The camera **27** is, for example, a high-performance single-lens reflex camera that is equipped with an imaging element having 20 million pixels or more and has a distance measurement function of measuring a distance to an object, a shake correction function of correcting a shake, and the like. The illumination lamp **28** is, for example, a light-emitting diode (LED) that has a light distribution angle exceeding an imaging angle of view of the camera **27**.
[0075] In a case where the imaging device main body **20** is mounted on the carriage **21**, the first support **231**, the first attachment plate **241**, and thus the first imaging unit **251** are located on the front side of the carriage **21** in a traveling direction. In addition, the second support **232**, the second attachment plate **242**, and thus the second imaging unit **252** are located on the rear side of the carriage **21** in the traveling direction. Therefore, the cameras **27** of the first imaging unit **251** and the second imaging unit **252** are disposed along the traveling direction of the carriage **21**. The traveling direction of the carriage **21** is along the length direction LD of the tunnel **10** as shown in FIG. **1**. Therefore, it can be said that the cameras **27** are disposed along the length direction LD. In addition, the cameras **27** are attached to surround the disk-shaped first attachment plate **241** and second attachment plate **242**, and the carriage **21** travels such that a direction normal to the first attachment plate **241** and the second attachment plate **242** is along the length direction LD. For these reasons, it can be said that the cameras **27** are disposed along the circumferential direction CD. Further, three or more cameras **27** may be disposed along the length direction LD. In addition, a plurality of cameras **27** may not be disposed along the length direction LD. Similarly, a plurality of cameras **27** may not be disposed along the circumferential direction CD. For example, one camera **27** may perform imaging a plurality of times in the circumferential direction CD while being moved along the circumferential direction CD.
[0076] In FIG. **2**, the carriage **21** has a carriage main body **35**, front wheels **36**, rear wheels **37**, a handle **38**, and the like. The carriage main body **35** has a box shape. The imaging device main body **20** is attached to a top plate portion of the carriage main body **35** that is parallel to a horizontal plane.
[0077] The front wheels **36** and the rear wheels **37** are disposed on the left and right sides of a lower portion of the carriage main body **35**. The carriage **21** travels on the road surface **15** by the front wheels **36** and the rear wheels **37**. The rear wheels **37** are rotationally driven by a rear wheel drive unit **39**. The front wheels **36** are rotated following the rotation of the rear wheels **37**. That is, the carriage **21** is a four-wheel carriage and is a rear-wheel drive type.
[0078] The rear wheel drive unit **39** is two motors that are connected to the left and right rear wheels **37**, respectively. The two motors rotate the left and right rear wheels **37** independently. Therefore, in a case where the right rear wheel **37** is rotated at a higher rotation speed than the left rear wheel **37** by the motor connected to the right rear wheel **37**, the carriage **21** turns left. On the other hand, in a case where the left rear wheel **37** is rotated at a higher rotation speed than the right rear wheel **37** by the motor connected to the left rear wheel **37**, the carriage **21** turns right.
[0079] The handle **38** is attached to an upper portion of a rear surface of the carriage main body **35**. The handle **38** has a cylindrical shape that is long in a width direction of the carriage main body **35**. The handle **38** is gripped by the imaging person UP to steer the carriage **21**. In other words, the carriage **21** travels on the road surface **15** by the operation of the handle **38** by the imaging person UP. Here, the operation of the handle **38** by the imaging person UP is an operation of the imaging person UP gripping the handle **38** and changing a way of applying force to the handle **38** or adjusting a direction of applying force to the handle **38**. As described above, the imaging person UP operates the handle **38** in the imaging device **12** to independently determine the traveling speed and direction and to drive the carriage **21**.
[0080] The rear wheel drive unit **39** is also driven in response to the operation of the handle **38** by the imaging person UP. However, the rear wheel drive unit **39** is driven solely according to the

force applied to the carriage **21** by the imaging person UP through the handle **38**. Therefore, the carriage **21** does not travel unless the force of the imaging person UP is applied. On the contrary, the carriage **21** does not travel only by the force of the imaging person UP and travels only with the assistance of the rear wheel drive unit **39**. The force applied to the carriage **21** by the imaging person UP is detected by, for example, a piezoelectric sensor (not shown), and the rear wheel drive unit **39** is driven according to the detection result. The imaging person UP may operate the imaging device **12** while riding on the carriage **21**. In addition, the carriage **21** may be automatically driven without the assistance of the imaging person UP.

[0081] A plurality of magnetic bodies **40** are attached to a rear surface of the rear wheel **37** at equal angles along the circumferential direction. In addition, a magnetic sensor **41** is provided at a position that faces the magnetic body **40** in the carriage main body **35**. The magnetic sensor **41** detects magnetism generated by the magnetic body **40**. In a case where the rear wheels **37** are rotated, a pulse PL corresponding to the magnetism of the magnetic body **40** is output from the magnetic sensor **41** along a time axis. A moving distance of the carriage **21** and thus the imaging device **12** can be derived based on the number of pulses PL, the circumference of the rear wheel **37**, the arrangement interval of the magnetic bodies **40**, and the like.

[0082] A tablet terminal **42** is attached to an inclined surface that is closer to the rear wheels **37** in the carriage main body **35**. The tablet terminal **42** is detachable from the carriage main body **35**. The tablet terminal **42** is operated by the imaging person UP. In addition, the tablet terminal **42** may be a commercially available terminal that can be used for other purposes or may be a terminal that is not capable of being used for anything other than the imaging device **12**.

[0083] As shown in FIG. **5** as an example, the cameras **27** of the first imaging units **251** image four regions (hereinafter, referred to as first imaging regions) **501** that are spaced apart from each other among nine rectangular regions obtained by dividing the inner wall surface **11** into nine equal parts. The cameras **27** of the second imaging units **252** image five regions (hereinafter, referred to as second imaging regions) **502** that are spaced apart from each other among the nine rectangular regions obtained by dividing the inner wall surface **11** into nine equal parts.

[0084] In both the first imaging region **501** and the second imaging region **502**, a short side direction is along the length direction LD, and a long side direction is along the circumferential direction CD. As shown in FIG. **4**, since the arrangement phases of the first imaging units **251** and the second imaging units **252** are different in the circumferential direction CD, the first imaging regions **501** and the second imaging regions **502** are arranged in a staggered pattern. The first imaging region **501** and the second imaging region **502** are an example of “different portions of the structure” according to the technology of the present disclosure. In addition, the first imaging region **501** and the second imaging region **502** slightly overlap each other in the length direction LD and the circumferential direction CD, which is not shown in FIG. **5**. Further, in FIG. **5**, a direction from the back to the front of the plane of paper is the traveling direction of the carriage **21**.

[0085] The imaging device **12** is moved along the length direction LD and images the first imaging regions **501** and the second imaging regions **502** with the cameras **27** of the first imaging units **251** and the cameras **27** of the second imaging units **252**, respectively, during the movement. Therefore, as shown in FIG. **6** as an example, a plurality of first captured images **511** of the first imaging region **501** and a plurality of second captured images **512** of the second imaging region **502** are obtained.

[0086] A long image **55** covering the entire inner wall surface **11** can be generated by registering the plurality of first captured images **511** and the plurality of second captured images **512** obtained in this way based on overlapping portions and combining the plurality of first captured images **511** and the plurality of second captured images **512** along the length direction LD and the circumferential direction CD. In the long image **55**, a long side direction is along the length direction LD, and a short side direction is along the circumferential direction CD. In addition,

reference numerals A1 to A9 and the like indicate a correspondence relationship between the actual positions of the first captured images **511** and the second captured images **512** in the inner wall surface **11** and the positions thereof in the long image **55**. Numbers 1 to 9 in the reference numerals A1 to A9 and the like are numbers attached in order to the nine regions obtained by dividing the inner wall surface **11** into nine equal parts. Even numbers 2, 4, 6, and 8 indicate the first captured images **511**, and odd numbers 1, 3, 5, 7, and 9 indicate the second captured images **512**. In addition, in FIG. **6**, a direction from the back to the front of the plane of paper is the traveling direction of the carriage **21** as in FIG. **5**. In the following description, the first captured image **511** and the second captured image **512** may be collectively referred to as a captured image **51**.

[0087] As shown in FIG. **7** as an example, the imaging device **12** generates captured image information **60** which is information of a plurality of captured images **51**. The captured image information **60** is information in which the captured image **51**, the capture date and time of the captured image **51**, a capture position of the captured image **51** in the circumferential direction CD (referred to as a circumferential direction position in FIG. **7**), a capture position of the captured image **51** in the length direction LD (referred to as a length direction position in FIG. **7**), and the like are registered for each image identification data (ID) item for uniquely identifying the captured image **51**. Any one of the numbers 1 to 9 in the reference numerals A1 to A9 and the like shown in FIG. **6** is registered in the capture position in the circumferential direction CD. The moving distance of the imaging device **12** derived based on the number of pulses PL and the like is registered in the capture position in the length direction LD. Further, basic information related to the captured image **51**, such as the distance from the camera **27** to the object (here, the inner wall surface **11**) measured by the distance measurement function, an imaging magnification, a focal length, and the number of pixels of the imaging element, is also registered in the captured image information **60**.

[0088] For example, an operation screen **65** shown in FIG. **8** is displayed on a touch panel display (not shown) of the tablet terminal **42**. A message **66** for notifying the imaging person UP of the distance from the entrance **13** of the tunnel **10**, which is an imaging start point, to the current position is displayed on the operation screen **65**. In addition, the operation screen **65** is provided with an imaging start button **67**, a pause button **68**, an imaging end button **69**, and a portion designation button **70**.

[0089] The imaging start button **67** is a button for the imaging person UP to give an instruction to start the capture of the captured image **51** to the imaging device **12**. The imaging person UP selects the imaging start button **67** at, for example, the entrance **13** of the tunnel **10**. In a case where the imaging start button **67** is selected, the illumination lamps **28** are turned on, and the capture of the captured image **51** by the camera **27** is started. In addition, the counting of the number of pulses PL output from the magnetic sensor **41** is also started, and the moving distance of the imaging device **12** is derived.

[0090] The pause button **68** is a button for the imaging person UP to give an instruction to pause and resume the capture of the captured image **51** to the imaging device **12**. In a case where the pause button **68** is selected during imaging, the capture of the captured image **51** by the camera **27** is paused. In a case where the pause button **68** is selected again in this state, the capture of the captured image **51** by the camera **27** is resumed.

[0091] The imaging end button **69** is a button for the imaging person UP to give an instruction to end the capture of the captured image **51** to the imaging device **12**. The imaging person UP selects the imaging end button **69** at, for example, the exit **14** of the tunnel **10**. In a case where the imaging end button **69** is selected, the illumination lamps **28** are turned off, and the capture of the captured image **51** by the camera **27** is ended. In addition, the counting of the number of pulses PL output from the magnetic sensor **41** is also ended.

[0092] The portion designation button **70** is a button that, in a case where the imaging person UP finds a portion that the imaging person UP thinks should be examined in detail in the subsequent

inspection of the long image **55** during the capture of the captured image **51** and thus the long image **55**, is used by the imaging person UP to input an instruction to record the portion. In a case where the imaging person UP finds the portion that the imaging person UP thinks should be examined in detail in the inspection of the long image **55**, the imaging person UP first stops the traveling of the imaging device **12**. Then, the user selects the portion designation button **70** after selecting the pause button **68** to pause the capture of the captured image **51** by the camera **27**. In a case where the portion designation button **70** is selected, the operation screen **65** is changed as shown in FIG. **9**.

[0093] As shown in FIG. **9** as an example, an input box **71**, a first recording button **721**, and a second recording button **722** are provided on the operation screen **65** in a case where the portion designation button **70** is selected. A text memo related to the designated portion is input to the input box **71** by the imaging person UP. The first recording button **721** is a button for giving an instruction to record the text memo and the portion in association with each other. The second recording button **722** is a button for giving an instruction to record only the portion without recording the text memo. As described above, the portion can be recorded with a text memo or can be recorded without a text memo.

[0094] As shown in FIG. **10** as an example, the imaging device **12** generates during-imaging designated portion information **75**. The during-imaging designated portion information **75** is information in which a date and time when the portion was designated, a designated position of the portion in the length direction LD (in FIG. **10**, referred to as a length direction position), a text memo, and the like are registered for each portion ID for uniquely identifying the portion. Similarly to the capture position of the captured image **51** in the length direction LD, the moving distance of the imaging device **12** derived based on the number of pulses PL and the like is registered in the designated position of the portion in the length direction LD. In addition, the portion designated by the imaging person UP is an example of a "portion designated by a user" and a "portion of interest" according to the technology of the present disclosure.

[0095] As shown in FIG. **11** as an example, the imaging device **12** is connected to an information management server **80** via a wide area network (WAN), such as the Internet or a public communication network, such that it can communicate therewith. The information management server **80** is, for example, a server computer. The information management server **80** receives the captured image information **60** and the during-imaging designated portion information **75** from the imaging device **12**.

[0096] The information management server **80** is further connected to an inspector terminal **81** via a WAN, such as the Internet or a public communication network, such that it can communicate therewith. The inspector terminal **81** is a desktop personal computer, a notebook personal computer, or a tablet terminal. The inspector terminal **81** is operated by an inspector UI of the long image **55**. The inspector terminal **81** is an example of an "image display device" according to the technology of the present disclosure. The inspector UI is an example of a "user" according to the technology of the present disclosure. In FIG. **11**, only one inspector terminal **81** is shown. However, in practice, a plurality of inspector terminals **81** are connected to the information management server **80**. Further, the inspector terminal **81** may be a commercially available terminal that can be used for other purposes or may be a terminal that is not capable of being used for anything other than the image display device.

[0097] As shown in FIG. **12** as an example, computers constituting the information management server **80** and the inspector terminal **81** basically have the same configuration and comprise a storage **85**, a memory **86**, a central processing unit (CPU) **87**, a communication unit **88**, a display **89**, and an input device **90**. These components are connected to one another via a bus line **91**.

[0098] The storage **85** is a hard disk drive that is built in the computer constituting each of the information management server **80** and the inspector terminal **81** or that is connected thereto via a cable or a network. Alternatively, the storage **85** is a disk array in which a plurality of hard disk

drives are connected in series. A control program, such as an operating system, various application programs (hereinafter, abbreviated to APs), various types of data associated with these programs, and the like are stored in the storage **85**. In addition, a solid state drive may be used instead of the hard disk drive.

[0099] The memory **86** is a work memory for the CPU **87** to execute processes. The CPU **87** loads the program stored in the storage **85** into the memory **86** and executes the processes corresponding to the program. Therefore, the CPU **87** controls the overall operation of each unit of the computer. In addition, the CPU **87** is an example of a "processor" according to the technology of the present disclosure. Further, the memory **86** may be built in the CPU **87**.

[0100] The communication unit **88** is a network interface that executes transmission control of various types of information via a WAN or the like. The display **89** displays various screens. The various screens have operation functions by a graphical user interface (GUI). The computers constituting the information management server **80** and the inspector terminal **81** receive the input of an operation instruction from the input device **90** through the various screens. The input device **90** is, for example, a keyboard, a mouse, a touch panel, and a microphone for voice input.

[0101] Further, in the following description, the subscript "A" is attached to the reference numerals indicating each unit (the storage **85** and the CPU **87**) of the computer constituting the information management server **80**, and the subscript "B" is attached to the reference numerals indicating each unit (the storage **85**, the CPU **87**, the display **89**, and the input device **90**) of the computer constituting the inspector terminal **81** to distinguish the units.

[0102] As shown in FIG. **13** as example, an operation program **95** is stored in the storage **85**A of the information management server **80**. The operation program **95** is an AP for causing the computer to function as the information management server **80**. In addition to the operation program **95**, a crack extraction model **96** and a during-inspection designated portion information **97** are stored in the storage **85**A.

[0103] In a case where the operation program **95** is started, the CPU **87**A of the computer constituting the information management server **80** functions as an acquisition unit **100**, a read write (hereinafter, referred to as RW) control unit **101**, an extraction unit **102**, and a screen distribution control unit **103** in cooperation with the memory **86** and the like.

[0104] The acquisition unit **100** acquires the captured image information **60** and the during-imaging designated portion information **75** from the imaging device **12**. The acquisition unit **100** outputs the captured image information **60** and the during-imaging designated portion information **75** to the RW control unit **101**.

[0105] The RW control unit **101** controls the storage of various types of data in the storage **85**A and the read-out of various types of data stored in the storage **85**A. The RW control unit **101** stores the captured image information **60** and the during-imaging designated portion information **75** from the acquisition unit **100** in the storage **85**A. The RW control unit **101** reads out the captured image information **60** from the storage **85**A and outputs the read-out captured image information **60** to the extraction unit **102** and the screen distribution control unit **103**. In addition, the RW control unit **101** reads out the during-imaging designated portion information **75** and the during-inspection designated portion information **97** from the storage **85**A and outputs the read-out during-imaging designated portion information **75** and during-inspection designated portion information **97** to the screen distribution control unit **103**. Further, the RW control unit **101** reads out the crack extraction model **96** from the storage **85**A and outputs the read-out crack extraction model **96** to the extraction unit **102**.

[0106] The extraction unit **102** applies the captured image **51** of the captured image information **60** to the crack extraction model **96** such that the crack extraction model **96** outputs an extracted image **110** (see FIG. **15**) of cracks **111** (see FIG. **15**). The extraction unit **102** outputs the extracted images **110** for all of the captured images **51**. The extraction unit **102** generates extracted image information **105** which is information related to the extracted images **110** for all of the captured

images **51**. The extraction unit **102** outputs the extracted image information **105** to the screen distribution control unit **103**.

[0107] The screen distribution control unit **103** controls the generation of various screens and the distribution of the various screens to the inspector terminal **81**. For example, the screen distribution control unit **103** performs control to generate a partial image display screen **135** (see FIG. **23**) based on the captured image information **60**, the during-imaging designated portion information **75**, the during-inspection designated portion information **97**, and the like and to distribute the generated partial image display screen **135** to the inspector terminal **81**.

[0108] More specifically, the screen distribution control unit **103** outputs the various screens in a form of screen data for web distribution created in a markup language such as Extensible Markup Language (XML). This enables the inspector terminal **81** to browse various screens on a web browser. The screen distribution control unit **103** specifies the inspector terminal **81**, which is a distribution destination of the various screens, with a terminal ID that uniquely identifies the inspector terminal and that is registered in a request to distribute various screens. Further, instead of XML, another data description language, such as JavaScript (registered trademark) Object Notation (JSON), may be used.

[0109] The during-inspection designated portion information **97** is information generated in a case where the inspector UI found a portion that the inspector UI thought should be monitored over time and input an instruction to record the portion on the partial image display screen **135** during the past inspection of the long image **55**. As shown in FIG. **14** as an example, similarly to the during-imaging designated portion information **75**, the during-inspection designated portion information **97** is information in which a date and time when the portion was designated, a designated position of the portion in the length direction LD (in FIG. **14**, referred to as a length direction position), a text memo, and the like are registered for each portion ID for uniquely identifying the portion. The portion designated by the inspector UI can be recorded with a text memo or without a text memo, similarly to the portion designated by the imaging person UP. The portion designated by the inspector UI is an example of the “portion designated by the user” and the “portion of interest” according to the technology of the present disclosure, similarly to the portion designated by the imaging person UP.

[0110] As shown in FIG. **15** as an example, the extraction unit **102** inputs the captured image **51** to the crack extraction model **96** such that the crack extraction model **96** outputs the extracted image **110**. The extracted image **110** is an image in which the crack **111** shown in the captured image **51** is indicated by, for example, a red line. The crack **111** is an example of a “specific object” according to the technology of the present disclosure. Further, FIG. **15** shows an example in which the crack **111** is extracted in the extracted image **110**. However, there is, of course, a case where the crack **111** is not extracted in the extracted image **110**.

[0111] The crack extraction model **96** is, for example, a machine learning model that is configured by a neural network. The crack extraction model **96** is repeatedly trained using, as training data, a set of the captured image **51** for learning and a correct answer image in which the crack **111** shown in the captured image **51** for learning has been manually annotated. The crack extraction model **96** outputs the extracted image **110** for learning in response to the input of the captured image **51** for learning. The crack extraction model **96** stored in the storage **85** is a model in which the extraction accuracy of the crack **111** in the extracted image **110** for training with respect to the correct answer image has reached a preset level.

[0112] As shown in FIG. **16** as an example, the extracted image information **105** is information in which the extracted image **110**, a position of the extracted image **110** in the circumferential direction CD (referred to as a circumferential direction position in FIG. **16**), a position of the extracted image **110** in the length direction LD (referred to as a length direction position in FIG. **16**), and the like are registered for each image identification data (ID) item for uniquely identifying the extracted image **110**, similarly to the captured image information **60**. The image ID of the

captured image **51**, the capture position of the captured image **51** in the circumferential direction CD, and the capture position of the captured image **51** in the length direction LD are transcribed in the image ID of the extracted image **110**, the position of the extracted image **110** in the circumferential direction CD, and the position of the extracted image **110** in the length direction LD, respectively.

[0113] As shown in FIG. **17** as an example, an inspection AP **112** is stored in the storage **85**B of the inspector terminal **81**. The inspection AP **112** is installed in the inspector terminal **81** by the inspector UI. The inspection AP **112** is an AP for causing the computer constituting the inspector terminal **81** to function as an "image display device" according to the technology of the present disclosure. That is, the inspection AP **112** is an example of a "program for operating an image display device" according to the technology of the present disclosure. In a case where the inspection AP **112** is started, the CPU **87**B of the inspector terminal **81** functions as a browser control unit **113** in cooperation with the memory **86** and the like. The browser control unit **113** controls the operation of a dedicated web browser of the inspection AP **112**.

[0114] The browser control unit **113** generates various screens. The browser control unit **113** receives screen data of various screens from the information management server **80**. The browser control unit **113** reproduces the various screens to be displayed on the web browser based on the screen data and displays the various screens on the display **89**B. In addition, the browser control unit **113** receives various operation instructions input from the input device **90**B by the inspector UI through various screens. The browser control unit **113** transmits various requests corresponding to the operation instructions to the information management server **80**.

[0115] As shown in FIGS. **18** and **19** as an example, the browser control unit **113** displays a bird's-eye view screen **115** distributed from the information management server **80** on the display **89** in response to a request from the inspector UI. The bird's-eye view screen **115** is divided into two regions of an upper display region **116** and a lower display region **117**. A whole index bar **118** is displayed in the upper display region **116**. The whole index bar **118** is an elongated rod-like GUI in which a long side direction is matched with the length direction LD. The whole index bar **118** indicates a distance range of 0 m to 10000 m. That is, the distance range of 0 m to 10000 m is the distance range of the total length of the tunnel **10**. The whole index bar **118** is an example of a "second index bar" according to the technology of the present disclosure. In addition, the distance range of 0 m to 10000 m is an example of a "second distance range" according to the technology of the present disclosure.

[0116] The whole index bar **118** is divided into small regions **119** each of which is 1000 m. Five small regions **119** of 0 m to 5000 m in the first half of the tunnel **10** are disposed in an upper portion of the upper display region **116**, and five small regions **119** of 5000 m to 10000 m in the second half of the tunnel **10** are disposed in a lower portion of the upper display region **116**.

[0117] A partial index bar **120** is displayed in the lower display region **117**. The partial index bar **120** is an elongated rod-like GUI in which the long side direction is matched with the length direction LD, similarly to the whole index bar **118**. The partial index bars **120** indicate 10 distance ranges of 0 m to 1000 m, 1000 m to 2000 m, 2000 m to 3000 m, . . . , 7000 m to 8000 m, 8000 m to 9000 m, and 9000 m to 10000 m obtained by dividing 0 m to 10000 m, which is the distance range of the total length of the tunnel **10**, into 10 equal parts. The partial index bar **120** is an example of a "first index bar" according to the technology of the present disclosure. In addition, the distance range of 0 m to 1000 m, 1000 m to 2000 m, or the like is an example of a "first distance range" according to the technology of the present disclosure.

[0118] A maximum of only five partial index bars **120** corresponding to 5000 m can be displayed in the lower display region **117**. A scroll bar **121** is provided in the lower display region **117**. The scroll bar **121** can be operated to change the partial index bars **120** displayed in the lower display region **117**. In addition, the partial index bars **120** to be displayed in the lower display region **117** can also be changed by placing a cursor **130** of a mouse (see FIG. **21** and the like) on a desired

small region **119** of the whole index bar **118** and single-clicking the mouse. For example, in a case where the small region **119** corresponding to the distance range of 2000 m to 3000 m is selected, the partial index bars **120** from the partial index bar **120** indicating the distance range of 2000 m to 3000 m to the partial index bar **120** indicating the distance range of 6000 m to 7000 m are displayed in the lower display region **117**.

[0119] On the bird's-eye view screen **115**, at least one of the brightness, color, or pattern of the small region **119**, which corresponds to the distance range indicated by the partial index bar **120** being displayed in the lower display region **117**, among the small regions **119** of the whole index bar **118** is changed (indicated by hatching) such that the small region **119** is displayed to be distinguishable from the other small regions **119**. This display makes it possible to indicate which position in the distance range of 0 m to 10000 m the partial index bar **120** being displayed in the lower display region **117** corresponds to. In addition, FIG. **18** shows a case where the partial index bars **120** corresponding to 0 m to 1000 m, 1000 m to 2000 m, 2000 m to 3000 m, 3000 m to 4000 m, and 4000 m to 5000 m are being displayed in the lower display region **117**. In addition, FIG. **19** shows a case where partial index bars **120** corresponding to 5000 m to 6000 m, 6000 m to 7000 m, 7000 m to 8000 m, 8000 m to 9000 m, and 9000 m to 10000 m are being displayed in the lower display region **117**.

[0120] As shown in FIG. **20** as an example, numerical values and gradations **125** indicating distances are displayed for every 100 m on the partial index bar **120**. In addition, a during-imaging designated portion mark **126** is displayed in an upper portion of the partial index bar **120**, a during-inspection designated portion mark **127** is displayed in a lower portion thereof, and a crack presence portion mark **128** is displayed therein. The during-imaging designated portion mark **126**, the during-inspection designated portion mark **127**, and the crack presence portion mark **128** are examples of a “portion-of-interest mark” according to the technology of the present disclosure.

[0121] The during-imaging designated portion mark **126** is a mark that imitates a pin shape. The screen distribution control unit **103** disposes the during-imaging designated portion mark **126** at the position of the partial index bar **120** corresponding to the designated position of the portion in the length direction LD in the during-imaging designated portion information **75**.

[0122] The during-inspection designated portion mark **127** is a triangular mark that imitates an arrowhead shape. The screen distribution control unit **103** disposes the during-inspection designated portion mark **127** at the position of the partial index bar **120** corresponding to the designated position of the portion in the length direction LD in the during-inspection designated portion information **97**.

[0123] The crack presence portion mark **128** is a line that extends over the entire width direction of the partial index bar **120**. The crack presence portion mark **128** is thicker than the gradation **125** to be distinguished from the gradation **125**. The screen distribution control unit **103** disposes the crack presence portion mark **128** at the position of the partial index bar **120** corresponding to the position of the extracted image **110**, in which the crack **111** having a length equal to or greater than a threshold value has been extracted, in the length direction LD. In addition, the portion in which the crack **111** having the length equal to or greater than the threshold value is present is an example of the “portion of interest” according to the technology of the present disclosure, similarly to the portion designated by the imaging person UP and the portion designated by the inspector UI.

[0124] The during-imaging designated portion mark **126** and the during-inspection designated portion mark **127** can be selected by the cursor **130** of the mouse. In a case where the during-imaging designated portion mark **126** is selected, as shown in FIG. **21** as an example, a balloon **131** of a text memo recorded in association with the portion designated by the imaging person UP is displayed above the selected during-imaging designated portion mark **126**. In addition, in a case where the during-inspection designated portion mark **127** is selected, as shown in FIG. **22** as an example, a balloon **132** of a text memo recorded in association with the portion designated by the inspector UI is displayed below the selected during-inspection designated portion mark **127**. In a

case where no text memo is recorded, the balloons **131** and **132** are not displayed.

[0125] In a case where an instruction to place the cursor **130** of the mouse on a desired small region **119** of the whole index bar **118** and to double-click the mouse is input on the bird's-eye view screen **115**, the browser control unit **113** transmits a request to distribute the partial image display screen **135** to the information management server **80**. The screen distribution control unit **103** receives the request to distribute the partial image display screen **135**, generates the partial image display screen **135** shown in FIG. **23** as an example, and distributes the generated partial image display screen **135** to the inspector terminal **81**. The browser control unit **113** displays the partial image display screen **135** on the display **89**B.

[0126] The partial image display screen **135** has the partial index bar **120** and a partial image display region **136**. A partial image **137**, which is a portion of the long image **55**, is displayed in the partial image display region **136**. Here, the partial image **137** is an image in a distance range of 50 m. In an initial display state of the partial image display screen **135**, the partial image **137** in the distance range of 50 m from the end closer to the entrance **13** is displayed.

[0127] Numerical values indicating the distances are displayed every 5 m in an upper portion of the partial image display region **136**. In addition, the during-imaging designated portion mark **126**, the during-inspection designated portion mark **127**, and the crack presence portion mark **128** are displayed in the upper portion of the partial image display region **136**, similarly to the partial index bar **120**.

[0128] FIG. **23** shows an example in which the small region **119** of 0 m to 1000 m is double-clicked on the bird's-eye view screen **115** and the partial index bar **120** of 0 m to 1000 m and the partial image **137** in the distance range of 0 m to 50 m are displayed. In addition, the partial image display screen **135** is an example of a “display screen” according to the technology of the present disclosure. Further, the partial image display region **136** is an example of a “display region” according to the technology of the present disclosure.

[0129] A back button **138** is provided in an upper portion of the partial image display screen **135**. In a case where the back button **138** is selected, the display is returned to the bird's-eye view screen **115**. In addition, an auxiliary window **139** in which the partial image **137** in the initial display state before enlargement display is displayed is provided in the partial image display region **136**. Further, an operation button group **140** is provided on the left side of the partial image display region **136**.

[0130] The partial index bar **120** of the partial image display screen **135** has basically the same display form as the partial index bar **120** of the bird's-eye view screen **115**. For example, the numerical values and gradations **125** indicating distances are displayed every 100 m, and the during-imaging designated portion mark **126** is displayed on the partial index bar **120** of the partial image display screen **135**. However, as shown in FIG. **24** as an example, a capture position mark **145** is displayed on the partial index bar **120** of the partial image display screen **135**. The capture position mark **145** indicates the capture position of the partial image **137** being displayed in the partial image display region **136** in the tunnel **10**. The capture position mark **145** is specifically a frame that surrounds the distance range of the tunnel **10** shown in the partial image **137**. FIG. **24** shows an example in which the partial image **137** in the distance range of 0 m to 50 m is displayed in the partial image display region **136** and the capture position mark **145** surrounding the distance range of 0 m to 50 m is displayed on the partial index bar **120**.

[0131] A display completion mark **146** indicating the portion whose partial image **137** is displayed is displayed below the partial index bar **120**. The display completion mark **146** is a filled bar that extends along the long side direction of the partial index bar **120**. The display completion mark **146** makes it possible to display the portion whose partial image **137** is displayed and the portion whose partial image **137** is not displayed to be distinguished from each other. In addition, as in the case of the bird's-eye view screen **115**, the text memo balloons **131** and **132** are displayed on the partial image display screen **135** in response to the selection of the during-imaging designated portion mark **126** and the during-inspection designated portion mark **127**, which is not shown.

[0132] Distance range switching buttons **147**A and **147**B are provided on the left and right sides of the partial index bar **120**. In a case where the distance range switching button **147**A is selected, the display of the partial index bar **120** is switched to the previous partial index bar **120** on the side of the entrance **13**. On the other hand, in a case where the distance range switching button **147**B is selected, the display of the partial index bar **120** is switched to the next partial index bar **120** on the side of the exit **14**. In addition, the display of the partial image **137** in the partial image display region **136** is switched in operative association with the change in the display of the partial index bar **120**.

[0133] For example, a case is considered in which the partial index bar **120** of the distance range of 3000 m to 4000 m is displayed and the distance range switching button **147**A is selected. In this case, the display of the partial index bar **120** of the distance range of 3000 m to 4000 m is switched to the partial index bar **120** of the distance range of 2000 m to 3000 m. In addition, the display of the partial image **137** in the partial image display region **136** is switched to the partial image **137** in the distance range of 2000 m to 2050 m. In addition, for example, a case is considered in which the partial index bar **120** of the distance range of 7000 m to 8000 m is displayed and the distance range switching button **147**B is selected. In this case, the display of the partial index bar **120** of the distance range of 7000 m to 8000 m is switched to the partial index bar **120** of the distance range of 8000 m to 9000 m. In addition, the display of the partial image **137** in the partial image display region **136** is switched to the partial image **137** in the distance range of 8000 m to 8050 m.

[0134] As shown in FIG. **25** as an example, it is possible to designate any position of the partial index bar **120** with the cursor **130** on the partial image display screen **135**. In a case where the designation of the position is received, the browser control unit **113** generates position designation information **150** indicating the designated position and transmits the position designation information **150** to the information management server **80**. The screen distribution control unit **103** displays the partial image **137** whose capture position corresponds to the designated position in the partial image display region **136**. In addition, the screen distribution control unit **103** also changes the display of the capture position mark **145** in response to the change in the display of the partial image **137**. Further, in a case where the partial image **137** whose display has been changed is a partial image **137** that has not been displayed so far, the screen distribution control unit **103** displays the display completion mark **146** below the partial index bar **120**. The screen distribution control unit **103** distributes the partial image display screen **135** generated in this way to the inspector terminal **81**.

[0135] FIG. **25** shows a case where a position of 180 m in the partial index bar **120** is designated by the cursor **130**. In this case, the partial image **137** in the partial image display region **136** is switched from the partial image **137** in the distance range of 0 m to 50 m to the partial image **137** in the distance range of 180 m to 230 m. In addition, the capture position mark **145** is also switched from the distance range of 0 m to 50 m to the distance range of 180 m to 230 m, and the display completion mark **146** is displayed below the distance range of 180 m to 230 m.

[0136] As shown in FIG. **26** as an example, the operation button group **140** includes a zoom button **155**, a movement and rotation button **156**, a superimposition/superimposition cancellation button **157**, a measurement button **158**, display switching buttons **159**A and **159**B, and the like.

[0137] The zoom button **155** is a button for enlarging or reducing the display size of the partial image **137** in the partial image display region **136**. As shown in FIG. **27** as an example, in a case where the zoom button **155** is operated to enlarge the display size of the partial image **137** in the partial image display region **136**, a frame **160** is displayed in the auxiliary window **139**. The frame **160** indicates which position of the partial image **137** in the initial display state before enlargement display the portion, which is currently displayed to be enlarged, corresponds to.

[0138] The movement and rotation button **156** is a button for changing the display position of the partial image **137** in the partial image display region **136** to any of the up, down, left, or right side. In addition, the movement and rotation button **156** is a button for changing the display orientation

of the partial image **137** in the partial image display region **136** clockwise or counterclockwise by a predetermined angle (for example, 90°).

[0139] The superimposition/superimposition cancellation button **157** is a button for giving an instruction to superimpose the extracted image **110** on the partial image **137** in the partial image display region **136** and to cancel the superimposition. In a case where the superimposition/superimposition cancellation button **157** is selected in FIG. **23**, as shown in FIG. **28** as an example, the extracted image **110** is displayed to be superimposed on the partial image **137** in the partial image display region **136**. In a case where the superimposition/superimposition cancellation button **157** is selected again in this state, the superimposition of the extracted image **110** is cancelled, and the display returns to the display form shown in FIG. **23**.

[0140] The measurement button **158** is a button for displaying the position of an object to be measured in the tunnel **10** in the partial image **137** in the partial image display region **136** and the actual size of the object be measured. As shown in FIG. **29** as an example, in a case where the measurement button **158** is selected and a rectangular region **165** surrounding the crack **111** as the object to be measured is designated, a display window **166** including the position of the crack **111** designated by the region **165** in the tunnel **10** and the actual size of the crack **111** designated by the region **165** is displayed in the partial image display region **136**. The position of the crack **111** designated by the region **165** in the tunnel **10** is the position of a center of a side along the length direction LD of the region **165**. In addition, here, the actual size is a width W of the crack **111** designated by the region **165** in the length direction LD and a height H thereof in the circumferential direction CD. FIG. **29** shows a case where the position in the tunnel **10** is 24 m, the width W is 4.8 m, and the height H is 2 m.

[0141] In addition, as shown in FIG. **30** as an example, in a case where the measurement button **158** is selected and a plurality of points **167** on the crack **111** as the object to be measured are designated, the display window **166** including the position of the crack **111** designated by the points **167** in the tunnel **10** and the actual size of the crack **111** designated by the points **167** is displayed in the partial image display region **136**. The position of the crack **111** designated by the points **167** in the tunnel **10** is a position of a center of a line connecting the points **167**. In addition, the actual size is a length L of the line connecting the points **167**. FIG. **30** shows a case where the position in the tunnel **10** is 24 m and the length L is 4.8 m. As described above, the object to be measured may be designated by the rectangular region **165** shown in FIG. **29** or the points **167** shown in FIG. **30**. In addition, the actual size can be calculated from the distance to the object measured by the distance measurement function of the camera **27**, the imaging magnification, the focal length, the number of pixels of the imaging element, the pixel size, the pixel pitch, and the like.

[0142] The display switching buttons **159**A and **159**B are buttons for switching the display of the partial image **137** being displayed in the partial image display region **136**. The display switching buttons **159**A and **159**B are examples of an “operation portion” according to the technology of the present disclosure.

[0143] As shown in FIGS. **31** and **32** as an example, in a case where the display switching buttons **159**A and **159**B are selected, the partial image **137** being displayed in the partial image display region **136** is switched to a partial image **137** adjacent to the partial image **137** being displayed in the partial image display region **136**.

[0144] FIG. **31** shows a case where the partial image **137** in a distance range of 600 m to 650 m is displayed in the partial image display region **136** and the display switching button **159**A is selected. In this case, the display of the partial image **137** in the partial image display region **136** is switched to a partial image **137** in a distance range of 550 m to 600 m adjacent to the partial image **137** in the distance range of 600 m to 650 m. In addition, the display of the capture position mark **145** is also switched from the distance range of 600 m to 650 m to the distance range of 550 m to 600 m. Further, the display completion mark **146** is also displayed below the distance range of 550 m to 600 m. In this case, the partial image **137** in the distance range of 550 m to 600 m is an example of

an “adjacent partial image” according to the technology of the present disclosure. Furthermore, in a case where the partial image **137** in the distance range of 550 m to 600 m has been displayed until that time, the display completion mark **146** has already been displayed below the distance range of 550 m to 600 m.

[0145] FIG. **32** shows a case where the partial image **137** in a distance range of 100 m to 150 m is displayed in the partial image display region **136** and the display switching button **159**B is selected. In this case, the display of the partial image **137** in the partial image display region **136** is switched to a partial image **137** in a distance range of 150 m to 200 m adjacent to the partial image **137** in the distance range of 100 m to 150 m. In addition, the display of the capture position mark **145** is also switched from the distance range of 100 m to 150 m to the distance range of 150 m to 200 m. Further, the display completion mark **146** is also displayed below the distance range of 150 m to 200 m. In this case, the partial image **137** in the distance range of 150 m to 200 m is an example of the “adjacent partial image” according to the technology of the present disclosure. In a case where the partial image **137** in the distance range of 150 m to 200 m has been displayed until that time, the display completion mark **146** has already been displayed below the distance range of 150 m to 200 m.

[0146] Next, the operation of the above-described configuration will be described with reference to a flowchart shown in FIG. **33** as an example. As shown in FIGS. **1**, **5**, and **6**, the inner wall surface **11** of the tunnel **10** is imaged by the cameras **27** of the imaging device **12**. In this case, the moving distance of the imaging device **12** is derived based on the pulses PL output from the magnetic sensors **41** according to the magnetism of the magnetic bodies **40** attached to the rear wheels **37** of the carriage **21** of the imaging device **12**. Then, as shown in FIG. **7**, the imaging device **12** generates the captured image information **60** which is information of the captured image **51** obtained by the imaging. In addition, as shown in FIG. **10**, the during-imaging designated portion information **75**, which is information of the portion designated by the imaging person UP through the operation screen **65** shown in FIG. **8** and the like, is generated.

[0147] In a case where the operation program **95** is started in the information management server **80**, as shown in FIG. **13**, the CPU **87**A of the information management server **80** functions as the acquisition unit **100**, the RW control unit **101**, the extraction unit **102**, and the screen distribution control unit **103**. In addition, in a case where the inspection AP **112** is started in the inspector terminal **81**, as shown in FIG. **17**, the CPU **87**B of the inspector terminal **81** functions as the browser control unit **113**.

[0148] As shown in FIG. **11**, the captured image information **60** and the during-imaging designated portion information **75** are transmitted from the imaging device **12** to the information management server **80**. The captured image information **60** and the during-imaging designated portion information **75** are acquired by the acquisition unit **100** (Step ST**100**). The captured image information **60** and the during-imaging designated portion information **75** are output from the acquisition unit **100** to the RW control unit **101** and are stored in the storage **85**A by the RW control unit **101** (Step ST**110**).

[0149] The inspector UI inputs a request to distribute the bird's-eye view screen **115** to the inspector terminal **81**, and the distribution request is transmitted from the browser control unit **113** to the information management server **80** (Step ST**200**). In a case where the request to distribute the bird's-eye view screen **115** is received (Step ST**120**), the RW control unit **101** reads out the captured image information **60** and the during-imaging designated portion information **75** from the storage **85**A (Step ST**130**). The captured image information **60** and the during-imaging designated portion information **75** are output from the RW control unit **101** to the screen distribution control unit **103**. In addition, the captured image information **60** is output to the extraction unit **102** together with the crack extraction model **96**. Further, the during-inspection designated portion information **97** is also read out from the storage **85**A by the RW control unit **101** and is output from the RW control unit **101** to the screen distribution control unit **103** together with the captured image

information **60** and the like.
[0150] The bird's-eye view screen **115** shown in FIGS. **18** and **19** is generated by the screen distribution control unit **103** and is distributed to the inspector terminal **81** (Step ST**140**). In the inspector terminal **81**, the browser control unit **113** displays the bird's-eye view screen **115** on the display **89**B (Step ST**210**). The whole index bar **118** is displayed in the upper display region **116** of the bird's-eye view screen **115**, and the partial index bar **120** is displayed in the lower display region **117**.
[0151] The whole index bar **118** is divided into a plurality of small regions **119** each of which is 1000 m. A small region **119** corresponding to the distance range indicated by the partial index bar **120** being displayed in the lower display region **117** among the plurality of small regions **119** is displayed to be distinguished from the other small regions **119**. In addition, as shown in FIG. **20**, the during-imaging designated portion mark **126**, the during-inspection designated portion mark **127**, and the crack presence portion mark **128** are displayed on the partial index bar **120**.
[0152] An instruction to distribute the partial image display screen **135** is input on the bird's-eye view screen **115**, and a distribution request corresponding to the distribution instruction is transmitted from the browser control unit **113** to the information management server **80** (Step ST**220**). In a case where the request to distribute the partial image display screen **135** is received (Step ST**150**), the partial image display screen **135** shown in FIG. **23** and the like is generated by the screen distribution control unit **103** and is distributed to the inspector terminal **81** (Step ST**160**). In the inspector terminal **81**, the browser control unit **113** displays the partial image display screen **135** on the display **89**B (Step ST**230**).
[0153] The partial image display screen **135** has the partial index bar **120** and the partial image display region **136**. However, the partial image display screen **135** does not have a display region for the long image **55**. The partial image **137**, which is a portion of the long image **55**, is displayed in the partial image display region **136**. The capture position mark **145** indicating the capture position of the partial image **137** being displayed in the partial image display region **136** in the tunnel **10** is displayed on the partial index bar **120**.
[0154] In a case where the zoom button **155** is operated and the partial image **137** in the partial image display region **136** is displayed to be enlarged, as shown in FIG. **27**, the frame **160** indicating which position of the partial image **137** in the initial display state before enlargement display the portion, which is currently displayed to be enlarged, corresponds to is displayed in the auxiliary window **139**.
[0155] In a case where the superimposition/superimposition cancellation button **157** is selected, as shown in FIG. **15**, the captured image **51** is input to the crack extraction model **96** in the extraction unit **102**, and the extracted image **110** is output from the crack extraction model **96**. Then, as shown in FIG. **16**, the extracted image information **105**, which is information of the extracted images **110** for all of the captured images **51**, is generated. The extracted image information **105** is output from the extraction unit **102** to the screen distribution control unit **103**. Then, as shown in FIG. **28**, the extracted image **110** is displayed to be superimposed on the partial image **137** in the partial image display region **136**.
[0156] In a case where the measurement button **158** is selected and the rectangular region **165** surrounding the object to be measured is designated as shown in FIG. **29** or the plurality of points **167** on the object to be measured are designated as shown in FIG. **30**, the display window **166** including the position of the designated object to be measured in the tunnel **10** and the actual size of the designated object to be measured is displayed.
[0157] In a case where the display switching buttons **159**A and **159**B are selected, as shown in FIGS. **31** and **32**, the partial image **137** being displayed in the partial image display region **136** is switched to a partial image **137** adjacent to the partial image **137** being displayed in the partial image display region **136**.
[0158] As described above, the CPU **87**B of the inspector terminal **81** comprises the browser

control unit **113**. The browser control unit **113** performs control to display the partial image display screen **135** on the display **89**B. The partial image display screen **135** has the partial index bar **120** and the partial image display region **136**. The partial image **137** is displayed in the partial image display region **136**. The partial image **137** is an image obtained by imaging the tunnel **10** extending in the length direction LD with the imaging device **12** and is a portion of the long image **55** in which the long side direction is along the length direction LD. The partial index bar **120** extends along the length direction LD and indicates at least a portion of the distance range of the tunnel **10** in the length direction LD. The capture position mark **145** indicating the capture position of the partial image **137** being displayed in the partial image display region **136** in the tunnel **10** is displayed on the partial index bar **120**.

[0159] The capture position mark **145** enables the inspector UI to recognize which portion of the tunnel **10** the partial image **137** being displayed in the partial image display region **136** corresponds to. Therefore, it is possible to prevent the occurrence of the problem in which it is not possible to specify the position of the tunnel **10** in which deformation, such as the crack **111**, has occurred.

[0160] The partial image display screen **135** has only the partial index bar **120** and the partial image display region **136** as described above. Therefore, the screen configuration is very simple. In a case where the display region for the long image **55** is provided, a large space is required for the display region. However, in a case where the partial index bar **120** is provided, a large space is not required as compared to the case of the long image **55**. In addition, in a case where a structure has a very large length like the tunnel **10** as in the present example, it is difficult to display the structure with the long image **55**. However, the partial index bar **120** makes it possible to display the structure even in a case where the length of the structure is large. Therefore, the technology of the present disclosure enables the inspector UI to recognize which portion of the tunnel **10** the partial image **137** being displayed in the partial image display region **136** corresponds to with a simple screen configuration.

[0161] As shown in FIG. **25**, the browser control unit **113** receives the designation of any position of the partial index bar **120**. The browser control unit **113** displays the partial image **137**, whose capture position corresponds to the designated position, in the partial image display region **136**. This enables the inspector UI to instantly display the desired partial image **137** with a simple operation, which facilitates the inspection of the long image **55**.

[0162] As shown in FIG. **18** and the like, the inspector terminal **81** can display the whole index bar **118** that indicates a distance range wider than the distance range of the partial index bar **120** and indicates which position in the distance range of the whole index bar **118** the partial index bar **120**, which is being displayed, corresponds to. This enables the inspector UI to recognize the position corresponding to the partial index bar **120** which is being displayed.

[0163] The distance range indicated by the whole index bar **118** is the entire distance range of the tunnel **10** in the length direction LD. This enables the inspector UI to recognize which position in the entire distance range of the tunnel **10** in the length direction LD the partial index bar **120**, which is being displayed, corresponds to. In addition, the distance range indicated by the whole index bar **118** may not be the entire distance range of the tunnel **10** in the length direction LD. For example, half of the distance range of the tunnel **10** in the length direction LD may be indicated by the whole index bar **118**.

[0164] As shown in FIG. **27**, in the inspector terminal **81**, the partial image **137** can be displayed to be enlarged in the partial image display region **136**. Then, it is possible to display the auxiliary window **139** including the frame **160** indicating which position in the partial image **137** the portion, which is displayed to be enlarged, corresponds to. This enables the inspector UI to recognize which portion of the partial image **137** is displayed to be enlarged.

[0165] As shown in FIGS. **26**, **31**, and **32**, the display switching buttons **159**A and **159**B for inputting an instruction to switch the partial image **137** being displayed in the partial image display region **136** to a partial image **137** adjacent to the partial image **137** being displayed in the partial

image display region **136** are provided on the partial image display screen **135**. Therefore, it is possible to instantly switch the display of the partial image **137** in the partial image display region **136** with a simple operation, which facilitates the inspection of the long image **55**.

[0166] As shown in FIG. **20**, the inspector terminal **81** can display the portion-of-interest mark, such as the during-imaging designated portion mark **126** indicating the portion of interest of the long image **55**, on the partial index bar **120**. This enables the inspector UI to recognize where the portion of interest is in the long image **55**. The portion of interest is a portion that the inspector UI should inspect with priority and emphasis. Therefore, in a case where the inspector UI can recognize where the portion of interest is, the inspection of the long image **55** is further facilitated.

[0167] The portion of interest includes a portion designated by the imaging person UP or the inspector UI, who is the user, and a portion in which the crack **111**, which is a specific object, is present. This enables the inspector UI to recognize the portion designated by the imaging person UP or the inspector UI and the portion in which the crack **111** is present.

[0168] As shown in FIGS. **21** and **22**, the inspector terminal **81** can display the text memo input by the imaging person UP or the inspector UI in association with the portion designated by the imaging person UP or the inspector UI. This enables the inspector UI to easily check the text memo.

[0169] The portion designated by the user is a portion designated by the imaging person UP of the long image **55** during the capture of the long image **55** and a portion designated by the inspector UI of the long image **55** during the inspection of the long image **55**. This enables the inspector UI to recognize the portion designated by the imaging person UP of the long image **55** during the capture of the long image **55** and the portion designated by the inspector UI of the long image **55** during the inspection of the long image **55**.

[0170] As shown in FIG. **24**, the inspector terminal **81** can display the display completion mark **146** indicating the portion whose partial image **137** is displayed, which makes it possible to display the portion whose partial image **137** is displayed and the portion whose partial image **137** is not displayed to be distinguished from each other on the partial index bar **120**. This enables the inspector UI to recognize the portion whose partial image **137** has been displayed and which has been inspected and the portion whose partial image **137** has not been displayed. It is possible to eliminate the double effort of inspecting the portion that has already been inspected without knowing that the portion has already been inspected.

[0171] As shown in FIGS. **29** and **30**, the browser control unit **113** receives the designation of the object to be measured in the partial image **137**. The browser control unit **113** displays the position of the object to be measured in the tunnel **10** and the actual size of the object to be measured in response to the designation. This enables the inspector UI to easily know the position of the object to be measured in the tunnel **10** and the actual size of the object to be measured. In addition, the display target is not limited to both the position of the object to be measured in the tunnel **10** and the actual size of the object to be measured, and at least one of these may be displayed.

[0172] As shown in FIG. **6**, the long image **55** is an image obtained by combining a plurality of captured images **51** obtained by imaging different portions of the tunnel **10** with the imaging device **12** a plurality of times along at least the length direction LD of the length direction LD and the circumferential direction CD intersecting (orthogonal to) the length direction LD. Therefore, the long image **55** is an image that shows different portions of the inner wall surface **11** of the tunnel **10** along at least the length direction LD and that is suitable for comprehensively inspecting the inner wall surface **11** of the tunnel **10** along the length direction LD. In addition, the “intersection” means that the first direction and the second direction intersect each other at a certain angle and includes something other than “orthogonality” between the length direction LD and the circumferential direction CD described as an example.

[0173] As shown in FIGS. **1**, **5**, and **6**, the plurality of captured images **51** are images obtained by imaging the inner wall surface **11** of the tunnel **10** at a plurality of different positions in the length

direction LD while moving the imaging device **12** along the length direction LD. Therefore, it is possible to easily obtain a plurality of captured images **51** showing different portions of the inner wall surface **11** of the tunnel **10** along the length direction LD.

[0174] In addition, as shown in FIGS. **2** to **4**, the imaging device **12** includes a plurality of cameras **27** arranged along the circumferential direction CD. Further, the plurality of captured images **51** are images obtained by imaging the tunnel **10** with the plurality of cameras **27** arranged along the circumferential direction CD. Therefore, it is possible to easily obtain a plurality of captured images **51** showing different portions of the inner wall surface **11** of the tunnel **10** along the circumferential direction CD. In addition, the imaging device **12** includes a plurality of cameras **27** arranged along the length direction LD. Further, the plurality of captured images **51** are images obtained by imaging the tunnel **10** with the plurality of cameras **27** arranged along the length direction LD. Therefore, it is possible to easily obtain a plurality of captured images **51** showing different portions of the inner wall surface **11** of the tunnel **10** along the length direction LD.

[0175] More specifically, the imaging device **12** includes a plurality of cameras **27** arranged along the circumferential direction CD. Further, the plurality of captured images **51** are images obtained by imaging the tunnel **10** with the plurality of cameras **27** while moving the imaging device **12** along the length direction LD. The long image **55** is an image obtained by combining the plurality of captured images **51** along the length direction LD and the circumferential direction CD. Therefore, it is possible to easily obtain a plurality of captured images **51** showing different portions of the inner wall surface **11** of the tunnel **10** along the length direction LD and the circumferential direction CD. In addition, the long image **55** is an image that shows different portions of the inner wall surface **11** of the tunnel **10** along the length direction LD and the circumferential direction CD and that is suitable for comprehensively inspecting the inner wall surface **11** of the tunnel **10** along the length direction LD and the circumferential direction CD.

[0176] The structure is the tunnel **10**, the first direction is the length direction LD connecting the entrance **13** and the exit **14** of the tunnel **10**, and the second direction is the circumferential direction CD of the tunnel **10**. This makes it possible to comprehensively inspect the inner wall surface **11** of the tunnel **10**.

[0177] On the partial image display screen **135**, the during-inspection designated portion mark **127** may be displayed not only in the portion designated by the inspector UI in the past but also in the portion designated by the inspector UI who is viewing the partial image display screen **135**.

[0178] The partial image **137** displayed in the partial image display region **136** may be an image in a distance range obtained by giving a slight margin of ±10 m to a preset distance range of 50 m. In this case, the adjacent partial image **137** whose display is switched in response to the selection of the display switching buttons **159**A and **159**B is also an image in the distance range with a slight margin. For example, in a case where the display switching button **159**B is selected while the partial image **137** in a distance range of 190 m to 260 m (a distance range of 200 m to 250 m without margin) is being displayed in the partial image display region **136**, the display is switched to the partial image **137** in a distance range of 240 m to 310 m (a distance range of 250 m to 300 m without margin). In this case, the partial image **137** in the distance range of 240 m to 310 m is an example of the “adjacent partial image” according to the technology of the present disclosure.

[0179] A method of displaying the portion whose partial image **137** is displayed and the portion whose partial image **137** is not displayed to be distinguished from each other is not limited to the display completion mark **146** described as an example. As an example, as shown by hatching in FIG. **34**, in the partial index bar **120**, the portion whose partial image **137** is displayed may be displayed in at least one of brightness, color, or pattern different from that of the portion whose partial image **137** is not displayed such that the portions are distinguished from each other. This display method also enables the inspector UI to recognize the portion whose partial image **137** has been displayed and which has been inspected and the portion whose partial image **137** has not been displayed, and can eliminate the double effort of inspecting the portion that has already been

inspected without knowing that the portion has already been inspected.
[0180] In addition, as shown in FIG. **35** as an example, the during-imaging designated portion mark **126**, the during-inspection designated portion mark **127**, the crack presence portion mark **128**, and the display completion mark **146** may be displayed not only on the partial index bar **120** but also on the whole index bar **118**.
[0181] The memo to be recorded in association with the portion designated by the imaging person UP is not limited to the text memo described as an example. As an example, instead of the text memo, a voice memo may be recorded as in during-imaging designated portion information **170** shown in FIG. **36**. In a case where the during-imaging designated portion mark **126** of the partial index bar **120** is selected, the voice memo is reproduced and displayed from a speaker. In addition, the memo to be recorded in association with the portion designated by the inspector UI may also be a voice memo, which is not shown. In short, the memo to be recorded in association with the portion designated by the imaging person UP or the inspector UI may be at least one of a text memo or a voice memo.
[0182] Instead of imaging and inspecting the entire inner wall surface **11** of the tunnel **10**, a portion of the inner wall surface **11**, such as the right surface, the left surface, or the ceiling, may be imaged and inspected. In addition, the road surface **15** may be imaged and inspected in addition to the inner wall surface **11**.
[0183] The specific object to be extracted is not limited to the crack **111** described as an example. Other deformations, such as peeling, rust, water leakage, or exposure of reinforcing bars, may be extracted. A plurality of types of deformations may be extracted, and the extracted images of the plurality of types of deformations may be displayed to be selectively superimposed on the partial image **137** in response to the operation of the superimposition/superimposition cancellation button **157**. In addition, the specific object to be extracted is not limited to the deformation. Further, the specific object to be extracted may be illumination lamps, ventilation ports, or the like arranged at regular intervals in the tunnel **10**.
[0184] The structure is not limited to the tunnel **10**. The structure may be a dam, a bridge, a levee, a public facility, or the like. The imaging device **12** may also be a flying object such as a drone. In the case of the dam, for example, a width direction of a dam body is the first direction, and a height direction thereof is the second direction. In the case of the bridge, for example, a length direction of a bridge girder is the first direction, and a height direction thereof is the second direction.
[0185] A hardware configuration of the computer constituting the information management server **80** can be modified in various ways. For example, the information management server **80** can be configured by a plurality of computers separated as hardware for the purpose of improving processing capability and reliability. Specifically, the functions of the acquisition unit **100** and the RW control unit **101** and the functions of the extraction unit **102** and the screen distribution control unit **103** are distributed to two server computers. In this case, the information management server **80** is configured by two server computers. In addition, some or all of the functions of the information management server **80** may be assigned to the inspector terminal **81**.
[0186] As described above, the hardware configuration of the computer can be appropriately changed according to the required performance, such as processing capability, security, and reliability. It is needless to say that not only the hardware but also the AP, such as the operation program **95**, can be duplicated or distributed and stored in a plurality of storage devices for the purpose of ensuring safety and reliability.
[0187] The installation portion and operation entity of the information management server **80** may be a data center operated by a company different from the inspection company of the structure or may be one of a plurality of inspection companies.
[0188] In the above-described embodiment, for example, the following various processors can be used as a hardware structure of processing units that execute various processes such as the acquisition unit **100**, the RW control unit **101**, the extraction unit **102**, the screen distribution

control unit **103**, and the browser control unit **113**. The various processors include, for example, the CPUs **87**A and **87**B which are general-purpose processors executing software (the operation program **95** and the inspection AP **112**) to function as various processing units as described above, a programmable logic device (PLD), such as a field programmable gate array (FPGA), which is a processor whose circuit configuration can be changed after manufacture, and a dedicated electric circuit, such as an application specific integrated circuit (ASIC), which is a processor having a dedicated circuit configuration designed to perform a specific process.

[0189] One processing unit may be configured by one of the various processors or by a combination of two or more processors of the same type or different types (for example, a combination of a plurality of FPGAs and/or a combination of a CPU and an FPGA). In addition, a plurality of processing units may be configured by one processor.

[0190] A first example of the configuration in which a plurality of processing units are configured by one processor is an aspect in which one processor is configured by a combination of one or more CPUs and software and functions as a plurality of processing units. A representative example of this aspect is a client computer or a server computer. A second example of the configuration is an aspect in which a processor that implements the functions of the entire system including a plurality of processing units using one integrated circuit (IC) chip is used. A representative example of this aspect is a system on chip (SoC). As described above, various processing units are configured by using one or more of the various processors as the hardware structure.

[0191] In addition, more specifically, an electric circuit (circuitry) in which circuit elements, such as semiconductor elements, are combined can be used as the hardware structure of these various processors.

[0192] It is possible to understand the techniques described in the following supplementary notes from the above description.

Supplementary Note 1

[0193] An image display device comprising: [0194] a processor, [0195] wherein the processor is configured to: [0196] perform control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.

Supplementary Note 2

[0197] The image display device according to Supplementary Note 1, [0198] wherein the processor is configured to: [0199] receive a designation of any position of the first index bar; and [0200] display the partial image, whose capture position corresponds to the designated position, in the display region.

Supplementary Note 3

[0201] The image display device according to Supplementary Note 1 or 2, [0202] wherein a second index bar that indicates a second distance range wider than the first distance range and indicates which position in the second distance range the first index bar being displayed corresponds to is capable of being displayed.

Supplementary Note 4

[0203] The image display device according to Supplementary Note 3, [0204] wherein the second distance range is an entire distance range of the structure in the first direction.

Supplementary Note 5

[0205] The image display device according to any one of Supplementary Notes 1 to 4, [0206] wherein the partial image is capable of being displayed to be enlarged in the display region, and [0207] an auxiliary window indicating which position of the partial image the portion displayed to

be enlarged corresponds to is capable of being displayed.

Supplementary Note 6

[0208] The image display device according to any one of Supplementary Notes 1 to 5, [0209] wherein an operation portion for inputting an instruction to switch the partial image being displayed in the display region to a partial image adjacent to the partial image being displayed in the display region is provided on the display screen.

Supplementary Note 7

[0210] The image display device according to any one of Supplementary Notes 1 to 6, [0211] wherein a portion-of-interest mark indicating a portion of interest in the long image is capable of being displayed on the first index bar.

Supplementary Note 8

[0212] The image display device according to Supplementary Note 7, [0213] wherein the portion of interest includes at least one of a portion designated by a user or a portion in which a specific object is present.

Supplementary Note 9

[0214] The image display device according to Supplementary Note 8, [0215] wherein a text memo or a voice memo input by the user is displayed in association with the portion of interest.

Supplementary Note 10

[0216] The image display device according to Supplementary Note 8 or 9, [0217] wherein the portion designated by the user is at least one of a portion designated by an imaging person of the long image during capture of the long image or a portion designated by an inspector of the long image during inspection of the long image.

Supplementary Note 11

[0218] The image display device according to any one of Supplementary Notes 1 to 10, [0219] wherein a portion whose partial image is displayed and a portion whose partial image is not displayed are capable of being displayed to be distinguished from each other on the first index bar.

Supplementary Note 12

[0220] The image display device according to Supplementary Note 11, [0221] wherein a display completion mark indicating the portion whose partial image is displayed is displayed on the first index bar such that the portion whose partial image is displayed and the whose partial image is not displayed are displayed to be distinguished from each other.

Supplementary Note 13

[0222] The image display device according to Supplementary Note 11, [0223] wherein at least one of a brightness, color, or pattern of the first index bar is changed such that the portion whose partial image is displayed and the portion whose partial image is not displayed are displayed to be distinguished from each other.

Supplementary Note 14

[0224] The image display device according to any one of Supplementary Notes 1 to 13, [0225] wherein the processor is configured to: [0226] receive a designation of an object to be measured in the partial image; and [0227] display at least one of a position of the object to be measured in the structure or an actual size of the object to be measured in response to the designation.

Supplementary Note 15

[0228] The image display device according to any one of Supplementary Notes 1 to 14, [0229] wherein the long image is an image obtained by combining a plurality of captured images obtained by imaging different portions of the structure with the imaging device a plurality of times along at least the first direction, of the first direction and a second direction intersecting the first direction.

Supplementary Note 16

[0230] The image display device according to Supplementary Note 15, [0231] wherein the plurality of captured images are images obtained by imaging the structure at a plurality of different positions in the first direction while moving the imaging device in the first direction.

Supplementary Note 17
[0232] The image display device according to Supplementary Note 15 or 16, [0233] wherein the imaging device has a plurality of cameras that are arranged along the second direction, and [0234] the plurality of captured images are images obtained by imaging the structure with the plurality of cameras.
Supplementary Note 18
[0235] The image display device according to Supplementary Note 17, [0236] wherein the imaging device has a plurality of cameras that are arranged along the first direction, and [0237] the plurality of captured images are images obtained by imaging the structure with the plurality of cameras.
Supplementary Note 19
[0238] The image display device according to any one of Supplementary Notes 15 to 18, [0239] wherein the imaging device has a plurality of cameras that are arranged along the second direction, [0240] the plurality of captured images are images obtained by imaging the structure with the plurality of cameras while moving the imaging device along the first direction, and [0241] the long image is an image obtained by combining the plurality of captured images along the first direction and the second direction.
Supplementary Note 20
[0242] The image display device according to any one of Supplementary Notes 15 to 19, [0243] wherein the structure is a tunnel, [0244] the first direction is a length direction connecting an entrance and an exit of the tunnel, and [0245] the second direction is a circumferential direction of the tunnel.
[0246] In the technology of the present disclosure, the above-described various embodiments and/or various modification examples can be combined with each other as appropriate. In addition, the present disclosure is not limited to the above-described embodiments, and various configurations can be adopted without departing from the gist of the present disclosure. Furthermore, the technology of the present disclosure extends to a storage medium that stores a program in a non-transitory manner, in addition to the program.
[0247] The above descriptions and illustrations are detailed descriptions of portions related to the technology of the present disclosure and are only examples of the technology of the present disclosure. For example, the above description of the configurations, functions, operations, and effects is the description of examples of the configurations, functions, operations, and effects of the portions related to the technology of the present disclosure. Therefore, unnecessary portions may be deleted or new elements may be added or replaced in the above descriptions and illustrations without departing from the gist of the technology of the present disclosure. In addition, in the above descriptions and illustrations, the description of, for example, common technical knowledge that does not need to be particularly described to enable the implementation of the technology of the present disclosure is omitted in order to avoid confusion and facilitate the understanding of portions related to the technology of the present disclosure.
[0248] In the specification, “A and/or B” is synonymous with “at least one of A or B”. That is, “A and/or B” means only A, only B, or a combination of A and B. Further, in the present specification, the same concept as “A and/or B” is applied to a case where the connection of three or more matters is expressed by “and/or”.
[0249] All of the publications, the patent applications, and the technical standards described in the specification are incorporated by reference herein to the same extent as each individual document, each patent application, and each technical standard are specifically and individually stated to be incorporated by reference.

Claims

1. An image display device comprising: a processor, wherein the processor is configured to: perform control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.
2. The image display device according to claim 1, wherein the processor is configured to: receive a designation of any position of the first index bar; and display the partial image, whose capture position corresponds to the designated position, in the display region.
3. The image display device according to claim 1, wherein a second index bar that indicates a second distance range wider than the first distance range and indicates which position in the second distance range the first index bar being displayed corresponds to is capable of being displayed.
4. The image display device according to claim 3, wherein the second distance range is an entire distance range of the structure in the first direction.
5. The image display device according to claim 1, wherein the partial image is capable of being displayed to be enlarged in the display region, and an auxiliary window indicating which position of the partial image the portion displayed to be enlarged corresponds to is capable of being displayed.
6. The image display device according to claim 1, wherein an operation portion for inputting an instruction to switch the partial image being displayed in the display region to a partial image adjacent to the partial image being displayed in the display region is provided on the display screen.
7. The image display device according to claim 1, wherein a portion-of-interest mark indicating a portion of interest in the long image is capable of being displayed on the first index bar.
8. The image display device according to claim 7, wherein the portion of interest includes at least one of a portion designated by a user or a portion in which a specific object is present.
9. The image display device according to claim 8, wherein a text memo or a voice memo input by the user is displayed in association with the portion of interest.
10. The image display device according to claim 8, wherein the portion designated by the user is at least one of a portion designated by an imaging person of the long image during capture of the long image or a portion designated by an inspector of the long image during inspection of the long image.
11. The image display device according to claim 1, wherein a portion whose partial image is displayed and a portion whose partial image is not displayed are capable of being displayed to be distinguished from each other on the first index bar.
12. The image display device according to claim 11, wherein a display completion mark indicating the portion whose partial image is displayed is displayed on the first index bar such that the portion whose partial image is displayed and the portion whose partial image is not displayed are displayed to be distinguished from each other.
13. The image display device according to claim 11, wherein at least one of a brightness, color, or pattern of the first index bar is changed such that the portion whose partial image is displayed and the portion whose partial image is not displayed are displayed to be distinguished from each other.
14. The image display device according to claim 1, wherein the processor is configured to: receive a designation of an object to be measured in the partial image; and display at least one of a position of the object to be measured in the structure or an actual size of the object to be measured in response to the designation.
15. The image display device according to claim 1, wherein the long image is an image obtained by

combining a plurality of captured images obtained by imaging different portions of the structure with the imaging device a plurality of times along at least the first direction of the first direction and a second direction intersecting the first direction.

16. The image display device according to claim 15, wherein the plurality of captured images are images obtained by imaging the structure at a plurality of different positions in the first direction while moving the imaging device in the first direction.

17. The image display device according to claim 15, wherein the imaging device has a plurality of cameras that are arranged along the second direction, and the plurality of captured images are images obtained by imaging the structure with the plurality of cameras.

18. The image display device according to claim 17, wherein the imaging device has a plurality of cameras that are arranged along the first direction, and the plurality of captured images are images obtained by imaging the structure with the plurality of cameras.

19. The image display device according to claim 15, wherein the imaging device has a plurality of cameras that are arranged along the second direction, the plurality of captured images are images obtained by imaging the structure with the plurality of cameras while moving the imaging device along the first direction, and the long image is an image obtained by combining the plurality of captured images along the first direction and the second direction.

20. The image display device according to claim 15, wherein the structure is a tunnel, the first direction is a length direction connecting an entrance and an exit of the tunnel, and the second direction is a circumferential direction of the tunnel.

21. A method for operating an image display device, the method comprising: performing control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.

22. A non-transitory computer-readable storage medium storing a program for operating an image display device, the program causing a computer to execute a process comprising: performing control to display, on a display, a display screen having a display region for a partial image that is a portion of a long image, which is obtained by imaging a structure extending in a first direction with an imaging device and in which a long side direction is along the first direction, and a first index bar which extends in the first direction and indicates a first distance range that is at least a portion of a distance range of the structure in the first direction and on which a capture position mark indicating a capture position of the partial image, which is being displayed in the display region, in the structure is displayed.