

MARKING ROBOT SYSTEM AND METHOD FOR CONTROLLING MARKING ROBOT
SYSTEM

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to a marking robot system and a method for controlling a marking robot system.

2. Description of the Related Art

10 In recent years, at construction sites, there has been a growing movement to automate work, such as marking, which could only be performed by skilled operators, using robots. For example, JP 2019-31901 A discloses a marking robot system that automatically performs the marking.

15 JP 2019-31901 A discloses a marking robot system including a printing means (printer) that is provided in a movable body which can be two-dimensionally moved and a control means that moves the movable body to a mark printing position (marking point) on the basis of a measurement position of the movable
20 body measured by a three-dimensional measurement means and supplies control information for marking to the printing means (printer). Further, in JP 2019-31901 A, an actuator that can be moved two-dimensionally and the printer that is rotatably installed in the actuator are mounted on the movable body, and
25 it is possible to print the length of a black line printed at a

marking position, a black line in any direction, and the attribute information of the black line.

In the related art, in the marking operation performed by skilled operators, the content (for example, lines, shapes, and words) of mark printing is appropriately changed depending on a device that is installed in a building as necessary. The content is displayed in an easy-to-understand manner for the operator, who installs the device, such that the occurrence of human error is suppressed. That is, in construction work, various devices are installed at various positions, such as the anchor positions of the devices to be installed, the anchor positions of ceiling-suspended devices, and the positions of electric equipment and air conditioners. In the marking performed by skilled operators, for example, the shape and words to be marked are added or changed to content that is easy for the operator to understand, depending on the device to be installed, and the content that is easy for the operator, who installs the device, to understand is printed.

On the other hand, the marking robot system (for example, JP 2019-31901 A) according to the related art does not have a function of performing mark printing in a predetermined format at a predetermined point and enabling an operator (worker), who is on site, to easily customize the content of marking as necessary (a function of performing editing such as addition and change). That is, the content of the mark printing is a method

that performs the mark printing on the basis of preset marking information, and the operator is not able to customize the content of printing to be convenient at his or her own will.

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SUMMARY OF THE INVENTION

Accordingly, an object of the invention is to provide a marking robot system that does not uniformly perform mark printing, is improved to edit the content of the mark printing to content that is easy for an operator (worker) understand and to perform the mark printing, and performs marking close to shapes or words marked by skilled operators in the related art.

According to an aspect of the invention, there is provided a marking robot system including: a marking robot including a printer performing mark printing, an actuator to which the printer is attached and which is capable of moving the printer, a movable body that has the printer and the actuator mounted thereon and is moved, and a main body control unit controlling the printer, the actuator, and the movable body; a tracking-type three-dimensional measurement device that measures a position of the marking robot and transmits a position measurement result to the main body control unit; and a control operation unit communicating with the main body control unit to instruct the main body control unit to perform a marking process. The main body control unit has a function of transmitting and receiving information to and from the tracking-type three-dimensional

measurement device and the control operation unit and stores marking information composed of basic marking information and editable information corresponding to the basic marking information. The control operation unit acquires the marking
5 information, displays an editing screen for an operator to edit the editable information, generates customized marking information on the basis of an operation result on the editing screen, and transmits the customized marking information to the main body control unit. The main body control unit performs the
10 mark printing on the basis of the customized marking information.

According to another aspect of the invention, there is provided a method for controlling a marking robot system including a marking robot that has a printer mounted on a movable body and performs mark printing on the basis of marking
15 information using the printer, a tracking-type three-dimensional measurement device measuring a position of the marking robot, and a control operation unit transmitting information for controlling the marking robot, the marking information being composed of basic marking information and editable information
20 corresponding to the basic marking information. The method includes: displaying an editing screen on the control operation unit on the basis of the marking information; causing the control operation unit to generate customized marking information on the basis of an operation result on the editing screen; and causing
25 the marking robot to perform the mark printing on the basis of

the customized marking information.

According to the invention, the control operation unit generates the customized marking information, and mark printing is performed using the customized marking information.

5 Therefore, it is possible to perform the mark printing in which the intention of the operator has been reflected.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram illustrating a configuration of a marking robot system according to an embodiment of the invention;
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Fig. 2 is a diagram illustrating a schematic configuration of a marking robot;

Fig. 3 illustrates an example of image accessory information that is installed in the marking robot together with an image of a marking type;
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Fig. 4A is a diagram illustrating an example of an editing screen for customizing mark printing;

Fig. 4B is a diagram illustrating an example of the editing screen for customizing the mark printing;

20 Fig. 4C is a diagram illustrating an example of the editing screen for customizing the mark printing;

Fig. 5 is a diagram illustrating a specific example of the content of the mark printing;

Fig. 6 is a flowchart illustrating an operation flow of the mark printing in the embodiment;
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Fig. 7 is a diagram illustrating a case in which the mark printing is performed in the vicinity of a wall;

Fig. 8 is a flowchart illustrating an operation flow in the case in which the mark printing is performed in the vicinity
5 of the wall; and

Fig. 9 is a diagram illustrating an example of a black dot selection screen for an operator who wants to preferentially perform marking when the marking is performed.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, an embodiment (example) will be described in detail with reference to the drawings. The invention is not construed as being limited to the content of the embodiment described below. That is, those skilled in the art will easily
15 understand that the configuration can be changed without departing from the technical idea or gist of the invention. In addition, in the configuration of the embodiment described below, the same reference numerals are used for the same devices or portions having similar operations and functions, and redundant
20 description thereof may be omitted. Further, the position, size, shape, range, and the like of each component illustrated in the drawings are intended to facilitate understanding of the invention and do not indicate the actual position, size, shape, range, and the like of each component. Furthermore, portions
25 having poor relations to the content of the operation of the

invention (for example, the detailed configuration of a movable body of a marking robot or the detailed description of a positioning operation) will be described in brief.

First, a configuration of a marking robot system according to an embodiment of the invention will be described with reference to Figs. 1 and 2. Fig. 1 is a diagram illustrating the configuration of the marking robot system according to the embodiment of the invention. Fig. 2 is a diagram illustrating a schematic configuration of a marking robot.

As illustrated in Fig. 1, a marking robot system 1 according to the embodiment of the invention includes a marking robot 10, a tracking-type three-dimensional measurement device 20 that measures the position of the marking robot, and a control operation unit 30. The control operation unit 30 can transmit and receive information to and from the marking robot 10 and the tracking-type three-dimensional measurement device 20, creates customized marking information on the basis of marking information from the marking robot 10, and transmits the customized marking information to the marking robot 10. The marking robot 10 performs mark printing according to the customized marking information.

Next, the schematic configuration of the marking robot 10 will be described with reference to Fig. 2. The marking robot 10 is a robot that is deployed, for example, at a construction site, such as a building, or a civil engineering site, such as

a road, and automatically performs mark printing. The marking robot 10 runs autonomously using positional information of the tracking-type three-dimensional measurement device 20 in response to an operation command from a user, is moved to a predetermined marking point (mark printing position), and performs the mark printing according to the marking information using its own printer.

In Fig. 2, the marking robot 10 includes a main body control unit 11 that stores "marking information", which is information for performing the mark printing, and controls the entire marking robot 10. In addition, the marking robot 10 includes a printer 12 that performs the mark printing under the control of the main body control unit 11, a movable body 13 that moves the entire marking robot 10, and an actuator 14 that is installed on the movable body and moves the printer 12 in a two-dimensional (X-Y plane) direction. Further, the marking robot 10 includes a measurement target 15 that is installed on the actuator 14 and is used by the tracking-type three-dimensional measurement device 20 to measure the position.

An information device having the functions of a general computer is used as the main body control unit 11. That is, the main body control unit 11 includes a storage unit that stores a control program for controlling the entire marking robot 10, marking information, and information necessary for operations, a transmitting and receiving unit that transmits and receives

information to and from the control operation unit 30, and an arithmetic processing unit that locates the marking robot and the printer at a marking position according to the control program and drives the printer to perform the mark printing according to the marking information. In addition, the description of the detailed configuration and operation of the storage unit, transmitting and receiving unit, and the arithmetic processing unit will be omitted.

The movable body 13 includes, for example, a frame 131, a driving unit 132 that is attached to a lower side of the frame 131 and moves the movable body 13, and tires 133 for movement with a driving force of the driving unit 132. The detailed configuration of the movable body in the marking robot is well known (for example, JP 2019-31901 A), and the detailed description thereof will be omitted.

The actuator 14 is disposed on the movable body 13, and the printer 12 is attached to the lower side of the actuator 14. The actuator 14 moves and locates the printer 12 at the mark printing position under the positioning control of the main body control unit 11. The actuator 14 according to this embodiment can move the printer 12 in the two-dimensional direction of the X-Y plane and can also move a print head of the printer in the Z-axis direction in order to locate the print head at a position suitable for printing on a marking surface (a floor, a wall, or a ceiling) at the time of the mark printing.

The positioning of the marking robot 10 in this configuration can be implemented as follows. The main body control unit 11 performs position control to move the marking robot 10 to a marking point, on the basis of the marking position (target printing position) included in the marking information and the measurement position of the marking robot 10 from the tracking-type three-dimensional measuring device 20 and performs positioning control to locate the printer 12 at the marking point (mark printing position) with high accuracy, using the actuator 14. The detailed description of the positioning control will be omitted.

The tracking-type three-dimensional measurement device 20 according to this embodiment is a measurement device that tracks the measurement target 15 attached to the marking robot 10 with a laser and measures the position of the measurement target 15, that is, the position of the marking robot 10 in the three-dimensional space using light reflected from the measurement target. The tracking-type three-dimensional measurement device 20 can measure the position of the measurement target 15 in a state in which the measurement target 15 is attached to the marking robot 10 to measure the position of the marking robot 10 with high accuracy. In addition, the tracking-type three-dimensional measurement device is not limited to the measurement device using laser light and may be any measurement device as long as it can measure the position of the marking robot. The

position of the marking robot 10 measured by the tracking-type three-dimensional measurement device 20 is transmitted to the main body control unit 11 to be used for movement control (positioning) of the marking robot 10 to the marking position.

5 In addition, the position is also transmitted to the control operation unit 30 according to command information from the control operation unit 30 as necessary.

The control operation unit 30 is a terminal that transmits and receives information between the marking robot 10 and the tracking-type three-dimensional measurement device 20 and controls the operations of the marking robot 10 and the tracking-type three-dimensional measurement device 20. In addition, the control operation unit 30 according to the embodiment of the invention has a function of editing (customizing) the marking information on the basis of the marking information received from the main body control unit 11 in response to the operation of the operator through the control operation unit 30. Therefore, the control operation unit 30 can transmit and receive information to and from the main body control unit 11 and share the marking information with the main body control unit 11. In addition, the control operation unit 30 has a function of acquiring "marking basic information" which is basic marking information in the "marking information" and "editable information" for customization and displaying an editing screen to be operated by the operator and an operation function for a

selection operation of the operator using the editing screen.

A known tablet terminal device having a touch panel that is integrated with a screen display can be used as the control operation unit 30 having the function of displaying information on the screen and enabling the operator to perform the selection operation. Therefore, in the following description, it is assumed that a known tablet terminal device is used as the control operation unit 30 according to this embodiment. Further, in addition to the tablet terminal device, for example, a terminal, such as a portable personal computer (PC) or a smart phone, can be used as the control operation unit 30.

Next, a configuration of the marking information according to the embodiment of the invention will be described with reference to Fig. 3.

First, Fig. 3 illustrates an example of the editable information (information that can be printed in addition to basic information) that is downloaded to the marking robot together with the basic marking information of the marking information. This editable information can be described in configuration files such as Comma-Separated Values (CSV) and Java Script Object Notation (JSON). A storage medium (not illustrated), on which the marking information has been recorded, can be inserted into the main body control unit 11, and the marking information can be downloaded to the main body control unit 11 through this storage medium. Alternatively, the marking

information recorded on the storage medium can be downloaded through a wireless communication technique (for example, "Bluetooth"). In addition, Bluetooth is a registered trademark.

In Fig. 3, 301 described as "File Name" is an image file name of a marking type. 302 described as "Long Text" is a name displayed when the image file of the marking type is selected. 303 described as "Direction" is arrow editing information indicating whether or not to combine an arrow image with an image of the marking type. The "Direction" can be set for each type of the image of the marking type. For example, 0 indicates that the direction is not selectable, 1 indicates that only the direction is present, and 2 indicates that the direction is selectable. 304 described as "Input Name" is information indicating whether or not to combine characters with the image of the marking type. The "Input Name" can be set for each type of the image of the marking type. For example, 0 indicates that addition is not available, and 1 indicates that addition is available. 305 described as "Priority" is information indicating priority in a case in which a character and a line of a background image (basic marking image) overlap each other. For example, the object to be emphasized can be selected such that 0 indicates that priority is given to the line, 1 indicates that priority is given to the character. 306 described as "Rotation" is information indicating whether or not to rotate the orientation of an image during marking. For example, it is

possible to set the rotation of the image during marking such that 0 indicates that the image is not rotated and 1 indicates that the image is rotated.

Next, how the operator edits (customizing) the marking
5 information on the basis of the marking information (composed of the basic marking information and the editable information) with the control operation unit 30 will be described. First, the marking robot 10 (specifically, the main body control unit 11) downloads "marking information" for mark printing which has
10 been created by an external device (not illustrated). The "marking information" according to this embodiment includes the "basic marking information", which is basic information, and the "editable information" for the operator to perform the work of operating the control operation unit 30 to add printing
15 information, corresponding to the basic marking information.

Further, as a method for downloading the marking information including the basic marking information and the editable information, in addition to the above-described method, for example, the marking information stored in an external
20 device, such as an external cloud system, may be downloaded through a communication network such as the Internet.

The control operation unit 30 inputs the marking information including the editable information from the main body control unit 11. The operator operates the "editing screen"
25 for a marking editing operation, which is displayed on the screen

of the control operation unit 30, to perform editing. The control operation unit 30 according to this embodiment is configured to facilitate editing by the selection operation (a selection operation for a selection portion such as a check box) using the editing screen. In addition, the control operation unit 30 according to this embodiment can change (enlarge or reduce) the size of printing content in response to the operation on the editing screen. A specific example of the editing screen used for the editing operation and a specific editing method (customizing method) using the editing screen will be described below.

Further, the control operation unit 30 according to this embodiment has a function of adding an image captured by a camera as a portion of the editable information. That is, an image of comments (for example, characters, symbols, and marks) desired to be added by customization is captured by a built-in camera and is acquired as image information. Then, a process of adding the acquired image information to a portion of the editable information can be performed to use the image information as a portion of the editable information.

Here, for ease of understanding, in the following description, it is assumed that the marking information is transmitted and received between the main body control unit 11 and the control operation unit 30 whenever the control operation unit 30 is used to perform the operation of customizing each

marking information item. However, the invention is not limited to this method. When customization is started, all of the marking information to be customized or a certain amount of marking information may be transmitted from the main body control unit 11 to the control operation unit 30. The control operation unit 30 may be configured to transmit the customized marking information to the main body control unit 11 when the customization of the marking information is ended.

Next, an editing operation (customization method) of the control operation unit 30 will be described using an example of the editing screen. A specific example of the editing screen for performing this editing operation is illustrated in Figs. 4A to 4C.

First, a screen 501 illustrated in Fig. 4A is an editing screen for displaying an image to be printed with the basic marking information and for adding an "arrow" to basic mark printing content. The screen 501 illustrated in Fig. 4A includes an input portion 51 for the marking information to be edited, a guidance display portion 52 for prompting an operation, a display portion 53 for displaying a basic marking image 54 based on the basic marking information, a shape list display portion 55, a check box 56 for selecting whether or not to perform printing for adding an arrow, a back button 57 that is an indication for returning to the previous screen, and a decision button 58 for deciding to perform editing (to add an arrow in

this example).

That is, the screen 501 is an example of a screen for selecting a basic marking image (background image) to be marked and for editing the printing of an "arrow", and the image set
5 in the image file name 301 (File Name) illustrated in Fig. 3 can also be displayed at a preview position. In addition, the words set in the name 302 (Long Text) in Fig. 3 can be displayed in a shape list, and the words that are easy for the operator to understand can be displayed in the shape list. The check box
10 56 for selecting the direction refers to the arrow editing information 303 (Direction) illustrated in Fig. 3. In a case in which the arrow editing information 303 is 0 (the direction is not selectable), the check box is not displayed. In a case in which the arrow editing information 303 is 1 (only the
15 direction is present), the check box 56 is not capable of being changed from a state in which the check box 56 is checked. In a case in which the arrow editing information 303 is 2 (the direction is selectable), the operator can select whether to check or uncheck the check box 56.

20 Next, a screen 502 illustrated in Fig. 4A is an example of the editing screen for adding the printing of an arrow and is an editing screen that appears in a case in which the check box 56 illustrated in Fig. 4A is checked and the decision button 58 is operated. On the screen 502, check boxes 59 indicates check
25 boxes for selecting the direction of the arrow. The operator

checks one or more of the top, the bottom, the left, and the right shown in the check boxes 59. In addition, in this example, an example of the check boxes for selecting the top, the bottom, the left, and the right is described. However, the check boxes
5 may be configured such that other directions, such as oblique directions, are selected. The direction in which the arrow is printed is determined by this selection (checking the check boxes). The operator operates the decision button 60 when there is no problem with the content of the check.

10 This operation makes it possible for the control operation unit 30 to create not only the basic marking information but also information for inserting an "arrow" in the direction determined by the operator. That is, it is possible to create customized marking information, in which the arrow has been
15 added in a predetermined direction, together with the basic marking information. The customized marking information (in this case, the marking information having the arrow added thereto) is transmitted to the main body control unit 11. The main body control unit 11 can store the customized marking
20 information, locate the marking robot at a predetermined marking position on the basis of the customized marking information, and drive the printer 12 to perform the mark printing.

Next, Fig. 4B illustrates an example of an editing screen in a case in which comments, such as characters, are printed on
25 the basic marking information. When a name input 61 is entered

on a screen 503 illustrated in Fig. 4B, marking image information corresponding to the name is read, and comments can be entered in a comment column 62. In this example, a case in which characters "electrical outlet" are entered as the comments is described. A check box 63 is used in a case in which comments are also entered on the lower side. In this example, a case in which characters "▲▲ mm from ○" are entered as the comments to be printed on the lower side in a comment column 64 on the lower side is described. In the case of only comments to be entered (printed) on the upper side, the comment column 64 on the lower side is not used. In addition, when the check box 63 for automatically inputting the distance from a reference core is checked, the distance can be automatically calculated from drawing data. When the operator determines that there is no problem with the edited content of the screen 503, the operator operates the decision button 58. Then, the control operation unit 30 can create customized marking information obtained by adding the input comments to the basic marking information. The customized marking information (in this case, marking information with comments) is transmitted to the main body control unit 11 and then stored in the internal storage unit. Therefore, the marking robot 10 is moved to a predetermined position by the control operation of the main body control unit 11 and drives the printer 12 to perform customized mark printing at the predetermined position. A screen 504 illustrated in Fig.

4B is an example of an editing screen in a case in which other comments are entered. A detailed description of the screen 504 will be omitted since the content of the screen 504 is the same as that of the screen 503.

5 Next, how the operator determines a printing method using the control operation unit 30 in a case in which the comments overlap the basic mark printing when the customized marking information with comments is printed will be described. A screen 505 illustrated in Fig. 4C is an example of an editing screen
10 in this case. On the screen 505, the control operation unit 30 determines whether or not basic mark printing content and comment printing content overlap each other. In a case in which the overlap occurs, a screen indicating that the overlap occurs is displayed in a comment column 65. This makes it possible for
15 the operator to recognize that the overlap occurs. Then, the operator operates this editing screen and operates a selection portion 66 to select whether to leave the overlap as it is (to permit the overlap) or to perform mark printing with priority given to (with an emphasis on) the display of the comments.
20 After this selection, the operator operates the decision button 58.

 This operation makes it possible for the control operation unit 30 to generate customized marking information that enables mark printing in a state desired by the operator. This
25 customized marking information is transmitted to the main body

control unit 11. After the marking robot 10 is moved to a predetermined position by the control operation of the main body control unit 11, the marking robot 10 drives the printer 12 to perform customized mark printing at the predetermined position.

5 Fig. 5 illustrates an example of an image obtained by combining the basic mark printing content and the customized mark printing content. An image 601 illustrated in Fig. 5 is an example of the basic mark printing content (background image). An image 602 is an image (customized image) obtained by adding
10 an arrow and some comments to the content of the image 601. An image 603 illustrates an example of basic marking content. An image 604 is an image (an image after customization) obtained by adding an arrow and comments to the content of the image 603. An image 605 is an example of an L-shaped background image (basic
15 mark printing content), and an image 606 is an image obtained by adding an arrow to the image 605. An image 607 is an example of a background image of a partition marking of 45 mm.

Next, an example of the operation of creating the customized marking information will be described with reference
20 to Fig. 6. Fig. 6 is an example of a flowchart illustrating the editing of the marking information (a change in the marking type).

In Fig. 6, in Step S01, the operator selects a print image change with the control operation unit in order to change the
25 marking type of the drawing data.

Then, in Step S02, the operator selects a background image to be marked (the content of the basic marking information). When the operator operates the editing screen to select a background image, arrow editing information 303 (Direction) 5 illustrated in Fig. 3 is referred to (Step S03).

Then, in Step S04, in a case in which the arrow editing information 303 (Direction) indicates that the direction is not selectable, the process is skipped. In a case in which the arrow editing information 303 indicates that only the direction 10 is present or the direction is selectable, the direction in which the arrow is added is selected.

Then, character editing information 304 (Input Name) is referred to (Step S05).

Then, in Step S06, in a case in which character editing 15 information 304 (Input Name) indicates that addition is unavailable, the process is skipped. In a case in which the character editing information 304 indicates that addition is available, the characters to be added are input.

The characters to be added can be freely input. However, 20 it is also possible to calculate the distance from the reference core from the drawing data and to automatically insert the characters. Therefore, in Step S07, the input characters may overlap the line of the background image which is the image of the basic marking information, and the control operation unit 25 30 checks whether or not the characters actually overlap the

line.

In Step S08, in a case in which the line and the characters overlap each other, the information 305 (Priority) for selecting which of the line and the characters is given priority is referred to.

In a case in which the information 305 for selecting which of the line and the characters is given priority indicates that the line is given priority, the process is skipped. In a case in which the information 305 indicates that the characters are given priority, the consent of the operator for the removal of the line is obtained (Step S08).

Then, in Step S09, in a case in which the consent of the operator is obtained, the control operation unit 30 performs a process of filling the background of the characters with white.

Then, in Step S10, the control operation unit 30 generates customized marking information (print image) obtained by combining the characters and the background image.

According to the flowchart illustrated in Fig. 6, for example, the image 601 illustrated in Fig. 5 can be edited (changed) to the image 602. When the operator requests the main body control unit 11 to perform mark printing through the control operation unit 30, the marking robot 10 can mark the customized image 602 at a predetermined position.

As described in detail above, according to the embodiment of the invention, the operator can edit the editable information

according to the editing screen of the control operation unit 30, and the control operation unit 30 can create (customized) marking information in which the editing result has been reflected. The marking robot 10 can perform customized mark printing at a predetermined marking position on the basis of the customized marking information.

Next, a configuration will be described in which the printing direction of the mark printing is changed and the mark printing is performed, for example, in a case in which a mark printing position is close to a wall at the time of marking. Fig. 7 is a diagram illustrating an operation in a case in which the mark printing is performed at a position close to the wall. Fig. 8 is an example of a flowchart for calculating a rotation angle of the mark printing in the case illustrated in Fig. 7.

In Fig. 7, the marking robot system 1 can recognize a wall 701 from drawing data such as building information modeling (BIM). For example, in a case in which marking is performed on a neighboring area such as a wall, the marking robot 10 is moved to a marking point and then calculates a perpendicular line 703 that is perpendicular to the wall from the drawing data. Further, the area, which is the wall, can be recognized from a range sensor or a camera image, in addition to the drawing data.

Then, the marking robot 10 moves the measurement target 15, and the tracking-type three-dimensional measurement device 20 measures the positions of two points and calculates the

orientation of the marking robot 10 from the coordinates. An angle θ is calculated from the intersection of the calculated perpendicular line 703 and a straight line 704 of the orientation of the robot. At the time of marking, an image 705 to be marked
5 is rotated by θ using the angle θ to obtain an image 706.

Marking information which is the image 706 created in this way is transmitted to the main body control unit 11, and the marking robot 10 can perform marking such that an arrow is pointed in the direction of the wall 701 as in the image 706.

10 Fig. 8 is a flowchart for achieving the operation described in Fig. 7. In Fig. 8, in Step S21, the perpendicular line 703 that is perpendicular to the wall 701 is calculated from the drawing data.

Then, in Step S22, the tracking-type three-dimensional
15 measurement device 20 measures the positions of two points and calculates the orientation of the marking robot 10 from the coordinates.

Then, in Step S23, the angle θ is calculated from the intersection of the perpendicular line 703 calculated in Step
20 S21 and the straight line 704 of the orientation of the robot calculated in Step S22. In Step S24, marking information for rotating the image 705 to be marked by θ using the angle θ is created.

This operation makes it possible to perform mark printing
25 such that the arrow is pointed in the direction of the wall 701

as in the image 706.

Next, an example of a black dot editing screen for an operator who wants to have priority will be described with reference to Fig. 9. Fig. 9 illustrates an example of a black dot selection screen for an operator (for example, an electrical specialist) who wants to preferentially perform marking when the marking is performed. A screen 901 is an example in a case in which black dot information for an electric equipment supplier is set in a filter column in filter condition settings 91 and all items are selected by a selection button 92. When settings for other operators can be selected in this way, it is also possible to give priority to marking for other operators.

In addition, a case in which the black dot to be marked is selected on the screen 901 is given as an example. However, a method may be used in which the type of black dots to be prioritized is selected on the screen immediately before marking to select the black dots for the operator to be prioritized.

What is claimed is:

1. A marking robot system comprising:

a marking robot including a printer performing mark printing, an actuator to which the printer is attached and which
5 is capable of moving the printer, a movable body that has the printer and the actuator mounted thereon and is moved, and a main body control unit controlling the printer, the actuator, and the movable body;

a tracking-type three-dimensional measurement device that
10 measures a position of the marking robot and transmits a position measurement result to the main body control unit; and

a control operation unit communicating with the main body control unit to instruct the main body control unit to perform a marking process,

15 wherein the main body control unit has a function of transmitting and receiving information to and from the tracking-type three-dimensional measurement device and the control operation unit and stores marking information composed of basic marking information and editable information corresponding to
20 the basic marking information,

the control operation unit acquires the marking information, displays an editing screen for an operator to edit the editable information, generates customized marking information on the basis of an operation result on the editing
25 screen, and transmits the customized marking information to the

main body control unit, and

the main body control unit performs the mark printing on the basis of the customized marking information.

5 2. The marking robot system according to claim 1,
 wherein the marking information stored in the main body
control unit is downloaded through a storage medium.

3. The marking robot system according to claim 1,
10 wherein the marking information is downloaded from an
external device storing the marking information through a
communication line.

4. The marking robot system according to claim 1,
15 wherein the control operation unit has a function of adding
an image captured by a built-in camera as a portion of the
editable information.

5. The marking robot system according to claim 1,
20 wherein the editable information includes at least
information of an arrow or characters.

6. The marking robot system according to claim 5,
 wherein, in a case in which a line included in the basic
25 marking information and the characters overlap each other, it

is possible to select whether to give priority to the line or to the characters.

7. The marking robot system according to claim 1,

5 wherein the marking robot system has a function of enlarging or reducing a size of a mark printed by the mark printing on the basis of the basic marking information.

8. The marking robot system according to claim 1,

10 wherein the marking robot system has a function of changing a direction of the mark printing with respect to a wall and performing the mark printing when performing the mark printing in the vicinity of the wall.

15 9. The marking robot system according to claim 1,

wherein the marking robot system generates a route for an operator who wants to preferentially perform marking and performs the marking.

20 10. A method for controlling a marking robot system including a marking robot that has a printer mounted on a movable body and performs mark printing on the basis of marking information using the printer, a tracking-type three-dimensional measurement device measuring a position of the marking robot, and a control
25 operation unit transmitting information for controlling the

marking robot, the marking information being composed of basic marking information and editable information corresponding to the basic marking information, the method comprising:

5 displaying an editing screen on the control operation unit
on the basis of the marking information;

causing the control operation unit to generate customized marking information on the basis of an operation result on the editing screen; and

10 causing the marking robot to perform the mark printing on
the basis of the customized marking information.