

CONSTRUCTION ROBOT

TECHNICAL FIELD

[0001] The present invention relates to the field of robotics, in particular to a construction robot for automatic drilling and blasting.

BACKGROUND

[0002] In buildings, for the installation of some infrastructure such as wiring, water supply and exhaust ducts, heating/cooling fluid ducts, air conditioning ducts and other facilities, it is necessary to drill holes in the ceilings or walls and then install expansion bolts.

[0003] In construction projects on construction sites, traditional drilling and installation of blasting screws often require workers to work at height, which poses certain risks and is time-consuming and labor-intensive. In order to eliminate the risks of working at height and save manpower and resources, the Utility Model Announcement Number CN 212072459 U obtained by the applicant through long-term production practice discloses a drilling device for drilling holes in ceilings or walls, wherein the drilling device comprises a first linear guide, which is equipped with a first slider; a second linear guide, which is arranged on the first slider, and a second slider is arranged on the second linear guide, wherein the second linear guide is perpendicular to the first linear guide; a third linear guide, which is arranged on the second slider, and a third slider is arranged on the third linear guide, the third linear guide is perpendicular to the first linear guide and the second linear guide, respectively; an electric drill fixing bracket, which is arranged on the third slider, and the electric drill fixing bracket is equipped with a hole depth sensor for sensing the drilling depth, as well as an electric drill switch for controlling the start and stop of the electric drill; a positioning laser transmitter, which is arranged on the electric drill fixing bracket or the third linear guide; an electric control box, wherein the first linear guide is fixed on the electric control box, wherein a control and power supply box are arranged, and a control circuit board and a rechargeable power supply are arranged inside the control and power supply box; a wireless control unit, which is wirelessly connected to the control circuit board. The drilling device for ceiling or wall drilling can be controlled wirelessly to drill holes in the ceilings or walls, without the need for

construction personnel to work at height, ensuring the safety and health of construction personnel, and improving their work efficiency.

[0004] However, in this type of drilling device for ceiling or wall drilling, after the drilling is completed, it cannot automatically install blasting screws and requires a process of installing blasting screws, which cannot meet the needs of users.

SUMMARY

[0005] The present invention aims to address the shortcomings of traditional drilling devices for ceiling or wall drilling, which cannot automatically install blasting screws after drilling is completed and requires a process of installing blasting screws, which cannot meet the needs of users, and to provide a construction robot, which can automatically select a blasting screw of appropriate size based on the diameter of a drilled hole and insert it into the drilled hole. The blasting screw transmission mechanism can freely select different sizes of blasting screws according to needs, and transport the blasting screws of that size for the robot to pick up, wherein whether the blasting screw is in place and whether the inventory is sufficient can be tracked in real time.

[0006] The technical solution used in the present invention to achieve the above technical requirements is: a construction robot, comprising a control mechanism, a robotic arm, and a drilling electric drill; Under the control of the control mechanism, the robotic arm picks up the drilling electric drill to complete the drilling process; further comprising a blasting electric drill, wherein the robotic arm, under the control of the control mechanism, picks up the blasting electric drill and inserts the blasting screw into the drilled hole of the drilling electric drill to achieve blasting.

[0007] Furthermore, the aforementioned construction robot also comprises a position sign identification module for drilling and blasting, which comprises at least one camera connected to the control mechanism.

[0008] Furthermore, the aforementioned construction robot also comprises a position indication module for drilling and blasting, which comprises at least two cross radium ray emitters set to be controlled by the control mechanism.

[0009] Furthermore, the aforementioned construction robot also comprises a blasting screw transmission mechanism that facilitates the pickup of blasting screws for a blasting electric drill.

[0010] Furthermore, in the aforementioned construction robot, the blasting screw

transmission mechanism comprises at least one blasting clamp, which includes a vertical slot for storing blasting screws, a blasting screw conduit arranged upwards at the bottom of the slot, and a push rod arranged downwards at the bottom of the slot to move the blasting screws moved here along the blasting screw conduit upwards.

[0011] Furthermore, in the aforementioned construction robot, a vibration unit is also installed on the slot to drive the vibration of the slot, and an inventory sensor is used to detect whether there are enough blasting screws in the slot, wherein the inventory sensor is connected to the controller of the blasting clamp.

[0012] Furthermore, in the aforementioned construction robot, a blasting screw detection sensor is installed at the end of the blasting screw conduit to detect whether the blasting screw in the conduit is in place, and the push rod and blasting screw detection sensor are respectively connected to the controller of the blasting clamp.

[0013] Furthermore, in the aforementioned construction robot, the blasting clamp is set on a vertically arranged blasting clamp plate.

[0014] Furthermore, in the aforementioned construction robot, the control mechanism is located inside a chassis, on which a guide for installing the robotic arm is provided.

[0015] Furthermore, in the aforementioned construction robot, all blasting clamps are arranged in sequence within the chassis, and the end of the blasting screw conduit set along the blasting clamp plate is connected to the blasting screw outlet set on the upper plate of the chassis.

[0016] In the present invention, a robotic arm is used to flexibly pick up a drilling electric drill and a blasting electric drill, and after drilling, the blasting operation can be carried out.

[0017] In addition, a blasting clamp is also provided for convenient transmission of blasting screws.

[0018] The present invention is further described below in conjunction with the accompanying drawings and specific embodiments.

BRIEF DESCRIPTION OF DRAWINGS

[0019] FIG. 1 illustrates a structural diagram of the construction robot in Example 1 of the present invention.

[0020] FIG. 2 illustrates the structure of the blasting clamp of the construction robot in Example 1 of the present invention.

[0021] FIG. 3 illustrates a framework diagram of the electrical system for the blasting clamp of the construction robot in Example 1 of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] Example 1: This embodiment is an automatic drilling and blasting construction robot, which continues to carry out blasting after drilling. As shown in FIG. 1, the control mechanism 100 of the robot is set in a dedicated box, and a guide 600 is set on the box, and the robotic arm 200 can move along the guide 600 under the control of the control mechanism 100 until the robotic arm 200 can remove the tool where the operation is performed. As shown in FIG. 1, the construction robot of this embodiment comprises a control mechanism 100, a robotic arm 200, a drilling electric drill 300, a blasting electric drill 400, a blasting clamp 500, etc. The control mechanism 100 is arranged inside a box, and the robotic arm 200 can slide on a guide 600 on the box. The drilling electric drill 300 and the blasting electric drill 400 are set at a designated position on the side of the guide 600, making it convenient for the robotic arm 200 to move on the guide 600 to access it. The blasting clamp 500 is a mechanism used to provide blasting screws 520 for the robotic arm 200 when it uses the blasting electric drill 400 for drilling and blasting.

[0023] In this embodiment, it also comprises a position sign identification module for drilling and blasting, and the position sign identification module for drilling and blasting comprises at least one camera 700 connected to the control mechanism 100. It will be appreciated by those skilled in the art that the control mechanism 100 of the robot is an intelligent terminal with strong computing power, and images can be obtained through several cameras 700 to identify the position signs of drilling and blasting.

[0024] In this embodiment, a position indication module 800 for drilling and blasting is also included, and the position indication module 800 for drilling and blasting comprises at least two cross radium ray emitters set to be controlled by the control mechanism 100. Under the control of control mechanism 100, two cross radium ray emitters project a rectangular area on the ceiling based on the preset range of drilling and blasting. This area is the coverage area where the robot can complete drilling and blasting screws on the ceiling. The camera 700 can then search for the location marks of drilling and blasting within this coverage area, reducing blindness.

[0025] In this embodiment, a specially designed blasting screw 520 supply mechanism is used. In practice, other conveying devices can also be used to transport different types

of blasting screws (expansion screws) to a convenient location for the robotic arm 200 to access. In this embodiment, the construction robot, like various other industrial robots, has a control mechanism located inside a control box, which is the brain of the industrial robot. Under the control of the control mechanism 100, the robotic arm 200 can complete many repetitive tasks, such as picking up the drilling electric drill 300 or blasting electric drill 400, using a drilling electric drill 300 to drill holes in the designed area, and then picking up the blasting electric drill 400 to obtain the corresponding model of a blasting screw 520 through a blasting clamp 500 to carry out blasting on the drilled hole.

[0026] In this embodiment, the blasting screw transmission mechanism comprises at least one blasting clamp 500. In practice, a group of blasting clamps 500 of different models are stored in the chassis box, and the construction robot selects the appropriate blasting screws according to the program design requirements. In this embodiment, the blasting clamp 500, as shown in FIG. 2, comprises a slot 510 for vertically storing the blasting screws 520, a blasting screw conduit 540 set at the bottom end of the slot 510 facing upwards, and a push rod 530 set at the bottom side of the slot 510 that moves the blasting screws 520 here along the blasting screw conduit 540 facing upwards. In addition, in order to achieve intelligent blasting control, in the blasting clamp 500 in this embodiment, a vibration unit 550 is also installed on the slot 510 to drive the vibration of the slot 510, and an inventory sensor 560 which detects whether there are enough blasting screws 520 in the slot 510 is connected to a controller 580 of the blasting clamp 500. In this embodiment, the blasting screw 520 is neatly and vertically arranged in a slot 510 on one side against a blasting clamp plate 590. Due to its own weight, it generally slides downwards along the slot 510. If it slides too slowly to quickly reach the lowest point, that is, the end of the slot 510, a vibration unit 550 will be used to make the blasting screw 520 inside the slot 510 quickly slide and access the top of the opening push rod 530. In addition, a push rod 530 is installed at the end of the slot 510, and an inventory sensor 560 is installed on the side of the push rod 530. In practice, the inventory sensor 560 is a pair of infrared correlated tubes installed on both sides of the end of the slot 510. When the infrared ray emitted by the transmitter tube is blocked and cannot be emitted to the correlated infrared receiver tube, it indicates that there are blasting screws 520 inside the slot 510. When the infrared receiver tube receives the infrared ray emitted by the infrared transmitter tube, it indicates that there are no blasting screws blocking the area. Therefore, the inventory of blasting screws 520 in slot 510 is no longer available and needs to be

replenished in a timely manner. An inventory indicator light can be installed on the chassis to remind you to replenish the inventory in a timely manner when the inventory of blasting screws 520 is used up. In addition, the end of the blasting screw conduit 540 is equipped with a blasting screw detection sensor 570 to detect whether the blasting screw 520 in the conduit is in place. The push rod 530 and the blasting screw detection sensor 570 are respectively connected to the controller 580 of the blasting screw clamp 500. In this embodiment, the blasting clamp 500 has a separate controller 580, which determines the position of the blasting screw through the blasting screw detection sensor 570. After detecting the position of the blasting screw, the control push rod 530 stops pushing. The blasting screw detection sensor 570, like the inventory sensor 560, can also be a pair of infrared correlated tubes. When the receiver tube cannot receive the infrared ray emitted by the transmitter tube, it indicates that the blasting screw 520 pushed by the push rod 530 is blocking the area. At this point, the blasting screw 520 is in place, and the controller 580 controls the push rod 530 to stop pushing up. When the robotic arm 200 retrieves the blasting screw 520, the receiver tube receives the infrared ray emitted by the transmitter tube, and the controller 580 controls the push rod 530 to return to its position and wait for the next time. In this embodiment, all blasting clamps 500 are arranged in sequence inside the chassis, and the end of the blasting screw conduit 540 set along the blasting clamp plate 590 is connected to the blasting screw outlet 101 set on the upper plate of the chassis.

[0027] The construction robot in this embodiment can automatically select a blasting screw of appropriate size based on the diameter of a drilled hole after drilling, and drive it into the drilled hole. The key is the design and system implementation of the blasting screw clamp 500.

[0028] The blasting screw clamp (blasting clamp) in this embodiment comprises different independent electromechanical systems, each responsible for one size of blasting screw. A single independent system comprises a upload in place sensor, an inventory sensor, a vibration unit, and a upload mechanism, which can automatically upload the blasting screw to a specific location within the set range and send a signal to the controller after it is in place. At the same time, the controller is connected to the control mechanism of the robot, prompting the robotic arm to pick it up. After the inventory of blasting screws is less than a certain number, the inventory sensor can detect and send a signal to the control board, indicating the need to supplement the blasting screws. After the blasting screw is picked up, the vibration mechanism is activated to automatically fill the next

blasting screw to its original position. Electrically, each subsystem is connected to the same embedded control board using plugs, making it easy to achieve modular operations during installation and maintenance.

[0029] In this embodiment, the basic principle of the construction robot is:

[0030] The robotic arm 200 can pick up the drilling electric drill 300 or blasting electric drill 400 to complete drilling and blasting operations. The robotic arm is equipped with an image vision system to identify drilling marks and complete drilling and blasting operations at the identified target points. One or more cameras of the image vision system are installed at the bottom of the robotic arm, which can quickly, real-time, and widely recognize drilling marks and the blasting position after drilling.

[0031] After the robotic arm 200 completes the drilling, replace it with a blasting drill bit 400. The blasting drill bit 400 can pick up the blasting screw 520 from the designed blasting clamp 500 according to different sizes.

[0032] The robotic arm 200 is installed on the guide 600, which can move along the guide according to the operation target, thereby adjusting the position and expanding the operation range.

[0033] The control mechanism 100 is located in a control box, which comprises a power supply (including batteries and chargers), an industrial computer, a pneumatic control system, etc. It not only provides the power for the entire system, but also controls the operation of the robotic arm, designs and implements various algorithms, including visual recognition, drilling bit and blasting bit motion trajectory. There is also a controller 580 of the blasting clamp 500 installed inside the control box.

[0034] The basic principle of the blasting clamp 500 in this embodiment is:

[0035] After the controller 580 receives the blasting command, the push rod 530 will push the blasting screw 520 upwards until the blasting screw detection sensor 570 is triggered, and the blasting screw is in place, waiting to be picked up.

[0036] After the blasting drill bit 400 picks up the blasting screw 520, the push rod 530 will push back, and the blasting screw 520 above will fall to the empty position of the push rod due to gravity. At the same time, the vibration unit 550 will start, slowly shaking down the blasting screw 520 above until the blasting screw 520 is fully replenished.

[0037] Each size of blasting clamp has its own system installed on an independent blasting clamp plate 590, with independent functions. Different sizes of blasting clamps 500 are connected through hinges and upper screws.

[0038] When the number of blasting screws 520 is less than a certain number, it will trigger the inventory sensor 560 and transmit the trigger signal to the embedded control board through the controller 580.

[0039] The circuit control principle of this embodiment is shown in FIG. 3:

[0040] The blasting clamp 500 filling system comprises multiple blasting clamp modules of different sizes, an embedded controller 580, and a robotic arm master control. Each blasting clamp module comprises a blasting upload push unit, a upload positioning sensor, an inventory sensor, and a vibration unit.

[0041] The main control of the robotic arm 200 communicates with the embedded control board (controller), and sends instructions to pick up suitable blasting screws. After receiving instructions, the embedded control board checks the inventory sensor status: if there is inventory, start the blasting upload push device until the upload sensor senses successful upload, and then feed back the successful upload information to the robotic arm, prompting the robotic arm to carry out blasting operations; If there is no inventory, feed back information to the robotic arm master control, notifying the user to supplement the blasting screws to the blasting clamp. In this embodiment, a blasting screw can be manually added to the blasting clamp.

[0042] The basic principle of laser indication 800 for the effective operating range of the robot in this embodiment is:

[0043] The robot base is equipped with two laser emitters, each of which projects two straight lines vertically upwards to form a cross. The four intersecting lines projected by the two lasers form a rectangular shape, accurately displaying the operating range that the robot can cover.

[0044] The construction robot of this embodiment has the following characteristics:

[0045] 1. The construction robot can perform multi task operations such as drilling and blasting. It can automatically identify the drilling sign on the ceiling, complete the drilling operation, and automatically pick up a blasting screw of appropriate size after drilling, accurately driving it into the drilled hole.

[0046] 2. The blasting clamp system comprises multiple independent subsystems, each of which controls a size of blasting screw and can automatically sense whether the blasting screws are in place, and notify the robotic arm to pick them up when they are in place. When a blasting screw is picked up, the next blasting screw can automatically replenish.

[0047] 3. The use of inventory sensor can automatically detect insufficient inventory of

blasting screws and prompt users to replenish screws to ensure normal operation.

[0048] 4. Each size of blasting screw system is independent and can be stacked with any number of sizes of blasting screws. It can independently access and modularize various sub functions, making it convenient for debugging, installation, and maintenance.

[0049] 5. The blasting control part is separated from the robotic arm control unit independently, facilitating debugging, installation, and maintenance.

[0050] The construction robot of this embodiment has the following advantages:

[0051] 1. Utilize the combination of robotic arm and guide to achieve large-scale operation of the robotic arm.

[0052] 2. Provide drilling and blasting tools for different tasks.

[0053] 3. Multiple blasting subsystems are stacked on the blasting clamp, each of which includes a blasting upload device, a vibration unit, a upload positioning sensor, and an inventory sensor. It can automatically prompt users to supplement blasting screws and automatically push screws of appropriate size to the required positions, ensuring the smooth progress of blasting operations.

[0054] 4. The mechanical and electronic circuits of the blasting clamp are separated, and interact with the control unit through circuit interfaces, making it easy to install by plugging and unplugging.

[0055] 5. The robot base is equipped with two laser emitters, and the four intersecting lines projected form a rectangle, which is the operating range that the robot can cover.

What is claimed is:

1. A construction robot comprising a control mechanism (100), a robotic arm (200), and a drilling electric drill (300); The robotic arm (200) picks up the drilling electric drill (300) to complete the drilling under the control of the control mechanism (100); It is characterized in that it also comprises a blasting electric drill (400), and the robotic arm (200), under the control of the control mechanism, picks up the blasting electric drill (400) and inserts the blasting screw (520) into the drilled hole of the drilling electric drill (300) to achieve blasting.

2. The construction robot of claim 1, characterized in that it further comprises a position sign identification module for drilling and blasting, and the position sign identification module for drilling and blasting comprises at least one camera (700) connected to the control mechanism (100).

3. The construction robot of claim 1, characterized in that it further comprises a position indication module (800) for drilling and blasting, and the position indication module (800) for drilling and blasting comprises at least two cross laser line emitters set to be controlled by a control mechanism (100).

4. The construction robot of claim 1, characterized in that it further comprises a blasting screw transmission mechanism that facilitates the pickup of blasting screws (520) for a blasting electric drill (400).

5. The construction robot of claim 4, characterized in that the blasting screw transmission mechanism comprises at least one blasting clamp (500), wherein the blasting clamp (500) comprises a slot (510) for vertically storing blasting screws (520), and a blasting screw conduit (540) arranged at the bottom end of the slot (510) facing upwards, and a push rod (530) set at the bottom of the slot (510) to move the blasting screw (520) upward along the blasting screw conduit (540).

6. The construction robot of claim 5, characterized in that a vibration unit (550) that drives the vibration of the slot (510) is also provided on the slot (510), and an inventory sensor (560) that detects whether there are enough blasting screws (520) in the slot (510) is connected to the controller (580) of the blasting clamp (500).

7. The construction robot of claim 6, characterized in that: at the end of the blasting screw conduit (540), there is a blasting screw detection sensor (570) that detects whether the blasting screw (520) in the conduit is in place, and a push rod (530) and a blasting screw detection sensor (570) are respectively connected to a controller (580) of the blasting screw clamp (500).

8. The construction robot of claim 7, characterized in that the blasting clamp (500) is set on a vertically arranged blasting clamp plate (590).

9. The construction robot of claim 8, characterized in that the control mechanism (100) is arranged inside a chassis, on which a guide (600) for installing a robotic arm (200) is provided.

10. The construction robot of claim 9, characterized in that: all different specifications of blasting screws (520) corresponding to blasting clamps (500) are sequentially arranged in the chassis, and the end of the blasting screw conduit (540) set along the blasting clamp plate (590) is connected to the blasting screw outlet (101) set on the panel on the chassis.