

ROBOTIC ARM FOR AN AUTOMATED WAREHOUSE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to robotic arms, and more particularly to a robotic arm used in an automated warehouse.

2. The Prior Arts

[0002] In a manufacturing plant, a material processing time constitutes only a relatively small part of an entire production flow, most of the time being consumed by waiting, transport, or storage procedures. Moreover, a conventional robotic arm used in an automated warehouse usually can move only along X and Y axes of a warehouse shelf, and cannot move or rotate with respect to a Z-axis. Therefore, there is a need for an improved robotic arm suitable for use in an automated warehouse that can solve the above problems.

SUMMARY OF THE INVENTION

[0003] The present invention provides a robotic arm for an automated warehouse that includes: a robotic arm placed at an access side of a storage shelf, the robotic arm comprising: two X-axis linear servo platforms respectively placed at a bottom and a top of the access side, the two X-axis linear servo platforms being parallel to each other, the two X-axis linear servo platforms respectively having two X-axis linear servo sliders that are driven by a X-axis servo motor to move concurrently in either direction along a X-axis; a Y-axis linear servo platform having two ends respectively connected to the two X-axis linear servo sliders, the Y-axis linear servo platform being perpendicular to the two X-axis linear servo platforms, the Y-axis linear servo platform having a Y-axis linear servo slider slidably disposed thereon that is driven by

a Y-axis servo motor to move in either direction along a Y-axis; a horizontal frame having an end connected to the Y-axis linear servo slider, and another end that extends to a right side or a left side and forms an extending end; a Z-axis and R-axis linear servo platform having a R-axis rotary mount and a telescopic rod, wherein the R-axis rotary mount is disposed on the extending end of the horizontal frame, the rotation axis of the R-axis rotary mount being parallel to the direction of movement of the Y-axis linear servo platform, the R-axis rotary mount being driven in rotation by a R-axis servo motor, the telescopic rod having an end connected to the R-axis rotary mount and another end connected to a fetch mechanism, the telescopic rod having an extension and retraction axis perpendicular to a rotation axis of the R-axis rotary mount, the telescopic rod being driven by a Z-axis servo motor to move in either direction along a Z-axis.

[0004] According to an embodiment of the present invention, the fetch mechanism is a suction type mechanism.

[0005] Preferably, the robotic arm is controlled with a human-machine interface.

[0006] Preferably, the R-axis rotary mount has a rotation range between 180 degrees and 270 degrees.

[0007] With the present invention, objects on a shelf can be transported without the need of human efforts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a perspective view showing an embodiment of a robotic arm for an automated warehouse according to the present invention.

[0009] FIG. 2 is an enlarged view showing two X-axis linear servo platforms of the robotic arm according to the present invention.

[0010] FIG. 3 is an enlarged view showing a Y-axis linear servo platform of the robotic arm according to the present invention.

[0011] FIG. 4 is an enlarged view showing a Z-axis and R-axis linear servo platform of the robotic arm according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] Reference is made hereinafter to the accompanying drawings to describe embodiments of the present invention. Similar reference numbers will be used in the drawings to refer to the same elements.

[0013] The embodiments depicted hereinafter with reference to the drawings will be used to describe the advantages, features and implementation of the present invention. However, the present invention can be achieved in different ways and shall not be construed as being limited to the embodiments depicted herein. Rather, the embodiments are intended to provide a thorough and complete understanding of the present invention so that the scope of the present invention can be fully conveyed to a person of ordinary skill in the art. Furthermore, the present invention is limited only by the claims.

[0014] Embodiments of the present invention are depicted in the drawings with certain shape, size, scale, angle and quantity, which are shown for illustrative purpose only and shall not limit the present invention. For the sake of clarity, the description of certain well-known functions will be omitted herein so as to more clearly depict the features of the present invention.

[0015] Unless the restricting word “only” is used, the terms “comprise”, “has/have” and “include” are understood to encompass the presence of other elements. Unless otherwise specified, the singular form is understood to cover plural.

[0016] Although there may be no explicit indication, it is understood that the interpretation of each element includes a tolerance thereof.

[0017] When the relative positions of two elements are described by using terms such as “above”, “below”, “beside”, one or more additional element may be disposed between the two elements, unless the words “only” or “directly” are used to indicate otherwise.

[0018] Reference is made hereinafter to the accompanying drawings to describe a robotic arm for an automated warehouse according to an embodiment of the present invention.

[0019] FIG. 1 is a perspective view showing an embodiment of a robotic arm for an automated warehouse according to the present invention. As shown in FIG. 1, a robotic arm for an automated warehouse includes a robotic arm 200. The robotic arm 200 is placed at an access side 110 of a storage shelf 100. The robotic arm 200 includes two X-axis linear servo platforms 210 respectively placed at a top and a bottom of the access side, a Y-axis linear servo platform 220 disposed on the X-axis linear servo platforms 210, a Z-axis and R-axis linear servo platform 230 disposed on the Y-axis linear servo platform 220, and a fetch mechanism (not shown) disposed on the Z-axis and R-axis linear servo platform 230. The fetch mechanism disposed on the Z-axis and R-axis linear servo platform 230 can fetch an object which then can be transported to a target location by movement and rotation of the X-axis linear servo platforms 210, the Y-axis linear servo platform 220 and the Z-axis and R-axis linear servo platform 230.

[0020] FIG. 2 is an enlarged view showing the two X-axis linear servo platforms 210 of the robotic arm 200. FIG. 3 is an enlarged view showing the Y-axis linear servo platform 220 of the robotic arm 200. As shown in FIGS. 2 and 3, the two X-axis linear

servo platforms 210 are parallel to each other. The two X-axis linear servo platforms 210 respectively have two X-axis linear servo sliders 211 slidably disposed thereon that are driven by a X-axis servo motor 212 to move concurrently in either direction along the X-axis. Two ends of the Y-axis linear servo platform 220 are respectively connected to the two X-axis linear servo sliders 211 so that the Y-axis linear servo platform 220 is movable along with the two X-axis linear servo sliders 211, the Y-axis linear servo platform 220 being perpendicular to the two X-axis linear servo platforms 210. The Y-axis linear servo platform 220 has a Y-axis linear servo slider 221 slidably disposed thereon that is driven by a Y-axis servo motor 222 to move in either direction along the Y-axis.

[0021] FIG. 4 is an enlarged view showing the Z-axis and R-axis linear servo platform 230 of the robotic arm 200. As shown in FIG. 4, the Z-axis and R-axis linear servo platform 230 has a R-axis rotary mount 232 and a telescopic rod 233, and is disposed on the Y-axis linear servo platform 220 via a horizontal frame 231. The horizontal frame 231 has an end connected to the Y-axis linear servo slider 221, and another end that extends to the right side and upward and is connected to the Z-axis and R-axis linear servo platform 230. The R-axis rotary mount 232 is driven in rotation by a R-axis servo motor 234, the rotation axis of the R-axis rotary mount 232 being parallel to the direction of movement of the Y-axis linear servo platform 220. The telescopic rod 233 has an end connected to the R-axis rotary mount 232, and another end connected to a fetch mechanism (not shown). The telescopic rod 233 rotates with the R-axis rotary mount 232, and has an extension and retraction axis perpendicular to the rotation axis of the R-axis rotary mount 232. The telescopic rod 233 is driven by a Z-axis servo motor 235 to move in either direction along the Z-axis. The fetch mechanism can move as the Z-axis and R-axis linear servo platform 230

retracts/extends and rotates, and an object held on the fetch mechanism can be displaced from the shelf 100 to a carrying vehicle through rotation of the R-axis rotary mount 232. Moreover, the fetch mechanism can be a suction mechanism, which can hold an object via downward suction. For example, the fetch mechanism can include a plurality of suction plates that can be connected to a vacuum pump via ducts. The vacuum pump can operate to create vacuum at the suction plates for providing the suction action. According to another embodiment, the other end of the horizontal frame 231 can be modified so as to extend to the left side.

[0022] Furthermore, according to another embodiment, the robotic arm 200 can use a human-machine interface (not shown) to control the operation of the X-axis servo motor 212, the Y-axis servo motor 222, the Z-axis servo motor 235 and the R-axis servo motor 234.

[0023] In addition, according to another embodiment, the R-axis rotary mount 232 has a rotation range between 180 degrees and 270 degrees.

[0024] The features and operation of the present invention are as follows.

[0025] The robotic arm 200 according to the present invention respectively uses the movement of the X-axis linear servo sliders 211 of the two X-axis linear servo platforms 210 to control the position of the fetch mechanism on the X-axis, the movement of the Y-axis linear servo slider 221 of the Y-axis linear servo platform 220 to control the position of the fetch mechanism on the Y-axis, and the extension/retraction and rotation of the Z-axis and R-axis linear servo platform 230 to control the position of the fetch mechanism on the Z-axis and the rotational position of the fetch mechanism. The controlled movement of the robotic arm 200 can be thereby used to spatially position the fetch mechanism as desired. With the present invention, a user can transport an object with the robotic arm 200.

[0026] Although the present invention has been described with reference to the preferred embodiments thereof, it is apparent to those skilled in the art that a variety of modifications and changes may be made without departing from the scope of the present invention which is intended to be defined by the appended claims.

WHAT IS CLAIMED IS:

1. A robotic arm for an automated warehouse, comprising:

a robotic arm placed at an access side of a storage shelf, the robotic arm comprising:

two X-axis linear servo platforms respectively placed at a bottom and a top of the access side, the two X-axis linear servo platforms being parallel to each other, the two X-axis linear servo platforms respectively having two X-axis linear servo sliders that are driven by a X-axis servo motor to move concurrently in either direction along a X-axis;

a Y-axis linear servo platform having two ends respectively connected to the two X-axis linear servo sliders, the Y-axis linear servo platform being perpendicular to the two X-axis linear servo platforms, the Y-axis linear servo platform having a Y-axis linear servo slider slidably disposed thereon that is driven by a Y-axis servo motor to move in either direction along a Y-axis;

a horizontal frame having an end connected to the Y-axis linear servo slider, and another end that extends to a right side or a left side and forms an extending end;

a Z-axis and R-axis linear servo platform having a R-axis rotary mount and a telescopic rod, wherein the R-axis rotary mount is disposed on the extending end of the horizontal frame, the rotation axis of the R-axis rotary mount being parallel to the direction of movement of the Y-axis linear servo platform, the R-axis rotary mount being driven in rotation by a R-axis servo motor, the telescopic rod having

an end connected to the R-axis rotary mount and another end connected to a fetch mechanism, the telescopic rod having an extension and retraction axis perpendicular to a rotation axis of the R-axis rotary mount, the telescopic rod being driven by a Z-axis servo motor to move in either direction along a Z-axis, the telescopic rod is perpendicular to rotation axis of the Z-axis servo motor.

2. The robotic arm according to claim 1, wherein the fetch mechanism is a suction type mechanism.
3. The robotic arm according to claim 1, wherein the robotic arm is controlled with a human-machine interface.
4. The robotic arm according to claim 1, wherein the R-axis rotary mount has a rotation range between 180 degrees and 270 degrees.