# Intelligent Storage and Transfer Station and System

## FIELD OF THE INVENTION

The present invention generally belongs to the technical field of robots and, more particularly, relates to an intelligent storage and transfer station and system.

## BACKGROUND OF THE INVENTION

With the rapid development of autonomous walking technology, robots have been widely used in our daily life. To reduce the movement distance of the robot in operation, a number of storage and transfer stations are provided in the service area, so that the robot can pick up or release the goods, which can greatly reduce the time of the robot due to long-distance pick-up and release in the process of distribution. However, the functions of the conventional transfer stations are relatively simple, and only a single or a few goods can be stored, picked up or released. The conventional transfer stations cannot effectively manage the automatic picking up and release of a number of goods, which will affect the distribution efficiency of the robot distribution system.

In view of the foregoing, what is needed, therefore, is to provide an intelligent storage and transfer station and system to overcome the above disadvantages.

## SUMMARY OF THE INVENTION

One object of the present invention is to provide an intelligent storage and transfer station and system, which can solve the problem that the conventional robot transfer station cannot effectively

manage the automatic pickup and release of a number of goods, so as to improve the distribution efficiency of the robot distribution system.

According to one embodiment of the present invention, an intelligent storage and transfer station includes a profile frame, as well as a docking mechanism, a conveying mechanism and a storing mechanism arranged on the profile frame, wherein the profile frame is provided with a receiving chamber for entering and exit of robots, the receiving chamber is provided with a chamber entering port, the docking mechanism includes a hatch door and a hatch door driving assembly, the hatch door driving assembly is configured to drive the hatch door to open or close the chamber entering port, the storing mechanism is provided with a number of carrier chambers, and the conveying mechanism is configured to transfer the carrier boxes between a number of carrier chambers, and between the storing mechanism and the chamber entering port.

According to one embodiment of the present invention, the storing mechanism and the docking mechanism are arranged side by side, and the conveying mechanism is arranged on a same side of the docking mechanism and the storage mechanism.

According to one embodiment of the present invention, the conveying mechanism includes a vertical driving assembly provided on the profile frame and a horizontal driving assembly provided on the vertical driving assembly, and the horizontal driving assembly is provided with a carrier bracket for loading a carrier box.

According to one embodiment of the present invention, the vertical driving assembly includes a first support rod horizontally seated on a top of the profile frame and a pair of first driving wheels fixed at a bottom of the profile frame at intervals. Two ends of the first support rod are provided with second driving wheels. The first driving wheels and the second driving wheels are connected in a one-to-one correspondence through a first synchronous belt. Two sides of the horizontal driving assembly are fixedly connected by two first synchronous belts respectively, and the first support rod is

driven to rotate via a first motor, thereby driving the horizontal driving assembly to move up and down with the first synchronize belt.

According to one embodiment of the present invention, a fixed end of the first motor is fixed on the profile frame. A movable end of the first motor is provided with a third driving wheel. A middle part of the first support rod is sleeved with a fourth driving wheel. The third driving wheel and the fourth driving wheel are sleeved with a second synchronous belt, and running of the first motor drives the first support rod rotates.

According to one embodiment of the present invention, the horizontal driving assembly includes a pair of horizontal rods arranged at intervals and a pair of vertical rods connected to a same side of the two horizontal rods respectively. The carrier bracket is positioned between the pair of horizontal rods and can slide along the horizontal rods, and the vertical rods are connected with the vertical driving assembly.

According to one embodiment of the present invention, two ends of the vertical rod are provided with fifth driving wheels. The fifth driving wheels on a same side of the two vertical rods are sleeved and connected through a third synchronous belt. The vertical rod is fixed with a second motor, and the second motor is configured to drive the third synchronous belt.

According to one embodiment of the present invention, the fifth driving wheels on one side of the two vertical rods close to the second motor are connected by a driving rod. The driving rod is provided with a sixth driving wheel at a middle part thereof. A movable end of the second motor is provided with a seventh driving wheel. The sixth driving wheel and the seventh driving wheel are sleeved and connected by a fourth synchronous belt, and running of the second motor drives the driving rod to rotate, so that the fifth driving wheel close to the second motor rotates and drives the third synchronous belt, to drive the carrier bracket slides along the horizontal rod.

According to one embodiment of the present invention, upper and lower sides of the carrier

bracket each is provided with a first pulley, and sides of the two first pulleys close to each other are in contact with sides of the two horizontal rods away from each other respectively.

According to one embodiment of the present invention, a second pulley is provided on one side of the two vertical rods away from each other. The vertical driving assembly includes a pair of second support rods vertically spaced at intervals. Sides of the two second pulleys close to each other are respectively abutted on sides of the two second support rods away from each other.

According to one embodiment of the present invention, the intelligent storage and transfer station further includes an order entering mechanism arranged on the profile frame. The order entering mechanism includes a fixing plate arranged on the profile frame as well as a chamber plate and a third motor arranged on the fixing plate. The fixing plate is provided with an order entering port, and the third motor drives the chamber plate to close or open the order entering port.

According to one embodiment of the present invention, the fixing plate is provided with a sliding pole. The sliding pole is sleeved with a sliding block fixedly connected with the chamber plate, and the third motor drives the sliding block to move along the sliding pole, so as to drive the chamber plate to slide.

According to one embodiment of the present invention, a movable end of the third motor is connected to an eighth driving wheel. The fixing plate is provided with a ninth driving wheel spaced from the eighth driving wheel. The eighth driving wheel and the ninth driving wheel are sleeved and connected by a fifth synchronous belt. The fifth synchronous belt is arranged in parallel with the sliding pole. The sliding block is fixedly connected to the fifth synchronous belt. When the third motor drives the eighth driving wheel to rotate, the fifth synchronous belt is driven to drive the sliding block to move along the sliding pole.

According to one embodiment of the present invention, the docking mechanism includes a tenth driving wheel fixed on a top of the profile frame and an eleventh driving wheel provided on a top of

the hatch door. The tenth driving wheel and the eleventh driving wheel are sleeved and connected via a sixth synchronous belt. The top of the profile frame is provided with a fourth motor, and the fourth motor drives the sixth synchronous belt to drive the hatch door to move up and down.

According to one embodiment of the present invention, the receiving chamber is provided with two guiding rods on left and right sidewalls of the receiving chamber, and when a robot enters the receiving chamber, the two guiding rods are respectively abutted on two sides of the robot.

According to one embodiment of the present invention, an elastic member is provided on a side wall of the receiving chamber opposite to the hatch door. The hatch door is provided with a movable support rod bracket. One end of the support rod bracket away from the hatch door is connected to one end of a pull belt, and the other end of the pull belt is connected to the hatch door after bypassing a fixing member fixed on a top of the receiving chamber. When the hatch door driving assembly pulls the hatch door, the robot enters the receiving chamber and squeezes the elastic member, and the support rod bracket hangs down naturally under its own gravity.When the driving assembly drives the hatch door to close the receiving chamber, lowering of the hatch door drives the pull belt to tighten, so that the support rod bracket is horizontally fixed and the robot is fixed between the elastic member and the support rod bracket.

According to one embodiment of the present invention, the hatch door driving assembly includes a driving motor, a driving shaft disposed above the hatch door, and a pair of transmitting wheels disposed on two sides of the hatch door respectively. Two sides of the driving shaft are provided with driving wheels. Each drive wheel is connected to a transmitting wheel on a same side through a belt. One side of the hatch door facing the receiving chamber is fixed with a pull rod. Two ends of the pull rod are respectively fixed on a pair of belts. The driving motor drives the driving shaft to rotate, to driving the pair of belts to move up and down and drive the hatch door to open and close.

According to one embodiment of the present invention, two ends of the pull rod are provided

with a clamp and a fastener, and the clamp and the fastener press and fix a corresponding belt.

According to one embodiment of the present invention, the hatch door is further provided with a pull belt guiding rod. The pull belt guiding rod is perpendicular to a moving direction of the hatch door, and a middle portion of the belt is wound around the pull belt guiding rod.

According to one embodiment of the present invention, an intelligent storage and transfer system includes a robot and the intelligent storage and transfer station according to the present invention.

In the intelligent storage and transfer station and system of the present invention, the profile frame is provided with a receiving chamber and a corresponding chamber entering port, so that the robot can be accurately parked at a preset position of the receiving chamber under the action of the docking mechanism, to facilitate the conveying mechanism to pick up and release the carrier box relative to the robot, In addition, under the conveying action of the conveying mechanism, the carrier box can be transferred between multiple carrier chambers and between the storing mechanism and the chamber entering port, so as to manage multiple carrier boxes in an orderly manner. Modular expansion can also be used to increase the number of carrier boxes stored, thereby correspondingly improving the delivery efficiency of the robotic delivery system.

## BRIEF DESCRIPTION OF THE DRAWINGS

In order to illustrate the technical solutions of the embodiments of the present invention more clearly, the accompanying drawings in the embodiments will be briefly introduced below. It should be understood that, the accompanying drawings only show certain embodiments of the present invention, and therefore should not be regarded as a limitation of the scope of the present invention. For one ordinary skilled in the art, other drawings can also be obtained according to the drawings without any creative work.

Fig. 1 is a perspective view of an intelligent storage and transfer station according to one embodiment of the present invention;

Fig. 2 is another perspective view of the intelligent storage and transfer station shown in Fig. 1, wherein some of the housing has been removed;

Fig. 3 is a perspective view of a horizontal driving assembly in the intelligent storage and transfer station shown in Fig. 1;

Fig. 4 is another perspective view of the horizontal driving assembly in the intelligent storage and transfer station shown in Fig. 3;

Fig. 5 is a perspective view of a vertical driving assembly in the intelligent storage and transfer station shown in Fig. 1;

Fig. 6 is a perspective view of an order entering mechanism in the intelligent storage and transfer station shown in Fig. 1;

Fig.7 is a perspective view of a docking mechanism of the intelligent storage and transfer station according to a fourth embodiment of the present invention;

Fig. 8 is another perspective view of the docking mechanism of the intelligent storage and transfer station shown in Fig. 7;

Fig. 9 is a perspective view of a docking mechanism of the intelligent storage and transfer station according to a fifth embodiment of the present invention; and

Fig. 10 is another perspective view of the docking mechanism of the intelligent storage and transfer station shown in Fig. 9.

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| 100 | intelligent storage and transfer station |
| 200 | robot |
| 300 | carrier box |

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| 10 | profile frame |
| 11 | receiving chamber |
| 12 | chamber entering port |
| 20 | docking mechanism |
| 21 | hatch door |
| 22 | hatch door driving assembly |
| 211 | tenth driving wheel |
| 212 | eleventh driving wheel |
| 213 | sixth synchronous belt |
| 214 | fourth motor |
| 215 | guiding rod |
| 221 | elastic member |
| 222 | driving motor |
| 223 | driving shaft |
| 224 | transmitting wheel |
| 225 | driving wheel |
| 226 | belt |
| 227 | pull rod |
| 228 | support rod bracket |
| 229 | pull belt |
| 230 | pull belt guiding rod |
| 30 | conveying mechanism |
| 31 | vertical driving assembly |
| 311 | first support rod |
| 312 | first driving wheel |
| 313 | second driving wheel |
| 314 | first synchronous belt |
| 315 | first motor |
| 316 | third driving wheel |
| 317 | fourth driving wheel |
| 318 | second synchronous belt |
| 32 | horizontal driving assembly |
| 321 | horizontal rod |
| 322 | vertical rod |
| 323 | fifth driving wheel |
| 324 | third synchronous belt |
| 325 | second motor |
| 326 | driving rod |
| 327 | sixth driving wheel |
| 328 | seventh driving wheel |
| 329 | fourth synchronous belt |
| 33 | carrier bracket |
| 331 | first pulley |
| 332 | second pulley |

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|---|---|
| 40 | storing mechanism |
| 41 | carrier chamber |
| 50 | order entering mechanism |
| 51 | fixing plate |
| 511 | order entering port |
| 52 | chamber plate |
| 53 | third motor |
| 54 | sliding pole |
| 55 | sliding block |
| 56 | eighth driving wheel |
| 57 | nineth driving wheel |
| 58 | fifth synchronous belt |

## DETAILED DESCRIPTION OF THE INVENTION

In order to make the objects, technical solutions and technical effects of the present invention clearer, the present invention will now be further described in detail below with reference to the accompanying drawings and embodiments. It should be understood that, the embodiments described in the specification below are only for explaining the present invention, not for limiting the present invention.

It should also be understood that, the terms used in the specification of the present invention is for the purpose of describing particular embodiments only, and is not intended to limit the scope of the present invention. As used in the specification and the claims, unless otherwise indicated in the specification, the singular forms "a", "an" and "the" also intend to include the plural forms.

It should be further understood that, as used in the specification and the appended claims, the term "and/or" refers to any and all possible combinations of one or more associated listed items, including all of the combinations.

**First embodiment**

In the first embodiment of the present invention, an intelligent storage and transfer station 100 is

provided for storing goods to be distributed (eg, a carrier box 300), as a docking station for the distribution of a robot 200.

Referring to Figs. 1-10, an intelligent storage and transfer station 100 includes a profile frame 10, as well as a docking mechanism 20, a conveying mechanism 30 and a storing mechanism 40 provided on the profile frame 10. Among them, the profile frame 10 is configured to provide support for the docking mechanism 20, the conveying mechanism 30 and the storing mechanism 40 provided thereon.

The profile frame 10 is provided with a receiving chamber 11 for entering and exit of a robot. In the present embodiment, the receiving chamber 11 is provided at the lower left corner of the profile frame 10. A charging device can be provided in the receiving chamber 11 for charging the robot. The receiving chamber 11 is provided with a chamber entering port 12 for entering and exit of the robot 200.

The docking mechanism 20 includes a hatch door 21 and a hatch door driving assembly 22. The hatch door driving assembly 22 is configured to drive the hatch door 21 to open or close the chamber entering port 12. At the same time, the docking mechanism 20 is also configured to limit the position of the robot 200 in the receiving chamber 11, so that the robot 200 can be accurately parked in a preset position in the receiving chamber 11, so that the conveying mechanism 30 can pick up and release the carrier box 300 from the robot 200.

The storing mechanism 40 includes a number of carrier chambers 41, and each carrier chamber 41 can store one carrier box 300. The conveying mechanism 30 is configured to transfer the carrier box 300 between a number of carrier chambers 41 as well as between the storing mechanism 40 and the receiving chamber 11. In the present embodiment, each carrier chamber 41 has a rectangle shape matching the size of the standard s carrier box 300, and the multiple carrier chambers 41 are arranged in a matrix of upper and lower layers, so that the conveying mechanism 30 can accurately pick up and

release the carrier box 300 of the carrier chamber 41.

The storing mechanism 40 and the docking mechanism 20 are arranged side by side, i.e., they are arranged on the same side of the receiving chamber 11, i.e. the front part of the profile frame 10 in the present embodiment. The conveying mechanism 30 is arranged at the same side of the receiving chamber 11, the docking mechanism 20 and the storing mechanism 40, i.e., the rear part of the profile frame 10 in the present embodiment, so that the conveying mechanism 30 can reach any position of the receiving chamber 11, the docking mechanism 20 and the storing mechanism 40, which increases the range for the conveying mechanism 30 to transport the carrier box 300.

**Second embodiment**

Referring to Figs. 3-5, the conveying mechanism 30 includes a vertical driving assembly 31 provided on the profile frame 10 and a horizontal driving assembly 32 provided on the vertical driving assembly 31. The horizontal driving assembly 32 is provided with a carrier bracket 33 for loading the carrier box 300. In the present embodiment, the vertical driving assembly 31 drives the horizontal driving assembly 32 to move along the vertical direction, and the horizontal driving assembly 32 drives the carrier bracket 33 to move along the horizontal direction, thereby realizing random movement of the carrier bracket 33 in the entire vertical plane to place the carrier box 300 on the carrier bracket 33 into a corresponding carrier chamber 41.

Referring to Fig. 5, the vertical driving assembly 31 includes a first support rod 311 horizontally seated on the top of the profile frame 10 and a pair of first driving wheels 312 arranged at intervals fixed on the bottom of the profile frame 10. Two ends of the first support rod 311 are provided with second driving wheels 313, and the first driving wheels 312 and the second driving wheels 313 are connected in a one-to-one correspondence with each other through the first synchronous belt 314. It should be noted that, a guiding rod (not shown in the Figure) can also be provided between the first driving wheel 312 and the corresponding second driving wheel 313, so that the horizontal driving

assembly 32 can slide up and down along the guiding rod to avoid drop of the horizontal driving assembly 32 to provide some support for the horizontal driving assembly 32. Two sides of the horizontal driving assembly 32 are fixedly connected by two first synchronous belts 314 respectively. The first support rod 311 is driven by a first motor 315 to rotate, thereby driving the horizontal driving assembly 32 to move up and down with the first synchronous belt 314 and realizing the up and down movement of the horizontal driving assembly 32 and the carrier bracket 33 thereon.

Specifically, a fixed end of the first motor 315 is fixed on the profile frame 10, a movable end of the first motor 315 is provided with a third driving wheel 316, and the middle of the first support rod 311 is sleeved with a fourth driving wheel 317. The third driving wheel 316 and the fourth driving wheel 317 are sleeved with a second synchronous belt 318. When the first motor 315 is running, the first motor 315 drives the third driving wheel 316 to rotate, and drives the fourth driving wheel 317 to rotate through the second synchronous belt 318, thereby driving the first support rod 311 to rotate.

Referring to Fig. 3 to Fig. 4, the horizontal driving assembly 32 includes a pair of horizontal rods 321 arranged at intervals and a pair of vertical rods 322 respectively connected to the same side of the two horizontal rods 321, so that the pair of horizontal rods 321 and the pair of vertical rods 321 are connected to each other to form a rectangular frame structure. The carrier bracket 33 is disposed between the pair of horizontal rods 321 and can slide along the horizontal rods 321. Further, the upper and lower sides of the carrier bracket 33 are provided with first pulleys 331, and the sides of the two first pulleys 331 that are close to each other are respectively abutted on the sides of the two horizontal bars 321 away from each other, thereby lowering the frictional force when the carrier bracket 33 slides relative to the horizontal rod 321.

The vertical rods 322 are connected to the vertical driving assembly 31, that is, a pair of vertical rods 322 are fixedly connected to the two first synchronous belts 314 in one-to-one correspondence. Further, a second pulley 332 is provided on the side of the two vertical rods 322 away from each other. In the present embodiment, the vertical driving assembly 31 includes a pair of vertically spaced

second support rods (not shown in the Figure). It should be noted that, the second support rods may be the previously described guiding rods, or may be other structures. The sides of the two second pulleys 332 close to each other are respectively abutted on the sides of the two second support rods away from each other, to provide support for the horizontal driving assembly 32 under the up and down driving action of the first synchronous belt 314 and lower the friction in sliding.

In the second embodiment of the present invention, two ends of the vertical rods 322 are provided with fifth driving wheels 323, and the fifth driving wheels 323 on the same side of the two vertical rods 322 are sleeved and connected by the third synchronous belt 324, that is, there are two third synchronous belts 324, and the two third synchronous belts 324 are arranged in parallel and spaced vertically while each third synchronous belt 324 is arranged horizontally. A second motor 325 is also fixed on the vertical rod 322, and the second motor 325 is configured to drive the third synchronous belt 324.

Specifically, the fifth driving wheel 323 on the side of the two vertical rods 322 close to the second motor 325 is connected by the driving rod 326, that is, the driving rod 326 is vertically arranged, and two ends thereof are respectively connected with a fifth driving wheel 323 coaxially. It should be noted that, the number of the driving rod 326 may be one, which may be provided on one side of the horizontal rod 321. The middle of the driving rod 326 is provided with a sixth driving wheel 327, and a movable end of the second motor 325 is provided with a seventh driving wheel 328. The sixth driving wheel 327 and the seventh driving wheel 328 are sleeved and connected via a fourth synchronous belt 329. Running of the second motor 325 drives the driving rod 326 to rotate, so that the fifth driving wheel 323 on the side close to the second motor 325 rotates, thereby driving the third synchronous belt 324, so that the carrier bracket 33 slides along the horizontal rod 321 and the horizontal drive of the carrier bracket 33 is realized.

**Third embodiment**

Referring to Fig. 1 and Fig. 6 , the intelligent storage and transfer station 100 further includes an order entering mechanism 50 disposed on the profile frame 10. The order entering mechanism 50 is configured to provide pick up and release of bills, small goods, and so on. The order entering mechanism 50 includes a fixing plate 51 arranged on the profile frame 10, a chamber plate 52 and a third motor 53 arranged on the fixing plate 51. The fixing plate 51 is provided with an order entering port 511 and the third motor 53 drives the chamber plate 52 to close or open the order entering port 511. In the third embodiment of the present invention, there are two chamber plates 52, and the opening or closing of the order entering port 511 is realized by the two chamber plates 52 being away from or close to each other.

The fixing plate 51 is provided with a sliding pole 54. The sliding pole 54 is sleeved with a sliding block 55. The sliding block 55 is fixedly connected with the chamber plate 52. The third motor 53 drives the sliding block 55 to move along the sliding pole 54, and further drive the chamber plate 52 to slide.

Specifically, a movable end of the third motor 53 is connected to an eighth driving wheel 56. The fixing plate 51 is further provided with a ninth driving wheel 57 spaced from the eighth driving wheel 56. The eighth driving wheel 56 and the ninth driving wheel 57 are sleeved and connected via a fifth synchronous belt 58. The fifth synchronous belt 58 is arranged in parallel with the sliding pole 54, and the sliding block 55 is fixedly connected with the fifth synchronous belt 58, wherein the fifth synchronous belt 58 is arranged horizontally. When the third motor 53 drives the eighth driving wheel 56 to rotate, the eighth driving wheel 56 drives the fifth synchronous belt 58, so as to drive the sliding block 55 to move along the sliding pole 54, thereby realizing the horizontal movement of the chamber plate 52, so that the chamber plate 52 can be opened or closed the order entering port 511.

**Fourth embodiment**

Referring to Figs. 7 and 8, the hatch door driving assembly 22 of the docking mechanism 20

includes a tenth driving wheel 211 fixed on the top of the profile frame 10 and an eleventh driving wheel 212 provided on the top of the hatch door 21. The tenth driving wheel 211 and the eleventh driving wheel 212 are sleeved and connected via a sixth synchronous belt 213. The top of the profile frame 10 is provided with a fourth motor 214. The fourth motor 214 drives the sixth synchronous belt 213, so as to drive the hatch door 21 to move up and down, thereby opening or closing the chamber entering port 12.

Further, guiding rods 215 are provided on the left and right side walls of the receiving chamber 11 relative to the hatch door 21. The guiding rods 215 are arranged perpendicular to the hatch door 21, and the distance between the two guiding rods 215 is adapted to the width of the robot 200. When the robot 200 enters the receiving chamber 11, the two guiding rods 215 abut on both sides of the robot 200 respectively, so as to limit the positions of the left and right sides of the robot 200.

**Fifth embodiment**

Referring to Figs. 9 and 10, elastic members 221 are provided on the side walls of the receiving chamber 11 relative to the hatch door 21, that is, when the robot 200 enters the hatch door 11, the front end portion will contact the elastic members 221. And under the action of the power of the robot 200, the elastic member 221 is squeezed to shorten the elastic member 221, so that the robot 200 obtains more forward displacement.

In the fifth embodiment of the present invention, the hatch door driving assembly 22 includes a driving motor 222, a driving shaft 223 disposed above the hatch door 21, and a pair of transmitting wheels 224 disposed on two sides of the hatch door 21 respectively. Both sides of the driving shaft 223 are provided with driving wheels 225, and each driving wheel 225 is connected with the transmitting wheel 224 on the same side through a belt 226. A pair of transmitting wheels 224 is fixed on the side wall of the receiving chamber 11 on the side close to the hatch door 21. A pull rod 227 is fixed to the side of the hatch door 21 facing the receiving chamber 11, and both ends of the pull rod

227 are respectively fixed to a pair of belts 226. It can be understood that, each belt 226 includes an ascending portion and a descending portion, and one end of the pull rod 227 is only fixed on one of the ascending portion and the descending portion of the corresponding belt 226. The driving motor 222 drives the driving shaft 223 to rotate, thereby driving the pair of belts 226 to move up and down and further driving the hatch door 21 to open and close.

Further, two ends of the pull rod 227 include clamps and fasteners (not shown in the figure). The clamps and the fasteners press and fix the corresponding belt 226. The clamps and the fasteners are in the shape of a sheet, and a part of the corresponding belt 226 is pressed and fixed by means of riveting, screwing. The belt 226 in operation will drive the pull rod 227 to move up or down, thereby realizing up and down movement of the hatch door 21.

The hatch door 21 is provided with a movable support rod bracket 228, one end of the support rod bracket 228 away from the hatch door 21 is connected to one end of the pull belt 229, and the other end of the pull belt 229 bypasses the fixing member fixed on the top of the receiving chamber 11 and connects with the hatch door 21. Specifically, the pull belt 229 is a flexible belt, and two ends of the pull belt 229 are respectively fixed to the hatch door 21 (for example, fixed on the pull rod 227 of the hatch door 21) and the middle part of the support rod bracket 228, and the middle poriton of the pull belt 229 is wound around the fixing member and the position is higher than the position of the two ends, thereby forming a structure similar to a fixed pulley. Therefore, the fixing member may be a fixed pulley provided on the top of the receiving chamber 11, or may be the driving shaft 223 of the hatch door driving assembly 22. Further, the hatch door 21 is also provided with a pull belt guiding rod 230. The pull belt guiding rod 230 is perpendicular to the moving direction of the hatch door 21, that is, the pull belt guiding rod 230 is arranged in parallel with the pull rod 227. In other embodiment of the present invention, the pull belt guiding rod 230 may be incorporated with the pull rod 227. The middle of the pull rod 229 is wound on the pull belt guiding rod 230, that is, the pull belt 229 passes through the gap between the pull belt guiding rod 230 and the hatch door 21, thereby increasing the

angle between the pull belt 229 and the support rod bracket 228, and improving the pulling ability of the pull belt 229 to the support rod bracket 228.

In operation, when the hatch door driving assembly 22 pulls the hatch door 21, the hatch door 21 rises, and the robot 200 enters the receiving chamber 11 and maintains the running state, so as to squeeze the elastic member 221 at all times. At this time, one end of the pull belt 229 is driven by the hatch door 21 to rise and in a relaxed state, and the support rod bracket 228 is naturally placed in a downward position under the action of its own gravity, that is, one side of the support rod bracket 228 is attached to the surface of the hatch door 21. When the hatch door driving assembly 22 drives the hatch door 21 to close the receiving chamber 11, the hatch door 21 descends and drives one end of the pull belt 229 to descend. Due to the orientation of the fixing member, the pull belt 229 is tightened, so that one end connecting the support rod bracket 228 rises and the support rod bracket 228 is fixed horizontally. Then, the robot 200 stops running and naturally moves in the direction of the support rod bracket 228 under the elastic force of the elastic member 221, and finally the robot 200 is maintained between the elastic member 221 and the support rod bracket 228, to realize limit of the robot 200 in the movement direction.

**Sixth embodiment**

The present invention also provides an intelligent storage and transfer system including a robot 200 and the intelligent storage and transfer station 100 according to any embodiment of the present invention as described previously, wherein the robot 200 can enter and exit the receiving chamber 11 through the chamber entering port 12 to complete the connection and transfer of the carrier box 300.

In view of the foregoing, in the intelligent storage and transfer station and system of the present invention, the profile frame 10 is provided with a receiving chamber 11 and a corresponding chamber entering port 12, so that the robot 200 can be accurately parked at a preset position of the receiving chamber 11 under the action of the docking mechanism 20, to facilitate the conveying mechanism 20

to pick up and release the carrier box 300 relative to the robot 200. In addition, under the conveying action of the conveying mechanism 30, the carrier box 30 can be transferred between multiple carrier chambers 41 and between the storing mechanism 40 and the chamber entering port 12, so as to manage multiple carrier boxes 300 in an orderly manner. Modular expansion can also be used to increase the number of carrier boxes 300 stored, thereby correspondingly improving the delivery efficiency of the robot 200.

The present invention is not limited to the embodiments as described in the specification. One ordinary skilled in the art can easily realize other advantages and modifications without departing from the spirit and scope of the concept defined by the claims and equivalents thereof. The present invention is not limited to the specific details, representative apparatus and illustrative examples illustrated and described herein.

**WHAT IS CLAIMED IS:**

1. An intelligent storage and transfer station, comprising a profile frame, as well as a docking mechanism, a conveying mechanism and a storing mechanism arranged on the profile frame, wherein the profile frame is provided with a receiving chamber for entering and exit of robots, the receiving chamber is provided with a chamber entering port, the docking mechanism comprises a hatch door and a hatch door driving assembly, the hatch door driving assembly is configured to drive the hatch door to open or close the chamber entering port, the storing mechanism is provided with a plurality of carrier chambers, and the conveying mechanism is configured to transfer the carrier boxes between a number of carrier chambers, and between the storing mechanism and the chamber entering port.

2. The intelligent storage and transfer station according to claim 1, wherein the storing mechanism and the docking mechanism are arranged side by side, and the conveying mechanism is arranged on a same side of the docking mechanism and the storage mechanism.

3. The intelligent storage and transfer station according to claim 1, wherein the conveying mechanism comprises a vertical driving assembly provided on the profile frame and a horizontal driving assembly provided on the vertical driving assembly, and the horizontal driving assembly is provided with a carrier bracket for loading a carrier box.

4. The intelligent storage and transfer station according to claim 3, wherein the vertical driving assembly comprises a first support rod horizontally seated on a top of the profile frame and a pair of first driving wheels fixed at a bottom of the profile frame at intervals, two ends of the first support rod

are provided with second driving wheels, the first driving wheels and the second driving wheels are connected in a one-to-one correspondence through a first synchronous belt, two sides of the horizontal driving assembly are fixedly connected by two first synchronous belts respectively, and the first support rod is driven to rotate via a first motor, thereby driving the horizontal driving assembly to move up and down with the first synchronize belt.

5. The intelligent storage and transfer station according to claim 4, wherein a fixed end of the first motor is fixed on the profile frame, a movable end of the first motor is provided with a third driving wheel, a middle part of the first support rod is sleeved with a fourth driving wheel, the third driving wheel and the fourth driving wheel are sleeved with a second synchronous belt, and running of the first motor drives the first support rod rotates.

6. The intelligent storage and transfer station according to claim 3, wherein the horizontal driving assembly comprises a pair of horizontal rods arranged at intervals and a pair of vertical rods connected to a same side of the two horizontal rods respectively, the carrier bracket is positioned between the pair of horizontal rods and can slide along the horizontal rods, and the vertical rods are connected with the vertical driving assembly.

7. The intelligent storage and transfer station according to claim 6, wherein two ends of the vertical rod are provided with fifth driving wheels, the fifth driving wheels on a same side of the two vertical rods are sleeved and connected through a third synchronous belt, the vertical rod is fixed with a second motor, and the second motor is configured to drive the third synchronous belt.

8. The intelligent storage and transfer station according to claim 7, wherein the fifth driving wheels on one side of the two vertical rods close to the second motor are connected by a driving rod, the driving rod is provided with a sixth driving wheel at a middle part thereof, a movable end of the second motor is provided with a seventh driving wheel, the sixth driving wheel and the seventh driving wheel are sleeved and connected by a fourth synchronous belt, and running of the second motor drives the driving rod to rotate, so that the fifth driving wheel close to the second motor rotates and drives the third synchronous belt, to drive the carrier bracket slides along the horizontal rod.

9. The intelligent storage and transfer station according to claim 6, wherein upper and lower sides of the carrier bracket each is provided with a first pulley, and sides of the two first pulleys close to each other are in contact with sides of the two horizontal rods away from each other respectively.

10. The intelligent storage and transfer station according to claim 9, wherein a second pulley is provided on one side of the two vertical rods away from each other, the vertical driving assembly comprises a pair of second support rods vertically spaced at intervals, sides of the two second pulleys close to each other are respectively abutted on sides of the two second support rods away from each other.

11. The intelligent storage and transfer station according to claim 1, further comprising an order entering mechanism arranged on the profile frame, the order entering mechanism comprises a fixing plate arranged on the profile frame as well as a chamber plate and a third motor arranged on the fixing plate, the fixing plate is provided with an order entering port, and the third motor drives the chamber plate to close or open the order entering port.

12. The intelligent storage and transfer station according to claim 11, wherein the fixing plate is provided with a sliding pole, the sliding pole is sleeved with a sliding block fixedly connected with the chamber plate, and the third motor drives the sliding block to move along the sliding pole, so as to drive the chamber plate to slide.

13. The intelligent storage and transfer station according to claim 12, wherein a movable end of the third motor is connected to an eighth driving wheel, the fixing plate is provided with a ninth driving wheel spaced from the eighth driving wheel, the eighth driving wheel and the ninth driving wheel are sleeved and connected by a fifth synchronous belt, the fifth synchronous belt is arranged in parallel with the sliding pole, the sliding block is fixedly connected to the fifth synchronous belt, and when the third motor drives the eighth driving wheel to rotate, the fifth synchronous belt is driven to drive the sliding block to move along the sliding pole.

14. The intelligent storage and transfer station according to claim 1, wherein the docking mechanism comprises a tenth driving wheel fixed on a top of the profile frame and an eleventh driving wheel provided on a top of the hatch door, the tenth driving wheel and the eleventh driving wheel are sleeved and connected via a sixth synchronous belt, the top of the profile frame is provided with a fourth motor, and the fourth motor drives the sixth synchronous belt to drive the hatch door to move up and down.

15. The intelligent storage and transfer station according to claim 14, wherein the receiving chamber is provided with two guiding rods on left and right sidewalls of the receiving chamber, and when a

robot enters the receiving chamber, the two guiding rods are respectively abutted on two sides of the robot.

16. The intelligent storage and transfer station according to claim 1, wherein an elastic member is provided on a side wall of the receiving chamber opposite to the hatch door, the hatch door is provided with a movable support rod bracket, one end of the support rod bracket away from the hatch door is connected to one end of a pull belt, other end of the pull belt is connected to the hatch door after bypassing a fixing member fixed on a top of the receiving chamber, when the hatch door driving assembly pulls the hatch door, the robot enters the receiving chamber and squeezes the elastic member, the support rod bracket hangs down naturally under its own gravity; when the driving assembly drives the hatch door to close the receiving chamber, lowering of the hatch door drives the pull belt to tighten, so that the support rod bracket is horizontally fixed and the robot is fixed between the elastic member and the support rod bracket.

17. The intelligent storage and transfer station according to claim 16, wherein the hatch door driving assembly comprises a driving motor, a driving shaft disposed above the hatch door, and a pair of transmitting wheels disposed on two sides of the hatch door respectively, two sides of the driving shaft are provided with driving wheels, each drive wheel is connected to a transmitting wheel on a same side through a belt, one side of the hatch door facing the receiving chamber is fixed with a pull rod, two ends of the pull rod are respectively fixed on a pair of belts, the driving motor drives the driving shaft to rotate, thereby driving the pair of belts to move up and down and driving the hatch door to open and close.

18. The intelligent storage and transfer station according to claim 17, wherein two ends of the pull rod are provided with a clamp and a fastener, and the clamp and the fastener press and fix a corresponding belt.

19. The intelligent storage and transfer station according to claim 16, wherein the hatch door is further provided with a pull belt guiding rod, the pull belt guiding rod is perpendicular to a moving direction of the hatch door, and a middle portion of the belt is wound around the pull belt guiding rod.

20. An intelligent storage and transfer system, comprising a robot and the intelligent storage and transfer station according to any one of claims 1-19.