

INTELLIGENT ROBOT ARM, INTELLIGENT STORAGE APPARATUS AND INTELLIGENT DOCUMENT ISSUANCE APPARATUS

TECHNICAL FIELD

The present disclosure relates generally to a technical field of transmission mechanism, and more particularly, to an intelligent robot arm, an intelligent storage apparatus and an intelligent document issuance apparatus.

BACKGROUND

When the documents are made, they should be stored in a centralized way and taken out in a directional way according to the target information. However, during the storage and distribution of the documents, a lot of manual intervention are still required, which leads to low efficiency, relatively high error rate, high personnel cost and is time-consuming. Moreover, documents are divided into book-type documents (such as ICAO passport/ePassport) and card-type documents (such as China ID card, Singapore ID card, Hong Kong and Macao ID cards, Bank card, etc.), which increases the workload and makes it difficult to manage intensively.

SUMMARY

The object of the present application is to provide an intelligent robot arm, an intelligent storage apparatus and an intelligent document issuance apparatus, aiming at the technical problems in the prior art of low efficiency, relatively high error rate, high personnel cost and time-consuming during the storage and distribution of the documents.

In a first aspect, an intelligent robot arm assembled on a mounting frame is provided, which reciprocates between a feeding area and a target area of the mounting frame to realize an automatic storage and retrieval of documents, wherein the target area has a plurality of storage positions for storing documents. The intelligent robot arm comprises a main control unit, a transmission mechanism and a gripping device which are both connected with and controlled by the main control unit, wherein the transmission mechanism is arranged on the mounting frame and connected with the gripping device and drives the gripping device to transmits the

documents reciprocally between the feeding area and the target area under the control of the main control unit, wherein the main control unit controls the gripping device to grip and release.

In a second aspect, an intelligent storage apparatus in communication connection with a server is provided, which comprising a mounting frame having a feeding area and a target area, a storage device arranged in the target area and the intelligent robot arm discussed above, wherein the storage device has a plurality of storage positions for storing documents and each storage position has a unique address code recorded on the server; wherein the transmission mechanism of the intelligent robot arm is arranged on the mounting frame and connected with the gripping device, the main control unit is in communication connection with the server, and the transmission mechanism drives the gripping device to reciprocate between the target area and each storage position.

In a third aspect, an intelligent document issuance apparatus in communication connection with a server is provided, which comprising a mounting frame having a feeding area and a target area, an operation component for document retrieval personnel to conduct a document retrieval operation and the intelligent robot arm discussed above. The transmission mechanism of the intelligent robot arm is arranged on the mounting frame and connected with the gripping device. The transmission mechanism, the gripping device and the operation component are connected with and controlled by the main control unit, the main control unit is in communication connection with the server, and the transmission mechanism drives the gripping device to reciprocate between the feeding area and the target area.

The intelligent robot arm, intelligent storage apparatus and intelligent document issuance apparatus according to the present disclosure has following technical effects. The intelligent robot arm comprises the main control unit, and the transmission mechanism and gripping device controlled and deployed by the main control unit, wherein the transmission mechanism is arranged on the mounting frame and connected with the gripping device, the mounting frame has the feeding area and target area, the feeding area has a plurality of storage positions for storing documents. The transmission mechanism drives the gripping device to transmit the documents reciprocally between the feeding area and the target area of the mounting frame under the control of the main control unit. In such a way, the automatic storage and retrieval of the documents can be realized. The gripping device can grip and realize the documents under the control of the main

control unit. In this way, when the batches of documents transmitted to the feeding area should be stored in the target area, the document in the feeding area can be transmitted to the target area one by one through the intelligent robot arm. When the document in a certain storage position should be taken out, the intelligent robot arm can be moved to the storage position of the document to take the document out and transmit it to the feeding area for taking away. Such that a full intelligent and automatic operation for documents storage and retrieval is realized and the storage capacity can be set according to the demand. The intelligent robot arm can completely replace the manual operation, and avoid the manual work of storing documents one by one and searching for and taking out the target documents in the target area, thus achieving the effects of fast document storage and fast and accurate removal document retrieval, saving time and effort. In addition, the storage capacity of the target area can be expended which can greatly reduce the cost investment and achieve the intelligence and automation product effect.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to more clearly illustrate the technical solution in the embodiment of the present disclosure, the drawings used in the embodiments or prior arts will be briefly introduced. It is obvious that the drawings in the following description are only some embodiments of the present application. For ordinary technicians in the present art, they can also obtain other drawings without paying creative labor according to these drawings.

Fig. 1 is a component stereogram of the intelligent robot arm provided by the first embodiment of the present application.

Fig. 2 is a local stereoscopic exploded diagram of the intelligent robot arm provided by the first embodiment of the present application.

Fig. 3 is a stereoscopic exploded diagram of the slide joint component provided by the first embodiment of the present application.

Fig. 4 is a stereoscopic exploded diagram of the vertical transmission device provided by the first embodiment of the present application.

Fig. 5 is a first schematic diagram of the power-off protection structure provided by the first embodiment of the present application.

Fig. 6 is a schematic diagram of the second schematic diagram of the power-off protection structure provided by the first embodiment of the present application.

Fig. 7 is a stereoscopic exploded diagram of the second horizontal transmission device and the gripping device provided by the first embodiment of the present application.

Fig. 8 is a component stereogram of the second horizontal transmission device and the gripping device provided by the first embodiment of the present application.

Fig. 9 is a stereogram of the intelligent storage apparatus provided by the second embodiment of the present application.

Fig. 10 is a stereogram of the storage unit provided by the second embodiment of the present application.

Fig. 11 is a stereogram of the intelligent document issuance apparatus provided by the third embodiment of the present application.

Fig. 12 is a stereogram of the intelligent document issuance apparatus provided by the fourth embodiment of the present application from another angle.

Fig. 13 is a stereogram of the invalidation device provided by the fourth embodiment of the present application.

Reference number list

Mounting frame	100	Feeding area	101
Target area	102	Intelligent robot arm	200
Transmission mechanism	210	Gripping device	220
First horizontal transmission device	211	Vertical transmission device	212
Second horizontal transmission device	213	First drive component	2111
First slide joint component	2112	First support frame	2113
First power producer	21111	First gear	21112
First gear rack	21113	Slide rail	10
Slide block	20	Slide joint slot	11

Slide protrusion	21	First slide rail	21121
First slide block	21122	Second drive component	2114
Second slide joint component	2115	Second support frame	2116
Upper crossbeam	110	Lower crossbeam	120
Second power producer	21141	Second gear	21142
Second slide block	21151	Vertical drive component	2121
Vertical fixing frame	2122	Vertical support frame	2123
Stator	21211	Rotor	21212
Vertical slide joint component	2124	Vertical frame body	21221
Vertical slide rail	21241	Vertical slide block	21242
U-shaped slot	201	Position detection component	2125
Lower detection element	21251	Upper detection element	21252
Positioning element	21253	Upper buffer element	2126
Lower buffer element	2127	Side panel	21222
Dustproof cloth	21223	Receiving slot	202
Power-off protection structure	2128	Lock head	21281
Elastic element	21282	Transmission component	21283
Drive element	21284	Through hole	203
Locking position	204	Locking inclined plane	205
Push rod	21286	Mounting housing	21285
Transmission element	21287	Open cavity	206
Third drive component	2131	Third slide joint component	2132
Third support frame	2133	Third fixing frame	2134
Third power producer	21311	Third gear	21312
Third gear rack	21313	Bar-shaped window	207
Third slide rail	21321	Third slide block	21322

Limit position detection element	2135	Rotation transmission component	214
Rotation drive source	2141	Speed reducer	2142
First roller	2143	Second roller	2144
Waste recycling structure	446	Threading hole	208
Position limiting block	2136	Angle limiting detection component	2145
First angle limit detection element	21451	Second angle limit detection element	21452
Gripping power producer	221	Gripping component	222
Gripping support frame	223	First gripper	2221
Second gripper	2222	Guiding inclined plane	209
First positioning block	2223	Second positioning block	2224
Identification unit	224	RFID module	2241
OCR module	2242	Gripping detection unit	225
Target detection unit	226	Guiding frame	227
Guiding structure	2271	Guiding slot	2001
Connection component	228	Guiding rod	2281
U-shaped frame	2272	Guiding slide joint component	2283
Head end	2002	Tail end	2003
Intelligent storage apparatus	300	Storage device	310
Storage position	301	Transmission area	103
Transmission opening	104	Clamping structure	311
Elastic plate	312	Rebound opening	302
Storage unit	313	Positioning plate	130
Transmission space	105	Intelligent document issuance apparatus	400
Operation component	410	Touch screen	411

Camera	412	Fingerprint instrument	413
Special code identifier	414	Document retrieval housing	420
Document entry opening	106	Card retrieval opening	107
Book retrieval opening	108	Transmission space	109
Guiding plate	430	Invalidation device	440
Invalidation frame body	441	Invalidation drive source	442
Moveable frame body	443	First invalidation structure	444
First invalidation position	401	First invalidation space	402
Second invalidation space	403	Second invalidation position	404
Card invalidation opening	405	Book invalidation opening	406
Invalidation cutter	4441	Pressing part	4442
Second invalidation structure	445		

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In order to make the object, technical scheme and advantages of the present application more clear, the present application will be further described in detail in combination with the drawings and the embodiments. It should be understood that the specific embodiments described herein are only used to explain the present application and are not used to limit the present application.

It should be noted that when an element/component is mentioned as being "fixed" or "arranged" on another element/component, it can be directly on another element/component or it may be indirectly fixed or arranged on another element/component through a third element/component. When an element/component is mentioned as being "connected" with another element/component, it may be directly connected with another element/component or it may be indirectly connected to another element/component through a third component.

It should be noted that the technical terms, such as "length", "width", "upper", "lower", "front", "back", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer", indicating the orientation or position relationship are based on the orientation or position relationship shown in the attached drawings. They are just for the description convenience and

simplifying, rather than indicating or implying that the device or element referred to must have the specific orientation, or be constructed and operated in the specific orientation, and cannot be understood as the limitation of the present application.

In addition, the terms "first" and "second" are used for descriptive purposes only and cannot be understood as indicating or implying the relative importance or implicitly indicating the number of technical features. Thus, the features defined with "first" and "second" can explicitly or implicitly include one or more of these features. In the description of the present application, "a plurality of" means two or more, unless otherwise is specifically defined.

Embodiment one

When simultaneously referring Figs.1-2, the first embodiment of the present application has provided an intelligent robot arm for transmitting documents which are divided into book-type documents (such as passport) and card-type documents (such as ID card, Hong Kong and Macao passport, Bank card, etc.). The intelligent robot arm 200 given in this embodiment is not only applied to document transmission, but also can be applied to other material transmission without restriction. The intelligent robot arm 200 is assembled on the mounting frame 100 and reciprocates between the feeding area 101 and the target area 102 of the mounting frame 100 for the automatic transmission of the documents. The target area 102 may be an area for storing the documents or an area for outputting the documents. The feeding area 101 belongs to the document supply area. The intelligent robot arm 200 can be used to transmit the document in the feeding area 101 to the target area 102, or retrieve the document in the target area 102 and return it back to the feeding area 101 to realize the automatic reciprocating transmission operation. The intelligent robot arm 200 comprises a main control unit and a transmission mechanism 210 and a gripping device 220 which are both connected with and controlled by the main control unit. The transmission mechanism 210 is arranged on the mounting frame 100 and connected with the gripping device 220, and drives the gripping device 220 to transmits the documents reciprocally between the feeding area 101 and the target area 102 under the control of the main control unit. The main control unit controls the gripping device 220 to grip and release.

In this embodiment, the intelligent robot arm 200 comprises the main control unit, and the transmission mechanism 210 and gripping device 220 controlled and deployed by the main control unit. The transmission mechanism 210 is arranged on the mounting frame 100 and

connected with the gripping device 220. The mounting frame 100 has a feeding area 101 and a target area 102. Under the control of the main control unit, the transmission mechanism 210 drives the gripping device 220 to transmit the documents reciprocally between the feeding area 101 and the target area 102 of the mounting frame 100, so as to realize the automatic storage and retrieval of the documents. The gripping device 220 can grip and release the documents under the control of the control unit. In this way, the intelligent robot arm 200 can be used to transmit the documents in the feeding area 101 to the target area 102 one by one, or take out the documents in the target area 102 and transmit it to the feeding area 101, so as to realize the full intelligence and automation of document management. The intelligent robot arm 200 can completely replace the manual operation, and avoid the manual work of storing documents one by one and searching for and taking out the target documents in the target area, thus achieving the effects of fast document storage and fast and accurate removal document retrieval, saving time and effort, greatly reducing the cost investment and achieving the intelligence and automation product effect.

When simultaneously referring Figs.1-3, the transmission mechanism 210 comprises a first horizontal transmission device 211, a vertical transmission device 212, and a second horizontal transmission device 213, which are all connected with and controlled by the main control unit.

The first horizontal transmission device 211 is arranged on the mounting frame 100 and connected with the vertical transmission device 212, and drives the vertical transmission device 212 to reciprocate along the first horizontal direction in the horizontal plane.

The vertical transmission device 212 is connected with the second horizontal transmission device 213, and drives the second horizontal transmission device 213 to reciprocate in the vertical direction.

The second horizontal transmission device 213 is connected with the gripping device 220, and drives the gripping device 220 to reciprocate along the second horizontal direction in the horizontal plane. There is an angle θ between the second horizontal direction and the first horizontal direction, and the angle θ satisfies: $0^\circ < \theta < 180^\circ$.

In this embodiment, the gripping device 220 is brought to move along the first horizontal direction, the second horizontal direction and the vertical direction through the first horizontal transmission device 211, vertical transmission device 212, and second horizontal transmission

device 213 of the transmission mechanism 210. Generally, the angle θ between the second horizontal direction and the first horizontal direction is 90 degrees, that is, the gripping device 220 can displace and transmit in the three-dimensional space formed by the X-axis (the first horizontal direction) and the Y-axis (the second horizontal direction), and Z-axis (the vertical direction) freely, thus improving the space range and flexibility of the document transmission, as shown in Figs.1-2.

The first horizontal transmission device 211 comprises a first drive component 2111, a first slide joint component 2112 and a first support frame 2113. The first slide joint component 2112 is connected between the mounting frame 100 and the first support frame 2113, so that the slide direction of the first support frame 2113 relative to the mounting frame 100 is the first horizontal direction. The first drive component 2111 drives the first support frame 2113 to slide reciprocally along the first horizontal direction under the control of the main control unit, while the vertical transmission device 212 is fixedly connected with the first support frame 2113. In this way, at the same time when the first drive component 2111 drives the first support frame 2113 to slide reciprocally along the first horizontal direction, it also drives the vertical transmission device 212 fixed on the first support frame 2113 to slide reciprocally along the first horizontal direction. In addition, as the gripping device 220 is indirectly connected with the first support frame 2113 through the vertical transmission device 212 and the second horizontal transmission device 213, and the vertical transmission device 212 is connected with the second horizontal transmission device 213, so the gripping device 220 is driven to move along the first horizontal direction.

The first drive component 2111 comprises a first power producer 21111, a first gear 21112 and a first gear rack 21113. The first power producer 21111 is fixed on the first support frame 2113, and its power output shaft is connected with the first gear 21112 to drive the first gear 21112 to rotate forward and backward synchronously. The first gear rack 21113 is fixed on the mounting frame 100 and engaged with the first gear 21112. In this way, the forward and backward engagement movement of the first gear 21112 and the first gear rack 21113 is transformed into the forward and backward movement of the first support frame 2113 relative to the first gear rack 21113. The extension direction of the first gear rack 21113 is the first horizontal direction. In this embodiment, the first power producer 21111 is a driving motor.

According to the acquired signal, the main control unit controls the starting time, the forward rotation and backward rotation of the driving motor.

The first gear 21112 and the first gear rack 21113 can be engaged by straight teeth or helical teeth engagement.

In order to achieve the stable movement and accurate directional transmission effect, the matching mode of the slide rail 10 and slide block 20 is usually adopted, which generally has two structural schemes. In scheme 1, the slide rail 10 is long while the slide block 20 is short, the extension direction of the slide rail 10 is consistent with the predetermined transmission direction, and the slide block 20 and the slide rail 10 are slidably connected and cooperated with each other, and slide along the extension direction of the slide rail 10. In scheme 2, the slide rail 10 is short while the slide block 20 is long, the extension direction of block 20 is consistent with the predetermined transmission direction, and the slide block 20 and the slide rail 10 are slidably connected and cooperated with each other, and slide along the extension direction of the slide block 20. The slide joint structure of the slide rail 10 and the slide block 20 usually includes the slide joint slot 11 and the slide protrusion 21 inserted into and slidable relative to the slide joint slot. The slide joint slot 11 and the slide protrusion 21 can be respectively arranged on the slide rail 10 and slide block 20 to realize the slide joint cooperation relationship between slide rail 10 and slide block 21, as shown in Fig. 3.

When simultaneously referring Figs.1-3, the first slide joint component 2112 comprises at least one first slide rail 21121 and at least one first slide block 21122. The specific structure scheme can employ the above scheme 1 or 2 of the slide rail 10 and slide block 20. The long element (the slide rail 10 in the scheme 1 or the slide block 20 in the scheme 2) is fixed the mounting frame 100, while the short element (the slide block 20 in the scheme 2 or the slide rail 10 in the scheme 1) is fixed on the first support frame 2113. The short element slides along the extension direction of the long element, while the extension direction of the long element is the same as that of the first gear rack 21113. In this way, the first support frame 2113 and the mounting frame 100 are connected through the first slide joint component 2112, so as to realize the stable support of the first support frame 2113 on the one hand, and realize the directional reciprocating movement of the first support frame 2113 along the first horizontal direction on the

other hand and improve the stability of its movement, that is, improve the stability of the reciprocating movement of the gripping device 220 along the first horizontal direction.

In this embodiment, the first slide joint component 2112 adopts the above scheme 1. The length direction of each first slide rail 21121 and the length direction of the first gear rack 21113 are the same as the first horizontal direction.

Preferably, at least one first slide block 21122 matched with each first slide rail 21121 can be configured, and the number of which can be determined according to specific requirements.

Preferably, there are two first slide joint components 2112 having the same slide direction, arranged parallel to each other with intervals. Both first slide joint components 2112 are connected with the first support frame 2113 and the mounting frame 100, which can further improve the movement stability of the gripping device 220 along the first horizontal direction. Preferably, the first drive component 2111 is located between the two first slide joint components 2112.

When simultaneously referring Figs.1-3, in order to better improve the transmission stability of the gripping device 220 along the first horizontal direction, the first horizontal transmission device 211 further comprises a second drive component 2114, a second slide joint component 2115 and a second support frame 2116. The second slide joint component 2115 is connected between the mounting frame 100 and the second support frame 2116, so that the slide direction of the second support frame 2116 relative to the mounting frame 100 is the first horizontal direction. The second drive component 2114 drives the second support frame 2116 to slide reciprocally along the first horizontal direction and synchronized with the first support frame 2113 under the control of the main control unit, while the vertical transmission device 212 is fixedly connected with the second support frame 2116. In this way, the first drive component 2111 and the second drive component 2114 are turned on at the same time to drive the first support frame 2113 and the second support frame 2116 to slide reciprocally along the first horizontal direction, and also drive the vertical transmission device 212 to slide reciprocally along the first horizontal direction. In such a way, the smoothness and stability of the slide along the first horizontal direction can be improved, avoiding the unstable transmission, reduced accuracy, and even reduce overall service life, resulted by the offset caused by starting

just one end but delaying the other end. In addition, the transmission stroke of the gripping device 220 in the vertical direction is effectively expanded to meet the use demand. The two ends of the vertical transmission device 212 are respectively fixed on the first support frame 2113 and the second support frame 2116.

The mounting frame 100 comprises an upper crossbeam 110 and a lower crossbeam 120 arranged parallel to each other with intervals. The first slide joint component 2112 is connected with the lower crossbeam 120 and the first support frame 2113, the second slide joint component 2115 is connected with the upper crossbeam 110 and the second support frame 2116. The two ends of the vertical transmission device 212 are respectively fixed on the first support frame 2113 and the second support frame 2116. The distance between the upper crossbeam 110 and lower crossbeam 120 is determined by the vertical stroke of the gripping device 220.

The second drive component 2114 comprises a second power producer 21141, a second gear 21142 and a second gear rack (not shown). The second power producer 21141 is fixed on the second support frame 2116, and its power output shaft is connected with the second gear 21142 to drive the second gear 21142 to rotate forward and backward synchronously. The second gear rack 21143 is fixed on the mounting frame 100 and engaged with the second gear 21142. In this way, the forward and backward engagement movement of the second gear 21142 and the second gear rack 21143 is transformed into the forward and backward movement of the second support frame 2116 relative to the second gear rack 21143. The extension direction of the second gear rack 21143 is the first horizontal direction. In this embodiment, the second power producer 21141 is a driving motor. According to the acquired signal, the main control unit controls the synchronous starting time, the forward rotation and backward rotation of the first power producer 21111 and the second power producer 21141 to synchronize the moving direction and speed of the first support frame 2113 and second support frame 2116.

The second gear 21142 and the second gear rack 21143 can be engaged by straight teeth or helical teeth.

When simultaneously referring Figs.1-3, the second slide joint component 2115 comprises at least one second slide rail (not shown) and at least one second slide block 21151. The specific structure scheme can employ the above scheme 1 or 2 of the slide rail 10 and slide block 20. The long element (the slide rail 10 in the scheme 1 or the slide block 20 in the scheme

2) is fixed the mounting frame 100, while the short element (the slide block 20 in the scheme 2 or the slide rail 10 in the scheme 1) is fixed on the second support frame 2116. The short element slides along the extension direction of the long element, while the extension direction of the long element is the same as that of the second gear rack. In this way, the second support frame 2116 and the mounting frame 100 are connected through the second slide joint component 2115, so as to realize the stable support of the second support frame 2116 on the one hand, and realize the directional reciprocating movement of the second support frame 2116 along the first horizontal direction on the other hand and improve the stability of its movement, that is, improve the stability of the reciprocating movement of the gripping device 220 along the first horizontal direction.

Preferably, there are two second slide joint components 2115 having the same slide direction, arranged parallel to each other with intervals. Both second slide joint components 2115 are connected with the second support frame 2116 and the mounting frame 100, which can further improve the movement stability of the gripping device 220 along the first horizontal direction. Preferably, the second drive component 2114 is located between the two second slide joint components 2115.

As the alternative solution to the first drive component 2111 and/or the second drive component 2114, the driving of the support frame can be realized by the cooperation of the screw rod and nut, and such alternative solution can comprises the screw rod, the power producer and the nut. The power output shaft of the power producer abuts with one end of the screw rod for driving the screw rod to rotate, and the nut is sleeved on the screw rod and thread-connected with the screw rod for circumferentially position limitation. When the screw rod rotates, the nut does not rotate with the rotation of the screw rod, but moves with the rotation of the screw rod, and the moving direction is the extension direction of the screw rod. The first and second support frames can be fixedly connected with the nuts, and the vertical transmission device 212 is fixed on the upper side of the support frame to realize reciprocating movement along the first horizontal direction with the vertical transmission device 212. The first horizontal direction is the same as the length direction of the screw rod.

When simultaneously referring Figs.2-4, the vertical transmission device 212 comprises a vertical drive component 2121, a vertical fixing frame 2122 and a vertical support frame 2123.

The two ends of the vertical fixing frame 2122 are fixedly connected with the first support frame 2113 and the second support frame 2116 respectively. The vertical drive component 2121 drives the vertical support frame 2123 to slide reciprocally along the vertical direction relative to the vertical fixing frame 2122 under the control of the main control unit. The second horizontal transmission device 213 is fixedly connected with the vertical support frame 2123, that is, indirectly drives the gripping device 220 to displace along the vertical direction.

In this embodiment, the vertical drive component 2121 is a linear motor, that is, the vertical drive component 2121 includes a primary winding and a secondary winding. Its working principle is as follows. When the primary winding is connected with the AC power supply, the traveling wave magnetic field will be generated in the air gap. When cutting by the traveling wave magnetic field, the secondary winding will induce the electromotive force and generate the current which will act with the magnetic field in the air gap to generate the electromagnetic thrust, that is, the electric energy will be converted into the mechanical energy of the straight line movement. If the primary winding (stator 21211) is fixed, the secondary winding (winding 21212) moves in the straight line under the action of thrust. Otherwise, the primary moves in the straight line. The former is selected in this embodiment. The stator 21211 is fixed on the vertical fixing frame 2122, and the rotor 21212 is fixed on the vertical support frame 2123. When powered on, the rotor 21212 is pushed to bring the vertical support frame 2123 to slide in the vertical direction relative to the vertical fixing frame 2122.

As the alternative solution, the vertical drive component 2121 can employ the cooperation of the screw rod and nut, the specific embodiment can refer to the alternative solution to the first drive component 2111 and/or the second drive component 2114.

When simultaneously referring Figs.2-4, preferably, the vertical transmission device 212 also comprises the vertical slide joint component 2124 connected with the vertical fixing frame 2122 and vertical support frame 2123 to enable the vertical support frame 2123 to slide relative to the vertical fixing frame 2122, and the sliding direction is the vertical direction. That is, the vertical support frame 2123 and the vertical fixing frame 2122 are slidably connected and cooperated with each other through the vertical slide joint component 2124. In this way, on the one hand, the directional sliding is realized, and on the other hand, the displacement of the

vertical support frame 2123 is more stable and in addition the effect of connecting the vertical support frame 2123 and the vertical fixing frame 2122 is achieved.

The vertical fixing frame 2122 comprises the vertical frame body 21221 whose two ends are respectively fixed on the first support frame 2113 and the second support frame 2116. The stator 21211 is fixed on the vertical frame body 21221. The vertical slide joint component 2124 comprises the vertical slide rail 21241 and the vertical slide block 21242, at least one of which are provided. The specific structural scheme can be scheme 1 or scheme 2 in the above structural scheme of slide rail 10 and slide block 20. Taking scheme 1 as an example, the vertical slide rail 21241 is fixed on the vertical frame body 21221, the vertical slide block 21242 is fixed on the vertical support frame 2123, and the vertical slide block 21242 is slidably connected with the vertical slide rail 21241. The sliding direction is the vertical direction. In this way, driven by the vertical drive component 2121, the vertical support frame 2123 and the vertical fixing frame 2122 are slidably connected through the vertical slide joint component 2124, so as to better realize the stable and directional (in vertical direction) reciprocating sliding of the gripping device 220.

Specifically, the vertical frame body 21221 has a vertical through U-shaped slot 201, and the stator 21211 is fixed at the slot bottom of the U-shaped slot 201 to protect the stator 21211.

Preferably, there are two vertical slide rails 21241 respectively fixed at both end surfaces of the transverse notches in the vertical frame body 21221, and the extension direction of each vertical slide rail 21241 is the same as that of the vertical frame body 21221, and all of them are the vertical direction. At least one vertical block 21242 matched with each vertical slide rail 21241 can be configured, and fixedly connected with the vertical support frame 2123. The rotator 21212 is fixed between two rows of the vertical slide rail 21241 and is opposite to the stator 21211. In this way, the supporting and sliding stability of the vertical support frame 2123 is better improved, and the vertical drive component 2121 is also protected.

As an alternative method to the slideable connection cooperation between the vertical fixing frame 2122 and the vertical support frame 2123, there can be no additional vertical slide joint component, and the vertical fixing frame 2122 and the vertical support frame 2123 can be in the slideable connection cooperation. The specific slideable connection can refer to the slideable connection structure of the slide rail 10 and the slide block 20.

Referring to Fig. 4, the vertical transmission device 212 further comprises a position detection component 2125 which further comprises the lower detection element 21251 for detecting that the vertical support frame 2123 has slidden to the lower limit position of the vertical fixing frame 2122, and the upper detection element 21252 for detecting that the vertical support frame 2123 has slidden to the upper limit position of the vertical fixing frame 2122. The lower detection element 21251 is fixed on the lower limit position of the vertical fixing frame 2122, while the upper detection element 21252 is fixed on the upper limit position of the vertical fixing frame 2122. The distance between the upper limit position and the lower limit position of the vertical fixing frame 2122 is the maximum sliding stroke of the vertical support frame 2123 in the vertical direction, that is, the sliding stroke of the gripping device 220 in the vertical direction. When it is detected that the vertical support frame 2123 has slidden to the upper limit position or the lower limit position, the main control unit controls the vertical support frame 2123 to stop. In this embodiment, the upper and lower detection elements are position sensors. The position detection component 2125 further comprises the positioning element 21253 fixed on one side of the vertical support frame 2123. When the vertical support frame 2123 is driven by the vertical drive component 2121 and has slidden to the upper limit position, the upper detection element 21252 at the upper limit position senses the positioning element 21253, and controls the vertical drive component 2121 to stop driving. Similarly, when the vertical support frame 2123 has slidden to the lower limit position, it still would be sensed and stop sliding. In this way, on the one hand, the vertical stroke can be determined; on the other hand, the safety of the vertical sliding can be better protected.

Referring to Fig. 4, the vertical support frame 2123 is provided with the upper buffer element 2126 and lower buffer element 2127. There is at least one upper buffer element 2126 fixed on the upper side of the vertical support frame 2123, while there is also at least one lower buffer element 2127 fixed on the lower side of the vertical support frame 2123. The upper buffer element 2126 and the lower buffer element 2127 have a certain cushioning performance. When the vertical support frame 2123 has slidden to the upper limit position and the lower limit position of the vertical fixing frame 2122, the upper buffer element 2126 and the lower buffer element 2127 can directly abut the extreme end of the vertical fixing frame 2122 or the first support frame 2113 and the second support frame 2116, so as to avoid the direct contact of the

rigid elements to cause their damage, reduce their service life, and generate the collision noise, etc. Therefore, the vertical support frame 2123 and the vertical fixing frame 2122 are protected.

The upper buffer element 2126 and the lower buffer element 2127 can employ the elements with cushioning effect, such as being made of rubber material, silica gel material and so on. In addition, the upper and lower buffer elements can be made of different material, according to the different stress.

Referring to Fig. 4, the vertical fixing frame 2122 further comprises the side panels 21222 formed by extending the two end surfaces of the transverse notch in the vertical frame body 21221. Each side panel 21222 extends along the length direction of the vertical frame body 21221, and the vertical slide joint component 2124 is located between the two side panels 21222. In this way, the side panels 21222 can protect the elements between them, prevent the dust and metal elements from entering to affect the normal operation of the vertical transmission device 212. Preferably, both ends of each side plate 21222 extend to and fixedly connected the first support frame 2113 and the second support frame 2116 respectively.

Referring to Fig. 4, the vertical fixing frame 2122 further comprises the dust cloth 21223 with one end fixed on the first support frame 2113, and the other end fixed on the second support frame 2116. The dust cloth 21223 is tightened between the first support frame 2113 and the second support frame 2116. The width of the dust cloth 21223 is greater than or equal to the distance between the side panels 21222 on both sides. The vertical support frame 2123 is internally sliding on the dust cloth 21223 for better protecting the elements in the vertical fixing frame 2122, preventing the dust and metal elements from entering to affect the normal operation of the vertical transmission device 212. In particular, when the vertical drive component 2121 employs the linear motor, the stator 21211 having a certain magnetic attraction is fixed on the slot bottom of the vertical frame body 21221, and requirements to be emphatically protected.

Referring to Fig. 4, it is preferred that the vertical support frame 2123 has a vertical through receiving slot 202 which is opposite to the vertical drive component 2121 for passing through the dust cloth 21223 to prepare for the subsequent fixed connection with the second horizontal conveyor 213.

Referring to Fig. 4 to Fig. 6, the vertical transmission device 212 further comprises a power-off protection structure 2128, which further including a lock head 21281, an elastic element 21282, a transmission component 21283, a drive element 21284 and a mounting housing 21285 fixed on the vertical support frame 2123. The mounting housing 21285 is provided with a through hole 203 on the side wall facing the vertical fixing frame 2122, and the transmission component 21283 is arranged in the mounting housing 21285 and electrically connected with the drive element 21284. The transmission end of the transmission component 21283 passes through the through hole 203 and is connected with the lock head 21281. The elastic element 21282 is arranged on the transmission end of the transmission component 21283 and compressed between the lock head 21281 and the mounting housing 21285.

A plurality of locking positions 204 are arranged on the surface of the vertical fixing frame 2122 facing the lock head 21281 at intervals along the vertical direction, so as to make sure that in case of the power failure happens on the drive component 2121 at any position, there is a corresponding locking position 204, so as to provide the power failure protection.

The end of the lock head 21281 facing the locking position 204 is provided with a locking inclined plane 205 used for quick direction guiding when connecting with the locking position 204, so as to improve the locking efficiency. The locking inclined plane 205 is a diagonal plane or a conical plane. In the present embodiment, the diagonal plane is employed, just as shown in Fig. 5 and Fig. 6.

When the drive element 21284 is powered on, the transmission component 21283 is pulled to displace, thus moving the lock head 21281 towards the mounting housing 21285 and compressing the elastic element 21282. At this time, a safe distance is kept between the lock head 21281 and each locking position 204, so that the vertical support frame 2123 can slide vertically and reciprocally under the drive of the vertical drive component 2121, and the lock head 21281 will not touch any elements. When the drive element 21284 is powered off, under the elastic restoring force of the elastic element 21282, the locking head 21281 is rapidly pushed to the relative locking position 204 corresponding to the power-off time and then locked and cooperated with the locking position 204. The power supply of the drive element 21284 and the vertical drive component 2121 is the same. Understandably, when the drive element 21284 is powered on, it drives the transmission component 21283 to pull the lock head 21281 to move

towards the mounting housing 21285. At the same time, the lock head 21281 and the mounting housing 21285 jointly compress the elastic element 21282. At this time, there is a certain distance between the lock head 21281 and each locking position 204, so as to ensure that the vertical support 2123 can slide reciprocally and smoothly in the vertical direction under the drive of the vertical drive component 2121. When the drive element is powered off, the elastic element 21282 has a certain elastic restoring force. In addition, the pulling force exerted on the lock head 21281 by the transmission component 21283 disappears due to the power failure of the drive element 21284. In this way, the lock head 21281 is quickly ejected under the elastic restoring force of the elastic element 21282, and locked together with the locking position 204 when the power failure occurs, so as to fix the vertical support 2123 and prevent the vertical transmission device 212 from the damage caused by the sudden drop or free fall due to the power failure.

The drive element 21284 is a stepping motor, which is an open-loop controlled motor that converts the electric pulse signal into the angular displacement. It can be understood that when the drive element 21284 is powered on, its output shaft rotates for a certain angular displacement. The transmission component 21283 connected with the output shaft is linearly displaced, and the lock head 21281 is pulled to move together. When the drive element 21284 is powered off, the power source of the output shaft disappears. Under the elastic restoring force of the elastic element 21282, the lock head 21281 is instantly ejected from the locking position 204 corresponding to the power-off time and the output shaft reverses to the initial position by the action of the elastic restoring force for the restoration.

In this embodiment, the elastic element 21282 is a spring, which can be a cylindrical spiral spring or a conical spiral spring. The specific type can be selected according to the requirements.

Referring to Fig. 4 and Fig. 5 simultaneously, the transmission component 21283 includes a push rod 21286 and a transmission element 21287 thread-connected with the output shaft of the drive element 21284. One end of the push rod 21286 is fixedly connected with the transmission element 21287, and the other end of the push rod 21286 extends through the through hole 203 and is fixedly connected with the lock head 21281. The elastic element 21282

is sleeved on the extended end of the push rod 21286, and the transmission element 21287 is circumferentially positioned in the mounting housing 21285.

In this embodiment, the center line of the push rod 21286 is the same as the output shaft axis of the drive element 21284.

In this embodiment, the drive element 21287 has an open cavity 206, and the output shaft of the drive element 21284 is inserted into the open cavity 206 from its opening and thread-connected with the opening. At the same time, the outer profile of the cross section of the drive element 21287 is non-circular, and matched with the inner wall of the mounting housing 21285 to realize the circumferential position limit of the drive element 21287. When the power output shaft has an angular displacement, the drive element 21287 displaces along the axis direction of the power output shaft for pulling the push rod 21286.

Referring to Figs. 4-6 simultaneously, as an alternative solution, the transmission component 21283 comprises a push rod 21286 and a transmission element 21287 moves synchronously with the output shaft of the drive element 21284. One end of the push rod 21286 is hinged with the transmission element 21287, and its hinged position has a certain distance from the axis. The other end of the push rod 21286 is extended out through the through hole 203 and fixedly connected with the lock head 21281. The elastic element 21282 is sleeved on the extended end of the push rod 21286. Specifically, the transmission element 21287 is a rotation wheel with an angular displacement generated together with the power output shaft, and it can be a cam or other conventional elements. One end of the push rod 21286 is hinged on the transmission element 21287 and has a certain distance from the rotation axis of the transmission element 21287. Such distance can be the rotation radius. When the power output shaft has an angular displacement, the transmission element 21287 will also have the angular displacement synchronously and pull the push rod 21286 which has a certain distance from the rotation axis to displace, so as to pull the push rod 21286.

Referring to Fig. 2, Fig.4, Figs.7-8, the second horizontal transmission device 213 comprises a third drive component 2131, a third slide joint component 2132 and a third support frame 2133. The third slide joint component 2132 is connected between the vertical support frame 2123 and the third support frame 2133 to enable the third support frame 2133 to slide relative to the vertical support frame 2123, and the sliding direction is the second horizontal

direction. Under the control of the main control unit, the third drive component 2131 drives the third support frame 2133 to slide reciprocally along the second horizontal direction. The gripping device 220 is connected with the third support frame 2133 and slides reciprocally along the second horizontal direction together with the third support frame 2133, to increase the freedom degree of the gripping device 220. There is an angle θ between the second horizontal direction and the first horizontal direction, and the angle θ satisfies: $0^\circ < \theta < 180^\circ$ and generally, θ is 90° .

The second horizontal transmission device 213 further comprises a third fixing frame 2134, one end of which is fixed on the vertical support frame 2123. Specifically, the third fixing frame 2134 is fixed on the side of the vertical support frame 2123 opposite to the vertical drive component 2121 and encloses a receiving cavity for the dust cloth 21223 to pass through, together with the receiving slot 202 of the vertical support frame 2123.

Referring to Fig. 7 and Fig. 8, the third drive component 2131 comprises a third power producer 21311, a third gear 21312 and a third gear rack 21313. The third power producer 21311 is fixed on the other end of the third fixing frame 2134. The third gear 21312 is located between the third fixing frame 2134 and the third support frame 2133, and connected with the power output shaft of the third power producer 21311 which can drive the third gear 21312 to rotate forward and backward synchronously. The third gear rack 21313 is fixed on the third support frame 2133 and engaged with the third gear 21312. In this way, the forward and reverse engagement movement of the third gear 21312 and the third gear rack 21313 is transformed into the reciprocating movement of the third support frame 2133 relative to the third fixing frame 2134. The extension direction of the third gear rack 21313 is the second horizontal direction. In this embodiment, the third power producer 21311 is a driving motor. According to the acquired signal, the main control unit controls the starting time, the forward or reverse rotation of the driving motor. The third gear rack 21313 can be integrally formed with the third support frame 2133.

In this embodiment, the third support frame 2133 is provided with a bar-shaped window 207, and its length direction is the second horizontal direction. The toothed part of the third gear rack 21313 and the third gear 21312 are exposed from the bar-shaped window 207. This is because the third fixing frame 2134 is facing the third support frame 2133, and the third power

producer 21311 is fixed on the side of the third fixing frame 2134 opposite to the third support frame 2133, that is, located on the same side with the vertical support frame 2123. The end of the power output shaft of the third power producer 21311 extends horizontally between the third fixing frame 2134 and the third support frame 2133, and the toothed part of the third gear rack 21313 is arranged upward or downward. The arrangement of the bar-shaped window 207 on the one hand can facilitate the observation about whether the third gear 21312 and the third gear rack 21313 are assembled in place thus facilitating the adjustment, and on the other hand can keep away from the third gear 21312 for avoiding the element service life reduction caused by the position interference between the third gear 21312 and the third support frame 2133 during the movement. The length of the bar-shaped window 207 may be the maximum sliding stroke of the gripping device 220 in the second horizontal direction. If the bar-shaped window 207 is too long, a plurality of reinforcing ribs can be added in it middle. In addition, the overall assembly structure between the third drive component 2131, the third fixing frame 2134 and the third support frame 2133 is compact for reducing the space occupation rate.

The third gear 21312 and the third gear rack 21313 can be engaged by straight teeth or helical teeth engagement.

When simultaneously referring Figs.3 and 7, the third slide joint component 2132 comprises at least one third slide rail 21321 and at least one third slide block 21322. The specific structure scheme can employ the above scheme 1 or 2 of the slide rail 10 and slide block 20. Take the scheme 1 for example, the third slide rail 21321 is fixed to the third support frame 2133, while the third slide block 21322 is fixed in the third fixing frame 2134. The third slide block 21322 and third slide rail 21321 are slidably connected and their sliding direction is the second horizontal direction. In this way, under the drive of the third drive component 2131, the third support frame 2133 and the third fixing frame 2134 are slidably connected through the third slide joint component 2132, so as to improve the stable and directed reciprocating movement of the gripping device 220 along the second horizontal direction.

Preferably, there are two third slide joint components 2132 having the same slide direction, arranged parallel to each other with intervals. Both third slide joint component 2132 are connected with the third support frame 2122 and the third fixing frame 2134, which can further improve the movement stability of the gripping device 220 along the second horizontal

direction. Preferably, the third drive component 2131 is located between the two third slide joint components 2132.

When referring Fig.7, the second horizontal transmission device 213 further comprises a limit position detection element 2135 fixed on the third support frame 2133 or the third fixing frame 2134 to detect the limit position when the third support frame 2133 is withdrawn, and such limit position can also be recorded as the zero position.

The limit position detection element 2135 is fixed on the transmission end of the third support frame 2133 which is opposite to the detection end of the third fixing frame 2134. Of course, another sensing element can be fixed on the third fixing frame 2134. When the limit position detection element 2135 approaches the target (the end of the third fixing frame 2134 or another sensing element) during the return stroke, it indicates that the third support frame 2133 has returned to the limit position or zero position, and the main control unit controls the third power producer 21311 to stop the power output for protection.

Referring to Fig. 2, Fig. 4, Fig. 7 and Fig. 8 simultaneously, the transmission mechanism 210 comprises a rotation transmission component 214, which is fixed on the second horizontal transmission device 213 and drives the gripping device 220 to rotate around the power output shaft axis of the rotation transmission component 214 under the control of the main control unit. The second horizontal transmission device 213 drives the rotation transmission component 214 to move reciprocally along the second horizontal direction with the gripping device 220. Combined with the above content, using the transmission mechanism 210 to drive the gripping device 220, can realize the transmission of the gripping device 220 in the first horizontal direction, the second horizontal direction, the vertical direction and the rotation direction, thus having four freedom degrees and improving the spatiality and flexibility of the transmission in an even better way.

In this embodiment, the main control unit controls the rotation transmission component 214 to drive the gripping device 220 to rotate reciprocally between the feeding area 101 and the target area 102, so as to improve the document transmission flexibility of the gripping device 220. The rotation angle is generally from 0 ° to 180 °. Of course, the range of rotation angle can be expanded if needed.

When simultaneously referring Figs.7-8, the rotation transmission component 214 further comprises a rotation drive source 2141 fixed on the transmission end of the third support frame 2133, the power output shaft of the rotation drive source 2141 is connected with the gripping device 220, and drives the gripping device 220 to rotate synchronously.

The rotation transmission component 214 further comprises a speed reducer 2142, whose power input end is connected with the power output shaft of the rotation drive source 2141, and whose power output shaft is connected with the gripping device 220. Through the arrangement of the speed reducer 2142, the output rotation speed of the rotation drive source 2141 can be effectively controlled, which enables the transmission of the gripping device 220 more stable. In this example, the rotation drive source 2141 is a driving motor while the speed reducer 2142 is a harmonic speed reducer.

The rotation transmission component 214 also comprises a first roller 2143, a second roller 2144 and a transmission belt. The first roller 2143 is sleeved on the power output shaft of the rotation drive source 2141 and rotates synchronously with the power output shaft. The second roller 2144 is connected with the power input end of the speed reducer 2142, and the speed reducer 2142 is also fixed on the transmission end of the third support frame 2133. The first roller 2143 and the second roller 2144 are located at the same side of the third support frame 2133, and the transmission belt is sleeved on both of the first roller 2143 and the second roller 2144 for power transmission. The transmission belt can be a toothed belt, which the first roller 2143 and the second roller 2144 are toothed wheels matched with it.

In order to avoid the position interference between the rotation drive source 2141 and the third fixing frame 2134, the rotation drive source 2141 is fixed on the upper or lower side of the third support frame 2133. In this way, the overall structure is more compact.

In order to adjust the tension degree of the transmission belt, the fixing position of the rotation drive source 2141 can be adjusted to realize the adjustable tension degree of the transmission belt. Or, a tensioning wheel (not shown) rotationally connected to the transmission end of the third support frame 2133 is added. The tensioning wheel is located on the same side as the first roller 2143 and the second roller 2144. The transmission belt is sleeved on the tensioning wheel. The tensioning wheel, the first roller 2143 and the second roller 2144 form a triangle together. The tension of the transmission belt can be adjusted by making the tensioning

wheel getting close to or away from the connection line between the axes of the first roller 2143 and the second roller 2144 for satisfying the usage requirement.

The speed reducer 2142 is provided with a threading hole 208 along its axis direction, and such threading hole 208 can be used for passing through each connection line and making the wiring more standardized and safer.

The third support frame 2133 is provided with a position limiting block 2136 on the surface opposite to the third fixing frame 2134. The position limiting block 2136 is fixed between the speed reducer 2142 and the extreme end of the third gear rack 21313. When the third support frame 2133 returns to the limit position, the position limiting block 2136 is close to the end of the third fixing frame 2134. The limit position detection element 2135 is fixed on the position limiting block 2136, and the detection head is opposite to the end of the third fixing frame 2134.

The position of the rotation transmission component 214 can be arranged according to the requirements, mainly according to the rotation range of the gripping device 220, such that the gripping device 220 can rotate in the vertical plane, in the horizontal plane, or in any other planes. In this embodiment, the gripping device 220 rotates in the vertical plane, the feeding area 101 is arranged under the gripping device 220, and the target area 102 is arranged on the opposite side of the gripping device 220.

Referring to Fig. 8, the rotation transmission component 214 further comprises an angle limit detection component 2145, which further includes a first angle limit detection element 21451 and a second angle limit detection element 21452, both of which are fixed on the third support frame 2133 and near the joint of the gripping device 220 and the rotation transmission component 214. In this way, the rotation angle limit position of the gripping device 220 can be detected. When detecting that the gripping device 220 has reached the limit position, the main control unit controls the rotation transmission component 214 to stop the power output, which can protect other elements outside the limit rotation range and avoid the position interference. The first and second angle limit detection elements are sensors, which are similar to the magnetic induction switch.

Referring to Fig. 2, Fig.4, Fig.7 and Fig. 8 simultaneously, the gripping device 220 comprises the gripping power producer 221, a gripping component 222 and a gripping support

frame 223, which is connected with the power output shaft of the rotation transmission component 214 and rotates synchronously with the power output shaft. The gripping power source 221 is fixed on the gripping support frame 223 and connected with the gripping component 222. Under the control of the main control unit, the gripping power producer 221 drives the gripping component 222 to grip and release. The gripping power producer 221 is a driving motor.

The gripping component 222 comprises a first gripping element 2221 and a second gripping element 2222, one end of which is fixedly connected with the two power output ends of the gripping power producer 221, and the other ends of the first gripping element 2221 and the second gripping element 2222 face each other and jointly form a gripping opening for gripping the documents. In this embodiment, the gripping ends of the first gripping element 2221 and the second gripping element 2222 are provided with a guiding inclined plane 209 on the surface opposite to the gripping opening. The guiding inclined plane 209 is a guiding surface facing towards the gripping end faces of the first and second gripping elements 2221 and 2222 and being close and inclined to the gripping opening direction. In this way, it is convenient for the gripping component 222 to store and retrieve the documents smoothly and quickly between the feeding area 101 and the target area 102.

Referring to Fig. 7 and Fig. 8 simultaneously, the first gripping element 2221 extends from its gripping end towards the second gripping element 2222 to form a first positioning block 2223 located at the tail end of the gripping opening for abutting the document when gripping the document, thus positioning the gripping operation. The contact surface of the first positioning block 2223 with the document is a plane, which increases the contact area with the document and improves the positioning accuracy.

The second gripping element 2222 extends from its gripping end towards the first gripping element 2221 to form a second positioning block 2224 located at the inner end of the gripping opening for abutting the document when gripping the document, thus positioning the gripping operation. The contact surfaces of the first positioning block 2223 and the second positioning block 2224 are coplanar, which increases the stability of the document positioning and improves the positioning accuracy.

In this embodiment, when the first gripping piece 2221 is separated from the second gripping piece 2222, both of the first positioning block 2223 and the second positioning block 2224 are exposed at the inner end of the gripping opening.

Referring to Fig. 7 and Fig. 8 simultaneously, the gripping device 220 further comprises an identification unit 224 for identifying and/or reading the document information. The identification unit 224 faces the document when the gripping component 222 grips the document, and the identification unit 224 is arranged on the gripping support frame 223 or the mounting frame 100. When the intelligent robot arm 200 is applied to the storage device, the identification unit 224 is used to obtain the document information gripped by the gripping component 222, and the server matches one storage position for the document in the target area 102, and associates the position information of the storage position with the document information, so that the specific position of the target document can be obtained at the first time when retrieving the document. When the document is taking out, the document information can be read and verified. When the intelligent robot arm 200 is applied to the document retrieval device, the identification unit 224 is used to obtain the document information and verify whether it is the target document. When the document in the target area 102 exceeds the preset receiving time, the intelligent robot arm 200 grips the document and obtains the document information, and the server automatically records the delay. In this embodiment, the first angle limit detection element 21451 is used to detect the vertical upward position of the gripping end of the gripping device 220, and the angle limit detection element 21452 is used to detect the vertical downward position of the gripping end of the gripping device 220.

The identification unit 224 is RFID module 2241 and/or OCR module 2242. Some document information is stored in the chip inside the document, and can be read out by the RFID module 2241. Some document information can be printed on the document, such as in the special code form (such as the bar code, two-dimensional code, special check code, etc.) or text information form, and can be identified by the OCR module 2242. Such document information comprises but not limited to the document number, type, and the identity information of the personnel to whom the document belongs, and so on.

Referring to Fig. 7 and Fig. 8 simultaneously, the gripping device 220 further comprises a gripping detection unit 225 for detecting whether there is a document on the gripping component

222 and for detecting whether the document is inserted into the specified position of the gripping component 222 when gripping the document, and the gripping detection unit 225 is arranged on the gripping support frame 223. In this way, on the one hand, it is easy to control the position of the document to ensure that the document is good gipped, and on the other hand, the scraping of other elements during transmission which may affect the normal transmission can be prevented.

In this embodiment, the gripping detection unit 225 is a sensor that can emit a laser beam. Specifically, the detection end of the gripping detection unit 225 faces the inner end of the gripping opening in which the document is inserted for detecting whether the document is inserted in place and whether there is a document on the gripping component 222.

Referring to Fig. 7 and Fig. 8 simultaneously, the gripping device 220 further comprises a target detection unit 226 for detecting whether there is a document in the target position of the target area 102 and the feeding position of the feeding area 101 when the document is stored or taken out. The target detection unit 226 is arranged on the gripping support frame 223. When the intelligent robot arm 200 is applied to the storage device, the gripping device 220 grips the document and transmits it to the target area 102. Whether there is a document in the specified target position is detected. If yes, the storage is stopped, and the detection result is fed back to the server for matching the storage address again, thus avoiding the document damage caused by the direct document storage. When the document is retrieved, whether there is a document in the target storage position is detected. If no, the document retrieval is stopped, and the reason for this is detected. In this way, it is convenient to monitor the abnormal situation and ensure the smooth access of documents. The target detection unit 226 is a sensor that can emit a laser beam.

Referring to Fig. 7 and Fig. 8 simultaneously, the gripping device 220 further comprises a guiding frame 227 arranged on the gripping support frame 223 and can be elastically retracted relative to the gripping component 222. The guiding frame 227 is provided with a guiding structure 2271 for the directional import and export of the documents. The guiding structure 2271 is opposite to the gripping component 222. When the gripping component 222 grips the document, the guiding structure 2271 can be used for the directional import of the document; when the gripping component 222 sends out the document, the guiding structure 2271 can be used for the directional export of the document. When the gripping component 222 is transmitting the document, the guiding structure 2271 can cooperate with the gripping

component 222 to support or hold the end of the document. In this way, when taking out and sending out the document, the gripping component 222 can be assisted to realize the directional import and export. In addition, during the transmission of the document, the document end can be supported or gripped for improving stability and accuracy of the retrieval, transmission and storage operations of the document, especially the book-type document, thus better regulating the book-type document and avoiding the page turning and folding.

The identification unit 224 is arranged on the guiding frame 227 and opposite to the guiding structure 2271, for the identification and reading of the document information on the guiding structure 2271 when the gripping device 220 obtains the document. In this way, before storing the document in the target area 102, a specified storage position address is matched for the document, so that the document can be stored in the target area 102 directionally. When the document is retrieved from the storage position, whether the retrieved document is the target document is verified, so that the whole operation is faster and more accurate.

Referring to Fig. 7 and Fig. 8 simultaneously, the guiding structure 2271 includes two guiding slots 2001, which are respectively arranged on the guiding frame 227. The slot openings of the two guiding slots 2001 are opposite to each other, and the extension direction of the two guiding slots 2001 is the same as that of the gripping component 222 for gripping or sending out the document. The two sides of the document are respectively inserted in the two guiding slots 2001, and can slide relative to the guiding slots 2001.

Referring to Fig. 7 and Fig. 8 simultaneously, the gripping device 220 further comprises a connection component 228 connecting the guiding frame 227 and the gripping support frame 223. The connection component 228 comprises a guiding rod 2281, an elastic member and a guiding slide joint component 2283, wherein the guiding frame 227 has a head end 2002 facing the same direction as the gripping end of the gripping component 222 and a tail end 2003 opposite to the head end 2002. The guiding frame 227 has a guiding hole (unlabeled) for inserting the guiding rod 2281 arranged at the end surface of its tail end and extended towards the head end 2002. One end of the guiding rod 2281 is fixed on the gripping support frame 223, and the other end is inserted into the guiding hole and limited therein. The elastic elements are arranged on the guiding rod 2281 and their two ends respectively press against the guiding frame 227 and the gripping support frame 223. In the natural state, the elastic elements are in the compression state,

the guiding frame 227 is far away from the tail of the gripping support frame 223, and the gripping component 222 can be located between the two guiding slots 2001 or far away from the two guiding slots 2001. When the gripping component 222 grips or stores the document, the guiding frame 227 moves to the tail part of the gripping support frame along the guiding rod 2281, and the gripping end of the gripping component 222 extends out from the head end 2002 of the guiding frame 227 to grip or store the document. At this time, the elastic elements are compressed, and the end of the guiding frame 227 abuts the target area 102 or the feeding area 101. The guiding slide joint component 2283 is connected between the guiding frame 227 and the gripping support frame 223, which can make the guiding frame 227 slide directionally and improve the smoothness and stability of the telescopic movement of the guiding frame 227. The specific structure can refer to the structure scheme of the above slide rail 10 and slide block 20.

In this embodiment, the RFID module is fixed on the guiding frame 227 and is opposite to the space between the two guiding slots 2001, which is used to identify the ID card with the chip. The guiding frame 227 is also provided with a U-shaped frame 2272 on which the OCR module is fixed opposite to the space between the two guiding slots 2001 for identifying the document with special code or text information.

In this embodiment, the gripping detection unit is fixed on the guiding frame 227 and opposite to the inner end of the gripping component 222 in the natural state. The target detection unit 226 is also fixed on the guiding frame 227 at the head end of the guiding frame 227.

The intelligent robot arm 200 further comprises a visual detection unit (not shown) for obtaining the image of the document to be gripped in the feeding area 101 and calculating its offset. The visual detection unit is arranged on the gripping device 220. The main control unit controls the movement of the transmission mechanism 210 according to the offset, and transmits the gripping device 220 to a position aligned with the document to be gripped. In this way, the accurate document positioning of the feeding area 101 is unnecessary, and the whole structure is more intelligent.

Embodiment two

When simultaneously referring Figs.9-10, and Figs.1-8 in the embodiment one, the second embodiment of the present application has provided an intelligent storage apparatus 300 in communication connection with a server, which comprising a mounting frame 100 having a

feeding area 101 and a target area 102. The intelligent storage apparatus 300 further comprises a storage device 310 arranged in the target area 102 and the intelligent robot arm 200 discussed above. The storage device 310 has a plurality of storage positions 301 for storing documents and each storage position 301 has a unique address code and each address code is recorded on the server. The address code is the spatial coordinate position of the storage position 301. The transmission mechanism 210 is arranged on the mounting frame 100 and connected with the gripping device 220, and the main control unit is in communication connection with the server. The transmission mechanism 210 drives the gripping device 220 to reciprocate between the target area 102 and the storage position 301.

In this embodiment, when the document needs to be stored, the transmission mechanism 210 is controlled by the main control unit to drive the gripping device 220 to displace to the feeding area 101, and gripping the document to be stored from the feeding area 101. At the same time, the server matches the document with one storage position 301. That is, the address code corresponding to the storage position 301 is sent to the main control unit which controls the transmission mechanism 210 to transmit the gripping device 220 to the specified storage position 301 according to the address code, align the document with the gripping device 220, and store the document. When the specified document needs to be retrieved, the server sends the specified address code to the main control unit which controls the transmission mechanism 210 to transmit the gripping device 220 to the specified storage position 301, take out the document, and transmit it to the feeding area 101, so as to complete the document retrieval operation and realize the full intelligence and automation of document storage and retrieval, and the storage capacity can be set according to the demand. The intelligent robot arm 200 can completely replace the manual operation, and avoid the manual work of storing documents one by one and searching for and taking out the target documents in the target area 102, thus achieving the effects of fast document storage and fast and accurate removal document retrieval, saving time and effort. In addition, the storage capacity of the target area 102 can be expended which can greatly reduce the cost investment and achieve the intelligence and automation product effect.

When the intelligent robot arm 200 in the first embodiment is applied on the document storage device, the target area 102 has a plurality of storage positions 301 for storing the document, and each storage position 301 has a unique address code, and each address code

contains the spatial coordinate information of the corresponding storage position 301. When the document storage operation is performed, the transmission mechanism 210 is controlled by the main control unit to drive the gripping device 220 to grip the document from the feeding area 101 and obtain the document information by the identification unit on the gripping device 220 and upload it to the server. The server matches one empty storage position 301 for the document information and sends the address code to the main control unit. The transmission mechanism 210 is controlled by the main control unit to transmit the gripping device 220 to the specified storage position 301 to store the document. When the document retrieval operation is performed, the main control unit obtains the address code of the target document issued by the server, and the transmission mechanism 210 is controlled by the main control unit to drive the gripping device 220 to grip the document from the storage position 301 corresponding to the address code in the target area 102, obtain the document information, and verify whether it is the target document, feedback the results, and transmit the document to the feeding area 101 to realize the document retrieval operation.

The feeding area 101 has a plurality of feeding positions, each of which has a unique address number stored in the server. When the intelligent robot arm 200 goes to the feeding area 101 to retrieve the document, the visual inspection unit is used to obtain the picture of the feeding area 101 and upload it to the server. The server analyzes whether each feeding position is equipped with a document, and then sends the address code of the feeding position with a document to the main control unit to control the intelligent robot arm 200 to accurately grip the document. Or the server is directly used to send the address code for the document gripping. When the document needs to be stored in the feeding area 101, the image of the feeding area 101 is also obtained and uploaded to the server to analyze whether each feeding position is empty, and then one empty feeding position is matched and its address code is sent to the main control unit to control the intelligent robot arm 200 to store the document accurately.

The storage device 310 includes a first storage unit for storing the book-type document and a second storage unit for storing the card-type document. The first storage unit and the second storage unit have multiple storage positions 301, so that the device can store the book-type document and the card-type document at the same time and enrich the storage performance.

Referring to Fig. 9 and Fig. 10, the mounting frame 100 has two transmission areas 103 each equipped with at least one intelligent robot arm 200. The feeding area 101 is equipped with two intelligent robot arms 200 positioned in the two transmission areas 103, respectively. Each feeding area 101 is at least equipped with one transmission opening 104 for document transmission. Each intelligent robot arm 200 at least corresponds to one transmission opening 104. The two transmission areas 103 are separately arranged at the two opposite sides of the target area 102. Each storage position 301 of the storage device 310 has two communicated insertion openings, which face the intelligent robot arm 200 on each side respectively. In this way, on the one hand, the storage efficiency is improved, and on the other hand, when the intelligent robot arm 200 on one side fails, the intelligent robot arm 200 on the opposite side can continue working, thus ensuring the stable and orderly storage operation. Each storage position 301 of the storage device 310 is a document storage slot arranged on the storage device 310. The document storage slots on the storage device 310 are arranged in an array, and they have two insertion openings facing the two transmission areas 103 respectively.

Referring to Fig. 9 and Fig. 10 simultaneously, at least one side of each storage position 301 is provided with a clamping structure 311 for clamping the document. The clamping end of the clamping structure 311 is inserted into the storage position 301, so that the document can be stably stored in the storage position 301 after being inserted in place.

The clamping structure 311 can be a rib plate protruded from the inner wall of each storage position 301, and clamping the document by its own space.

Alternatively, the clamping structure 311 comprises an elastic plate 312 and a rebound opening 302. The rebound opening 302 is arranged on the inner wall of each storage position 301 and extends along the document insertion direction. The two ends of the elastic plate 312 connected at the rebound opening 302 face the rebound opening 302 and extend along the document insertion direction. The elastic plate 312 is elastically bent at the rebound opening 302 to form a rebound bulge which is positioned in the storage position 301. When the document is inserted, it can elastically abut the document to stabilize the document. The rebound bulge is trapezoid, arc, V-shape and so on. The rebound opening 302 can keep away from the deformed part after the elastic deformation of the elastic plate 312. The elastic plate 312 is integrally formed or detachably connected with the storage device 310.

The storage device 310 is composed of a plurality of storage units 313 which are detachably connected together. Each storage unit 313 has a plurality of storage positions 301. In this way, it is easy to repair, maintain or replace, thus reducing the maintenance cost while satisfying the usage requirements.

The intelligent storage device 300 cooperates with the transmission robot which in communication connection with the server. The server uniformly schedules them. A transmission space 105 is arranged under the mounting frame 100 for the transmission robot to pass through. The transmission space 105 is positioned under the transmission area 103 and communicated with each transmission opening 104. The transmission robot can accommodate multiple documents (card-type documents and/or book-type documents). When the transmission robot proceeds to the transmission space 105, the feeding device accommodating the documents is pushed to the corresponding transmission opening 104 for the intelligent robot arm 200 to grip. When the specified document needs to be taken away, the intelligent robot arm 200 places the retrieved document on the feeding device of the transmission robot and sends it out by the transmission robot. In this way, the full intelligent and automatic management of the document transmission and storage can be realized.

At least one positioning plate 130 is fixed at the bottom of the mounting frame 100, and each positioning plate 130 is provided with the transmission opening 104 each arranged downward and circumferentially provided with a guiding inclined plane, so that the feeding device of the transmission robot can be quickly inserted into the transmission opening 104 along the guiding inclined plane. Even if there is a small deviation between the feeding device and the transmission opening 104, it still can be corrected due to the positioning and guiding effect of the guiding inclined plane. Preferably, the transmission opening 104 is adapted to the shape of the feeding device.

Embodiment 3

When referring to Fig. 1 in embodiment 1 and Fig. 10 in embodiment 2, the present third embodiment of the present application has provided another intelligent storage device 300, which is different from embodiment 2 in that the structure of the storage device 310 and the arrangement of the intelligent robot arm 200 corresponding to the storage device 310 are different. The similarities between the two embodiments will not be repeated, while the specific

differences are as follows. The mounting frame 100 has a transmission area 103 which is equipped with at least one intelligent robot arm 200. The feeding area 101 is positioned in the transmission area 103 and provided with at least one transmission opening 104 for document transmission, and each intelligent robot arm 200 at least corresponds to one transmission opening 104. The target area 102 is adjacent to the transmission area 103, and each storage position 301 has one insertion opening facing the intelligent robot arm 200. In this way, the access efficiency of the device is effectively improved. Each storage position 301 of the storage device 310 is a storage slot arranged on the storage device 310. Each storage position 301 of the storage device 310 is a document storage slot arranged on the storage device 310. The document storage slots on the storage device 310 are arranged in an array, and they have two insertion openings facing the two transmission areas 103 respectively.

The storage device 310 can rotate relative to the mounting frame 100 to increase the storage amount.

Embodiment 4

When simultaneously referring to Figs.11-12, and Figs. 1-8 in embodiment 1, the fourth embodiment of the present application has provided an intelligent document issuance apparatus 400 in communication connection with a server. The intelligent document issuance apparatus 400 comprises a mounting frame 100 having a feeding area 101 and a target area 102, an operation component 410 for document retrieval personnel to conduct a document retrieval operation and the intelligent robot arm 200 discussed above. The transmission mechanism 210 of the intelligent robot arm 200 is arranged on the mounting frame 100 and connected with the gripping device 220. The transmission mechanism 210, the gripping device 220 and the operation component 410 are connected with and controlled by the main control unit which is further in communication connection with the server. The transmission mechanism 210 drives the gripping device 220 to reciprocate between the feeding area 101 and the target area 102.

In this embodiment, the document retrieval personnel input information through the operation component 410, the server obtains the information and obtains the document information matched with the information, and transmits the target document to the feeding area 101. After it is in place, the main control unit controls the intelligent robot arm 200 to grip the target document and transmit it to the target area 102, and the document retrieval personnel can

take it away directly. If the document is not taken away after the preset time, the server will send the detaining signal to the main control unit, and the main control unit will control the gripping device 220 to take away the document detained in the target area 102 and put it back to the feeding area 101, so as to prevent others from taking it by mistake on the one hand and facilitate subsequent normal operation on the other hand. Through the intelligent document issuance apparatus 400, it can achieve the fast document retrieval without any manual addition, so it is convenient and fast.

The operation component 410 comprises a touch screen 411, which can provide the document retrieval operation guidance for the document retrieval personnel and be used for verification information input of the document retrieval personnel to play a human-computer interaction role.

The operation component 410 further comprises a camera 412 used to take pictures of the current document retrieval operator and store them in the server. It can also be used for face recognition and verification. In addition, it can also be used for living identification and determining whether the operator wears a mask, etc., so as to prevent illegal operation.

The operation component 410 further comprises a fingerprint instrument 413, which is used to obtain the fingerprint of the document retrieval personnel for identity verification.

The operation component 410 further comprises a special code identification device 414, and the document retrieval personnel can carry a document retrieval slip with a special code for scanning, identification and document retrieval.

The operation component 410 further comprises a printer (not shown in the figure) for printing a document retrieval voucher after the document retrieval operation.

Touch screen 411, camera 412, fingerprint instrument 413, special code identifier 414 and printer are connected with the main control unit.

The intelligent document issuance apparatus 400 further includes a document retrieval housing 420, which is wrapped on the upper and peripheral sides of the mounting frame 100, and a movable door arranged according to the needs. The touch screen 411, camera 412, fingerprint instrument 413, special code identifier 414 and printer are arranged on the same side of the document retrieval housing 420.

The feeding area 101 is provided with a document entry opening 106 and the target area 102 is provided with a document retrieval opening. The document retrieval opening comprises a card retrieval opening 107 or a book retrieval opening for transmitting the card-type or book-type document. Of course, they can share the same exit opening.

The intelligent document issuance apparatus 400 cooperates with the transmission robot in communication connection with the server. The server uniformly schedules them. A transmission space 109 is arranged under the mounting frame 100 for the transmission robot to pass through. The transmission space 109 is positioned under the transmission area 103 and communicated with the document entry opening 106. The transmission robot can accommodate multiple documents (card-type documents and/or book-type documents). When the transmission robot proceeds to the transmission space 109, the feeding device accommodating the documents is pushed to the corresponding document entry opening 106 for the intelligent robot arm 200 to grip. When the detained document needs to be taken away, the intelligent robot arm 200 places the retrieved document on the feeding device of the transmission robot and sends it out by the transmission robot. In this way, the full intelligent and automatic management of the document transmission and storage can be realized.

A guiding plate 430 provided with the document entry opening 106 is fixed at the bottom of the mounting frame 100. The document entry opening 106 is arranged downward and circumferentially provided with a guiding inclined plane, so that the feeding device of the transmission robot can be quickly inserted into the document entry opening 106 along the guiding inclined plane. Even if there is a small deviation between the feeding device and the document entry opening 106, it still can be corrected due to the positioning and guiding effect of the guiding inclined plane. Preferably, the document entry opening 106 is adapted to the shape of the feeding device.

Referring to Fig. 12 and Fig.13, the intelligent document issuance apparatus 400 further comprises an invalidation device 440 further comprising an invalidation drive source 442, an invalidation frame body 441, a movable frame body 443 arranged on the invalidation frame body 441 and an invalidation structure. The invalidation frame body 441 and the movable frame body 443 together form an invalidation space having an invalidation position for inserting document. The invalidation position is arranged on the movable frame body 443 or the invalidation frame

body 441 opposite to the movable frame body 443. The invalidation structure is arranged in the invalidation space and opposite to the invalidation position. The invalidation drive source 442 is connected with and controlled by the main control unit, and the movable frame body 443 is connected with the invalidation drive source 442 and driven by the invalidation drive source 442 to move the invalidation structure close to or far away from the invalidation position. After obtaining the new document, the document retrieval personnel need to invalidate the old document or invalid document to avoid discarding at will and then being used by the lawless people.

There are two invalidation spaces, namely the first invalidation space 402 and the second invalidation space 403. The first and second invalidation spaces 402 and 403 are respectively placed on the opposite sides of the movable frame body 443. They can be arranged at the left and right sides, the upper and lower sides without any orientation restrictions.

There are two invalidation positions, namely the first invalidation position 401 for inserting the book-type document and the second invalidation position 404 for inserting the card-type document. The first invalidation position 401 is arranged in the first invalidation space 402, the second invalidation position 404 is arranged in the second invalidation space 403. The first invalidation position 401 is arranged on the movable frame body 443 or the invalidation frame body opposite to the movable frame body 443, and the second invalidation position 404 is arranged on the movable frame body 443 or the invalidation frame body opposite to the movable frame body 443. The device can be used for getting the book-type document and the card-type document and also used for damaging the book-type document and the card-type document at the same time.

The operation side of the document retrieval housing 420 is also provided with an invalidation opening, which further comprises a card invalidation opening 405 for inserting the card-type document and a book invalidation opening 406 for inserting the book-type document. The card invalidation opening 405 is opposite to the first invalidation position 401, and the book invalidation opening 406 is opposite to the second invalidation position 404.

There are two invalidation structures, namely the first invalidation structure 444 arranged in the first invalidation space 402 and opposite to the first invalidation position 401, and the

second invalidation structure 445 arranged in the second invalidation space 403 and opposite to the second invalidation position 404.

As shown in Fig.13, the invalidation structure includes an invalidation cutter 4441 and a pressing part 4442. Before the document has been invalidated, the pressing part 4442 moves to the invalidation position and clamps the document to be invalidated together with the invalidation position. After the document is clamped, the invalidation drive source 442 drives the invalidation cutter 4441 to invalidate the document, effectively avoiding the displacement caused by external force when damaging the document is invalidated, thus preventing the occurrence of the invalidation failure. When the document has been invalidated, the invalidation cutter 4441 is driven to be firstly separated from the invalid document, and then the pressing part 4442 is driven to be separated from the invalidation position after the separation of the invalidation cutter, so that the invalid document can be quickly and smoothly separated from the invalidation cutter 4441. The first and second invalidation structures are all the above invalidation structures. The invalidation cutter 4441 can be a punching cutter or a shearing cutter. The movable frame body 443 is driven by the invalidation drive source 442 to displace between the first invalidation space 402 and the second invalidation space 403.

The invalidation device 440 further comprises a displacement drive source (not shown) connected with the invalidation frame body 441 and used to drive the invalidation frame body 441 to displace towards or away from the invalidation insertion opening, so as to ensure the safe invalidation of the document. When the document is inserted into the invalidation position, the main control unit controls the displacement drive source to displace the invalidation frame body towards the direction away from the invalidation insertion opening, which can effectively prevent the invalidation person from taking away the document during the invalidation operation which would result in the failure of normal invalidation of the document. When the document has been invalidated, the invalidation frame body 441 is driven to displace the invalidation frame body towards the invalidation insertion opening, for restoration, and then the invalidation personal can take away the invalid documents.

The invalidation device 440 further comprises a waste recycling structure 446 fixed at the bottom of the invalidation frame body 441 for recycling the waste after the document has been invalidated.

The above descriptions are only better embodiments of the present application, and not to limit the present application. Any modification, equivalent replacement and improvement made within the spirit and principle of the present application shall be included in the protection scope of the present application.

CLAIMS

1. An intelligent robot arm assembled on a mounting frame comprising a feeding area and a target area, wherein the intelligent robot arm comprises a main control unit, a transmission mechanism and a gripping device which are both connected with and controlled by the main control unit, wherein the transmission mechanism is arranged on the mounting frame and connected with the gripping device and drives the gripping device to transmits the documents reciprocally between the feeding area and the target area under a control of the main control unit, wherein the main control unit controls the gripping device to grip and release.

2. The intelligent robot arm according to claim 1, wherein the transmission mechanism comprises a first horizontal transmission device, a vertical transmission device , and a second horizontal transmission device, which are all connected with and controlled by the main control unit;

wherein first horizontal transmission device is arranged on the mounting frame and connected with the vertical transmission device, and drives the vertical transmission device to reciprocate along a first horizontal direction in a horizontal plane;

wherein the vertical transmission device is connected with the second horizontal transmission device, and drives the second horizontal transmission device to reciprocate in a vertical direction;

wherein the second horizontal transmission device is connected with the gripping device, and drives the gripping device to reciprocate along a second horizontal direction in the horizontal plane; wherein there is an angle θ between the second horizontal direction and the first horizontal direction, and the angle θ satisfies $0^\circ < \theta < 180^\circ$.

3. The intelligent robot arm according to claim 2, wherein the first horizontal transmission device comprises a first drive component, a first slide joint component and a first support frame, wherein the first slide joint component is connected between the mounting frame and the first support frame, so that a slide direction of the first support frame relative to the mounting frame is the first horizontal direction, wherein the first drive component drives the first

support frame to slide reciprocally along the first horizontal direction under the control of the main control unit, while the vertical transmission device is fixedly connected with the first support frame.

4. The intelligent robot arm according to claim 3, wherein the first horizontal transmission device further comprises a second drive component, a second slide joint component and a second support frame, wherein the second slide joint component is connected between the mounting frame and the second support frame, so that a slide direction of the second support frame relative to the mounting frame is the second horizontal direction, wherein the second drive component drives the second support frame to slide reciprocally along the first horizontal direction and synchronized with the first support frame the control of the main control unit, while the vertical transmission device is fixedly connected with the second support frame.

5. The intelligent robot arm according to claim 4, wherein the vertical transmission device comprises a vertical drive component, a vertical fixing frame and a vertical support frame; wherein two ends of the vertical fixing frame are fixedly connected with the first support frame and the second support frame respectively; wherein the vertical drive component drives the vertical support frame to slide reciprocally along the vertical direction relative to the vertical fixing frame under the control of the main control unit; wherein the second horizontal transmission device is fixedly connected with the vertical support frame.

6. The intelligent robot arm according to claim 5, wherein the vertical transmission device further comprises a power-off protection structure, which further including a lock head, an elastic element, a transmission component, a drive element and a mounting housing fixed on the vertical support frame; wherein the mounting housing is provided with a through hole on a side wall facing the vertical fixing frame, and the transmission component is arranged in the mounting housing and electrically connected with the drive element; wherein a transmission end of the transmission component passes through the through hole and is connected with the lock head; wherein the elastic element is arranged on the transmission end of the transmission component and compressed between the lock head and the mounting housing;

wherein a plurality of locking positions are arranged on a surface of the vertical fixing frame facing the lock head at intervals along the vertical direction;

wherein, the lock head has a retraction state of being pulled by the transmission component and keeping a safe distance from each locking position when the drive element is powered on, and a locking state of being extended by an elastic restoring force of the elastic element and locked with a corresponding locking position when the driving element is powered off.

7. The intelligent robot arm according to claim 6, wherein the transmission component includes a push rod and a transmission element thread-connected with an output shaft of the drive element, wherein one end of the push rod is fixedly connected with the transmission element, and the other end of the push rod extended through the through hole and is fixedly connected with the lock head; wherein the elastic element is sleeved on the extended end of the push rod, and the transmission element is circumferentially positioned in the mounting housing; or

the transmission component comprises a push rod and a transmission element moves synchronously with an output shaft of the drive element; wherein one end of the push rod is hinged with the transmission element, and its hinged position has a certain distance from an axis, and the other end of the push rod is extended out through the through hole and fixedly connected with the lock head; wherein the elastic element is sleeved on the extended end of the push rod.

8. The intelligent robot arm according to claim 5, wherein the second horizontal transmission device comprises a third drive component, a third slide joint component and a third support frame; wherein the third slide joint component is connected between the vertical support frame and the third support frame to enable the third support frame to slide relative to the vertical support frame, and the sliding direction is the second horizontal direction; wherein the third drive component drives the third support frame to slide reciprocally along the second horizontal direction under the control of the main control unit.

9. The intelligent robot arm according to any one of claims 2-8, wherein the transmission mechanism further comprises a rotation transmission component, which is fixed on the second horizontal transmission device and drives the gripping device to rotate around an power output shaft axis of the rotation transmission component under the control of the main control unit;

wherein the second horizontal transmission device drives the rotation transmission component to move reciprocally along the second horizontal direction with the gripping device.

10. The intelligent robot arm according to claim 9, wherein the gripping device comprises the gripping power producer, a gripping component and a gripping support frame which is connected with the power output shaft of the rotation transmission component and rotates synchronously with the power output shaft; wherein the gripping power source is fixed on the gripping support frame and connected with the gripping component and drives the gripping component to grip and release under the control of the main control unit.

11. The intelligent robot arm according to claim 10, wherein the gripping device further comprises an identification unit for identifying and/or reading the document information; wherein the identification unit faces the document when the gripping component grips the document, and the identification unit is arranged on the gripping support frame or the mounting frame.

12. The intelligent robot arm according to claim 10, wherein the gripping device further comprises a gripping detection unit for detecting whether there is a document on the gripping component and for detecting whether the document is inserted into a specified position of the gripping component when gripping the document, wherein the gripping detection unit is arranged on the gripping support frame.

13. The intelligent robot arm according to claim 10, wherein the gripping device further comprises a target detection unit for detecting whether there is a document in a target position of the target area and a feeding position of the feeding area when the document is stored or taken out; wherein the target detection unit is arranged on the gripping support frame.

14. The intelligent robot arm according to claim 10, wherein the gripping device further comprises a guiding frame arranged on the gripping support frame and can be elastically retracted relative to the gripping component; wherein the guiding frame is provided with a guiding structure opposite to the gripping component and used for directional importing and exporting the document when the gripping component grips the document or sends out the document, and supporting or holding an end of the document when the gripping component is transmitting the document.

15. The intelligent robot arm according to any one of claims 1-8, wherein the intelligent robot arm further comprises a visual detection unit for obtaining an image of the document to be gripped in the feeding area and calculating its offset; wherein the visual detection unit is arranged on the gripping device and the main control unit controls a movement of the transmission mechanism according to the offset, and transmits the gripping device to a position aligned with the document to be gripped.

16. An intelligent storage apparatus in communication connection with a server, comprising a mounting frame having a feeding area and a target area, a storage device arranged in the target area and the intelligent robot arm according to any one of claims 1-15, wherein the storage device has a plurality of storage positions for storing documents and each storage position has a unique address code recorded on the server; wherein the transmission mechanism of the intelligent robot arm is arranged on the mounting frame and connected with the gripping device, the main control unit is in communication connection with the server, and the transmission mechanism drives the gripping device to reciprocate between the target area and each storage position.

17. The intelligent storage apparatus according to claim 16, wherein the mounting frame has a transmission area which is equipped with at least one intelligent robot arm; wherein the feeding area is positioned in the transmission area and provided with at least one transmission opening for document transmission, wherein each intelligent robot arm at least corresponds to one transmission opening; wherein the target area is adjacent to the transmission area, and each storage position has one insertion opening facing the intelligent robot arm; or

the mounting frame has two transmission areas each equipped with at least one intelligent robot arm; wherein the feeding area is equipped with two intelligent robot arms positioned in the two transmission areas, respectively; wherein each feeding area is at least equipped with one transmission opening for document transmission; wherein each intelligent robot arm at least corresponds to one transmission opening, and the two transmission areas are separately arranged at two opposite sides of the target area; wherein each storage position of the storage device has two communicated insertion openings, which face the intelligent robot arm on each side respectively.

18. An intelligent document issuance apparatus in communication connection with a server, comprising a mounting frame having a feeding area and a target area, an operation component for document retrieval personnel to conduct a document retrieval operation and the intelligent robot arm according to any one of claims 1-15, wherein the transmission mechanism of the intelligent robot arm is arranged on the mounting frame and connected with the gripping device; wherein the transmission mechanism, the gripping device and the operation component are connected with and controlled by the main control unit, the main control unit is in communication connection with the server, and the transmission mechanism drives the gripping device to reciprocate between the feeding area and the target area.

19. The intelligent document issuance apparatus according to claim 18, wherein further comprises an invalidation device comprising an invalidation drive source, an invalidation frame body, a movable frame body arranged on the invalidation frame body and an invalidation structure; wherein the invalidation frame body and the movable frame body together form an invalidation space having an invalidation position for inserting document; wherein the invalidation position is arranged on the movable frame body or the invalidation frame body opposite to the movable frame body; wherein the invalidation structure is arranged in the invalidation space and opposite to the invalidation position; wherein the invalidation drive source is connected with and controlled by the main control unit, and the movable frame body is connected with the invalidation drive source and driven by the invalidation drive source to move the invalidation structure close to or far away from the invalidation position.

20. The intelligent document issuance apparatus according to claim 19, wherein there are two invalidation spaces, namely the first invalidation space and the second invalidation space, respectively placed on opposite sides of the movable frame body;

wherein there are two invalidation positions, namely a first invalidation position for inserting a book-type document and a second invalidation position for inserting a card-type document; wherein the first invalidation position is arranged in the first invalidation space, the second invalidation position is arranged in the second invalidation space; wherein the first invalidation position is arranged on the movable frame body or the invalidation frame body opposite to the movable frame body, and the second invalidation position is arranged on the movable frame body or the invalidation frame body opposite to the movable frame body;

wherein there are two invalidation structures, namely a first invalidation structure arranged in the first invalidation space and opposite to the first invalidation position, and a second invalidation structure arranged in the second invalidation space and opposite to the second invalidation position;

wherein the movable frame body is driven by the invalidation drive source to displace between in the first invalidation space and the second invalidation space.