SLIDING RAIL, ROBOT, CONVEYING MECHANISM, AND ROBOT LOAD DOCKING SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to the technical field of robots, and in particular, to a sliding rail, a robot, and a robot load docking system.

BACKGROUND

[0002] At present, the application scope of robots is getting wider and wider, but with the subdivision of functions, there are more and more types of robots, so that production and design of robots face problems of types are too many and standards cannot be unified. As a result, major manufacturers often only focus on their respective subdivisions, such that cost of robots remains high. For example, in the prior art, there are delivery robots specially used for delivery, disinfecting robots specially used for disinfecting operations, and firefighting robots specially used for firefighting, which cannot be integrated on a unified platform.

[0003] In view of this, it is indeed necessary to provide a robot functional module conveying mechanism, a robot, and a robot load docking system to overcome the above defect.

SUMMARY OF THE DISCLOSURE

[0004] A purpose of the present invention is to provide a sliding rail, which is mounted on a robot, so that the robot can be compatible with installing various functional modules with different functions.

[0005] In order to achieve the above purpose, a first aspect of the present invention provides a sliding rail, which includes a sliding rail body, the sliding rail body includes a put-in end and a limiting end distancing from the put-in end, and the sliding rail body is provided thereon with a self-locking mechanism, at least one power supply module, and a driving mechanism; the self-locking mechanism is arranged at the put-in end of the sliding rail body, the driving mechanism is

arranged at the limiting end of the sliding rail body, and the power supply module is arranged between the put-in end and the limiting end of the sliding rail body; the power supply module includes a power supply resilient piece, a power supply connector, and a power supply mounting base, the power supply mounting base is inserted in the sliding rail body, the power supply resilient piece has resilience and is embedded in the power supply mounting base, and a top of the power supply resilient piece protrudes from a surface of the power supply mounting base and fixes the power supply connector on the sliding rail body suspendedly, the sliding rail body defines a power supply mounting hole configured to mount the power supply mounting base.

[0006] In a preferred embodiment, the power supply mounting base defines a resilient piece mounting groove at a bottom thereof, and defines a resilient piece opening for the power supply resilient piece to extend out at a top thereof.

[0007] In a preferred embodiment, the power supply resilient piece is of a shape of an arched bridge, and has one end fixedly connected to an inside wall of the resilient piece mounting groove, another end abutting against the inside wall of the resilient piece mounting groove, and a middle part extending out of the resilient piece opening and configured to connect with the power supply connector.

[0008] In a preferred embodiment, the power supply connector includes a power supply seat connected with the power supply resilient piece and a plurality of power supply contact pieces formed by extending from an edge of the power supply seat.

[0009] In a preferred embodiment, an edge of the power supply seat is bent to form a flanging, and the flanging is cut to form a plurality of power supply contact pieces

[0010] In a preferred embodiment, the self-locking mechanism includes a rotation shaft rotatably connected with the sliding rail body, a resilient resetting sleeve sheathed on the rotation shaft, and a self-locking arm having one end inserted in the rotation shaft and connected with the resilient resetting sleeve; the sliding rail body defines a self-locking mounting groove configured to receive the

self-locking mechanism at the put-in end, an end of the self-locking arm distancing from the rotation shaft extends out of the self-locking mounting groove under action of the resilient resetting sleeve.

[0011] In a preferred embodiment, the self-locking mechanism further includes an unlocking steering gear, the unlocking steering gear includes an unlocking driving element, an unlocking swing arm, a first connecting rod, and a second connecting rod; the unlocking swing arm is connected between the unlocking driving element and the first connecting rod, the second connecting rod is rotatably connected between the first connecting rod and the self-locking arm, and the first connecting rod is further slidably connected to the sliding rail body; the unlocking driving element pushes the first connecting rod to pull the second connecting rod by swing the unlocking swing arm, such that the second connecting rod pulls the self-locking arm into the self-locking recess to complete unlocking.

[0012] In a preferred embodiment, a side of the sliding rail body away from the functional modules is provided with an unlocking bump, the unlocking bump is provided thereon with a gap groove allowing the first connecting rod to pass through, the gap groove is provided therein with an unlocking securing rod penetrating through the unlocking bump, and an end of the first connecting rod distancing from the unlocking swing arm defines an unlocking sliding slot slidably matching the unlocking securing rod.

[0013] In a preferred embodiment, the driving mechanism includes a driving motor and an output shaft connected with the driving motor, the driving motor is mounted at a bottom of the sliding rail body, and the output shaft is away from the driving motor, passes through the sliding rail body, and is provided with a force output part.

[0014] In a preferred embodiment, the driving motor is slidably connected with the sliding rail body, and a resetting spring is arranged between the driving motor and the sliding rail body.

[0015] In a preferred embodiment, a top of the driving motor is provided with a pair of mounting plates and a docking slider slidably connected between the pair

of mounting plates, the pair of mounting plates are fixedly connected with the sliding rail body, and the docking slider is connected with the driving motor to hang the driving motor below the pair of mounting plates.

[0016] In a preferred embodiment, the sliding rail is further provided with an in-place detection assembly, the in-place detection assembly includes any one of a progressive switch, a Hall sensor, and a magnetic sensing switch, and the in-place detection assembly is mounted at the limiting end.

[0017] In a preferred embodiment, the sliding rail body includes a bearing plate configured to bear objects and a positioning plate formed by extending from an edge of a side of the bearing plate, the bearing plate is provided with a plurality of load bearing wheels, the positioning plate is provided with a plurality of first positioning wheels and a plurality of second positioning wheels, and the first positioning wheels and the second positioning wheels are pressed on the objects born by the bearing plate along two different directions respectively.

[0018] In a preferred embodiment, the positioning plate is perpendicularly arranged at an edge of a side of the bearing plate, the first positioning wheels are pressed on the objects born by the bearing plate along a direction being perpendicular to the bearing plate, the second positioning wheels are pressed on the objects born by the bearing plate along a direction being perpendicular to the positioning plate, and height of the first positioning wheels is greater than height of the second positioning wheels.

[0019] A second aspect of the present invention provides a robot, which includes a chassis, a housing mounted on the chassis, and a plurality of interchangeable functional modules; the chassis is provided with a power module and a navigation module configured for autonomous navigation and walking of a robot; one end or two ends of the housing define an opening configured to receive the functional modules, the functional modules are placed into the housing through the opening of the housing, an inside wall of the housing is provided with a plurality of said sliding rails, and the sliding rails are arranged in pairs and configured to mount the functional modules.

[0020] In a preferred embodiment, a bottom of the functional module defines a

self-locking recess matching with the self-locking mechanism.

[0021] In a preferred embodiment, a bottom of the functional module is provided with a power supply socket that can mate by insertion one by one with power supply connectors.

[0022] In a preferred embodiment, the power supply socket is provided with a socket ring groove, and a bottom of the socket ring groove is provided with a plurality of power supply jack holes.

[0023] A third aspect of the present invention provides a conveying mechanism configured to connect said robot with a preset conveying apparatus, the conveying mechanism includes a carrying bracket and a synchronizing bracket that can be coupled with each other, the carrier bracket is detachably mounted on a pair of said sliding rails, the synchronizing bracket is detachably mounted on the preset conveying apparatus, the preset apparatus is configured to transport functional modules; the carrier bracket and the synchronizing bracket are respectively provided with a first synchronizing tape mechanism and a second synchronizing tape mechanism, and the functional modules are transferred between the preset conveying apparatus and a pair of sliding rails of the robot through the first synchronizing tape mechanism and the second synchronizing tape mechanism.

[0024] A fourth aspect of the present invention provides a robot load docking system, which includes the aforementioned conveying mechanism and the aforementioned robot.

[0025] The sliding rail provided by the present invention enables assembly of functional modules to achieve standardization and universality, and further enables a robot to become a multi-functional platform; at the same time, the robot can be further assembled with a conveying mechanism through the sliding rail, such that the robot can be connected with a preset conveying apparatus; furthermore, through a robot load docketing system, the robot is enabled to realize replacement of functional modules without a mechanical hand.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] In order to describe technical solutions in embodiments of the present

invention more clearly, drawings required being used in the embodiments will be simply introduced below. It should be understood that the following drawings only show some embodiments of the present invention and therefore should not be considered as any limit to the scope. For one of ordinary skill in the art, other related drawings can be obtained according to these drawings without paying creative work.

[0027] FIG. 1 is a stereoscopic view of a robot provided by the present invention.

[0028] FIG. 2 is a stereoscopic view of the robot shown in FIG. 1, wherein functional modules are detached.

[0029] FIG. 3 is a stereoscopic view of a type of functional module shown in FIG. 1.

[0030] FIG. 4 is an enlarged view of the area A shown in FIG. 3.

[0031] FIG. 5 is an enlarged view of the area B shown in FIG. 3.

[0032] FIG. 6 is a stereoscopic view of the sliding rail shown in FIG. 2.

[0033] FIG. 7 is a stereoscopic view of the sliding rail shown in FIG. 6, wherein a self-locking mechanism is disassembled.

[0034] FIG. 8 is an enlarged view of the area C shown in FIG. 7.

[0035] FIG. 9 is a stereoscopic view of the sliding rail shown in FIG. 6, wherein a power supply module is disassembled.

[0036] FIG. 10 is a stereoscopic disassembled view of the power supply module shown in FIG. 6.

[0037] FIG. 11 is a stereoscopic view of a power supply resilient piece shown in FIG. 6 mounted on a power supply mounting base.

[0038] FIG. 12 is a stereoscopic view of the power supply resilient piece shown in FIG. 6 mounted on the power supply mounting base, viewed from another angle.

[0039] FIG. 13 is a stereoscopic view of the sliding rail shown in FIG. 6, wherein a driving mechanism is disassembled.

[0040] FIG. 14 is a structural schematic view of a conveying mechanism provided by an embodiment III of the present invention.

[0041] Wherein:

[0042] 100-robot; 10-chassis; 12-housing; 14-functional module; 16-human-computer interaction module; 141-self-locking recess; 142-power supply socket; 143-docking piece; 1421-power supply jack hole; 1423-socket ring groove;

[0043] 200-sliding rail; 20-sliding rail body; 23-self-locking mechanism; 25-power supply module; 27-driving mechanism; 201-put-in end; 202-limiting end; 203-bearing plate; 204-positioning plate; 205-bearing wheel; 206-first positioning wheel; 207-second positioning wheel; 208-self-locking mounting groove; 209-unlocking bump; 210-power supply mounting hole; 211-motor hole; 2041-guiding part; 231-rotation shaft; 232-resilient resetting sleeve; 233-self-locking arm; 234-unlocking steering gear; 2331-roller; 2341-unlocking driving element; 2342-unlocking swing arm; 2343-first connecting rod; 2345-unlocking sliding slot; 251-power supply resilient piece; 252-power supply connector; 253-power supply mounting base; 2521-power supply seat; 2523-power supply contact piece; 2524-flanging; 2531-resilient piece mounting groove; 271-driving motor; 272-output shaft; 2712-mounting plate; 2713-docking slider; 2721-force output part;

[0044] 300-conveying mechanism; 30-carrier bracket; 32-synchronizing bracket.

DETAILED DESCRIPTION

[0045] In order to make purposes, technical solutions, and advantageous technical effect of the present invention be clearer and more explicit, the present invention is further described in detail below in combination with drawings and specific embodiments. It should be understood that the specific embodiments described in this specification are only intended to illustrate the present invention, but not to limit the present invention.

[0046] It should also be understood that terms used in this specification of the present invention are only for the purpose of describing particular embodiments, and are not intended to limit the present invention. As used in this specification

and the appended claims of the present invention, singular forms “a”, “an”, and “the” are intended to include plural forms unless the context clearly dictates otherwise.

[0047] It should further be understood that the term “and/or” as used in this specification and the appended claims of the present invention refers to any combination and all possible combinations of one or more of the associated listed items and includes these combinations.

[0048] Embodiment I

[0049] Referring to FIG. 1 to FIG. 5, in an embodiment I of the present invention, a robot 100 is provided. The robot 100 includes a chassis 10, a housing 12 mounted on the chassis 10, and a plurality of interchangeable functional modules 14.

[0050] Among them, the chassis 10 is provided with a power module (not shown in the drawings) and a navigation module (not shown in the drawings) so as to achieve the purpose of being capable of autonomously navigating and walking. One end or two ends of the housing 12 is/are opened so as to receive the functional modules 14, for example, the housing 12 can be of a hollowed shape and defines two openings, the functional modules 14 enters and exits the housing 12 from one opening; at the same time, an inside wall of the housing 12 has a plurality of sliding rails 200 arranged in pairs, each pair of sliding rails 200 can be used to mount one functional module 14. The functional modules 14 can be, but are not limited to, any one of a delivery functional module configured to perform delivery tasks, a disinfecting functional module configured to perform disinfecting tasks, and a firefighting functional module configured to perform firefighting tasks, that is, the robot 100 can replace corresponding functional modules 14 based on requirements of task scenes.

[0051] In this embodiment, a top of the housing 12 is further provided with a human-computer interaction module 16 and an Internet of Things module (not shown in the drawings). The human-computer interaction module 16 is used for personnel operations, and the Internet of Things module is used for acquiring and uploading task data. Among them, the Internet of Things module can be

integrated in the human-computer interaction module 16.

[0052] It should be understood that the robot 100 is provided with a plurality of interchangeable functional modules 14, and has an autonomous navigation function, so that the robot 100 can perform various tasks independently, and can replace manual work to execute tasks with certain risks, such as disinfecting and firefighting tasks, and can also replace manual work to finish tasks with a large amount of tasks (for example, express delivery tasks), so that various manual work cost can be effectively reduced.

[0053] Embodiment II

[0054] Referring to FIG. 6, in an embodiment II of the present invention, a sliding rail 200 is provided. The sliding rail 200 is mounted on a robot 100 and configured to load functional modules 14 of the robot 100. It should be understood that the function of the sliding rail 200 is used to improve universality of the robot 100, such that the robot 100 can replace corresponding functional modules 14 based on requirements of task scenes. For example, when the robot 100 is required to perform a delivery task, it is just possible to load a delivery functional module 14 on the robot 100; and when the robot 100 is required to perform a disinfecting task, it is just possible to load a disinfecting functional module 14 on the robot 100.

[0055] Specifically, the sliding rail 200 includes a sliding rail body 20, the sliding body 20 is provided with a put-in end 201 and a limiting end 202 distancing from the put-in end 201, and a functional module 14 is put into a pair of sliding rail bodies 20 along a direction from the put-in end 201 to approaching the limiting end 202. The sliding rail body 20 includes a bearing plate 203 configured to bear objects and a positioning plate 204 formed by extending from an edge of a side of the bearing plate 203, when a width of the functional module 14 matches with a distance between two positioning plates 204 of a pair of sliding rails 200, it is possible to put the functional module 14 into the pair of sliding rails 200, replacement of the functional module 14 is convenient.

[0056] Further, in order to reduce difficulty of mounting the functional module 14, the bearing plate 203 is provided thereon with a plurality of load bearing

wheels 205, the positioning plate 204 is provided thereon with a plurality of first positioning wheels 206 and a plurality of second positioning wheels 207, and the first positioning wheels 206 and the second positioning wheels 207 are pressed on the functional module 14 born by the bearing plate 203 along two different directions respectively.

[0057] It should be understood that the load bearing wheels 205, the first positioning wheel 206, and the second positioning wheel 207 can reduce friction between the functional module 14 and the slide rail body 20, thereby reducing difficulty of loading the functional module 14 and reducing abrasion of the functional module 14 and the slide rail body 20, such that the service life of the slide rail body 20 and the functional module 14 are increased. At the same time, the first positioning wheels 206 and the second positioning wheels 207 are pressed on the functional module 14 along two different directions respectively, so that the function module 14 will not be offset when sliding along the slide rail body 20, and loading accuracy of the functional module 14 can be improved.

[0058] In this embodiment, in order to ensure that the functional module 14 can slide on the sliding rail body 20 along the direction from the put-in end 201 to approaching the limiting end 202, the load bearing wheels 205, the first positioning wheel 206, and the second positioning wheel 207 are all arranged linearly along the direction from the put-in end 201 to approaching the limiting end 202. In this way, rolling directivities of the load bearing wheels 205, the first positioning wheel 206, and the second positioning wheel 207 are all consistent with a sliding direction of the functional module 14, such that a movement direction of the sliding module 14 can be effectively maintained.

[0059] Correspondingly, the positioning plate 204 is perpendicularly arranged at an edge of a side of the bearing plate 203, the first positioning wheels 206 are pressed on the functional module 14 along a direction being perpendicular to the bearing plate 203, and the second positioning wheels 207 are pressed on the functional module 14 along a direction being perpendicular to the positioning plate 204, so as to improve positioning effect of the first positioning wheels 206 and the second positioning wheels 207 on the functional module 14. At the same

time, a certain height difference is provided between the first positioning wheels 206 and the second positioning wheels 207, this can increase a lateral force area of the functional module 14, such that limiting stability of the first positioning wheels 206 and the second positioning wheels 207 is improved. For example, the first positioning wheels 206 can be arranged at a top position of the positioning plate 204, and the second positioning wheels 207 can be arranged at a middle area of the positioning plate 204, that is, it is just possible to make heights of the first positioning wheels 206 be greater than heights of the second positioning wheels 207.

[0060] In this embodiment, both the bearing plate 203 and the positioning plate 204 are made of aluminum alloy material, and the bearing plate 203 and the positioning plate 204 are manufactured by integral molding, so as to shorten production and manufacturing time and thereby improve production efficiency.

[0061] At the same time, in order to facilitate guiding the functional module 14 into the sliding rail body 20, an end of the positioning plate 204 adjacent to the put-in end 201 is provided with an inclined guiding part 2041, two guiding parts 2041 of a pair of sliding rails 20 form a trumpet opening, such that the functional module 14 can enter the sliding rail 20 more easily. It should be noted that the guiding part 2041 can also be used to mount the second positioning wheels 207 thereon, which also makes the functional module 14 enter the sliding rail 20 more easily.

[0062] Furthermore, referring to FIG. 7 and FIG. 8, in order to facilitate securing the functional module 14, the sliding rail 200 further includes a self-locking mechanism 23, the self-locking mechanism 23 is arranged at the put-in end 201 of the sliding rail body 20. Specifically, the self-locking mechanism 23 is mounted on the bearing plate 203 of the sliding rail body 20 and used to lock the functional module 14 on the sliding rail body 20 to achieve the purpose of preventing falling off, for example, it is possible to prevent the functional module 14 on the sliding rail body 20 from being stolen, and it is also possible to prevent the functional module 14 from falling off when the sliding rail body 20 is in a tilted state. Correspondingly, a bottom of the functional module

14 defines a self-locking recess 141 matching with the self-locking mechanism 23.

[0063] More specifically, the self-locking mechanism 23 includes a rotation shaft 231 rotatably connected with the sliding rail body 20, a resilient resetting sleeve 232 sheathed on the rotation shaft 231, and a self-locking arm 233 having one end inserted in the rotation shaft 231 and connected with the resilient resetting sleeve 232; correspondingly, the sliding rail body 20 defines a self-locking mounting groove 208 configured to receive the self-locking mechanism 23 at the put-in end 201; in this embodiment, the rotation shaft groove 208 is arranged at a position on the bearing plate 203 adjacent to the put-in end 201, an end of the self-locking arm 233 distancing from the rotation shaft 231 extends out of the self-locking mounting groove 208 under action of the resilient resetting sleeve 232, so as to form cooperation with the self-locking recess 141.

[0064] It should be understood that when the functional module 14 is mounted, the functional module 14 will first press the end of the self-locking arm 233 distancing from the rotating shaft 231 into the self-locking mounting groove 208; and when the self-locking recess 141 moves to a top of the self-locking arm 233, the self-locking arm 233 is ejected from the self-locking mounting groove 208 and stuck in the self-locking recess 141, so as to form self-locking of the function module 14, the structure is simple and reliable.

[0065] It should also be noted that, in order to facilitate the movement of the functional module 14 against the self-locking arm 233, the end of the self-locking arm 233 distancing from the rotating shaft 231 is provided with a roller 2331, that is, the functional module 14, when pressing against the self-locking arm 233, will form rolling fit with the roller 2331, such that a frictional force between the self-locking arm 233 and the functional module 14 can be reduced, and the service life of the self-locking mechanism 23 is improved.

[0066] At the same time, the self-locking mechanism 23 further includes an unlocking steering gear 234, the unlocking steering gear 234 is mounted on a side of the sliding rail body 20 away from the functional module 14 and connected with the self-locking arm 233. A function of the unlocking steering gear 234 is

to limit an ejecting height of the self-locking arm 233, such that the self-locking mechanism 23 cannot be self-locked, that is, the unlocking steering gear 234 is used to release the self-locked state.

[0067] Specifically, the unlocking steering gear 234 can include an unlocking driving element 2341, an unlocking swing arm 2342, a first connecting rod 2343, and a second connecting rod (not shown in the drawings); the unlocking swing arm 2342 is connected between the unlocking driving element 2341 and the first connecting rod 2343, the second connecting rod is rotatably connected between the first connecting rod 2343 and the self-locking arm 233, and the first connecting rod 2343 is further slidably connected to the sliding rail body 20. Correspondingly, a side of the sliding rail body 20 away from the functional module 14 is provided with an unlocking bump 209, the unlocking bump 209 is provided thereon with a gap groove (not shown in the drawings) allowing the first connecting rod 2343 to pass through, the gap groove is provided therein with an unlocking securing rod 2091penetrating through the unlocking bump 209, and an end of the first connecting rod 2343 distancing from the unlocking swing arm 2342 defines an unlocking sliding slot 2345 slidably matching the unlocking securing rod 2091.

[0068] It should be understood that when unlocking, the unlocking driving element 2341 pushes the first connecting rod 2343 to pull the second connecting rod by swing the unlocking swing arm 2342, such that the second connecting rod pulls the self-locking arm 233 into the self-locking recess 141 to complete the unlocking action.

[0069] Furthermore, referring to FIG. 9 to FIG. 12, the sliding rail body 20 is further provided with at least one power supply module 25 between the put-in end 203 and the limiting end 204, so as to provide electric energy for the functional module 14; correspondingly, a bottom of the functional module 14 is provided with a power supply socket 142 that can match with the power supply module 25.

[0070] Specifically, the power supply module 25 includes a power supply resilient piece 251, a power supply connector 252, and a power supply mounting base 253, the power supply mounting base 253 is inserted in the sliding rail body

20. Correspondingly, the sliding rail body 20 defines a power supply mounting hole 210 configured to mount a power supply mounting base 253, the power supply resilient piece 251 has resilience and is embedded in the power supply mounting base 253, and a top of the power supply resilient piece 251 protrudes from a surface of the power supply mounting base 253 and fixes the power supply connector 252 on the sliding rail body 20 suspendedly, the power supply connector 252 can mate by insertion with the power supply socket 142.

[0071] In this embodiment, the functional module 14 will press on the power supply connector 252 after entering the slide rail 200, so that the power supply connector 252 sinks, that is, the power supply module 25 will not affect mounting of the functional module; then after the functional module 14 is locked by the self-locking mechanism the 23, the power supply connector 252 can just be inserted into the power supply socket 142 to form electrical connection, so as to achieve the purpose of supplying power to the power supply module 25.

[0072] It should be understood that through resilient action of the power supply resilient piece 251 of the power supply module 25 and gravity action of the functional module 14, it is possible to make the power supply connector 252 and the power supply socket 142 be combined together more stably, thereby bringing better electric connection effect.

[0073] More specifically, the power supply mounting base 253 defines a resilient piece mounting groove 2531 at a bottom thereof, and defines a resilient piece opening 2532 for the power supply resilient piece 251 to extend out at a top thereof. The power supply resilient piece 251 is of a shape of an arched bridge, and has one end fixedly connected to an inside wall of the resilient piece mounting groove 2531, another end abutting against the inside wall of the resilient piece mounting groove 2531, and a middle part extending out of the resilient piece opening 2532 and configured to connect with the power supply connector 252. It should be understood that after the functional module 14 presses against the power supply connector 252, the end of the power supply resilient piece 251 abutting against the inside wall of the resilient piece mounting groove 2531 will move downwards, such that the power supply connector 252 can sink, the

structure is simple and reliable.

[0074] The power supply connector 252 includes a power supply seat 2521 connected with the power supply resilient piece 251 and a plurality of power supply contact pieces 2523 formed by extending from an edge of the power supply seat 2521, correspondingly, the power supply socket 142 is provided thereon with a plurality of power supply jack holes 1421 corresponding to the power supply contact pieces 2523 one by one, that is, when the functional module 14 is locked on the sliding rail 200, the power supply contact pieces 2523 will be inserted in the power supply jack holes 1421 one by one. It should be noted that an end of the power supply seat 2521 adjacent to the self-locking mechanism 23 should not be provided with the power supply resilient piece 251, so as to prevent the power supply resilient piece 251 from obstructing the functional module 14. For example, the power supply seat 2521 can be in a shape of a rectangular plate, the number of the power supply contact pieces 2523 can be set to be five, wherein four power supply contact pieces 2523 are respectively arranged at two sides of the power supply seat 2521, and the remained one power supply contact piece is arranged at and end of the power supply seat 2521 distancing from the self-locking mechanism 23; moreover, the power supply contact pieces 2523 have certain resilience, such that the power supply contact pieces 2523 are not prone to generate deformation during plugging and unplugging. In this embodiment, an edge of the power supply seat 2521 is bent to form a flanging 2524, and the flanging 2524 is cut to form a plurality of power supply contact pieces 2523; correspondingly, the power supply socket 142 is provided thereon with a socket ring groove 1423 that can cooperate with the flanging 2524, and forms a boss sleeved with the power supply seat 2521; the power supply jack holes 1421 are arranged at a bottom of the socket ring groove 1423, that is, when the power supply connector 252 is inserted in the power supply socket 142, the power supply seat 2521 can be just sheathed on the boss, stability of electric connection can be improved.

[0075] Furthermore, referring to FIG. 13, the sliding rail body 20 is further provided with a driving mechanism 27 at the limiting end 202, the driving

mechanism 27 is configured to connect the functional module 14 on the sliding rail body 20 and supply power to the functional module 14. For example, when the functional module 14 is a delivery functional module, the driving mechanism 27 can be used to open or close a barn door of the delivery functional module.

[0076] Specifically, the driving mechanism 27 includes a driving motor 271 and an output shaft 272 connected with the driving motor 271, the driving motor 271 is mounted at a bottom of the sliding rail body 20, and the output shaft 272 is away from the driving motor 271, passes through the sliding rail body 20, and is provided with a force output part 2721 configured to dock with the functional module 14. Correspondingly, the functional module 14 is provided with a docking piece 143 that can dock with the force output part 2721, and the sliding rail body 20 defines a motor hole 211 for the output shaft 2721 to run through. Preferably, there is gearing transmission between the force output part 2721 and the docking piece 143.

[0077] In this embodiment, the driving motor 271 is slidably connected with the sliding rail body 20, and a resetting spring (not shown in the drawings) is arranged between the driving motor 271 and the sliding rail body 20, such that the force output part 2721 and the docking piece 143 can tightly abut against each other, it is possible to improve engaging effect and improve force output efficiency. Specifically, a top of the driving motor 2721 is provided with a pair of mounting plates 2712 and a docking slider 2713 slidably connected between the pair of mounting plates 2712, the pair of mounting plates 2712 are fixedly connected with the sliding rail body 20, and the docking slider 2713 is connected with the driving motor 271 to hang the driving motor 271 below the pair of mounting plates 2712.

[0078] Further, the sliding rail 200 can be further provided with various in-place detection assemblies including a progressive switch, a Hall sensor, a magnetic sensing switch, and so on, which are configured to detect whether an engaging position of the transmission docking piece 143 is in-place or configured to detect whether the functional module 14 is mounted in-place, thereby protecting functions of detection assemblies. Specifically, the in-place detection

assemblies can be mounted at the limiting end 203 of the sliding rail 200 so as to approach the driving mechanism 27 for detection.

[0079] In conclusion, the sliding rail 200 is provided with the power supply module 25, the self-locking mechanism 23, and the driving mechanism 27, such that the sliding rail 200 can fix the functional module 14, and can also supply power to the functional module 14, and can further transmit a driving force to the functional module 14, therefore it is possible to effectively improve diversity of tasks of the robot 100.

[0080] Embodiment III

[0081] Referring to FIG. 14, in an embodiment III of the present invention, a conveying mechanism 300 is provided. The conveying mechanism 300 connects the above-mentioned robot with a preset conveying apparatus (not shown in the drawings), so as to transfer the functional module 14 between the preset conveying apparatus and the robot 100. For example, it is possible to connect a conveying line for placing a delivery function module 14 with the sliding rail 200 of the robot 100 through the conveying mechanism 300. The function of the conveying mechanism 300 is to load the delivery function module on the conveying line into the sliding rail 200 of the robot 100. It should be understood that through the conveying mechanism 300, labor cost can be reduced, and pickup and delivery efficiency of delivery tasks can be improved. Of course, the conveying mechanism 300 can also be used to convey other functional modules 14, which are not specifically limited here.

[0082] Specifically, as shown in FIG. 8 to FIG. 14, the conveying mechanism 300 includes a carrying bracket 30 and a synchronizing bracket 32 that can be coupled with each other, the carrier bracket 30 is detachably mounted on a pair of said sliding rails 200, the synchronizing bracket 32 is detachably mounted on the preset conveying apparatus, the preset conveying apparatus is configured to transport the functional module 14; the carrier bracket 30 and the synchronizing bracket 32 are respectively provided with a first synchronizing tape mechanism and a second synchronizing tape mechanism, that is, the carrier bracket 30 and the synchronizing bracket 32 can be two synchronizing tape mechanisms that can be

coupled with each other, so that the functional module 14 is transferred between the preset conveying apparatus and a pair of sliding rails 200 of the robot.

[0083] Embodiment IV

[0084] As shown in FIG. 9, FIG. 10, and FIG. 14, the present invention further provides a robot load docking system including the conveying mechanism, the sliding rail 200, and the robot 100 according to any one of the above-mentioned embodiments. It can be understood that the system can place the functional module 14 on the preset conveying apparatus, the robot 100 can automatically receive the functional module 14 from the preset conveying apparatus through the conveying mechanism, or place the functional module 14 having completed its own task into the preset conveying apparatus. No manual participation is required in this process, an automation degree of the system can be effectively improved, and the structure is simple, design and production cost can be effectively reduced.

[0085] In conclusion, the robot load docking system provided by the present invention enables the robot to dock with other conveying apparatuses for the functional module 14, and realizes mutual transferring of the functional module 14; traditional grasping mechanisms for the functional module 14, such as mechanical arms, are omitted, the structure of the system is simplified, and task execution efficiency of the robot is improved.

[0086] The present invention is not limited only to what is described in the specification and the embodiments, so for those skilled in the art, additional advantages and modifications can be easily realized, so without departing from the spirit and scope of the general concepts defined by the claims and equivalent scopes thereof, the present invention is not limited to specific details, representative apparatus, and the illustrative examples shown and described herein.

What is claimed is:

1. A sliding rail, comprising a sliding rail body, wherein the sliding rail body includes a put-in end and a limiting end distancing from the put-in end, and the sliding rail body is provided thereon with a self-locking mechanism, at least one power supply module, and a driving mechanism; the self-locking mechanism is arranged at the put-in end of the sliding rail body, the driving mechanism is arranged at the limiting end of the sliding rail body, and the power supply module is arranged between the put-in end and the limiting end of the sliding rail body; the power supply module includes a power supply resilient piece, a power supply connector, and a power supply mounting base, the power supply mounting base is inserted in the sliding rail body, the power supply resilient piece has resilience and is embedded in the power supply mounting base, and a top of the power supply resilient piece protrudes from a surface of the power supply mounting base and fixes the power supply connector on the sliding rail body suspendedly, the sliding rail body defines a power supply mounting hole configured to mount the power supply mounting base.

2. The sliding rail according to claim 1, wherein the power supply mounting base defines a resilient piece mounting groove at a bottom thereof, and defines a resilient piece opening for the power supply resilient piece to extend out at a top thereof.

3. The sliding rail according to claim 2, wherein the power supply resilient piece is of a shape of an arched bridge, and has one end fixedly connected to an inside wall of the resilient piece mounting groove, another end abutting against the inside wall of the resilient piece mounting groove, and a middle part extending out of the resilient piece opening and configured to connect with the power supply connector.

4. The sliding rail according to claim 1, wherein the power supply connector comprises a power supply seat connected with the power supply resilient piece and a plurality of power supply contact pieces formed by extending from an edge of the power supply seat.

5. The sliding rail according to claim 4, wherein an edge of the power supply

seat is bent to form a flanging, and the flanging is cut to form a plurality of power supply contact pieces.

6. The sliding rail according to claim 1, wherein the self-locking mechanism comprises a rotation shaft rotatably connected with the sliding rail body, a resilient resetting sleeve sheathed on the rotation shaft, and a self-locking arm having one end inserted in the rotation shaft and connected with the resilient resetting sleeve; the sliding rail body defines a self-locking mounting groove configured to receive the self-locking mechanism at the put-in end, an end of the self-locking arm distancing from the rotation shaft extends out of the self-locking mounting groove under action of the resilient resetting sleeve.

7. The sliding rail according to claim 6, wherein the self-locking mechanism further comprises an unlocking steering gear, the unlocking steering gear includes an unlocking driving element, an unlocking swing arm, a first connecting rod, and a second connecting rod; the unlocking swing arm is connected between the unlocking driving element and the first connecting rod, the second connecting rod is rotatably connected between the first connecting rod and the self-locking arm, and the first connecting rod is further slidably connected to the sliding rail body; the unlocking driving element pushes the first connecting rod to pull the second connecting rod by swing the unlocking swing arm, such that the second connecting rod pulls the self-locking arm into the self-locking recess to complete unlocking.

8. The sliding rail according to claim 7, wherein a side of the sliding rail body away from the functional modules is provided with an unlocking bump, the unlocking bump is provided thereon with a gap groove allowing the first connecting rod to pass through, the gap groove is provided therein with an unlocking securing rod penetrating through the unlocking bump, and an end of the first connecting rod distancing from the unlocking swing arm defines an unlocking sliding slot slidably matching the unlocking securing rod.

9. The sliding rail according to claim 1, wherein the driving mechanism includes a driving motor and an output shaft connected with the driving motor, the driving motor is mounted at a bottom of the sliding rail body, and the output shaft

is away from the driving motor, passes through the sliding rail body, and is provided with a force output part.

10. The sliding rail according to claim 9, wherein the driving motor is slidably connected with the sliding rail body, and a resetting spring is arranged between the driving motor and the sliding rail body.

11. The sliding rail according to claim 1, wherein a top of the driving motor is provided with a pair of mounting plates and a docking slider slidably connected between the pair of mounting plates, the pair of mounting plates are fixedly connected with the sliding rail body, and the docking slider is connected with the driving motor to hang the driving motor below the pair of mounting plates.

12. The sliding rail according to claim 11, wherein the sliding rail is further provided with an in-place detection assembly, the in-place detection assembly includes any one of a progressive switch, a Hall sensor, and a magnetic sensing switch, and the in-place detection assembly is mounted at the limiting end.

13. The sliding rail according to claim 1, wherein the sliding rail body comprises a bearing plate configured to bear objects and a positioning plate formed by extending from an edge of a side of the bearing plate, the bearing plate is provided with a plurality of load bearing wheels, the positioning plate is provided with a plurality of first positioning wheels and a plurality of second positioning wheels, and the first positioning wheels and the second positioning wheels are pressed on the objects born by the bearing plate along two different directions respectively.

14. The sliding rail according to claim 13, wherein the positioning plate is perpendicularly arranged at an edge of a side of the bearing plate, the first positioning wheels are pressed on the objects born by the bearing plate along a direction being perpendicular to the bearing plate, the second positioning wheels are pressed on the objects born by the bearing plate along a direction being perpendicular to the positioning plate, and height of the first positioning wheels is greater than height of the second positioning wheels.

15. A robot, comprising a chassis, a housing mounted on the chassis, and a plurality of interchangeable functional modules; wherein the chassis is provided

with a power module and a navigation module configured for autonomous navigation and walking of a robot; one end or two ends of the housing define an opening configured to receive the functional modules, the functional modules are placed into the housing through the opening of the housing, an inside wall of the housing is provided with a plurality of sliding rails according to any one of claims 1-14, and the sliding rails are arranged in pairs and configured to mount the functional modules.

16. The robot according to claim 15, wherein a bottom of the functional module defines a self-locking recess matching with the self-locking mechanism.

17. The robot according to claim 15, wherein a bottom of the functional module is provided with a power supply socket that can mate by insertion one by one with power supply connectors.

18. The robot according to claim 17, wherein the power supply socket is provided with a socket ring groove, and a bottom of the socket ring groove is provided with a plurality of power supply jack holes.

19. A conveying mechanism configured to connect a robot according to any one of claims 15-18 with a preset conveying apparatus, wherein the conveying mechanism comprises a carrying bracket and a synchronizing bracket that can be coupled with each other, the carrier bracket is detachably mounted on a pair of said sliding rails, the synchronizing bracket is detachably mounted on the preset conveying apparatus, the preset apparatus is configured to transport functional modules; the carrier bracket and the synchronizing bracket are respectively provided with a first synchronizing tape mechanism and a second synchronizing tape mechanism, and the functional modules are transferred between the preset conveying apparatus and a pair of sliding rails of the robot through the first synchronizing tape mechanism and the second synchronizing tape mechanism.

20. A robot load docking system, comprising the conveying mechanism according to claim 19 and the robot according to any one of claim 15-18.