

AUTOMATIC PARKING APPARATUS

FIELD OF THE INVENTION

[0001] The present invention relates to an automatic device, and more particularly to an automatic parking apparatus.

BACKGROUND OF THE INVENTION

[0002] With the popularity of vehicle, vehicle parking has become one of the most important facilities in the modern life. However, because of the limited parking space, drivers may spend a lot of time for finding an available parking space in a traditional parking lot. In addition, the traditional parking lot may need an extra space for the drivers to move or turn around their vehicles. Moreover, car collisions or accidents are easily happened in a traditional parking if the vehicle drivers drive without concentration.

[0003] In recent years, warehouse parking lot has become more and more popular. Unlike the traditional parking lot, drivers in the warehouse car park only need to drive their vehicles into a parking carrier, and then the parking carrier parked with vehicle will be automatically delivered to an assigned parking space by a transmitting mechanism of the warehouse parking lot. Although the warehouse parking lot can solve the aforementioned problems happened in a traditional parking lot, the mechanical equipment employed in the warehouse parking lot cannot be used in the traditional parking lot; and accordingly, plenty of time and cost are required for reconstructing a traditional parking lot into a warehouse parking lot.

SUMMARY OF THE INVENTION

[0004] An object of the present invention is to provide an automatic parking apparatus capable of being used in a traditional parking lot thereby solving the aforementioned problems.

[0005] The present invention provides an automatic parking apparatus for automatically parking a vehicle in one of a plurality of parking spaces of the parking lot. The automatic parking apparatus includes at least a self-propelled carrier and a central control device. The self-propelled carrier is adapted to carry the vehicle. The central control device is adapted to communicate with the self-propelled carrier thereby issuing a proceeding signal to the self-propelled carrier. The self-propelled carrier is further adapted to automatically move to one of the parking spaces according to the proceeding signal.

[0006] In one embodiment, the self-propelled carrier further includes a carrier platform, a moving device and a control device. The moving device is connected to the carrier platform and is adapted to drive the carrier platform to move. The control device is disposed on the carrier platform and adapted to communicate with the central control device and the moving device and control the moving device according to the proceeding signal.

[0007] In one embodiment, the automatic parking apparatus further includes a plurality of supporting devices and a plurality of upper platforms. The supporting devices are disposed in the parking spaces respectively. The self-propelled carrier further includes a plurality of lifting devices disposed on the carrier platform, and the lifting devices are adapted to support one of the upper platforms.

[0008] In one embodiment, the parking lot further includes a plurality

of identification elements. The self-propelled carrier further includes a location identification device disposed on the carrier platform. The location identification device is adapted to identify a location of the carrier platform according to the identification elements of the parking lot thereby generating an identification data, and transmit the identification data to the control device.

[0009] In one embodiment, the identification element is an identification mark, and the location identification device is an image identification device.

[0010] In one embodiment, the self-propelled carrier further includes a plate identification device disposed on the carrier platform. The plate identification device is adapted to identify a plate number of the vehicle thereby generating identification data and transmit the identification data to the control device.

[0011] In one embodiment, the self-propelled carrier further includes an anti-collision detecting device disposed on the carrier platform. The anti-collision detecting device is adapted to detect one or more objects around the carrier platform.

[0012] In one embodiment, the central control device further includes a remote connection system.

[0013] In one embodiment, the parking lot further includes a parking/pick-up area and a carrier stop area adjacent to the parking/pick-up area. The automatic parking apparatus further includes a parking/pick-up terminal disposed in the parking/pick-up area and in communication with the central control device.

[0014] In one embodiment, the automatic parking apparatus further includes a safety detecting device disposed in the parking/pick-up area.

The safety detecting device is adapted to communicate with the central control device and detect whether there is a user staying in the carrier stop area or not.

[0015] In one embodiment, the automatic parking apparatus includes more than one self-propelled carriers driven by electric power. The automatic parking apparatus further includes a plurality of electric charging devices respectively disposed in the parking spaces of the parking lot. The electric charging devices are adapted to electrically charge the self-propelled carriers.

[0016] In one embodiment, the automatic parking apparatus further includes a plurality of loading and unloading devices disposed in the parking spaces, respectively. Each loading and unloading device is adapted to move the vehicle from the self-propelled carrier to the corresponding parking space or move the vehicle from the corresponding parking space to the self-propelled carrier.

[0017] In summary, through employing the self-propelled carrier adapted to carry a vehicle to an assigned parking space in a parking lot, the automatic parking apparatus of the present invention can save the space of the parking lot. In addition, through configuring the central control device to communicate with the self-propelled carrier, assigning a parking space to the self-propelled carrier according to an actual situation of the parking lot, calculating a route according to the map of the parking lot, and transmitting the route to the self-propelled carrier thereby directing the self-propelled carrier to move to the assigned parking space according to the route, the automatic parking apparatus of the present invention can be used in a traditional parking lot thereby solving the problems in the traditional parking lot, such as the time wasting for finding a parking space,

poor space usage and easily-happened collisions.

[0018] For making the above and other purposes, features and benefits become more readily apparent to those ordinarily skilled in the art, the preferred embodiments and the detailed descriptions with accompanying drawings will be put forward in the following descriptions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

[0020] FIG. 1 is a block diagram of an automatic parking apparatus in accordance with an embodiment of the present invention;

[0021] FIG. 2 is a schematic diagram illustrating a parking lot disposed with the automatic parking apparatus of FIG. 1;

[0022] FIG. 3 is another schematic diagram illustrating a parking lot disposed with the automatic parking apparatus of FIG. 1;

[0023] FIG. 4 is a schematic top diagram of a self-propelled carrier in accordance with an embodiment of the present invention;

[0024] FIG. 5 is a flow chart of a vehicle parking process of the automatic parking apparatus in accordance with an embodiment of the present invention;

[0025] FIG. 6 is a flow chart of a vehicle pick-up process of the automatic parking apparatus in accordance with an embodiment of the present invention;

[0026] FIG. 7A is a top view of a part of an automatic parking apparatus in accordance with an embodiment of the present invention; and

[0027] FIG. 7B is a side view of a part of an automatic parking

apparatus in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0028] The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for purpose of illustration and description only. It is not intended to be exhaustive or to be limited to the precise form disclosed.

[0029] FIG. 1 is a block diagram of an automatic parking apparatus in accordance with an embodiment of the present invention. FIG. 2 is a schematic diagram illustrating a parking lot disposed with the automatic parking apparatus of FIG. 1. Please refer to FIGS. 1 and 2. As shown, the automatic parking apparatus 100 in the present embodiment, adapted to be disposed in a parking lot 200 with a plurality of parking spaces P, is for parking a vehicle C into one of the parking spaces P. The automatic parking apparatus 100 includes at least a self-propelled carrier 110 and a central control device 120. Specifically, the self-propelled carrier 110 is adapted to carry the vehicle C. The central control device 120 is adapted to communicate with the self-propelled carrier 110 and issue a proceeding signal to the self-propelled carrier 110, so that the self-propelled carrier 110 can move to one of the parking spaces P according to the proceeding signal.

[0030] In the present embodiment, the central control device 120 is exemplified by being connected with the self-propelled carrier 110 through a wireless local area network; however, it is understood that other types of connection may be employed in response to specific requirements and the present invention is not limited thereto. The central control

device 120 includes a database 121, which is stored with specific data, such as the related information of the parking spaces P, a map of the parking lot 200, the parking location, the plate number and the in and out time of each vehicle C. Thus, the central control device 120 can manage the parking lot 200 according to the data stored in the database 121. In addition, the central control device 120 is further adapted to calculate a route for the vehicle C in the parking lot 200 according to some specific factors, such as the map of the parking lot 200 and the usage of the parking spaces P. The central control device 120 then transmits the route data to the self-propelled carrier 110 thereby automatically driving the self-propelled carrier 110 to an assigned parking space P according to the route data calculated and provided by the central control device 120.

[0031] Additionally, in the present embodiment, the central control device 120 further includes a remote connection system 122, through which a user can transmit data between the remote connection system 122 and an external device. The aforementioned external device is, for example, a mobile electronic device, such as a cell-phone, a notebook or a tablet PC, and the present invention is not limited thereto. Through connecting the external device with the remote connection system 122 via internet or other specific ways, a user can be aware of the usage of the parking lot 200 and accordingly make a reservation for a vehicle parking or pick-up, thereby preventing the time waste for waiting for the vehicle parking or pick-up.

[0032] Please refer to FIG. 2. As shown, the parking lot 200 further includes parking/pick-up areas 240a, 240b and carrier stop areas 250a, 250b adjacent to the parking/pick-up areas 240a, 240b, respectively. In one embodiment, the parking/pick-up area 240a is specifically referred to

as a parking area for a driver to park the vehicle C and the parking/pick-up area 240b is specifically referred to as a pick-up area for a driver to pick up the vehicle C. The automatic parking apparatus 100 further includes parking/pick-up terminals 130a, 130b disposed in the parking/pick-up areas 240a, 240b, respectively. Both of the parking/pick-up terminals 130a, 130b are adapted to communicate with the central control device 120. In one embodiment, the parking/pick-up terminal 130a is specifically referred to as a parking terminal and the parking/pick-up terminal device 130b is specifically referred to as a pick-up terminal. The parking/pick-up terminals 130a, 130b may be connected with the central control device 120 through a local area network, but the present invention is not limited thereto. In addition, the aforementioned connections between the parking/pick-up terminals 130a, 130b and the central control device 120 may be realized by wire or wireless manners. Specifically, the parking terminal 130a is adapted to process the related procedure for vehicle parking, and the pick-up terminal device 130b is adapted to process the related procedure for vehicle pick-up. The detailed procedures of the vehicle parking and pick-up will be described below.

[0033] The parking lot 200 of FIG. 2 is exemplified by including two parking/pick-up areas 240a, 240b; however, the number of the parking/pick-up area is adjustable and the present invention is not limited thereto. For example, in one embodiment, the parking area 240a and the pick-up area 240b can be integrated into one area. In another embodiment, the number of the parking/pick-up area can be adjusted according to the number of the parking spaces P in the parking lot 200. In addition, the number of the self-propelled carrier 110 capable of being

parked in each one of the carrier stop areas 250a, 250b at the same time is not limited. In other words, each one of the carrier stop areas 250a, 250b may be capable of allowing one or more self-propelled carriers 110 to be parked at the same time.

[0034] In the present embodiment, the automatic parking apparatus 100 further includes a safety detecting device 160 disposed in each one of the parking/pick-up areas 240a, 240b. The safety detecting device 160 is adapted to communicate with the central control device 120. In one embodiment, the safety detecting device 160 is an infrared human-body sensor, but the present invention is not limited thereto. The safety detecting device 160 is adapted to detect whether there exists a user still staying on the self-propelled carrier 110 or not. Specifically, when detecting a user staying on the self-propelled carrier 110, the safety detecting device 160 is adapted to transmit a signal to the central control device 120, thereby configuring the central control device 120 to control the self-propelled carrier 110 to stay in the carrier stop areas 205a, 205b without moving so as to ensure the safety of the user.

[0035] In one embodiment, each self-propelled carrier 110 is corresponding to one parking space P. That is, the number of the self-propelled carrier 110 is equal to the number of the parking space P, and consequentially each self-propelled carrier 110 can be parked in its corresponding parking space P along with the carried vehicle C. In another embodiment as illustrated in FIG. 3, each self-propelled carrier 110 is corresponding to a plurality of parking spaces P'. That is, the number of the self-propelled carrier 110 is smaller than the number of the parking space P', and consequentially each self-propelled carrier 110 will not be parked in the corresponding parking spaces P' along with the

carried vehicle C. In other words, each parking space P' is further disposed with a loading and unloading device 280, which is for unloading the vehicle C from the self-propelled carrier 110 to the parking space P' or loading the vehicle C parked in the parking space P' to the self-propelled carrier 110. The loading and unloading device 280 is adapted to communicate with the central control device 120 (shown in FIG. 1). In one embodiment, the loading and unloading device 280 is realized by a manipulator.

[0036] FIG. 4 is a schematic top diagram of the self-propelled carrier 110 in accordance with an embodiment of the present invention. Please refer to FIGS. 2 and 4. As shown, the self-propelled carrier 110 in the present embodiment includes a carrier platform 111, a moving device 112 and a control device 113. The carrier platform 111 is adapted to support a vehicle C. The moving device 112 is connected to the carrier platform 111 and is adapted to drive the carrier platform 111 to move. The control device 113 is disposed on the carrier platform 111 and is adapted to communicate with the central control device 120 (shown in FIG. 1) and the moving device 112. Specifically, the control device 113 is adapted to control the moving device 112 according to the proceeding signal issued from the central control device 120. In one embodiment, the control device 113 and other related components and circuits can be disposed in or under the carrier platform 111 thereby preventing from being damage by the vehicle C.

[0037] The moving device 112 includes, for example, a plurality of motor sets (not shown) and tires for driving the carrier platform 111 to move. In the present embodiment, the moving device 112 is exemplified by including four tires; however, it is understood that the present invention

is not limited thereto and the number of the tire or the type of the moving device 112 can be adjusted in response to a specific requirement. To have the advantage of high weight-loading (e.g., 3000 kg), in one embodiment the moving device 112 may be realized by a high-torque electric motor and associated gear sets. In addition, each motor may have an independent steering system, which makes the tire able to have a 90-degree turn thereby saving the turn-around space.

[0038] The self-propelled carrier 110 may be an electrically-driven carrier, but the present invention is not limited thereto. In the embodiment that the self-propelled carrier 110 is an electrically-driven carrier, correspondingly the automatic parking apparatus 100 may further include a plurality of electric-charging devices 170 (shown in FIG. 2) respectively disposed in the plurality of parking spaces P of the parking lot 200. Thus, the self-propelled carrier 110 can be electrically charged by the respective electric-charging device 170 when the self-propelled carrier 110 is parked in the respective parking space P. In addition, the self-propelled carrier 110 may further include a location identification device 114 disposed on the carrier platform 111; and correspondingly, the parking lot 200 may further include a plurality of identification elements R. Specifically, these identification elements R are disposed beside the parking spaces P and the vehicle routes. Through the location identification device 114 identifying the identification elements R, the self-propelled carrier 110 is adapted to identify the location itself in the parking lot 200, accordingly generate identification data, and then transmit the identification data to the control device 113. In one embodiment, the identification element R is, for example, a coordinate mark composed of numbers or symbols; and correspondingly the location identification

device 114 is, for example, an image capturing device, which is adapted to capture the image of the identification element R, analyze the coordinate mark composed of numbers or symbols to generate location information, and then identify the relative position of the self-propelled carrier 110 in the parking lot 200. In one embodiment, the identification element R may further include error correcting code, through which the location identification device 114 can have higher identification rate on the identification element R. In another embodiment, the identification element R is an element capable of emitting radio wave signals; and correspondingly the location identification device 114 is a signal receiver, which is adapted to retrieve the radio wave signals from the identification element R and convert the received radio wave signals into the location information. In still another embodiment, the location identification device 114 may be designed for capturing image or receiving signals from the identification element R only; and correspondingly the central control device 120 (shown in FIG. 1) is adapted to identify the location of the self-propelled carrier 110 in the parking lot 200 according to the data obtained by the location identification device 114. In yet another embodiment, the location identification device 114 may conduct the location identification by using the Global Positioning System (GPS), and accordingly the identification elements R can be omitted.

[0039] In the present embodiment, the self-propelled carrier 110 may further include a plate identification device 115, which is disposed on the carrier platform 111 and is adapted to identify the plate number of the vehicle C, accordingly generate identification data, and transmit the identification data to the control device 113. Consequentially, the control device 113 then transmits the identification data to the central control

device 120 (shown in FIG. 1) for data saving. In one embodiment, the plate identification device 115 may be an image capturing device, which is adapted to capture the plate of the vehicle C, identify the plate number and transmit the identified plate number to the central control device 120. Similarly, the plate identification device 115 may be designed for capturing image only; and correspondingly the central control device 120 (shown in FIG. 1) is adapted to identify the plate number of the vehicle C according to the image captured by the plate identification device 115. In one embodiment, the self-propelled carrier 110 may further include one or more anti-collision detecting devices 116 disposed on the carrier platform 111. In the present embodiment, the self-propelled carrier 110 may include four anti-collision detecting devices 116, which are respectively disposed the head, back, left and right of the carrier platform 111. The anti-collision detecting device 116 is adapted to detect objects around the carrier platform 111 thereby preventing the self-propelled carrier 110 from being collided by any object (e.g., people or animals) in the parking lot 200.

[0040] FIG. 5 is a flow chart of a vehicle parking process of the automatic parking apparatus 100 in accordance with an embodiment of the present invention. Referring to FIGS. 1, 2 and 5. Firstly, when an available self-propelled carrier 110 is parked in the carrier stop area 250a, a driver drives a vehicle C onto the self-propelled carrier 110 (step S110). In one embodiment, the driver then gets a parking ticket or other data capable of being identified (e.g., code) through the parking terminal 130a. In another embodiment, the aforementioned data capable of being identified is the plate number which is obtained by the automatic parking apparatus 100. In addition, it is understood that the driver is not needed

to pay the parking fee when leaving the parking lot 200 if the driver has already paid, for example, a monthly fee in advance and all the driver has to do is for example, slid a month-fee card to the parking terminal 130a or the automatic parking apparatus 100 automatically identify the plate number of the vehicle C for the charging.

[0041] Next, the safety detecting device 160 detects whether there exists people staying on the self-propelled carrier 110 or not (step S120). In one embodiment, the parking process stops performing any further step until all the people have left the self-propelled carrier 110. In another embodiment, the safety detecting device 160 may further issue an alarm to ask the people staying on the self-propelled carrier 110 to leave. Next, after making sure that there is no any people staying on the self-propelled carrier 110, the self-propelled carrier 110 transmits a parking need signal to the central control device 120 (step S130). Next, the central control device 120 assigns an available parking space P to the vehicle C, calculates a route from the carrier stop area 250a to this assigned parking space P, and transmits the route data to the self-propelled carrier 110 (step S140). Next, the self-propelled carrier 110 is automatically driven to this assigned parking space P through the calculated route (step S150). In the automatically driving process, the self-propelled carrier 110 can identify the location in the parking lot 200 through the identification device 114 disposed on the self-propelled carrier 110 which can identify the identification elements R in the parking lot 200.

[0042] In one embodiment, when a driver drives the vehicle C into the parking area 240a but there is no available self-propelled carrier 110 parked in the carrier stop region 250a, the central control device 120 is adapted to arrange an available self-propelled carrier 110 in the parking lot

200 according to the actual condition of the parking lot 200; and accordingly the driver can wait in the parking area 240a for an available self-propelled carrier 110 being driven into the carrier stop area 250a. Moreover, to optimize the usage of the parking spaces P, the central control device 120 may be further adapted to actively move the self-propelled carriers 110 parked in the parking spaces P according to the actual usage of all the parking spaces P. For example, the parking spaces P which are easier for parking may be adjusted to an idle state thereby increasing the parking efficiency. As illustrated in FIG. 3, it is to be noticed that the central control device 120 is further adapted to control the loading and unloading device 280 to unload the vehicle C from the self-propelled carrier 110 to the assigned parking space P' when the self-propelled carrier 110 is pulled over beside the assigned parking space P'.

[0043] FIG. 6 is a flow chart of a vehicle pick-up process of the automatic parking apparatus 100 in accordance with an embodiment of the present invention. Referring to FIGS. 1, 2 and 6. Firstly, a driver enters into the pick-up area 240b and input the pick-up command (e.g., by a parking smartcard, a monthly fee card or inputting a code or the plate number) through the pick-up terminal 130b disposed in the pick-up area 240b (step S210). Next, once confirming that the fee is paid, the pick-up terminal 130b transmits a pick-up signal to the central control device 120 (step S220). Next, the central control device 120 calculates a route and transmits the route to the self-propelled carrier 110 carried with the vehicle C (step S230). As illustrated in FIG. 3, it is to be noted that the central control device 120 is further adapted to control the loading and unloading device 280 to load the vehicle C from the parking space P to the

self-propelled carrier 110.

[0044] Next, the self-propelled carrier 110 is automatically driven, according to the calculated route, to the carrier stop area 250b beside the pick-up area 240b (step S240). As described above, in the process of the automatic driving of the self-propelled carrier 110, the self-propelled carrier 110 can identify its location in the parking lot 200 through the location identification device 114 disposed on the self-propelled carrier 110 identifying the identification elements R disposed in the parking lot 200. Next, the safety detecting device 160 detects whether the vehicle C has been driven out from the self-propelled carrier 110 or not (step S250). If not, the self-propelled carrier 110 stops any movement and waits in the pick-up area 240b until the vehicle C has been driven away in one embodiment or the safety detecting device 160 issues an alarm sound to remind the driver to drive the vehicle C away in another embodiment. Next, once the vehicle C is driven out from the self-propelled carrier 110, the central control device 120 transmits a route to direct the self-propelled carrier 110 to a stand-by area (step S260). The stand-by area may be the carrier stop area 250a beside the parking area 240a, the parking spaces P or a specific area in the parking lot 200. In the embodiment of the parking area and the pick-up area being integrated into one area, the step S260 can be omitted.

[0045] It is understood that the dispositions of the parking spaces P, P' illustrated in FIGS. 2, 3 are for the exemplary purpose only. To achieve the best efficiency, the actual dispositions of the parking spaces P, P' may be made upon the size and shape of the parking lot 200 and the present invention is not limited thereto. In addition, the way of moving the vehicle C from the self-propelled carrier 110 to the parking spaces P'

is not limited in the present invention. That is, the aforementioned loading and unloading device 280 may be replaced by other devices with the similar functions as described as follow, but the present invention is not limited thereto.

[0046] FIGS. 7A, 7B are top and side views of a part of an automatic parking apparatus in accordance with an embodiment of the present invention. Referring to FIGS. 7A and 7B. As shown, the automatic parking apparatus in the present embodiment further includes a plurality of supporting devices 390 and a plurality of upper platforms 317. The supporting devices 390 are disposed in the parking spaces P", respectively. In the present embodiment, the number of the supporting devices 390 is six, but the present invention is not limited thereto. The self-propelled carrier 310 further includes a plurality of lifting devices 318 disposed on the carrier platform 311. The lifting devices 318 are adapted to support the upper platform 317. In one embodiment, the lifting device 318 has a function similar to a jack, but the present invention is not limited thereto. As show in FIG. 7A, the size of the carrier platform 311 is smaller than that of the upper platform 317. In addition, a certain space is formed between two adjacent supporting devices 390 thereby allowing the carrier platform 311 to pass through, so that the carrier platform 311 can be driven into the parking space P" without being affected by the supporting devices 390. In the present embodiment, the number of the lifting device 318 is exemplified by four and the four lifting devices 318 are disposed between the carrier platform 311 and the upper platform 317; however, the number of the lifting device 318 is not limited in the present invention. As shown in FIG. 7B, after the vehicle C" is driven onto the upper platform 317, the upper platform 317 is lifted by the lifting devices 318

disposed on the carrier platform 311. Then, the upper platform 317 is delivered to the parking space P'' by the carrier platform 311. The height of the lifted upper platform 317 is higher than the height of the supporting devices 390 disposed in the parking space P''. Thus, the carrier platform 311 with the lifted upper platform 317 can be driven into the parking space P'' without being affected by the supporting devices 390. In one embodiment, after the carrier platform 311 is driven into the parking space P'', the central control device 120 (shown in FIG. 1) is adapted to control the lifting devices 318 to lower the upper platform 317 so that the supporting devices 390 can hold the upper platform 317. It is understood that the carrier platform 311 is adapted to be driven out from the parking space P'' and carry another upper platform 317 once the carried upper platform 317 is hold by the supporting devices 390.

[0047] In addition, in another embodiment, it is understood that the aforementioned supporting devices 390 may be also disposed in the carrier stop area 250a, 250b (shown in FIG. 3) for supporting the upper platforms 317.

[0048] In summary, through employing the self-propelled carrier adapted to carry a vehicle to an assigned parking space in a parking lot, the automatic parking apparatus of the present invention can save the space of the parking lot. In addition, through configuring the central control device to communicate with the self-propelled carrier, assigning a parking space to the self-propelled carrier according to an actual situation of the parking lot, calculating a route according to the map of the parking lot, and transmitting the route to the self-propelled carrier thereby directing the self-propelled carrier to move to the assigned parking space according to the route, the automatic parking apparatus of the present invention can be

used in a traditional parking lot thereby solving the problems in the traditional parking lot, such as the time wasting for finding a parking space, poor space usage and easily-happened collisions.

[0049] The above description is given by way of example, and not limitation. Given the above disclosure, one skilled in the art could devise variations that are within the scope and spirit of the invention disclosed herein, including configurations ways of the recessed portions and materials and/or designs of the attaching structures. Further, the various features of the embodiments disclosed herein can be used alone, or in varying combinations with each other and are not intended to be limited to the specific combination described herein. Thus, the scope of the claims is not to be limited by the illustrated embodiments.

WHAT IS CLAIMED IS:

1. An automatic parking apparatus for automatically parking a vehicle in one of a plurality of parking spaces of a parking lot, the automatic parking apparatus comprising:

at least a self-propelled carrier, adapted to carry the vehicle; and

a central control device, adapted to communicate with the self-propelled carrier thereby issuing a proceeding signal to the self-propelled carrier,

wherein the self-propelled carrier is further adapted to automatically move to one of the parking spaces according to the proceeding signal.

2. The automatic parking apparatus according to claim 1, wherein the self-propelled carrier comprises:

a carrier platform;

a moving device, connected to the carrier platform and adapted to drive the carrier platform to move; and

a control device, disposed on the carrier platform and adapted to communicate with the central control device and the moving device and control the moving device according to the proceeding signal.

3. The automatic parking apparatus according to claim 2, further comprising:

a plurality of supporting devices, disposed in the parking spaces respectively; and

a plurality of upper platforms, wherein the self-propelled carrier further comprises a plurality of lifting devices disposed on the carrier platform, and the lifting devices are adapted to support one of the upper

platforms.

4. The automatic parking apparatus according to claim 1, wherein the parking lot further comprises a plurality of identification elements, the self-propelled carrier further comprises a location identification device disposed on the carrier platform, the location identification device is adapted to identify a location of the carrier platform according to the identification elements of the parking lot thereby generating an identification data, and transmit the identification data to the control device.

5. The automatic parking apparatus according to claim 4, wherein the identification element is an identification mark and the location identification device is an image identification device.

6. The automatic parking apparatus according to claim 1, wherein the self-propelled carrier further comprises a plate identification device disposed on the carrier platform, and the plate identification device is adapted to identify a plate number of the vehicle thereby generating an identification data and transmit the identification data to the control device.

7. The automatic parking apparatus according to claim 1, wherein the self-propelled carrier further comprises an anti-collision detecting device disposed on the carrier platform, and the anti-collision detecting device is adapted to detect one or more objects around the carrier platform.

8. The automatic parking apparatus according to claim 1, wherein the

central control device further comprises a remote connection system.

9. The automatic parking apparatus according to claim 1, wherein the parking lot further comprises a parking/pick-up area and a carrier stop area adjacent to the parking/pick-up area, the automatic parking apparatus further comprises a parking/pick-up terminal disposed in the parking/pick-up area and in communication with the central control device.

10. The automatic parking apparatus according to claim 9, further comprising a safety detecting device disposed in the parking/pick-up area, wherein the safety detecting device is adapted to communicate with the central control device and detect whether there is a user staying in the carrier stop area or not.

11. The automatic parking apparatus according to claim 1, wherein the automatic parking apparatus comprises more than one self-propelled carriers driven by electric power, and the automatic parking apparatus further comprises a plurality of electric charging devices respectively disposed in the parking spaces of the parking lot, the electric charging devices are adapted to electrically charge the self-propelled carriers.

12. The automatic parking apparatus according to claim 1, further comprising a plurality of loading and unloading devices disposed in the parking spaces respectively, wherein each loading and unloading device is adapted to move the vehicle from the self-propelled carrier to the corresponding parking space or move the vehicle from the corresponding parking space to the self-propelled carrier.