security inspection is directly transported to the end point of the second transport area, thereby reducing the probability of missed inspection and improving the reliability of security inspection.

[0072] In the embodiment, a plurality of management and control subsystems are provided, and a plurality of transport vehicles are divided into a plurality of groups, so that one group of transport vehicles are controlled by one management and control subsystem, and a plurality of groups of management and control subsystems are controlled by a centralized control center. Based on the above arrangement, a plurality of groups of transport vehicles can operate independently in a plurality of transport areas, thereby ensuring the effective application of baggage transport in areas such as airports.

[0073] In some application scenarios, the transport control system may also include a baggage sorting service subsystem, which is provided corresponding to a management and control subsystem. The baggage sorting service subsystem is configured to manage a plurality of baggage out devices. Baggage check-in information is sent to a corresponding management and control subsystem. The management and control subsystem sends the baggage check-in information to the centralized control center, and the centralized control center generates a baggage scheduling task based on the baggage check-in information.

[0074] Specifically, the transport areas include a first transport area and a second transport area. In the first transport area, a baggage out device is a track device of a check-in counter, and a baggage handling device is a security inspection device. In the second transport area, the baggage out device is the security inspection device, and the baggage handling devices include a platform device for manual inspection, a carrying device for collecting early-arrived baggage, and a carrying device for collecting on-time-arrived baggage, etc.

[0075] Additionally, baggage check-in information includes, but is not limited to, the number of pieces of baggage to be transported.

[0076] In the embodiment, after receiving the baggage check-in information, the centralized control center generates a corresponding baggage scheduling task by counting the distribution of pieces of consigned baggage and the number of pieces of consigned baggage. Based on the baggage scheduling task, the management and control subsystem can determine

which baggage out device has baggage to be transported, as well as the specific number of pieces of baggage to be transported. Based on these pieces of information, a target start point can be determined, and then a transport route can be further determined based on the target start point and a target end point. The transport route is sent to a transport vehicle to further improve the transport efficiency.

[0077] In some embodiments, the centralized control center is specifically configured to send, to each management and control subsystem, management and control privilege information of a corresponding managed transport area. A transport vehicle is specifically configured to send a preset scheduling code to a management and control subsystem. The management and control subsystem is specifically configured to send grant information to the transport vehicle when verification of the scheduling code is passed based on the management and control privilege information. The grant information is used to determine a management and control privilege for the transport vehicle, so that the transport vehicle has a privilege to travel in the corresponding transport area.

[0078] The centralized control center configures the privilege information of each transport area and sends it to a management and control subsystem configured to control the transport vehicle(s) in the transport area. The management and control subsystem obtains the information to be verified sent by the transport vehicle. The information to be verified is specifically a preset scheduling code. The management and control subsystem determines whether the information to be verified matches grant information. Therefore, when it is detected that the to be verified information matches the grant information, the transport vehicle can operate in a transport area to which it belongs. Based on the above verification procedure, granting of a transport vehicle to operate in any transport area is realized to ensure that a transport vehicle in each transport area only operates in the transport area, thereby realizing the controllability of the transport vehicle operation.

[0079] In addition, as a specific authentication method, an area identity of a transport area and a scheduled vehicle list that has a mapping relationship with the area identity of transport area may be configured in the privilege information, and when the management and control subsystem finds the scheduling code in the scheduled vehicle list, it can be determined that the verification of the scheduling code is passed.

[0080] In an embodiment, as a way to flexibly configure the area privilege information of each transport area, the area privilege information of the first transport area includes an area identity of the first transport area and a corresponding scheduled vehicle list, and the scheduled vehicle list includes transport vehicles with serial numbers 1 to 25, so as to limit the transport vehicles with serial numbers 1 to 25 to operate in the first transport area. The area privilege information of the second transport area includes an area identity of the second transport area and a corresponding scheduled vehicle list, and the scheduled vehicle list includes transport vehicles with serial numbers 26 to 50, so as to limit the transport vehicles with serial numbers 26 to 50 to operate in the second transport area. When the management and control subsystem corresponding to the first transport area receives a scheduling code between 1 and 25 sent by a transport vehicle, the management and control subsystem sends grant information to the transport vehicle, allowing it to travel in the first transport area. When the management and control subsystem corresponding to the second transport area receives a scheduling code between 26 and 50 sent by a transport vehicle, the management and control subsystem sends grant information to the transport vehicle, allowing it to travel in the second transport area. In this way, the embodiment can ensure reliable operations of transport vehicles.

[0081] In some embodiments, the centralized control center is specifically configured to send a management and control privilege change instruction to a management and control subsystem. The management and control subsystem is specifically configured to receive the privilege information change instruction sent by the centralized control center, determine a candidate transport vehicle to be changed and a change type based on the change instruction, generate corresponding traveling privilege change information based on the change type, and send the traveling privilege change information to the candidate transport vehicle to be changed. The transport vehicle is specifically configured to, in response to the traveling privilege change information sent by the management and control subsystem, determine a target change area, and travel from a current transport area to the target change area.

[0082] The centralized control center obtains transport capacity scheduling information, determines a transport vehicle to be scheduled in at least one transport area based on the transport capacity scheduling information, and generates a change instruction

for the transport vehicle to be scheduled. The corresponding change type is suitable for moving the transport vehicle to be scheduled across areas.

[0083] The change types include but are not limited to: changing from one transport area to another transport area, or changing from one transport area to a repair and maintenance area.

[0084] Specifically, an initiator initiates a change application for a cross-area movement of a transport vehicle through the centralized control center. After multiple levels of approval, the centralized control center generates an instruction with a time window to a control operator. After the control operator confirms the instruction, the centralized control center sends a change code to a management and control subsystem as required. The management and control subsystem assigns the change code to the transport vehicle to be scheduled, and sends the traveling privilege change information to the transport vehicle. After obtaining the change code and traveling privilege change information, the designated transport vehicle to be scheduled passes through a physical isolation object or a physical isolation facility through a specific channel. After completing the cross-area movement, the transport vehicle sends a cross-area completion report to the management and control subsystem which then submits it to the centralized control center for confirmation.

[0085] In this embodiment, after obtaining the transport capacity scheduling information, the centralized control center determines based on the capacity scheduling information that a transport vehicle to be scheduled in one transport area is scheduled to another transport area, and generates a change instruction. The management and control subsystem receives the privilege information change instruction sent by the centralized control center. In this way, when there is an uneven distribution of scheduling tasks in different transport areas, for example, one transport area has more transport tasks and another transport area has fewer tasks, by modifying the privilege granted to a transport vehicle, the transport vehicle in one transport area can be scheduled to work in another transport area, thereby improving the utilization rate of the transport vehicle and thus ensuring the balanced operations of the transport vehicles.

[0086] Specifically, taking an airport as an example, an airport may involve more than 700 transport vehicles. By adopting a two-level scheduling mode in which a centralized

control center and management and control subsystem(s) are involved, the problems of system balance, scheduling efficiency and centralized resource management under large-scale applications are solved.

[0087] In some embodiments, the centralized control center is further configured to: receive change success information for a changed transport vehicle fed back by a management and control subsystem, and send a change notification to a designated management end based on the change success information.

[0088] In this embodiment, the centralized control center generates a change notification for an area status change of a transport vehicle, and sends the change notification to a management team and a security team via email and text message(s). The notification procedure ends after sending the area exchange success information. The grant procedure and the exchanged AGV information cannot be deleted and are permanently retained.

[0089] The following is a further description of the transport control system for baggage consignment disclosed herein in conjunction with the description of a charging module for charging a transport vehicle.

[0090] Charging modules may be divided into a plurality of groups based on different arrangements or arrangement areas. In addition, the charging method between a charging module and a transport vehicle may be wired charging based on an interface or contact wireless charging. By providing a combination of a plurality of groups of charging modules, the charging efficiency of the transport vehicles can be improved, thereby further increasing the standby time of the charging vehicles.

[0091] A charging module may be configured to report operating condition information to a management and control subsystem;

[0092] the management and control subsystem is specifically configured to generate a charging instruction based on the status information reported by the transport vehicle and/or the operating condition information reported by the charging module, so as to send the charging instruction to the transport vehicle. The charging instruction is used to drive the transport vehicle to a corresponding charging module for charging operations.

[0093] As shown in FIG. 2, in some embodiments, the charging modules include a first charging module 112, a second charging module 114, and a third charging module 116.

[0094] The first charging module is in communication connection with a management and control subsystem. The first charging module 112 includes a plurality of first charging rails 1122 arranged in a transport area between a plurality of baggage out devices and a plurality of baggage handling devices for charging a transport vehicle in a traveling state.

[0095] Through a communication connection, the first charging module can send occupancy information of each first charging rail to the management and control subsystem.

[0096] Specifically, as an application mode, when the transport vehicle travels onto a first charging rail, the transport vehicle can be charged by the first charging rail.

[0097] In this embodiment, the first charging module is provided. The first charging module is specifically arranged in the transport area of the transport vehicle, and may include a plurality of first charging rails. The start point of the first charging rails is close to a baggage out device, and the end point is close to a baggage handling device. The first charging rails may specifically be high-speed online charging rails. Furthermore, the first charging rails are specifically arranged in a high traffic flow operation area in the transport area. The first charging rails are specifically in a plane arrangement or in a space arrangement. By providing the first charging rails, online charging for normally moving transport vehicle(s) is realized. The length of this section of the charging rails is relatively long, so that transport vehicles can be charged during running, which can reduce the arrangement of fixed charging stations and the number of used fixed charging stations, prevent the transport vehicles from being off duty during transport, ensure the attendance rate and operation reliability of the transport vehicles, and also extend the standby time of the transport vehicles.

[0098] In addition, the provision of the first charging module in the form of a rail is also beneficial to reducing the number of fixed charging stations.

[0099] The second charging module 114 includes a plurality of second charging rails 1142, which are arranged in a standby area and/or a queuing area for charging transport vehicle(s) in a waiting state. The standby area and/or the queuing area is located at the front end of a plurality of baggage handling devices, and/or the front end of a baggage out device, and/or an area where transport vehicle(s) is(are) located when waiting for task instructions.

[00100] As compared with the first charging rails in the first charging module which

are used to charge transport vehicle(s) in the operating state, the second charging rails in the second charging module are used to charge transport vehicle(s) in the waiting state. Thus, the first charging rails are longer than the second charging rails.

[00101] By providing the first charging rails and the second charging rails, the utilization rate of the transport area(s) can be improved and the charging function in the transport area(s) is realized, and also the arrangement of charging stations can be reduced while the baggage transport efficiency is improved.

[00102] The third charging module 116 includes a plurality of charging stations 1162, which are arranged in a non-transport area and are used to charge transport vehicle(s) in an idle state.

[00103] In this embodiment, by providing the third charging module including a plurality of charging stations, it is possible to charge the transport vehicle(s) in an idle state, thereby ensuring the reliability of the transport vehicle(s) in an idle state as standby transport vehicle(s).

[00104] Specifically, the second charging module includes charging rails arranged in the queuing area /standby area. When a transport vehicle runs to the queuing area or standby area, the transport vehicle automatically travels onto a second charging rail. When the second charging rail senses the transport vehicle, it can directly start charging the charging vehicle, or it can send the sensed information to a management and control subsystem, so that the management and control subsystem can send a charging instruction.

[00105] In some embodiments, a vertical lifting mechanism is also provided. The vertical lifting mechanism is arranged in at least one transport area and is communicatively connected to a corresponding management and control subsystem.

[00106] The management and control subsystem is specifically configured to send an energy-saving mode operation instruction to the vertical lifting mechanism when the vertical lifting mechanism carries both transport vehicles to be ascended and to be descended, or to send a normal mode operation instruction to the vertical lifting mechanism when the vertical lifting mechanism only carries a transport vehicle to be ascended or a transport vehicle to be descended.

[00107] The vertical lifting mechanism is specifically a vertical lifting elevator.

[00108] In this embodiment, a vertical lifting mechanism is provided to realize vertical transfer of transport vehicle(s) in a ramp-free application scenario. Transport vehicles with similar weights but opposite transfer directions are deployed by the management and control subsystem to share the vertical lifting mechanism, thereby realizing energy-saving operation of the vertical lifting mechanism.

[00109] In addition, in a scenario where there is only a transport vehicle that needs to ascend, or there is only a transport vehicle that needs to descend, the management and control subsystem skip the energy-saving logic based on the up and down traffic flow and task priority.

[00110] In some embodiments, the centralized control center is specifically configured to periodically send a maintenance decision on a transport vehicle to a management and control subsystem. The management and control subsystem is specifically configured to determine a corresponding maintenance instruction based on the maintenance decision, and send the maintenance instruction to a transport vehicle to be maintained. The transport vehicle is specifically configured to switch a traveling privilege to a maintenance privilege in response to the received maintenance instruction, and based on the maintenance privilege, travel to a repair operation area according to a maintenance route carried in the maintenance instruction to perform a maintenance operation.

[00111] In this embodiment, the centralized control center specifically obtains a repair and maintenance request, determines a transport vehicle to be repaired and maintained in at least one transport area based on the repair and maintenance request, and generates a maintenance decision based on the transport vehicle to be maintained. Specifically, the repair and maintenance request is initiated based on a repair and maintenance schedule or a detected fault, and a personnel responsible for repair and maintenance, a safety personnel, and the centralized control center are notified in turn. The centralized control center generates a maintenance decision with a time window based on the repair and maintenance request, and sends it to the management and control subsystem. The management and control subsystem generates corresponding traveling privilege change information for the transport vehicle. The transport vehicle exits the transport area based on the traveling privilege change information, passes through a physical isolation object or a physical isolation facility through a specific

channel, and leaves the transport area. After leaving the transport area, the transport vehicle sends departure information to the management and control subsystem, and the management and control subsystem then feeds back the result to the centralized control center.

[00112] In addition, for a transport vehicle, in order to realize baggage transport, the transport vehicle is equipped with a sensing device and pre-configured with map information of a plurality of transport areas. The sensing device may be a laser radar.

[00113] In some embodiments, the transport vehicle is further provided with a collision avoidance device. The collision avoidance device may be provided on the front end side wall of the transport vehicle.

[00114] In some embodiments, the transport vehicle is provided with a conveyer device, on which a plurality of sensors are arranged along a conveying direction, and the sensors are used to sense the position of baggage on the conveyer device. The conveyer device may specifically be a conveyor belt.

[00115] It should be noted that baffles may be set on both sides of the conveyer device along the conveying direction, so that there is no risk of baggage falling when baggage moves left and right. Of course, a plurality of sensors 1086 may be arranged on the baffles on both sides of the conveyer device along the conveying direction.

[00116] In addition, the transport vehicle may also detect and monitor the weight and size of baggage based on sensor(s). This design ensures that the AGV baggage sorting system meets the safety standards of the aviation transport industry, significantly improves the reliability of aviation baggage security inspection, and prevents baggage from falling.

[00117] In some embodiments, a transport vehicle includes a weighing device configured to record the weight of baggage on the conveyer device.

[00118] In some embodiments, a transport vehicle is provided with an air pressure sensor, which is configured to sense the air pressure of the environment in which the transport vehicle is located, so as to determine the height of the position where the transport vehicle is based on the ambient air pressure, thereby assisting in determining the current floor where the transport vehicle is currently located.

[00119] In some embodiments, the management and control subsystem is also configured to calibrate the air pressure information fed back by the transport vehicle.

[00120] Specifically, by calibrating the air pressure information, the accuracy in determining the floor where the transport vehicle is located can be improved. For example, a barometer is installed at a position where the height is determinate, and the barometer sends a signal to the management and control subsystem. The floor where the transport vehicle is located may be determined by comparing the air pressure value of the transport vehicle itself. Since the air pressure at the same height also changes according to the temperature and weather, the real-time relative value of the air pressure can be obtained through calibration, thereby more accurately determining the floor.

[00121] In some embodiments, a transport vehicle is further provided with a battery management module and a fire suppression module.

[00122] The following describes in detail the transport control method for baggage consignment in the present disclosure which is performed by a management and control subsystem.

[00123] As shown in FIG. 3, a transport control method for baggage consignment according to an embodiment of the present disclosure is applied to a management and control subsystem. The method includes:

[00124] In step S302, in response to a baggage scheduling task sent by a centralized control center, a baggage out device from which baggage is discharged is determined.

[00125] In step S304, a target baggage handling device for receiving the baggage is selected from a plurality of baggage handling devices.

[00126] In step S306, a baggage transport route is generated based on a position of the baggage out device and a position of the target baggage handling device.

[00127] In step S308, a baggage transport task is generated based on the baggage transport route and the baggage scheduling task.

[00128] Generating the baggage transport task based on the baggage scheduling task may specifically include: allocating several pieces of baggage to the baggage transport task.

[00129] In step S310, the baggage transport task is sent to a transport vehicle, so that the transport vehicle transports the baggage from the baggage out device to the target baggage handling device based on the baggage transport route.

[00130] Specifically, before sending the baggage transport task to the transport vehicle,

an operation of selecting the transport vehicle for actually carrying the transport task may also be performed. As an example implementation of selecting a target transport vehicle from a plurality of transport vehicles, the plurality of transport vehicles send current position information and status information to the management and control subsystem. The management and control subsystem selects the target transport vehicle from the plurality of transport vehicles based on the baggage scheduling task, the position information and the status information of the transport vehicles, and sends the transport task to the target transport vehicle.

[00131] The status information may include task status and battery level status. The management and control subsystem selecting the target transport vehicle from the plurality of transport vehicles includes: determining a first group of transport vehicles that do not perform tasks based on the task status, determining a second group of transport vehicles in the first group of transport vehicles that meet a power requirement based on the battery level status, determining the number of pieces of baggage to be transported based on the baggage scheduling task, and selecting the target transport vehicle from the second group of robots based on the number of pieces of baggage to be transported.

[00132] Based on the above operations, the management and control subsystem receives the position information and status information of the transport vehicles, and determines, based on the status information, which of all the managed transport vehicles do not perform tasks and have sufficient power, and identifies these robots as available transport vehicles. Furthermore, based on the baggage scheduling task, the management and control subsystem determines the number of transport vehicles that need to perform the transport task, and selects the target transport vehicle(s) in combination with the position information of the transport vehicles to ensure balanced scheduling of the transport vehicles.

[00133] In the embodiments, a management and control subsystem for managing transport vehicles and other related device(s) is provided. When the management and control subsystem receives a baggage scheduling task sent by the centralized control center, the baggage out device from which the baggage is discharged (that is, the transport start point of the transport vehicle) is determined based on the information in the baggage scheduling task, and the transport end point of the transport vehicle is determined by selecting a target

baggage handling device for receiving the baggage from a plurality of baggage handling devices. A traveling route is planned based on the transport start point and the end point to further generate a baggage transport task. The transport vehicle performs the baggage transport task based on the transport route. As compared with the belt transportation or track transportation solutions in the related art, by using the transport vehicle as a transport device, on the one hand, the solutions in the embodiments do not require the initial investment in the construction of facilities such as conveyer tracks, and can be directly put into use in existing places such as airports. On the other hand, since it is not needed to set a fixed route, the traveling route of the transport vehicle(s) and the number of used transport vehicles can be configured more flexibly, which is conducive to optimizing the transport path and improving the transport efficiency.

[00134] As shown in FIG. 4, a transport control method for baggage consignment according to another embodiment of the present disclosure is applied to a management and control subsystem. The method includes:

[00135] In step S402, baggage check-in information reported by baggage out device(s) is received.

[00136] In step S404, the baggage check-in information is reported to the centralized control center to receive the baggage scheduling task assigned by the centralized control center based on the baggage check-in information.

[00137] In step S406, in response to the baggage scheduling task sent by the centralized control center, a baggage transport task is generated accordingly.

[00138] Reference may be made to the steps shown in FIG. 3 for the specific implementations.

[00139] In step S408, the baggage transport task is sent to a transport vehicle, so that the transport vehicle transports the baggage from the baggage out device to the target baggage handling device based on the baggage transport route.

[00140] As shown in FIG. 5, in some embodiments, an example implementation of selecting the target baggage handling device for receiving baggage from the plurality of baggage handling devices in step S304 includes:

[00141] In step S502, a current load amount of each baggage handling device is

obtained.

[00142] Specifically, as an implementation of obtaining the current load amount of a baggage handling device, the baggage handling device actively sends its load amount to the management and control subsystem. Thus, the management and control subsystem determines the target baggage handling device based on the received load amounts.

[00143] As another implementation of obtaining the current load amount of a baggage handling device, the management and control subsystem records the load amount of a corresponding target baggage handling device after each assignment of a baggage transport task, so as to select a next target baggage handling device for a next assignment of a baggage transport task. After all baggage transport tasks are assigned, the recorded load amount data is deleted until the next round of reclassification of baggage transport tasks.

[00144] In step S504, loads of the plurality of baggage handling devices are ranked based on the load amounts.

[00145] In step S506, the target baggage handling device is selected from the plurality of baggage handling devices based on a ranking result.

[00146] In some embodiments, selecting, from the plurality of baggage handling devices, the target baggage handling device based on the ranking result further includes:

[00147] when it is determined based on the ranking result that there are at least two to-be-selected devices among the plurality of baggage handling devices and both of the at least two to-be-selected devices have the smallest load amount, a to-be-selected device having the shortest transport route is determined as the target baggage handling device.

[00148] In an embodiment, for an implementation of selecting the target baggage handling device for a transport vehicle from the plurality of baggage handling devices, the load amount of each baggage handling device is obtained. A large load amount indicates that the baggage handling device has more pieces of baggage to be handled, and a small load amount indicates that the baggage handling device has less pieces of baggage or no baggage to be handled. Based on this criterion, a baggage handling device with the smallest load amount is determined as the target baggage handling device, so as to ensure a balanced distribution of pieces of baggage to be handled in the baggage handling devices, so as to improve baggage handling efficiency.

[00149] As shown in FIG. 6, in some embodiments, another example implementation of selecting the target baggage handling device for receiving the baggage from the plurality of baggage handling devices in step S304 includes:

[00150] In step S602, handling loads of a plurality of baggage handling devices are ranked based on load amounts.

[00151] In step S604, an alternative route is determined based on the position information of the target transport vehicle, the baggage out device and the plurality of baggage handling devices.

[00152] In step S606, the target baggage handling device is selected based on the handling load ranking and the alternative route.

[00153] In this embodiment, the baggage check-in information is detected by the management and control subsystem to determine the handling loads of baggage handling devices at a plurality of destinations, and the loads are ranked. A lower handling load corresponds to a higher priority, and a higher handling load corresponds to a lower priority. Furthermore, if a plurality of alternative target destinations with the same priority are monitored, an alternative route is further calculated based on the position information, the target start point and the positions of the alternative target destinations, and an alternative destination with a shorter route is selected as the target destination to ensure the reliability of the transport vehicles in transporting the baggage.

[00154] As shown FIG. 7, in some embodiments, another example implementation of selecting the target baggage handling device for receiving the baggage from the plurality of baggage handling devices in step S304 includes:

[00155] In step S702, handling loads of a plurality of baggage handling devices are ranked based on acquired load amount of each baggage handling device.

[00156] In step S704, distribution information of a plurality of transport vehicles in a designated area is obtained.

[00157] In step S706, a target destination is selected based on the distribution information and the handling load ranking.

[00158] In this embodiment, the management and control subsystem obtains the distribution information of a plurality of target transport vehicles in the designated area, so as

to take the density of transport vehicles in the area into consideration when selecting the target terminal, and further optimize the transport route.

[00159] In some embodiments, the management and control subsystem is further configured to: select the target baggage handling device based on at least one of: a round-robin scheduling model, a waterfall model, and an area monitoring model.

[00160] In this embodiment, based on the round-robin scheduling model, the waterfall model and the area monitoring model, the above mentioned selection of the target baggage handling device based on the handling load ranking and the alternative route in combination with the occupancy information and the distribution information can be implemented, so as to obtain a preferred transport path, thereby improving the operation efficiency of the baggage transport control system based on transport vehicle(s).

[00161] In some embodiments, there are a plurality of management and control subsystems, and a plurality of transport vehicles are divided into a plurality of groups. Each management and control subsystem manages and controls a corresponding group of transport vehicles. Sending a baggage transport task to a transport vehicle includes: sending the baggage transport task to a transport vehicle for which the management and control subsystem has a management and control privilege.

[00162] As shown in FIG. 8, in some embodiments, before sending the baggage transport task to the transport vehicle with the privilege of being managed and controlled in step S310, the method further includes:

[00163] In step S802, management and control privilege information sent by the centralized control center is received. The management and control privilege information is used to control at least one of a plurality of transport areas.

[00164] The management and control privilege information may be obtained by being sent by the centralized control center, or management and control privilege information may be obtained by being input by an administrator.

[00165] In step S804, a scheduling code reported by a transport vehicle is received.

[00166] In step S806, when verification of the scheduling code based on the management and control privilege information is passed, grant information is sent to the transport vehicle. The grant information is used to determine a management and control

privilege with respect to the transport vehicle, so that the transport vehicle has the traveling privilege in a corresponding transport area.

[00167] The management and control privilege information includes an area identity of a transport area and a scheduling code list that has a mapping relationship with the area identity. When the scheduling code is found in the scheduled vehicle list, it is determined that verification of the scheduling code is passed.

[00168] In this embodiment, the scheduling code reported by the transport vehicle is received, and the scheduling code is used as identity verification information to verify the identity of the transport vehicle. When the verification is passed, the transport vehicle is granted to travel within a managed transport area, thereby ensuring the control of the traveling area of the transport vehicle. Accordingly, the embodiment can ensure the reliability of the transport operation of the transport vehicle, and prevent the transport vehicle from traveling to an area outside the granted transport area, which may result in baggage loss or missing inspection of baggage. In some embodiments, the plurality of baggage handling devices include a first group of handling devices and a second group of handling devices. The second group of handling devices include a plurality of types. The transport areas include a first transport area and a second transport area. The end point of the first transport area and the start point of the second transport area are overlapping area, The first group of handling devices are arranged in the overlapping area, and the second group of handling devices are arranged in the end point area of the second transport area.

[00169] Specifically, the first group of handling devices include security inspection devices, including but not limited to a scanning and identification system and an X-ray security inspection system, etc. The security inspection devices are connected to the centralized control center through communication, and after performing security inspection on the unloaded baggage, the obtained security inspection results are fed back to the centralized control center. In addition, the first transport area may be an area between the counter and the security inspection device(s), and the second transport area may be an area between the security inspection device(s) and the manual inspection area or the early-arrived baggage area or the flight baggage collection area.

[00170] The same group of transport vehicles may be distributed in different transport

areas. For example, for a group of transport vehicles controlled by the same management and control subsystem, a part of the transport vehicles work in a first transport area, and the other part of the transport vehicles work in a second transport area.

[00171] Alternatively, a group of transport vehicles controlled by the same management and control subsystem may all work in the same transport area.

[00172] Specifically, the management and control subsystems include a first management and control subsystem and a second management and control subsystem.

[00173] When the management and control subsystem is the first management and control subsystem, selecting, from the plurality of baggage handling devices, the target baggage handling device for receiving the baggage includes: selecting, from the first group of handling devices, the target baggage handling device.

[00174] When the management and control subsystem is the second management and control subsystem, selecting, from the plurality of baggage handling devices, the target baggage handling device for receiving the baggage includes: selecting, from the second group of handling devices, the target baggage handling device.

[00175] In this embodiment, a security inspection device is arranged in the overlapping area of the first transport area and the second transport area, the entrance of the security inspection device corresponds to the end point of the first transport area, and the exit of the security inspection device corresponds to the start point of the second transport area. By reasonably selecting the target security inspection device, the efficiency of baggage security inspection in areas such as airports is guaranteed, and baggage check-in information is generated based on the baggage that has completed security inspection, so as to further generate a baggage scheduling task for the second transport area.

[00176] As shown in FIG. 9, in some embodiments, selecting, from the second group of handling devices, the target baggage handling device includes:

[00177] In step S902, a security inspection result fed back by a security inspection device is received. The security inspection result is a result of security inspection performed by the security inspection device on the received baggage.

[00178] In step S904, a device type that matches the security inspection result is determined.

[00179] In step S906, the target baggage handling device is selected from the second group of handling devices having the device type.

[00180] The second group of handling devices include a platform device for manual inspection, a carrying device for collecting early-arrived baggage, and a carrying device for collecting on-time-arrived baggage.

[00181] In this embodiment, the inspection result of the security inspection is obtained by the management and control subsystem. In the second transport area, the working start point of a transport vehicle is a security inspection machine, and the end point is a baggage carousel, or a device in an early-arrived baggage buffer area, or a device in a special area after unpacking inspection. The area division prevents the baggage transported by the transport vehicle from being directly transported to the baggage carousel without security inspection. On the one hand, the orderliness and reliability of the baggage transport are guaranteed, and on the other hand, the reliability of the security inspection is guaranteed.

[00182] As shown in FIG. 10, in some embodiments, the transport control method further includes:

[00183] In step S1002, a privilege information change instruction sent by the centralized control center is received.

[00184] In step S1004, a candidate transport vehicle to be changed and a change type are determined based on the change instruction.

[00185] In step S1006, corresponding traveling privilege change information is generated based on the change type.

[00186] In step S1008, traveling privilege change information is sent to the candidate transport vehicle to be changed.

[00187] In this embodiment, the management and control subsystem receives a change instruction to change the traveling privilege of transport vehicle(s) sent by the centralized control center. In this way, when scheduling tasks are distributed unevenly in different transport areas, for example, when a part of transport areas have more transport tasks and another part of transport areas has fewer tasks, by modifying the granted privilege of transport vehicle(s), the transport vehicle(s) in one transport area can be scheduled to work in another transport area, so as to improve the utilization rate of the transport vehicle(s), thereby

ensuring the balanced operations of transport vehicles.

[00188] As shown in FIG. 11, in some embodiments, the transport control method further includes:

[00189] In step S1102, a maintenance decision sent by the centralized control center is received.

[00190] In step S1104, a corresponding maintenance route and a maintenance privilege are determined based on the maintenance decision.

[00191] In step S1106, a maintenance instruction is generated based on the maintenance route and maintenance privilege.

[00192] In step S1108, the maintenance instruction is sent to a transport vehicle to be maintained. The maintenance instruction is adapted to switch the traveling privilege of the transport vehicle to the maintenance privilege, so that the transport vehicle travels to a repair operation area based on the maintenance route.

[00193] In this embodiment, by receiving the maintenance decision sent by the centralized control center, the maintenance instruction is generated based on the maintenance decision. The maintenance instruction is used to change the traveling privilege of the transport vehicle, so that based on the maintenance instruction, the transport vehicle automatically exits the transport area and travels to the repair and maintenance area to perform maintenance operations. This embodiment is beneficial to extend the service life of the transport vehicle and reduce the probability of failure of the transport vehicle when performing transport task(s).

[00194] Specifically, a repair and maintenance management module for routine maintenance of transport vehicles may be set up in the centralized control center. The repair and maintenance management module formulates a preventive maintenance plan based on a technical parameter table and automatically assigns a corresponding task to an operator and a transport vehicle that needs maintenance. The transport vehicle exits a standby transport vehicle list after completing a current task and arrives at a designated position at designated time. If the task target time conflicts with the current ongoing task, the transport vehicle sends new time to the management and control subsystem, and the management and control subsystem notifies the control center, which adjusts the plan by itself and notifies the operator

of the relevant updates.

[00195] In some embodiments, the plurality of transport vehicles include a faulty transport vehicle and/or a missing transport vehicle. The transport control method further includes: when receiving fault information reported by the faulty transport vehicle or detecting a missing transport vehicle, sending take-over information to a standby transport vehicle. The take-over information includes a fault position of the faulty transport vehicle or a contact loss position where the missing transport vehicle is last detected before loss of contact. Accordingly, the standby transport vehicle travels to the fault position or the contact loss position in response to the take-over information.

[00196] The fault information includes but is not limited to insufficient power, a navigation failure, and a communication failure.

[00197] A repair instruction is sent to the faulty transport vehicle. The repair instruction is generated based on a repair route and a repair privilege. The repair instruction is adapted to switch the traveling privilege of the transport vehicle to the repair privilege, so that the transport vehicle travels to the repair operation area based on the repair route.

[00198] The standby transport vehicle is a transport vehicle that does not receive a baggage transport task.

[00199] In this embodiment, a transport vehicle with power failure or loss or a transport vehicle having a navigation failure is recorded as a faulty transport vehicle, and a transport vehicle losing contact is recorded as a missing transport vehicle. When communication is normal, the faulty transport vehicle sends position information to the management and control subsystem. When position information cannot be sent due to loss of contact, the missing transport vehicle may also indicate its position by turning on a warning light on the transport vehicle. The management and control subsystem deploys a standby transport vehicle to the position of the faulty transport vehicle and/or the missing transport vehicle, the baggage is manually transferred, braking is manually released, and the standby transport vehicle is manually pushed away from the workplace to a corresponding emergency area. The warning light here can be powered separately, and all AGVs in the emergency processing area execute specific information security procedures and fault investigation procedures.

[00200] Specifically, the repair and maintenance procedure for a transport vehicle includes but not limited to:

[00201] Preventive maintenance procedure: the management and control subsystem generates a preventive maintenance task and report it to the centralized control center. The management and control subsystem plans a route. The corresponding transport vehicle receives an instruction and ends the grant in a corresponding activity area and enters a repair operation area. After completion of the maintenance, the transport vehicle is re-granted to enter the corresponding transport area.

[00202] Temporary common failure procedure for the transport vehicle: the management and control subsystem receives failure information, instructs a standby transport vehicle to take over the baggage, reports information update to the centralized control center, instructs the faulty transport vehicle to enter the repair operation area and releases the grant in the operation area. The transport vehicle enters the maintenance operation area. After completion of repair, the transport vehicle is re-granted to enter the corresponding operation area.

[00203] No power or thermal runaway procedure: the management and control subsystem receives fault information or detects that a transport vehicle loses contact, instructs a standby transport vehicle to take over the baggage, reports information update to the centralized control center, releases the grant of the faulty transport vehicle in the operating area, and notifies maintenance personnel to handle the situation on site. The transport vehicle is manually transferred to an emergency processing area.

[00204] As shown in FIG. 12, in some embodiments, the method further includes:

[00205] In step S1202, status information of a transport vehicle is obtained. The status information includes remaining battery level and/or working status.

[00206] Through the status information of the transport vehicle, it is possible to determine whether the transport vehicle needs to be charged, the amount of electricity required to be charged, when to charge, where to complete the charging, etc. based on the status information.

[00207] In step S1204, a charging instruction is generated based on the status information and/or acquired operating condition information of a charging module.

[00208] Specifically, the charging module includes but is not limited to a charging rail and a charging station, and the operating condition information of the charging module includes the charging power of the charging module, occupancy status of the charging module, etc.

[00209] Taking the status information being remaining battery level as an example, if the remaining battery level is high, the transport vehicle may directly travel to the charging rail and complete the charging by the charging rail. If the remaining battery level is low, the transport vehicle may travel to the charging station and complete the charging by the charging station.

[00210] In addition, taking the status information being whether it is in the baggage transporting state as an example, if the transport vehicle is transporting baggage, the transport vehicle may directly travel to the charging rail and complete charging while traveling. If the transport vehicle is in an idle state, the transport vehicle may travel to an idle charging rail to perform charging, or the transport vehicle may travel to a charging station to perform charging.

[00211] In step S1206, a charging instruction is sent to the transport vehicle. The charging instruction is used to drive the transport vehicle to travel to a corresponding charging module to perform a charging operation.

[00212] In this embodiment, by acquiring information such as the remaining battery level and/or working status of the transport vehicle, a charging plan is configured for the transport vehicle based on the above information, so as to ensure that the transport vehicle has sufficient battery level when performing a transport task.

[00213] In some embodiments, the charging module includes a first charging module, a second charging module and a third charging module. Generating the charging instruction based on the remaining battery level and/or the detected state of the transport vehicle includes: when it is detected that the transport vehicle is in a transport state, generating a first charging instruction based on the remaining battery level, where the first charging instruction is used to drive the transport vehicle to the first charging module or the second charging module.

[00214] When it is detected that the transport vehicle is in an idle state, a second

charging instruction is generated based on the remaining battery level, where the second charging instruction is used to drive the transport vehicle to the second charging module or the third charging module.

[00215] The first charging module includes a plurality of first charging rails, which are arranged in a transport area between a plurality of baggage out devices and a plurality of baggage handling devices, and are used to charge transport vehicle(s) in a traveling state. The second charging module includes a plurality of second charging rails, which are arranged in a standby area and/or a queuing area, and are used to charge transport vehicle(s) in a queuing waiting state. The standby area and/or the queuing area are located at the front end of the plurality of baggage handling devices, and/or the front end of the baggage out devices, and/or an area where the transport vehicle(s) is(are) located when waiting for a task instruction. The third charging module includes a plurality of charging stations, which are arranged in a non-transport area, and are used to charge transport vehicle(s) in an idle state.

[00216] As shown in FIG. 13, in some embodiments, selecting, from the plurality of baggage handling devices, the target baggage handling device based on the ranking result further includes:

[00217] In step S1302, occupancy of a plurality of first charging rails is acquired.

[00218] In step S1304, occupancy of the plurality of first charging rails is ranked.

[00219] In step S1306, a coordinated selection is performed based on a ranking result of the occupancy and the ranking result of the load amounts, and the target baggage handling device is determined based on a result of the coordinated selection.

[00220] In this embodiment, in a transport area where the first charging rails are provided, it is determined which first charging rails have a smaller load, and it is determined which baggage handling devices have a smaller load in combination with the handling load ranking. Based on the above determination results, the preferred target baggage handling device is determined. If there are more than two alternative target terminals for the same transport vehicle, the optimal transport route is continuously selected according to the alternative route distances to optimize the transport route.

[00221] For the third charging module, as shown in FIG. 14, the process of the management and control subsystem controlling the third charging module to charge the idle

transport vehicle to be charged includes:

[00222] In step S1402, the third charging module sends operating condition information to the management and control subsystem, so that the management and control subsystem determines the position of a vacant charging station based on the operating condition information.

[00223] In step S1404, the management and control subsystem receives status information sent by an idle transport vehicle.

[00224] In step S1406, the management and control subsystem determines the transport vehicle to be charged based on the received status information.

[00225] In step S1408, the management and control subsystem generates a charging route based on the position information of the transport vehicle to be charged and the position of the vacant charging station.

[00226] In step S1410, the management and control subsystem sends the charging route to the transport vehicle to be charged, so that the transport vehicle to be charged travels to the vacant charging station based on the charging route. The transport vehicle to be charged is charged by the vacant charging station.

[00227] In addition, the management and control subsystem can also obtain the remaining battery level fed back from the transport vehicle to be charged, and evaluate whether the transport vehicle to be charged can still complete at least one round of transport work based on the remaining battery level, so as to select a second charging rail or charging station for the transport vehicle to be charged based on the evaluation result.

[00228] Specifically, when it is detected that the remaining battery level is lower than or equal to a first battery level threshold, it indicates that the transport vehicle can still complete at least one round of transport work. At this time, a charging vehicle can enter the queuing area or the standby area and select an available charging rail from a plurality of second charging rails.

[00229] When it is detected that the remaining battery level is lower than or equal to a second battery level threshold, it indicates that the transport vehicle cannot complete at least one round of transport work, and an available charging station is selected from a plurality of charging stations.

[00230] The first battery level threshold is greater than the second battery level threshold.

[00231] In this embodiment, a charging subsystem is arranged in at least one of the operating area of the transport vehicle, the standby area/queuing area and a centralized charging area. The charging subsystem includes a plurality of first charging rails, a plurality of second charging rails and a plurality of charging stations. The first charging rails are high-speed online charging rails, and the second charging rails are standby/queuing area charging rails. A plurality of charging stations are arranged in the centralized charging area. The high-speed online charging rails are arranged in a high traffic flow operation area. The charging rails in a plane arrangement or a space arrangement are used to charge transport vehicles in normal movement online. The length of this section of the charging rail is relatively long, so as to charge the transport vehicles in a high-speed running state. The standby/queuing area charging rails are arranged in the standby area and an area where queuing occurs frequently. The charging rails in a plane arrangement or a space arrangement are used to charge the transport vehicles on standby or in queue online. The length of this section of the charging rail is relatively short. Through the combination of the above three active charging methods, the transport vehicles can be charged during operation, so as to reduce the number of used fixed charging stations, avoid or shorten the off-duty charging time, and improve the transport attendance rate.

[00232] In some embodiments, a vertical lifting mechanism is provided in at least one transport area. The transport control method further includes: when it is detected that a transport vehicle travels to the vertical lifting mechanism, and the vertical lifting mechanism carries transport vehicles to be ascended and to be descended at the same time, sending an energy-saving mode operation instruction to the vertical lifting mechanism, so that the vertical lifting mechanism operates based on an energy-saving mode, and ascending of the transport vehicle to be ascended and descending of the transport vehicle to be descended can be performed synchronously; or when the vertical lifting mechanism only carries a transport vehicle to be ascended or to be descended, sending a normal mode operation instruction to the vertical lifting mechanism, so that the vertical lifting mechanism operates based on a normal mode to enable ascending of the transport vehicle to be ascended, or to enable

descending of the transport vehicle to be descended.

[00233] In this embodiment, the vertical lifting mechanism controlled by a management and control subsystem is provided to realize vertical transfer of transport vehicle(s) in a ramp-free application scenario. The management and control subsystem arranges transport vehicles with similar weights but opposite transfer directions to share the vertical lifting mechanism, thereby realizing energy-saving operation of the vertical lifting mechanism.

[00234] As shown in FIG. 15, in some embodiments, sending the baggage transport task to the transport vehicle further includes:

[00235] In step S1502, when receiving obstacle avoidance information fed back by a transport vehicle based on the baggage transport route, a type of obstacle in the obstacle avoidance information is identified.

[00236] The identification of the obstacle type in the obstacle avoidance information may be achieved by setting an image acquisition module on the transport vehicle, and the image acquisition module on the transport vehicle collects the image of the obstacle. The type of obstacle may be identified by recognizing the image of the obstacle. The type of obstacle may also be determined by detecting the traffic map of the transport area.

[00237] In step S1504, an avoidance instruction is generated based on the type of obstacle and the traffic map of the managed transport area.

[00238] In step S1506, the avoidance instruction is sent to the transport vehicle.

[00239] In this embodiment, when the management and control subsystem receives the obstacle avoidance information reported by the transport vehicle, it indicates that the transport vehicle has an obstacle avoidance request. By identifying the type of obstacle, different obstacle avoidance strategies may be generated to ensure the reliability and safety of obstacle avoidance.

[00240] As shown in FIG. 16, in some embodiments, generating the avoidance instruction based on the type of obstacle and the traffic map of the managed transport area in step S1504 includes:

[00241] In step S1602, when it is detected that the obstacle is a same type transport vehicle, whether the transport vehicle and the same type transport vehicle are in a queuing

area of the transport area is detected based on the traffic map.

[00242] In step S1604, when it is detected that the transport vehicle and the same type transport vehicle are in the queuing area, a following instruction for following the same type transport vehicle is generated, so as to determine the following instruction as the avoidance instruction.

[00243] In step S1606, when it is detected that the transport vehicle and same type transport vehicle are not in the queuing area, or when it is detected that the obstacle is an unknown object on the traffic map, a turning instruction for avoiding the obstacle is generated to determine the turning instruction as the avoidance instruction.

[00244] In this embodiment, if the obstacle is a foreign object or an object not known in the map, the obstacle can be bypassed by controlling the transport vehicle (for example, an Automated Guided Vehicle (AGV) robot) to move left or right. If the obstacle is other working transport vehicle (for example, other AGV robot), the current area where the AGV robot is located is determined. If the AGV robot is in the queuing area, the AGV robot follows the movement. If the AGV robot is in the non-queuing area, the AGV robot autonomously bypasses the obstacle.

[00245] Furthermore, if no successful obstacle avoidance feedback is received from the transport vehicle after a predetermined period of time has passed since the avoidance instruction was sent, or if obstacle avoidance information reported by the same transport vehicle is received again after a predetermined period of time, it indicates that the transport vehicle has still not bypassed the obstacle. At this time, the transport route is re-planned, such as reselecting a target baggage handling device as a new destination, to ensure the smoothness and safety of the traveling of the transport vehicle.

[00246] Further, a re-planned destination reported by the transport vehicle may also be received.

[00247] The following describes in detail the transport control method for baggage consignment in the present disclosure which is performed by a centralized control center.

[00248] As shown in FIG. 17, a transport control method for baggage consignment according to another embodiment of the present disclosure is applied to a centralized control center. The method includes:

[00249] In step S7102, a baggage scheduling task is sent to a management and control subsystem, so that the management and control subsystem sends to, a transport vehicle, a baggage transport task which is generated based on the baggage scheduling task, so that the transport vehicle performs the baggage transport task.

[00250] In some embodiments, there are a plurality of management and control subsystems, and before sending the baggage scheduling task to the management and control subsystem, the method further includes: receiving a plurality of sets of baggage check-in information reported by a plurality of baggage out devices, where the baggage check-in information includes baggage information and flight information; based on the flight information, collecting distribution information of the plurality of baggage out devices; based on the distribution information and a coordinated allocation result of the baggage information, generating baggage scheduling tasks for the plurality of management and control subsystems.

[00251] Specifically, the baggage check-in information includes baggage information and flight information. Since flights usually correspond to baggage counters (i.e., baggage out devices), the distribution information of the baggage out devices may be obtained based on the correspondence relationship. In combination with the specific baggage information, a corresponding baggage scheduling task may be generated.

[00252] In this embodiment, baggage scheduling tasks are sent to management and control subsystems by the centralized control center, so that the tasks are sent after the centralized control center evaluates the overall balance and coordination of baggage transport, thereby ensuring that the baggage scheduling tasks are carried out in parallel on a plurality of lines.

[00253] In some embodiments, before sending the baggage scheduling task to the management and control subsystem, the method further includes: sending, to each management and control subsystem, management and control privilege information of a corresponding managed transport area, so that the management and control subsystem, based on the management and control privilege information, grants a traveling privilege to transport vehicle(s) for travelling in a corresponding transport area.

[00254] In this embodiment, the centralized control center sends, to each management

and control subsystem, the management and control privilege information of a corresponding managed transport area, thereby realizing the grouping of transport vehicles and the limitation of traveling areas. In combination with the specific management and control of the management and control subsystems, it can be ensured that the transport vehicles can travel reliably in their respective limited areas.

[00255] In some embodiments, the method further includes: sending a management and control privilege change instruction to the management and control subsystem, so that the management and control subsystem sends traveling privilege change information to a candidate transport vehicle to be changed based on the change instruction.

[00256] In some embodiments, the method further includes: periodically sending a maintenance decision on the transport vehicle to the management and control subsystem.

[00257] The following describes in detail the transport control method for baggage consignment in the present disclosure which is performed by a transport vehicle.

[00258] As shown in FIG. 18, a transport control method for baggage consignment according to another embodiment of the present disclosure is applied to a transport vehicle. The transport control method includes:

[00259] In step S1802, a baggage transport task sent by a management and control subsystem is received.

[00260] In step S1804, a baggage transport route in the baggage transport task is extracted.

[00261] In step S1806, after completing baggage loading, the transport vehicle travels based on the baggage transport route.

[00262] The detection of whether the baggage loading is completed may be achieved by sensing weight of the transport vehicle itself or receiving an indication that baggage has been loaded.

[00263] As shown in FIG. 19, in some embodiments, before receiving the baggage transport task sent by the management and control subsystem in step S1802, the method further includes:

[00264] In step S1902, a preset scheduling code is sent to the management and control subsystem.

[00265] In step S1904, grant information, which is fed back by the management and control subsystem when verification of the scheduling code is passed, is received. The grant information is used to grant a traveling privilege in a transport area managed by the management and control subsystem.

[00266] In some embodiments, the method further includes: determining a target change area in response to traveling privilege change information sent by the management and control subsystem; and traveling from a current transport area to the target change area, where the target change area is a changed transport area, or other area(s) outside the transport area.

[00267] In some embodiments, the method further includes: switching the traveling privilege to a maintenance privilege in response to the received maintenance instruction; and traveling to a repair operation area according to a maintenance route carried in the maintenance instruction based on the maintenance privilege to perform the maintenance operation.

[00268] In some embodiments, the transport vehicle is further configured to: when it is detected that maintenance time has been reached based on a periodic maintenance task, if a baggage scheduling task is being performed, feed a change request for changing the maintenance time back to the management and control subsystem; the management and control subsystem is further configured to: report the change request to the centralized control center.

[00269] In this embodiment, the daily maintenance of transport vehicle(s) is carried out by a repair and maintenance management subsystem, which formulates a preventive maintenance plan based on a technical parameter table and automatically assigns a corresponding task to an operator and a transport vehicle that needs maintenance. The transport vehicle exits a standby AGV list after completing a current task and arrives at a designated position at designated time. If the daily maintenance time conflicts with the current ongoing task, the transport vehicle sends new time to the management and control subsystem, and the management and control subsystem notifies the centralized control center, which adjusts the plan by itself and notifies the operator.

[00270] As shown in FIG. 20, in some embodiments, a transport vehicle is equipped

with a sensing device and is pre-configured with map information of a plurality of transport areas. Traveling based on the baggage transport route includes:

[00271] In step S2002, a first distance from a surrounding reference object is sensed by a sensing device.

[00272] The sensing device may be a laser radar, and the surrounding reference object may be a plurality of auxiliary positioning facilities arranged in the transport area, such as reflective stickers, positioning columns, etc., or may be an infrastructure object in the area.

[00273] In step S2004, position information of the transport vehicle itself is determined based on the map information and the first distance.

[00274] In step S2006, the transport vehicle travels along the baggage transport route based on the position information.

[00275] In this embodiment, the sensing device on the transport vehicle senses the first distance from the surrounding reference object while traveling, and in combination with the recognition of map information, accurately determines the position of the transport vehicle itself according to the map and an auxiliary navigation object. Only when the transport vehicle itself cannot successfully avoid obstacles does it need to query the management and control subsystem. Based on different obstacle conditions, the management and control subsystem gives different instructions in combination with the scheduling information of the control center, thereby improving the transport vehicle's ability to autonomously deal with system interruptions and communication interruptions.

[00276] As shown in FIG. 21, in some embodiments, traveling along the baggage transport route based on the position information includes:

[00277] In step S2102, when traveling along the baggage transport route based on the position information, a safe distance for collision avoidance is calculated based on the baggage transport route and a current traveling speed.

[00278] In step S2104, a second distance from the obstacle is detected based on the sensing device.

[00279] The collision avoidance strategy is configured based on a relationship between the second distance and the safe distance L2.

[00280] As shown in FIG. 22, obstacles around an AGV 106 are detected by a sensing

device to prevent collision with obstacles. The detection range is a sector area with a radius R and an angle of 270°, where L1 is an emergency braking distance, and L2 is a safe distance.

[00281] In some embodiments, configuring the collision avoidance strategy based on the relationship between the second distance and the safe distance includes:

[00282] In step S2106, an emergency braking distance that matches the current traveling speed is determined.

[00283] In step S2108, when it is detected that the second distance is greater than the safe distance, the transport vehicle continues to travel based on the current traveling speed.

[00284] In step S2110, when it is detected that the second distance is less than or equal to the safe distance and greater than the emergency braking distance, slow-down traveling is performed.

[00285] In step S2112, when it is detected that the second distance is less than or equal to the emergency braking distance, a braking operation is performed.

[00286] In this embodiment, the transport vehicle detects the second distance from the obstacle(s) in real time through the sensing device, and the sensing device is a radar. The safe distance matching the current vehicle speed is calculated according to the path and Lidar technology. If the real-time second distance is greater than the safe distance, the transport vehicle runs at a normal speed. If the real-time second distance of the transport vehicle is less than or equal to the set safe distance corresponding to the vehicle speed but greater than the set emergency braking distance, a corresponding running speed is calculated according to the distance change speed and the transport vehicle travels in a reduced speed. If the real-time second distance is less than or equal to the set emergency braking distance corresponding to the vehicle speed, the vehicle brakes and performs obstacle avoidance processing to ensure the safety of the transport vehicle during traveling.

[00287] As shown in FIG. 23, in some embodiments, traveling along the baggage transport route based on the position information further includes:

[00288] In step S2302, the traveling route is compared with the map information to generate a comparison result.

[00289] In step S2304, when it is determined based on the sensing result and the comparison result that there is an obstacle on the baggage transport route, whether the

obstacle can be bypassed by the transport vehicle itself is evaluated; if “yes”, step S2308 is performed; if “no”, step S2310 is performed.

[00290] The sensing result is generated by the sensing device.

[00291] In order to evaluate whether it is possible to bypass an obstacle by the transport vehicle itself, the sensing result may be used to determine whether the obstacle is in a stationary state or a moving state. If the obstacle is in a stationary state, a self-avoidance path may be generated based on a relative distance and the transport vehicle’s own running speed. If the obstacle is in a moving state, a movement direction and a movement speed of the obstacle may be further obtained. If the movement speed of the obstacle tends to be constant and the movement direction deviates from the traveling route, the obstacle can also be bypassed by the transport vehicle itself. If the movement speed of the obstacle fluctuates greatly and does not deviate from the traveling path, it is necessary to report to the management and control subsystem for help.

[00292] In step S2306, when it is evaluated that the obstacle can be bypassed by the transport vehicle itself, a self-avoidance path is generated to bypass the obstacle according to the self-avoidance path.

[00293] In step S2308, when it is evaluated that the obstacle cannot be bypassed by the transport vehicle itself, obstacle avoidance information is generated.

[00294] In step S2310, the obstacle avoidance information is reported to the management and control subsystem, and an avoidance instruction which is fed back by the management and control subsystem based on the obstacle avoidance information is received.

[00295] In step S2312, the baggage transport route is adjusted based on the avoidance instruction to bypass the obstacle.

[00296] In this embodiment, when a transport vehicle detects an obstacle, the transport vehicle first checks whether it can bypass the obstacle by itself. When it detects that it can bypass the obstacle by itself, there is no need to report the obstacle avoidance need to the management and control subsystem. This method enables the transport vehicle to have the ability to make a response autonomously and in a timely manner, thereby ensuring obstacle avoidance efficiency.

[00297] In some embodiments, adjusting the baggage transport route based on the

avoidance instruction to avoid the obstacle includes:

[00298] when the avoidance instruction is a following instruction, traveling by following the obstacle to bypass the obstacle;

[00299] when the avoidance instruction is a turning instruction, adjusting the traveling direction to bypass the obstacle.

[00300] In addition, in some embodiments, traveling along the baggage transport route based on position information further includes: when it is detected that the obstacle is a fellow transport vehicle, detecting whether the transport vehicle is in a queuing area based on the position information; and when it is detected that the transport vehicle is in the queuing area, moving following the fellow transport vehicle.

[00301] Specifically, by setting an image acquisition module on a transport vehicle, images in front of the transport vehicle may be collected. When the obstacle in front of the transport vehicle is identified as a fellow transport vehicle (i.e., a same type transport vehicle which is of the same type as the transport vehicle which feeds back the obstacle avoidance information) based on an image recognition model, it is further detected whether the transport vehicle is in the queuing area based on its own position information. If the above two conditions are met at the same time, the transport vehicle can directly follow the fellow transport vehicle.

[00302] In some embodiments, the transport vehicle is specifically an AGV. When the AGV detects an obstacle, the AGV autonomously determines the type of obstacle based on its position information and map information, and based on the type of obstacle, the AGV autonomously plans an avoidance route to run based on the avoidance route to bypass the obstacle.

[00303] As shown in FIG. 22, obstacles around an AGV are detected by Lidar technology. The detection range is a sector area with a radius of R and an angle of 270°. Based on the SLAM algorithm, the detected information is compared with a preset map of a designated area to identify the current position of the transport vehicle and the information of the obstacle. Based on the identified obstacle information and the current position of the transport vehicle, the obstacle is bypassed autonomously. Only when the AGV cannot complete the obstacle avoidance within preset time, it will send a report to the management

and control subsystem to query the traffic status and obstacle information. Different strategies for obstacle avoidance are carried out for different situations, or the management and control subsystem re-plans a transport route. Most of the time, the AGV can autonomously identify obstacles and autonomously bypass them, so that the AGV has the ability to autonomously deal with system interruptions and communication interruptions. The transport vehicle has high autonomous control performance, which effectively simplifies the calculations of the management and control subsystem and the centralized control center, and improves the self-adaptive ability of the entire system under failure.

[00304] In some embodiments, the transport vehicle is further configured to: when it is detected that the obstacle is a fellow transport vehicle, detect whether the transport vehicle is in a queuing area based on the position information, so as to move following the fellow transport vehicle when in the queuing area.

[00305] In this embodiment, if the obstacle is a foreign object, or an object not marked on the map or an infrastructure object in a designated area, the transport vehicle can move left or right to bypass the obstacle. If the obstacle is another moving transport vehicle, the current area where the transport vehicle is located is determined. If the transport vehicle is in a queuing area, it moves following the another moving transport vehicle. If transport vehicle is in a non-queuing area, it bypasses the obstacle autonomously. If the obstacle cannot be bypassed after a preset period of time, the transport vehicle sends a report to the management and control subsystem to request the management and control subsystem to re-plan a route, that is, re-plan the target baggage handling device (that is, excluding the current target baggage handling device and selecting a best target baggage handling device from other destinations).

[00306] In addition, if the planned target baggage handling device has a heavy load, the transport vehicle can also perform a proactive report to re-plan the destination.

[00307] As shown in FIG. 24, in some embodiments, a transport vehicle is further provided with a collision avoidance device 1082. The collision avoidance device 1082 is provided on the front end side wall of the transport vehicle 106.

[00308] As shown in FIG. 25, the collision avoidance operation performed by the transport vehicle includes:

[00309] In step S2502, when the collision avoidance device detects a collision action, the transport vehicle performs emergency braking and shuts down a power device.

[00310] The collision avoidance device may specifically be a collision avoidance bar with a sensing capability.

[00311] In step S2504, the transport vehicle generates collision information based on the collision action and reports the collision information to the management and control subsystem.

[00312] In step S2506, the management and control subsystem generates obstacle avoidance information based on the collision information, and sends the obstacle avoidance information to a designated transport vehicle.

[00313] The designated transport vehicle refers to a transport vehicle that has a third distance from the transport vehicle in collision. The third distance is less than an effective avoidance distance. The effective avoidance distance is a distance that a transport vehicle can perform autonomous avoidance.

[00314] In this embodiment, the collision avoidance device is set at the front end of the transport vehicle. In this way, in special operating conditions such as failure of autonomous obstacle avoidance, the emergency braking is triggered by hardware. When an actual collision occurs, the collision avoidance device is triggered, the emergency braking is carried out and the power device is shut down. The transport vehicle sends collision information to the management and control subsystem, and the management and control subsystem sends obstacle avoidance information to a nearby designated AGV and sends a feedback to the centralized control center. Accordingly, the designated AGV can bypass in time the transport vehicle which experiences an emergency braking and an area load status is updated, especially when the transport vehicle is in the queuing area (such as the charging rail area and the security inspection area). When braking is carried out by hardware, manual reset is needed (through a reset button). The management and control subsystem captures the status information of the AGV before and after the collision, generates a record and report it to the centralized control center to facilitate subsequent investigations.

[00315] Specifically, the transport vehicle has autonomous controllability. In addition to detecting the distance from obstacles, the transport vehicle can also perform map

identification and accurately locate itself based on the map and auxiliary navigation object(s). Only when the transport vehicle cannot successfully avoid obstacles by itself, it needs to query the management and control subsystem. Based on different obstacle conditions, the management and control subsystem gives different instructions in combination with the scheduling information of the centralized control center. The AGV has the ability to autonomously deal with system interruptions and communication interruptions. As shown in FIG. 24, in some embodiments, the transport vehicle is provided with a conveyer device, and a plurality of sensors are arranged on the conveyer device along a conveying direction. The sensors are used to sense the position of the baggage on the conveyer device. Traveling based on the baggage transport route further includes: when it is detected that the baggage position deviates from the pre-placed position, determining a deviation direction; and based on the deviation direction, starting the conveyer device to perform a deviation correction operation.

[00316] The conveyer device may specifically be a conveyor belt.

[00317] In this embodiment, sensors are arranged at the front, middle and rear sides along the conveying direction of the conveyer device. For baggage of a smaller volume, only a middle sensor can sense the baggage under normal loading conditions. When there is a risk of falling because the baggage shifts and slides to the edge due to a small friction coefficient or other reasons, one of the sensors at the front or the sensors at the rear generates a signal change, i.e., sensing the baggage. At this time, the deviation direction is determined by the position of the sensor with the signal change, and the deviation correction operation is implemented by adjusting the conveyer device at front and rear sides. When it is restored to the state where only the middle sensor senses the baggage, it is determined that the deviation correction is completed.

[00318] For an operating condition where oversized baggage blocks three sensors at the same time, when a single edge sensor loses the package, the transport vehicle's controller determines an adjustment direction based on the position of the sensor where the package was lost and adjusts the package to the position where the three sensors are blocked again.

[00319] In some embodiments, a transport vehicle includes a weighing device for recording the weight of the baggage on the conveyer device. The transport vehicle is further configured to generate a security alarm upon detecting a weight change.

[00320] In some embodiments, the transport vehicle is also provided with a battery management module and a fire suppression module. The transport control method further includes: monitoring the operating condition of a power battery based on the battery management module, and activating the fire suppression module when determining that the power battery has a risk of thermal runaway based on the operating condition. Traveling based on the baggage transport route specifically further includes: triggering the conveyer device to discard the transported baggage.

[00321] In this embodiment, the transport vehicle is provided with a battery management module BMS. The BMS can activate a baggage protection procedure and a fire suppression system according to the information collected by the voltage, temperature and ultraviolet sensors and so on. The fire suppression system determines whether the battery is on the edge of thermal runaway or in a thermal runaway state according to the voltage, temperature, ultraviolet signal and the like monitored by the BMS, thereby activating the fire suppression module to suppress the impending thermal runaway or the ongoing runaway. The BMS predicts that the AGV autonomously abandons the baggage when the battery is in a thermal runaway state and travels into the emergency processing area as soon as possible.

[00322] BMS may also be used to achieve kinetic energy recovery, and recharge the battery back during braking, deceleration or downhill to extend the operating time and improve energy utilization.

[00323] In some embodiments, traveling based on the baggage transport route further includes: when a fault is detected, reporting fault information to the management and control subsystem.

[00324] In some embodiments, the method further includes: when in an idle state, receiving take-over information sent by the management and control subsystem, where the take-over information includes a fault position of a faulty transport vehicle or a contact loss position where a missing transport vehicle is last detected before loss of contact; extracting the fault position or contact loss position in the take-over information; and traveling to the fault position or contact loss position.

[00325] As shown in FIG. 26, the transport areas include a first transport area and a second transport area. The transport vehicle is controlled to travel in the first transport area

and the second transport area through the centralized control center and the management and control subsystem. A baggage out device provided in the first transport area is a baggage consignment counter 2602. A baggage handling device provided in the first transport area is an X-ray security inspection machine 2604. A baggage out device provided in the second transport area is an X-ray security inspection machine 2604. The baggage handling devices provided in the second transport area include a baggage carousel 2606, a device 2608 in early-arrived baggage buffer area, and a manual inspection device 2610. A vertical lifting mechanism 2612 is also provided in the first transport area or the second transport area for lifting the transport vehicle(s).

[00326] In addition, a non-transport area includes a maintenance area, and the maintenance area includes an emergency processing area 2614 and a repair and maintenance area 2616.

[00327] Specifically, the charging module includes a first charging module 2618 provided in a transport area, a second charging module 2620 provided in a queuing area, and a third charging module 2622.

[00328] As shown in FIG. 27, in some embodiments, the transport control system includes: a centralized control center 102 and two management and control subsystems 104.

[00329] The centralized control center 102 is configured to generate baggage scheduling tasks based on baggage check-in information, and send the baggage scheduling tasks to a management and control subsystem 104a and a management and control subsystem 104b.

[00330] The management and control subsystem 104a is configured to manage a plurality of transport vehicles 106a and realize information interaction by accessing a wireless network. The management and control subsystem 104b is configured to manage a plurality of transport vehicles 106b and realize information interaction by accessing the wireless network.

[00331] The centralized control center 102 also controls baggage out devices and baggage handling devices through a PLC device 126. The baggage handling devices include an X-ray machine 110A and a scanner 110B.

[00332] A baggage sorting service subsystem 116 is configured to manage baggage out

devices, is in communication connection with the centralized control center 104, and is configured to send baggage check-in information to the centralized control center. The baggage check-in information includes baggage information and flight information.

[00333] The transport control system further includes: a flight information subsystem 118, which is in communication connection with the baggage sorting service subsystem 116 and is configured to send flight information to the baggage sorting service subsystem; and a baggage information subsystem 120, which is in communication connection with the baggage sorting service subsystem 116 and is configured to send baggage information to the baggage sorting service subsystem.

[00334] As shown in FIG. 27, the baggage handling devices includes an X-ray security inspection device 110A and a scanner 110B. The baggage handling devices may be in communication connection with the centralized control center 102 directly through a PLC device.

[00335] In addition, as shown in FIG. 27, a monitoring service subsystem 122 and a system maintenance information management subsystem 124 may be further provided and respectively in communication connection with the centralized control center 102.

[00336] In a specific application scenario of the present disclosure, a plurality of transport vehicles are used to carry passengers' consigned baggage, for example, from a baggage out device consignment counter to a baggage handling device, that is, the security inspection device, and then from the security inspection device to a baggage carousel of a corresponding flight or an early-arrived baggage and manual operation table. Each transport vehicle includes an integrally welded frame, a conveying mechanism arranged on the frame, a traveling drive mechanism arranged under the frame and used to drive the frame to move, a weighing device, an object sensing sensor, an air pressure sensor, a battery that provides a power source for AGV movement and a battery management system, a control subsystem that communicates with a management and control subsystem, and a sensing device for detection and recognition of the surrounding environment.

[00337] Referring to FIG. 27, the centralized control center 102 manages one or more management and control subsystems 104. A management and control subsystem is a centralized system for controlling and managing a plurality of transport vehicles and

functional stations (such as charging modules and parking stations, etc.) in a transport area or non-transport area. The transport vehicles and charging modules communicate with the management and control subsystem through a wireless network to transmit status information of the transport vehicles/functional stations (such as position, load status, speed, air pressure, battery level and current waypoints) and receive task plans of the transport vehicles/functional stations. Then, the management and control subsystem collects the status of all transport vehicles and functional stations to calculate and generate transport vehicle tasks and information feedback to the centralized control center. The management and control subsystem generates task scheduling for each transport vehicle and functional station. The management and control subsystem also generates transport vehicle traffic management to avoid and prevent traffic conflicts between a plurality of transport vehicles.

[00338] As shown in FIG. 28, the management and control subsystem may be divided into a plurality of layers or levels, including task input, task management, task integration, task implementation and task execution, and so on.

[00339] The task input layer receives information sent by the centralized control center and uses a web interface or an enterprise platform and an airport platform, such as a baggage sorting service system, a monitoring service system, a system maintenance information management system and so on, to manually or automatically generate baggage scheduling tasks. This layer may also centrally display the status and task information of the transport vehicles through the web interface or monitoring service system or system maintenance information management system.

[00340] The task integration layer may be understood as being formed by a plurality of functional sub-subsystems, as shown in FIG. 19. The plurality of functional sub-subsystems include fleet management and control, infrastructure management, functional unit management, and a security inspection functional subsystem, as well as an AGV adapter, an Internet of Things device adapter, and a functional device adapter for respectively controlling transport vehicles and functional stations, and so on.

[00341] The task execution layer is configured to send task instructions to the transport vehicles or the charging subsystem.

[00342] The task management layer receives the task input from the task input layer

and the functional sub-subsystem status from the task integration layer to calculate and plan resource allocation (including a task dispatch rule, traffic flow management and time window control). From the task management layer to the task integration layer, the most suitable task is assigned to a corresponding functional sub-subsystem, and the functional sub-subsystem schedules each transport vehicle or functional station to realize task dispatch planning, traffic flow monitoring and time window control.

[00343] The task implementation layer is based on a plurality of functional sub-subsystems, and realizes system adaptation between the task integration layer and the transport vehicles, functional stations and terminal devices, and realizes the coordination with the transport vehicles, Internet of Things devices and functional devices. Internet of Things devices include Internet of Things terminals, etc. Functional devices include charging modules, lifting devices and so on. The task implementation layer is used to send instructions (such as baggage scheduling tasks, charging control and so on) generated by the task management core layer to corresponding transport vehicles, charging modules and so on, and is also used to receive status information sent by transport vehicles, functional stations and terminal devices.

[00344] A terminal device may be a device for specifically controlling a single transport vehicle, or a device for checking the operating status of a transport vehicle.

[00345] Specifically, the workflow of the transport control system for baggage consignment includes the following:

[00346] After a passenger has consigned the baggage at the counter, the baggage check-in information is uploaded to an airline server or an airport platform. Then, through a flight information system, the baggage check-in information is synchronized to a baggage sorting service system. The centralized control center calculates and coordinates the various management and control subsystems, receives the baggage information and flight information sent by the baggage sorting service subsystem, and generates baggage scheduling tasks. A management and control subsystem generates a baggage transport task based on a baggage scheduling task, allocates and sends the baggage transport task to a corresponding transport vehicle. The transport vehicle that receives the task moves to a position of a baggage out device (such as the counter) to obtain the passenger's baggage. At this time, the passenger

information, transport vehicle information and flight information are associated. After the transport vehicle obtains the baggage, the baggage is transported to the security inspection machine for security inspection according to an optimal route planned by the management and control subsystem. The security inspection machine confirms the baggage information and scans the baggage. The information of the baggage that passes the security inspection is sent to the security inspection control unit by the X-ray machine and notified to the centralized control center. The centralized control center continues to transport the baggage to a corresponding position by the transport vehicle, such as a corresponding baggage carousel, an early-arrived baggage storage area, etc. The baggage that fails the security inspection is transported to the unpacking inspection area by the transport vehicle, and the baggage that passes the unpacking inspection is then transported to a corresponding baggage carousel or an early-arrived baggage storage area by the transport vehicle. The baggage that fails the unpacking inspection is transported to a buffer area by the transport vehicle.

[00347] The working status and task status of the transport vehicles are also fed back to the centralized control center and displayed centrally on the enterprise platform.

[00348] The following describes a transport control apparatus 2900 according to an embodiment of the present disclosure with reference to FIG. 29. The transport control apparatus 2900 shown in FIG. 29 is only an example and should not bring any limitation to the functions and scope of use of the embodiment of the present disclosure.

[00349] The transport control apparatus 2900 is in the form of hardware modules. The components of the transport control apparatus 2900 may include but are not limited to: a determination unit 2902 configured to determine a baggage out device from which the baggage is discharged in response to a baggage scheduling task sent by a centralized control center; a selection unit 2904 configured to select, from a plurality of baggage handling devices, a target baggage handling device for receiving baggage; a first generation unit 2906 configured to generate a baggage transport route based on a position of the baggage out device and a position of the target baggage handling device; a second generation unit 2908 configured to generate a baggage transport task based on the baggage transport route and the baggage scheduling task; and a first sending unit 2930 configured to send the baggage transport task to a transport vehicle, so that the transport vehicle transports the baggage from

the baggage out device to the target baggage handling device based on the baggage transport route.

[00350] The following describes a transport control apparatus 3000 according to an embodiment of the present disclosure with reference to FIG. 30. The transport control apparatus 3000 shown in FIG. 30 is only an example and should not bring any limitation to the functions and scope of use of the embodiment of the present disclosure.

[00351] The transport control apparatus 3000 is in the form of a hardware module. The components of the transport control apparatus 3000 may include but are not limited to: a second sending unit 3002 configured to send a baggage scheduling task to a management and control subsystem, so that the management and control subsystem sends, to a transport vehicle, a baggage transport task generated based on the baggage scheduling task, so that the transport vehicle performs the baggage transport task.

[00352] The following describes a transport control apparatus 3100 according to an embodiment of the present disclosure with reference to FIG. 31. The transport control apparatus 3100 shown in FIG. 31 is only an example and should not bring any limitation to the functions and scope of use of the embodiment of the present disclosure.

[00353] The transport control apparatus 3100 is in the form of hardware modules. The components of the transport control apparatus 3100 may include but are not limited to: a receiving unit 3102 configured to receive a baggage transport task sent by a management and control subsystem; an extracting unit 3104 configured to extract a baggage transport route in the baggage transport task; and an executing unit 3106 configured to travel based on the baggage transport route after completing baggage loading.

[00354] An electronic device 3200 according to an embodiment of the present disclosure is described below with reference to FIG. 32. The electronic device 3200 shown in FIG. 32 is only an example, and should not impose any limitation on the functions and scope of use of the embodiments of the present disclosure.

[00355] As shown in FIG. 32, the electronic device 3200 is shown in the form of a general-purpose computing device. The components of the electronic device 3200 may include, but are not limited to, at least one processing unit 3210, at least one storage unit 3220, and a bus 3230 connecting different system components (including the storage unit

3220 and the processing unit 3210).

[00356] The storage unit stores program codes, and the program codes can be executed by the processing unit 3210, so that the processing unit 3210 executes various example implementations according to the present disclosure described in the "example methods" section of the present specification. For example, the processing unit 3210 may perform the steps S302 to S310 shown in FIG. 2, and other steps of the methods in the present disclosure.

[00357] The storage unit 3220 may include a readable medium in the form of a volatile storage unit, such as a random access storage unit (RAM) 32201 and/or a cache storage unit 32202, and may further include a read-only storage unit (ROM) 32203.

[00358] The storage unit 3220 may further include a program/utility tool 32204 having a set (at least one) of program modules 32205. Such program modules 32205 include, but are not limited to, an operating system, one or more application programs, other program modules, and program data. Each or some combination of these examples may include an implementation of a network environment.

[00359] The bus 3230 may be one or more of several types of bus structures, including a storage unit bus or a storage unit controller, a peripheral bus, a graphics acceleration port, a processing unit, or a local area bus using any bus structure in a variety of bus structures.

[00360] The electronic device 3200 may also communicate with one or more external devices 3260 (such as a keyboard, a pointing device, a Bluetooth device, etc.), and may also communicate with one or more devices that enable a user to interact with the electronic device, and/or may also communicate with any device (such as a router, a modem) that can enable the electronic device 3200 to interact with one or more other computing devices. Such communication can be performed through an input/output (I/O) interface 3250. Moreover, the electronic device 3200 may also communicate with one or more networks (such as a local area network (LAN), a wide area network (WAN), and/or a public network, such as the Internet) through the network adapter 3250. As shown in the figure, the network adapter 3250 communicates with other modules of the electronic device 3200 through the bus 3230. It should be understood that although not shown in the figure, other hardware and/or software modules may be used in conjunction with the electronic device, including but not limited to: microcode, device drivers, redundant processing units, external disk drive arrays, RAID

systems, tape drives and data backup storage systems.

[00361] Through the description of the foregoing embodiments, those skilled in the art can easily understand that the example embodiments described herein can be implemented by software, or by software in combination with necessary hardware. Therefore, the technical solutions according to the embodiments of the present disclosure may be embodied in the form of a software product, and the software product may be stored in a non-volatile storage medium (which may be a CD-ROM, a U disk, a mobile hard disk, etc.) or on a network. The software product may include instructions to cause a computing device (which may be a personal computer, a server, a terminal device, or a network device, etc.) to execute the methods according to example embodiments of the present disclosure.

[00362] An example embodiment of the present disclosure also provides a computer-readable storage medium having stored thereon a program product capable of implementing the above methods according to embodiments of the present disclosure. In some possible implementations, aspects of the present disclosure may also be implemented in the form of a program product, which includes program codes. When the program product is run on a terminal device, the program codes are used to cause the terminal device to perform the steps according to various example embodiments of the present disclosure described in the above-mentioned exemplary methods.

[00363] A program product for implementing the above methods according to an implementation of the present disclosure is provided. The program product may be stored by a portable compact disc read-only memory (CD-ROM) and include program codes, and may be executed on a terminal device, such as a personal computer. However, the program product of the present disclosure is not limited thereto. The readable storage medium may be any tangible medium containing or storing a program, and the program may be used by an instruction execution system, apparatus, or device, or the program may be used in combination with an instruction execution system, apparatus, or device.

[00364] A computer-readable signal medium may include a data signal in baseband or propagated as part of a carrier wave, which carries readable program codes. Such a propagated data signal may have many forms, including but not limited to electromagnetic signals, optical signals, or any suitable combination of the foregoing. The readable signal

medium may also be any readable medium other than a readable storage medium, and the readable medium may send, propagate, or transmit a program that is used by an instruction execution system, apparatus, or device, or that is used in combination with an instruction execution system, apparatus, or device.

[00365] The program codes contained on the readable medium may be transmitted using any appropriate medium, including but not limited to wireless, wired, optical fiber, RF, etc., or any suitable combination of the foregoing.

[00366] The program codes for performing the operations of the present disclosure can be written in any combination of one or more programming languages, which include object-oriented programming languages, such as Java, C++, and so on. The programming languages also include conventional procedural programming language, such as "C" or a similar programming language. The program codes can be executed entirely on the user computing device, can be executed partly on the user device, can be executed as an independent software package, can be executed partly on the user computing device and partly on a remote computing device, or can be executed entirely on the remote computing device or server. In the case of a remote computing device, the remote computing device can be connected to the user computing device through any kind of network, including a local area network (LAN) or a wide area network (WAN), or the remote computing device can be connected to an external computing device, for example, by the Internet provided by the Internet service providers.

[00367] It should be noted that although several modules or units of the devices for action execution are described above, such division is not mandatory. In fact, according to the implementations of the present disclosure, the features and functions of two or more modules or units described above may be embodied in one module or unit. Conversely, the features and functions of a module or unit described above can be further divided into multiple modules or units.

[00368] Furthermore, although various steps of the methods of the present disclosure are described in a particular order in the drawings, this does not imply that the steps must be performed in that particular order or that all of the steps shown must be performed to achieve a desired result. Additionally or alternatively, certain steps may be omitted, multiple steps may be combined into one step, and/or one step may be split into multiple steps, and so on.

[00369] Through the description of the foregoing implementations, those skilled in the art can easily understand that the example implementations described herein can be implemented by software, or by software in combination with necessary hardware. Therefore, the technical solutions according to the implementations of the present disclosure may be embodied in the form of a software product, which may be stored in a non-volatile storage medium (which may be a CD-ROM, a U disk, a mobile hard disk, and so on) or on a network. The software product may include instructions to cause a computing device (which may be a personal computer, a server, a mobile terminal, or a network device, and so on) to perform methods according to implementations of the present disclosure. Those skilled in the art will readily contemplate other implementations of the present disclosure after considering the specification and practicing the disclosure. The present disclosure is intended to cover any variations, uses, or adaptive changes of the present disclosure. These variations, uses, or adaptive changes follow the general principles of the present disclosure and include the common general knowledge or conventional technical means in this art which is not described herein. The specification and embodiments should be considered as exemplary only, and the true scope and spirit of the disclosure should be defined by the appended claims.

WHAT IS CLAIMED IS:

1. A transport control method for baggage consignment, wherein the transport control method is applied to at least one management and control subsystem, wherein the management and control subsystem is configured to manage and control a plurality of transport vehicles, and the transport control method comprises:

in response to a baggage scheduling task sent by a centralized control center, determining a baggage out device from which baggage is discharged;

selecting, from a plurality of baggage handling devices, a target baggage handling device for receiving the baggage;

generating a baggage transport route based on a position of the baggage out device and a position of the target baggage handling device;

generating a baggage transport task based on the baggage transport route and the baggage scheduling task; and

sending the baggage transport task to at least one of the plurality of transport vehicles, so that the at least one of the plurality of transport vehicles transports the baggage from the baggage out device to the target baggage handling device based on the baggage transport route.

2. The transport control method according to claim 1, wherein selecting, from the plurality of baggage handling devices, the target baggage handling device for receiving the baggage comprises:

obtaining a current load amount of each baggage handling device;

ranking load amounts of the plurality of baggage handling devices based on the load amount; and

selecting, from the plurality of baggage handling devices, the target baggage handling device based on a ranking result.

3. The transport control method according to claim 2, wherein selecting, from the plurality of baggage handling devices, the target baggage handling device based on the ranking result further comprises:

when it is determined based on the ranking result that there are at least two to-be-selected devices among the plurality of baggage handling devices and both of the at least two

to-be-selected devices have the smallest load amount, determining one of the to-be-selected devices having the shortest transport route as the target baggage handling device; and/or

wherein there are a plurality of management and control subsystems, the plurality of transport vehicles are divided into a plurality of groups, each of the plurality of management and control subsystems manages and controls a corresponding group of transport vehicles,

wherein sending the baggage transport task to the at least one of the plurality of transport vehicles comprises:

sending the baggage transport task to the transport vehicle for which the management and control subsystem has a management and control privilege; and/or

wherein before sending the baggage transport task to the transport vehicle for which the management and control subsystem has a management and control privilege, the method further comprises:

receiving management and control privilege information sent by the centralized control center, wherein the management and control privilege information is used to manage and control at least one of a plurality of transport areas;

receiving a scheduling code reported by the transport vehicle;

when verification of the scheduling code is passed based on the management and control privilege information, sending grant information to the transport vehicle, wherein the grant information is used to determine a management and control privilege for the transport vehicle so that the transport vehicle has a traveling privilege in a corresponding transport area;

wherein the management and control privilege information comprises an area identity of a transport area and a scheduled vehicle list that has a mapping relationship with the area identity, and when the scheduling code is found in the scheduled vehicle list, it is determined that verification of the scheduling code is passed.

4. The transport control method according to claim 3, wherein the plurality of baggage handling devices comprise a first group of handling devices and a second group of handling devices, the second group of handling devices comprise a plurality of types, the transport areas comprise a first transport area and a second transport area, an end point of the first transport area overlaps a start point of the second transport area to form an overlapping area, the first group of handling devices are arranged in the overlapping area, the second group of

handling devices are arranged in an end point area of the second transport area, the management and control subsystems comprise a first management and control subsystem and a second management and control subsystem;

wherein when the management and control subsystem is the first management and control subsystem, selecting, from the plurality of baggage handling devices, the target baggage handling device for receiving the baggage comprises:

selecting the target baggage handling device from the first group of handling devices;

wherein when the management and control subsystem is the second management and control subsystem, selecting, from the plurality of baggage handling devices, the target baggage handling device for receiving the baggage comprises:

selecting the target baggage handling device from the second group of handling devices; and/or

wherein the first group of handling devices comprises a security inspection device,

wherein selecting, from the second group of handling devices, the target baggage handling device comprises:

receiving a security inspection result fed back by the security inspection device, wherein the security inspection result is a result of a security inspection performed by the security inspection device on received baggage;

determining a device type that matches the security inspection result;

selecting, from the second group of handling devices having the device type, the target baggage handling device;

wherein the second group of handling devices comprise a platform device for manual inspection, a carrying device for collecting early-arrived baggage, and a carrying device for collecting on-time-arrived baggage.

5. The transport control method according to claim 3, further comprising:

receiving a change instruction of the privilege information sent by the centralized control center;

determining a candidate transport vehicle whose privilege information is to be changed and a change type based on the change instruction;

generating corresponding traveling privilege change information based on the change

type; and

sending the traveling privilege change information to the candidate transport vehicle whose privilege information is to be changed; and/or

wherein the method further comprises:

receiving a maintenance decision sent by the centralized control center;

determining a corresponding maintenance route and a maintenance privilege based on the maintenance decision;

generating a maintenance instruction based on the maintenance route and the maintenance privilege;

sending the maintenance instruction to a transport vehicle to be maintained, wherein the maintenance instruction is adapted to switching a traveling privilege of the transport vehicle to a maintenance privilege to make the transport vehicle travel to a repair operation area based on the maintenance route; and/or

wherein the plurality of transport vehicles comprise a faulty transport vehicle and/or a missing transport vehicle,

wherein the transport control method further comprises:

when receiving fault information reported by the faulty transport vehicle or detecting the missing transport vehicle, sending take-over information to a standby transport vehicle, wherein the take-over information comprises a fault position of the faulty transport vehicle or a contact loss position where the missing transport vehicle is last detected before loss of contact, so that the standby transport vehicle travels to the fault position or the contact loss position in response to the take-over information, and

sending a repair instruction to the faulty transport vehicle, wherein the repair instruction is generated based on a repair route and a repair privilege, and the repair instruction is adapted to switch a traveling privilege of the transport vehicle to a repair privilege, so that the transport vehicle travels to a repair operation area based on the repair route;

wherein the standby transport vehicle is a transport vehicle that does not receive the baggage transport task.

6. The transport control method according to claim 2, further comprising:

acquiring status information of at least one of the plurality of transport vehicles, wherein

the status information comprises remaining battery level and/or working status;

generating a charging instruction based on the status information and/or acquired operating condition information of a charging module; and

sending the charging instruction to the at least one of the plurality of transport vehicles, wherein the charging instruction is used to drive the transport vehicle to travel to a corresponding charging module to perform a charging operation; and/or

wherein the charging module comprises a plurality of first charging rails, the first charging rails are arranged in a transport area between the baggage out device and the baggage handling device,

wherein selecting, from the plurality of baggage handling devices, the target baggage handling device based on the ranking result further comprises:

acquiring occupancy of the plurality of first charging rails;

ranking occupancy of the plurality of first charging rails;

performing a coordinated selection based on a ranking result of the occupancy and the ranking result of the load amounts, and determining the target baggage handling device based on a result of the coordinated selection.

7. The transport control method according to any one of claims 1 to 6, wherein sending the baggage transport task to the transport vehicle further comprises:

when obstacle avoidance information fed back by the transport vehicle based on the baggage transport route is received, identifying a type of an obstacle in the obstacle avoidance information;

generating an avoidance instruction based on the type of the obstacle and a traffic map of a managed transport area; and

sending the avoidance instruction to the transport vehicle; and/or

wherein generating the avoidance instruction based on the type of the obstacle and the traffic map of the managed transport area comprises:

when it is detected that the obstacle is a same type transport vehicle which is of the same type as the transport vehicle which feeds back the obstacle avoidance information, detecting whether the transport vehicle which feeds back the obstacle avoidance information and the same type transport vehicle are in a queuing area of the transport area based on the traffic

map;

when it is detected that the transport vehicle which feeds back the obstacle avoidance information and the same type transport vehicle are in the queuing area, generating a following instruction for following the same type transport vehicle to determine the following instruction as the avoidance instruction;

when it is detected that the transport vehicle which feeds back the obstacle avoidance information and the same type transport vehicle are not in the queuing area, or when it is detected that the obstacle is an unknown object on the traffic map, generating a turning instruction for avoiding the obstacle to determine the turning instruction as the avoidance instruction.

8. A transport control method for baggage consignment, wherein the method is applied to a centralized control center, the centralized control center is configured to centrally control at least one management and control subsystem, the at least one management and control subsystem is configured to manage and control a plurality of transport vehicles, and the transport control method comprises:

sending a baggage scheduling task to the management and control subsystem, so that the management and control subsystem sends a baggage transport task generated based on the baggage scheduling task to at least one of the plurality of transport vehicles, wherein the at least one of the plurality of transport vehicles performs the baggage transport task.

9. The transport control method according to claim 8, wherein the at least one management and control subsystem comprises a plurality of management and control subsystem subsystems,

wherein before sending the baggage scheduling task to the management and control subsystem, the method comprises:

receiving a plurality sets of baggage check-in information reported by a plurality of baggage out devices, wherein the baggage check-in information comprise baggage information and flight information;

based on the flight information, collecting distribution information of the plurality of baggage out devices; and

based on the distribution information and a coordinated allocation result of the baggage

information, generating a plurality of baggage scheduling tasks for the management and control subsystems; and/or

wherein before sending the baggage scheduling task to the management and control subsystem, the method further comprises:

sending management and control privilege information of a corresponding managed transport area to each management and control subsystem, so that each management and control subsystem, based on the management and control privilege information, grants a traveling privilege to the transport vehicle for travelling in the corresponding transport area; and/or

wherein the method further comprises:

sending a management and control privilege change instruction to the management and control subsystem, so that the management and control subsystem sends traveling privilege change information to a candidate transport vehicle to be changed based on the change instruction; and/or

wherein the method further comprises:

periodically sending a maintenance decision on the transport vehicle to the management and control subsystem.

10. A transport control method for baggage consignment, wherein the method is applied to a transport vehicle, and the transport control method comprises:

receiving a baggage transport task sent by a management and control subsystem;

extracting a baggage transport route in the baggage transport task; and

after completing baggage loading, travelling based on the baggage transport route.

11. The transport control method according to claim 10, wherein before receiving the baggage transport task sent by the management and control subsystem, the method further comprises:

sending a preset scheduling code to the management and control subsystem; and

receiving grant information which is fed back by the management and control subsystem when verification of the scheduling code is passed, wherein the grant information is used to grant a traveling privilege in a transport area managed by the management and control subsystem.

12. The transport control method according to claim 11, further comprising:

in response to traveling privilege change information sent by the management and control subsystem, determining a target change area; and

travelling from a current transport area to the target change area;

wherein the target change area is a changed transport area, or other area outside the transport area; and/or

wherein the method further comprises:

in response to a received maintenance instruction, switching the traveling privilege to a maintenance privilege; and

based on the maintenance privilege, travelling to a repair operation area according to a maintenance route carried in the maintenance instruction to perform a maintenance operation; and/or

wherein the transport vehicle is equipped with a sensing device and is pre-configured with map information of a plurality of transport areas,

wherein traveling based on the baggage transport route comprises:

sensing a first distance from a peripheral reference object based on the sensing device;

determining position information of the transport vehicle itself based on the map information and the first distance; and

traveling along the baggage transport route based on the position information; and/or

wherein traveling along the baggage transport route based on the position information comprises:

when traveling along the baggage transport route based on the position information, calculating a safe distance for collision avoidance based on the baggage transport route and a current traveling speed;

detecting a second distance from an obstacle based on the sensing device; and

configuring a collision avoidance strategy based on a relationship between the second distance and the safe distance; and/or

wherein configuring the collision avoidance strategy based on the relationship between the second distance and the safe distance comprises:

determining an emergency braking distance matching the current traveling speed;

when it is detected that the second distance is greater than the safe distance, continuing to travel based on the current traveling speed;

when it is detected that the second distance is less than or equal to the safe distance and greater than the emergency braking distance, performing slow-down traveling; and

when it is detected that the second distance is less than or equal to the emergency braking distance, performing a braking operation; and/or

wherein traveling along the baggage transport route based on the position information further comprises:

comparing a traveling route with the map information to generate a comparison result;

when it is determined that there is an obstacle on the baggage transport route based on the sensing result and the comparison result, evaluating whether the obstacle can be bypassed autonomously, wherein the sensing result is generated by the sensing device;

when it is evaluated that the obstacle can be bypassed autonomously, generating an autonomous avoidance path to bypass the obstacle according to the autonomous avoidance path;

when it is evaluated that the obstacle cannot be bypassed autonomously, generating obstacle avoidance information;

reporting the obstacle avoidance information to the management and control subsystem, and receiving an avoidance instruction fed back by the management and control subsystem based on the obstacle avoidance information; and

adjusting the baggage transport route based on the avoidance instruction to bypass the obstacle.

13. The transport control method according to claim 10, wherein the transport vehicle is provided with a conveyer device, a plurality of sensors are arranged on the conveyer device along a conveying direction, the plurality of sensors are used to sense a position of the baggage on the conveyer device,

wherein traveling based on the baggage transport route further comprises:

when it is detected that the position of the baggage deviates from a pre-placed position, determining a deviation direction; and

starting the conveyer device to perform a deviation correction operation based on the

deviation direction; and/or

wherein the transport vehicle is further provided with a battery management module and a fire suppression module,

wherein the transport control method further comprises:

monitoring an operating condition of a power battery based on the battery management module, and activating the fire suppression module when determining based on the operating condition that the power battery has a risk of thermal runaway; and

wherein traveling based on the baggage transport route specifically comprises:

triggering the conveyer device to discard transported baggage; and/or

wherein the method further comprises:

when in an idle state, receiving take-over information sent by the management and control subsystem, wherein the take-over information comprises a fault position of a faulty transport vehicle, or a contact loss position where a missing transport vehicle is last detected before loss of contact;

extracting the fault position or the lost connection position in the take-over information; and

traveling to the fault position or the contact loss position.

14. A transport control system for baggage consignment, wherein the transport control system comprises a centralized control center, a management and control subsystem and a plurality of transport vehicles, the centralized control center is configured to control at least one of management and control subsystem, the management and control subsystem is configured to control and manage the plurality of transport vehicles, wherein:

the centralized control center is configured to perform the transport control method for baggage consignment according to any one of claims 8 to 9;

the management and control subsystem is configured to perform the transport control method for baggage consignment according to any one of claims 1 to 7; and

the transport vehicle is configured to perform the transport control method for baggage consignment according to any one of claims 10 to 13.

15. A transport control apparatus for baggage consignment, wherein the transport control apparatus is applied to a management and control subsystem, the management and control

subsystem is configured to manage and control a plurality of transport vehicles, and the transport control apparatus comprises:

a determination unit configured to determine a baggage out device from which baggage is discharged, in response to a baggage scheduling task sent by a centralized control center;

a selection unit configured to select, from a plurality of baggage handling devices, a target baggage handling device for receiving the baggage;

a first generation unit configured to generate a baggage transport route based on a position of the baggage out device and a position of the target baggage handling device;

a second generation unit configured to generate a baggage transport task based on the baggage transport route and the baggage scheduling task; and

a first sending unit configured to send the baggage transport task to a transport vehicle, so that the transport vehicle transports the baggage from the baggage out device to the target baggage handling device based on the baggage transport route.

16. A transport control apparatus for baggage consignment, wherein the transport control apparatus is applied to a centralized control center, the centralized control center is configured to centrally control at least one management and control subsystem, the management and control subsystem is configured to manage and control a plurality of transport vehicles, and the transport control apparatus comprises:

a second sending unit configured to send a baggage scheduling task to the management and control subsystem, to make the management and control subsystem send to the transport vehicle a baggage transport task which is generated based on the baggage scheduling task, so that the transport vehicle performs the baggage transport task.

17. A transport control apparatus for baggage consignment, wherein the transport control apparatus is applied to a transport vehicle, and the transport control apparatus comprises:

a receiving unit configured to receive a baggage transport task sent by a management and control subsystem;

an extracting unit configured to extract a baggage transport route in the baggage transport task; and

an execution unit configured to travel based on the baggage transport route after completing baggage loading.

18. An electronic device, comprising:

a processor; and

a memory storing instructions executable by the processor, wherein the processor is configured to perform the transport control method for baggage consignment according to any one of claims 1 to 7 or the transport control method for baggage consignment according to any one of claims 8 to 9 by executing the executable instructions.

19. A transport vehicle, comprising:

a processor; and

a memory storing instructions executable by the processor, wherein the processor is configured to perform the transport control method for baggage consignment according to any one of claims 10 to 13 by executing the executable instructions.

20. A computer-readable storage medium having a computer program stored thereon, wherein when the computer program is executed by a processor, the transport control method for baggage consignment according to any one of claims 1 to 13 is implemented.