

CONTROL METHOD, APPARATUS, ELECTRONIC DEVICE, STORAGE MEDIUM AND CONVEYING SYSTEM

[0001] The present application claims priority to Chinese Patent Application No. 202311047432.3, filed on August 18, 2023, the content of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to a field of security inspection technology, and particularly, to a control method for a conveying system, a control apparatus for a conveying system, an electronic device, a readable storage medium, and the conveying system.

BACKGROUND

[0003] An aviation article security inspection system is a large-scale system for scanning aviation articles, which requires various conveying devices to transport the aviation articles into an enclosed scanning space, coordinate to complete the scanning, and then convey the aviation articles out. The entire conveying process involves actions such as lifting, docking, moving, rotating and bidirectional conveying of the conveyor. These integrated operations require close coordination of the conveying devices to ensure secure and safe completion of the inspection process.

[0004] Currently, if an abnormality occurs in the system, the process may be interrupted. Since the weight of aviation article is generally measured in tons, it is extremely difficult to manually move and clear the aviation article stranded on the conveyor. Furthermore, since some conveying devices are located inside a CT device, manual entry into the CT device is not only inconvenient but also carries the risk of radiation exposure.

[0005] All functionalities within the relevant conveyor are executed either independently by individual conveying devices or through their coordinated operation. The control functions may be implemented via standalone device control or centralized control through a master system. According to the conventional approach, one way is that operators physically access each device's control zone to manually operate the corresponding conveying device, so as to move the article in jog mode. In this case, if two or more conveying devices cooperate to transport article, multiple operators are required to operate devices in their respective zones to coordinate with each other to achieve the recovery. In addition, synchronization is difficult to manage, which may lead to conveying device overload or other risks. Another way is to operate an integrated single-step function button on the human-machine interface of the main system to control the corresponding conveying device. In this case, if there are multiple articles on the conveyor, the master system cannot automatically determine which article is to be moved, and it is required to manually operate the button corresponding the article to be moved. This introduce a lot of such buttons, resulting in a complex human-machine interface, thereby increasing the risk of erroneous operations.

SUMMARY

[0006] According to an aspect of the present disclosure, there is provided a control method for a conveying system, where the conveying system includes a plurality of conveying devices coordinating with each other, and the control method includes: in response to an article entering a security inspection system, generating a simulated article in a simulated system pre-created for the conveying system on a human-machine interface, and encoding the simulated article, where the simulated system includes a plurality of simulated conveying devices corresponding to the plurality of conveying devices; updating a location information of the simulated article corresponding to the article in the simulated system, based on a positioning information of the article in the conveying system, where the location information includes an indication of the simulated conveying device where the simulated article is located; and

when conveying of the article in the conveying system completely stops or abnormally stops, controlling, based on the location information of the simulated article corresponding to the article, an action of the conveying device corresponding to the simulated conveying device indicated in the location information to complete the conveying of the article in the conveying system.

[0007] In some embodiments, the method further includes: integrating a virtual button to the simulated article, where when conveying of the article in the conveying system completely stops or abnormally stops, controlling, based on the location information of the simulated article corresponding to the article, an action of the conveying device corresponding to the simulated conveying device indicated in the location information to complete the conveying of the article in the conveying system includes: in response to triggering a touch button, displaying a pop-up window presenting a device control option to be selected, where controlling of the conveying device corresponding to the simulated conveying device indicated in the location information is performed based on the device control option; and in response to triggering the device control option, controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information.

[0008] In some embodiments, in response to triggering the device control option, controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information includes: in response to triggering the device control option, determining whether the conveying device corresponding to the simulated conveying device indicated in the location information meets an activation condition; determining whether an article is present on the conveying device located downstream in a conveying direction of the article; and when the conveying device corresponding to the simulated conveying device indicated in the location information meets the activation condition and no article is present on the conveying device located downstream in the conveying direction of the article, controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information.

[0009] In some embodiments, controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information includes: generating an operation instruction based on a current device state of the conveying device corresponding to the simulated conveying device indicated in the location information; and controlling the conveying device to perform an operation according to the operation instruction, where the operation instruction includes at least one of forward movement, backward movement, roller clockwise rotation, roller counterclockwise rotation, lifting, lowering, rotating, or docking.

[0010] In some embodiments, the touch button is configured such that a touch operation is valid when an authorized person logs in; otherwise, the touch operation is invalid.

[0011] In some embodiments, updating a location information of the simulated article corresponding to the article in the simulated system, based on a positioning information of the article in the conveying system includes: recording an entry time of the article in response to the article entering the conveying system; obtaining a driving information of a driving component of each conveying device in the conveying system; obtaining an arrival detection information from a sensor of each conveying device; determining the positioning information of the article based on the entry time, the driving information and the arrival detection information; and updating the location information of the simulated article corresponding to the article in the simulated system based on the positioning information.

[0012] According to another aspect of the present disclosure, there is provided a control apparatus for a conveying system, the conveying system includes a plurality of conveying devices coordinating with each other, and the control apparatus includes: a generation module configured to: in response to an article entering a security inspection system, generating a simulated article in a simulated system pre-created for the conveying system on a human-machine interface, and encoding the simulated article, where the simulated system includes a plurality of simulated conveying devices corresponding to the plurality of conveying devices; an update module configured to:

updating a location information of the simulated article corresponding to the article in the simulated system, based on a positioning information of the article in the conveying system, where the location information includes an indication of the simulated conveying device where the simulated article is located; and a control module configured to: when conveying of the article in the conveying system completely stops or abnormally stops, controlling, based on the location information of the simulated article corresponding to the article, an action of the conveying device corresponding to the simulated conveying device indicated in the location information to complete the conveying of the article in the conveying system.

[0013] According to another aspect of the present disclosure, there is provided an electronic device, including: one or more processors; and one or more memories for storing executable instructions, where the executable instructions, when executed by the one or more processors, implement the method as described above.

[0014] According to another aspect of the present disclosure, there is provided a computer-readable storage medium, storing executable instructions, where the instructions, when executed by a processor, implement the method as described above.

[0015] According to another aspect of the present disclosure, there is provided a conveying system, including a plurality of conveying devices, where the plurality of conveying devices include: an entrance lifting platform constructed to have a lifting function; a security inspection device including a security inspection chamber and a security inspection machine arranged within the security inspection chamber, where the security inspection chamber has an input port and an output port, a protective door is provided at the input port, and the entrance lifting platform is arranged at the input port outside the security inspection chamber; a transfer platform arranged within the security inspection chamber, and configured to transfer an article undergoing security inspection; a rail-guided cart configured to travel on a rail, where at least part of the rail is laid from the transfer platform to the output port; and an exit conveying line arranged at an end of the rail.

[0016] Part of additional aspects and advantages of the present disclosure will be introduced in the following descriptions, and part will become apparent from the following descriptions, or will be learned through practice of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] For a more complete understanding of the present disclosure and its advantages, reference will be made to the following description combined with the accompanying drawings, in which:

[0018] FIG. 1 shows a flowchart of a control method of a conveying system according to an embodiment of the present disclosure;

[0019] FIG. 2 shows a flowchart of updating, based on a positioning information of an article in the conveying system, a location information of a simulated article corresponding to the article in a simulated system according to an embodiment of the present disclosure;

[0020] FIG. 3 shows a flowchart of controlling, based on a location information of a simulated article corresponding to an article, an action of a conveying device corresponding to a simulated conveying device indicated in the location information when conveying of the article in the conveying system stops, so as to complete the conveying of the article in the conveying system, according to an embodiment of the present disclosure;

[0021] FIG. 4 shows a flowchart of controlling an action of a conveying device corresponding to a simulated conveying device indicated in the location information in response to triggering a device control option according to an embodiment of the present disclosure;

[0022] FIG. 5 shows a flowchart of controlling an action of a conveying device corresponding to a simulated conveying device indicated in the location information according to an embodiment of the present disclosure;

[0023] FIG. 6 shows a schematic structural diagram of a conveying system according to an embodiment of the present disclosure;

[0024] FIG. 7 schematically shows a block diagram of a control apparatus for a conveying system according to an embodiment of the present disclosure; and

[0025] FIG. 8 schematically shows a block diagram of an electronic device according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0026] Embodiments of the present disclosure will be described below with reference to the accompanying drawings. However, it will be understood that these descriptions are only exemplary and are not intended to limit the scope of the present disclosure. In addition, in the following description, descriptions of well-known structures and technologies are omitted to avoid unnecessary confusion of the concepts of the present disclosure. In addition, the various embodiments provided below in the present disclosure and the technical features in the embodiments may be combined with each other in any manner.

[0027] The terms used herein are for describing the specific embodiments only, and are not intended to limit the present disclosure. In addition, the terms “include”, “comprise” and the like used herein indicate the existence of the stated features, steps, operations and/or components, but do not exclude the existence or addition of one or more other features, steps, operations or components. All terms (including technical and scientific terms) used herein have the meanings commonly understood by those skilled in the art unless otherwise defined. It will be noted that the terms used herein will be interpreted as having a meaning consistent with the context of the present specification and should not be interpreted in an idealized or overly rigid manner.

[0028] An aviation article security inspection system is a large-scale system for scanning aviation articles, which requires various conveying devices to transport the

aviation articles into an enclosed scanning space, coordinate to complete the scanning, and then convey the aviation articles out. The entire conveying process involves actions such as lifting, docking, moving, rotating and bidirectional conveying of the conveyor. These integrated operations require close coordination of the conveying devices to ensure secure and safe completion of the inspection process.

[0029] Currently, if an abnormality occurs in the system, the process may be interrupted. Since the weight of aviation article is generally measured in tons, it is extremely difficult to manually move and clear the aviation article stranded on the conveyor. Furthermore, since some conveying devices are located inside a CT device, manual entry into the CT device is not only inconvenient but also carries the risk of radiation exposure.

[0030] All functionalities within the relevant conveyor are executed either independently by individual conveying devices or through their coordinated operation. The control functions may be implemented via standalone device control or centralized control through a master system. According to the conventional approach, one way is that operators physically access each device's control zone to manually operate the corresponding conveying device, so as to move the article in jog mode. In this case, if two or more conveying devices cooperate to transport article, multiple operators are required to operate devices in their respective zones to coordinate with each other to achieve the recovery. In addition, synchronization is difficult to manage, which may lead to conveying device overload or other risks. Another way is to operate an integrated single-step function button on the human-machine interface of the main system to control the corresponding conveying device. In this case, if there are multiple articles on the conveyor, the master system cannot automatically determine which article is to be moved, and it is required to manually operate the button corresponding the article to be moved. This introduce a lot of such buttons, resulting in a complex human-machine interface, thereby increasing the risk of erroneous operations.

[0031] Embodiments of the present disclosure provide a control method for a conveying system, an apparatus for a conveying system, an electronic device, a readable

storage medium, and a conveying system. The control method for the conveying system may ensure personnel safety and equipment safety while saving manpower.

[0032] Descriptions of the control method for the conveying system, the apparatus for the conveying system, the electronic device, the readable storage medium and the conveying system according to the embodiments of the present disclosure are made as follows with reference to FIG. 1 to FIG. 8. The conveying system includes a plurality of coordinated conveying devices.

[0033] As shown in FIG. 1, the control method for the conveying system according to the embodiments of the present disclosure includes operations S210 to S230.

[0034] In operation S210, in response to an article entering the security inspection system, a simulated article is generated and encoded on a simulated system pre-created for the conveying system on the human-machine interface. The simulated system includes a plurality of simulated conveying devices corresponding to the plurality of conveying devices. It may be understood that pre-creating the simulated system may include modeling the conveying system using computer technology to form the simulated system. The simulated system may include a three-dimensional simulated system or a planner simulated system.

[0035] In some examples, a sensor for identifying articles entering the conveying system may be provided at the entrance of the conveying system. The sensor may transmit an identification signal to a control device for implementing the control method. The control device may generate a simulated article based on the identification signal using computer technology, and the simulated article may be encoded for the convenience of managing articles. For example, the sensor may be a counting sensor, which may be used for sequentially numbering simulated articles.

[0036] In operation S220, a location information of the simulated article corresponding to the article in the simulated system is updated based on a positioning information of the article in the conveying system. The location information includes

an indication of the simulated conveying device where the simulated article is located.

[0037] As an example, as shown in FIG. 2, operation S220 of updating the location information of the simulated article corresponding to the article in the simulated system based on the positioning information of the article in the conveying system includes operation S221 to operation S225.

[0038] In operation S221, in response to the article entering the security inspection system, an entry time of the article is recorded. It may be understood that the sensor provided at the entrance of the conveying system may send the entry time of the article to the control device.

[0039] In operation S222, a driving information of a driving component of each conveying device in the conveying system is obtained. The driving component may be a motor, a cylinder, a hydraulic cylinder, etc. The driving information may include a driving speed and a driving state. The driving state may be “running”, “stopped”, “fault” or the like.

[0040] In operation S223, an arrival detection information of a sensor of each conveying device is obtained. It may be understood that each conveying device may be provided with sensor(s), which may detect whether there is any article arriving at the position where the sensor is located. The sensor on each conveying device may be an arrival sensor, which may send to the control device an arrival detection information indicating whether an article arrives at the sensor.

[0041] In operation S224, the positioning information of the article is determined based on the entry time, the driving information and the arrival detection information. For example, the control device may calculate the travel distance of article A according to the obtained entry time of article A and the driving speed of the conveying devices through which article A has passed. If a sensor at the corresponding travel distance position detects an object, it can be confirmed that article A has arrived, and this position serves as the positioning information of article A.

[0042] In operation S225, the location information of the simulated article

corresponding to the article in the simulated system is updated based on the positioning information. By using computer technology, the simulated article may be arranged at a corresponding position in the simulated system based on the positioning information so as to update the location information. Operations S221 to S225 may facilitate the updating of the location information of the simulated article corresponding to the article in the simulated system based on the positioning information of the article in the conveying system.

[0043] In operation S230, when the conveying of the article in the conveying system stops, based on the location information of the simulated article corresponding to the article, an action of the conveying device corresponding to the simulated conveying device indicated in the location information is controlled to complete the conveying of the article in the conveying system.

[0044] According to the control method for the conveying system in the embodiments of the present disclosure, by generating the simulated article on the simulated system pre-created on the human-machine interface, encoding the simulated article, and updating the location information of the simulated article based on the positioning information of the article, it is convenient to monitor and manage the simulated article. In this way, the simulated article is intuitively monitored, which may facilitate the control of the action of the conveying device corresponding to the simulated conveying device indicated in the location information based on the location information of the simulated article, so as to complete the conveying of the article in the conveying system. Compared with the related art, the control method in the present disclosure does not require personnel to enter the CT device, thereby eliminating radiation risks. Also, it is not necessary for multiple personnel to operate in their respective independent device areas coordinately, which may reduce the waste of manpower and eliminate the worry that operations of multiple personnel may raise a desynchronization problem of the conveying devices. Furthermore, the simulated article and the simulated conveying device are displayed on the human-machine interface in the present disclosure, thus the human-machine interface is simple and

intuitive, thereby reducing risks of erroneous operations.

[0045] In some examples of the present disclosure, the control method for the conveying system further includes operation S240, in which performing a case-closing archival process on the simulated article corresponding to the conveyed article when the article is normally conveyed through and exits the conveying system..

[0046] In some embodiments of the present disclosure, the control method for the conveying system may further include operation S001, in which a touch button is integrated to the simulated article. For example, the touch button may be a hidden touch button or an icon-based touch button. No specific limitation is made to the implementation form of the touch button herein.

[0047] As shown in FIG. 3, the operation S230 of controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information based on the location information of the simulated article corresponding to the article to complete the conveying of the article in the conveying system when the conveying of the article in the conveying system stops includes operation S231 and operation S232.

[0048] In operation S231, in response to triggering the touch button, a pop-up window presenting device control option(s) to be selected is displayed. The controlling of the device corresponding to the simulated conveying device indicated in the location information may be achieved by using the device control option(s). For example, the device control option(s) may include at least one of “forward”, “backward” or “turn off”, but are not limited thereto.

[0049] In operation S232, in response to triggering the device control option, an action of the conveying device corresponding to the simulated conveying device indicated in the location information is controlled. With operation S231 and operation S232, when the conveying of the article in the conveying system stops abnormally, the action of the conveying device corresponding to the simulated conveying device indicated in the location information is controlled based on the location information of

the simulated article corresponding to the article, so as to complete the conveying of the article in the conveying system. In addition, the human-machine interface of the present disclosure contains the simulated article and the simulated conveying device. Instead of deploying all operation buttons of operation instructions on the human-machine interface, the control of the article is achieved by triggering the simulated article on the human-machine interface to activate a pop-up window which displays corresponding device control options. Furthermore, the device control option(s) is not displayed when the article is not operated, achieving a simple and intuitive human-machine interface, thereby reducing the risk of erroneous operations.

[0050] According to some embodiments of the present disclosure, as shown in FIG. 4, the operation S232 of controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information in response to triggering the device control option includes operations S2321 to S2323.

[0051] In operation S2321, in response to triggering the device control option, it is determined whether the conveying device corresponding to the simulated conveying device indicated in the location information meets an activation condition.

[0052] For example, the conveying device may include an entrance lift platform, a protective door, a transfer platform, a rail-guided cart, or an exit conveying line. When the conveying device includes an entrance lift platform, the activation condition of the conveying device may be that the entrance lifting platform reaches the same height as the transfer platform. When the conveying device includes a protective door, the activation condition of the conveying device may be that the door body is opened or the door body is closed. When the conveying device includes a transfer platform, the activation condition of the conveying device may be the baffle extending or the baffle retracting. When the conveying device includes a rail-guided cart, the activation condition of the conveying device may be that the rail-guided cart is in place.

[0053] In operation S2322, it is determined whether there is any article on a conveying device located downstream in a conveying direction F1 of the article.

[0054] In operation S2323, the action of the conveying device corresponding to the simulated conveying device indicated in the location information is controlled, when the conveying device corresponding to the simulated conveying device indicated in the location information meets the activation condition and no article is present on the downstream conveying device in the conveying direction F1 of the article.

[0055] For example, in the conveying direction F1 of the article, the conveying devices of the transport system is arranged in the following sequence: the entrance lift platform, the protective door, the transfer platform, the rail-guided cart and the exit conveying line. Assuming that an article is detained at the entrance lifting platform and an operator triggers the device control option “forward”, it is determined whether the entrance lifting platform meets the activation condition, that is, determining whether the entrance lifting platform reaches the same height as the transfer platform, in response to triggering the device control option “forward”. The entrance lifting platform may be controlled to convey the article to the transfer platform, when the entrance lifting platform is at the same height as the transfer platform, the protective door of the downstream device of the entrance lifting platform is opened, and no article is present on the transfer platform. Operations S2321 to S2323 may facilitate the control of the action of the conveying device corresponding to the simulated conveying device indicated in the location information in response to triggering the device control option.

[0056] According to some embodiments of the present disclosure, when the conveying device corresponding to the simulated conveying device indicated in the location information does not meet the activation condition, or there is an article on the downstream conveying device in the conveying direction F1 of the article, a prompt may be presented on the human-machine interface, indicating that the activation condition is not met or there is an article on the downstream conveying device.

[0057] When the conveying device corresponding to the simulated conveying device indicated in the location information meets the activation condition, the conveying device system may perform corresponding action(s) based on the specific state of each conveying device. The action(s) includes at least one of motor forward

rotation, motor reverse rotation, roller extension, roller retraction, lifting, lowering, rotating, or docking.

[0058] In some embodiments of the present disclosure, as shown in FIG. 5, the operation S2323 of controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information includes operation S23231 and operation S23232.

[0059] In operation S23231, an operation instruction is generated based on a current device state of the conveying device corresponding to the simulated conveying device indicated in the location information. It should be noted that the device state may be interpreted as device ready, fault, or operation in progress, and the current device state may be interpreted as incomplete or completed actions. For example, the actions executable by the entrance lifting platform include ascending, conveying and descending, and the corresponding completed actions may include ascending complete, conveying stop, and descending complete. If the entrance lifting platform stops abnormally during ascending, the conveying device is in fault state, and the current device state is ascending incomplete.

[0060] In operation S23232, the conveying device is controlled to perform an operation based on the operation instruction. The operation instruction includes at least one of forward movement, backward movement, roller clockwise rotation, roller counterclockwise rotation, lifting, lowering, rotating, or docking.

[0061] For example, if the article is on the entrance lifting platform and the simulated article on the entrance lifting platform on the human-machine interface is triggered, a pop-up window including three buttons “forward”, “backward” and “turn off” is activated. If the “forward” button is triggered, the performed operation is to convey the article from the entrance lifting platform to the transfer platform. Particularly, after the article conveying system receives the forward instruction, the system determines whether the conveying devices involved (in this embodiment, the entrance lifting platform, the entrance protection door and the transfer platform) are ready, and whether there is any article on the downstream conveying device (in this embodiment, the transfer platform). If the conveying devices are ready and no article is

present on the downstream conveying device, the operation instruction is executed. When executing the operation instruction, the state of each conveying device is determined, and actions will be automatically executed based on the actual states of the conveying devices. That is, it is determined whether the entrance lifting platform ascends to target position (ascending complete). If the entrance lifting platform does not ascend to target position, the action of raising the entrance lifting platform to target position is executed. If the entrance lifting platform is raised to the right position, it is determined whether the entrance protective door is fully opened. If the entrance protective door is not fully opened, the action of opening the entrance protective door is executed. If the entrance protective door is fully opened, it is determined whether the entrance roller of the transfer platform is extended to target position. If the entrance roller is not extended to target position, the action of extending the entrance roller to target position is executed. If the entrance roller is extended to target position, forward conveying between the roller of the entrance lifting platform and the transfer platform is started. When the article is conveyed to the transfer platform, the roller is stopped, and the entrance docking roller is retracted to target position. After the entrance docking roller is retracted to target position, the action of closing the entrance protective door is executed. After the protective door is fully closed, the process ends and the execution of the instruction is completed.

[0062] Operation S23231 and operation S23232 may facilitate the control of the action of the conveying device corresponding to the simulated conveying device indicated in the location information.

[0063] According to some embodiments of the present disclosure, the touch button may be configured such that the touch operation of the touch button is valid when authorized personnel log in; otherwise, the touch operation of the touch button is invalid. This may prevent erroneous operations by non-operating personnel or maintenance personnel, thereby avoiding potential safety hazards to the equipment or personnel on site.

[0064] As shown in FIG. 6, the conveying system 100 according to the

embodiments of the present disclosure includes a plurality of conveying devices. The plurality of conveying devices include an entrance lifting platform 101, a security inspection device 102, a protective door 103, a transfer platform 104, a rail-guided cart 105, a rail 106, and an exit conveying line 107.

[0065] Specifically, the entrance lifting platform 101 is constructed to have a lifting function. The security inspection device 102 includes a security inspection chamber 1021 and a security inspection machine arranged in the security inspection chamber 1021. The security inspection chamber 1021 has an input port 10211 and an output port 10212. A protective door 103 is installed at the input port 10211 and/or the output port 10212. The entrance lifting platform 101 is arranged at the input port 10211 outside the security inspection chamber 1021. The transfer platform 104 is arranged in the security inspection chamber 1021, and is used to transfer an article undergoing security inspection. The rail-guided cart 105 is configured to travel on the rail 106. At least part of the rail 106 is laid from the transfer platform 104 to the output port 10212. The exit conveying line 107 is arranged at an end of the rail 106.

[0066] It may be understood that when the truck transports an article to the conveying system 100, the entrance lifting platform 101 may be lowered to the same height as the truck, thereby facilitating the transfer of the article from the truck to the entrance lifting platform 101. The entrance lifting platform 101 carrying the article is raised to the same height as the transfer platform 103. At this time, the protective door 103 may be opened, and the entrance lifting platform 101 conveys the article to the transfer platform 103. Then the rail-guided cart 105 docks with the transfer platform 104, and the transfer platform 104 conveys the article to the rail-guided cart 105. After the article is conveyed to the rail-guided cart 105, retractable roller(s) of the transfer platform 104 is retracted, the protective door 103 is closed, and the rail-guided cart 105 starts to move into the security inspection channel. The security inspection machine performs security inspection on the article on the rail-guided cart 105. The security inspection machine may be CT device. After the security inspection is completed, the rail-guided cart 105 transfers the article to the exit conveying line 107. The article may

be conveyed away from the conveying system 100 by the exit conveying line 107. The transfer platform 103 may have a retractable roller, which may connect the input port 10211 to the rail-guided cart 105 during the conveying. When conveying the article, the rail-guided cart 105 may move straight along the rail 106 and rotating with respect to the rail 106. The conveying system 100 in the present disclosure may facilitate safety inspection of articles.

[0067] Of course, the present disclosure is not limited to fixed continuous conveying methods, but may also include various conveying devices, such as lifting devices, telescoping docking devices, rotating devices, and even AGVs (Automated Guided Vehicles). These devices are all designed to accomplish a specific function or cooperatively complete a certain function, but their ultimate purpose is to achieve article conveyance. The control method of the present disclosure is not restricted to aviation article but is applicable to any large-scale article. When a complex process is involved, requiring coordinated operation among multiple devices to accomplish the intended function, this method may be employed.

[0068] Based on the control method for the conveying system mentioned above, the present disclosure further provides a control apparatus 10 for the conveying system. The control apparatus 10 for the conveying system is described in detail below with reference to FIG. 7. The conveying system includes a plurality of conveying devices coordinating with each other.

[0069] As shown in FIG. 7, the control apparatus 10 for the conveying system according to the embodiments of the present disclosure includes a generation module 1, an update module 2 and a control module 3.

[0070] The generation module 1 is configured to perform operation S210, in which in response to an article entering the security inspection system, a simulated article is generated on a simulated system pre-created for the conveying system on the human-machine interface, and the simulated article is encoded, where the simulated system includes a plurality of simulated conveying devices corresponding to the

plurality of conveying devices.

[0071] The update module 2 is configured to perform operation S220, in which a location information of the simulated article corresponding to the article in the simulated system is updated based on a positioning information of the article in the conveying system, where the location information includes an indication of a simulated conveying device where the simulated article is located.

[0072] The control module 3 is configured to perform operation S230, in which when the conveying of the article in the conveying system stops, an action of the conveying device corresponding to the simulated conveying device indicated in the location information is controlled based on the location information of the simulated article corresponding to the article, so as to complete the conveying of the article in the conveying system.

[0073] The control apparatus 10 for the conveying system mentioned above is provided based on the control method for the conveying system, thus the beneficial effects of the control apparatus 10 for the conveying system are the same as those of the control method for the conveying system, which will not be repeated here.

[0074] In addition, according to the embodiments of the present disclosure, any combination of more than one module from the generation module 1, the update module 2 and the control module 3 may be integrated into a single module for implementation, or any one of the generation module 1, the update module 2 and the control module 3 may be split into more than one module. Alternatively, at least part of the functions of one or more of these modules may be combined with at least part of the functions of other modules and implemented in a single module.

[0075] According to the embodiments of the present disclosure, at least one of the generation module 1, the update module 2 or the control module 3 may be at least partially implemented as a hardware circuit, such as a field programmable gate array (FPGA), a programmable logic array (PLA), a system on a chip, a system on a substrate, a system on a package, an application-specific integrated circuit (ASIC), or may be

implemented by hardware or firmware forming in any other appropriate way of integrating or packaging the circuit, or may be implemented in any one of three implementation methods of software, hardware and firmware or in an appropriate combination of any of them.

[0076] Alternatively, at least one of the generation module 1, the update module 2 or the control module 3 may be at least partially implemented as a computer program module, and when the computer program module is run, corresponding functions may be executed.

[0077] FIG. 8 schematically shows a block diagram of an electronic device applicable for the implementation of the above method according to the embodiments of the present disclosure.

[0078] As shown in FIG. 8, an electronic device 900 according to the embodiments of the present disclosure includes a processor 901, which may perform various appropriate operations and processes based on a program stored in a read-only memory (ROM) 902 or a program loaded from a storage portion 908 to a random-access memory (RAM) 903. The processor 901 may include, for example, a general-purpose microprocessor (e.g., a CPU), an instruction set processor and/or a related chip set and/or a special-purpose microprocessor (e.g., an application-specific integrated circuit (ASIC)), etc. The processor 901 may further include an on-board memory for caching. The processor 901 may include a single processing unit or a plurality of processing units for performing different operations of the method flow based on the embodiments of the present disclosure.

[0079] In the RAM 903, various programs and data necessary for operations of the electronic device 900 are stored. The processor 901, the ROM 902 and the RAM 903 are connected to each other via a bus 904. The processor 901 performs various operations of the method flow according to the embodiments of the present disclosure by executing the program in the ROM 902 and/or the RAM 903. It will be noted that the program may also be stored in one or more memories other than the ROM 902 and

the RAM 903. The processor 901 may also perform the various operations of the method flow according to the embodiments of the present disclosure by executing program(s) stored in the one or more memories.

[0080] According to the embodiments of the present disclosure, the electronic device 900 may further include an input/output (I/O) interface 905, which is also connected to the bus 904. The electronic device 900 may further include one or more of the following components connected to the I/O interface 905: an input part 906 including a keyboard, a mouse, etc.; an output part 907 including a cathode ray tube (CRT), a liquid crystal display (LCD), a speaker, etc.; a storage part 908 including a hard disk, etc.; and a communication part 909 including a network interface card such as a LAN card, a modem, etc. The communication part 909 performs communication processing via a network such as the Internet. A driver 910 is also connected to the input/output (I/O) interface 905 as desired. A removable medium 911, such as a magnetic disk, an optical disk, a magneto-optical disk, a semiconductor memory or the like, is mounted on the driver 910 as desired, so that a computer program read therefrom is installed into the storage portion 908 as desired.

[0081] The present disclosure further provides a computer-readable storage medium, which may be included in the device/apparatus/system described in the above embodiments; or may exist independently without being assembled into the device/apparatus/system. The computer-readable storage medium carries one or more programs, which when executed, implement the method according to the embodiments of the present disclosure.

[0082] According to the embodiments of the present disclosure, the computer-readable storage medium may be a non-volatile computer-readable storage medium, for example, may include but is not limited to: a portable computer disk, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or flash memory), a portable compact disk read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the above. In the present disclosure, a computer readable

storage medium may be any tangible medium that may contain or store a program for use by or in connection with an instruction execution system, apparatus, or device. For example, according to the embodiments of the present disclosure, the computer-readable storage medium may include the ROM 902 and/or the RAM 903 described above and/or one or more memories other than the ROM 902 and the RAM 903.

[0083] In the description of the present disclosure, it will be understood that the terms “center”, “longitudinal”, “lateral”, “length”, “width”, “thickness”, “up”, “down”, “front”, “back”, “left”, “right”, “vertical”, “horizontal”, “top”, “bottom”, “inside”, “outside”, “clockwise”, “counterclockwise”, “axial”, “radial”, “circumferential” and the like indicate positions or positional relationships based on the positions or positional relationships shown in the drawings, and are only for the convenience of describing the present disclosure and simplifying the description, rather than indicating or implying that the device or element referred to must have a specific orientation, be constructed and operated in a specific orientation, and therefore cannot be understood as a limitation on the present disclosure. In addition, features defined as “first” and “second” may explicitly or implicitly include one or more of the features. In the description of the present disclosure, unless otherwise specified, “a plurality of” means two or more.

[0084] In the description of the present disclosure, it will be noted that unless otherwise clearly specified and limited, the terms “installed”, “connected with” and “connection” will be understood in a broad sense, which may, for example, refer to a fixed connection, a detachable connection, or an integral connection; which may be a mechanical connection or an electrical connection; or which may be a direct connection, an indirect connection through an intermediate medium, or an internal connection of two elements. For those of ordinary skill in the art, the specific meanings of the above terms in the present disclosure may be understood according to specific circumstances.

[0085] In the description of the specification, the description of the reference terms “an embodiment”, “some embodiments”, “exemplary embodiments”, “examples”, “specific examples”, or “some examples” refers to specific features, structures, materials or characteristics described in combination with embodiments or

examples are included in at least one embodiment or example in the present disclosure. In the specification, schematic expressions of the above terms do not necessarily refer to the same embodiment or example. In addition, the specific features, structures, materials or characteristics described may be combined in any one or more embodiments or examples in a suitable manner.

[0086] Although the embodiments of the present disclosure are shown and described, those of ordinary skill in the art will appreciate that various changes, modifications, substitutions and alterations may be made to the embodiments without departing from the principles and spirit of the present disclosure, and the scope of the present disclosure is defined by the claims and their equivalents.

[0087] Those skilled in the art will appreciate that the features described in the various embodiments and/or claims of the present disclosure may be combined and/or integrated in various ways, even if such combinations or integrations are not explicitly described in the present disclosure. In particular, various combinations and/or integrations of features recited in the various embodiments and/or claims of the present disclosure may be made without departing from the spirit and teachings of the present disclosure. All such combinations and/or integrations fall within the scope of the present disclosure.

[0088] Although the present disclosure has been illustrated and described with reference to the specific exemplary embodiments of the present disclosure, those skilled in the art will understand that various modifications in form and details may be made to the present disclosure without departing from the spirit and scope of the present disclosure as defined by the appended claims and their equivalents. Therefore, the scope of the present disclosure should not be limited to the above-described embodiments, but should be determined not only by the appended claims but also by the equivalents of the appended claims.

What is claimed is:

1. A control method for a conveying system, wherein the conveying system comprises a plurality of conveying devices coordinating with each other, and the control method comprises:

in response to an article entering a security inspection system, generating a simulated article in a simulated system pre-created for the conveying system on a human-machine interface, and encoding the simulated article, wherein the simulated system comprises a plurality of simulated conveying devices corresponding to the plurality of conveying devices;

updating a location information of the simulated article corresponding to the article in the simulated system, based on a positioning information of the article in the conveying system, wherein the location information comprises an indication of the simulated conveying device where the simulated article is located; and

when conveying of the article in the conveying system completely stops or abnormally stops, controlling, based on the location information of the simulated article corresponding to the article, an action of the conveying device corresponding to the simulated conveying device indicated in the location information to complete the conveying of the article in the conveying system.

2. The method according to claim 1, further comprising:

integrating a virtual button to the simulated article,

wherein when conveying of the article in the conveying system completely stops or abnormally stops, controlling, based on the location information of the simulated article corresponding to the article, an action of the conveying device corresponding to the simulated conveying device indicated in the location information to complete the conveying of the article in the conveying system comprises:

in response to triggering a touch button, displaying a pop-up window presenting a device control option to be selected, wherein controlling of the conveying device corresponding to the simulated conveying device indicated in the location

information is performed based on the device control option; and

in response to triggering the device control option, controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information.

3. The method according to claim 2, wherein in response to triggering the device control option, controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information comprises:

in response to triggering the device control option, determining whether the conveying device corresponding to the simulated conveying device indicated in the location information meets an activation condition;

determining whether an article is present on the conveying device located downstream in a conveying direction of the article; and

when the conveying device corresponding to the simulated conveying device indicated in the location information meets the activation condition and no article is present on the conveying device located downstream in the conveying direction of the article, controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information.

4. The method according to claim 3, wherein controlling the action of the conveying device corresponding to the simulated conveying device indicated in the location information comprises:

generating an operation instruction based on a current device state of the conveying device corresponding to the simulated conveying device indicated in the location information; and

controlling the conveying device to perform an operation according to the operation instruction, wherein the operation instruction comprises at least one of forward movement, backward movement, roller clockwise rotation, roller counterclockwise rotation, lifting, lowering, rotating, or docking.

5. The method according to claim 2, wherein the touch button is configured such that a touch operation is valid when an authorized person logs in; otherwise, the touch operation is invalid.

6. The method according to claim 1, wherein updating a location information of the simulated article corresponding to the article in the simulated system, based on a positioning information of the article in the conveying system comprises:

- recording an entry time of the article in response to the article entering the conveying system;

- obtaining a driving information of a driving component of each conveying device in the conveying system;

- obtaining an arrival detection information from a sensor of each conveying device;

- determining the positioning information of the article based on the entry time, the driving information and the arrival detection information; and

- updating the location information of the simulated article corresponding to the article in the simulated system based on the positioning information.

7. A control apparatus for a conveying system, wherein the conveying system comprises a plurality of conveying devices coordinating with each other, and the control apparatus comprises:

- a generation module configured to: in response to an article entering a security inspection system, generating a simulated article in a simulated system pre-created for the conveying system on a human-machine interface, and encoding the simulated article, wherein the simulated system comprises a plurality of simulated conveying devices corresponding to the plurality of conveying devices;

- an update module configured to: updating a location information of the simulated article corresponding to the article in the simulated system, based on a positioning information of the article in the conveying system, wherein the location information comprises an indication of the simulated conveying device where the

simulated article is located; and

a control module configured to: when conveying of the article in the conveying system completely stops or abnormally stops, controlling, based on the location information of the simulated article corresponding to the article, an action of the conveying device corresponding to the simulated conveying device indicated in the location information to complete the conveying of the article in the conveying system.

8. An electronic device, comprising:

one or more processors; and

one or more memories for storing executable instructions, wherein the executable instructions, when executed by the one or more processors, implement the method according to any one of claims 1 to 6.

9. A computer-readable storage medium, storing executable instructions, wherein the instructions, when executed by a processor, implement the method according to any one of claims 1 to 6.

10. A conveying system, comprising a plurality of conveying devices, wherein the plurality of conveying devices comprise:

an entrance lifting platform constructed to have a lifting function;

a security inspection device comprising a security inspection chamber and a security inspection machine arranged within the security inspection chamber, wherein the security inspection chamber has an input port and an output port, a protective door is provided at the input port, and the entrance lifting platform is arranged at the input port outside the security inspection chamber;

a transfer platform arranged within the security inspection chamber, and configured to transfer an article undergoing security inspection;

a rail-guided cart configured to travel on a rail, wherein at least part of the rail is laid from the transfer platform to the output port; and

an exit conveying line arranged at an end of the rail.