

Method for facilitating movement of a deadload during ramp operations and smart glass thereof

FIELD OF INVENTION

[001] The present invention relates broadly, but not exclusively, to methods for facilitating movement of a deadload during ramp operation.

BACKGROUND

[002] A “ramp” or “apron” is known as an area of an airport where aircraft are parked, unloaded or loaded, refueled or boarded. In the aviation industry, a ramp operation is an operation for aircraft servicing and ground handling, especially loading and unloading “deadloads”, which is the term use to describe cargo, baggage and mail collectively. Due to an increase in flight traffic, the time available for ramp operation for each flight is getting shorter and shorter. Thus, efficient ramp operation is required to ensure that flights are serviced on time.

[003] Conventionally, ramp operations are manually conducted based on instructions printed or written on paper. Several designated persons, such as a ramp loading officer (RLO/RO), a ramp service man (RSM) and an equipment operator (EO) are involved in ramp operations, and these people communicate with each other over a communication device such as a walkie-talkie. The RLO receives a loading instruction report (LIR) in paper form, prepares a photocopy of such physical LIR, and distributes such copy to the RSM together with his instructions of the ramp operations to be performed.

[004] Since most of the ramp operation processes are done manually, human error may occur in each step along the way. Such human error tends to result in severe consequences. Furthermore, the manual processes cannot effectively deal with last-minute changes in loading instructions. There are many reasons for such last-minute changes, such as faulty maintenance, bad weather, errors in destination of luggage. Thus, ramp operation is extremely dynamic and ramp operation processes must be flexible to deal with such dynamism.

[005] A need therefore exists to provide method and/or apparatus to address at least one of the above problems.

SUMMARY

[006] According to a first aspect, there is provided a method for facilitating movement of a deadload during ramp operations comprising: identifying a current location of a deadload; identifying a desired location of the deadload; and highlighting both the current location and the desired location of the deadload using a display on a smart glass.

[007] According to a second aspect, there is provided a smart glass for facilitating movement of a deadload during ramp operations, comprising a location identifier for identifying the current location and desired location of the deadload; a display for highlighting the current location and desired location of the deadload; and a processor for receiving location information of the deadload from the location identifier and instructing the display to highlight both the current location and the desired location of the deadload based on the location information.

[008] According to a third aspect, there is provided a computer readable medium comprising instructions which, when executed by a processor, makes the processor perform a method for facilitating movement of a deadload during ramp operations comprising: receiving location information of a deadload from a location identifier and instructing a display of a smart glass to highlight both current location and desired location of the deadload based on the location information.

BRIEF DESCRIPTION OF THE DRAWINGS

[009] Embodiments and implementations are provided by way of example only, and will be better understood and readily apparent to one of ordinary skill in the art from the following written description, read in conjunction with the drawings, in which:

[0010] Figure 1 shows a flow diagram illustrating a method for facilitating movement of a deadload during ramp operation according to various embodiments;

[0011] Figure 2 shows an illustration of a smart glass as used with a server and a transmitter according to various embodiments;

[0012] Figure 3A shows an illustration of an exemplary view from a smart glass and information flow between a smart tag, a smart glass and a central server according to various embodiments;

[0013] Figure 3B shows an illustration of an exemplary view from a smart glass according to various embodiments;

[0014] Figure 3C shows an illustration of an exemplary view from a smart glass according to various embodiments;

[0015] Figure 3D shows an illustration of an exemplary view from a smart glass according to various embodiments;

[0016] Figure 4 shows an illustration of an exemplary view from a smart glass showing a confirmation checklist and optical recognitions according to various embodiments;

[0017] Figure 5A shows an exemplary illustration of various possible deployment positions of a deadload and a loading instruction report according to various embodiments;

[0018] Figure 5B shows an illustration of a conventional process flow of ramp operations;

[0019] Figure 5C shows an illustration of an exemplary process flow of ramp operations according to various embodiments; and

[0020] Figure 6 depicts an exemplary computing device according to various embodiments.

DETAILED DESCRIPTION

Overview

[0021] Various embodiments provide devices and methods for facilitating movement of deadload during ramp operations.

[0022] According to various embodiments, devices and methods are provided with which movement of a deadload during ramp operations can be facilitated. By using smart glasses and highlighting information for users such as a RLO and a RSM, ground handling operations are facilitated, which allows better flight service to be processed in a timely manner.

[0023] Advantageously, with the devices and methods according to various embodiments, movement of deadload is facilitated and a risk of human error is reduced. In addition, last-minute changes can be managed with flexibility.

Terms Description (in Addition to Plain and Dictionary Meaning of Terms)

[0024] A smart glass refers to a wearable device to provide information (e.g. visual and/or audio) to one eye or two eyes. For example, a smart glass includes a head mount display, a glass with transparent display, an attachment to general spectacles which shows visual information.

[0025] A deadload, container, pallet or unit load device (ULD) refers to any property carried or to be carried in a ship, airplane or vehicle. For example, a deadload includes passenger luggage, freight, goods, and merchandises.

[0026] A smart tag refers to a device including a memory and a transmitter so that predetermined information in the memory is configured to transfer to a receiver within transmission range a signal from the transmitter. The smart tag may include a RFID (radio frequency identifier) tag, a beacon device and a GPS tracker etc.

[0027] A central server, system, or real-time location system refers to a suitable type of computing device that is remotely operationally coupled to the smart glass. Each of the central server, system and real-time location system may include a memory, a processor and a communication interface.

Exemplary Embodiments

[0028] Embodiments will be described, by way of example only, with reference to the drawings. Like reference numerals and characters in the drawings refer to like elements or equivalents.

[0029] Figure 1 shows a flow diagram 100 illustrating a method for facilitating movement of a deadload during ramp operations. In 102, a current location of the deadload is identified. In 104, a desired location of the deadload is identified. In 106, both the current location and the desired location of the deadload are highlighted using a display on a smart glass.

[0030] According to various embodiments, the current location of the deadload is identified in 102 in response to the receipt of a signal (e.g. a suitable electrical signal)

from one or more transmitters attached to the deadload. In an example, a smart glass receives a signal from the one or more transmitters attached to the deadload and identifies the current location of the deadload based on the signal from one or more transmitters that are attached to the deadload. Alternatively, the signal from the one or more transmitters that are attached to the deadload is sent to a central server for identification of the current location of the deadload and information for the current location of such deadload is forwarded to a smart glass. In this alternate embodiment, it is made possible for a user to identify the current location of the deadload even if it is not within the line of sight of the user.

[0031] According to various embodiments, the current location of the deadload is identified in 102 based on optical recognition of the deadload using an optical sensor of the smart glass. In one example, an optical sensor of a smart glass is configured to perform a spatial scan and to identify an object such as a deadload. Alternatively, an optical sensor of a smart glass is configured to perform a scan of the surface of several deadloads to identify the presence of an identifier. The identifier (e.g. a RFID (radio frequency identifier) tag or a location identifier) may be shown on a surface of the deadloads based on the information in the identifier which provides several types of information pertaining to a corresponding deadloads. The optical sensor of the smart glass identifies the deadload to be moved.

[0032] According to various embodiments, a desired location of the deadload is identified in 104 based on information received from a central server. In an example, an electronic LIR that includes information regarding a corresponding desired location for each deadload is saved in a central server and the corresponding desired location for each deadload is managed by the central server. Information regarding the corresponding desired location for each deadload is forwarded to a smart glass so that the smart glass highlights (or displays) the desired location of the deadload in the field of view shown in the smart glass. In the following description, as the deadload is selected for movement during ramp operation, the location at which the deadload should be moved to is referred to as “a desired location”, which is meant to be differentiated from “a current location” which is where the deadload is located before being moved during ramp operations.

[0033] According to various embodiments, the display is a see-through display and both the current location and the desired location of the deadload are highlighted in 106 by overlaying a highlight of the current location and/or the desired location of the

deadload in the see-through display. Examples of highlighting the locations are provided with reference to Figure 3A.

[0034] According to various embodiments, both the current location and the desired location of the deadload are highlighted by displaying images captured by an optical sensor of a smart glass with highlight of the current location and the desired location of the deadload. In an embodiment, the highlight of the current location and/or the desired location may include a representative image (e.g. a box) over the deadload to indicate the current location and/or the desired location. In other embodiments, highlighting the current and/or the desired locations may include making the current location and/or the desired location to appear in a different tone from the surroundings (e.g., making the current location and/or the desired location to appear brighter). In an example, the smart glass does not include see-through display. However, one or more cameras or optical devices or image capturing devices are incorporated in the smart glass so that the smart glass can capture the images as viewed using the smart glass.

[0035] According to various embodiments, information (or detailed information) of the deadload is received and the received information of the deadload is shown on the display of the smart glass. In an example, a smart tag is attached to a deadload and the smart tag includes information of the deadload. The smart tag may include a transmitter that will send the location and other information of the deadload to a smart glass and/or a central server.

[0036] According to various embodiments, information of the deadload is received and the received information of the deadload is overlaid on the current location of the deadload on the display of the smart glass. In an example, a smart glass may identify the location and information of the deadload and overlay the information on the identified location of the deadload so that the user of the smart glass can understand the information of the deadload.

[0037] According to various embodiments, the current location of two or more deadloads may be identified in response to receiving a signal from each of the two or more deadloads. Further, the desired location of the two or more deadloads may be identified based on an electronic LIR saved in a central server that records the desired locations of the two or more deadloads. The current location of two or more deadloads and the desired location corresponding to each of the two or more deadloads are highlighted to show the link between the current location and the desired location of each of the two or more deadloads. In an example, the smart glass may perform

pairing of the current location and the desired location of each deadload and highlight a corresponding one of these pairs in a different corresponding color so the user of the smart glass can recognize the link between current location and the desired location of each of the two or more deadloads.

[0038] According to various embodiments, an order of movement of deadload among the two or more deadloads is determined. In an example, the electronic LIR would determine the loading position of deadloads and then with a predetermined rule plan the loading sequence with the smart glass prioritize an order of movement of two or more deadloads based on a predetermined rule to facilitate loading and unloading of two or more deadloads. The movement timings of the deadloads may be used to determine one predetermined rule. For example, the rule may determine that a deadload that has been first loaded to a location (e.g., a dolly) should be unloaded later than another deadload that has been loaded later to the same location.

[0039] Figure 2 shows an illustration of a smart glass 200 for facilitating movement of a deadload during ramp operation according to various embodiments. In an example, the smart glass 200 may include a location identifier 202, a processor 204 and a display 206. In an example, the smart glass 200 is operationally coupled to a central server 208 and/or a transmitter 210 attached to the deadload.

[0040] According to various embodiments, the location identifier 202 may be a receiver for receiving signals from a transmitter 210 attached to the deadload to identify the current location of the deadload. The signal may be transmitted from the transmitter 210 to the central server 208 and then forwarded to the location identifier 202. The transmitter 210 may be a smart tag including location information and other detailed information of the deadload to which the smart tag is attached.

[0041] According to various embodiments, the smart glass 200 may be operationally coupled to a central server that processes information on the desired locations of the deadloads. The location identifier 202 may be a receiver for receiving the information on the desired location of the deadload from the central server 208. The desired location of the deadload may be specified in an electronic LIR saved in the central server 208 and provided to the location identifier 202 of the smart glass 200 so that the display 206 of the smart glass 200 may show the desired location to a user of the smart glass 200.

[0042] According to various embodiments, the location identifier 202 may include an optical sensor for identifying a current location of the deadload based on optical recognition. The optical sensor may include an optical scanner which can scan the surface of a deadload to identify a deadload to be moved. Alternatively, the optical sensor may include a camera which can recognize a deadload based on optical recognition.

[0043] According to various embodiments, the display 206 of the smart glass 200 may be a see-through display including a transparent screen and the processor 204 may be configured to instruct the display 206 to overlay highlights of the current location and the desired location of the deadload in the see-through display of the smart glass 200.

[0044] According to various embodiments, the display 206 may be configured to show images captured by the optical sensor of the smart glass 200 with highlights of the current location and the desired location of the deadload.

[0045] According to various embodiments, the processor 204 may be configured to receive information of the deadload from a central server 208 and to instruct the display 206 to display information relating to the deadload. Alternatively, the processor 204 may be configured to receive information of the deadload from a smart tag attached to the deadload and instruct the display 206 to display the information so that a user of the smart glass 200 can receive information.

[0046] According to various embodiments, the display 206 is configured to overlay the information of the deadload at the place where the user perceives the deadload on the smart glass. The user of the smart glass 200 may receive the information of the deadload in an intuitive manner by using Augmented Reality (AR) and/or Mixed Reality (MR) technology. Examples of overlaying the information are provided with reference to Figure 3A.

[0047] According to various embodiments, the processor 204 may be configured to receive current and desired location information of two or more deadloads and instruct the display 206 to highlight current locations corresponding to each of the two or more deadloads and desired location corresponding to each of the two or more deadloads and to display a link visually connecting the current location and the desired location of the deadload. The location identifier 202 may identify the current location and the desired location of the two or more deadloads and the processor 204 may determine a pairing of the current location and the desired location for each of the two or more

deadloads and instruct the display 206 to highlight the pairing of the current location and the desired location for each of the two or more deadloads in a different color for each of the two or more deadloads.

[0048] According to various embodiments, the processor 204 may be configured to determine an order of movement of deadload among the two or more deadloads based on a predetermined rule. The user of the smart glass 200 may prioritize an order of the two or more deadloads to be moved and facilitate the movement of the two or more deadloads from the current location to the desired location.

[0049] Figure 3A shows an illustration of an exemplary information flow 300 between a smart tag 302, a smart glass 306 and a central server 308 and an exemplary view 310 from smart glass 306 according to various embodiments. The exemplary view 310 may be arranged for a RLO. In an example, information to be displayed to each RLO may be limited to information of at least one flight that has been assigned to the RLO for security reasons.

[0050] In an example, a signal from the smart tag 302 may be transmitted to smart glass 306 to identify the location of the smart tag 302. If the smart tag 302 is attached to a deadload, a current location of the deadload may be identified in response to the signal from the smart tag 302. The signal from the smart tag 310 may include information of the deadload such as deadload number, weight of the deadload, sequence of the deadload when it is loaded. Information may also be derived from the server by the corresponding unique ID number on the smart tag.

[0051] In an example, smart tag may be placed on all ULD which contain cargo and/or baggage. The smart tag may be used by the smart glass to correctly identify all the ULDs from a distance of about 30 meters by e.g. receiving an electric signal representing each of the ULD. An exemplary configuration may be 1 or 2 containers on 1 dolly, 1 pallet on 1 dolly, and 1 container to 1 trailer. This will identify the ULDs at the bay and segregate the correct ones that are assigned to the aircraft against the incorrect ones where an alert message will be sent to the control center.

[0052] Smart tags which are used in conjunction with the smart glass may need to be able to correctly identify ULDs placed as close as 2 meters apart. This may be necessary to ensure the right information for each ULD may be projected onto the smart glass of the operators such as the RSM and RLO.

[0053] The information required for each ULD may be stored on the smart tag itself or separately. The requirement may be for the information to be projected onto the relevant ULD and may move along when the ULD moves. For baggage, the information may include ULD numbers, Flight number, Date, Destination/Origin, Number of Pieces, Volume, Special handling (HOT/VIP/etc)-special instructions in LIR and others. For cargo, the information may include ULD numbers, flight numbers, date, destination/origin, weight, special handling codes, through transit details for cargos which are transferred to other aircrafts for delivery to the other destination, and others. The information may be used in the system and may be displayed in smart glasses for verification and reconciliation to ensure all the processes are in order. The smart tag may be collected after flight handling for reuse for subsequent flights. The central server 308 may provide the smart glass 306 with the desired location of selected deadloads. For example, in Figure 3A, a current location 312 and a desired location 314 of a deadload are highlighted in an exemplary view 310 of the smart glass 306. By selecting a current location of each deadload, a desired location of the selected deadload may be highlighted. The information shown in the smart glass 306 may be kept updated so that the user of the smart glass 306 can always receive the latest information to prevent errors arising from obsolete information.

[0054] In an example, each deadload, container and pallet 312 may be tagged with a tag 302 with a unique identifier. The tag 302 may be configured to communicate to a real-time location system 308. The initial tagging may link each tag 302 with the corresponding information and may be stored in a system 308. The real-time location system may communicate wirelessly with the smart glass 306 to provide the tag identifiers and the corresponding location information. The smart glass 306 may communicate with the system to retrieve the relevant deadload information specific to the tag identifier. AR message overlay (for example, information overlaying deadload 312) may appear at the locations of each tag and display the information specific to that tag.

[0055] The exemplary view 310 shows a RLO's view from the smart glass 306. In an example, an active electronic LIR with an indication of sequential loading of the next ULD to be loaded is described. This can be in the form of a blinking image above the ULD that needs to be loaded next as seen on the device. Loading sequence will also consider feedback from the RSM on their readiness to load the next ULD. Feedback will be given through the system.

[0056] A RLO may be able to see virtual indication on the ULD with the following data (ULD type, ULD number, nature of deadload, weight, destination, loading position, transfer details). The system may need to be able to distinguish two or more distinct ULDs placed in positions which may not be in direct line of sight of the RLO by identifying a hidden ULD. This is done by using precise location information of the ULD derived from the tag on the ULD, which creates unique pairs of tag identifiers and corresponding location coordinates. The system is then able to process the relative orientation and position of the RLO vis-à-vis the location of the ULDs, indicating the location of the ULDs on the smart glass. In addition, the system may need to be able to identify two ULDs if they are on the same dolly based on object recognition of the smart glass. The system may need to present all these information in a manner which is effective for operations and not confusing.

[0057] After the system verifies that the ULD has been appropriately placed based on information from the RSM and/or the RLO, the system will then move on to the next ULD to be loaded. This may be achieved by using object recognition technology or manual input by the operator. The system response time that is taken by the system to any such confirmation transactions may be less than 5 seconds. After completion of loading, there may be a final confirmation to be triggered by the RLO. Also, the RLO may be able to toggle to the views of any other operators. Further, alerts may appear on the smart glass 306 if ULDs that are not meant for the flight are identified. The alert may also be sent to the Load Control Officer (LCO).

[0058] Figure 3B shows an exemplary view 320 from the smart glass 306 according to various embodiments. The exemplary view 320 shows a RSM – Transporter's view from the smart glass 306. In an example, the RSM may be able to see the next ULD to be moved. Loading sequence may also consider feedback from the RSMs on their readiness to load the next ULD. Feedback will be given through the system. The system may indicate whether the next ULD is meant for the FWD (front side of aircraft) or AFT (rear side of aircraft) hold, based on the loading position.

[0059] In an example, the RSM – Transporter may be able to see the planned loading position of the ULD that is transferred onto the transporter after the system's verification process performed by the RLO. In other words, the RSM – Transporter may be able to prepare for the movement of the next ULD immediately after the completion of movement of the current ULD, which facilitates the movement of ULD.

[0060] In an example, the RSM may select a location 324 in an aircraft as shown in 326. In response to the selection, a deadload corresponding to the location 324 may be highlighted in the smart glass 306 as shown in 322. Thus, the RSM may be able to know which deadload is to be moved to the selected location 324.

[0061] Figure 3C shows an exemplary view 330 from the smart glass 306 according to various embodiments. The exemplary view 330 shows a RSM – Joint Container Pallet Loader (JCPL)’s view from the smart glass 306. In an example, each RSM may only see the loading position 334 of his assigned deadload hold 332. Virtual indication of the ULD position may be displayed after first verifying that the ULD is meant for the said flight.

[0062] Figure 3D shows an illustration of an exemplary view 340 from the smart glass showing a confirmation checklist 344 and optical recognitions 346, 348 according to various embodiments. The exemplary view 340 shows the RSM-JCPL’s view from the smart glass 306. A virtual checklist to remind staff to conduct a final confirmation check may be provided or viewing using the smart glass. This virtual checklist may be manually triggered. In an example, when the RSM is loading or is preparing to load a deadload to an aircraft, the smart glass may provide further information to the RSM who is wearing the smart glass to update a change in location of the deadload. For example, information 342 of a deadload may be overlaid on the deadload which is moved by the RSM.

[0063] In an example, text recognition software may be used to verify if the deadload has been loaded in the right position. For example, “21R”, “21P” in a circle 346 may be recognized by text recognition software installed in the smart glass. In an example, object recognition software installed in the smart glass may be used to verify if the pallet locks are raised as shown in a circle 348. After completing the loading of the deadload, confirmation check box 344 may be prepared for the RSM to confirm the completion of the loading.

[0064] Figure 4 shows an exemplary view 400 for a LCO on a dashboard in the office according to various embodiments. The LCO may be able to monitor the progress of loading activity as shown in 404. The LCO may view each staff’s loading video through the ‘See-What-I-See’ technology. An exemplary view of the technology may be shown in 402. In any case, if the LCO may need to do any specific changes or deviations, the LCO may directly contact the relevant staff (e.g. a particular RSM) by using calling

function 406. The LCO may also be able to update the electronic LIR instantaneously and send a revised electronic LIR to the RLO.

[0065] In an example, recording of video streams and audio conversations may be allowed so that the LCO is empowered to look into details of the operations of the RSM and RLO. These recorded data may be saved and processed so that the LCO can search using a keyword to identify when a relevant deadload is handled and how the deadload is treated.

[0066] Figure 5A shows an exemplary illustration of various possible deployment positions 500 and an exemplary LIR 510. In an example, the JCPLs 506 may be located at a FWD Hold (JCPL1) and an AFT Hold (JCPL2) of an aircraft. A transporter 504 may be located near the rear side of aircraft. A ULD 502 may also be located together with the transporter 504 so that the transporter 504 can move the ULD 502 to the JCPLs 506.

[0067] The exemplary paper LIR 510 shows several types of information pertaining to the deadload, including at least a flight number, a destination, a scheduled timing to be loaded or unloaded, a desired location of each ULD. Although the exemplary LIR 510 is in paper form, for various embodiments of the invention, the information in such a paper LIR shall be digitized into an electronic LIR and saved in a computing device such as a tablet computer or a wearable computer, or alternatively, saved in a central server and provided to a smart glass in response to a request to retrieve the information of the LIR.

[0068] Figure 5B shows an illustration of a conventional process flow 530 of ramp operations. In 532, the RLO may receive a paper LIR, Notice to Captain (NOTOC) and Deadload Statement (DLS, which is a list that details the type of cargo and/or mail, specifying the type of information such as weight, destination and any special instructions) from LCO about 75 minutes prior to the scheduled time of departure (STD). In a conventional process, if there is any update required of the loading instructions, the RLO needs to receive a new paper LIR (revised LIR will be called as LIR version 2 and so on) from the LCO or revise his existing paper LIR by conversation with the LCO over walkie-talkie. While all of the above is taking place, deadloads could have already been loaded into the aircraft and may need to offload only to be reloaded into a new location if required in the new changes.

[0069] In 534, the RLO arrives at a loading area and checks all ULDs to be loaded prior on flight at about minus 75 minutes. The RLO checks on condition of deadload

and restricted items received at bay and tallies them against the DLS, paper LIR and NOTOC. Also, the RLO passes a photocopy of paper LIR to the RSM - JCPLs who are responsible for moving the ULDs. In 536, the RLO indicates key milestones during movement of the ULDs. In 538, the RLO may make a telephone call to LCO to ask about missing ULDs, if necessary. In 540, once all ULDs are accounted for, loading operations may commence. The RLO direct the RSM – JCPL and the RSM – transporter to load deadload into aircraft in accordance to LIR. Also, the RLO performs the first readback (which may be considered to be a briefing confirming instructions) to LCO at about 30 minutes to STD.

[0070] In 542, the RLO needs to direct a RSM – transporter to pick up various ULDs and to send them to either to the FWD or AFT of the aircraft cargo door according to the LIR, and he uses hand signals. Since this process is manually performed, the efficiency of the process relies on the skills and reliability of the RLO. Also, human errors may occur in this process such as mixing up one ULD with the other ULD, especially during nighttime or during rain when visibility is low. The RLO also has to receive outgoing baggage dispatched by baggage staff and sign baggage acknowledge forms concurrently. Thereafter, the RLO directs his team such as the RSM – JCPL and the RSM – transporter to load baggage containers and loose bags onto the aircraft. The number of baggage container may be annotated on LIR. When restricted items are uplifted on aircraft, the NOTOC is signed by the RLO and the NOTOC is presented to the captain no later than 30 minutes to STD. If unloading is required, the RLO consults with an airline representative, the relevant integrated operations centre and his LCO. Any last change in load plan to be done by 15 minutes to STD. This is when the second readback to the LCO is performed.

[0071] In 544, the RSM – transporter picks up the ULDs as directed by the RLO and drives them to the appropriate RSM - JCPL and relays their loading position to the RSM-JCPL. IN 546, the RSM - JCPL may check the ULD number indicated on the ULD against information on his copy of the paper LIR. In 548, the RSM-JCPL may load the ULD to the planned position. In 550, the RSM – JCPL may raise the pallet locks to secure the ULD in the planned position. In 552, the RSM – transporter and the RSM – JCPL may continue the loading of ULDs until all ULDs are loaded. Thereafter, the RLO performs final readback to load control by 5 minutes to STD. Upon completion of loading, the RLO informs LCO and signs off on the paper LIR. Cargo hold doors are closed and motorized GSEs are withdrawn. This is when cabin doors are closed after embarkation of passengers is completed. Thereafter, PLBs (passenger loading bridges) are withdrawn. In 554, the RLO may return to his office to raise a flight service

report for archival purpose. In 556, a ULD control message may be keyed in by an officer and sent by telex to the respective airlines. Figure 5A shows that the conventional process is very tedious manually, and relies heavily on the various individuals who are responsible for specific job tasks.

[0072] For arrival flight handling process, the RLO and his handling team would standby at the designated bay about 10 minutes before arrival and conduct foreign object damage (FOD) checks, PLB testing, and would also turn on the air-conditioning at PLB. Once the aircraft chocks are on, and the ground engineer gives clearance for the handling team to approach the aircraft. Motorized GSEs are docked to facilitate the unloading of ULDs and loose items. PLBs are positioned and cabin door is opened according to the airline's requirements to enable disembarkation of passengers. Thereafter, baggage containers and loose bags are unloaded from aircraft.

[0073] Discharged bags are towed to the baggage arrival sorting area in accordance to a sequence of priority and BPT (baggage presentation timing). Interline bags are towed to the interline baggage sorting area. After unloading baggage containers, deadload pallets/containers, loose deadload are unloaded from the aircraft. The unloaded deadloads are sent to AFT and all transfer deadloads are dispatched to the relevant departing aircraft on ground or to a transit holding area, depending on the time of transit. OCS (overseas courier service) mail is discharged from bulk hold delivered to respective baggage arrival sorting area (unless otherwise instructed). Mail containers / loose mails and mail trolleys are sealed and towed to a location for mail containers in the airport. Similar to departure flight handling, baggage containers, cargos etc. are required to be moved to a specific area. However, in a conventional process, paper documents provide the required information for RLOs to perform their tasks.

[0074] Figure 5C shows an illustration of an exemplary process flow 560 of ramp operations according to various embodiments. In 562, the RLO may log in on the smart glass and receive flight assignments. In other words, the RLO receives instruction from a command center such as a LCO via a smart glass.

[0075] In 564, the RLO may arrive at a loading area, with the smart glass projecting AR boxes over the ULD at bay, with color codes to indicate planned positions and warnings about wrong flights etc. The smart glass may also indicate graphically on an electronic LIR which ULDs are missing. In 566, the RLO updates the status of key milestones. In 568, the RLO activates the smart glass' call/alert function to the command center or load control office. In 570, the RLO may confirm that all ULDs are accounted for and that loading operation may commence.

[0076] In 572, a system such as smart glass and/or system may pre-plan a loading sequence based on the ULDs and the electronic LIR. On his smart glass, the RSM - transporter may see a blinking box over the ULD which he needs to pick and which the RSM - JCPL needs to move. In 574, the RSM - transporter may pick up the ULD and drive it to the appropriate JCPL. In 576, the RSM may see, on his smart glass, the box with all relevant information pertaining to the ULD he/she is loading. The system may verify if it is the correct ULD and may indicate the location at which it should be loaded to.

[0077] In 578, the RSM - JCPL may load the ULD into the desired location. The system may verify the loading position using text recognition, basing on the markings along the aircraft cargo hold walls. In 580, the RSM may raise the pallet locks to secure the ULD. The system may verify that the pallet locks are raised using object recognition. In 582, the RSM may move to pick the next ULD once the current ULD is transferred to the JCPL. In 584, loading may continue until all ULDs are loaded. In 586, the system may generate ULD control message automatically and inform the respective airlines of the completion of the loading or unloading via telex for example.

[0078] As mentioned above, the exemplary process flow according to various embodiments as shown in Figure 5C has several advantages over a conventional process flow as shown in Figure 5B. In an example, an electronic LIR can be viewed on the smart glass according to various embodiments, which enables for the user of the smart glass to continue his work without interruption to check on a paper LIR. In addition, the system according to various embodiments may advantageously compute the most optimal loading sequence of ULD with information from the system and display such sequence on an electronic LIR. This may significantly facilitate the movement of ULD. Furthermore, the actual loading positions may be confirmed with a customized checklist to remind an operator such as a RSM of certain key items such as raising pallet locks to fix the ULD according to various embodiments. The customized checklist may advantageously allow an operator such as a RSM to reduce human errors during the operations.

[0079] The system according to various embodiments may be applicable to through transit system for ULDs which are transferred to other aircrafts for delivery to the other destination. The system advantageously ensures efficiency and accuracy between ramp-to-ramp transfers for ULDs. Also, real time recording feeds to the control center on status of loading advantageously enables the control center to monitor the

operations and look into details if necessary. Further, messages such as container pallet messages (CPM, which is a message received from the airline before arrival on the deadload load out) and ULD control message (UCM, which is a message sent to the airline regarding the ULDs loaded onto the aircraft when departure flight loading has completed) may be automatically generated in response to completion of loading or unloading and sent to next operation area without delay.

[0080] The system according to various embodiments may advantageously improve productivity with greater simplicity and accuracy through enhanced reconciliation to ensure all baggage are loaded or unloaded in an orderly manner. Also, several automations such as messaging and read-backs of information may improve accuracy of the operations. Archiving data related to operations may allow identification of errors if necessary. In addition, the system may significantly improve operational communications which may advantageously reduce miscommunication among operators.

[0081] As mentioned above, one of the roles of the central server 208 is to facilitate communication between the transmitter 210 (that is attached on the deadload) and the smart glass 200. In other words, the central server 208 may serve as a means through which the transmitter 210 may communicate with the smart glass 200 in a manner that identification and verification may be performed. In specific implementations, the central server 208 may receive a signal relating to a load (e.g., a deadload or a ULD) and a signal identifying a location at which the load is located. The signal may be transmitted from a transmitter 210 located on the deadload. The various types of signals include the signals described in Figure 2. In response to receiving the signal, the central server 208 determines the location at which the load is located and transmits the determined location to a wearable device (e.g., a smart glass 200). The transmitted information may be displayed on a display of the wearable device. Alternatively, the transmitted information may be made known to a user in other possible ways.

[0082] In an embodiment, the central server 208 may retrieve corresponding location information for the load and compare the determined location to verify if the determination step has been carried out correctly.

[0083] Figure 6 depicts an exemplary computing device 600, hereinafter interchangeably referred to as a computer system 600 or as a server 600, where one or more such computing devices 600 may be used to implement the smart glass 306 and/or the central server 308 shown in Figure 3A. The following description of the

computing device 600 is provided by way of example only and is not intended to be limiting.

[0084] As shown in Figure 6, the example computing device 600 includes a processor 604 for executing software routines. For the avoidance of doubt, although a single processor is shown for the sake of clarity, the computing device 600 may also include a multi-processor system. The processor 604 is connected to a communication infrastructure 606 for communication with other components of the computing device 600. The communication infrastructure 606 may include, for example, a communications bus, cross-bar, or network.

[0085] The computing device 600 further includes a main memory 608, such as a random access memory (RAM), and a secondary memory 610. The secondary memory 610 may include, for example, a storage drive 612, which may be a hard disk drive, a solid state drive or a hybrid drive and/or a removable storage drive 614, which may include a magnetic tape drive, an optical disk drive, a solid state storage drive (such as a USB flash drive, a flash memory device, a solid state drive or a memory card), or the like. The removable storage drive 614 reads from and/or writes to a removable storage medium 644 in a well-known manner. The removable storage medium 644 may include magnetic tape, optical disk, non-volatile memory storage medium, or the like, which is read by and written to by removable storage drive 614. As will be appreciated by persons skilled in the relevant art(s), the removable storage medium 644 includes a computer readable storage medium having stored therein computer executable program code instructions and/or data.

[0086] In an alternative implementation, the secondary memory 610 may additionally or alternatively include other similar means for allowing computer programs or other instructions to be loaded into the computing device 600. Such means can include, for example, a removable storage unit 622 and an interface 640. Examples of a removable storage unit 622 and interface 640 include a program cartridge and cartridge interface (such as that found in video game console devices), a removable memory chip (such as an EPROM or PROM) and associated socket, a removable solid state storage drive (such as a USB flash drive, a flash memory device, a solid state drive or a memory card), and other removable storage units 622 and interfaces 640 which allow software and data to be transferred from the removable storage unit 622 to the computer system 600.

[0087] The computing device 600 also includes at least one communication interface 624. The communication interface 624 allows software and data to be transferred between computing device 600 and external devices via a communication path 626. In

various embodiments of the inventions, the communication interface 624 permits data to be transferred between the computing device 600 and a data communication network, such as a public data or private data communication network. The communication interface 624 may be used to exchange data between different computing devices 600 which such computing devices 600 form part an interconnected computer network. Examples of a communication interface 624 can include a modem, a network interface (such as an Ethernet card), a communication port (such as a serial, parallel, printer, GPIB, IEEE 1394, RJ45, USB), an antenna with associated circuitry and the like. The communication interface 624 may be wired or may be wireless. Software and data transferred via the communication interface 624 are in the form of signals which can be electronic, electromagnetic, optical or other signals capable of being received by communication interface 624. These signals are provided to the communication interface via the communication path 626.

[0088] As shown in Figure 6, the computing device 600 further includes a display interface 602 which performs operations for rendering images to an associated display 630 and an audio interface 632 for performing operations for playing audio content via associated speaker(s) 634.

[0089] As used herein, the term "computer program product" (or computer readable medium, which may be a non-transitory computer readable medium) may refer, in part, to removable storage medium 644, removable storage unit 622, a hard disk installed in storage drive 612, or a carrier wave carrying software over communication path 626 (wireless link or cable) to communication interface 624. Computer readable storage media (or computer readable media) refers to any non-transitory, non-volatile tangible storage medium that provides recorded instructions and/or data to the computing device 600 for execution and/or processing. Examples of such storage media include magnetic tape, CD-ROM, DVD, Blu-ray™ Disc, a hard disk drive, a ROM or integrated circuit, a solid state storage drive (such as a USB flash drive, a flash memory device, a solid state drive or a memory card), a hybrid drive, a magneto-optical disk, or a computer readable card such as a PCMCIA card and the like, whether or not such devices are internal or external of the computing device 600. Examples of transitory or non-tangible computer readable transmission media that may also participate in the provision of software, application programs, instructions and/or data to the computing device 600 include radio or infra-red transmission channels as well as a network connection to another computer or networked device, and the Internet or Intranets including e-mail transmissions and information recorded on Websites and the like.

[0090] The computer programs (also called computer program code) are stored in main memory 608 and/or secondary memory 610. Computer programs can also be received via the communication interface 624. Such computer programs, when executed, enable the computing device 600 to perform one or more features of embodiments discussed herein. In various embodiments, the computer programs, when executed, enable the processor 604 to perform features of the above-described embodiments. Accordingly, such computer programs represent controllers of the computer system 600.

[0091] It is to be understood that the embodiment of Figure 6 is presented merely by way of example. Therefore, in some embodiments one or more features of the computing device 600 may be omitted. Also, in some embodiments, one or more features of the computing device 600 may be combined together. Additionally, in some embodiments, one or more features of the computing device 600 may be split into one or more component parts. The main memory 608 and/or the secondary memory 610 may serve(s) as the memory for the smart glass 306; while the processor 604 may serve as the processor of the smart glass 306.

[0092] Some portions of the description herein are explicitly or implicitly presented in terms of algorithms and functional or symbolic representations of operations on data within a computer memory. These algorithmic descriptions and functional or symbolic representations are the means used by those skilled in the data processing arts to convey most effectively the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities, such as electrical, magnetic or optical signals capable of being stored, transferred, combined, compared, and otherwise manipulated.

[0093] Unless specifically stated otherwise, and as apparent from the description herein, it will be appreciated that throughout the present specification, discussions utilizing terms such as “receiving”, “identifying”, “highlighting”, “determining”, or the like, refer to the action and processes of a computer system, or similar electronic device, that manipulates and transforms data represented as physical quantities within the computer system into other data similarly represented as physical quantities within the computer system or other information storage, transmission or display devices.

[0094] The present specification also discloses apparatus for performing the operations of the methods. Such apparatus may be specially constructed for the required purposes, or may comprise a computer or other device selectively activated or

reconfigured by a computer program stored in the computer. The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various machines may be used with programs in accordance with the teachings herein. Alternatively, the construction of more specialized apparatus to perform the required method steps may be appropriate. The structure of a computer suitable for executing the various methods / processes described herein will appear from the description herein.

[0095] In addition, the present specification also implicitly discloses a computer program, in that it would be apparent to the person skilled in the art that the individual steps of the method described herein may be put into effect by computer code. The computer program is not intended to be limited to any particular programming language and implementation thereof. It will be appreciated that a variety of programming languages and coding thereof may be used to implement the teachings of the disclosure contained herein. Moreover, the computer program is not intended to be limited to any particular control flow. There are many other variants of the computer program, which can use different control flows without departing from the spirit or scope of the invention.

[0096] Furthermore, one or more of the steps of the computer program may be performed in parallel rather than sequentially. Such a computer program may be stored on any computer readable medium. The computer readable medium may include storage devices such as magnetic or optical disks, memory chips, or other storage devices suitable for interfacing with a computer. The computer readable medium may also include a hard-wired medium such as exemplified in the Internet system, or wireless medium such as exemplified in the GSM mobile telephone system. The computer program when loaded and executed on such a computer effectively results in an apparatus that implements the steps of the preferred method.

[0097] According to various embodiments, a "circuit" may be understood as any kind of a logic implementing entity, which may be special purpose circuitry or a processor executing software stored in a memory, firmware, or any combination thereof. Thus, in an embodiment, a "circuit" may be a hard-wired logic circuit or a programmable logic circuit such as a programmable processor, e.g. a microprocessor (e.g. a Complex Instruction Set Computer (CISC) processor or a Reduced Instruction Set Computer (RISC) processor). A "circuit" may also be a processor executing software, e.g. any kind of computer program, e.g. a computer program using a virtual machine code such as e.g. Java. Any other kind of implementation of the respective functions which will be described in more detail

below may also be understood as a "circuit" in accordance with an alternative embodiment.

[0098] It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. A method for facilitating movement of a deadload during ramp operations comprising:
 - identifying a current location of a deadload;
 - identifying a desired location of the deadload; and
 - highlighting both the current location and the desired location of the deadload using a display of a smart glass.
2. The method in accordance with claim 1, wherein the identifying the current location of the deadload comprises identifying the current location of the deadload by receiving one or more signals from one or more transmitters attached to the deadload.
3. The method in accordance with claim 2, wherein the identifying the current location of the deadload comprises identifying the current location of the deadload based on an optical recognition of the deadload using an optical sensor of the smart glass.
4. The method in accordance with claim 1, wherein the identifying the desired location of the deadload comprises identifying the desired location of the deadload based on information received from a central server.
5. The method in accordance with claim 1, wherein the display is a see-through display and wherein the highlighting both the current location and the desired location of the deadload comprises overlaying highlights of the current location and the desired location of the deadload in the see-through display.
6. The method in accordance with claim 3, wherein highlighting both the current location and the desired location of the deadload comprises displaying images captured by the optical sensor of the smart glass with highlight of the current location and the desired location of the deadload.
7. The method in accordance with claim 1, further comprising receiving detailed information of the deadload, and showing the detailed information of the deadload on the display of the smart glass.

8. The method in accordance with claim 1, further comprising receiving detailed information of the deadlock, and overlaying the detailed information of the deadlock on the position of the deadlock on the display.
9. The method in accordance with claim 1, wherein the highlighting both the current location and the desired location of the deadlock comprises highlighting current location of two or more deadlocks and the desired location corresponding to each of the two or more deadlocks to display a visual link between the current location and the desired location of each of the two or more deadlocks.
10. The method in accordance with claim 9, further comprising determining the order of movement of deadlock among the two or more deadlocks.
11. A smart glass for facilitating movement of a deadlock during ramp operations, comprising:
 - a location identifier for identifying current location and desired location of the deadlock;
 - a display for highlighting the current location and desired location of the deadlock;
 - a processor for receiving location information of the deadlock from the location identifier and instructing the display to highlighting both the current location and the desired location of the deadlock based on the location information.
12. The smart glass in accordance with claim 11, wherein the location identifier is a receiver for receiving signals from one or more transmitters attached to the deadlock to identify the current location of the deadlock.
13. The smart glass in accordance with claim 11, wherein the smart glass is coupled to a central server that records and stores the desired location of the deadlock and wherein the location identifier is a receiver for receiving information on the desired location of the deadlock from a central server.
14. The smart glass in accordance with claim 11, wherein the location identifier comprises an optical sensor for identifying current location of the deadlock based on optical recognition.
15. The smart glass in accordance with claim 11, wherein the display is a see-through display comprising a transparent screen and the processor is configured to

instruct the display to overlay highlights on the current location and the desired location of the deadload in the see-through display of the smart glass.

16. The smart glass in accordance with claim 14, wherein the display is configured to show images captured by the optical sensor of the smart glass with highlights of the current location and the desired location of the deadload.

17. The smart glass in accordance with claim 11, wherein the processor is configured to receive detailed information of the deadload from a central server and instruct the display to show the detailed information of the deadload.

18. The smart glass in accordance with claim 11, wherein the display is configured to overlay the detailed information of the deadload on the position of the deadload.

19. The smart glass in accordance with claim 11, wherein the processor is configured to receive location information of two or more deadloads and to instruct the display to highlight the current location of two or more deadloads and the desired location corresponding to each of the two or more deadloads to display a visual link between the current location and the desired location of each of the two or more deadloads.

20. The smart glass in accordance with claim 19, wherein the processor is configured to determine order of movement of deadload among the two or more deadloads.

21. A computer readable medium comprising instructions which, when executed by a processor, makes the processor perform a method for facilitating movement of a deadload during ramp operations comprising: receiving location information of a deadload from a location identifier and instructing a display of a smart glass to highlight both the current location and the desired location of the deadload based on the location information.