

A SYSTEM, METHOD AND AN APPARATUS FOR SIMULATION IN A VIRTUAL REALITY ENVIRONMENT

FIELD OF INVENTION

- 5 The present invention relates to a system, method and an apparatus for simulation in a virtual reality environment, more particularly the present invention relates to a system, method and an apparatus for an interactive simulation in a virtual reality environment.

BACKGROUND ART

- 10 Simulation training has become one of the prerequisites for training and assessing trainees, and there is a big number of simulation systems to accommodate these sessions. One of the major challenges often faced by users is the lack of support for centralised management and monitoring of participants in a restricted virtual reality environment.

- 15 For example, the airport industry is a large business of transportation. Airports are divided into landside and airside areas. The landside area is open to the public, while access to the airside area is tightly controlled due to aircraft traffic, security and ongoing logistics operations. The airside area includes all parts of the airport around the aircraft, and the parts of the buildings that are only accessible to staffs or passengers only. There are million of
20 passengers travel while tons of cargos are being transported in and out of the airport from and to several destinations domestically and internationally. This involves cargo handling, and the operation at the airside include ground support equipment (GSE) comprising of diverse range of vehicles and equipment necessary to provide service to the aircrafts during passenger and cargo loading and unloading, maintenance, and other ground-based operations.

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This wide range of activities associated with aircraft ground operations lead to an equally wide-ranging fleet of GSEs. Hence, a simulator to train these GSEs drivers/operators are necessary

because the airport management at the airside can tolerate zero mistake and therefore simulation training is vital to prepare the drivers/operators for the real world duty such as for driving and docking from and to aircraft and operating equipment at the airside area.

5 There are several prior art divulged networked simulators training system. US8864497 discloses a method and system for providing a distributed simulation system, in which the prior art aims to provide improvement by reducing latency for human-controlled entities such as, but not limiting to, vehicles, and more particularly aircraft, in a simulated world. US2008091403 discloses a method and system for establishing a plurality of training simulation sites, in which
10 enable control of multiple simulations within a network, and allows synchronization of the sites, based on a single activity/simulation activity. US8777619 discloses a simulation system adapted for virtual training for vehicle crews of various types, in which the system provides individual, crew and collective training to platoons of drivers, commanders, gunners and observer.

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However, the prior art documents do not disclose a mixed entities environment and for enabling control of all simulation centrally and/or individually.

Therefore, there is a need for a simulator that is efficient, comprehensive and capable of
20 training these ground support equipment operators in multiple levels and dimensions.

SUMMARY OF INVENTION

The present invention aims to provide a system, method and an apparatus for an interactive simulation in a virtual reality environment, in a secured and restricted environment.

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It is an object of the present invention to provide a system for simulation in a virtual reality environment comprising a station with a first interface for monitoring and controlling the

simulation, an apparatus with a second interface, configured for simulating an object and for receiving instructions from the station in the event of simulation, the first interface and second interface are graphical user interfaces, wherein the system is configured for an interactive simulation in a virtual reality environment via interaction between the station and the apparatus
5 in a real time operation, in a manner that the virtual reality environment is a shared environment, the shared environment is a secured and restricted environment, being shared by the simulation of the station and the apparatus or a plurality of the apparatus, which are operated by human users via the graphical user interfaces.

10 It is another object of the present invention to provide method for simulation in a virtual reality environment comprising the steps of initiating the simulation by a station operated by a user, simulating an object and receiving instructions from the station in the event of simulation by an apparatus operated by another user, and completing the simulation and generating a report.

15 It is yet another object of the present invention to provide an apparatus comprising a controller module, and a display for displaying images in a graphical user interface mode, wherein the display is configured for providing an omnidirectional view of the virtual reality environment to a user operating the apparatus.

20 The present invention addresses the need for a simulator that is efficient, comprehensive and capable of training these ground support equipment operators in a mixed entities environment and for enabling control of all simulation centrally and/or individually.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

25 To further clarify various aspects of some embodiments of the present invention, a more particular description of the invention will be rendered by references to illustrations in the appended drawings. It is appreciated that these drawings depict only typical embodiments of

the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the accompanying drawings in which:

- 5 Figure 1 illustrates a schematic representation of a station in accordance with the preferred embodiment of the present invention.

Figure 2a illustrates a schematic representation of an apparatus in accordance with the preferred embodiment of the present invention.

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Figure 2b illustrates a schematic representation of an apparatus in accordance with the preferred embodiment of the present invention.

- Figure 3 illustrates a schematic representation of a system for simulation in a virtual reality
15 environment in accordance with the preferred embodiment of the present invention.

Figure 4 illustrates a schematic representation of a simulation scenario in a virtual reality environment in accordance with the preferred embodiment of the present invention.

- 20 Figure 5 illustrates a flow diagram of introducing at least an unexpected event into the virtual reality environment in accordance with the preferred embodiment of the present invention.

Figure 6 illustrates a screenshot image of a pedestrian crossing in accordance with the preferred embodiment of the present invention.

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Figure 7 illustrates a screenshot image of a vehicle crossing in accordance with the preferred embodiment of the present invention.

Figure 8 illustrates a screenshot image of an oil spill in accordance with the preferred embodiment of the present invention.

Figure 9 illustrates a screenshot image of an object drop in accordance with the preferred
5 embodiment of the present invention.

Figure 10 illustrates a screenshot image of sudden brake of a front vehicle in accordance with the preferred embodiment of the present invention.

10 Figure 11 illustrates a screenshot image of a user attempting to overtake a front vehicle in accordance with the preferred embodiment of the present invention.

Figure 12 illustrates a screenshot image of an insertion of cargo in accordance with the preferred embodiment of the present invention.

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Figure 13 illustrates screenshot images of a two dimensional view, a zoomed out view and zoomed in view, as well as a computer mouse scrolling directions in accordance with the preferred embodiment of the present invention.

20 Referring to Figure 13a, the figure illustrates an example of a layout of a graphical user interface at a station in accordance with the preferred embodiment of the present invention.

Referring to Figure 13b, the figure illustrates an example of a layout of a graphical user interface at a station in accordance with the preferred embodiment of the present invention

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Figure 14 illustrates screenshot images of exterior views of a vehicle via navigation of a keyboard arrow buttons in accordance with the preferred embodiment of the present invention.

Figure 15 illustrates screenshot images of all-around viewing via navigation of a keyboard arrow buttons in accordance with the preferred embodiment of the present invention.

Figure 16 illustrates a flow diagram of simulating vehicle roles in accordance with the preferred
5 embodiment of the present invention.

Figure 17 illustrates a schematic representation of types of vehicles for simulation in accordance with the preferred embodiment of the present invention.

10 Figure 18 illustrates a flow diagram of simulation in a virtual reality environment in accordance with the preferred embodiment of the present invention.

Figure 19 illustrates a schematic representation of an apparatus in accordance with the preferred embodiment of the present invention.

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Figure 20 illustrates a schematic representation of an apparatus with a rackmount cabinet in accordance with the preferred embodiment.

Figure 21 illustrates a schematic representation of a user's view in accordance with the
20 preferred embodiment of the present invention.

Figure 22 illustrates a schematic representation of a user's view in accordance with the preferred embodiment of the present invention.

25 **DETAILED DESCRIPTION OF THE INVENTION**

Reference will now be made in detail to the preferred embodiments of the present invention, and results of which are illustrated in the accompanying drawings.

Referring to Figure 1, the figure illustrates a schematic representation of a station (100) in accordance with the preferred embodiment of the present invention. Referring to Figure 2a, the figure illustrates a schematic representation of an embodiment of an apparatus (200) in accordance with the preferred embodiment of the present invention, wherein the apparatus (200) preferably comprises a simulation cabin and a graphical user interface for simulating an object. Referring to Figure 2b, the figure illustrates a schematic representation of another embodiment of an apparatus (200) in accordance with the preferred embodiment of the present invention, wherein the apparatus (200) is preferably but not limited to a virtual reality goggle for simulating a crew member. The relationship between the station (100) and any one embodiment of the apparatus (200) will be further described in the following description of the embodiments of the present invention.

Referring to Figure 3, the figure illustrates a schematic representation of a system for simulation in a virtual reality environment in accordance with the preferred embodiment of the present invention, wherein the system comprising a station (100) with a first interface for monitoring and controlling the simulation, an apparatus (200) with a second interface, configured for simulating an object and for receiving instructions from the station (100) in the event of simulation. The first interface and the second interface are preferably but not limited to graphical user interfaces. In the preferred embodiment, the system is configured for an interactive simulation in a virtual reality environment via interaction between the station (100) and the apparatus (200) in a real time operation, in a manner that the virtual reality environment is a shared environment, the shared environment is a secured and restricted environment, being shared by the simulation of the station (100) and the apparatus (200) or a plurality of the apparatus (200), which are operated by human users via the graphical user interfaces.

It is shown in Figure 3, that the station (100) and the apparatus (200) are connected via a Local Area Network (LAN) hub. It should be appreciated that that the station (100) and the apparatus

(200) are able to be connected via any wireless communication technology or any network protocol, of which the station (100) and a plurality of apparatus (200), each operated from different parts of world where internet connection is accessible. In this context, the respective simulators can be connected to the simulation network via preferably but not limited to Local Area Network, internet, wireless technology, 5G wireless system, or any networked protocol. The station (100) is shown being operated by a human user, and this human user is the instructor or known as a trainer. It will be appreciated by a person with skills in the art that the station (100) will comprise preferably but not limited to a screen display as a graphical user interface for monitoring the simulation, a central processing unit (CPU) for processing the simulation and generating reports of the simulation, controllers for providing controlling ability and a printing device for printing reports of the simulation. The apparatus (200) in the preferred embodiment of the present invention is also shown being operated by another human user, and this human user is the operator or known as the trainee. It will be appreciated by a person with skills in the art that the apparatus (200) will comprise preferably but not limited to a screen display as a graphical user interface for displaying the simulation activity to the user, a processing unit for processing the simulation activity, and controllers for controlling the simulated object in the virtual reality environment. The simulated object is preferably but not limited to at least a vehicle, an aircraft or a crew member.

Referring to Figure 4, the figure illustrates a schematic representation of a simulation scenario in a virtual reality environment in accordance with the preferred embodiment of the present invention. It is shown in the figure that the apparatus (200) is either configured for simulating an object or configured for simulating a human member within the virtual environment. The human member is preferably but not limited to a crew member.

In the preferred embodiment of the present invention, the interactive simulation in a virtual reality environment between the station (100) and the apparatus (200), permits simulation for

a plurality of the said apparatus (200), wherein the station (100) is capable of hosting and monitoring multiple vehicles within the simulation and each vehicle having a specific role. The distributed system of the present invention provides a shared simulated environment for the plurality of vehicles, aircrafts or crew members, each having simulated controls and simulated
5 to collaboratively and collectively achieve a common objective or a mission in real time.

The system in the preferred embodiment of the present invention is configured for teamwork simulation by interaction and communication between the simulated object and human member within the simulated shared environment. The station (100) is configured for modifying
10 any one of numbers or types of the simulated object or human member and the plurality of entities which are the vehicles, aircrafts or crew members, preferably are geographically dispersed from each other, namely the vehicle simulators and human simulators each controlled by at least an apparatus (200) and each having separate controls and locations collaborating together in the same shared virtual reality environment. Also, the vehicle
15 simulator in the preferred embodiment of the present invention, is able to transport a crew member or human simulator anywhere in the simulated virtual reality environment. There is also an instance where the human simulators are tested for teamwork with the vehicle simulators in communicating successful simulation between them. It is shown in Figure 4 that the system of the present invention also provides a simulation where hand movement by a
20 crew member, is controlled and generated by the human simulator, which can be used as a virtual guiding assistance to the vehicle simulator operator to maneuver the correct path for docking safely. This feature is required in an actual airport operation where a marshaller is required to guide the docking of ground support equipment vehicles to the aircraft cargo door.

25 The station (100) in the preferred embodiment of the present invention play a role as the central controlling and monitoring station that is able to monitor the simulated activities of all entities collectively as a group in real time without any discrepancies in terms of cause and effects of

the simulation between the entities or from the controls or its simulated effects as observed between the entities and the station (100). The main challenge in achieving this multi entity simulation is to solve the synchronization between the connecting image generator computers that includes the graphic effects, particles, lightings, physic effects, sound effects and weather effects discrepancies. This is addressed by implementing a networking algorithm.

Further in the interaction and teamwork solution for networked simulators of mixed entities in accordance with the preferred embodiment of the present invention, the system is capable of providing a multiple level concept of a simulator riding on another simulator. This enables a crew member or plurality of crew member entities controlled by a group of human users, which can be transported from one point of a location (assuming point A) to another point of a destination (assuming point B) within the virtual reality environment, by the vehicle entities which are controlled by other group of human users, of which the crew entities are able to be mounted onto the vehicle entities so as to operate and control the virtual equipment that is coupled to the vehicle entities, wherein each equipment has different functions to meet with the objectives of the simulation in real time.

Also, the system enables a teamwork simulation between different entities that may be operated at locations different from one another. In another simulation, the vehicle or transport entity is able to transport virtual objects from one point of a location (assuming point A) to another point of a destination (assuming point B), and the crew member entity is able to collect the virtual objects by the hand movement tracking device and then load it to another vehicle or transport entity which will then carry the virtual object to a final point of a destination (assuming point C), in which all entities are separately controlled and the entities are being operated in one simulated operation. Accordingly, all users via the respective simulators connected to the simulation network is provided with a common view in the virtual reality environment. In this context, all entities are able to view one another in the same simulation in the shared

environment without any discrepancies between connecting computers of the station (100) and apparatus (200) or a plurality of apparatus (200).

Referring to Figure 5, the figure illustrates a flow diagram of introducing at least an unexpected event into the virtual reality environment in accordance with the preferred embodiment of the present invention. Said at least an unexpected event is preferably but not limited to any one of a pedestrian crossing (11), vehicle crossing (12), oil spill (13), object drop (14), sudden brake of a front vehicle (15), or an insertion of cargo (16). Said at least an unexpected event is not developed as a pre-programmed function but is programmed at the station (100) for an instructor or trainer to activate said at least an unexpected event at any time according to the instructor or trainer's discretion or direction. The instructor operating the station (100) is able to inject a direct hazard or dangerous situation in-real time to test the operator's reaction, alertness and decision making at random and spontaneously when such sudden situations are introduced to the operators on the road. Said at least an unexpected event further includes preferably but not limited to aircraft crossing, animal crossing on the road, land slide incident on the pathway, fire breakout, vehicle malfunction such as brake malfunction, accelerator malfunction, engine abruptly stopping, tire bursting or incorrect actions of other members to introduce a surprise element to the operator. For example, the instructor is able to introduce an aircraft crossing at the airside area that could block the operator's or driver's path so that the operator or driver of any ground support equipment needs to stop and give way to the aircraft to continue its journey, or to introduce fire incident on a certain object at the simulated environment of the airside such as aircraft, building, terminal, or any other object, or to introduce malfunction of operator's vehicle such as brake malfunction, accelerator malfunction or tire burst out. In this case, the operator or driver needs to press emergency stop button that is attached to his vehicle to completely stop the engine and prevent the vehicle from moving. Example of this situation is during the docking exercise where a ground support equipment vehicle abruptly experiences a brake malfunction and the vehicle ramps into the aircraft body

causing damage. Another situation is an instance at airside where a push back tug or tractor experiences an abrupt engine switching off causing the vehicle's steering to be stiff or tight which will be difficult to steer or maneuver, resulting in the vehicle to be driven straight to a drain or hitting a wall, aircraft or building. These situations can be introduced into the simulation. It is difficult to implement such training in the real world because of fatality and high costs. The system in the preferred embodiment of the present invention is a two-way interactive concept, wherein the station (100) is programmed to activate said at least an unexpected event directly to the simulator according to the instructor's time and choice. This makes the simulated training more effective in building the operator's reaction, alertness and decision-making skills at a moment's notice.

Referring to Figure 6, Figure 7, Figure 8, Figure 9, Figure 10, Figure 11 and Figure 12, these figures respectively illustrate screenshot images of said at least an unexpected event described in the foregoing description, wherein Figure 6 shows an example of a pedestrian crossing (11), Figure 7 shows an example of a vehicle crossing (12), Figure 8 shows an example of an oil spill (13), Figure 9 shows an example of an object drop (14), Figure 10 shows an example of a sudden brake of a front vehicle (15), Figure 11 shows an example of a user overtaking a front vehicle (16), and Figure 12 shows an example of an insertion of cargo (17). In the event if the simulation, the operator shall react and responds to said at least an unexpected event, of which the simulation results will be generated and captured in a database, preferably at the station (100) for future reference or print out.

Referring to Figure 13, the figure illustrates screenshot images of a two dimensional view, a zoomed out view and zoomed in view, as well as a computer mouse scrolling directions in accordance with the preferred embodiment of the present invention. It is shown in the top left screenshot that the image is a two dimensional view of a part of the virtual reality environment. The bottom left screenshot shows an image of a zoomed out view of a part of the virtual reality

environment. The bottom right screenshot shows an image of a zoomed in view of a part of the virtual reality environment. The top right image shows a computer mouse scrolling directions. In the case where the scroller is moved upwards, the image in the virtual reality environment would be zoomed in, and if the event the scroller is moved downwards, the image in the virtual reality environment would be zoomed out. The computer mouse scrolling directions is also able to be configured in reversed, such that where the scroller is moved upwards, the image in the virtual reality environment would be zoomed out, and if the scroller is moved downwards, the image in the virtual reality environment would be zoomed in.

Referring to Figure 13a, the figure illustrates an example of a layout of a graphical user interface at a station in accordance with the preferred embodiment of the present invention. It is shown that the graphical user interface is displaying a two-dimensional view of a part of the virtual reality environment, as a selection of the button "2D Top View" below the displaying of the two-dimensional view. Referring to Figure 13b, the figure illustrates an example of a layout of a graphical user interface at a station in accordance with the preferred embodiment of the present invention. It is shown that the graphical user interface is displaying a three-dimensional view of a part of the virtual reality environment, as a selection of the button "3D Top View" below the displaying of the three-dimensional view. An instructor is able to toggle between the views by clicking either the "2D Top View" or the "3D Top View". The graphical user interface also provide statistic information status of subject vehicle.

Referring to Figure 14, the figure illustrates screenshot images of exterior views of a simulated vehicle via navigation of a keyboard arrow buttons in accordance with the preferred embodiment of the present invention. Referring to Figure 1, Figure 3, Figure 4, Figure 13 and Figure 14, it will be appreciated that the station (100) is configured for the human user to view the entire area of the virtual reality environment using controllers such as a computer mouse and a keyboard, and the station (100) is also configured for the human user to control any one

or a combination of a weather condition, temperature, wind speed, humidity level, or time of a day, within the virtual reality environment, as well as modifying any one of numbers or types of a vehicle as operated using the apparatus (200) for the simulation, by a human user.

- 5 Furthermore, human user or the instructor operating the station (100) is able to monitor the simulation on a graphical user interface and select preferably but not limited to a top view, three-dimensional rotating view around the simulated vehicle, and an entire surrounding view of the simulated area, within a single graphical user interface of the station (100). The top two-dimensional view is where a camera tracks or follows the operator's vehicle movement from
10 the top and able to zoom in and out. However, the three-dimensional view is where the camera rotates around the operator's vehicle movement in a 360° view.

Referring to Figure 15, the figure illustrates screenshot images of all-around viewing via navigation of a keyboard arrow buttons in accordance with the preferred embodiment of the
15 present invention. Referring to Figure 1, Figure 3, Figure 4, Figure 13, Figure 14 and Figure 15, it will be appreciated that the station (100) is configured for the human user to view the entire area of the virtual reality environment using controllers such as a computer mouse and a keyboard. The human user or the instructor operating the station (100) is able to monitor the simulation and an all-around viewing control of the simulation in progress as if it is a function
20 of a moving camera controlled by an administrator travelling from one point to another with the ability to zoom in and out within the three-dimensional space.

Referring to Figure 16, the figure illustrates a flow diagram of simulating vehicle roles in accordance with the preferred embodiment of the present invention, wherein the simulation of
25 vehicle roles mainly comprises a station (100) operated by an instructor and an apparatus (200) operated by an operator. In the flow diagram, the instructor or trainer initially assigns a vehicle role using a host application to launch the simulation. The host application then sends

a selected vehicle role identification (ID) to the simulator through Network TCP/IP, and the simulator Network TCP/IP obtains information on selected vehicle role ID. Then, the simulator Interface boards obtains the information from a switching relay board and vehicle selection buttons, and the simulator sends a vehicle role ID selected by an operator to the host application through Network TCP/IP. Subsequently, the host application compares the vehicle role ID from the instructor with the operator while launching a simulation scenario. If the selected vehicle role ID by server host application is not the same with the vehicle role ID electronics, a pop-up message will appear requesting the operator to select the correct vehicle role. The simulator will not function until the operator choses the correct vehicle role ID. Once both vehicle role ID are matched, all gauges and indicators in the simulation would fully function. In the preferred embodiment of the present invention, the station (100) is configured for modifying any one of numbers or types of the simulated object during the simulation.

Referring to Figure 17, the figure illustrates a schematic representation of types of vehicles for simulation in accordance with the preferred embodiment of the present invention, wherein the apparatus (200) is configured for simulating any one of a tow tug or a tow tractor (21), jet refueler (22), baggage conveyor (23), vestibule door (24), mobile passenger boarding steps/stairs (25), catering truck (26), passenger bus (27), toilet truck (28), or a portable water truck (29). The apparatus (200) is also configured for further simulating any one of a fuel service vehicles, baggage tractor with dolly, dollies, ground power units, buses, air start units, portable water trucks, catering vehicles, passenger boarding stairs, sky loader or a baggage conveyor, joint container pallet loader, container loader, push back tugs and tractors, tow tugs, transporters, container transporters, hi-lift trucks, fuel bowzers, water bowzers, lavatory service vehicles, passengers loading bridge, passenger vans, belt loaders, de/anti-icing vehicles or an aircraft rescue and firefighting vehicles. The apparatus (200) is preferably operated remotely.

Referring to Figure 18, the figure illustrates a flow diagram of simulation in a virtual reality environment in accordance with the preferred embodiment of the present invention, wherein the station (100) is configured for modifying any one of numbers or types of the simulated object or human member. In the flow diagram, the simulated objects or human member are
5 simulated by an apparatus (200). There is shown that the apparatus (200) is capable of simulating ground support equipment such as a tractor, a sky loader or baggage loader, join container pallet loader, any type of other vehicle denoted by "x", and a plurality of human members. As for each object simulators, there are provided a multi display, controls, gauges and indicators, interface board, computer and network interface card. As for the human
10 members, there are provided a display such as a virtual reality goggle, controls, hand tracking sensor, locomotion sensor, computer and a network interface card. The human member is preferably or marshaller or a crew member. The controllers for each simulated object or human member are varied to suit the specific requirements of the simulated object or human member. Also, the vehicle simulators and human simulators are located remotely from the station (100)
15 or known as the instructor operator station (IOS) and the vehicle simulators and human simulators collaborate together in the same shared virtual airside environment, wherein the simulation is for a training session in a virtual reality environment is an airside of an airport.

It is shown in the flow diagram of Figure 18 that each simulator broadcasts its own session
20 identification or session ID during startup together with a "Ready Status" using TCP/IP. The instructor operator station (IOS) Host Application will listen and capture the session ID with the "Ready Status" for inclusion into a client list. In the Host Application, the operator will then assign roles for each simulator and launch a simulation or training session. Further, the instructor operator station (IOS) Host Application is also capable of centralized monitoring and
25 controlling of environmental changes, scenario intervention and synchronization of all graphic.

In a further configuration and modification of the system in the preferred embodiment of the present invention, the simulation for a training session is modified for a ship port operation, fire and rescue operation, and/or military operation such as for convoying, striking and ambushing.

- 5 In the preferred embodiment of the present invention, there is provided a method for simulation in a virtual reality environment comprising the steps of initially initiating the simulation by a station (100) operated by a user, simulating an object and receiving instructions from the station (100) in the event of simulation by an apparatus (200) operated by another user. and completing the simulation and generating a report on the simulation. The preferred
- 10 embodiment of the present invention is also capable of replaying of a previous session. The simulation is for a training session. The virtual reality environment is preferably but not limited to any one of an airside of an airport, ship port operation, fire and rescue operation and/or military operation.
- 15 Referring to Figure 19, the figure illustrates a schematic representation of an apparatus (200) in accordance with the preferred embodiment of the present invention, wherein the apparatus (200) for simulating an object in a virtual reality environment comprising mainly a controller module (201), a display (202) connected to the controller module (201) for displaying images in graphical user interface mode, wherein in the display (202) is configured for providing an
- 20 omnidirectional view of the virtual reality environment to a user operating the apparatus (200). The apparatus (200) is preferably motion base, whereby the apparatus (200) is capable of movement during simulation and capable of providing effect and feelings of being in a moving vehicle while the operator is controlling the vehicle. It is shown in Figure 19, the controller module (201) comprises features that are specific to a vehicle simulator, preferably the
- 25 controller module (201) of one preferred embodiment of the present invention comprises a baggage loader driver dashboard panel (31), a steering wheel (32), an automatic gear and handbrake (33), a conveyor control panel (34), a cargo loader operator's control panel (35), a

cargo loader driver dashboard panel (36), an automatic gear for tractor (37) and handbrake for tractor and baggage loader (38).

It will be appreciated by a person with skills in the art that the apparatus (200) is modifiable
5 and customizable to accommodate varying features and handling of different types of vehicle
simulators, wherein controller module (201) is able to be configured for controlling in simulation
of any one of a vehicle shown in Figure 17 such as a tow tug or tow tractor (21), jet refueler
(22), baggage conveyor (23), vestibule door (24), mobile passenger boarding steps/stairs (25),
catering truck (26), passenger bus (27), toilet truck (28), or a portable water truck (29). The
10 apparatus (200) is also configured for further simulating any one of a fuel service vehicles,
baggage tractor with dolly, dollies, ground power units, buses, air start units, portable water
trucks, catering vehicles, passenger boarding stairs, sky loader or a baggage conveyor, joint
container pallet loader, container loader, push back tugs and tractors, tow tugs, transporters,
container transporters, hi-lift trucks, fuel bowzers, water bowzers, lavatory service vehicles,
15 passengers loading bridge, passenger vans, belt loaders, de/anti-icing vehicles or an aircraft
rescue and firefighting vehicles. The apparatus (200) is preferably operated remotely.

Referring to Figure 20, the figure illustrates a schematic representation of an apparatus (200)
with a rackmount cabinet (41) in accordance with the preferred embodiment of the present
20 invention, wherein the apparatus (200) is shown a having controller module (201) and a display
(202). The display (202) is shown constructed by a plurality of screen panels (42) and said
plurality of screen panels (42) are arranged in a room-like structure having a door (43). The
door (43) is for providing entry and exit to an operator into and out of the room. The display
(202) is also provided with an air duct (44) for air ventilation within the room. As shown in
25 Figure 20, in one preferred embodiment of the present invention, the display (202) is configured
for multi-layered viewing to provide an unobstructed view of the virtual reality environment by
at least a further screen panel (45) connected to said plurality of screen panels (42).

In another preferred embodiment of the present invention, the display (202) is configured as a singular connecting curved screen panel for displaying images in an omnidirectional view or 360° view, and such singular connecting curved screen panel is capable to be configured as a dome-like structure. The display (202) in one preferred embodiment of the present invention is preferably a plurality and combined screen panels (42) for displaying indefinite number of continuing simulated images, wherein the plurality and combined screen panels (42) for displaying images arranged on a base formed by any polygon shape. The polygon shape is any one of an octagon, hexagon, square, pentagon, nonagon or a decagon combined screen panels (42). The polygon shape provides continuous images in an omnidirectional view or 360° view.

Referring to Figure 21, illustrates a schematic representation of a user's view in accordance with the preferred embodiment of the present invention. As shown in the figure, the display (202) is preferably constructed by multilayers of screen panels and arranged on a base formed by an octagon shape. Each screen panel is configured to display at appropriate view angles of preferably but not limited to 0°, -28° (downward view) and 28° (upward view) to achieve a continuous and seamless vertical field of view (FOV) of a vast 80° from operator's height and point of view. It will be appreciated that the view angles are variable for different configurations, sizes, aspect ratios, resolutions, and positions of the display (202). The radius distance of the user's eye to the screen is a position at where the octagon loop is made up of 360° view circle and in which at this point, all three-dimensional models, buildings and simulated environment rendered and displayed on the graphic user interface shall achieve the accurate size and distance from the operator's point of view, in view of that the images that are in continuation to each other and connected in 360° circle shall project the accurate scale of the simulated environment. This is required for example, the tractor, dollies, joint container pallet loader, and sky loader wide view operation as downward view is required to see platform of the equipment being raised up from ground or dolly movement that rolls on the ground level which require the

operator to turn his/her head to the rear downward, or to look upward to see the sky loader's baggage conveyor ramp docking into the aircraft door from the operator's vehicle in a seated point of view.

- 5 In actual practice, while driving a tractor that pulls a chain of loads behind (pallet dolly or baggage trolley or container trailer), the operator needs to look back to ensure the pallet dolly movement that is safely attached to the tractor body while the operator drives and controls the tractor vehicle. Thus, an omnidirectional view or unobstructed view of 360° view screen is required to allow the operator to view the chain of dollies that the operator pulls at all angles
- 10 including his back. This includes driving in straight line, cornering and looking backward to perform a dolly parking inside a parking box. As for operating a joint container pallet loader, the operator needs to look backward and downward at the rear bottom area of the vehicle at where the vehicle's platform is carrying a cargo, then the operator is required to press a switch to raise up the platform while observing the cargo being raised up to the bridge level and then
- 15 operating the equipment control to roll in the cargo movement into the aircraft door. At this time, the operator is required to observe the roll in movement of the cargo from rear to side view and finally to the front view at where the aircraft's door awaits the cargo to enter. As for operating a sky loader, the operator is required to look upward at the front right of the vehicle at where the vehicle's conveyor ramp is to be raised up to dock to the aircraft door for the
- 20 operator to deliver baggage inside the aircraft. At this time, the operator is required to observe the raise up movement of the conveyor ramp from normal position up to the aircraft door position.

The apparatus in the preferred embodiment of the present invention is able to address the

25 actual practice problems within the simulation in a virtual environment by providing a display (202) configured for an omnidirectional or a 360° of the virtual reality environment.

Referring to Figure 22, the figure illustrates a schematic representation of a user's view in accordance with the preferred embodiment of the present invention. It is shown in the figure that the display (202) or an arrangement of plurality of monitors in 360° view construction are made of eight continuous images in an octagon order, and each is configured to display a horizontal field of view (FOV) of continuing images up to 360° degree. The continuous images are generated by networking between computers connected to the plurality of monitors in a simulation program that is capable of generating images that correspond to one another. The simulation program is also capable of varying the viewing angles.

10 In the preferred embodiment of the present invention, each computer is preconfigured with the respective Display Mode ID (for example: Master Display, Slave Left Display, Slave Right Display) and each computer broadcasts Display Mode ID through Network TCP/IP. The instructor operator station (IOS) Host Application then listens and captures each Display Mode ID and subsequently launch the simulation by combining all Display Mode IDs into one
15 integrated 360° view monitor. The multi layered monitors configuration in the preferred embodiment of the present invention is to provide additional view angle layers for upward view layer and downward view layer, in addition to the existing horizontal view layer.

The objective of the system, method and apparatus of the present invention is to provide
20 learning to new trainee drivers/operators on how to operate the vehicle and equipment safely, how to operate the vehicle in the airport area, familiarization on specific routes at the airport, how to be a defensive driver, how to respond in operations and procedures including various emergency or rare events, how to identify, diagnose and manage fault conditions on the vehicle, as well as providing extensive and objective reports of monitoring and evaluating of
25 trainees performance. The training includes preferably but not limited to free driving, assessment driving, defensive driving, and equipment operation of docking exercise.

The present invention may be embodied in other specific forms without departing from its essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore indicated by the appended claims rather than by the foregoing description. All changes, which come within the

5 meaning and range of equivalency of the claims, are to be embraced within their scope.

CLAIMS

1. A system for simulation in a virtual reality environment comprising:

5 a station (100) comprising a screen display displaying a first graphical user interface, a central processing unit and controllers, wherein the station (100) is operated by a human user for monitoring and controlling the simulation; and

10 at least one apparatus (200) comprising a screen display (202) displaying a second graphical user interface, wherein the at least one apparatus (200) is operated by another human user, configured for simulating an object or a human member, and for receiving instructions from the station (100) in the event of simulation;

characterized in that the system is configured for an interactive simulation in a virtual reality environment via interaction between the station (100) and the at least one apparatus (200) in a real time operation,

15 wherein the interactive simulation is a mixed entities environment, in a manner that the virtual reality environment is a shared environment, comprising mixed entities including objects and human members simulated by a plurality of the apparatus (200) and involving interaction and communication between the objects and human members within a simulated environment, wherein simulated activities are centrally monitored and controlled by the station (100).

- 20 2. The system of claim 1, wherein the simulated human member is a crew member.

3. The system of claim 1, wherein the station (100) is configured for modifying any one of numbers or types of the simulated object or the simulated human member.

- 25 4. The system of claim 1, wherein the station (100) is configured for introducing at least an unexpected event into the virtual reality environment.

5. The system of claim 4, wherein said at least an unexpected event is any one of a pedestrian crossing (11), vehicle crossing (12), oil spill (13), object drop (14), sudden brake of a front vehicle (15), or an insertion of cargo (16).

5

6. The system of claim 1, wherein the station (100) is configured for the human user to view the entire area of the virtual reality environment.

7. The system of claim 1, wherein the station (100) is configured for the human user to control any one or a combination of a weather condition, temperature, wind speed, humidity level, or time of a day, within the virtual reality environment.

10

8. The system of claim 1, wherein the simulated object comprises a tow tractor (21), jet refueler (22), baggage conveyor (23), vestibule door (24), mobile passenger stairs (25), catering truck (26), passenger bus (27), toilet truck (28), or a portable water truck (29).

15

9. The system of claim 1, wherein the simulated object further comprises a fuel service vehicles, baggage tractor with dolly, dollies, ground power units, buses, air start units, portable water trucks, catering vehicles, passenger boarding stairs, sky loader or a baggage conveyor, joint container pallet loader, container loader, push back tugs and tractors, tow tugs, transporters, container transporters, hi-lift trucks, fuel bowzers, water bowzers, lavatory service vehicles, passengers loading bridge, passenger vans, belt loaders, de/anti-icing vehicles or an aircraft rescue and firefighting vehicles.

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10. The system of claim 1, wherein the apparatus (200) is operated remotely.

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11. The system of claim 1, wherein the apparatus (200) for simulating the human member comprises a virtual reality goggle.

12. The system of claim 1, wherein the simulation is for a training session.

5

13. The system of claim 1, wherein the virtual reality environment is any one of an airside of an airport, ship port operation, fire and rescue operation, or military operation.

14. A method for simulation in a virtual reality environment using the system of claim 1, the
10 method comprising the steps of:

initiating the simulation by the station (100) operated by a human user;

simulating an object or a human member, and receiving instructions from the station (100) in the event of simulation by the at least one apparatus (200) operated by another human user; and

15 completing the simulation and generating a report on the simulation;

characterized in that the system is configured for an interactive simulation in the virtual reality environment via interaction between the station (100) and the at least one apparatus (200) in a real time operation,

20 wherein the interactive simulation is a mixed entities environment, in a manner that the virtual reality environment is a shared environment, comprising mixed entities including objects and human members simulated by a plurality of the apparatus (200) and involving interaction and communication between the objects and human members within a simulated environment, wherein simulated activities are centrally monitored and controlled by the station (100).

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15. The method of claim 14, wherein the simulation is for a training session.

16. The method of claim 14, wherein the virtual reality environment is any one of an airside of an airport, ship port operation, fire and rescue operation, or military operation.

17. An apparatus (200) for simulating an object in a virtual reality environment comprising:

5 a controller module (201); and

 a display (202) connected to the controller module (201) for displaying images in a graphical user interface mode;

 wherein the display (202) is configured for providing multilayered omnidirectional view of the virtual reality environment to a human user operating the apparatus (200),

10 characterized in that the display (202) is configured for an interactive simulation in the virtual reality environment via interaction between a station (100) and the apparatus (200) in a real time operation;

 wherein the interactive simulation is a mixed entities environment, in a manner that the virtual reality environment is a shared environment, comprising mixed entities
15 including objects and human members simulated by a plurality of the apparatus (200) and involving interaction and communication between the objects and human members within a simulated environment, wherein the simulated activities are centrally monitored and controlled by the station (100).

20 18. The apparatus of claim 17, wherein the controller module (201) is configured for controlling in simulation of any one of the objects of a tow tractor (21), jet refueler (22), baggage conveyor (23), vestibule door (24), mobile passenger stairs (25), catering truck (26), passenger bus (27), toilet truck (28), or a portable water truck (29).

25 19. The apparatus of claim 17, wherein the controller module (201) is further configured for simulation of any one of the objects of a fuel service vehicles, baggage tractor with dolly, dollies, ground power units, buses, air start units, portable water trucks, catering

vehicles, passenger boarding stairs, sky loader or a baggage conveyor, joint container
 pallet loader, container loader, push back tugs and tractors, tow tugs, transporters,
 container transporters, hi-lift trucks, fuel bowzers, water bowzers, lavatory service
 vehicles, passengers loading bridge, passenger vans, belt loaders, de/anti-icing vehicles
 5 or an aircraft rescue and firefighting vehicles.

20. The apparatus of claim 17, wherein the controller module (201) is operated remotely.

21. The apparatus of claim 17, wherein the display (202) is a singular connecting curved
 10 screen panel for displaying continuous simulated images.

22. The apparatus of claim 21, wherein the singular connecting curved screen panel is
 configured as a dome-like structure.

15 23. The apparatus of claim 17, wherein the display (202) is a plurality and combined screen
 panels (42) for displaying indefinite number of images.

24. The apparatus of claim 23, wherein the plurality and combined screen panels (42) for
 displaying images are arranged on a base formed by any polygon shape.

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25. The apparatus of claim 24, wherein the polygon shape is any one of an octagon,
 hexagon, square, pentagon, nonagon or a decagon combined screen panels.

26. The apparatus of claim 25, wherein the polygon shape provides continuous images.

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