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TOOL FOR USE IN VIRTUAL ENVIRONMENT

Technical Field

- 5 The present invention relates, in general terms, to a tool for use in a virtual environment, particularly to interact with physical models that have a twin, or correspond to a virtual object, in the virtual environment.

Background

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Simulation training is becoming increasingly important, to teach first responders and others how to operate in stressful or hazardous scenarios. Such simulations endeavour to recreate such scenarios, without the safety risk to trainees.

- 15 One significant hurdle in simulation is that the real-world considerations are not present. Considering a traffic accident scenario, real-world considerations would include heat from vehicle fires, locations of people relative to one another, obscured hazards or objects (e.g., injured people stuck behind or within a vehicle) and so on. Other real-world effects considerations on the user, such as
20 the user interacting with objects in the scenario, such as opening doors of vehicles, dealing with fires and the like.

- It would be desirable to overcome or ameliorate at least one of the above-described problems with current virtual environment scenario simulations, or at
25 least to provide a useful alternative.

Summary

- Disclosed is a tool for use by a user and configured to have a corresponding
30 avatar in a virtual environment, the tool comprising:
a body;
an engagement mechanism;

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a reaction motor; and

a tool controller,

wherein the engagement mechanism is configured to connect to a physical interactive zone corresponding to a virtual interactive zone of a virtual model in the virtual environment, and operation of the tool controller causes the reaction motor to move the tool relative to the physical interactive zone and thereby generate a reactive force in the body.

Also disclosed is a physical model for use in a virtual environment, the model comprising:

one or more physical interactive zones, each physical interactive zone comprising a corresponding engagement mechanism for engaging an engagement mechanism on a tool,

wherein at least one said physical interactive zone is a dynamic zone movable with one or more degrees of freedom.

Also disclosed is a wearable suit for use in a virtual environment, the wearable suit comprising:

an olfactory system for delivering a scent to a user of the wearable suit, the scent corresponding to a scent experienced in a scenario implemented in the virtual environment;

a thermal system for delivering heating and/or cooling to the user based on proximity of a heat or cold source in the scenario;

a receiver for receiving a suit control signal;

a suit controller adapted to control the olfactory system and thermal system based on the suit control signal, the suit control signal corresponding to changes in at least one of a location of the user in the virtual environment and progress in the scenario.

Also disclosed is a virtual environment system for controlling a virtual environment, comprising:

a virtual reality headset for displaying the virtual environment to a user;

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a scenario controller for managing a scenario implemented in the virtual environment;
a tool as described above;
a receiver for receiving a signal from the tool controller; and
5 a physical model as described above,
wherein the scenario comprises a plurality of steps, each step comprising one or more tasks to be performed by the user in the virtual environment, at least one step comprising engaging the engagement mechanism and corresponding engagement mechanism, and sending the tool control signal in response to
10 receiving the signal from the tool controller.

Brief description of the drawings

Embodiments of the present invention will now be described, by way of non-
15 limiting example, with reference to the drawings in which:

Figure 1 is a simplified illustration of a tool in accordance with present teachings;

Figure 2 is a simplified illustration of an object in accordance with present
20 teachings;

Figure 3 illustrates a wearable suit in accordance with present teachings, and a schematic illustration of components of the scenario controller; and

25 Figure 4 illustrates an alternative embodiment of a suit in accordance with present teachings.

Detailed description

30 Disclosed are tools that enable a user to interact with scenarios in a virtual environment. The scenarios generally involve the physical tool ("physical" being used in the sense that it is real) being handled by a user and causing a visible

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object reaction in the virtual environment. The tool enables the visible object reaction by engaging (i.e., establishing a connection with) a physical object that corresponds to a virtual object ("virtual" being used in the sense that it is rendered in the virtual environment). Thus, the tool and object each exist in the
5 real world and have a corresponding "avatar" in the virtual environment – the avatar does not need to look the same as the real world tool or object to which it corresponds, and behaviours can be rendered in the virtual environment that are not reproduced, or are produced differently, in the real world.

10 Figure 1 shows a tool 100 that is to be held or used by a user that is viewing a corresponding tool avatar (i.e., avatar corresponding to the tool) in a virtual environment. Where multiple users (also referred to as "players") are in the scenario, each avatar may be visible to all users or only a select group of users.

15 The tool 100 enables the user to interact with a physical object (not shown), and that interaction is replicated in the virtual environment, between the tool avatar and object avatar (i.e., avatar corresponding to the object).

The tool 100 comprises a body 102, an engagement mechanism 104, a reaction
20 motor 106 (shown in broken lines since, in this embodiment, it is internal of the tool body 102), and a tool controller 108.

The tool 100, or any parts thereof, may have the same appearance as their corresponding components in the tool avatar, or may have a different
25 appearance. Moreover, as described below, the reaction motor 106 will be used to generate a reactive force. The reactive force is applied through the body of the tool 100, to the user – e.g. to the hands of the user. The force replicates the force a user would experience when using the tool in a real life scenario. Thus, the reactive force can be of a magnitude corresponding to a task being
30 performed in the virtual environment, if that same task were to be performed in a real world scenario. For example, if the tool corresponds to a tool avatar that is a lever the user needs to actuate to open a concrete drain cover, the

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body may resist movement (i.e., activation) of the lever with an amount of force the user can expect to encounter when actuating the same lever in the real world. Moreover, the object to which the tool is connected may not change whereas the object avatar may change as the lever is actuated.

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The engagement mechanism 105 is configured to establish a connection between the tool and a physical interactive zone 200 corresponding to a virtual interactive zone of a virtual model in the virtual environment. That connection can be through physical, such as a clip or click fitting, or a friction fit, or another
10 type of connection such as magnetic or electromagnetic. For example, the engagement mechanism may be one of an electromagnetic member and a metal body (e.g., ferromagnetic body), with the physical interactive zone being the other of the electromagnetic member and metal body. The connection enables the reactive force to be generated against the physical interactive zone. The
15 reactive force is thus a force applied to the user that is generally equal and opposite to the force applied by the engagement mechanism against the physical interactive zone, or the force applied by the body to the engagement mechanism, where the engagement mechanism is articulated (e.g., can pivot, bend or otherwise move relative to the body).

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The engagement mechanism 104 can be in one or both of fixed orientation and fixed position relative to the body 102. Alternatively, the engagement mechanism 104 may move relative to the body 102, such as by having an articulated, hinged or otherwise moveable connection therebetween.

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The user can choose when the reactive force starts to be applied, through the tool controller 108. Operation of the tool controller 108 causes the reaction motor to move the tool relative to the physical interactive zone 110. That generates, through the connection between the tool and physical interactive
30 zone 110, the reactive force in the body and that force is then applied to the user.

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The tool 100 also includes one, and preferably more than one, orientation marker 112. Orientation markers 112 are used to locate and orient the tool in the virtual environment. Thus, the tool avatar is rendered at a distance from the user's viewpoint (typically a 3D headset), and at an angle to the user, as
5 determined from the orientation markers 112.

The object may also include orientation markers. However, the scenario controller may render the object at different distances from the user, to enable the user to progressively approach the object (e.g., through virtual teleportation
10 using a button to move from one location in the virtual environment to another location) and thus render the object at different sizes and orientations, depending on the distance and orientation of the object in the scenario.

The tool 100 shown in Figure 1 includes a receiver 114 for receiving an input
15 from a proximity sensor 116. The proximity sensor 116 senses the proximity of the physical interactive zone 110 relative to the engagement mechanism 104. The input may thus specifying a distance between the engagement mechanism 104 and the physical interactive zone 110. The controller 108 can then activate the engagement mechanism 104, to establish the connection, when the
20 engagement mechanism 104 comes within a predetermined distance of the physical interactive zone 110. For example, where the engagement mechanism 104 is an electromagnet, the tool controller 108 may activate the electromagnetic force in the engagement mechanism 104, to draw the engagement mechanism 104 against the physical interactive zone 110, thereby
25 connecting the tool and object (with is reflected by connection between the tool avatar and object avatar in the virtual environment).

The tool 100 may be powered by battery or wired power connection, or through any other means – e.g., powered through connection with the physical
30 interactive zone, once that connection is established.

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In one example, a road traffic accident simulation called MSXR-RTA is used. In MSXR-RTA, players need to rescue a trapped victim in a car crash. Players can use the physical real-world (i.e., real-life) tool, such as the jaws of life, which is tracked in the virtual world as a similar tool (e.g., tool avatar of the jaws of life).

- 5 A player will use this tool to extricate the victim from the car through a series of steps controlled by a scenario controller.

- When the player attaches the tool on the designated spot (physical interactive zone) and turns the knob (controller 108), there will be a reactive force against
- 10 the player to replicate the actual feeling when a real tool is being used on a car. Reactive force can vary depending on the interaction being done. Similarly, the same tool can correspond to multiple tool avatars, depending on the tool needed for a particular step. However, in some instances this is undesirable since the tool 110 may have a weight corresponding to a specific tool avatar, that may
- 15 different from the weight of other tool avatars.

- In addition to the tool 100, a physical model is also described herein for use in the virtual environment. As shown in Figure 2, the physical model 200 includes more than simply a physical interactive zone 202 – the present model 200
- 20 comprising multiple interactive zones 202, 204 (including zone 204' and zone 204").

- Each physical interactive zone 202, 204 has a corresponding engagement mechanism for engaging the engagement mechanism on the tool. Thus, the tool
- 25 interacts with the object 200 via connection or engagement with the physical interactive zones 202, 204. In the object 200, physical interactive zone 204 is a dynamic zone movable with one or more degrees of freedom. This enables physical interactive zone 204 to move in accordance with the requirements of the scenario. Movement of the dynamic zones of the physical objects in the real
- 30 world thus are made according to the virtual reality of the simulation (i.e., scenario) – the current state of gameplay in the simulation.

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The fixed physical interactive zones 202 are those where the tool does all of the movement, or where no movement is required. For example, where a zone 202 corresponds to a window of a car in the object avatar (i.e., virtual object), then tapping the tool on a physical interactive zone 202 with sufficient force (as
5 sensed by a force sensor in one or both of the tool and physical object) may correspond to breakage of the window of the object avatar and release of connection between the physical object and tool.

Dynamic interactive zone 204'' is mounted to, or comprises, an articulated joint
10 or hinge 208 that connects zone 204'' to base plate 206. Thus, the zone 204'' can pivot about the hinge 208 with movement of the tool by the user or in accordance with the requirements of a particular scenario. Moreover, the joint 208 may apply a force to resist pivoting or control the rate of pivoting. The base plate 206 is mounted on rails 210, enabling the dynamic zone 204'' to move
15 towards and away from the body 212 of the object 200.

Dynamic zone 204' is itself mounted to rails 214 that enable it to move vertically relative to the object body 212. For example, if the object 200 corresponds to an object avatar vehicle, the user is interacting with a door of the vehicle via
20 interactive zone 204', and the tyres on the vehicle burst, the body of a real life vehicle would slump towards the ground. Thus, the dynamic zone 204' may move downwardly along rails 214. Movement along rails 210, 214 may be through motorised control using a motor (not shown), or through friction against movement resulting from force applied by the user through the tool they're
25 operating.

Certain parts of the designated spot, or physical interactive zone, in the real world are thus movable mechanical parts that move to designated locations to match the spots (e.g., positions on an object) in the virtual world where the
30 player needs to aim the tool, or to where those spots would move in the scenario. The physical interactive zones 202, 204 in the present embodiments

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are metal plates where the tool is able to magnetize and attach itself to it to fulfil the operation required in a particular step in a scenario.

The physical model 200 can further include a receiver 216 for receiving a model
5 control signal from a scenario controller. The scenario controller controls behaviour of one or both of the object (model 200) and tool, in accordance with steps in the scenario being played. A model controller 218 receives the control signal from the receiver 216, and controls one or both of the position and orientation of the dynamic zones 204', 204'' in response to the control signal.

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To create an immersive experience in the scenario, players may also wear a MAV suit which generates sensations corresponding to those a player would experience in the virtual environment, such as heat and smell matching the heat and smell of burning objects.

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The MAV suit is an example of a wearable suit 300 for use in a virtual environment, in accordance with present teachings. The wearable suit 300 includes an olfactory system 302, a thermal system 304, a receiver 306 and suit controller 308. The olfactory system 302 is configured to deliver a scent to
20 a user of the wearable suit 300. The scent may correspond to a scent experienced in a scenario implemented in the virtual environment. The olfactory system 302 may comprise multiple scent components (e.g., in liquid form), in separate reservoirs, that can be dosed and mixed in predetermined ratios to develop the scent intended to be delivered towards the player's nostrils. The
25 scent may be delivered by any known means, such as through an atomiser or vaporiser, or through evaporation (for ambient scents). The thermal system 304 is used for delivering heating and/or cooling to the user based on proximity of a source of heat or cold in the scenario. For example, if the user is near a burning car in the virtual environment, the thermal system 304 will deliver heat to the
30 user corresponding to the heat from the burning car. Thermal control may be implemented across a plurality of heating and cooling pads over the suit 300,

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such that a player may experience directional heat and cooling, and full body immersion in the temperature of the virtual environment.

Control of systems 302, 304 is achieved using a suit controller 308. The suit
5 controller 308 is adapted to control the olfactory system 302 and thermal
system 304 based on a suit control signal. The suit control signal corresponds
to changes in at least one of a location of the user in the virtual environment
and progress in the scenario. These changes correlate with changes in the
location or presence of objects in the virtual environment, that are sources of
10 smell, heat, cold and so on. The suit control signal is received from the scenario
controller, via receiver 306.

In some embodiments, a haptic system 310 is also provided, that generates
forces such as vibrational forces (e.g., through counterweight motors) to
15 provide feedback to the user. The tool 100 may also comprise a haptic feedback
system that produces vibration when necessary. The force applied through the
tool 100 will generally be greater than achievable through suit 300, since tool
100 can leverage the connection with the physical interactive zones to generate
force, rather than the counterweight or expansion and contraction changes
20 achievable in a suit 300.

Figure 4 shows an alternative embodiment 500 of a suit in accordance with
present teachings. The suit 500 comprises a front panel 502, rear panel 504,
shoulder straps 506 and waist straps 508 that together define a vest for the
25 player. The suit 500 also comprises a VR headset such as headset 400 in Figure
3, and handheld controllers 403 that can be used to perform various actions
(such as teleporting) in the virtual environment. The straps 506, 508 may be
any form of strap such as a standard belt strap or a hook and loop fastener
strap. Extra panels, such as panel 510, can be inserted. Provision may be made
30 on panels 502, 504 for the extra panels. Using the extra panels, the suit 500
can be adapted for additional purposes, such as using extra heating or cooling
panels to improve thermal effects of wearing the suit.

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Each extra panel may comprise a digital identifier that is readable by a reader in the suit 500. The suit 500 can then wirelessly communicate the identifier to the scenario controller 402, such that the scenario controller 402 can
5 incorporate control of the extra panel(s) into the scenario.

Also disclosed is a virtual environment system for controlling the virtual environment. The system includes a virtual reality headset 400 (shown in Figure 3) for displaying the virtual environment to a user, a scenario controller 402, a
10 tool (such as tool 100), receiver 404 and a physical model (such as physical model 200).

The scenario controller 402 manages a scenario implemented in the virtual environment. A scenario comprises a sequence of steps that a player must
15 progress through, to move to the next step in the scenario. Each step comprises one or more tasks to be performed by the user in the virtual environment and, in accordance with present teachings, at least one step comprises engaging the engagement mechanism and corresponding engagement mechanism, and sending the tool control signal in response to receiving the signal from the tool
20 controller. For example, in a vehicle accident scenario, a player arrives in a scenario in a virtual environment. The first step may then comprise moving to the vehicle in the virtual environment, that has experienced the accident. The next, second or subsequent step, may then be identifying hazards in the scenario. The next, third or subsequent step, may then be to connect a tool to
25 an interactive zone of a physical object corresponding to a feature of the vehicle rendered in the virtual environment. Progress between steps may rely on proper performance of the previous step – proper performance may comprise navigating to a particular position in the virtual environment, proper operation of the tool once it is engaged or connected to a relevant interactive zone, and
30 so on. Thus, the scenario controller progresses from a first said step (whether the first step is the first step in the scenario, or a later step) to a second said step on confirmation of completion of the first said step.

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To ensure the appearance of the virtual environment changes in response to the steps, and the object avatar and tool avatar respond as intended in the scenario, control signals must be issued to one or both of the tool and object, that are
5 then interpreted by the respective tool controller and model controller, where there is a model controller. In steps where the tool is used, the tool will be operated by the player and operation of the tool, such as use of a trigger, control knob or similar, will result in the tool controller issuing signals to the receiver
404 of the virtual environment system.

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According to the above scenario, the virtual environment includes a virtual tool corresponding to the (physical) tool 100, and a virtual model comprising interactive zones corresponding to the physical interactive zones of the model
200. The scenario controller changes an appearance of at least one of the virtual
15 tool and the virtual model in accordance with the signal from the tool controller. The virtual environment may also include a rendering or avatar of the suit 300. In such embodiments, the scenario controller 402 sends the suit control signal in response to at least one of a change in user location in the virtual environment, or performance of a said task corresponding to a change in the
20 virtual environment. As discussed above, changes in location in the virtual environment may result in the user changing location relative to virtual objects in the virtual environment. Changes in relative location may alter the position of sources of aromas or smells, sources of heat or cold, and the like, relative to the player. These changes can be interpreted by the scenario controller and
25 delivered to the suit controller, that can control olfactory systems, thermal systems and others to produce physical sensations corresponding to sensations the player would experience if a real world scenario were produced to replicate the virtual environment.

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In an example scenario, the extended reality (XR) player for the MSXR - RTA system generally wears the (i) MAV vest, (ii) Tracking Gloves on both hands (the vest and gloves forming an embodiment of the suit 300), (iii) holds the

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MSXR Spreader Cutter Tool (corresponding to tool 100), to interact with (iv) MSXR Car Frame (corresponding to object 200). The player has to physically move in the scene to the interaction points in the VR and position of the player is relative to the interaction point of the scene.

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(i) MAV – the suit 300

Built on Arduino, the microcontroller operates a thermal system comprising 3 heating pads and an olfactory system comprising 1 air pump. The heating pads are located at the shoulder / clavicle area, as well as the sternum / stomach
10 area. Together, they provide heat to simulate the presence of a fire. When the software signals the start of the fire simulation, temperature sensors are used to determine the current temperature before initiating a pre-heating procedure, which then transits to a heating phase which keeps the wearer warm. The intervals of the heating phase are determined by a LOW and HIGH setting, which
15 is dependent on the player's activities in the virtual reality (VR) world. If overall temperature is detected to exceed a predetermined threshold, a safety cut-off is programmed to activate, which stops the heating pads from being powered any further. This will only be deactivated if the overall temperature falls through natural cooling to below another predetermined threshold. The air pump leads
20 to a bottle filled with a scent like the scent of smoke which is pumped towards the neck / chin of the wearer. The smell pumping cycle is activated based on the player's activities in the VR world.

(ii) MSXR Spreader Cutter Tool

25 The MSXR Spreader Cutter Tool is a handheld object that operates via both hands. It is built on Arduino which controls a latching mechanism, servo motor and receives input from proximity sensors and an input button. All components are assembled and housed in a mild steel / 3D printed nylon body that simulates the operational tools used in RTA extrication.

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(iii) Latching Mechanism, for connecting the engagement mechanism to the physical interactive zones

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Upon achieving certain conditions in the VR world, the latching or engagement mechanism at the front of the tool is activated. In this instance, an electromagnet is used as the engagement mechanism, to latch the Spreader Cutter Tool onto mild steel plates used as the physical interactive zones. This usually occurs when the player is holding the tool near the interactive zones. As a result, the electromagnetic force provides a strong hold, simulating the reactions of operational tools used in RTA extrication. This latching mechanism and process can be extended to alternatives such as pneumatic systems to accommodate organic interfaces or vacuum suction systems for soft bodies.

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(iv) Reactive Feedback

After the tool latches onto the interactive zones, a further positive input via the tool will result in rotation of the servo (reaction) motor. Direction of rotation is determined based on the player's activities in the VR world. As the tool is held in place while the servo rotates, this results in the rest of the tool rotating while the player is holding on to it. This simulates the reactions of operational tools used in RTA extrication.

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(v) Interactive Positioning

20 The MSXR Car Frame simulates the instance of a sedan car involved in a Road Traffic Accident, with locations of operative importance presented via 2 static interaction points (physical interactive zones) and 1 dynamic point (dynamic zone). For the dynamic point, the microcontroller controls a linear actuator and 2 servo motors to afford interactions ranging from a multitude of height and orientation in 2 axes. The combination and quantity of static and/or dynamic interaction points can be reconfigured based on the requirements of the simulation.

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(vi) The scenario controller

30 The scenario controller then sets up the scenario and renders the avatars for the player (if desired), tool and object in the virtual environment. Thereafter, control signals are issued to the tool and object, in accordance with the steps in

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the scenario, and control signals received from the tool or, in some instances, the suit (e.g., the user pressing a button to teleport to a different location in the virtual environment).

- 5 On completion of the scenario, whether that is successful completion or failure, the scenario displays a completion screen and exist the scenario.

It will be appreciated that many further modifications and permutations of various aspects of the described embodiments are possible. Accordingly, the
10 described aspects are intended to embrace all such alterations, modifications, and variations that fall within the spirit and scope of the appended claims.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises"
15 and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information
20 derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

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Claims

1. A tool for use by a user and configured to have a corresponding avatar in a virtual environment, the tool comprising:
 - 5 a body;
 - an engagement mechanism;
 - a reaction motor; and
 - a tool controller,wherein the engagement mechanism is configured to establish a
10 connection to a physical interactive zone corresponding to a virtual interactive zone of a virtual model in the virtual environment, and operation of the tool controller causes the reaction motor to move the tool relative to the physical interactive zone and thereby generate, through the connection, a reactive force in the body.
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2. The tool of claim 1, wherein the reactive force is of a magnitude corresponding to a task being performed in the virtual environment.
3. The tool of claim 1, further comprising an orientation marker by which to
20 locate and orient the tool in the virtual environment.
4. The tool of claim 1 or 2, wherein the engagement mechanism is one of an electromagnetic member and a metal body.
- 25 5. The tool of any none of claims 1 to 4, further comprising a receiver for receiving an input from a proximity sensor, the input specifying a distance between the engagement mechanism and the physical interactive zone, and wherein the controller activates the engagement mechanism, to establish the connection, when the engagement mechanism comes within
30 a predetermined distance of the physical interactive zone.
6. A physical model for use in a virtual environment, the model comprising:

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one or more physical interactive zones, each physical interactive zone comprising a corresponding engagement mechanism for engaging an engagement mechanism on a tool,
wherein at least one said physical interactive zone is a dynamic zone
5 movable with one or more degrees of freedom.

7. The physical model of claim 6, further comprising:
a receiver for receiving a model control signal; and
a model controller for controlling a position and/or orientation of
10 the dynamic zone in response to the control signal.

8. The physical model of claim 6 or 7, wherein each corresponding engagement mechanism is one of an electromagnetic member and a metal body.
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9. A wearable suit for use in a virtual environment, the wearable suit comprising:
an olfactory system for delivering a scent to a user of the wearable suit, the scent corresponding to a scent experienced in a scenario
20 implemented in the virtual environment;
a thermal system for delivering heating and/or cooling to the user based on proximity of a heat or cold source in the scenario;
a receiver for receiving a suit control signal;
a suit controller adapted to control the olfactory system and
25 thermal system based on the suit control signal, the suit control signal corresponding to changes in at least one of a location of the user in the virtual environment and progress in the scenario.

10.A virtual environment system for controlling a virtual environment,
30 comprising:
a virtual reality headset for displaying the virtual environment to a user;

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- a scenario controller for managing a scenario implemented in the virtual environment;
a tool according to any one of claims 1 to 5;
a receiver for receiving a signal from the tool controller; and
5 a physical model according to any one of claims 6 to 8,
wherein the scenario comprises a plurality of steps, each step comprising one or more tasks to be performed by the user in the virtual environment, at least one step comprising engaging the engagement mechanism and corresponding engagement mechanism, and sending the tool control
10 signal in response to receiving the signal from the tool controller.
- 11.The virtual environment system of claim 10, wherein the virtual environment comprises a virtual tool corresponding to the tool, and a virtual model comprising interactive zones corresponding to the physical
15 interactive zones of the model, and wherein the scenario controller changes an appearance of at least one of the virtual tool and the virtual model in accordance with the signal from the tool controller.
- 12.The virtual environment system of claim 10 or 11, wherein the scenario
20 controller progresses from a first said step to a second said step on confirmation of completion of the first said step.
- 13.The virtual environment system of any one of claims 10 to 12, further
25 comprising a wearable suit according to 9, wherein the scenario controller sends the suit control signal in response to at least one of a change in user location in the virtual environment, or performance of a said task corresponding to a change in the virtual environment.
- 14.The virtual environment system of claim 13, wherein the change in the
30 virtual environment comprises a change in location of the user to a virtual source rendered in the virtual environment, the virtual source comprising a source of heat or cold in the virtual environment, or a source of scent

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in the virtual environment.

15. The virtual environment system of claim 13 or 14, wherein the change in
the virtual environment comprises a change in the virtual source in
5 response to performance of a said task by the user.