A locomotion platform device enables a user to perform a simulation of various motions including walking and running. The device comprises a locomotion platform having a concave upward facing surface. The platform and/or the user’s footwear incorporate a mechanism to reduce friction between the user and the surface of the platform in order to allow the user’s feet to move freely.
WALK SIMULATION APPARATUS FOR EXERCISE AND VIRTUAL REALITY

[0001] This application is a continuation-in-part of co-pending U.S. patent application Ser. No. 10/853,886 filed May 26, 2004, which claimed the benefit of and priority from U.S. Provisional Patent Application Ser. No. 60/474,780 filed May 29, 2003, the benefit and priority of which is also claimed by the instant application.

FIELD OF INVENTION

[0002] The present invention relates in general to an exercise platform. In particular, the present invention relates to a walk simulation apparatus for exercise and virtual reality.

BACKGROUND OF THE INVENTION

[0003] There is a growing demand for exercise machines to become more entertaining and less tedious. Similarly, users of virtual reality computer games wish to enhance their experience through physical stimulation and exertion, thereby increasing their “immersion” in the game. To this end many developments have sought to improve the computer gaming experience, for instance through three-dimensional visual graphics, “surround sound” audio and various devices that provide a physical feedback.

[0004] As many games require the player to walk or run around a virtual world, several inventions have attempted to simulate walking and running. The key challenge to accomplishing this is to achieve a means of multi-directional movement within the restricted space usually required of such a game, while keeping the whole device compact.

[0005] A feature of walking/running exercise devices is that they tend to be computer controlled as opposed to providing an input to a computer. For instance, a treadmill requires the user to input the desired speed at which it should operate. There are dangers associated with forcing a user to “keep up” with a machine, and the user may suffer comfort and modesty issues due to the jogging motion. Another feature of many existing devices is that it can be difficult or even impossible to change direction. Ideally a locomotion platform should allow a user to traverse freely in any horizontal direction for any amount of time.

[0006] Phillips’ U.S. Pat. No. 6,106,397 demonstrates that when a user is constrained to a limited platform area while performing a walking action her/her movements can be monitored and the data used as input to a computer program. However, the disclosed platform is flat.

[0007] The US Army has been very active in exploiting computer game technology for training and recruitment. Virtual reality mission rehearsal allows Military to research mission scenarios to evaluate impact of new equipment, combat techniques, tactics and procedures on mission effectiveness. America’s Army is a First Person Shooter style computer game released free by the U.S. Army. It provides an indication of how seriously the U.S Army perceives game technology to be. The US Army has already installed ‘Omini-directional Treadmills’ at the U.S. Army Research Laboratory at Aberdeen Proving Ground, Md. and at Dismounted Battalions Battle Lab Simulation Center at Fort Benning, Ga. However, their design is extremely cumbersome, requiring the user to wear a harness in case he/she falls onto the 3400 computer controlled rollers. Originally built in 1997, a purchase order was approved in 2004 to spend a further $2.9M on improvements. What is needed is a device that has no moving parts and overcomes many significant drawbacks of the above design that were identified in a report by the US Naval College at Monterey.

[0008] There is a need for improved situation awareness training. A student can be forgiven for not knowing what is happening behind them if the student is training using a traditional keypad and screen, but that serious limitation is imposed by the equipment. Situation awareness training is a serious topic of research pertaining particularly to the military and aviation.

[0009] There is a need for improved Virtual Reality (VR) therapy. VR therapy provides controlled exposure to situations that patients find stressful. A broad range of conditions are treated including post traumatic stress disorder (PTSD), a variety of phobias and other anxiety syndromes.

[0010] There is a need for improved virtual tourism. Computer generated renditions of famous and historic places are becoming commonplace. They are generated using both computer graphics and by stitching together photographs taken from multiple angles. Now that such rich virtual environments are available, a basic human desire is to want to walk around them as any tourist would do if the tourist were actually at the real life version of the simulated environment.

[0011] Accordingly, there is a need for a simple concave platform for a user to stand on. There is a further need for a mechanism to reduce friction between a platform and a user. There is an additional need for a user to be constrained to the platform area but able to turn, jump, crouch, run and walk in any horizontal direction. The present invention satisfies these needs and provides other related advantages.

SUMMARY OF THE INVENTION

[0012] The objective of the disclosed invention is to provide a locomotion platform. The apparatus is a concave platform for a user to stand on. The platform and/or the user’s footwear are manufactured in such a way as to reduce the friction between them. Further objectives are that the users remain constrained to the platform area and that they may turn and walk in any horizontal direction. The locomotion platform has been designed to encourage people to exercise as well as change the way that computer games are played. The concept is to allow a person to physically walk and run around within a first person computer game or training simulation. The present invention is simple, compact, contains no moving parts, and is easy to manufacture and maintain. The health benefits are significant. The age when many children spend a large amount of time playing games coincides with the 11 to 14 age group. This period is thought to influence a person’s attitude to exercise throughout their life. Many parents are concerned about the amount of time their children spend sitting during their favorite pastimes. Brisk walking is now regarded as probably being the best form of exercise. A twenty minute walk, three times a week can provide much of the exercise people need. But no exercise device is beneficial unless it gets used. This health improving opportunity stems from providing frequent, weight-bearing, aerobic and cardiovascular exercise of sufficient duration, without it feeling like a chore. Considering that no one books a ski vacation just to get fit, exercise should be fun. The fact that the locomotion platform can be used in private will appeal to those in need of exercise but who are self-conscious about doing so in public.
The present invention makes the gaming experience much more immersive and thus far more entertaining. If greater immersion is attained, it will also make serious virtual reality training exercises more effective, and in the opinion of military leaders, fire-chiefs and many others, that saves lives. Computer game interfaces have not fundamentally changed since their inception. They require the player to view the action through a ‘window’ (screen) and control events by pressing keys. Many people think this to be a significant drawback as it prevents the player from feeling part of the action. The rapid growth of the computer games market has been driven more than anything else by achieving greater levels of immersion. The present invention recognizes that there is a limit to how immersive games can be when players remain ‘outside’ the game (i.e., looking in) rather than feeling they are ‘in’ the game.

Video glasses with head tracking have gone part of the way to overcoming this limitation but the locomotion aspect that the present invention provides has so far been missing.

Some people experience nausea when playing first and third person computer games. This may be due to the separation of perceived movement from actual movement (in a similar manner to travel sickness). The locomotion platform requires the user to physically turn around if they want to look behind them and should therefore be more natural.

In an exemplary embodiment of the present invention, a locomotion platform device permits a user to walk, run, crouch, jump or change direction, and continue these motions without impediment, while actually remaining constrained to the area of the device. A platform includes an upward facing, parabolic, concave surface upon which the user stands while performing the motions; and a mechanism for reducing friction of a portion of the user’s footwear or feet contacting the surface of the platform sufficiently to allow omni-directional motion; wherein users do not move substantially away from a center of the platform as the user moves his/her feet.

In another exemplary embodiment of the present invention, a simulation system comprises a locomotion platform permitting a user to walk, run, crouch, jump or change direction, and continue these motions without impediment, while remaining constrained to the area of the device, where the platform includes an upward facing, parabolic, concave surface upon which the user stands while performing these motions. The system includes a mechanism for reducing friction of a portion of the user’s footwear or feet contacting the surface of the platform sufficiently to allow omni-directional motion; wherein the user does not move substantially away from a center of the platform as the user moves his/her feet. A screen at least partially surrounds the platform wherein background images are projected onto the screen; and a camera is disposed between the screen and the platform.

Further features and advantages of the invention, as well as the structure and operation of various embodiments of the invention, are described in detail below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

The foregoing and other features and advantages of the invention will be apparent from the following, more particular description of various exemplary embodiments of the invention, as illustrated in the accompanying drawings, wherein like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements, wherein:

FIG. 1 illustrates a user standing upon a platform according to a first embodiment of the invention;
FIG. 2 illustrates a cross-sectional side view of the platform shown in FIG. 1;
FIG. 3 illustrates a view according to an alternative embodiment of the platform where the upper surface friction is reduced by the user wearing roller-skates;
FIG. 4 illustrates a cross-sectional side view of the platform shown in FIG. 3;
FIGS. 5A and 5B illustrate, respectively, side and bottom plan views of an alternative embodiment of a device used to support the platforms of FIGS. 1 and 3;
FIG. 6 illustrates a user standing upon a platform according to an additional embodiment of the invention;
FIG. 7 illustrates a user standing upon a platform according to a further embodiment of the invention;
FIG. 8 illustrates a user standing upon a platform according to yet another embodiment of the invention;
FIG. 9 illustrates a user standing upon an embodiment of a platform of present surrounded by a cylindrical shaped rear-projection screen;
FIG. 10 illustrates a typical camera view in accordance with the embodiment of FIG. 9;
FIG. 11 illustrates a user standing upon the platform of FIG. 9 with four cameras located at ninety-degree intervals;
FIG. 12 illustrates a top plan view of the platform and cameras of FIG. 11 with the user on the platform in the center;
FIG. 13 illustrates a side view of the platform and cameras of FIG. 11 with the user on the platform in the center;
FIG. 14 illustrates a user standing upon the platform of FIG. 9 with four cameras mounted at ninety-degree intervals along a rail rotating about the platform;
FIG. 15 illustrates a top plan view of the platform, cameras and rail of FIG. 14 with the user on the platform in the center;
FIG. 16 illustrates a side view of the rail of FIG. 14;
FIG. 17 illustrates a cross-sectional view of the rail of FIG. 14;
FIG. 18 illustrates a side view of the rail of FIG. 17;
FIG. 19 illustrates another embodiment of a platform mounted in a portable case;
FIG. 20 illustrates a user/player standing on a platform surrounded on three sides by rear-projected screens;
FIG. 21-23 illustrate snapshots showing how a camera can rotate around a user/player;
FIG. 24 illustrates a diagram of a video system; and
FIG. 25 illustrates a diagram of a network system.

DETAILED DESCRIPTION OF THE INVENTION

Notwithstanding any other forms that may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only. A person skilled in the relevant art will recognize that other components and configurations can be used without departing from the spirit and scope of the invention.

In general, the locomotion platform is of very simple construction, comprising a two to eight (preferably three to four) foot wide dish with a very low friction coating on which the user stands wearing special footwear. The user
performs a simulated walking action in any direction without actually moving any distance. The user can either be surrounded by projected computer displays (for certain professional uses such as television) or wear virtual reality eyewear.

[0045] FIG. 1 illustrates one exemplary embodiment of a locomotion platform 2. The platform upper surface 6 is concave and upward facing. The platform 2 is of firm enough construction to support a user's weight without deforming. A user can stand upon the platform 2 and slide their feet 4 (with or without footwear 10) back and fore across the platform's upper surface 6 in a simulated walking action. For example, from a standing position at a center 12 of the platform 2 one's right foot 4 (with or without footwear 10) can be slid forward as one's left foot 4 (with or without footwear 10) is slid back until reaching a point where the feet 4 (with or without footwear 10) are the distance apart of a normal pace and equidistant from the center 12 of the platform 2. To take another step the user would slide his/her right foot 4 (with or without footwear 10) back at the same time as sliding his/her left foot 4 (with or without footwear 10) forward until he/she has again completed a pace.

[0046] The concave nature of the platform's upper surface 6 is of a profile or angle that facilitates a user as he/she slides his/her feet 4 (with or without footwear 10) across the upper surface 6 of the platform 2. The concave profile of the upper surface 6 is generally parabolic, preferably approximately spherical, with a radius of curvature at least equal to the length of the user's legs 20. The platform 2 lacks handles or anything for a user to grab onto with his/her hands. The platform 2 may rest upon a generally horizontal floor or ground surface with an adhesive, a fastening mechanism (e.g., suction cup) or the like used to hold the center 12 of the platform 2 stationary relative to the floor or ground surface.

[0047] In order to reduce friction between the feet 4 (with or without footwear 10) of the user and the surface 6 of the platform 2, the platform 2 may be constructed from any suitable material including, without limitation, metal, wood, plastic, ceramic, toughened glass, any polymer-based material, carbon/graphite composite, fiberglass or the like that provides a coefficient of friction low enough to allow a user's feet 4 (or footwear 10) worn on the feet 4 of the user) to slide in the manner described above with relative ease. Also, the platform 2 may be constructed from a material such as polytetrafluoroethylene (PTFE) that reduces the coefficient of friction between the user's feet 4 (with or without footwear 10) and the platform 2. Although conventional materials can be used to successfully manufacture the locomotion platform 2, suitable nano-technologies and other products that can make adequately slippery surfaces are becoming increasingly available and cost effective.

[0048] The user is illustrated wearing virtual reality eyewear 8 but the eyewear 8 is only required when the platform 2 is used as part of virtual reality simulation or the like. Eyewear 8 is not essential when the platform 2 is used for exercise. Virtual reality eyewear products such as the Z800 marketed by eMagin Corporation, 10500 NE 8th Street, Suite 1400, Bellevue, Wash. 98004 (www.emagin.com) have brought this technology within the price reach of gamers. The precise shape of two mirrors whose position can be adjusted in front of each eye to reflect images from two (2) one cm wide liquid crystal display (LCD) screens form one large field of view. The eyewear 8 are supplied with head tracking sensors and the effect of being able to look around in any direction has to be tried first hand to fully understand the sensation, but is very impressive. The integrated head tracking detects which direction a player is facing.

[0049] The need for motion sensing to detect when a player is walking can be solved in a number of ways including, without limitation, tracking the exact foot positions, enabling software to interpret any movement as it chooses. A true stereoscopic (3D) image can be viewed by virtue of the fact that each eye has its own display. Once the user can look all around and see objects in three dimensions, the compulsion will be to want to walk up to them! A video card outputs 3D as frame-sequential stereo for use with virtual reality eyewear 8. It is preferable that virtual reality eyewear 8 provides good peripheral vision and there is little or no latency in the video display as the viewer turns his/her head.

[0050] A change in direction is achieved by altering the direction in which the user's feet 4 (with or without footwear 10) are slid. As an example, to turn right, the right foot 4 (with or without footwear 10) can be slid forward and to the right simultaneously while the left foot 4 (with or without footwear 10) slides backward and to the left.

[0051] FIG. 2 shows a partial cross-sectional view of another embodiment of the platform 2 illustrating one or more braces 14 to prevent movement of the platform 2 during use. The braces 14 may comprise a single brace surrounding the underside of the platform 2 or a number of individual vertical braces (separate or connected together by horizontal members) spaced about and supporting the underside of the platform 2. The whole assembly should rest on horizontal terrain (e.g., floor, ground surface or the like). The braces 14 may rest upon a generally horizontal floor or ground surface with an adhesive, a fastening mechanism or the like used to hold at least a portion of the underside of the platform 2 stationary relative to the braces 14 such that the platform is stationary relative to the floor or ground surface. The braces 14 may be stationary relative to the horizontal floor or ground surface due to the weight of the platform 2 and/or braces 14 alone. An adhesive, a fastening mechanism, vertical spikes extending downwardly from the braces 14 into the floor or ground or the like may be used to hold at least one brace 14 stationary relative to the floor or ground surface. For most adult or adolescent users, the platform 2 needs to be at least approximately two (2) to six (6) feet (preferably three (3) to four (4) feet) in diameter, or slightly more than a full walking stride in the horizontal plane. The platform 2, including a platform base 16, may be constructed from any suitable material, for example metal, wood, plastic, ceramic or toughened glass. In the alternative, the platform 2 may be placed within a recess (not shown) within a floor or ground surface. The recess can be similar in shape and/or size to the platform 2 with an adhesive, a fastening mechanism or the like used to hold the platform 2 stationary relative to the recess if the weight of the platform 2 with or without the additional weight of the user is not sufficient to maintain the platform 2 in a stationary position relative to the floor or ground surface while in use. The distance moved in a game does not have to be equivalent to that physically walked on the platform.

[0052] In one mode of use, the platform upper surface 6 shown in FIG. 1 includes a mechanism for reducing friction 18 of a portion of the user's feet 4 or footwear 10 contacting the surface 6 of the platform 2 sufficiently to allow omnidirectional motion; wherein the user does not move substantially away from a center of the platform as the user moves his/her feet 4 or footwear 10. The mechanism for reducing friction 18 may be a coating of a material such as PTFE placed
over the surface 6 of the platform 2 that reduces the coefficient of friction between the user’s footwear and the platform upper surface 6. Alternatively the upper surface 6 can be painted and treated with polish, wax or a suitable lubricant. The platform 2 can also be manufactured from PTFE. Alternatively or in addition to the mechanism for reducing friction 18, friction between the user’s feet 4 and the upper surface 6 of the platform 2 can be minimized by the user wearing footwear 10 with soles designed to minimize the friction between their surfaces and the upper surface 6 of the platform 2. Examples of the footwear sole material include, without limitation, PTFE, silk or any other material designed to minimize friction between the user’s feet 4 and the upper surface 6 of the platform 2. The soles of the footwear 10 should be pliable enough to allow smooth movement across the surface 6 of the platform 2. As the user moves his/her leg 20 forward or back in a straight line there is a tendency to follow the circular contour of the platform 2 to some extent (i.e. in more of an arc). When, for example, the right foot 4 is fully forward, there will be greater pressure on the front right of the foot 4 and when fully back more pressure on the rear right of the foot 4. The changing shape of the surface 6 with respect to the sole as it slides across the surface 6 might be accommodated by three methods: (a) the sole surface could be in sections to allow the sections to splay out under pressure (in a similar way to that of tiles laid upon a curved roof); (b) a thicker pliable sole material (or laminated layer) would permit distortion of the normally flat sole to match the dish contour; and (c) a gel-filled sole (similar to a gel-filled footwear insert but forming the sole of the footwear 10) would permit distortion of the normally flat sole to match the dish contour.

[0053] Also, the material used to construct the platform 2 may be such that there is sufficiently low friction between the surface 6 and the user’s feet 4 such that no coating for reducing friction is required.

[0054] The view from above the active platform 2 area is circular. The lowest point of the concave platform 2 is in its center 12. In this respect the platform 2 could be described as bowl or dish-shaped. The user is thus able to stand, walk, move, crouch or jump vertically, and change the direction he/she is facing without impediment. FIG. 2 further illustrates that from a cross-sectional view the concave platform 2 describes an arc, which has a radius that is at the least the distance from the base of the user’s footwear 4 to their hip joint 22. The diameter of the platform 2 could therefore be roughly at least twice the leg length of the user. This facilitates ease of leg movement, as one’s center of gravity will not move substantially and the angle 24 of one’s foot 4 with respect to one’s leg 20 will remain fairly constant. The body of the user should not move substantially away from the center 12 of the dish or platform 2 as he/she moves his/her legs 20. The contour of the platform 2 is the same in every direction from the center 12. The contour of the platform 52 may be the same in every direction from the center 12. The angle of the contour may increase a distance form the center 12, in order to limit the distance the user’s feet 4 can travel. The concave shape of the platform 2 performs two important functions: (a) the surface 6 describes an arc similar to that of a person’s feet 4 as they move them back and forth, keeping the user’s pelvis in roughly the same position; and (b) it assists the user to stay in the center 12 of the platform 2. The surface 6 of the platform 2 includes a perimeter edge 26 to prevent a user’s foot from sliding further than a perimeter rim of the platform 2.

[0055] In another exemplary embodiment shown in FIG. 3, a platform 32 is of the same/similar shape, construction and is used as the platform 2 previously described above but the platform 32 is not coated or manufactured from a specifically friction reducing material. In this instance the user wears roller skates or similar footwear 34, which are designed to roll over a fixed upper concave surface 36 of the platform 32. The same arrangement is illustrated in cross-sectional view FIG. 4. The friction reduction, which is necessary for the user’s feet to slide easily over the concave platform 32, is in this case achieved by the user wearing roller skates 34. The upper surface 36 in this example would not be treated with polish, wax or lubricant. However, any actual coating if desired or needed would be dependant on the particular material chosen for the platform 32, and would provide sufficient grip to prevent the wheels of the user’s footwear 34 from skidding as the user moves his/her legs 40 in a manner same and/or similar to the manner described above. Also, the material used to construct the platform 32 may be such that there is already sufficiently low friction between the surface 6 and the user’s footwear 34 such that no coating for reducing friction is required. The surface 36 of the platform 32 includes a perimeter edge 46 to prevent a user’s foot from sliding further than a perimeter rim of the platform 32. The user is illustrated wearing virtual reality eyewear 38 but eyewear 38 is only required when the platform 32 is used as part of virtual reality simulation or the like. Eyewear 38 is not required by the user when the platform 32 is used just for exercise.

[0056] Notwithstanding that the locomotion platform 2, 32 of the present invention may be used simply for the purpose of exercise, the movement thus obtained is suitable for detection via electronic sensors. The data thus derived can be used by a computer program for analysis or as user input. Multiple methods of movement detection are possible. The following examples outline some of the methods to derive the movement data.

[0057] In one mode of use, the user wears a movement detection mechanism 42 for detecting motion and position of the user, as seen in FIGS. 2 and 4. This movement detection mechanism 42 comprises a number of three-dimensional (3D) tracking sensors or devices placed on or close to the user’s feet 4. 3-D tracking devices are typically used for motion capture. Alternatively, these tracking devices 42 may also be placed at a number of locations on the user’s body including, without limitation, legs, torso, arms and head. These 3-D devices output channels of information that corresponds to their X, Y and Z position relative to a magnetic source. A computer program that samples the X, Y and Z position at sufficient intervals can compute the user’s speed and direction. To calibrate this system, the sensors 42 would be placed at certain predefined positions relative to the platform 2, 32, such as the center 12 and at the limits of where the user’s feet or footwear 4, 10, 34 would be expected to travel. The computer program would then monitor the X, Y, and Z positions of the sensors 42 placed on the user and calculate, by reference to the calibration points, how far the sensors 42 moved in each sample time interval and therefore how fast they were moving and if they had changed direction. This arrangement can also operate in the reverse sense, whereby the user wears the reference sources and the sensors 42 are mounted in the platform 2, 32 or nearby. For example, if the user wears visual reference markings, optical sensors can be used to detect the absolute or relative position of these markings. Sampling the marker positions at sufficient time inter-
vals and comparing these against elapsed time enables the user’s speed and direction to be computed. In another example, if radio frequency (RF) chips, such as radio frequency identification (RFID) tags are used, RF sensors can be used to detect the absolute or relative position of these RFID tags. Sampling the RFID tags positions at sufficient time intervals and comparing these against elapsed time enables the user’s speed and direction to be computed. Other methods of position and movement detection are possible.

[0058] Methods of motion detection can range from “simple” to “advanced.” A “simple” method of motion detection can occur in the context of a first-person computer game. Such first-person computer games often use keys to move forward and back but the user can only move in the direction the user is “looking” in the game (and that view is controlled by moving the mouse). Game-pads also work in a similar manner. Video glasses like virtual reality eyewear can incorporate a head-tracker having output used to control where the user is looking (e.g., as the user looks or turns right, the video view also turns right). The walk action is to slide each leg 20 in anti-phase to one another so as one leg 20 moves forward, the other leg 20 moves backward. This way, the user does not move far from the center 12 of the platform 12. The simple method of operation for the platforms 2, 32 would additionally detect any leg 20 movement and interpret this as forward movement. Backward movement, if needed, could be accomplished by (a) a button press while the user is moving their legs (e.g., press a button on a gun, sword or whatever the user may be holding), (b) the user’s position with respect to the absolute center of the dish (e.g., there can be a tendency for the user to climb the side of the platform 2, 32 the user is facing, even though the user constantly slips back from it, so the relative position to center 12 of the platform 2, 32 might be used), or (c) even which of the user’s legs 20 moves first (e.g., from a starting stand if the user is right-footed, the user normally walks forward with his/her right foot first). Alternatively, brain sensors could be used to determine which direction the user desires to walk in. The drawback to the simple method is that if the user tried to look backward over his/her shoulder in the real world while wearing virtual reality eyewear in order to see “behind” himself/herself in the virtual world, the user might wind up travelling in that direction in the virtual world even though the user’s legs are pointing “forward ahead” in the real world.

[0059] An “advanced” method of motion detection occurs, ideally, such that when the user “looks” while wearing virtual reality eyewear, the user would see the user’s own virtual legs move at the same time and by the same amount as the user’s real legs. The user would also be able to look over his/her shoulder and still walk in the direction the user’s legs are facing. To achieve this, the software game or virtual world allows more channels of input to distinguish the field of view from the direction of travel. In hardware terms, a greater number of movement sensors are needed to track each limb. As suggested above, a variety of methods are commonly available such as optical (camera) or XYZ trackers based upon accelerometers. Preferably, movement detection is accomplished by using either accelerometers attached to the user’s body or by an optical solution such as a camera (e.g., the SONY EYETOY, a color digital camera device, similar to a webcam, for a SONY PLAYSTATION that uses computer vision to process images taken by the camera, allowing players to interact with games using motion, color detection and also sound, through a built-in microphone with the camera being hand-held or mounted on a pivot to allow for positioning).

[0060] FIGS. 5A and 5B illustrate, respectively, side and bottom plan views of another embodiment of the platform 2, 32 illustrating one or more braces 44 to prevent movement of the platform 2 during use. The braces 44 may comprise four braces extending radially away from a center that is directly underneath the center of the platform 2, 32 surrounding the underside of the platform 2, 32. The whole assembly should rest on horizontal terrain (e.g., floor, ground surface or the like). The braces 44 may rest upon a generally horizontal floor or ground surface with an adhesive, a fastening mechanism (e.g., fasteners; suction cups; a series of grooves, tabs and slots on the underside of the platform 2, 32 and upper surfaces of the braces 44) or the like used to hold at least a portion of the underside of the platform 2, 32 stationary relative to the braces 44 such that the platform 2, 32 is stationary relative to the floor or ground surface. The braces 44 may be stationary relative to the horizontal floor or ground surface due to the weight of the platform 2, 32 and/or braces 44 alone. An adhesive, a fastening mechanism (e.g., fasteners, suction cups or the like), vertical spikes extending downwardly from the braces 44 into the floor or ground or the like may be used to hold at least one brace 44 stationary relative to the floor or ground surface.

[0061] In another mode of use, as illustrated in FIG. 6, and in conjunction with another exemplary embodiment of the present invention, a platform 52 is of the same/similar concave shape, construction and is used as the platforms 2, 32 previously described above but an upper surface 56 of the platform 32 includes a plurality of switch elements or pressure sensors 58 that are activated as the user’s feet 54 (with or without footwear 60) press downwardly upon the sensors 58. By analyzing the position and sequence of activated sensors, relative to time, the user’s speed and direction is computed. As described above with respect to the platforms 2, 32, the platform 52 and/or the user’s footwear 60 can be manufactured in such a way as to reduce the friction between the upper surface 56 of the platform 52 and the footwear 60. As described above, the concave shape of the platform 52 assists a person to slide their feet 54 (with or without footwear 60) back and forth across the surface 56 of the platform 52. If each foot 54 (with or without footwear 60) is slid in the opposite direction to the other, an approximate walking and/or running actions can be simulated. The pressure sensors 58 at the bottom edges at 54 (with or without footwear 60) are positioned on the platform 52. The interface may be a wired or wireless connection between the pressure sensors 58 and the computer.

[0062] A suitable computer program would interpret the activated switch elements 58 to determine the position, speed and direction of the user’s feet 54 (with or without footwear 60). Analyzing the sequence that the switch elements 58 are activated and released can derive the speed and directional information. The position of the switch elements 58 can be laid out so that during use slight changes in the direction that the user is sliding their feet 54 (with or without footwear 60) can be determined. Change of direction and speed of change can be derived from the switch data. Switch data from the platform surface 56 can be used to determine a change in direction that the user is sliding his/her feet 54, but the actual
degree of change, or absolute direction that the user is now pointing need not always be exact. For instance, it may or may not be necessary if the user was to turn a full three hundred sixty (360) degrees for the computer program to reflect that the user is now pointing in the same direction. The switch data from the platform 52 may be used in any manner a computer program chooses. Walking/running/stop/turning/jumping/turning are some examples but others are possible. Relative or absolute position of feet 54 can indicate anything a computer program decides.

[0063] The switch elements 58 could be in the form of a touch-sensitive membrane adhered to the top of the platform surface 56 whose switch outputs are fed, via a suitable electrical interface, to a computer. The user stands vertically on top of the platform 52 and slides their feet 54 back and forth across the surface 56, actuating the membrane switch contacts. Alternatively the switch elements 58 could be attached to the underside of the platform surface 56, in a similar manner to some types of membrane keyboards. The concave nature of the platform surface 56 should be of a profile or angle that facilitates a user as they slide their feet 54 (with or without footwear 60) across the surface 56.

[0064] The platform upper surface 56 shown in FIG. 6 includes a mechanism for reducing friction 62 of a portion of the user's feet 54 or footwear 60 contacting the surface 56 of the platform 52 sufficiently to allow omni-directional motion; wherein the user does not move substantially away from a center of the platform as the user moves his/her feet 4 or footwear 10. The surface 56, including any switch membrane, may be coated with a material that reduces the coefficient of friction between the user's feet 54 (with or without footwear 60) and the platform surface 56 (e.g., wax, polish, lubricant, PTFE or the like). The pressure sensors 58 previously described may be of an inductive type, e.g. magnetic pickup, instead of contact closures. That is, instead of switch elements 58 creating a contact closure, a change in resistance, capacitance or impedance may also be used to indicate pressure detection. Alternatively or in addition to the mechanism for reducing friction 62 between the user's feet 54 and the upper surface 56 of the platform 52 can be minimized by the user wearing footwear 60 with soles designed to minimize the friction between his/her feet 54 and the upper surface 56 of the platform 52.

[0065] Examples of the footwear sole material include, without limitation, PTFE, silk or any other material designed to minimize friction between the user's feet 54 and the upper surface 56 of the platform 52. The footwear 60 may also be in the form of roller skates or similar footwear designed to roll over the fixed upper concave surface 56 of the platform 52. The upper surface 56 in this example could be treated with a polish, wax or lubricant (dependant on the particular material chosen for the platform 52) that would provide sufficient grip to prevent the wheels of the user's footwear 60 from skidding as the user moves his/her legs 40 in a manner same and/or similar to the manner described above. In the alternative, the surface 52 may not include a coating for reducing friction when roller skates are worn by the user. Also, the material used to construct the platform 52 may be such that there is sufficiently low friction between the surface 56 and the user's feet 54 or footwear 60 such that no coating for reducing friction is required. The surface 56 of the platform 52 includes a perimeter edge 66 to prevent a user's foot from sliding further than a perimeter rim of the platform 52. The user is illustrated wearing virtual reality eyewear 68 but eyewear 68 is only required when the platform 52 is used as part of virtual reality simulation or the like. Eyewear 68 is not required by the user when the platform 52 is used for exercise.

[0066] In another mode of use, as illustrated in FIG. 7, and in conjunction with another exemplary embodiment of the present invention, a platform 72 is of the same/similar concave shape, construction and is used as the platforms 2, 32, 52 previously described above but the platform surface 76 can be manufactured from a flexible material forming a cushioned or diaphragm surface which deforms under the weight of the user. The flexible material forming the platform surface 76 can be made of a material that reduces friction between the platform surface 76 and the user's feet 74 (with or without footwear 80) in a manner similar to that described above. The flexible material forming the platform surface 76 can also be covered with a coating, similar to the ones described above, that also reduces friction between the platform surface 76 and the user's feet 74 (with or without footwear 80). The footwear 80 can also have a sole constructed in a manner similar to that described above with respect to the footwear 10, 60 that reduces friction between the platform surface 76 and the user's feet 74. In this instance, a circle around the user might be anchored so that the path the user's feet 74 (with or without footwear 80) make as they slide over the surface 76 describes an upward arc as the user moves his/her feet 74 (with or without footwear 80) further apart. As such, the surface 76 when used achieves a concave profile. The platform surface 76 could contain a flexible touch sensitive membrane similar in form and function to the one described above. Alternatively, external devices, such as optical-electric sensors, could detect movement of the user's legs 90 in a manner similar to that described above. The surface 76 of the platform 72 includes a perimeter edge 86 to prevent a user's foot from sliding further than a perimeter rim of the platform 72. The user is illustrated wearing virtual reality eyewear 78 but eyewear 78 is only required when the platform 72 is used as part of virtual reality simulation or the like. Eyewear 78 is not required by the user when the platform 72 is used for exercise.

[0067] In yet another mode of use, as illustrated in FIG. 8, and in conjunction with another exemplary embodiment of the present invention, a platform 102 is of the same/similar concave shape, construction and is used as the platforms 2, 32, 52, 72 previously described above but the platform surface 106 is embedded with ball bearings 108 that rotate under the weight of the user's feet 104 (with or without footwear 110) to facilitate friction reducer. Each ball bearing 108 includes a micro-switch mounted underneath it, which would activate as the user pressed on the ball bearing 108. The surface 106 of the platform 102 includes a perimeter edge 116 to prevent a user's foot from sliding further than a perimeter rim of the platform 102. The user is illustrated wearing virtual reality eyewear 118 but eyewear 118 is only required when the platform 102 is used as part of virtual reality simulation or the like. Eyewear 118 is not required by the user when the platform 102 is used for exercise.

[0068] FIG. 9 illustrates a system 130 used for televising first person computer games where a user, in the role of a player, stands upon an embodiment of a platform 2, 32, 52, 72, 102 surrounded by a cylindrically-shaped rear-projection screen 132. Alternatively, the screen 132 can be cube-shaped or any polygonal shape. The system 130 described herein allows players to play a computer game in a manner distinct from shows where the players control characters in a computer game. A key intention is for the viewer not to feel they
are watching someone play 'over their shoulder'. The show contestants become the game characters. The concept of online gaming can be emulated with players in one TV studio competing live against others in another town or country. Four high definition (HD) projectors 134 (only two are seen in FIG. 9) are used to display a continuous three hundred sixty (360) degree computer-generated scene around the player. Detectors or sensors (not shown) attached to the player’s footwear supply direction information, which is fed back to the computers (not shown) generating the back-projected images. The player is completely immersed in a virtual environment using surround video and audio. Additionally, sub-audio feedback can be added through the locomotion platform 2, 32, 52, 72, 102 and even infrasound (a low frequency note that causes unease that could be directed at a player (using devices the generate infrasound) during times of suspense). A production team can thus place a player into almost any imaginable scenario to film their reaction.

FIG. 10 illustrates a typical camera view where the player’s feet are always below shot 136. As the player performs a simulation of walking, running or the like, the player’s movement and that of the background images projected onto the screen 132 give the impression that the player is actually moving. Close-ups of an actor’s face most effectively convey drama. Most war cameramen maintain that some of their most effective material is footage of soldier’s faces. Thus, camera shots as described help “immerse” the viewer into the simulation.

FIG. 11 illustrates a user standing upon the platform of FIG. 9 with four cameras 138 located at ninety-degree intervals (e.g., a North (N) camera, a South (S) camera, an East (E) camera and a West (W) camera) between the platform 2, 32, 52, 72, 102 and the screen 132. The player is in the center of the platform 2, 32, 52, 72, 102 and none of the camera views include the other cameras 138. The cameras 138 may be held in a fixed position relative to each other or hand-held.

FIG. 12 illustrates a top plan view of the platform 2, 32, 52, 72, 102, cameras 138 and screen 132 of FIG. 11 with the user in the center of the platform 2, 32, 52, 72, 102. The dotted lines in FIG. 12 extending outwardly from each camera 138 illustrate the wide-angle field of view 140 of each camera 138. Each camera 138 can also zoom in to obtain close-ups of the player’s face. Because many games have a maze-like construction, a player or players would predominantly face one of the cameras 138, even if the positions of each camera 138 were fixed.

FIG. 13 illustrates a side view of the platform 2, 32, 52, 72, 102 and cameras 138 of FIG. 11 with the user in the center of the platform 2, 32, 52, 72, 102. The view from the S camera 138 will not include the E and W cameras 138 and the player’s body prevents the S camera 138 from seeing the N camera 138.

FIGS. 14-18 illustrate a user standing upon the platform 2, 32, 52, 72, 102 of FIG. 9 with four cameras 138 mounted, at ninety-degree intervals, on a ring or circular rail 142 rotating about the platform 2, 32, 52, 72, 102 between the platform 2, 32, 52, 72, 102 and the screen 132. The cameras 138 mounted on the rail 142 are rotated around the player by a rotating wheel 144 or the like engaging the rail 142. The rotating wheel 144 is itself rotated by a motor (not shown). As the cameras 138 are at fixed ninety-degree intervals, the rail 142 supporting them need only rotate forty-five degrees in either direction to obtain a full three hundred sixty (360) degrees of vision from the cameras 138. This also minimizes the length of trailing cables if the cameras 138 are not connected wirelessly to a computer system. Operation camera control uses traditional joysticks with the addition of left and right foot pedals.

FIG. 15 illustrates a top plan view of the platform 2, 32, 52, 72, 102, cameras 138 and screen 132 of FIG. 14 with the user in the center of the platform 2, 32, 52, 72, 102. The dotted lines extending outwardly from each camera 138 illustrate the wide-angle field of view 140 of each camera 138. FIG. 16 illustrates a side view of the rail 142 and the cameras 138 mounted thereto that illustrates the rotation of the rail 142 being enabled by the rail 142 nesting upon and engaging a plurality of freely rotating wheels 146 mounted on brackets 148 affixed to or otherwise resting on the ground surface where the rotating wheels 146 are positioned beneath the rail 142 in a generally circular configuration. The motorized wheel 144 engages the rail 142 to provide the movement and the wheels/brackets 146/148 are arranged in a circular arrangement in accordance with the generally circular shape of the rail 142. FIGS. 17 and 18 illustrate views of the rail 142 engaging one of the wheels 146 and brackets 148.

As illustrated in FIGS. 19-23, an alternative set-up 150 to that seen in FIG. 9 can be made using three back-projections. FIG. 19 illustrates a platform 152 similar to the platforms 2, 32, 52, 72, 102 described above where the platform 152 is mounted in a portable case 156 with a material 158 (e.g., foam) surrounding the platform 152. For example, as seen in FIG. 20, a user stands on the platform 152 surrounded on three sides by back-projected screens 154 which form the set, with the 3D virtual images taken by the cameras (not shown) rendered on three networked personal computers (not shown), running 3D graphic software. Alternatively, the player seen in FIG. 20 could be surrounded on four sides using four screens with associated back-projections. Factors affecting the simulation include the quality of the 3D image textures and synchronism of the three back-projected screens. A reliable frame-lock synchronizing mechanism is used. Cursor keys can be pressed to simulate telemetry information of the player’s movements. In the alternative, a hand-held camera can be used to provide the context of the virtual surroundings and facial close-up reaction shots can be captured and combined without disjointed cuts. Apart from just the pleasing look of these camera shots, it is possible to follow two opponents simultaneously, and cut between them, without losing continuity, as described below. As seen in FIG. 20, an image of a maze is projected on the screens 154 (for reasons of clarity, only the rear screen 154 behind the player is illustrated with an image of a maze projected thereon but images of the maze would be projected on the screens 154 to the sides of the player during actual gameplay). A view of a player is shown in FIG. 21 with two screens 154 seen behind the player and another view in FIG. 22 with two screens 154 seen to the side and front of the user (for reasons of clarity, projected images of a maze are not seen on the visible screens 154 of FIG. 21 and projected images of a maze are not seen on the visible side screen 154 of FIG. 22 but images of the maze would be projected on all the screens 154 during actual gameplay).
The set-up described above can be used to produce a 3D PACMAN-type game, with the player assuming the role of the 'Muncher'. The set-up includes a number of components: (1) a maze/map with themed areas; (2) two opposing contestants playing simultaneously; (3) objects to collect for points; (4) a beast chasing them; (5) doors that the players can lock to trap their opponent in with the beast; (6) mildly comic treatment of 'caught' players, such as Shrinking them using special effects by using a computer to manipulate the player's image relative to the background image; and (7) played over the intranet from two separate locations. The aim is for the game to be readily understood but highly unpredictable. Various options are available as a forfeit when the beast catches a player. These include going back to the start or being frozen at a location for a period. One option is shrinking the player by means of camera angles and expanding the 3D back-projected images. Sound effects will be louder the closer a player is to the source of the sound (e.g., sliding doors, beast's footsteps or the like). Infrasound can also be added to make a player feel less comfortable in areas like tombs. Simple but robust loudspeaker voice-coils are attached to the locomotion platform to provide vibration effects such as judderings and jolts. As there is no physical set required, with simple lighting and a single camera person at each site, maximum fun can be achieved for minimum cost.

In order to prevent drift over time of the three back-projected images, XYZ position network packets are broadcast from a master personal computer (PC) at roughly twenty five (25) times per second. The client PC's render their images on receipt of this information. The precise frame rate is not critical due to the image persistence of the liquid crystal display (LCD) projectors. This means that the PCs only need to be able to render about twenty five (25) frames per second, and should therefore operate well within tolerance. The synchronization network packets will only occupy about 0.01% of the available bandwidth. This enormous headroom means this solution is very flexible and should not present any problems when connecting sites over the wide area. Another great advantage is that any PC can run at any time and immediately be in sync; providing many equipment redundancy options should the shows be aired live.

Figs. 24 and 25 illustrate diagrams of examples of a video system and a network system of the type used to implement a televised first person computer game. It is illustrated that two players (each player on a platform 2, 32, 52, 72, 102, 152) can play the same simulated game in two different locations. Alternatively, a single player can be in a studio (e.g., television studio) at Location One (e.g., London, New York, etc.) but the simulation is controlled remotely at another studio (e.g., television studio) at Location Two (e.g., Manchester, Philadelphia, etc.) which could be miles away from Location One. The video system diagrams how cameras are controlled and the various views (e.g., 'Beast' view, player's view, third person view, etc.) that can be obtained and integrated into the simulation. As seen in FIG. 25, one player is located in a television studio at Location One while another player is located in a television studio at Location Two. The xyz positions of each players is sent to a Master PC associated with that player. Various display PC's and projectors are connected to the Master PC. The two studios are connected by an intranet or an internet A PC dedicated to control of the 'Beast' in the game is connected to the network system as well as a PC for the Lighting Director's control. A computer dedicated to providing 'Plan view' Color Separation Overlay (CSO) (CSO being a British Broadcasting Corporation (BBC) term, otherwise known as Chroma-keying ("blue-screen" although it can be green)) background and a computer dedicated to 'Player views' are also connected to the network system. A 3D graphics engine can be used and the rendered scenes can be greatly enhanced by a professional graphics artist. The textures used can, at a minimum, be basic specimens supplied with a graphic design package. Having control of every aspect of the graphic engine is preferable. Another technical innovation is that the lighting director has a tool giving them complete control of lighting the virtual set in addition to the physical studio lighting, ensuring a better match. Test images and line-up tools can be provided for setting up virtual camera views.

As seen in Figs. 24 and 25, there are a variety of camera options available to be used. For example, steadicams and overhead cans are alternatives that can be used in place of or in conjunction with fixed cameras (or the cameras positioned on the moving rail). Steadicams, fixed cans, and overhead cans can be used alone or in combination to provide a variety of camera shots. It is illustrated how the xyz movements (the xyz positions being determined by movement sensors that send information to a Master PC to drive the background CGI generated video) of more than one player (e.g., two players are illustrated but there can be many, many more players) in more than one separate locations. Color Separation Overlay (CSO) or Chroma-key is used to map CGI as a background. IP TV provides optional video feeds provided using internet protocol. Control Location One and Control Location Two are the respective central control areas for Location One and Location Two with the two locations connected by video circuits (e.g., SDI video circuits). The two locations can be connected by wires or wirelessly (using analog or digital signals).

The principal problems the embodiments of the present invention overcome are that the presenters or contestants: (a) are very restricted in how far they can walk; (b) cannot see the background that the viewer sees and have to imagine; and (c) have visible 'fringing' where the video background and foreground touch. The exact content of the show will depend to some extent on what is technically feasible and produces the best results. For example, two contestants playing simultaneously concentrate attention on the game and are more compelling. Rather than consume time and money where it may not add to the enjoyment, or cater for situations that may not happen in practice, intriguing game rules can be devised to turn these into a feature. One illustration is that neither player might be able to see their opponent but can see the effect of their actions. Similarly the 'best's view could be a monochrome background with a thermal camera type image of the contestant.

The system including the locomotion platform does not require specific game software to be written for it but will open up opportunities for game makers to exploit. The system can be connected via USB to a console or PC as a direct replacement for a hand-held gamepad. Thus, first person games will not necessarily require modification. Peripherals that enhance immersion include joysticks and steering wheels, especially with force feedback. Once a player is used to this, it is difficult to enjoy the games without them.

The concave surface of the locomotion platform 2, 32, 52, 72, 102 is very stable to stand and move on, despite the low-friction surface 6, 36, 56, 76, 106. It should therefore fall well within the 'safety envelope' of similar devices, for
instance: roller-blades, trampolines, bicycles and skateboards. One of the key advantages is that little or no momentum is possible, so even if the user does topple over there will not be any speed element or other extraneous influence, such as being hit by a vehicle. There is also no fear that the platform 2, 32, 52, 72, 102 will run out of control or need to be stopped in an emergency.

[0083] Safety equipment will be recommended such as a cycle helmet and possibly a ring shaped inflatable crash mat (similar to a large inner-tube). Further to this any other potential safety concerns would be fully investigated. As an example, research has already identified that neither cinemas nor computer games are considered to induce epileptic seizures.

[0084] As with normal motion-capture, sensors can be placed on the player/actor to control an avatar (i.e., virtual character). However, the detected motion can be used to control the background image rather than a foreground (avatar) image. The sensor information can be used to manipulate the foreground image when that image is the camera output (i.e. the real person). Because the locomotion platform 2, 32, 52, 72, 102 confines the user to one place, sensor information can be used to control digital video effects (DVE) equipment which allows a user’s camera image to be manipulated in real-time. For instance, the user’s head could be altered to be as large as his/her body or some other feature that might impact on the game the user is playing. One advantage of this is that while it might be considered inappropriate for participants to be seen shooting each other (a common aspect of many computer games), a caricature of a person might be able to get away with more and be more entertaining for the viewer. In fact, any visible feature of a person could be accentuated to monitor its effect, such as making the person appear taller, thinner, thicker, larger, more tanned, hairy or blond etc. Even individual features of a user, such as the user’s nose, could be modified (e.g., enlarged, shrunk, etc.). As outlined above, detection of the user’s movement drives the background.

[0085] While the present invention has been described in the context of exercise and the way computer games are played, it is clear that there are many other professional applications in television production and the training of military and emergency services staff. For domestic usage, where large screens surrounding the player are prohibitive, there are two possible solutions: (a) a wireless video link to the video glasses or virtual reality headset; or (b) a small enough games console to be worn by the user or placed in a backpack. A wireless video link might be based on WiFi or Bluetooth technology. It is critical that the wireless video link does not introduce any latency; such as often occurs with video compression technologies which examine each frame for redundant information. One aspect in its favor is that the transmission path will be very short and should therefore require very low power.

[0086] As alluded to above, both professional and domestic versions are envisaged, with the professional market likely to be early adopters. The professional market would include military—disembarked infantry, television virtual reality studios, and personnel training for Police, Firemen, flight crews etc. First person games will become a personal experience. This in turn creates new possibilities for game and simulation makers as it opens up the possibility for people to experience new things. Imagine being able to compete in your national football team alongside your favorite players. Karaske would extend to performing on stage in front of a virtual audience. World War II (WWII) simulations would feel much more real and it will be possible to understand what it felt like at historic events and places.

[0087] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should instead be defined only in accordance with the following claims and their equivalents.

1. A locomotion platform device permitting a user to walk, run, crouch, jump or change direction, and continue these motions without impediment, while remaining constrained to the area of the device, the device comprising:
   a platform including an upward facing, parabolic, concave surface upon which the user stands, while performing the motions; and
   means for reducing friction of a portion of the user’s foot or feet contacting the surface of the platform sufficiently to allow omni-directional motion; wherein the user does not move substantially away from a center of the platform as the user moves their feet.

2. The device of claim 1, wherein the concave surface of the platform comprises a low friction, fixed surface, firm enough to support a user’s weight without substantial deformation.

3. The device of claim 1, wherein the means for reducing low friction upward facing surface is selected from the group consisting of wax, polish, lubricant and polytetrafluoroethylene.

4. The device of claim 1, wherein the user wears footwear that reduces friction between the user and the surface.

5. The device of claim 1, wherein the user wears footwear that includes a low friction sole engaging the surface of the platform.

6. The device of claim 1, wherein the user wears footwear that includes wheels engaging the surface of the platform.

7. The device of claim 1, further comprising movement detection means for detecting motion and position of the user.

8. The device of claim 1, wherein the movement detection means is embedded in the platform.

9. The device of claim 1, wherein the movement detection means is worn by the user.

10. The device of claim 1, wherein said essentially spherically concave surface has a radius at least about the distance from a base of a user’s footwear to a user’s hip joint.

11. The device of claim 1, including a brace connected to the platform in order to prevent movement of the platform during use.

12. The device of claim 1, wherein the surface includes a perimeter edge to prevent a user’s foot from sliding further than a perimeter rim of the platform.

13. The device of claim 1, wherein the surface of the platform is constructed from a flexible material capable of minimizing injury to a user falling upon the surface.

14. A locomotion platform device lacking handles or anything for a user to grasp onto with hands that permits the user to walk, or run, crouch, jump or change direction, and continue these motions without impediment, while remaining constrained to a central area of the device, the device comprising:
   a stand-alone, stationary, dish-shaped platform having an upward facing, essentially spherically concave surface upon which the user stands while performing the
motions, the surface comprising a material selected from
the group consisting of wax, polish, lubricant and poly-
tetrafluoroethylene;
said concave surface of the platform comprising a low
friction, fixed surface, firm enough to support a user's
weight without substantial deformation; and
means for reducing contact friction between feet of the user
and the surface of the platform sufficiently to allow
omni-directional motion; wherein the friction reducing
means includes a low friction interface engaging the
feet, disposed between the feet and the surface of the
platform; wherein the user does not move substantially
away from a center of the platform as the user moves
their feet.
15. A simulation system comprising:
a locomotion platform permitting a user to walk, run,
crouch, jump or change direction, and continue these
motions without impediment, while remaining con-
strained to the area of the device, where the platform
includes an upward facing, parabolic, concave surface
upon which the user stands while performing the
motions;
means for reducing friction of a portion of the user’s foot-
wear or feet contacting the surface of the platform suf-
ciently to allow omni-directional motion; wherein the
user does not move substantially away from a center of
the platform as the user moves their feet;
a screen at least partially surrounding the platform wherein
background images are projected onto the screen; and
a camera disposed between the screen and the platform.
16. The system of claim 15, wherein the concave surface of
the platform comprises a low friction, fixed surface, firm
enough to support a user's weight without substantial defor-
mation.
17. The system of claim 15, wherein the means for reduc-
ing low friction upward facing surface is selected from the
group consisting of wax, polish, lubricant and polytetraflu-
oroethylene.
18. The system of claim 15, wherein the user wears foot-
wear that reduces friction between the user and the surface.
19. The system of claim 15, further comprising movement
detection means for detecting motion and position of the user.
20. The system of claim 15, wherein the camera comprises
a plurality of cameras rotatable about the user.