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(54) **THREAT TRAINING SYSTEM AND METHOD USING SIMULATED PROJECTILES**

(71) Applicants: **Jeffrey James Quail**, Winnipeg (CA); **Rory Bochinski**, Winnipeg (CA); **Alex McIlraith**, Winnipeg (CA)

(72) Inventors: **Jeffrey James Quail**, Winnipeg (CA); **Rory Bochinski**, Winnipeg (CA); **Alex McIlraith**, Winnipeg (CA)

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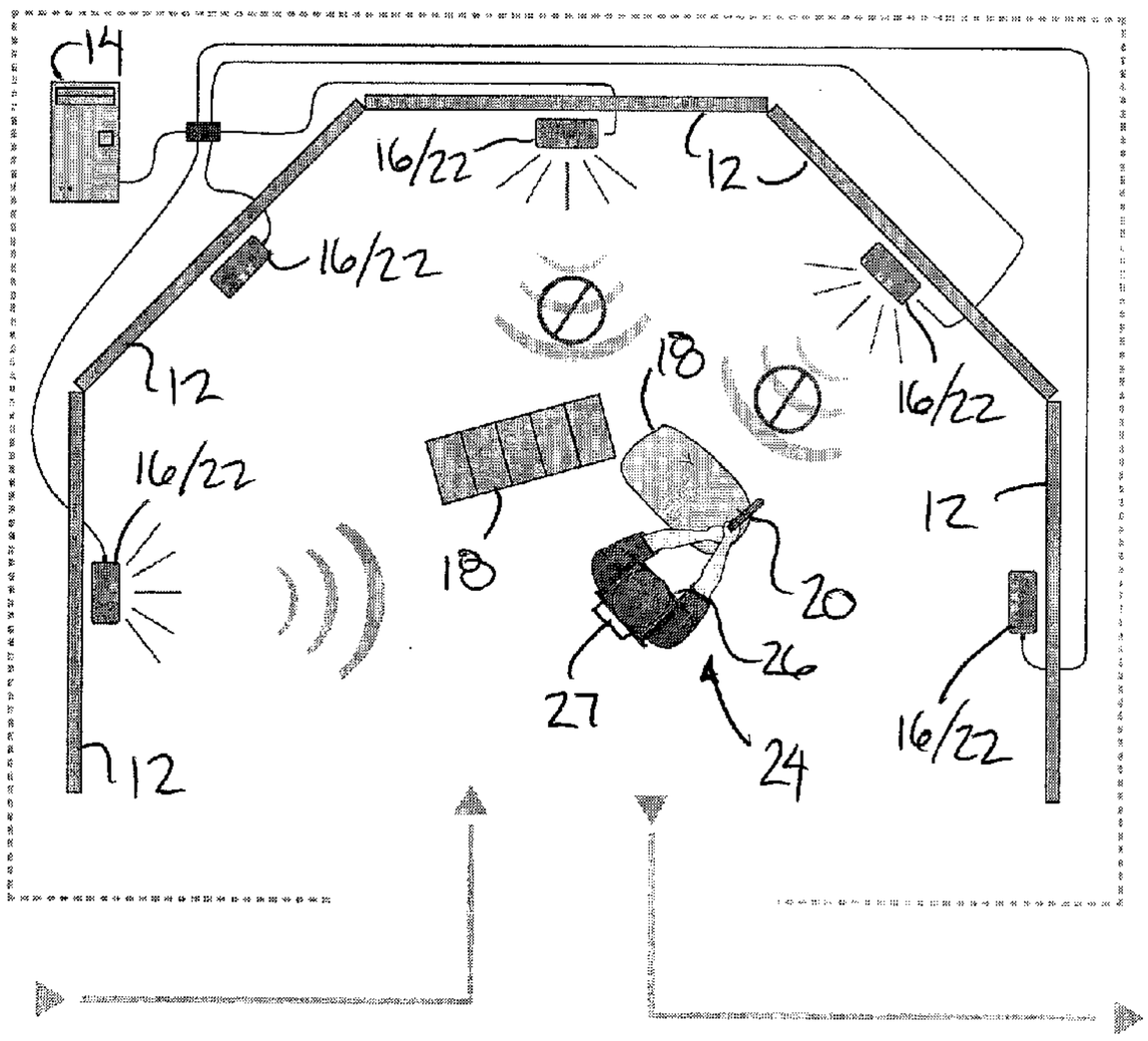
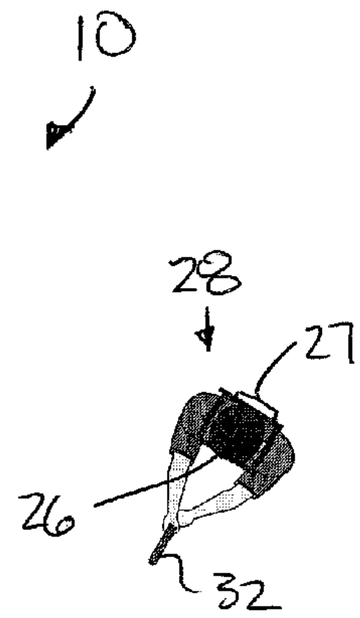
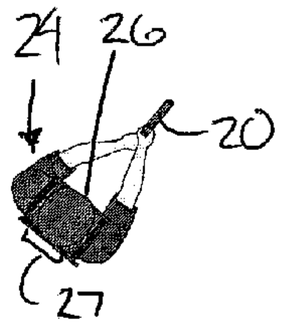
(57) **ABSTRACT**

A participant is trained against potential threats by carrying a device on the participant which includes a light based sensor element arranged to determine a hit in response to receiving a coded light based signal representing a simulated projectile and an indicator element arranged to indicate a hit to the participant in response to the determination of the hit by the light based sensor element. A training video including simulated threatening events is displayed to the participant. A light based signal source associated with the video display is arranged to be triggered under computer control to direct a coded light based signal representing a simulated projectile towards the participant in response to the threatening event being displayed to the participant.







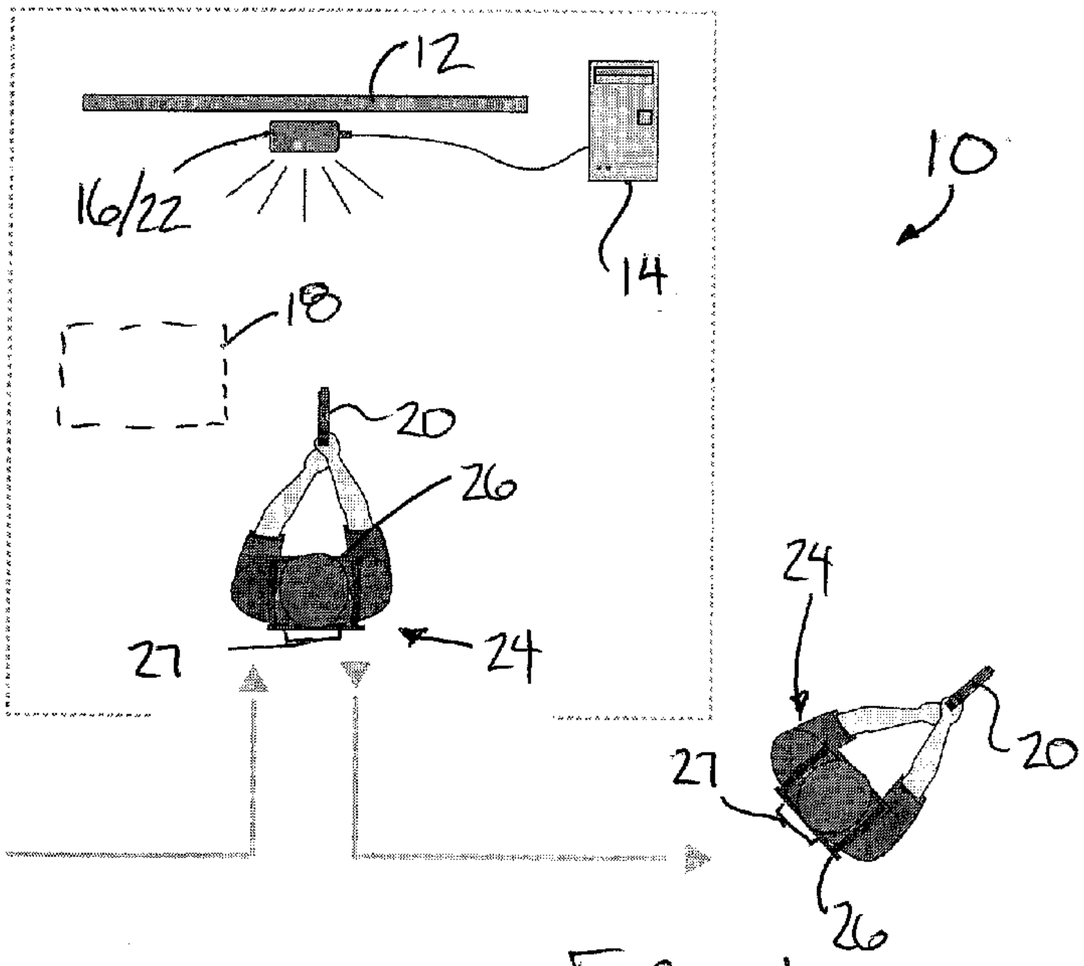

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FIG. 1

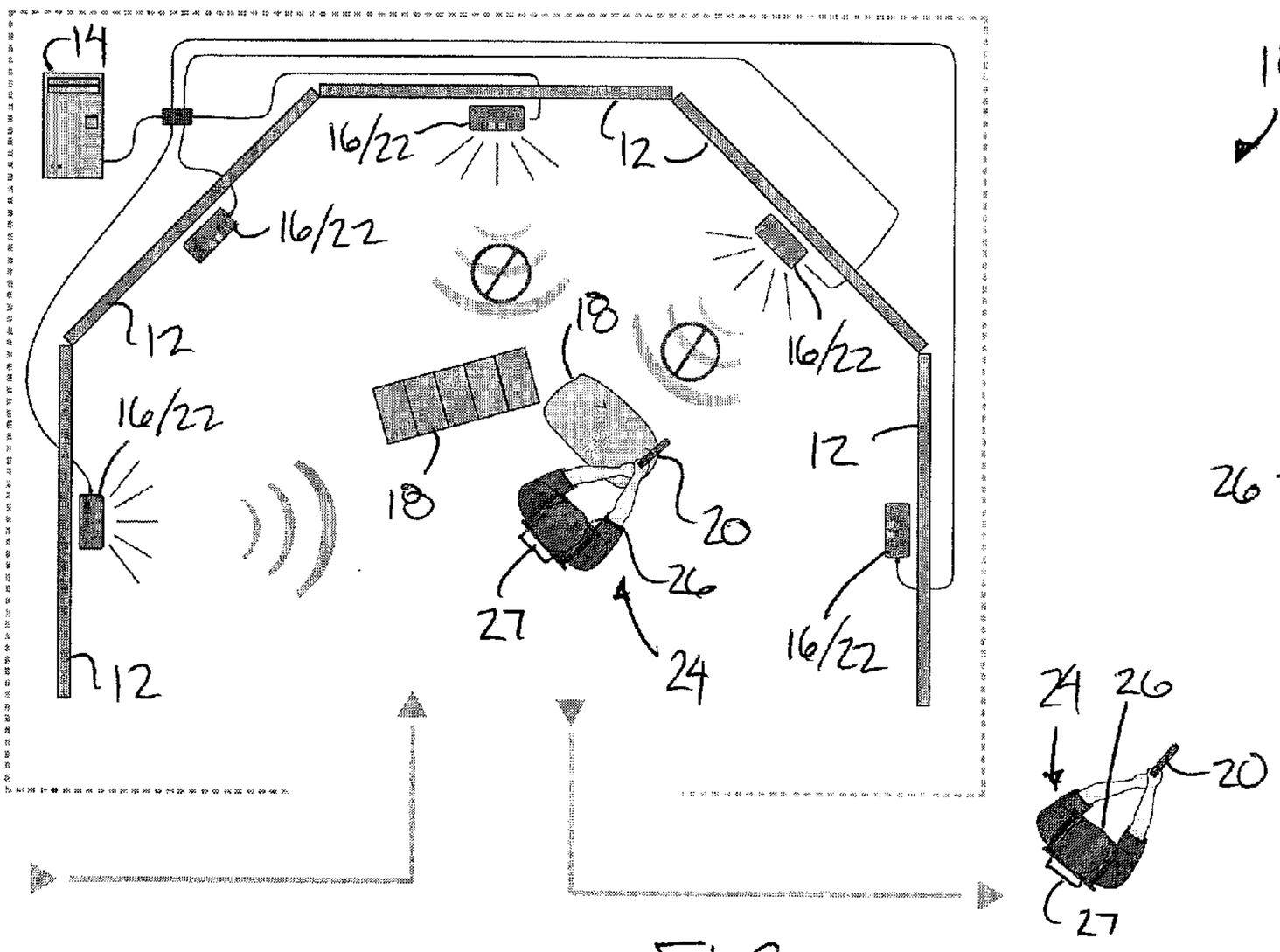
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FIG. 2

THREAT TRAINING SYSTEM AND METHOD USING SIMULATED PROJECTILES

[0001] This application claims the benefit under 35 U.S.C. 119(e) of U.S. provisional application Ser. No. 61/752629, filed Jan. 15, 2013.

FIELD OF THE INVENTION

[0002] The present invention relates to a method for training a participant against threats using a threat simulating system, and more particularly the present invention relates to a threat simulation system for displaying simulated threats to the participant and for simulating the impact of projectiles to the participant, for example bullets, using light based signals, which are directed at the participant under computer control.

BACKGROUND

[0003] Various threat simulation systems are known for training law enforcement, military and other security personal are known in the prior art as disclosed in U.S. Pat. No. 8,016,594 by Ferris et al. Ferris in particular discloses simulating a projectile impacting in a simulation system including a training video for being displayed to a trainee and an electrical impulse element worn by the trainee for delivering an electrical impulse to the trainee upon receipt of a radio frequency actuation signal from a controller. The reaction of the trainee to the training video must be judged by an instructor who then delivers the actuation signal according to the reaction of the trainee. The system is dependent upon the accurate judgement of the reaction by an instructor, thus requiring qualified expertise to execute the training. Accordingly there is no reasonable means to effectively automate the training environment. Nor is the components of the system have no practical use outside of the video training environment of the simulator system.

SUMMARY OF THE INVENTION

[0004] According to one aspect of the invention there is provided a method of threat training a participant, the method comprising:

[0005] providing a participant device arranged to be carried by the participant, the participant device comprising a light based sensor element arranged to determine a hit in response to receiving a coded light based signal representing a simulated projectile and an indicator element arranged to indicate a hit to the participant in response to the determination of the hit by the light based sensor element;

[0006] supporting the participant device on the participant;

[0007] displaying a training video to the participant in which the training video comprises a sequence of events including a threatening event which visually represents a threat to the participant; and

[0008] providing a light based signal source which is arranged to be triggered under computer control to direct a coded light based signal representing a simulated projectile towards the participant in response to the threatening event being displayed to the participant.

[0009] Preferably the indicator element comprises an electrical shocking element arranged to generate a non-incapacitating electrical shock. In this instance the participant device is supported on the user such that the non-incapacitating electrical shock is arranged to be delivered to the participant to indicate the hit to the participant in response to the determination of the hit by the light based sensor element. The indicator element may further comprise an audible indicator, a visual indicator, a vibrating indicator or any combination thereof.

[0010] The use of a light based signal allows the signal to be interrupted simply by the participant seeking cover behind an object within the training environment where the training video is displayed. Accordingly, the system is well suited to automation in that the light based signal can be directed towards the participant regardless of the participant's reaction according to a preferred mode of operation of the threat simulation system of the present invention. As the light based signal is directed in response to a threatening event being displayed on a respective display of the simulator system, actuation of the light based signal is accomplished automatically by the controller even without any operator or instructor input.

[0011] Accordingly in the preferred mode of operation indication of a hit to the participant is not dependent upon actuation of the light based signal which occurs anyway, but is instead determination of a hit is dependent upon whether or not the participant seeks cover to block the visual path between the source of the light based signal and the light based sensor element carried on the participant device. If the participant seeks cover, then the light path between the signal source and sensor element is blocked so that no hit is determined and the participant is not shocked by the electrical shocking element even though the coded light based signal is still automatically generated and directed towards the participant by the system in response to the threatening event being displayed.

[0012] According to one example of the present invention, the video displayed to the participant may initially display a threatening event as a visual representation of a potential assailant who is armed. The potential assailant initially aims a simulated weapon at the participant and then fires the weapons towards the participant visually represented as a flash after a short prescribed duration has expired. The controller times a shoot back signal in the form of a coded light signal from the signal source of the simulator system to coincide with the visual representation on the display screen video of the potential assailant's weapon being fired.

[0013] The coded light signal is generated from the direction of the threat outwards in all directions generally towards the area locating the participant regardless of whether an instructor is present or not. The signal source is adjacent to whichever display screen displays the threatening event when multiple screens are provided. If the participating trainee does not recognize in sufficient time that there is a potential threat of a weapon being fired subsequent to the potential assailant and weapon of the potential assailant being displayed in the training video, and the participating trainee has accordingly not sought appropriate cover behind a cover object in time, then the participant will be in the path of the coded light signal from the signal source and a hit will be determined. In the event of the indicator comprising a shocking element, this will also mean that the trainee will be penalized by being electrically shocked by the shocking element for not moving to cover. When multiple screens are provided, the participant must monitor potential threats from many different directions at once and must take cover from different directions of signal sources depending upon where a threat is displayed. Forcing the trainee to tack cover from different directions enhances the realism of the training scenario.

[0014] In some embodiments, more than one participant may be provided with similarly configured participant devices with shocking elements and sensing elements respectively which are responsive to light based signals generated by simulated weapons also carried by the participants. Accordingly the participants in this instance can engage in direct simulated force on force threat training between one another, or alternatively one or both participants can also interact with the simulated environment of scenarios presented in the form of training videos to increase the versatility in participant training.

[0015] Some embodiments of the invention will now be described in conjunction with the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. **1** is a schematic representation of a simulation system for threat training which is usable for the dual purpose of training a participant in response to a training video displayed on a single screen or training a participant in simulated engagement with another user.

[0017] FIG. **2** is a schematic representation of the simulation system according to FIG. **1** in which the system including multiple screens for displaying the training video to the participant.

[0018] In the drawings like characters of reference indicate corresponding parts in the different figures.

DETAILED DESCRIPTION

[0019] Referring to the accompanying figures, there is illustrated a threat training system generally indicated by reference numeral **10**. A system **10** is particularly suited for displaying simulated threats to a participant and for simulating projectile impacts to the participant. Although various embodiments are illustrated, the common features of the various embodiments will first be described.

[0020] The system **10** includes one or more displays **12** for displaying a training scenario to a participant within a training environment. The display is typically located at the perimeter of the training environment so as to be directed inwardly towards a central area where the participant is to be located.

[0021] The scenario is generated by a main computer controller **14** connected to all displays. The scenario generally comprises a training video which is assembled as a sequence of events displayed on each display. One or more of the events displayed on one or more of the displays is a threatening event which visually represents a threat to the participant. Each threatening event is located at a respective prescribed time step along the timeline between the start and end of the video.

[0022] The training environment also includes a light based signal source **16** at a fixed location adjacent each display **12**. The signal source **16** is operated under control of the computer controller **14** so as to be arranged to generate a coded light based shoot back signal which simulates a projectile impact to the participant. The shoot back signal is a pulsed beam of light which is projected in one or more directions radially outward from the signal source towards the central area of the training environment where the participant observing the training video is located. The light may comprise visible light of a specific monochrome color for example or non-visible light such as infrared light or other non-visible spectrums.

[0023] In a preferred mode of operation, the controller is typically operated to always trigger or actuate the signal source **16** to project the shoot back signal therefrom directed at the participant in response to detection by the controller that a threatening event has been or is currently being displayed on the respective display associated with that signal source. Generally, the signal is not delivered from the signal source **16** towards the user until a prescribed reaction duration has expired starting from the instant or time step of the initial display of the threatening event. The controller includes a timer component to measure the prescribed reaction duration. In this instance, a participant is given an opportunity to seek cover behind a respective cover object **18** within the training environment for blocking the light based shoot back signal from reaching the participant.

[0024] For example, the video may initially display a threatening event as a visual representation of a potential assailant who is armed. The timer begins when the potential assailant is initially displayed. Upon expiry of the reaction duration measured by the timer component, the controller directs the signal source **16** to generate the shoot back signal automatically without any instructor or operator input required. The shoot back signal is timed to coincide with the visual representation of the potential assailant appearing to shoot at the participating trainee. When the participating trainee views the potential assailant they must therefore seek cover before the shoot back signal is automatically timed for delivery by the signal source **16** under computer control to coincide with the visual representation of the potential assailant firing their weapon or a hit to the participant will be determined.

[0025] The shoot back signals generated are typically in the form of a cone beam or a plurality of linear beams of light projected in multiple respective radial directions outward from the signal source towards participants in the training area. In this manner, the shoot back signal can be operated in an automated manner by the controller without any aiming or special directional control being required by an instructor or operator of the training simulator environment. If the participant is within any visual line of sight of the signal source adjacent to the training video display without any cover objects therebetween, then the signal will reach the sensor element worn by the participant and a hit will be determined.

[0026] In an alternative mode of operation, the controller may remain automated without instructor/operator input required, but alternatively to the preferred mode, the controller in this instance is arranged such that the shoot back signal is only activated at the expiry of the reaction duration measured by the timer if a prescribed reaction condition by the participant as detected by the controller **14** is not yet met. In this instance, if the controller detects that the participant has met the prescribed reaction condition, then the signal source **16** is interrupted and prevented from delivering the coded light based shoot back signal towards the participant.

[0027] In the alternative mode of operation, the reaction condition of the participant may be determined by providing each participant with a simulated weapon **20**, for example a simulated gun arranged to be carried in the hand of the participant and generate a reaction signal when triggered. In the preferred embodiment, the simulated participant weapon **20** generates the reaction signal to be substantially identical to the coded light based shoot back signal; however, in further embodiments, the reaction signal may take other forms such as an RF signal for example.

[0028] Also in the alternative mode of operation, the system **10** also includes a receiver **22** associated with each display **12** which is arranged to receive the reaction signal from the participant for determining if the reaction condition has been met. The receiver **22** associated with each display upon which events of the training video are displayed is arranged to receive the reaction signal from the simulated weapon which is actuated by the participant, typically in reaction to a threatening event being displayed on the respective display.

[0029] Each participant wears a participant device **24** generally in the form of a vest arranged to be carried about the torso of the participant. The device **24** includes a light based sensor element **26**, for example an array of photodiodes, which are arranged to sense light-based signals directed thereon. In particular, the sensor element **26** is arranged to determine if the corresponding participant has been hit with a simulated projectile when the sensor element receives a shoot back signal corresponding to a simulated projectile.

[0030] Each device **24** also includes an indicator element for indicating when the participant has been hit. The indicator element may be: i) a vibrating element arranged to vibrate to indicate a hit to the participant in response to the determination of the hit by the light based sensor element; ii) an audio alarm arranged to audibly indicate the hit to the participant in response to the determination of the hit by the light based sensor element; iii) a visual indicator arranged to visually indicate the hit to the participant in response to the determination of the hit by the light based sensor element; iv) an electrical shocking element for electrically shocking the participant to indicate the hit to the participant in response to the determination of the hit by the light based sensor element; or v) any combination of i) through iv) noted above.

[0031] In the preferred embodiment, the indicator element is an electrical shocking element which is engaged with the participant when the participant device is worn such that a non-incapacitating electrical shock generated by the shocking element is arranged to be delivered to the user in response to determination of a hit by the light based sensor element.

[0032] When an auxiliary user **28** is also present as a second participant, the system includes an auxiliary user device **30** which is identical to the participant device **24** worn by the participant such that it similarly includes a sensor element **26** and a shocking element **27**. The auxiliary user is also provided with an auxiliary simulated weapon **32** which is substantially identical to the participant simulated weapon so as to be arranged to generate a light based shoot back signal substantially identical to the reaction signal from the participant simulated weapon and to the shoot back signal of the signal sources.

[0033] The similar configuration of the auxiliary user device permits various modes of operation. For example, according to a first mode of operation, one or more users may be located within the training environment of the system **10** for viewing the training scenario on the one or more displays **12**. Each of the two trainees has the same prescribed reaction duration to respond to any threatening events displayed on respective displays **12** to provide them with an opportunity to seek cover by locating one of the cover objects **18** between the trainee and the respective signal source associated with the display upon which the threatening event is displayed. Alternatively, either participant may actuate their respective simulated weapon to generate a respective signal detectable by the receiver **22** associated with the display screen upon which a threatening event is displayed to interrupt any shoot back signals generated by the respective signal source if the reaction signal is received within the prescribed reaction duration.

[0034] Alternatively, the participants may use the same components to engage one another in a simulated force on force environment where either participant is permitted to actuate their simulated weapon to generate a signal directed toward the sensor element of the other person to result in a non-incapacitating electrical shock being delivered to the person whose sensor element determines it has been hit by a light based signal representing a simulated projectile.

[0035] Turning now to the embodiment of FIG. **1**, the system **10** in this instance comprises a single display **12** displaying a single sequence of events thereon with a single signal source **16** and receiver **22** associated therewith. The system in this instance is operable either to always generate shoot back signals after the prescribed reaction duration has expired following threatening events being displayed, thus requiring the participant to seek cover in the usual mode of operation by the controller. In the alternative mode of operation, the shoot back signal may be interrupted if the participant actuates their simulated weapon to generate a reaction signal received by the receiver before expiration of the prescribed reaction duration.

[0036] Alternatively, as shown in FIG. **2**, the system may comprise multiple displays **12** at various locations about the perimeter of the training area so that each display faces generally radially inward towards a common central portion of the training area. Each signal source in this instance is also directed primarily radially inwardly towards the central area. The participants are generally located in the central portion of the training area so as to view all displays and be in the path of at least one signal source at any location within the training area. In this instance, the participant must always be mindful of the sequence of events of all displays during a training scenario and react appropriately to prevent receiving a shoot back signal which results in determination of a hit and an electrical shock being delivered to the participant.

[0037] Since various modifications can be made in my invention as herein above described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without department from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

1. A method of threat training a participant, the method comprising:

providing a participant device arranged to be carried by the participant, the participant device comprising a light based sensor element arranged to determine a hit in response to receiving a coded light based signal representing a simulated projectile and an indicator element arranged to indicate a hit to the participant in response to the determination of the hit by the light based sensor element;

supporting the participant device on the participant;

displaying a training video to the participant in which the training video comprises a sequence of events including a threatening event which visually represents a threat to the participant; and

providing a light based signal source which is arranged to be triggered under computer control to direct a coded light based signal representing a simulated projectile towards the participant in response to the threatening event being displayed to the participant.

2. The method according to claim **1** further comprising supporting the light based signal source in fixed relation to a display upon which the training video is displayed.

3. The method according to claim **1** further comprising directing the coded light based signal in a prescribed direction from the light based signal source.

4. The method according to claim **1** further comprising directing the coded light based signal in multiple directions from the light based signal source.

5. The method according to claim **1** further comprising supporting the light based signal source adjacent to a display upon which the training video is displayed.

6. The method according to claim **1** further comprising directing the coded light based signal at the participant after a prescribed reaction duration from the displaying of the threatening event to the participant.

7. The method according to claim **1** further comprising:

i) preventing the coded light based signal from being directed at the participant in response to a prescribed reaction by the participant to the threatening event before expiration of a prescribed reaction duration following displaying of the threatening event to the participant; and

ii) directing the coded light based signal at the participant after the prescribed reaction duration has expired in the absence of the prescribed reaction by the participant during the prescribed reaction duration as detected by a computer controller of the light based signal source.

8. The method according to claim **7** further comprising:

providing a participant simulated weapon arranged to be carried by the participant and to generate a reaction signal upon actuation by the participant; and

providing a display receiver associated with a display upon which the training video is displayed, the display receiver being arranged to receive the reaction signal from the participant simulated weapon;

wherein said prescribed reaction by the participant comprises the display receiver receiving the reaction signal from the participant simulated weapon by actuation of the participant simulated weapon by the participant.

9. The method according to claim **1** further comprising providing an auxiliary participant weapon arranged to be carried by an auxiliary user and to generate said coded light based signal upon actuation by the auxiliary user for indicating a hit to the participant upon determination of a hit by the light based sensor element of the participant device.

10. The method according to claim **9** further comprising:

supporting an auxiliary user device on the auxiliary user in which the auxiliary user device comprises a light based sensor element arranged to determine a hit in response to receiving a coded light based signal representing a simulated projectile and an indicator element arranged to indicate a hit to the auxiliary user in response to the determination of the hit by the light based sensor element;

providing a participant simulated weapon arranged to be carried by the participant and to generate said coded light based signal upon actuation by the participant for indicating a hit to the auxiliary user upon determination of a hit by the light based sensor element of the auxiliary user device.

11. The method according to claim **1** further comprising:

providing a plurality of displays;

displaying the training video to the participant as a sequence of events on each of the plurality of displays;

directing said coded light based signal towards the participant in response to a threatening event displayed on any one of the plurality of displays.

12. The method according to claim **11** further comprising providing a light based signal source in association with each display which is arranged to generate a respective coded light based signal directed towards the participant in response to a threatening event displayed on the associated display.

13. The method according to claim **1** wherein said coded light based signal is a pulsed beam of light.

14. The method according to claim **1** wherein said coded light based signal comprises a light signal in the visible light spectrum.

15. The method according to claim **1** wherein said coded light based signal comprises a light signal in the invisible light spectrum.

16. The method according to claim **15** wherein said coded light based signal comprises an infrared light signal.

17. The method according to claim **1** wherein the indicator element comprises an electrical shocking element arranged to generate a non-incapacitating electrical shock and wherein the participant device is supported on the user such that the non-incapacitating electrical shock is arranged to be delivered to the participant to indicate the hit to the participant in response to the determination of the hit by the light based sensor element.

18. The method according to claim **1** wherein the indicator element comprises a vibrating element arranged to vibrate to indicate a hit to the participant in response to the determination of the hit by the light based sensor element.

19. The method according to claim **1** wherein the indicator element comprises an audio alarm arranged to indicate the hit to the participant in response to the determination of the hit by the light based sensor element.

20. The method according to claim **1** wherein the indicator element comprises a visual indicator arranged to visually indicate the hit to the participant in response to the determination of the hit by the light based sensor element.

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