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(12) # EUROPEAN PATENT APPLICATION

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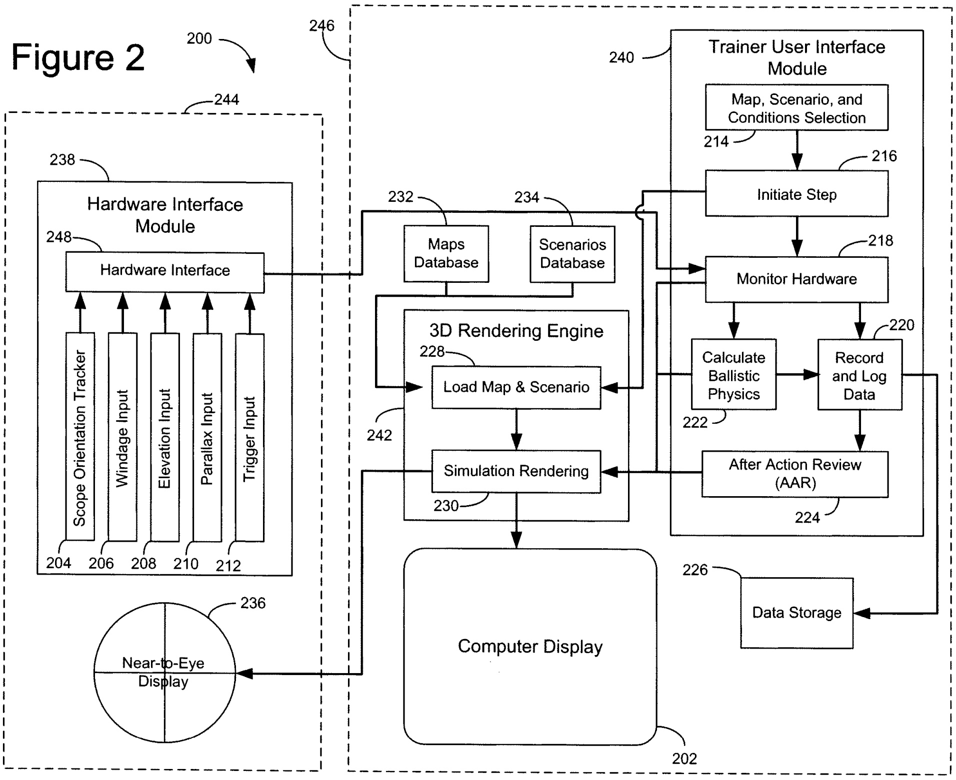
(54) **Sniper training system**

(57) For improved sniper training, a sniper skills training system is described. The sniper training system comprises a computer trainer station having a 3D rendering engine, a computer display, a trainer user interface module, at least one database, and a data storage; and a simulated rifle unit having a near-to-eye display and a hardware interface module, wherein the trainer station is interfaced with the simulated rifle unit to provide a simulated training scenario.

Figure 2



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Description

BACKGROUND

[0001] Snipers are utilized in various types of battle situations and environments, and can be a force multiplier on the battlefield if the respective sniper is well trained for the specific engagement. Training for a specific engagement however, is sometimes difficult. Current training methods can effectively train a sniper on aspects of marksmanship such as breath control, stance, support, and trigger control but are often lacking in addressing the critical skills for determining the point-of-aim on a target.

[0002] Determination of the point-of-aim on a target requires the consideration of several factors, and the combinations of those factors, including distance, wind and other weather conditions, target movements, and parallax. This is a skill that requires substantial practice not only to learn, but to maintain as well.

[0003] Point-of-aim practice is currently limited to firing range facilities, resulting in a limited variety of distance and weather condition. Sniper trainees would also need to relocate among firing range facilities to receive a more comprehensive training, costing time and money. In addition, firing range facilities which are suitable for sniper training, are not always available at all bases and when soldiers are deployed.

[0004] Another component to point-of-aim training is the ability to observe trace. Trace, which is the vapor trail formed by the bullet due to air turbulence, allows the trainer and the trainee to observe the path of the bullet to determine the point of impact on the target. The vapor trail however, lasts only a matter of seconds, making it difficult for new trainees to learn.

SUMMARY

[0005] For improved sniper training, a sniper skills training system is described. The sniper training system comprises a computer trainer station having a 3D rendering engine, a computer display, a trainer user interface module, at least one database, and a data storage; and a simulated rifle unit having a near-to-eye display and a hardware interface module, wherein the trainer station is interfaced with the simulated rifle unit to provide a simulated training scenario.

BRIEF DESCRIPTION OF FIGURES

[0006]

Figure 1 is a pictorial diagram showing the sniper training system, including a trainer computer station and a simulated trainee rifle unit, according to one embodiment of the invention.

Figure 2 is a block diagram showing the software architecture of the sniper training system, according to one embodiment of the invention.

Figure 3A is a flow diagram showing the interaction between the trainee and the sniper training system during a training session, according to one embodiment of the invention.

Figure 3B is a flow diagram showing the interaction between the trainee and the sniper training system during a training session with the help of a trainer, according to one embodiment of the invention.

Figure 4 is a pictorial diagram showing the setup of a sniper training session using a sniper training system, according to one embodiment of the invention.

DETAILED DESCRIPTION

[0007] Figure 1 is a pictorial diagram showing the sniper training system **100,** including a trainer computer station **102** and a simulated trainee rifle unit **104,** according to one embodiment of the invention. The trainer computer station **102** acts as the host to the simulations for training. Scenarios are created and loaded into the computer to provide the appropriate conditions that the trainee is preparing for. The trainer computer station **102** is interfaced with the simulated rifle unit **104,** which the trainee uses to simulate aiming and firing at targets during training. While the trainer computer station **102** is preferably a laptop or other portable computer for increased portability, other processing devices alternatively may be used.

[0008] The simulated rifle unit **104** includes a trigger sensor **110,** a motion tracker **106,** and a near-to-eye display system **112** with adjustment knobs **108.** In one embodiment of this invention, the main structure of the simulated rifle unit **104** is a construct of materials similar to those of an actual sniper rifle, such that the training simulations are as realistic as possible. Alternatively, the simulated rifle unit **104** does not need to be in the shape or form of an actual sniper rifle. For instance, a smaller unit may be appropriate for portability.

[0009] Determining the point-of-aim for a target, which is a core aspect of sniper skills training, is performed through the use of a scope. The near-to-eye display system **112,** which is in the shape of a scope, is mounted on the simulated rifle structure, similar to how scopes are mounted on the top of actual sniper rifles. Looking into the near-to-eye display system **112,** the trainee will see a high resolution, realistic training environment. Incorporated in the near-to-eye system **112** are adjustment knobs **108** for simulated windage control, elevation control, and parallax compensation. The scope orientation tracker **106** senses orientation of the simulated rifle unit. Information from this sensor along with input via the adjustment knobs **108** are processed by the trainer computer station **102** and the image in the near-to-eye display system **112** is updated in real-time. The trigger sensor **110** is excited when the trainee has determined the point-of-aim for the target in the scenario and takes the shot.

[0010] Figure 2 is a block diagram showing the software architecture **200** of the sniper training system, according to one embodiment of the invention. The entire architecture can be divided into two sections - a simulated rifle unit **244** and a simulation hosting trainer computer **246.**

[0011] The simulated rifle unit **244** includes a near-to-eye display **236** and a hardware interface module **238.** The hardware interface module **238** includes a scope orientation tracker **204,** a windage input **206,** an elevation input **208,** a parallax input **210,** and a trigger input **212,** all connected to the simulation hosting trainer computer **246** via a hardware interface **248.**

[0012] The simulation hosting trainer computer system **246** includes a computer display **202,** a trainer user interface module **240,** a 3D rendering engine **242,** a maps database **232,** a scenarios database **234,** and a data storage **226.**

[0013] The trainer user interface module **240** and 3D rendering engine **242** execute method steps, as shown in Figure 2. The trainer user interface module **240** includes a map, scenario and conditions selection step **214,** an initiate step **216,** a monitor hardware step **218,** a record and log data step **220,** a calculate ballistic physics step **222,** and an after action review (AAR) step **224.** The 3D rendering engine **242** includes a load map and scenario step **228** and a simulation rendering step **230.**

[0014] The data flow within the software architecture **200** begins with the maps, scenario and conditions selection **214.** Here a trainer or trainee can select from the geographical maps database **232** and scenarios database **234.** Geographical maps can be representations of actual locations, or virtually created environments. Scenarios will include different target situations, such as riding in a moving vehicle or standing at a podium, and different target behaviors. Entry-level scenarios may include static targets whereas high-level scenarios may include targets moving in less predictable ways. Conditions that can be selected will include weather elements that can affect the trajectory of a bullet, such as wind, rain fall, and elevation etc. Once these elements are selected, the training session will begin. An alternative to trainer or trainee selections of scenarios or conditions is random scenario generation. The sniper training system can generate random scenarios or semi-random scenarios that are increasingly more difficult, based on the trainee's prior performance.

[0015] The initiate step **216** activates the hardware interface module **238** in the simulated rifle unit **244** and loads the map and scenario **228** that was previously selected into the 3D rendering engine **242.** The 3D rendering engine can be a commercially available graphics engine such as the Unreal Engine 3 by Epic Games. In addition, foliage and groundcover can be rendered using programs such as the SpeedTree Application Programming Interface. Target models can be created using applications such as 3D Studio Max or Maya and imported into the user set virtual training environment. Most graphic engines, including the aforementioned Unreal Engine 3 offer robust artificial intelligence that closely approximates human target behaviors. With the provided map and scenario information and selected conditions, simulation rendering **230** occurs and the resulting image is presented to the trainee via the near-to-eye display **236.** The image presented through the near-to-eye display **236** includes a reticle, which is standard in optical scope eyepieces. For versatility, various types of reticles, such as the army reticle, the marine reticle, or the Horus reticle can be available for selection. The goal is to produce a realistic environment for the trainee when looking into the near-to-eye display **236.** The rendered image will also be present on the computer display **202**.

[0016] Based on what is seen in the near-to-eye display **236**, the trainee will make adjustments to elements in the hardware interface module **238**. Moving the simulated rifle unit **244** will prompt input from the scope orientation tracker **204.** The scope orientation tracker **204** that provides input to the hardware interface **204** calculates the direction the simulated rifle unit **244** is pointed. The hardware interface **204** sends the acquired information to the monitor hardware **218** which relays the information for simulation rendering 230 to provide an updated image on the near-to-eye display 236 and computer display **202** in real-time. Similar steps are executed in response to windage input **206,** elevation input **208,** and parallax input **210.** Windage adjustment is the side to side adjustment of the scope on a rifle, to account for the side force on a projectile from a cross wind. Elevation adjustment is the up down adjustment of the scope on a rifle to account for bullet drop as a result of gravity which varies depending on the distance to the target. Parallax compensation accounts for aiming errors from positioning one's eyes at different angles against the rifle scope. This error is often magnified when the target is moving.

[0017] This process continues in a loop until the trainee has determined the point-of-aim and is ready to take the shot. Each adjustment can be recorded and logged **220** then stored **226** for review later on and used to improve the trainee's process to determine point-of-aim.

[0018] Then the trainee will activate the trigger sensor when point-of-aim has been determined and a trigger input **212** will be sent to the monitor hardware **218** via the hardware interface **204.** This trigger input **212** will initiate ballistic physics calculation **222** to simulate the bullet path and result of the shot. The simulated firing event will be rendered **230** and be shown in real-time on the computer display **202** and the near-to-eye display **236**. The rendered real-time image will be similar to the result of an actual firing of a rifle, including the quickly disappearing bullet trace.

[0019] The resulting simulated firing event will be recorded and logged **220** and stored **226** and will also be immediately available for AAR **224**. Through graphics rendering **230** and display on the computer display **202**, the trainee and/or trainer can have a closer and more detailed look at the firing event that had just occurred, providing immediate feedback.

[0020] In addition to providing the trainee and/or trainer with feedback in the form of a rendering of the firing event, the training system can also generate recommended scope adjustments and/or point of aims for the scenario. Recommended scope adjustments and point of aims allows the trainee to compare his/her process to an optimized process. The recommended scope adjustments are an optimized series of adjustments that allows a sniper to quickly determine a point of aim. The recommended point of aim can be generated either from the resulting scope adjustments by the trainee or the recommended scope adjustments and can be shown on the display in the form of an indicator such as a red dot or a red crosshair.

[0021] Figure 3A is a flow diagram **300** showing the interaction between a trainee **302** and a sniper training system **304** during a training session, according to one embodiment of the invention. The different components include the trainee **302**; the sniper skills training system **304**, which further includes a near-to-eye display **306**, scope adjustments **308**, a trigger sensor **314**, and training session results **310**; and a training scenario **312** input.

[0022] First, the training scenario **312** is selected and loaded into the sniper training system **304**. The trainee **302** will now be able to look into the near-to-eye display **306** and begin to determine the best point-of-aim for the target in the loaded scenario by making simulated scope adjustments **308**. The display **306** is updated in accordance with the adjustments **308**. The trainee **302** will continue this process to make adjustments to determine the best point-of-aim. When the point-of-aim to take the shot is determined, the trainee **302** will excite the trigger sensor **314**. The result of the shot is then simulated and stored in the training session results **310**. After the shot is taken, the trainee can continue to make adjustments and take additional shots within the loaded scenario. The trainee **302** can look at the output of the training session results **310** either immediately after the shot, or after all the training scenarios have been completed.

[0023] Figure 3B is a flow diagram **350** showing the interaction between a trainee **352** and a sniper training system **354** during a training session with the help of a trainer **362**, according to one embodiment of the invention. The sniper training system in this embodiment includes a near-to-eye display **356**, a computer display **366,** scope adjustments **358,** a trigger sensor **364,** and training session results **360.**

[0024] The trainer **362** can select the scenario for the session. While the trainee **352** goes through the process of determining a point-of-aim for the target, the trainer **362** can monitor the trainee's selections through the computer display **366** and has the option to provide real-time feedback to the trainee **352**. At the end of the training session, the trainer **362** can review the training session results **360** and provide feedback to the trainee **352** based on those results.

[0025] Figure 4 is a pictorial diagram showing the setup of a sniper training session **400** using a sniper training system **414**, in one embodiment of the invention. The sniper training session **400** shown involves a trainer **402**, a trainee **404** and a sniper skills training system **414.** The sniper training system **414** includes a simulated rifle unit **406**, the trainer computer station **408**, a connection **412** from the computer station **408** to the rifle unit **406**, and a connection **410** from the rifle unit **406** to the computer station **408**. While wired communications **410** and **412** are shown, the connections **410** and **412** may alternatively be wireless.

[0026] The trainer **402** operates the computer station **408** portion of the sniper training system **414**, while the trainee **404** operates the simulated rifle unit **406** portion of the sniper training system **414**. One alternative training session setup may involve only a trainee operating both the computer station as well as the simulated rifle unit.

Claims

1. A sniper skills training system, comprising:

a computer trainer station having a 3D rendering engine, a computer display, a trainer user interface module, at least one database, and a data storage; and a simulated rifle unit having a near-to-eye display and a hardware interface 1. A sniper skills training system, comprising:

a computer trainer station having a 3D rendering engine, a computer display, a trainer user interface module, at least one database, and a data storage; and

a simulated rifle unit having a near-to-eye display and a hardware interface module, wherein the trainer station is interfaced with the simulated rifle unit to provide a simulated training scenario.

2. The sniper skills training system in Claim 1, wherein the at least one database comprises a maps database.

3. The sniper skills training system in Claim 1, wherein the at least one database comprises a scenarios database.

4. The sniper skills training system in Claim 1, wherein the at least one database comprises a maps database and a scenarios database.

5. The sniper skills training system in Claim 1, wherein the data storage is a portable storage device.

6. The sniper skills training system in Claim 1, wherein the hardware interface module is a wireless interface module.

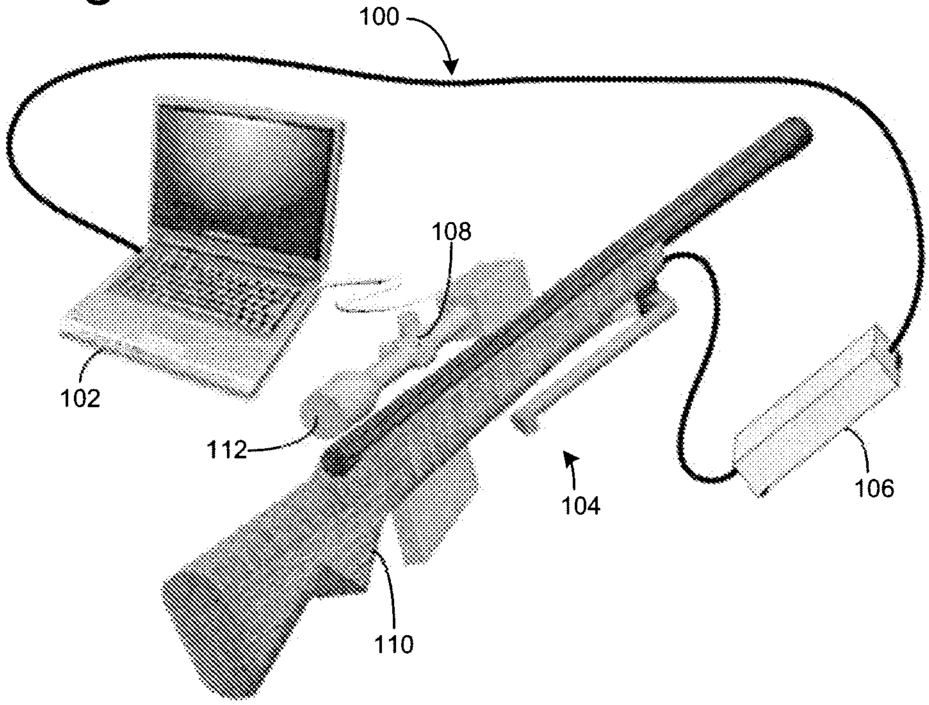
7. The sniper skills training system in Claim 1, wherein the simulated rifle unit is constructed to physical specifications of an actual rifle.

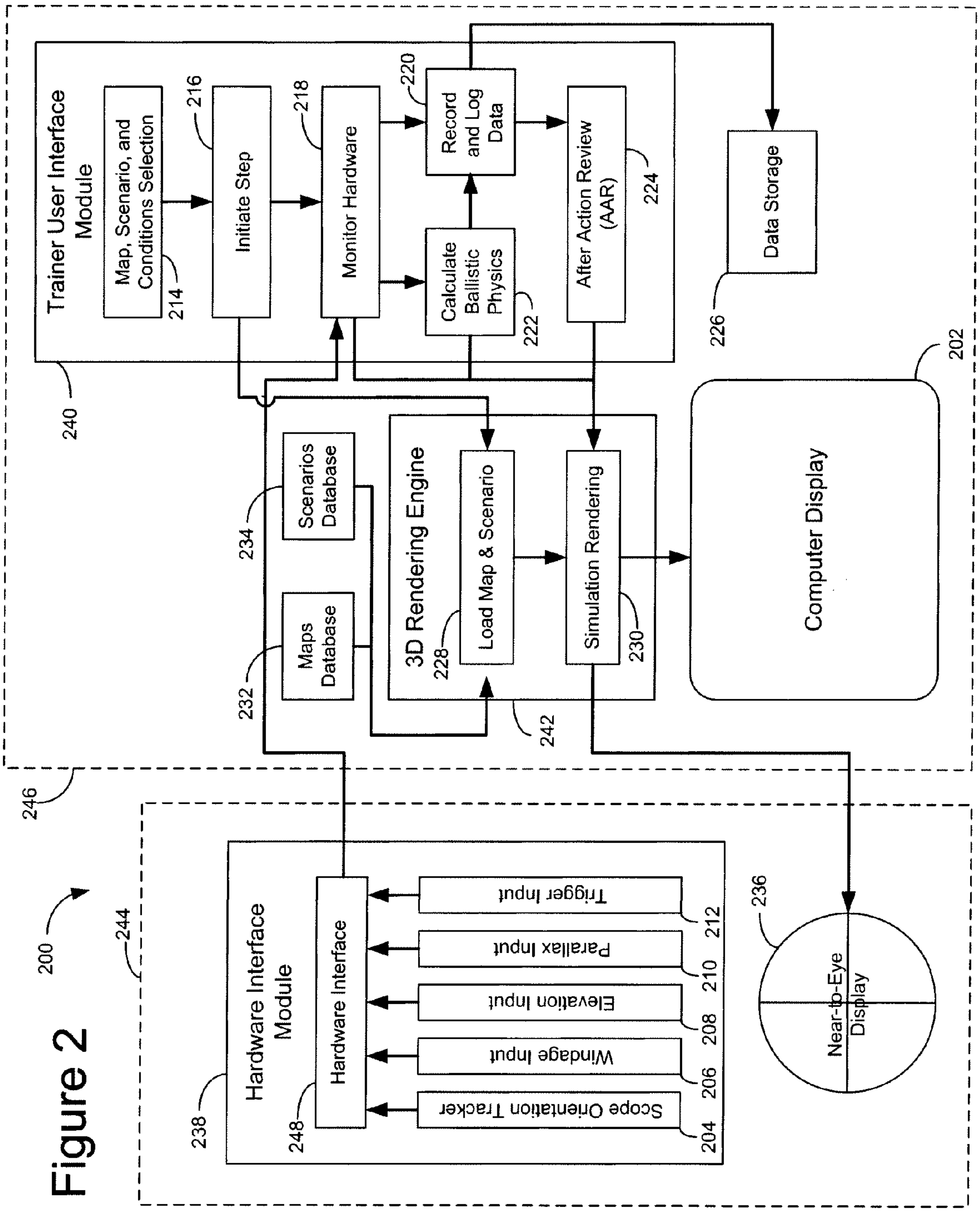
8. The sniper skills training system in Claim 1, wherein the computer trainer system is a laptop computer.

9. The sniper skills training system in Claim 1, wherein the near-to-eye display contains a reticle.

10. The sniper skills training system in Claim 9, wherein the reticle is chosen from the group consisting of army reticle, marine reticle, Horus reticle, German reticle, SVD type reticle, mil-dot reticle, and range-finding reticle.

Figure 1





Trainer User Interface Module
Map, Scenario, and Conditions Selection
214
Initiate Step
216
Monitor Hardware
218
Record and Log Data
220
Calculate Ballistic Physics
222
After Action Review (AAR)
224
Data Storage
226
240
Scenarios Database
234
Maps Database
232
3D Rendering Engine
Load Map & Scenario
228
Simulation Rendering
230
242
Computer Display
202
246
200
244
Hardware Interface Module
238
Hardware Interface
248
Trigger Input
212
Parallax Input
210
Elevation Input
208
Windage Input
206
Scope Orientation Tracker
204
Near-to-Eye Display
236

Figure 2

Figure 3A

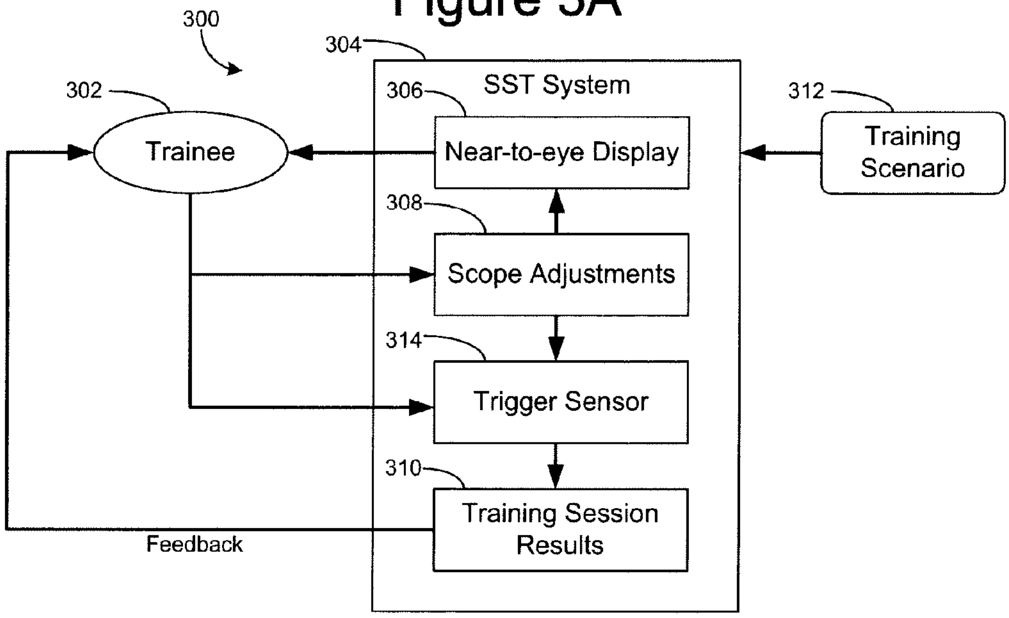


Figure 3B

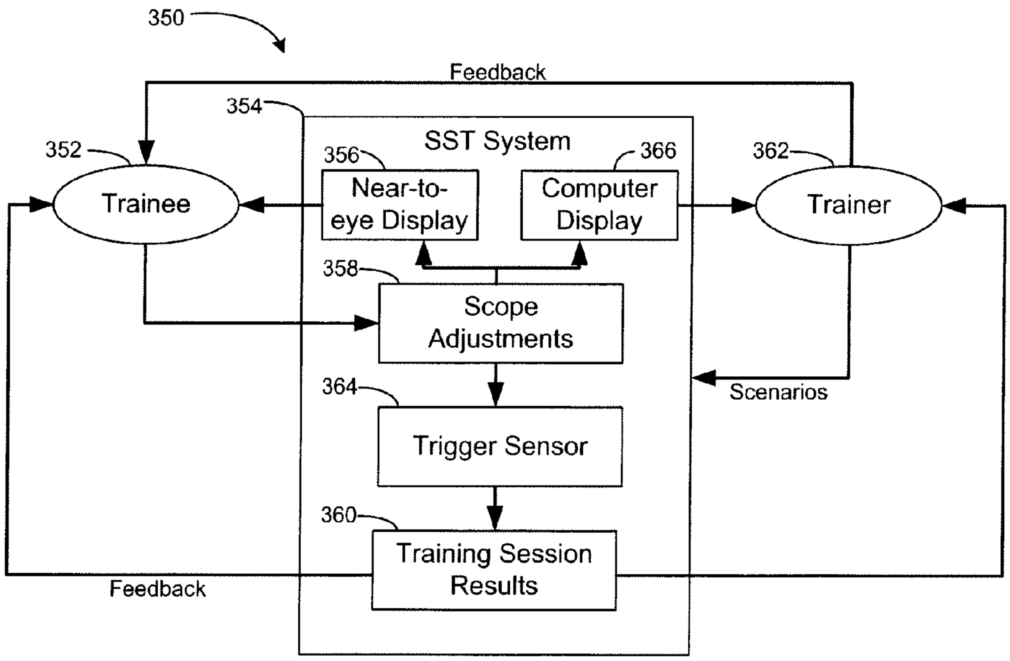
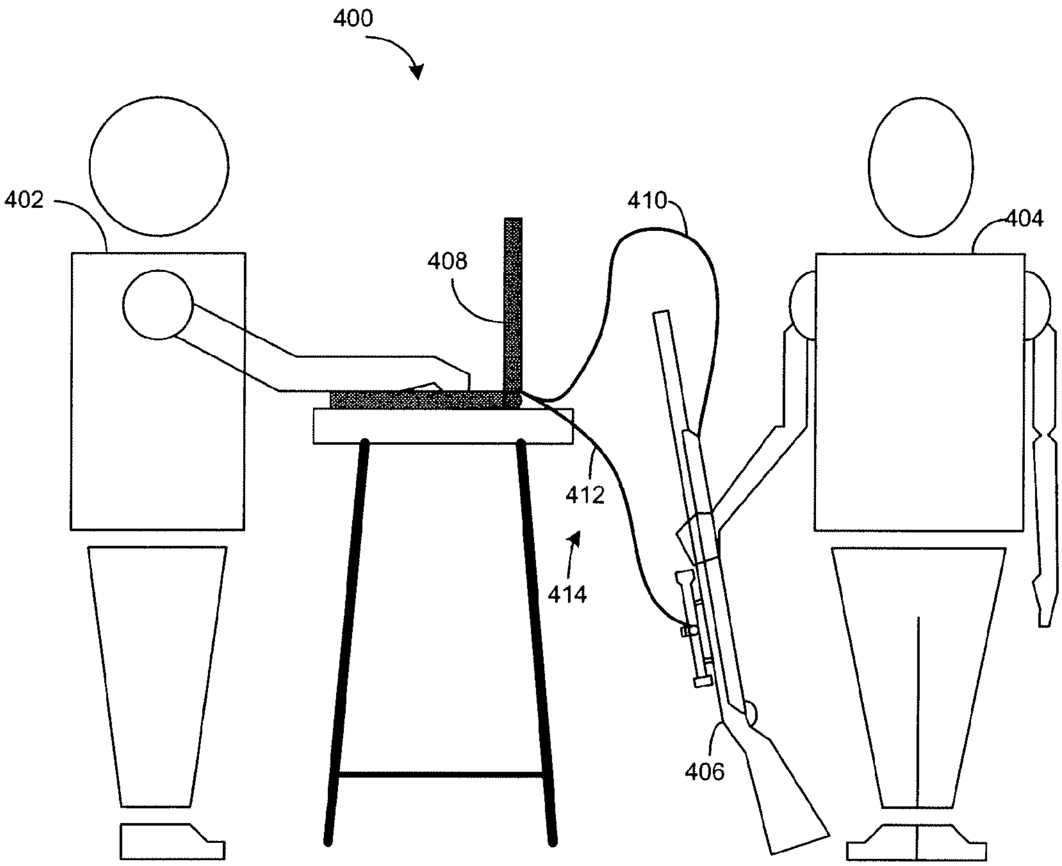


Figure 4



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EUROPEAN SEARCH REPORT

Application Number
EP 08 17 0624

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The present search report has been drawn up for all claims

3

Place of search	Date of completion of the search	Examiner
The Hague	10 August 2009	Blondel, François

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims

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