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(54) **Title:** AN ELECTRO-PNEUMATIC PROJECTILE LAUNCHING TRAINING SYSTEM

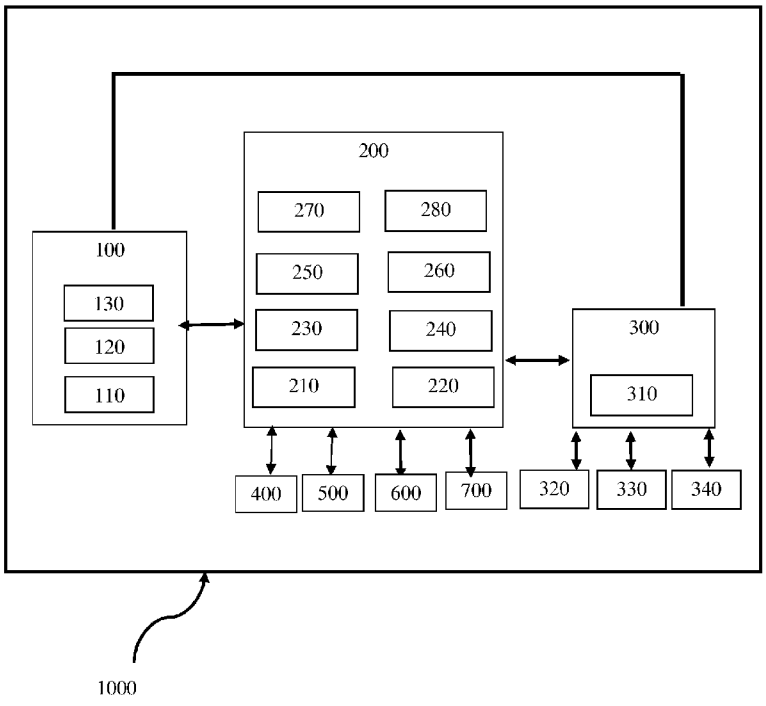

FIGURE 1

(57) **Abstract:** The present disclosure envisages a computer-implemented elector-pneumatic projectile launching training system (1000) for real-time simulation, which is easily reconfigurable for a variety of indoor and outdoor applications. The training system (1000) is configured for training at least one trainee by at least one instructor which can also be expanded to train three sets of trainees and instructors. The training system (1000) comprises of a computer- implemented simulation system employing electro-optical sensors (230) networked in wired and wireless means. This system employs scaled model of target mounted on an automated battery operated vehicle (260) and/or remotely controlled or real aerial simulated target system, a simulated projectile and a target, an electro-mechanically actuated motion simulator projectile launching mechanism (100), means for locking of the projectile inside the launching mechanism, a control unit, a trigger, a sensor, a repository 250 and a performance monitoring module (310). The trigger releases the pneumatic lock

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thereby letting the hydraulically compressed spring, launching the dummy projectile. The control unit (200) in combination with the performance monitoring and report generator module (310) is the nerve centre of the entire training system (1000), which is operable by one or more instructor(s) to generate any type of simulation or audio visual indications including emergencies associated with the simulated launching of projectile at the said target system (260) and store the results in the repository post processing by the performance monitoring and report generator (310). The array of networked optical tracking sensors (230) capture an image/video of the target and transmit it over the wireless trans-receiver (240) module to the display unit (220) of the said control unit (200) which in turn transfers it to the performance monitoring and report generator (310) for analysis and report generation. The repository 250 stores the image and the video. The crossover range trans-receiver (280) transmits the positional data of the target including the programmable aerial target (270), to the digital control unit (200) which is combined with the inputs of standalone and integrated optical tracking module (230) received via voice a wireless trans-receiver module (240). The Portable Indoor Training System (300) comprises of the Performance Monitoring and Report Generator Module (310) which is common to all the indoor and outdoor configurations, visor mounted display module (320) which can also be used in combination with motion simulator (100). The indoor display and audio visual components (330) and comparator and computing module (340) combine to impart indoor training based on the preloaded target parameters and the trainee's action with the specially configured launching tube and launching mechanism. The multisource power supply unit (400) comprises of conventional and renewable energy sources wherein this module also comprises of phase convertor equipment also to cater for the need of 3-phase power supply for components of motion simulator (100). The voice communication module (600) is integrated with the digital control unit (200) to enable one- way point-to-point communication from instructor trainee. The Observer and Instructor Training Kit (700) are also part of the training system (1000) wherein the digital control unit and performance monitoring and report generator module (310) are used in conjunction with all types of target systems.

AN ELECTRO-PNEUMATIC PROJECTILE LAUNCHING TRAINING SYSTEM

FIELD

The present disclosure relates to the field of training systems.

BACKGROUND

The background information herein below relates to the present disclosure but is not necessarily prior art.

Typically, a training system is a device or group of devices which provide realistic simulation of various scenarios in which an operator would function. A training system is generally used to provide simulated controls and operation of a system, equipment, platform, vehicle, aircraft or any other complex system. Particularly, training systems for air defense sensors and weapon systems are used by an organization like the air force to train the operators to handle various tricky situations. These training systems are generally built to train the operators and other concerned personnel to optimally use any particular type or group of equipment(s). As every equipment or system has its unique features, the training provided using a type specific training system would limit its utility to that particular equipment or system only. Further, most of the simulators are either indoor or outdoor simulators, which differ in their configuration and the training value imparted to the trainees. The conventional energy sources employed in the current simulators are cost intensive and entail stringent safety norms. Moreover, the type specific training systems are not easily modifiable to match specifications of other similar systems or any future upgradation.

Therefore, there is a need for a training system that overcomes the aforementioned drawbacks.

OBJECTS

Some of the objects of the present disclosure, which at least one embodiment herein satisfies, are as follows:

It is an object of the present disclosure to ameliorate one or more problems of the prior art or to at least provide a useful alternative besides providing a cost effective method of training.

An object of the present disclosure is to provide a simulation of projectile launching training system.

Another object of the present disclosure is to provide a projectile launching training system that facilitates target observation and tracking of real as well as simulated targets under real and simulated environment.

Yet another object of the present disclosure is to provide a projectile launching training system with a real time motion simulator with audio-visual indications with the aid of electro-pneumatic and hydraulic systems.

Still another object of the present disclosure is to provide a projectile launching training system which includes a simulator that is reconfigurable as per various needs of the operators and controllers.

Another object of the present disclosure is to provide simulation of target by employing three types of targets viz miniature model mounted on a remotely controlled battery operated vehicle as well as remotely controlled flying object.

A further object of the present disclosure is to provide an integrated projectile launching training system that can be used in both indoor and outdoor configurations.

An additional object of the present disclosure is to provide electro-optically aided simulation training to the observers, communicators and controllers who support the operators of the launching system.

One more object of the present disclosure is to provide interoperability of the modules to perform various combinations of training simulation and analysis thereof to provide a comprehensive report in respect of operators, observers and controllers.

Other objects and advantages of the present disclosure will be more apparent from the following description, which is not intended to limit the scope of the present disclosure.

SUMMARY

The present disclosure envisages an electro-pneumatic projectile launching training system. The projectile launching training system is configured for training at least one trainee by at

least one instructor in both indoor and outdoor configurations. The outdoor configuration comprises of various modules to simulate training against real and simulated targets wherein the targets are tracked and engaged with the help of electro-optical sensors networked in wired and wireless means. The simulated target system may also be remotely controlled flying platform or an automated ground vehicle mounted scaled model. In another configuration, the operator is trained to correctly track and aim at the simulated target with the help of electro-optical and electronic sensors. All these inputs processed by the digital control system are monitored by the trainer wherein the two-way communication is effected through audio, video and radio signal.

This simulated launching training system comprises of a projectile launching mechanism with launching tube in a digitally launchable mode, a digital control unit, a trigger, an optical sensor unit, a repository and a performance monitoring and report generator module all powered by multiple source of energy including renewable source of energy wherein all the components are connected in both wired and/or wireless mode. A spring is disposed in the launching tube of the projectile launching mechanism. This simulated launching training system also comprises a visor mounted display module. Activities are simulated and video input is provided through the visor mounted display module. Also, a provision is made to connect the visor mounted display module and performance monitoring and report generator module coupled with the digital control unit. This simulated launching training system also comprises an associated preparation bench or work stand to load, compress and lock the spring along with a simulated projectile. The performance monitoring module is configured to analyse the simulated activities and the video input provided through visor mounted display module.

The digital control unit is operable by an instructor to generate a various signals which can simulate scenario to the operator and also to create emergent conditions. The optical sensor unit is configured to capture the image of the target and relay it to the digital control unit and/or digital video monitoring system for processing and analysis. The repository is configured to cooperate with the control unit and is further configured to store the image and the video captured using the optical sensor unit.

In another embodiment, the repository is configured to store the visuals of a plurality of terrains, a plurality of targets recorded and a plurality of projectile motions simulated. The

performance monitoring module is configured to cooperate with the repository and is further configured to analyze the image and the video so as to produce an assessment based on the criteria specified.

In an embodiment of motion simulation, the simulated projectile launching system comprises a launching tube and a launching mechanism. The launching tube comprises a special spring which is configured to be compressed and locked by the means of hydraulic power and compressed air. The means for locking acts on a dummy projectile placed inside the launching tube to hold the compressed spring into a locked state. The launching mechanism comprises at least one pressure input unit cooperating with the launching tube. The launching mechanism is configured to generate a predetermined high pressure to propel the projectile over a predetermined distance, upon pressing the trigger. In another embodiment, a first sensor, disposed within the launching tube, is configured to sense the unlocking of the spring and generate a spring unlocking signal which is transmitted to the control unit. The launching tube is configured to receive at least two pneumatic pressure inputs from at least one pneumatic pressure input device. Locations of the pneumatic pressure inputs are (i) a first location near the operative front end of the launching tube wherein the locking system is located and (ii) a second location which is at the rear end wherein the pressure is employed to simulate blast effect in conjunction with audio-visual simulation. Upon pressing of the trigger of the launching tube by the trainee, the spring is released by the pneumatic lock. Upon receiving the spring unlocking signal, the digital control unit is configured to activate the audio-visual and pneumatic launch indications while the projectile is propelled out of the launching tube.

In this embodiment the electronic sensor disposed within the launching tube, is configured to generate a locking signal upon the projectile being locked in the simulated projectile launching mechanism. The second sensor, disposed within the launching tube, is configured to generate a triggering signal upon pressing the trigger. Both the locking signal and the triggering signal are transmitted to the video display unit and performance monitoring module through the digital control unit. The digital control unit is configured to generate the launching instructions for the trainee upon receiving a command from the instructor, and is further configured to transmit the launching instructions to the performance monitoring module. Moreover, there is another set of optical sensors disposed off at vantage positions to

monitor the movement of the simulated and/or real targets and relay the same to display and performance monitoring module.

According to an embodiment, the performance monitoring module includes a video monitoring module configured to analyze the video signal generated by the optical sensor unit and is further configured to generate a data set. The performance monitoring module is configured to generate a report of the performance of the trainee based on the data set, the locking signal and the trigger signal and the data set programmed by the instructor prior to the training session.

According to yet another embodiment, the system is provided with an audio-visual module configured to cooperate with the performance monitoring module. The audio-visual module is configured to output audio and visual signals corresponding to the launching instructions as well as a pre-recorded sound associated with launching of the projectile to simulate launching of the projectile based on the data set, the locking signal and the trigger signal.

According to still another embodiment, the report includes performance parameters which include time corresponding to locking of the projectile in the simulated projectile launching mechanism, time corresponding to pressing the trigger and accuracy of the trajectory followed by the projectile towards the target.

According to yet another embodiment, the system comprises a portable metallic stand configured to receive at least a portion of the simulated projectile launching mechanism. According to an embodiment, the portable stand is rotatable 360 degrees about a vertical axis and also in the vertical plane. This stand is modular in construction with provision to increase or decrease the height, to enable hands free operations and to release the locking mechanism faster during the training sessions. According to another embodiment, a radium-coated compass rose is configured around the portable stand for directional orientation.

In an embodiment, the system comprises a crossover range transceiver configured to facilitate communication between the control unit and an operator station associated with a pair of a trainee and a corresponding instructor.

In another embodiment, the system comprises a voice communication module which facilitates transfer of voice signals and instructions from the instructor through the digital control unit to a voice receiver coupled to the launching system carried by the trainee.

In yet another embodiment, the system comprises a built-in test equipment which monitors health of the various components of the entire system in wireless mode. This system, in another embodiment performs the role of monitoring system to display the images/video captured by the optical sensors including the sensor with pan, tilt and zoom provisions. This embodiment has the special feature of codification of error messages.

In another embodiment, the system comprises of an automated battery operated vehicle with provision to be controlled remotely. It is employed as a vehicle to carry the scaled model as well as to convey the associated equipment before and after the training sessions.

In yet another embodiment, this system comprises of non-renewable energy appliances and accessories to recharge the stand-alone systems especially in the wireless/remote mode.

In another embodiment, the training system comprises of equipment(s) which can be employed to enhance the expertise and skills of the trainees in terms of distance estimation, elevation/height an azimuth. This module employs electronic and optical sensors which are easily portable.

In still another embodiment, the system comprises an indoor training system. The indoor training unit is configured to cooperate with the control unit. The indoor training unit comprises a visor-mounted display unit, an orientation sensor, indoor audio visual display system, a computing module, comparator and a report generator. The repository is configured to store visuals of a plurality of terrains, a plurality of targets and a plurality of projectile motions with a provision to add the recorded visuals of outdoor training sessions, if needed. The visor-mounted display unit displays at least one combination of one each of the visuals plurality of terrains, the plurality of targets and the plurality of projectile motions, to be viewed by the trainees. The orientation sensor senses three-dimensional orientation of the simulated projectile launching mechanism. The computing module is configured to compute displacement of the projectile based on the orientation of the simulated projectile launching mechanism. The comparator is configured to compare the computed displacement by the computing module and displacement corresponding to the plurality of projectile motions

stored in the repository to determine the visuals of projectile motion to be displayed, based on the comparison. The control unit is configured to transmit a combination of visuals of a terrain and a target from the repository to the visor-mounted display unit for displaying as per instructions received from the instructor, and transmit the visuals of the projectile motion from the repository to the visor-mounted display unit as determined by the comparator. In another embodiment, this visor mounted indoor training system can be integrated with the outdoor system of pneumatic launching mechanism in conjunction with the digital control unit.

Thus the entire training system is designed and fabricated based on line replaceable unit concept thus making it more compact and cost effective.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWING

Figure 1 illustrates a schematic diagram of a projectile launching training system, in accordance with an embodiment of the present disclosure.

List and details of reference numerals used in the description and drawing:

Reference Numeral	Reference
1000	Electro-Pneumatic Projectile Launching Training System
100	Motion Simulator for Projectile Launching Mechanism
110	Pneumatic Lock and Launch Indication Module
120	Mechanical and Hydraulic Actuators
130	Electronic Actuating and Audio Visual System with interfacing unit
200	Digital Control Unit
220	Built-In Test Equipment cum Digital Video Monitor
230	Standalone and integrated Optical Tracking Module
240	Voice and Wireless Trans-receiver Module

250	Repository
260	Automated Vehicle with mounted Target
270	Programmable simulated Aerial Target
280	Crossover Range Trans-receiver
300	Portable Indoor Training System
310	Performance Monitoring and Report Generator Module
320	Visor Mounted Display Module
330	Indoor Display and Audio-Visual Components
340	Comparator and Computing Module
400	Multisource Power Supply Unit
500	Portable Integrated Stand with compass rose
600	Voice Communication Module
700	Observer and Instructor Training Kit

DETAILED DESCRIPTION

The present disclosure envisages an electro-pneumatic projectile launching training system 1000 which is now described with the help of accompanying drawing. Figure 1 illustrates a schematic diagram of a projectile launching training system 1000 (hereinafter referred to training system 1000) which is a pneumatically operated electromechanical simulator. Primarily, the training system 1000 can be used to provide outdoor field training and indoor simulation training to the operators. The training system 1000 is configured for training at least one trainee by at least one instructor. In an embodiment, a plurality of trainees and instructors such as three sets of trainees and instructors can be trained under field conditions with the help of the training system. The training system 1000 works in both wired and wireless modes.

The training system 1000 comprises at least one simulated projectile and at least one target, a projectile launching mechanism 100, a spring disposed within the mechanism 100, an electro-mechanically actuated motion simulator for projectile launching mechanism 100, an optical sensor unit 30, a means for compressing the spring hydraulically 120 and locking of the projectile inside the simulated projectile launching mechanism 110, wherein the electronic actuating and audio visual system with interfacing unit 130 is actuated by a trigger which in turn brings in the digital control unit 200 into action along with a performance monitoring module 310. The digital control unit 200 is also operable by an instructor to generate projectile launching instructions. The trigger enables release of the lock thereby launching the projectile. A switch coupled to the control unit 20 can be pressed by the instructor. The optical sensor unit 30 is configured to capture the image of the target and relay it to the digital control unit 200 for processing and analysis. This simulated launching training system 1000 also comprises a visor mounted display module 320. Activities are simulated and video input is provided through the visor mounted display module 330. Also, a provision is made to connect the visor mounted display module 320 and performance monitoring and report generator module 310 coupled with the digital control unit 200. This simulated launching training system also comprises an associated preparation bench or work stand to load, compress and lock the spring along with a simulated projectile. The performance monitoring module 310 is configured to analyse the simulated activities and the video input provided through visor mounted display module 330.

In another embodiment, this motion simulator 100 is also connected to the Portable Indoor Training System 300 for combining the features of indoor simulation and outdoor motion simulator, wherein both are connected to the digital control unit 200 for performance monitoring.

In an embodiment, the simulated projectile launching mechanism 100 comprises a launching tube and a propulsion mechanism. The conventional object/weapon/explosive/propellant has been replaced with a hydraulically compressed and pneumatically locked spring to launch the projectile on electromechanical actuation. The effect of explosions, blasts and motions are simulated by combination of electro-pneumatic and audio-visual components. The launching tube comprises of a compressible spring which is configured to be locked along with the dummy projectile by means a hydraulic power pack and a pneumatic mechanism for holding it in a locked state. The lock release mechanism comprises of one pressure input unit, such as

a compressor, cooperating with the launching tube. The mechanical propulsion system generates a predetermined high pressure to propel the projectile over a predetermined distance, upon pressing the trigger.

A first sensor, disposed within the launching tube, senses the unlocking of the spring and generates a spring unlocking signal which is transmitted to the control unit 200. The first sensor may be a contact-type or non-contact type sensor. Upon pressing of the trigger of the launching tube by the trainee, the pneumatic lock is released and upon receiving the spring unlocking signal, the control unit 200 activates audio-visual indications accompanied by a pneumatic blast at the rear of the launching tube. This also is accompanied by a means to simulate the flame.

The motion simulator 100 is communicatively coupled with the performance monitoring module 310.

The control unit 200 can be implemented as one or more microprocessors, microcomputers, digital signal processors, central processing units, state machines, logic circuitries, and/or any devices that manipulate signals based on operational instructions. Further, the control unit 200 is communicatively coupled with the motion simulator 100 and the performance monitoring module 310. The control unit 200 is configured to generate the launching instructions for the trainee upon receiving a command from the instructor, and is further configured to transmit the launching instructions to the performance monitoring module 310. It also can carry out additional functions such as digital video monitoring and processing, display of audio visual outputs pertaining to the performance of the trainees and transferring all the data thus collected to the performance monitor 310. The Control Unit 200 also can simulate emergency conditions to enhance the skills of the trainees. The command may also be given by an input device such as pressing a switch, by typing an instruction on an alpha-numeric device such as a keyboard, using other input devices such as a mouse-pointer, a stylus and so on, or simply by speaking out instructions in front of a microphone or any other futuristic technology.

Moreover, the camera unit 230 is disposed at the simulated projectile launching mechanism 100. The standalone and integrated optical tracking module 230 comprises of group of fixed and adjustable (pan, tilt and zoom) type of sensors. This module is communicatively coupled with the digital video monitor 220 and performance monitoring module 310.

According to an embodiment, the performance monitoring module 310 includes a video monitoring module 220 which in turn is configured to analyze the video signal generated by the sensor unit 230 and is further configured to generate the required data set. The performance monitoring module 310 generates a report of the performance of the trainee based on the data set, the locking signal and the trigger signal, and other relevant data as may be obtained using other special-purpose sensors. The report can include performance parameters which include time corresponding to locking of the projectile in the simulated projectile launching mechanism, time corresponding to pressing the trigger and accuracy of the trajectory followed by the projectile towards the target. The report can be stored in a dedicated repository 250 cooperating with the performance monitoring module 310, and can be displayed on a screen visible to the instructor or can be configured for printing on a paper using a printer device cooperating with the repository 250 and the control unit 200.

The training system 1000 is also provided with an audio-visual module 130 cooperating with the performance monitoring module 310. The audio-visual module 130 outputs audio and visual signals corresponding to the launching instructions as well as a pre-recorded sound associated with launching of the projectile to simulate launching of the projectile based on the locking signal and the trigger signal. The audio-visual module 130 includes a speaker device for audio and a light-emitting device, selected from the group consisting of an incandescent bulb, a CFL lamp, an LED array and an LED screen, an LCD screen, an OLED screen and the like, which glow and/or display text or images when the input is operated by the instructor, to be visible to the trainee. The audio-visual module 130 also includes a speaker which outputs instructions given by the instructor in audio format. The instructions spoken into a microphone by the operator can be transmitted directly by the microphone, or if the instructions are input by the instructor in any non-audio form using any input device from those listed above, the speaker may output a pre-recorded audio corresponding to the instructions. After the projectile is launched along its trajectory, the control unit 200 is configured to play, through the audio-visual device 130, pre-recorded audio clips to simulate explosion, motion through the air and blast. Additionally, emergency conditions can be simulated during the training sessions to enhance safety consciousness and preparedness of the operator in actual scenario, by employing the audio-visual module 130 to simulate the scenarios.

The control unit 200, with the various possibilities of input devices and methods, coupled with the audio-visual module 130, with its wide range of possible output means, is an effective aid which helps in training the instructor besides helping the operators in decision-making.

The training system 1000 is also provided with a portable stand configured to receive at least a portion of the simulated projectile launching mechanism 100.

The launching tube can be mounted on the portable, extendable stand. According to an embodiment, the portable stand is 360 degree rotatable about a vertical axis. The portable stand is designed to reduce fatigue of the trainees/operators while retaining the operational flexibility in terms of freedom of movement in multiple planes and enhancing situational awareness in terms of orientation and positional information of the object being tracked in any type of terrain.

A radium-coated compass rose is also provided around the portable stand. The radium-coated compass rose can have discrete or markings of angles at an interval of 30deg starting from 0^{o} to 359^{o}. The radium-coated compass rose enhances the situational awareness of the trainees/operators in terms of directional orientation. It can be effectively employed in any featureless terrain in both day and night.

In an embodiment, the training system 1000 comprises a crossover range transceiver 280 configured to facilitate communication between the control unit 200 and an operator station associated with a pair of a trainee and a corresponding instructor.

In another embodiment, the training system 1000 comprises a voice communication module 240 which facilitates transfer of voice signals from the control unit 200 to a voice recorder coupled to the launching system 1000.

In yet another embodiment, the training system 1000 comprises a built-in test equipment 220 which monitors health of the system and displays/records in the form of coding. It works in the wireless means of communication.

In still another embodiment, the training system 1000 comprises an indoor training unit 300. The indoor training unit 300 cooperates with the control unit 200. The indoor training unit

300 comprises a visor-mounted display unit 320, an orientation sensor, a computing and comparator module 340.

In an embodiment, the recorded visuals are stored in various photographic as well as videographic formats. The visor-mounted display unit 320 displays at least one combination of one each of the visuals of the plurality of terrains, the plurality of targets and the plurality of projectile motions and diurnal and weather changes to be experienced by the trainee. The orientation sensor senses three-dimensional orientation of the motion simulator for projectile launching mechanism 100, particularly the orientation of the launching tube, as the motion simulator for projectile launching mechanism 100 is held in hand or on shoulders or as mounted on the portable stand by the trainee. The orientation is measured in terms of angle in horizontal and vertical planes. The computing module 340 computes displacement of a projectile based on the orientation of the simulated launching tube. This displacement is measured in terms of distance travelled, i.e., range, although other parameters of the projectile motion such as initial velocity, time of flight, acceleration, velocity, parabolic trajectory maximum height and so on. The computing module 340 can also be configured to take earth's curvature into account while calculating the range. The comparator 340 is configured to compare the computed displacement by the computing module and displacement corresponding to the plurality of projectile motions stored in the repository 40 to determine the visuals of projectile motion to be displayed, based on the comparison. The control unit 200 is communicatively coupled with the repository 250. The control unit 200 is configured to transmit a combination of visuals of a terrain and a target from the repository 250 to the visor-mounted display unit 320 for displaying as per instructions received from the instructor, and transmit the visuals of the projectile motion from the repository 250 to the visor-mounted display unit 320 stored as determined by the comparator 340. Thus, the visor-mounted display unit 320, in combination with the speakers playing pre-recorded audio clips to simulate explosion, motion through the air and blast, simulate the field conditions such as a variety of terrains, for the trainee to be trained in an indoor training environment. Again, in case of the indoor training unit 300 as well, a trainee receives instructions from an instructor who transmits instructions through the inputs devices configured on the digital control unit 200. The training system 1000 may also be configured to provide a screen projecting real-time simulated projectile motion corresponding to the trainee's actions, to be observed or monitored by the instructor.

In one embodiment, the training system 1000 employs a multisource power supply unit 400. In an embodiment, the power supply unit 400 includes one source or multiple sources of electricity viz. renewable energy such as solar energy, rechargeable batteries (9V and 12 V and similar), online UPS and petrol/diesel generators. All the powered modules and other components of the training system 1000 have been designed to operate in both wired and wireless modes. This provides flexibility for deployment in any kind of terrain and topography and also ensures uninterrupted operations.

The modular construction of the training system 1000 enables integration of different genre of simulators onto a single platform thus optimizing the resources. The training system 1000 comprises various standalone and integrated modules which are easily modifiable to match the specifications of similar equipment as per present or future requirements. These individual modules present in the simulator can be employed for many other purposes with suitable modifications and additions as per the application needs.

TECHNICAL ADVANCEMENTS

The present disclosure described herein above has several technical advantages including, but not limited to, the realization of a projectile launching training system, which:

- facilitates target observation and tracking against real as well as simulated terrains;
- is a real-time simulator;
- is a combination of various types of simulators which are interoperable;
- is reconfigurable to a specific system, as per needs; and
- can be used in both indoor and outdoor configurations.

The embodiments herein and the various features and advantageous details thereof are explained with reference to the non-limiting embodiments in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the embodiments as described herein.

Throughout this specification the word “comprise”, or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

The use of the expression “at least” or “at least one” suggests the use of one or more elements or ingredients or quantities, as the use may be in the embodiment of the disclosure to achieve one or more of the desired objects or results.

Any discussion of documents, acts, materials, devices, articles or the like that has been included in this specification is solely for the purpose of providing a context for the disclosure. It is not to be taken as an admission that any or all of these matters form a part of the prior art base or were common general knowledge in the field relevant to the disclosure as it existed anywhere before the priority date of this application.

The numerical values mentioned for the various physical parameters, dimensions or quantities are only approximations and it is envisaged that the values higher/lower than the numerical values assigned to the parameters, dimensions or quantities fall within the scope of the disclosure, unless there is a statement in the specification specific to the contrary.

While considerable emphasis has been placed herein on the components and component parts of the preferred embodiments, it will be appreciated that many embodiments can be made and that many changes can be made in the preferred embodiments without departing from the principles of the disclosure. These and other changes in the preferred embodiment as well as other embodiments of the disclosure will be apparent to those skilled in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the disclosure and not as a limitation.

CLAIMS:

1. A computer-implemented electro-pneumatic projectile launching training system (1000) configured for training at least one trainee by at least one instructor, where in the system (1000) comprises:

- at least one simulated projectile and at least one target;
- an electro-pneumatically actuated motion simulator for projectile launching mechanism (100);
- a spring disposed in said motion simulator for projectile launching mechanism (100);
- means for compressing said spring and locking said compressed spring in a compressed configuration for holding said projectile inside said simulated projectile launching mechanism (100) in a launch-ready mode;
- a digital control unit (200) operable by an instructor to generate a projectile launching instruction and associated audio-visual and electrical signals;
- a trigger for enabling unlocking of said locked projectile thereby launching the projectile along with the associated audio-visual and blast effects;
- a visor mounted display module (320);
- a provision to connect said visor mounted display module (320) and performance monitoring and report generator module (310) coupled with said digital control unit (200);
- an associated preparation bench or work stand to load, compress and lock said spring along with said simulated projectile;
- an optical sensor unit (30) configured to capture the image of the target and relay it to the digital control unit (200) for processing and analysis;

- a repository (250) configured to cooperate with said digital control unit (200) and said optical sensor unit (30), said repository is configured to store said image and said video; and

- a performance monitoring module (310) configured to analyse said simulated activities and said video input provided through visor mounted display module (330).

2. The training system (1000) as claimed in claim 1, wherein said simulated projectile launching mechanism (310) comprises:

- a launching tube comprising a spring which is configured to be locked by hydraulic and electro-mechanical means for locking, wherein said means for locking acts on said projectile placed inside said launching tube to compress said spring into a locked state; and

- a propulsion mechanism configured to generate a predetermined high pressure to propel said projectile over a predetermined distance, upon pressing said trigger.

3. The training system (1000) as claimed in claim 2, wherein a combination of energy sources, namely, hydraulic, pneumatic, electromechanical, commercial supply and solar energy are employed, wherein a sensor fitted in launching tube, is configured to sense said unlocking of said spring and generate a spring unlocking signal which is transmitted to said control unit (200), said launching tube is configured to receive at least two pneumatic pressure inputs; wherein said pneumatic pressure input at a first location is lower than pneumatic pressure input at a second location until said trigger of said simulated projectile launching mechanism (100) is pressed by the trainee; and wherein,

i. upon pressing of said trigger of said launching tube by the trainee, said spring is unlocked; and

ii. upon receiving said spring unlocking signal, said mechanism is configured to actuate the pneumatic pressure source and release the lock of the projectile besides activating the audio-visual effects associated with the launch of the projectile.

4. The training system (1000) as claimed in claim 3, wherein,

- said motion simulator for projectile launching mechanism (100) comprises:
  - a second sensor, disposed within said launching tube, which is configured to generate a locking signal upon said projectile being locked in said simulated projectile launching mechanism (100); and
  - a sensor, disposed within said launching tube, configured to generate a triggering signal upon pressing said trigger;

wherein all the sensors are communicatively coupled to said performance monitoring module (310), and transmit said locking signal and said triggering signal to said performance monitoring module (310);

- said control unit (200) is communicatively coupled with said simulated projectile launching mechanism (310) and said performance monitoring module (310), wherein said digital control unit (200) is configured to:
  - generate said launching instructions for the trainee upon receiving a command from said instructor; and
  - transmit said launching instructions to said performance monitoring module (310); and

- said electronic sensor is disposed at said motion simulator projectile launching mechanism (100) and is communicatively coupled with said performance monitoring module (310), wherein said sensor unit is configured to:
  - transmit said captured electro-mechanical signal to said performance monitoring module (310).

5. The training system (1000) as claimed in claim 4, wherein said performance monitoring module (310) includes:

- an image and video display/monitoring module (220) configured to analyse said image signal generated by said optical unit (230) and generate an analysed data set, and

- a video monitoring module (220) configured to analyse said video signal generated by said optical unit (230) and generate another analysed data set; and

wherein, said performance monitoring module (310) is configured to generate a report of the performance of the trainee based on said first analysed data set, said second analysed data set, said locking signal and said trigger signal.

6. The training system (1000) as claimed in claim 5, wherein said first analysed data set includes data related to said target which includes real, simulated flying targets and scaled model target mounted on an automated battery operated vehicle.

7. The training system (1000) as claimed in claim 5, wherein said training system (1000) is provided with an audio-visual module (130) configured to cooperate with said performance monitoring module (310), wherein said audio-visual module (130) is configured to output audio and visual signals corresponding to said launching instructions as well as a pre-recorded sound associated with launching of said projectile to simulate launching of said projectile based on said analysed data set, said locking signal and said trigger signal.

8. The training system (1000) as claimed in claim 5, wherein said report includes performance parameters which include time corresponding to locking of said projectile in said motion simulator projectile launching mechanism (100), time corresponding to pressing said trigger and accuracy of the trajectory followed by said projectile towards said target.

9. The training system (1000) as claimed in claim 1, wherein said means for locking said projectile inside said simulated projectile launching mechanism (100) is a hydraulically actuated mechanism.

10. The training system (1000) as claimed in claim 1, wherein said training system (1000) comprises a portable stand configured to receive at least a portion of said motion simulator for projectile launching mechanism (100).

11. The training system (1000) as claimed in claim 10, wherein said portable integrated stand (500) is rotatable about a vertical axis and free to move in elevation besides having provision to adjust the height as per the need of the operator, wherein said stand (500) is meant to reduce the fatigue of the operator during long hours of operations besides enabling the operator to remove the launching tube in shortest possible time in case of an emergency simulation.

12. The training system (1000) as claimed in claim 11, wherein a radium-coated compass rose is configured around said portable stand to facilitate directional orientation throughout the day.

13. The training system (1000) as claimed in claim 1, wherein said training system (1000) comprises a crossover range trans-receiver (280) configured to facilitate communication between said control unit (200) and an operator station associated with a pair of a trainee and a corresponding instructor. This said crossover range trans-receiver (240) has the provision to work on standalone power supply (400).

14. The training system (1000) as claimed in claim 1, wherein said training system (1000) comprises a voice communication module (240) which facilitates transfer of voice signals from said instructor through the digital control unit to the headphone used by the trainee.

15. The training system (1000) as claimed in claim 1, wherein said system comprises a built-in test equipment (220) which monitors health of various components of said training system (1000).

16. The training system (1000) as claimed in claim 1, wherein said training system (1000) comprises an portable indoor training unit (300) configured to cooperate with said motion simulator projectile launching mechanism (100) and said repository (250), wherein said repository (250) is configured to store visuals of a plurality of terrains, a plurality of targets and a plurality of projectile motions, wherein said indoor training unit (300) comprises:

- a visor-mounted display unit (320) for displaying at least one combination of one each of said visuals plurality of terrains, said plurality of targets and said plurality of projectile motions, to be viewed by said trainee;

- an orientation sensor for sensing three-dimensional orientation of said motion simulator for projectile launching mechanism (100);

- a computing module (340) configured to compute displacement of said projectile based on said orientation of said simulated projectile launching mechanism (340); and

- a comparator (340) configured to compare the computed displacement by said computing module (340) and displacement corresponding to said plurality of projectile motions stored in said repository (250) to determine the visuals of projectile motion to be displayed, based on said comparison;

wherein said performance monitoring and report generator unit (310) is communicatively coupled with said repository (250), and said visor mounted display unit (320) is configured to:

- transmit a combination of visuals of a terrain and a target from said repository (250) to be viewed through the said visor-mounted display unit (320) for displaying as per instructions received from said instructor; and

- transmit the visuals of the projectile motion from said repository (250) to said visor-mounted display unit (320) stored as determined by said comparator (340).

- the said performance monitoring and report generator module (310) works in conjunction with the said digital control unit (200), built in test equipment (220), standalone and integrated optical tracking module (230) to record, analyse and generate a report to view or to print out, as required.

- said performance monitoring and report generator module (310) along with the said repository (250) stores and combines data related to the performance of the trainees in any programmed format.

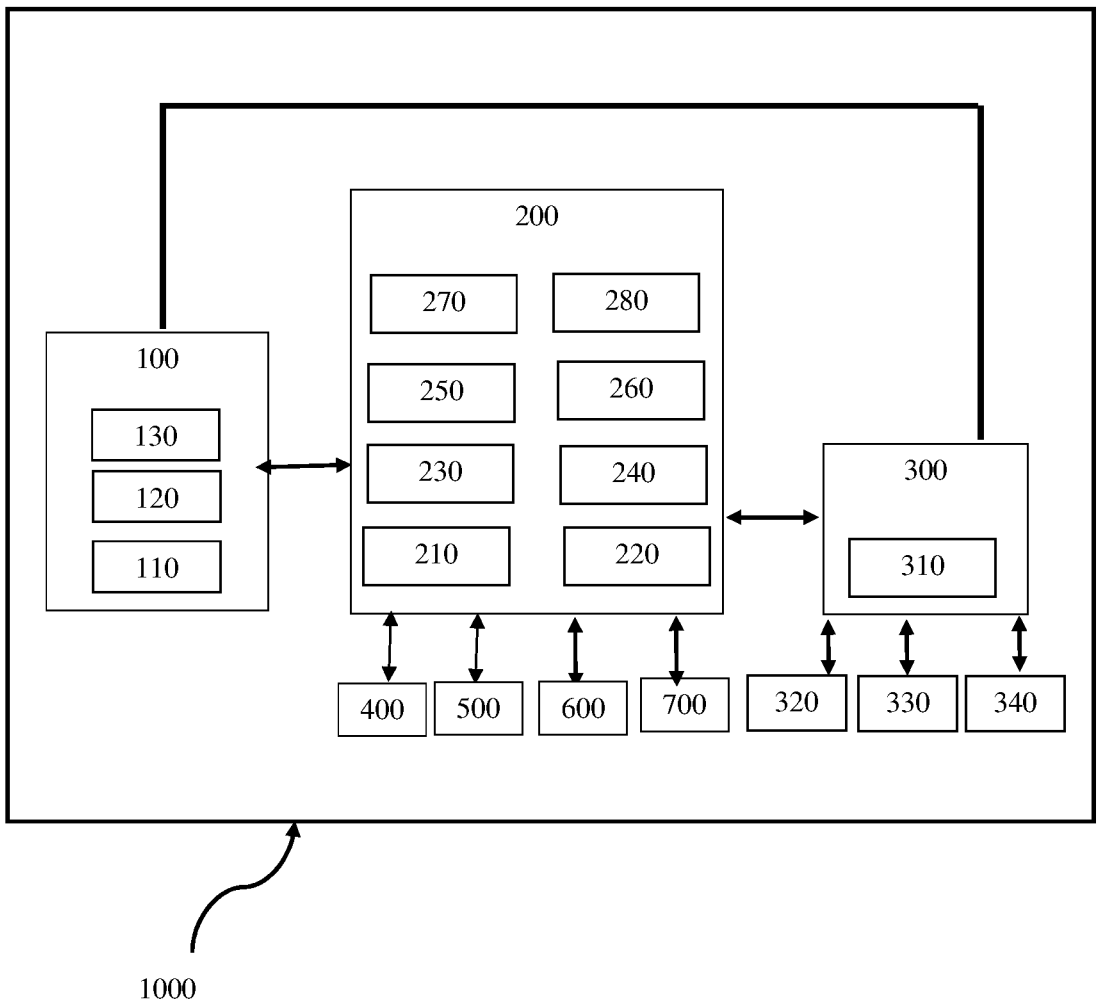
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FIGURE 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/055242

A. CLASSIFICATION OF SUBJECT MATTER
G09B9/00,F41G7/00 Version=2018.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G09B, F41G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DATABASES:- IPO INTERNAL, TOTAL PATENT ONE
KEYWORDS:- PNEUMATIC, PROJECTILE, LAUNCH, SIMULATE, CONTROL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US20170122705 A1 (ISRAEL AEROSPACE IND LTD[IL]) 04 May 2017 (04-05-2017) FIGURE 2A; PARAGRAPHS [0049], [0060], [0062], [0067]-[0069], [0079]	1-16
Y	US20140196267 A1 (TIBERIUS, Benjamin T. et al.) 17 July 2014 (17-07-2014) PARAGRAPHS [0007], [0009], [0046], [0054]; FIGURES 1-3	1-16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28-09-2018	28-09-2018

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2018/055242

Citation	Pub.Date	Family	Pub.Date
US 20170122705 A1	04-05-2017	WO 2009116038 A2	24-09-2009
		WO 2009116038 A3	29-12-2010
		EP 2288865 A2	02-03-2011
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US 20140196267 A1	17-07-2014	US 9719747 B2	01-08-2017