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(54) SYSTEM AND METHOD OF SIMULATING FIRING OF IMMOBILIZATION WEAPONS

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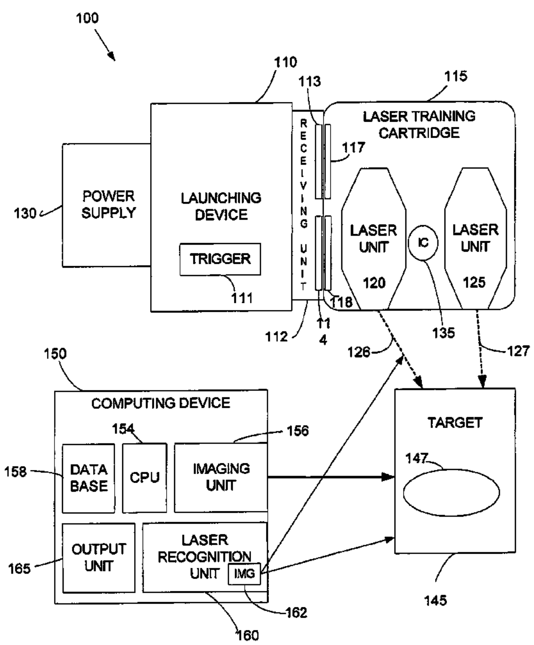
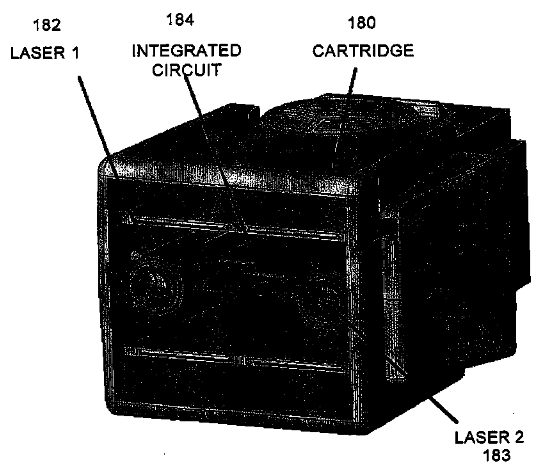
(57) **ABSTRACT**

A system, apparatus and method may simulate the operation of a demobilization instrument such as a taser, using, for example, a taser launching device with a cartridge to enable generation and firing of a plurality of simulated projectile probes. A plurality of laser events may be emitted at a simulated target. The events may be validated as valid laser pulses, the simulated projectile probe strike locations and identities may be determined, and an automated reaction may be generated. A laser system may be contained in a cartridge separable from a taser launching device or other holder.



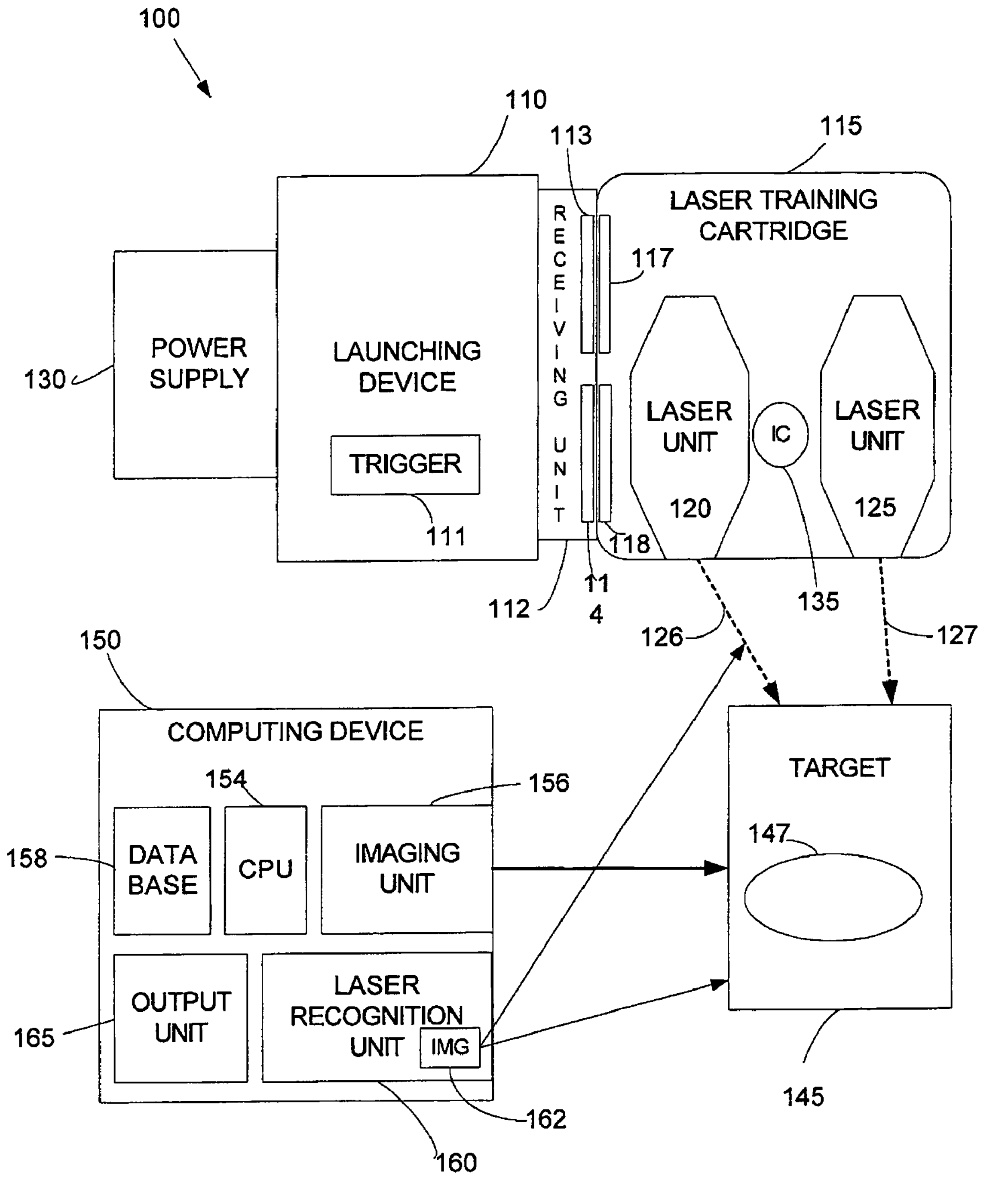

100
110
113
115
LASER TRAINING CARTRIDGE
117
POWER SUPPLY
130
LAUNCHING DEVICE
TRIGGER
111
RECEIVING UNIT
LASER UNIT 120
IC
LASER UNIT 125
118
112
114
135
126
127
150
COMPUTING DEVICE
154
156
158
DATA BASE
CPU
IMAGING UNIT
TARGET
147
165
OUTPUT UNIT
LASER RECOGNITION UNIT
IMG
162
160
145

FIG. 1A

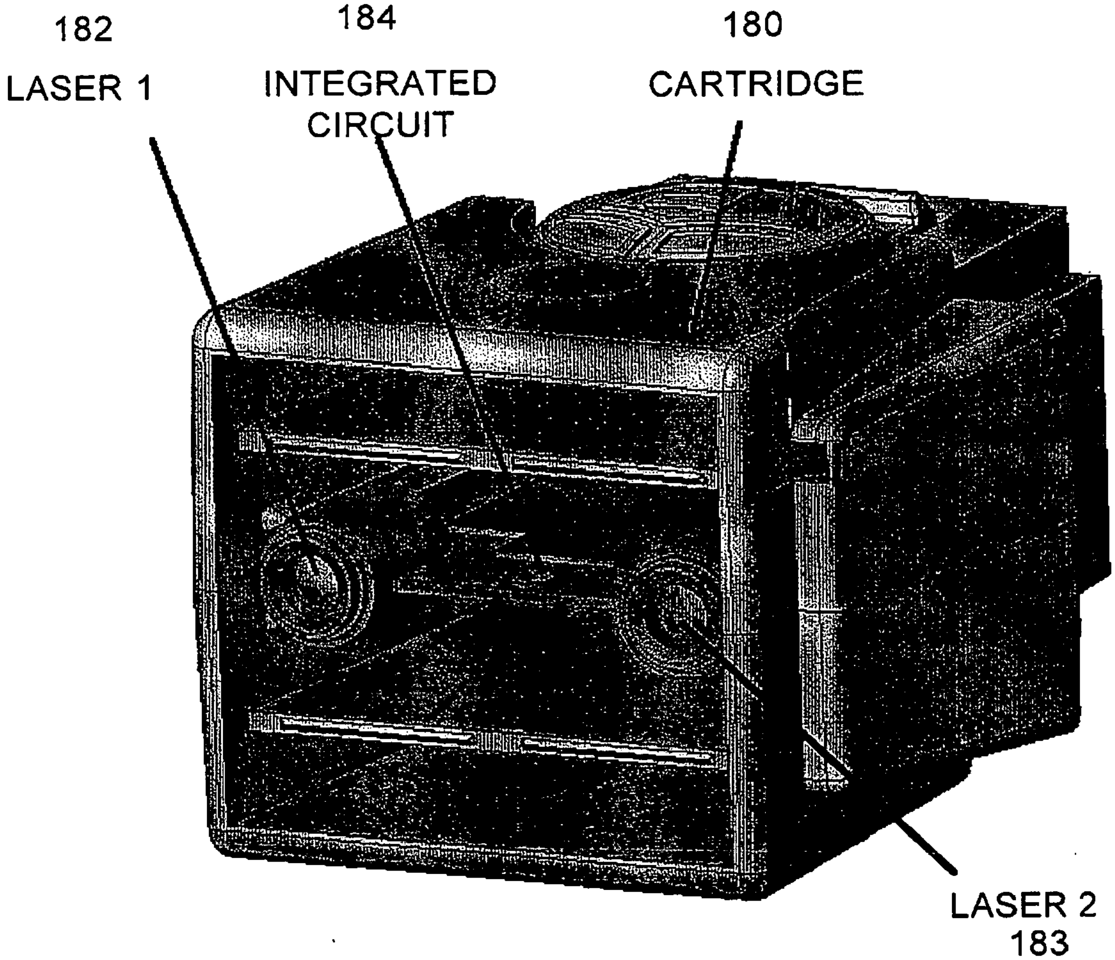

182
LASER 1
184
INTEGRATED CIRCUIT
180
CARTRIDGE
LASER 2
183

FIG. 1B

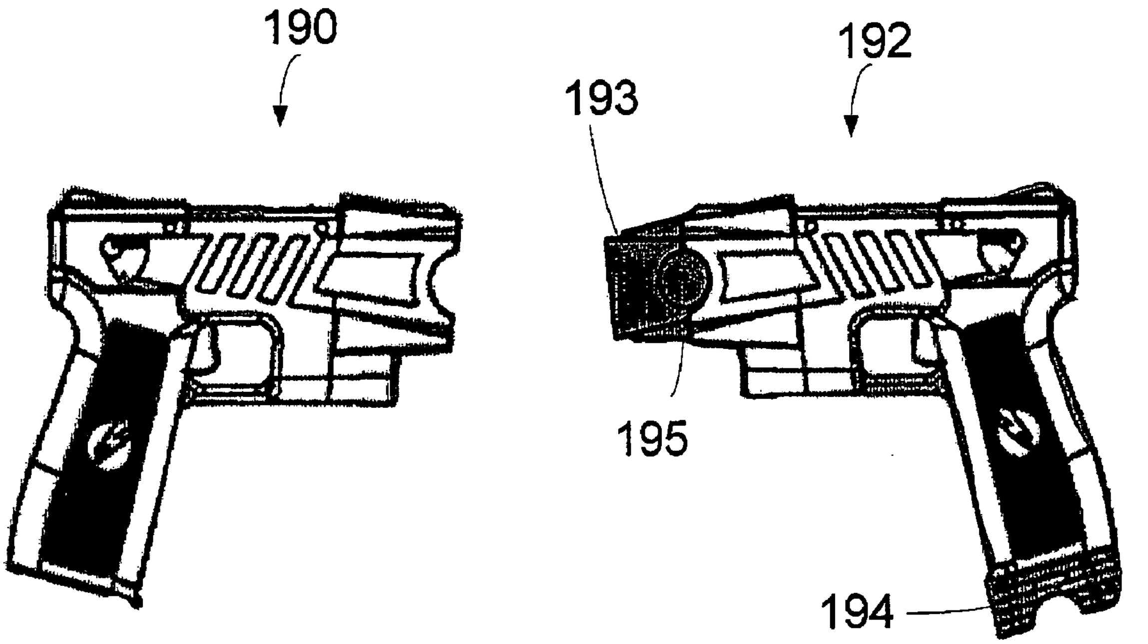



FIG. 1C

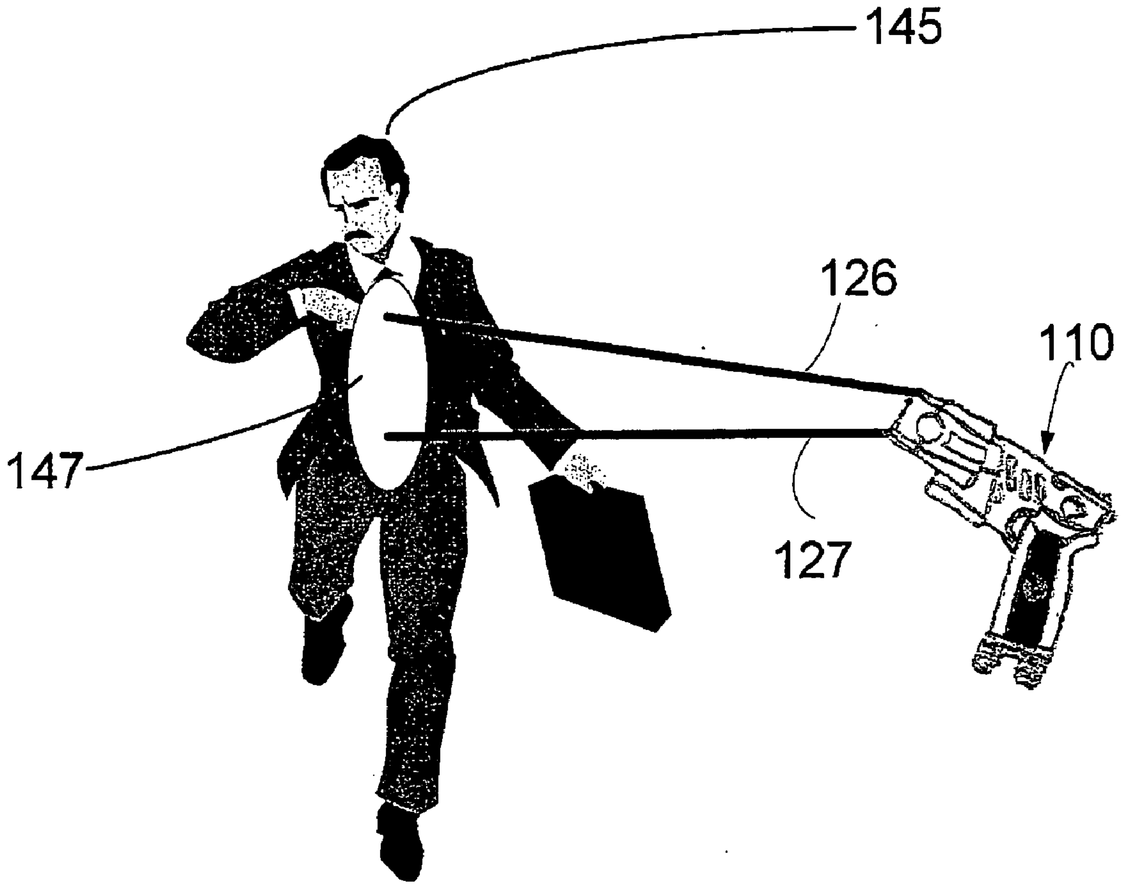



FIG. 1D

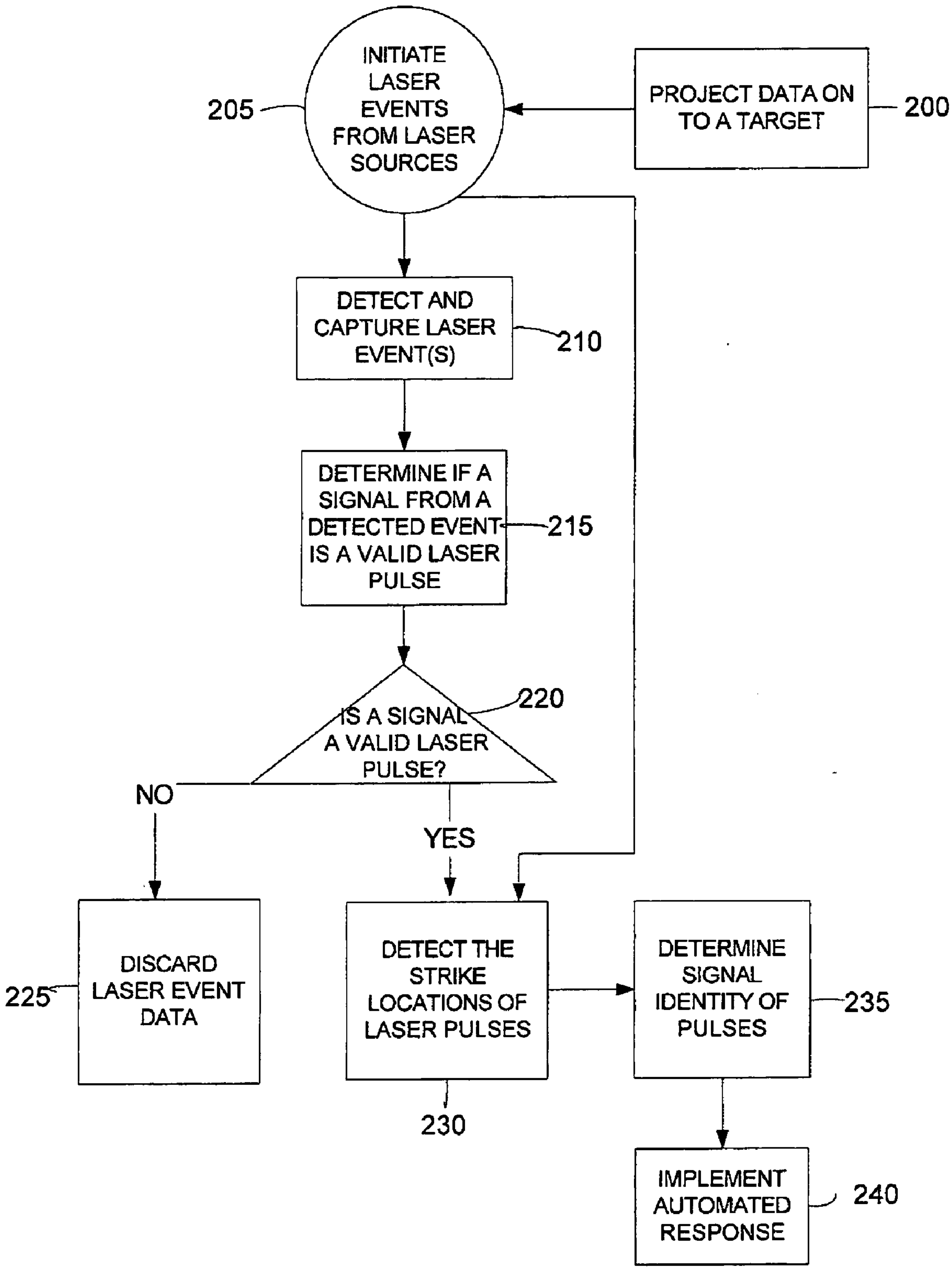

INITIATE LASER EVENTS FROM LASER SOURCES
205
PROJECT DATA ON TO A TARGET
200
DETECT AND CAPTURE LASER EVENT(S)
210
DETERMINE IF A SIGNAL FROM A DETECTED EVENT IS A VALID LASER PULSE
215
IS A SIGNAL A VALID LASER PULSE?
220
NO
YES
DISCARD LASER EVENT DATA
225
DETECT THE STRIKE LOCATIONS OF LASER PULSES
230
DETERMINE SIGNAL IDENTITY OF PULSES
235
IMPLEMENT AUTOMATED RESPONSE
240

FIG. 2

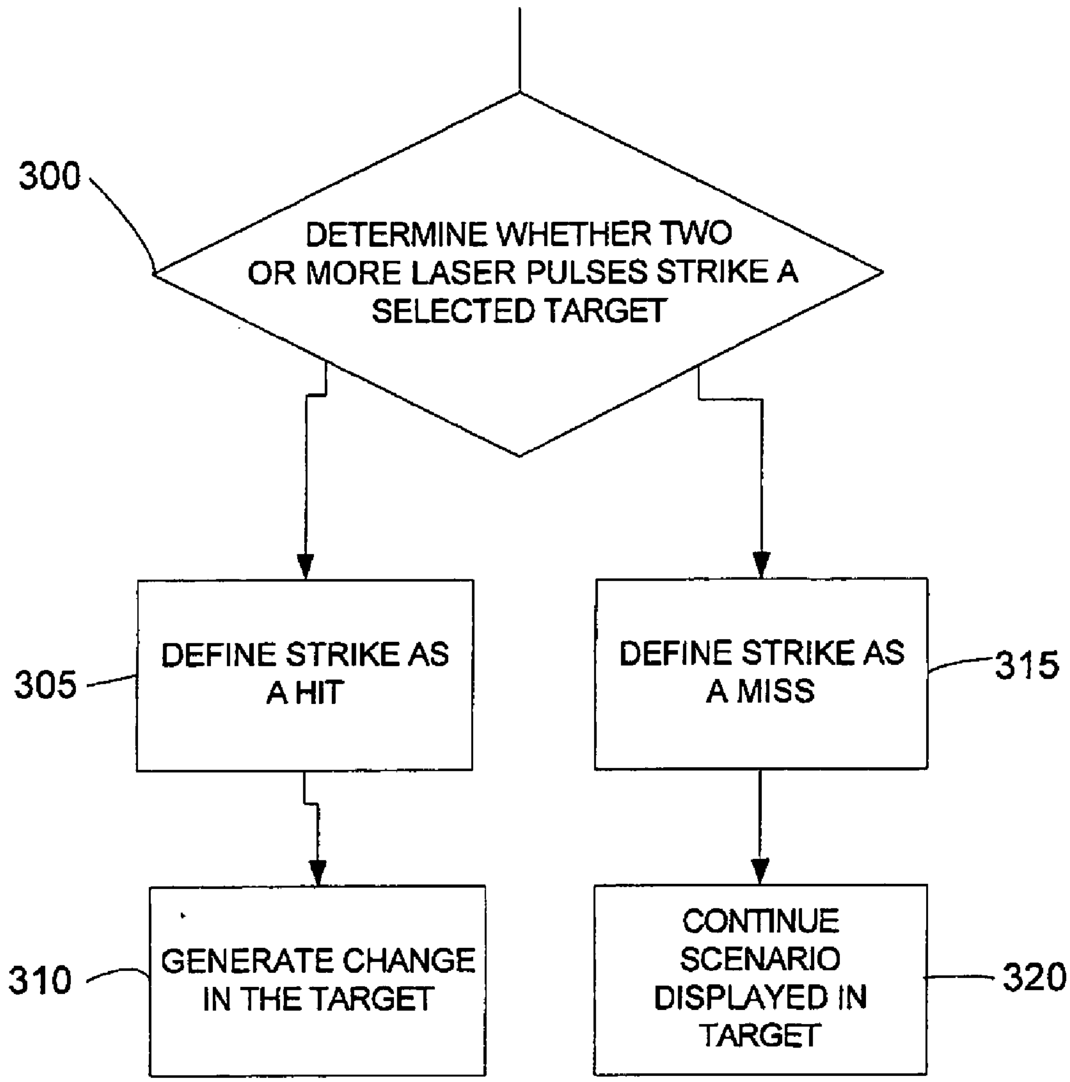

300
DETERMINE WHETHER TWO OR MORE LASER PULSES STRIKE A SELECTED TARGET
305
DEFINE STRIKE AS A HIT
315
DEFINE STRIKE AS A MISS
310
GENERATE CHANGE IN THE TARGET
CONTINUE SCENARIO DISPLAYED IN TARGET
320

FIG. 3

## SYSTEM AND METHOD OF SIMULATING FIRING OF IMMOBILIZATION WEAPONS

### FIELD OF THE INVENTION

[0001] The present invention relates to methods and devices useful in simulation training. Specifically, embodiments of the present invention relate to systems, methods, and apparatuses to enable simulating usage of immobilization weapons.

### BACKGROUND OF THE INVENTION

[0002] TASER® is the trademark for currently manufactured ballistic weapons which output electrical power pulses to immobilize humans and animals and which have a lower lethality than conventional fireamms. A taser, for example, may employ a pair of projectile probes or darts having tips designed to penetrate clothing or animal flesh, such as human flesh. In operation, a taser launching device may propel the tips at a fleeing or aggressive target, for example, with the hope that the tips embed in the flesh or clothing of the target. If the tips do embed in the flesh of the target, wires, which may be connected between the tips and the taser launching device itself, may be used to deliver a high-energy electrical shock through the tips to the target, thereby completing an electrical circuit between the tips of the probes, and delivering an electrical shock to the target.

[0003] Once the taser has been fired, it generally may not be easily reloaded and fired a second time, due to the wires connecting the taser and tips, and other physical limitations of heretofore known tasers. Such wires may further limit the range and velocity of the tips and thereby limit the utility of the taser to the length of the wires and the speed with which the wires can be deployed. Various types of taser cartridges have been designed to reload a taser after firing, thereby providing additional rounds for firing. A cartridge, however, may take time to load into the taser, and may be expensive to produce and acquire. For example, when training with tasers, multiple usages or shots of taser weapons may be required, possibly entailing prohibitive costs and much time for reloading.

[0004] It would be highly advantageous to have a taser training system providing relatively cost effective and user-friendly operational ability. It would be highly advantageous to have a taser cartridge that may be used for training on taser weapons.

### SUMMARY OF THE INVENTION

[0005] There is provided, in accordance with an embodiment of the present invention, an apparatus, system, and method for simulating operation of a demobilization instrument. According to some embodiments of the present invention, a launching device may be provided with a cartridge, which may be adapted to simulate firing a plurality of projectile probes from the launching device. The probes may be simulated using, for example, two or more lasers or other suitable electromagnetic radiation sources. The laser pulses may be detected by suitable detection equipment. The cartridge or other holding unit may include a computing device or a controller such as an integrated circuit and may be adapted to enable simultaneous or non-simultaneous firing from a plurality of laser units, for example, using time based laser operation and/or coded pulse laser operation. The launching device may include a power supply, which may provide power to the cartridge. A taser simulation system may include a target, which may be a projection screen. The taser simulation system may include a computing device, which may include a projection unit to project target images or video data, and a recognition module to detect the striking of a plurality of laser pulses on a target.

[0006] According to some embodiments of the present invention, a method is provided to simulate weapon firing, including emitting a plurality of laser events towards a target, the laser events being generated by a plurality of laser units located within a taser cartridge. The method may include detecting and capturing the laser events. The method may further include determining if signals from detected laser events are valid laser pulses, and if they are, detecting the strike locations of the laser pulses and/or determining the identity of the laser pulses. The method may further include implementing an automated reaction to a selected scenario.

[0007] Moreover, in accordance with an embodiment of the present invention, the method may be implemented using simultaneous or non-simultaneous firing of a plurality of laser units, for example, using time based laser operation and/or coded pulse laser operation.

[0008] According to some embodiments of the present invention a method may be provided to enable interactive taser simulation or other immobilization device training, for example, by projecting an image or other data such as multimedia data, including a selected target region on a target, detecting the striking of the target by a plurality of laser pulses, the laser pulses being generated by a cartridge associated with an immobilization apparatus, and determining whether the plurality of pulses strike the selected target region. If a plurality of pulses strike a selected target region, the laser firing may be defined as a hit. In one embodiment, an automated response associated with the pulses striking the target may be generated.

[0009] According to an embodiment of the present invention, a taser simulation apparatus may include an imaging unit, a data recognition unit, and a controller to receive indications from the data recognition unit of laser pulse receptions and to determine if a plurality of laser pulse receptions occur within a target area projected by the imaging unit. The controller may display interactive data on a target, and may generate an automated response associated with laser pulse receptions.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The principles and operation of the system, apparatus, and method according to the present invention may be better understood with reference to the drawings, and the following description, it being understood that these drawings are given for illustrative purposes only and are not meant to be limiting, wherein:

[0011] FIG. 1A is a schematic illustration of a non-lethal weapons simulation system, according to some embodiments of the present invention;

[0012] FIG. 1B is a graphic illustration of an example of a laser-based taser cartridge, according to an embodiment of the present invention;

[0013] FIG. 1C is a graphic illustration of an example of a taser launching device with and without a laser-based taser cartridge, according to an embodiment of the present invention;

[0014] FIG. 1D is a graphic illustration of an example of a successful strike of a target using a laser-based taser system, according to an embodiment of the present invention;

[0015] FIG. 2 is a flowchart illustrating a method for simulating usage of non-lethal weapons, according to some embodiments of the present invention; and

[0016] FIG. 3 is a flowchart illustrating an aspect of the method for simulating usage of non-lethal weapons illustrated in FIG. 2, according to some embodiments of the present invention.

[0017] It will be appreciated that for simplicity and clarity of illustration, elements shown in the drawings have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the drawings to indicate corresponding or analogous elements throughout the serial views.

## DETAILED DESCRIPTION OF THE INVENTION

[0018] The following description is presented to enable one of ordinary skill in the art to make and use the invention as provided in the context of a particular application and its requirements. Various modifications to the described embodiments will be apparent to those with skill in the art, and the general principles defined herein may be applied to other embodiments. Therefore, the present invention is not intended to be limited to the particular embodiments shown and described, but is to be accorded the widest scope consistent with the principles and novel features herein disclosed. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

[0019] The word "taser" as used herein may encompass various types of non-lethal weapons, including stun weapons, Electro-Muscular Disruption (EMD) weapons and any other suitable non-lethal electronic immobilization devices, instruments and weapons. Embodiments of the present invention need not be restricted to taser weapon simulation, but may include other types of immobilization weapons.

[0020] Embodiments of the present invention may enable interactive simulation training using immobilization instruments, for example, a taser device may be equipped with laser based non-tethered training cartridge that may enable simulation of taser probes using, for example, a plurality of laser units or other suitable electromagnetic radiation sources. Such embodiments may help in providing, for example, re-usable, cost efficient, and fast loading immobilization training devices; however systems and methods in accordance with embodiments of the invention may provide different or other benefits.

[0021] Reference is now made to FIG. 1, which is a schematic block diagram illustration of an embodiment of the present invention. As can be seen in FIG. 1, a taser simulation system **100** may include a launching device **110**, which may be a conventional taser launching device or a simulation of such a device, for example, an immobilization weapon, or a modified taser launching device for simulation purposes. When used herein, a simulated immobilization weapon or device may include, for example, a conventional taser or immobilization device which may accept a training cartridge or which is modified, or another suitable device. A simulated immobilization weapon or device need not use a separate cartridge. Launching device **110** need not be a conventional taser or other system, but instead may be configured specifically for a certain use, for example a holder for holding a laser system. Launching device **110** may be, for example, in the shape of a gun or other weapon, and upon firing of a trigger or other firing button **111**, the simulation system may be initiated. Launching device **110** may have a power supply **130**, which may be, for example, a battery pack providing high power electric current to system **100**. Launching device **110** may have a receiving unit **112** for receiving, for example, a firing cartridge or a training cartridge. Receiving unit **112** may include a receptacle or other unit including, for example, locking or holding mechanisms **113**, and/or electrical or electronic connection mechanisms **114**, for physically connecting the firing cartridge to launching device **110**. Launching device **110** may be, for example, a conventional immobilization weapon, for example, a taser, gun, mace, stick, rifle etc., or may be a modified immobilization weapon, for example, for training purposes. Launching device may be a conventional immobilization weapon and/or may also be used as an interactive training simulator. In another embodiment, a separate cartridge need not be used; for example, a set of lasers may be integral with a firing device.

[0022] System **100** may include a taser cartridge, which may be, for example, a laser-based training cartridge **115**. Training cartridge **115** may include two or more laser units **120** and **125**, and a controller such as an integrated circuit **135**. Laser units **120** and **125** may include, for example, laser diodes housed in a collimator. For example, a 785 nM laser with a maximum 5 mW output may be used. In alternate embodiments, other suitable laser types may be used. In some embodiments infrared lasers may be used, or other suitable electromagnetic energy producing devices. Laser units **120** and **125** may be provided, for example, to simulate two or more conventional projectiles, for example two laser pulses or beams **126**, **127** may be provided to simulate the flight paths of two or more probes (e.g., darts) released by an immobilization weapon. Laser units **120** and **125** may enable transmission of data to a target. For example, data transmitted may include the identity of the laser devices being used, or other suitable data that may encoded or otherwise integrated into the pulse of the laser being fired. Laser units **120** and **125** may be located within cartridge **115** such that the angle of the laser beams **126**, **127** and/or data emitted by laser units **120** and **125** simulates the probes emitted by a conventional taser gun; e.g., they may spread at an 8-degree angle within the same plane. Other suitable angles and simulated flight paths may be used. Other suitable numbers of lasers, other than two, may be used. Training cartridge **115** may include training cartridge physical connections **117** and/or electrical connections **118**, which may electrically and/or physically connect to receiving unit **112**. Receiving unit **112** may include suitable mechanical locking or holding mechanisms **113** and/or electrical connection mechanisms **114**. Connections **117** may be, for example, springs or other suitable connecting mechanisms.

[0023] A controlling or computing device such as an integrated circuit **135** may activate pre-selected functions in cartridge **115** when power or a certain signal is applied to it.

Integrated circuit **135** may, for example, enable simultaneous operation of two or more lasers in a time based (pulse length) laser operation and/or in a coded pulse laser operation. Integrated circuit **135** may, for example, enable non-simultaneous or relative delayed operation of each laser in a time based (pulse length) laser operation and/or in a coded pulse laser operation. An example of a time-based firing operation may include firing a plurality of laser pulses, each for a pre-defined time interval, e.g., 50 ms. An example of a coded pulse firing operation may include a firing pattern that, for example, turns each fired pulse off and on a plurality of times to achieve a required effect, e.g., to make the pulse viewable when it strikes a target. For example, circuit **135** may enable emission of a modulated (e.g., 50% duty cycle) non-coded pulse, for example, for 16 ms, and, for example, approximately 100 ms later, circuit **135** may activate a second laser emission in a similar fashion. Other pulses and combinations of pulses may be emitted. Circuit **135** may include, for example, a processing module, for example, a CPU or any other suitable data processing mechanism, and a memory unit, to store system data, user data, executable instructions, and other suitable data. For example, circuit **135** may include executable code to enable laser units **120** and **125** in cartridge **115** to fire laser pulses **126**, **127** simultaneously or non-simultaneously. Additionally, circuit **135** may enable time based (pulse length) and/or pulse coded laser operation for both simultaneous and non-simultaneous laser firing.

**[0024]** Training cartridge **115** may be powered by, for example, a standard DC power supply (e.g., a battery and/or battery array). Other suitable power supplies may be used. Training cartridge **115** may enable "non-tethered" operation, wherein no external cabling or other external wiring may be required to power or operate circuit **18** or lasers **150**. Circuit **135** may not require power to maintain circuit programming and therefore circuit **135** may be considered non-volatile. Circuit **135** may be located in cartridge **115**, external to cartridge **115**, for example, in launching device **110**, or other suitable locations. While in one embodiment a number of lasers may be placed in a cartridge which may be separate from and removable from a launching device, in another embodiment a launching device may include a number of lasers without including a removable cartridge.

**[0025]** Cartridge **115** may be designed to fit onto or into, or to connect with, a conventional immobilization weapon and/or a modified immobilization weapon in a substantially similar manner as a conventional immobilization cartridge fits onto a conventional immobilization weapon. Training cartridge **115** may be substantially similar in dimensions to a conventional immobilization cartridge. Of course, other structures and dimensions may be used.

**[0026]** Reference is now made to FIG. **1**B, which is a graphic illustration of an example of a laser-based taser cartridge, according to an embodiment of the present invention. Training cartridge **180** may be constructed from thermoplastic resins, for example, polypropylene or other suitable materials. Training cartridge **180** may include two or more laser units **182** and **183**, and a controller such as an integrated circuit **184**. Training cartridge **180** may include physical connections, for example wing type mechanism **117** and/or electrical connections (not seen in the figure), which may electrically and/or physically connect training cartridge **180** to receiving unit **112**. training cartridge **180**, laser units **182** and **183**, integrated circuit **184** and connection mechanism **117** may be of alternative shapes or types. Further other numbers and combinations of components may be used. Reference is now made to FIG. **1**C, which is a graphic illustration of examples of taser launching devices, according to an embodiment of the present invention. As can be seen in FIG. **1**C, taser firing apparatus **190** may be a standard taser firing apparatus. Taser firing apparatus **192** may have a laser-based cartridge loaded into it, as is indicated by the shaded area **193**. Taser firing apparatus **192** may have a power source, for example battery pack **194**, fitted, for example, into the butt of the firing apparatus **192**. Taser firing apparatus **192** may have a connection mechanism, for example, a clip on mechanism **195** to enable cartridge **193** to connect to taser firing apparatus **192**. According to the example illustrated the dimensions of the launching device may be increased to facilitate the cartridge. Other shapes or forms of launching devices and/or cartridges may be used.

**[0027]** System **100** may create or include a target **145**, which may include, for example, a target region **147** (e.g., an oval or other area of a target). For example, region **147** may an image of a person, or may be an area within an image of a person where a hit and electrical connection may be made using a genuine taser system. Target **145** may for example be a projection screen or other suitable monitor or display apparatus that may display a still or moving image and optionally other data such as multimedia data. Target **145** may enable marking and/or reflecting of laser events, for example, laser pulses **126**, **127**, hitting the target. Target **145** data, for example, graphic or video data, may be stored in a database **158** in computing device **150**. Targets and target regions may be referred to herein as simulated targets, since the images or data they contain may not necessarily be physical objects. For example, simulated targets may be selected from a predetermined set of still or moving images, for example, a person's body, a vehicle, an animal, a weapon, a structure, or any other suitable target. An image may be projected or otherwise displayed by an imaging unit **156**, which may include, for example, an image or video projector. In one embodiment the simulated target may be displayed in an aiming screen, for example, in a screen provided by a laser sight mechanism. Systems for projecting targets on a screen (e.g., a video screen, etc.) and for accepting user data (e.g., firearms firing data) from, for example, simulated weapons, such as simulated firearms (e.g., handguns, rifles, etc.) in an entertainment system, are known.

**[0028]** System **100** may include a laser recognition unit **160**, to enable detection of two or more laser events from laser units **120** and **125**, and/or detection of strikes of two or more laser pulses **126**, **127** on target **145**. Laser recognition unit **160** may include, for example, an electromagnetic radiation recognition unit. For example, laser recognition unit **160** may include one or more optical recognition devices or imagers **162** (e.g., a CMOS imager, Charge Coupled Device (CCD), a video or other camera, an array of light detector systems), an infrared detector, or any other suitable electromagnetic radiation detection mechanisms. Laser recognition unit **160** may, for example, digitize or otherwise process signals captured by an imager from two or more laser events generated by laser units **120** and **125**. Laser recognition unit **160** may format and deliver the signal(s) to a processing unit or CPU **154**.

[0029] CPU **154** may include, for example, strike simulation software, which may include executable code for providing simulated targets, implementing light pattern analysis, displaying laser event data, enabling interaction with simulated targets, and to implement other suitable functions. CPU **154** may enable execution of a signal algorithm, for example, to determine if a laser event meets minimum criteria to be considered a laser pulse, and in addition, to be identified as a laser pulse from a certain simulation device or a certain type of simulation device. The laser event may be defined as being a "valid laser pulse" or "noise" etc. Detection of laser events may be implemented and evaluated using known laser detection algorithms. The strike simulation software may enable detecting mechanisms and processing capabilities for multiple-laser events or laser pulses.

[0030] CPU **154** may operate executable code and/or other suitable software to enable, for example, pulse identification, strike location identification, and automated responses to selected scenarios, according to embodiments of the present invention. Each laser pulse fired from cartridge **115** may be identified according to the pulse timing, type, strike location, and/or other suitable characteristics. For example, laser unit **120** may be configured to fire a laser pulse for a selected interval of time (e.g., 16 ms, 58 ms, 96 ms, 120 ms and/or other suitable time intervals) that may correspond to a time length or a portion of a time length of a video field (e.g., half a frame). Such a pulse may be able to be detected, for example, by imager **162**, and such a pulse may be defined according to its length. According to one embodiment of the present invention, modulated pulses may be detected, for example, by a light signal recognition unit and/or an infrared sensor, to detect the laser pulses fired and/or the data included within the firing of the laser pulses.

[0031] For example, a pulse may be identified as "lane X", where "X" is a number representing the type of laser event. For example, in a taser simulation system where laser pulse types that may be generated include simultaneous time-based pulses, simultaneous pulse-coded, pulses, non-simultaneous time-based pulses, and non-simultaneous pulse-coded pulses, each pulse type may be identified by a lane number (e.g., lane **1-4**). Additionally or alternatively, CPU **154** may, for example, determine the identity of a laser pulse based on the length of a pulse as recorded in for example a video frame or by another detection method. For example, the pulse length may be based on the number of consecutive video frames during which the pulse lasts (e.g., a video frame may last for 1/30 seconds, and the pulse length may be determined from the number of video frames required to record the pulse).

[0032] CPU **154** may execute a location identification algorithm to determine X and Y or other coordinates of the strikes of the laser pulse(s) on target **145**. The location identification algorithm may, for example, process strike data recorded by imager **162**, and compute the strike data for each pulse that strikes target **145**.

[0033] CPU **154** may execute a decision algorithm, for example, to determine if the identity and location data collectively meet pre-selected criteria to initiate automated responses to selected scenarios. For example, interactive training may be enabled by playing a video or otherwise projecting a series of images on a projection screen. The video or image stream may provide multiple possible outcomes depending on the user interaction, e.g., if the user strikes a selected target the training session may be accordingly altered. For example, if a laser event is to result in an automated response, an example of such a response may be for computing device **150** to change the image displayed in the target. For example, a displayed object may react to the firing of the immobilization weapon, by moving, firing, falling, etc. For example, a function may be enabled to "watch" for simulated taser events. According to such a function, if a first pulse meets some portion of these criteria, then the first pulse may be stored until either another pulse or set of pulses occurs which meet the remainder of the criteria, thereby initiating such a special option, or until a timeout occurs. In either case system **100** may react to the laser pulse(s) according to, for example, user situation definitions, reaction criteria, and possible outcomes etc. Other criteria for initiating system functions may be defined, and other functions may be included.

[0034] Laser recognition unit **160** may detect two or more laser pulses, for example, pulses **126**, **127**, emitted or fired from cartridge **115** when the pulses strike a target **145**. Laser recognition unit **160** may enable detection of firing accuracy, for example, by measuring light reflections, and by recording the precise location of a strike on the target. Laser recognition unit **160** may be an infrared detector. Data received by laser recognition unit **160** may be transferred to computing device **150** for data processing, and may enable identification of, for example, user strike accuracy, user strike rate, user strike statistics, etc., using techniques as are known in the art of light signal detection.

[0035] For example, an image may be projected on a target **145**, for example an image of a human target. The image may be, for example, a video frame of a person, or an outline of a person, or another suitable target. Computing device **150** may determine if a "hit" is achieved whereby, if a real taser were being used, the target would be successfully hit. Such a hit, for example, may require both or all of the emitted laser pulses to strike the target or a certain portion of the target, so as to complete the electric circuit and cause the target to be immobilized. An example of a hit being attained using an interactive image may be seen with reference to FIG. 1D. Taser aiming apparatus **110** may fire laser pulses, for example, pulses **126** and **127** at target **145**. A target region **147** may be defined wherein two or more laser pulses **126**, **127** must strike to define the strike as a successful strike.

[0036] Computing device **150** may be or include a personal computer, mobile computer, processing module etc. Computing device **150** may include an output device **165**, for example, a monitor or any other suitable output device, to output processed simulation data. Computing device **150** may have instructions, for example in the memory unit, to process system data, user data, simulation training data, and any other suitable data.

[0037] According to some embodiments of the present invention, training cartridge **115** or other parts of system **100** may be colored or otherwise marked, for example, in a color distinguished for training cartridges, or may be otherwise distinguishable from conventional cartridges. In this way training cartridge **115** may be noticeable to a user as being for training purposes only, or as being not for immobilization purposes. Training cartridge **115** may be removable and replaceable, and may be permanently fixed to taser simulation system **100** or temporarily fixed to taser simulation system **100**. For example, training cartridge **115** may enable multiple firing rounds, yet may limit firing to one round at a time, with further rounds being permitted after cartridge removal and replacement, or after, for example, supervisor permission is granted. Other patterns of usage of training cartridge **115** may be used.

**[0038]** Lasers **150** and circuit **18** may be mounted in the training cartridge in such a way that the paths and targets of lasers **150** are substantially consistent with the paths and targets of conventional projectile probes of conventional immobilization cartridges that launching device **110** may fire. For example, the laser units may be located within cartridge **115** so as to simulate the probes emitted by a conventional taser gun; e.g., they may spread at an 8-degree angle within the same plane. Other suitable angles and configurations may be used. Training cartridge **115** may be powered through the use of the pre-existing contacts of a conventional simulated immobilization weapon in a substantially similar same manner that a conventional immobilization cartridge is powered by a conventional immobilization weapon. In such embodiments, no additional cabling or other external wiring may be required to power or operate training cartridge **115** or taser simulation system **100**. Taser training cartridge **115** may be operated two or more times, thereby enabling multiple firing of taser simulation system **100**. Furthermore, taser training cartridge **115** may be reused after power supply has been depleted, by replacing or recharging power supply **130**, thereby enabling further usage of taser training cartridge **115**.

**[0039]** Any other suitable implementations of the above-described components and associated software may be used. Furthermore, any desirable combination of hardware and/or software may be used for any of system **100** components. Of course, other structures and dimensions may be used.

**[0040]** FIG. **2** schematically illustrates a series of operations or processes that may be implemented by taser simulation system **100** to simulate, for example, firing of projectile probes by a taser immobilization weapon. As can be seen in FIG. **2**, at block **200** data (e.g., an image, video stream etc.) may be projected or displayed on a target (e.g., a display apparatus); the target may include a selected region or area for preferred striking. For example, a picture of a person with a background (e.g., a street scene) may be projected. The selected target region or area may be defined as the region that needs to be struck or hit by two or more laser pulses, for example, a person. A “successful” or “effective” shot maybe determined when two or more laser pulses, strike the selected target area. The selected target region or area may be defined as only part of a target, for example, a region within the torso of a person, if another definition of success is desired, or greater levels of accuracy are required. Other targets, target regions, and images, may be used. The target images or multimedia data etc. may be displayed using known display apparatuses, such as projection systems, monitors, or other suitable display systems.

**[0041]** At block **205** laser events may be initiated by two or more laser units. For example, two or more laser pulses, for example, pulses **126** and **127**, may be fired at a target or target region, the laser pulses being generated by two or more laser units located, for example, within a taser training cartridge. The laser events or pulses may be recorded by a laser recognition unit **160**, such as electromagnetic radiation recognition unit. In an alternate embodiment, a cartridge separate from a taser simulator need not be used.

**[0042]** At block **210**, the laser event(s) may be detected by laser recognition unit **160**, for example, by imaging device **162**. The laser recognition unit **160** may, for example, capture and digitize the signals captured by imager **162** from two or more laser events generated by laser units **120** and **125**. Laser recognition unit **160** may format and deliver the signal(s) to a processing unit or CPU **154**.

**[0043]** At block **215** CPU **154** may implement a signal algorithm, for example, to determine if a laser event meets minimum criteria to be considered a laser pulse. The laser event may accordingly be defined as being a “valid laser pulse” or “noise” etc.

**[0044]** At block **225**, in the case where a non-valid laser pulse or “noise” is determined, computing device **150** may discard the laser event data.

**[0045]** At block **230**, in the case where a “valid laser pulse” is determined, imager **162** may detect the strike locations of two or more laser pulses on target **145**. In some embodiments, laser events initiated from laser sources at block **205** may be detected on target at block **230**, without prior determination of laser pulse validity. For example, CPU **154** may use, for example, a location identification algorithm to determine X and Y coordinates of the strike locations of the laser pulse(s) on target **145**.

**[0046]** At block **235** CPU **154** may determine the identities of the laser pulses based, for example, on the length of a pulse in a video frame. CPU **154** may determine the identities of a plurality of laser pulses, for example, from a plurality of taser launching devices **110** and/or cartridges **115**. For example, it maybe required for two laser pulses fired simultaneously to strike a selected region of the target. Verification of a hit may, in such a case, require determining of the strike locations of two laser pulses (block **230**) and verification that the two laser pulses were the pulses fired from the laser sources simultaneously.

**[0047]** At block **240**, CPU **154** may implement an automated response, for example, by executing a decision algorithm to determine if the identity and/or location data collectively meet pre-selected criteria, and to optionally perform automated responses to selected actions. CPU **154** may manage the automated reaction, for example, by altering current supply to cartridge **115**, thereby enabling further laser firing, discontinuing firing of a trainee etc., simulating a change in the target image (e.g., an image of a person falling to the ground or running away if not hit etc.) or video on the projection screen, output firing statistics, or controlling other operations or functions etc.

**[0048]** Processed firing data may be output, for example, by computing device **150** on output unit **165**, for example, a monitor. The firing of the lasers may be simultaneous or non-simultaneous, for example, with a delay between the firings of the various lasers. For simultaneous or non-simultaneous firing, time based firing patterns or pulse coded firing patterns may be implemented. The firing pattern of the laser may be determined by appropriately programming integrated circuit (IC) **135**. For example, the IC **135**

may be programmed to implement time based firing, by assigning a specific time length "n" (e.g., 16 ms) to a circuit's memory. The circuit may then fire the lasers for n amount of time (e.g., the programmed time) each time the circuit is activated. In the case of taser cartridge **115**, IC **135** may be programmed, for example, to fire first laser **120** for "n" ms (e.g., 16 ms), wait for "x" ms (e.g., 100 ms), and then fire second laser **125** for "n" ms. Other methods, for example, assigning alternate firing lengths (e.g., more or less than 16 ms), breaking lengths e.g., more or less than 100 ms), coding the pulse to be captured by multiple or other electromagnetic radiation detection devices, etc. may be used.

[**0049**] Examples of the computation of X and Y coordinates of the laser pulse(s) on target **145** or another target region and/or the determining of the pulse identities of the pulses striking the target or target region, at block **235**, are described with reference to FIG. **3**. At block **300** CPU **154** may determine from the detections of the strike locations of the laser pulses from imager **162**, the X and Y coordinates of two or more laser pulse strike locations. CPU **154** may further determine whether two or more identified laser pulses have struck a selected target or target region. For example, CPU may determine whether a selected target, e.g., a person displayed on the target, or a portion of the person, was hit by two or more laser pulses fired according to at least one selected firing pattern. At block **305**, in the case where CPU **154** determines that two or more laser pulses did strike a selected target or target region, the firing of the taser weapon may be defined as having "hit" the target. At block **310**, where the target has been hit, the simulation software may, for example, generate a change in the target, or change the scenario displayed in the target in accordance with the successful firing of the trainee. For example, the simulation software may cause such a change to be displayed in the target, e.g., a person who was the target may fall down and be immobilized.

[**0050**] At block **315**, in the case where CPU **154** determines that two or more laser pulses did not strike a selected target or target region, the firing of the taser weapon may be defined as having "missed" the target. At block **320**, where the target has been missed, the simulation software may, for example, continue the scenario displayed in the target, or change the scenario displayed in the target in accordance with the unsuccessful firing of the trainee. For example, the simulation software may transmit data to the target, for example, such that a person who was the target may continue to fire, approach the trainee, or flee etc.

[**0051**] Any combination of the above steps may be implemented. Further, other steps or series of steps may be used.

[**0052**] The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. It should be appreciated by persons skilled in the art that many modifications, variations, substitutions, changes, and equivalents are possible in light of the above teaching. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

What is claimed is:

**1**. A system to simulate operation of a demobilization instrument, the system comprising:

a training cartridge, the training cartridge comprising a plurality of laser units.

**2**. The system of claim 1, wherein said cartridge comprises a controller.

**3**. The system of claim 2, wherein said controller is to enable simultaneous firing of said plurality of laser units.

**4**. The system of claim 3, wherein said controller is to enable time based laser operation for said plurality of laser units.

**5**. The system of claim 3, wherein said controller is to enable coded pulse laser operation for said plurality of laser units.

**6**. The system of claim 2, wherein said controller is to enable relative delayed ring of said plurality of laser units.

**7**. The system of claim 6, wherein said controller is to enable time based laser operation for said plurality of laser units.

**8**. The system of claim 6, wherein said controller is to enable coded pulse laser operation for said plurality of laser units.

**9**. The system of claim 1, said controller capable of transmitting data in laser pulses.

**10**. The system of claim 1, comprising a launching device, said launching device comprising:

a trigger mechanism to trigger firing of said plurality of laser units; and

a receiving unit to accept and hold said cartridge.

**11**. The system of claim 1, comprising a power supply.

**12**. The system of claim 1, comprising a projection screen.

**13**. The system of claim 12, comprising an imaging unit to project an image onto said projection screen.

**14**. The system of claim 1, wherein said plurality of lasers are adapted to simulate the firing of projectile probes from a taser.

**15**. The system of claim 1, comprising a laser recognition unit.

**16**. The system of claim 1, wherein said cartridge is removable.

**17**. A method to simulate demobilization instrument operation, the method comprising causing a plurality of laser units associated with a demobilization instrument simulation device to project laser events towards a target.

**18**. The method of claim 17, comprising simultaneously firing said plurality of lasers.

**19**. The method of claim 18, wherein said simultaneous firing is to initiate time based laser operation.

**20**. The method of claim 18, wherein said simultaneous firing is to initiate coded pulse laser operation.

**21**. The method of claim 17, comprising relative delayed firing said plurality of lasers.

**22**. The method of claim 21, wherein said relative delayed firing is to initiate time based laser operation.

**23**. The method of claim 21, wherein said relative delayed firing is to initiate coded pulse laser operation.

**24**. The method of claim 17, comprising transmitting information in said laser events.

**25**. The method of claim 17, wherein said laser units are located within a taser cartridge.

**26**. The method of claim 17, comprising determining if said laser events are valid laser pulses.

**27**. The method of claim 17, comprising detecting the strike locations of said laser events.

**28**. The method of claim 17, comprising determining the identity of said laser pulses.

**29**. The method of claim 17, comprising verifying that at least two of said plurality of laser events hit said target.

**30**. The method of claim 17, comprising projecting said target onto a projection screen.

**31**. The method of claim 17, comprising implementing an automated reaction to a selected scenario.

**32**. The method of claim 17, comprising powering a cartridge using a taser launching apparatus power source.

**33**. A method comprising:

projecting data on a target;

detecting the striking of said target by a plurality of laser pulses, said laser pulses being generated by an immobilization apparatus simulation device; and

determining whether said plurality of pulses strike a selected region of said target.

**34**. The method of claim 33, comprising, if at least two of said plurality of pulses strike said selected region, defining said firing a plurality of laser pulses as a hit.

**35**. The method of claim 33, comprising, if at least one of said pulses miss said selected region, defining said firing a plurality of laser pulses as a miss.

**36**. The method of claim 33, comprising activating an automated response associated with said pulses striking said target.

**37**. The method of claim 33, comprising transmitting information in said plurality of laser pulses.

**38**. An apparatus comprising:

an imaging unit to project an image on a target;

a data recognition unit to detect a plurality of laser pulse strikes on said target, said laser pulse strikes being generated by a simulated immobilization weapon; and

a controller to receive information from said data recognition unit of laser pulse strikes on said target and to determine if a plurality of laser pulses strike said target.

**39**. The apparatus of claim 38, wherein if at least two of said plurality of laser pulse strikes occur within a selected area of said target, said controller defines said laser pulse strikes as a hit.

**40**. The apparatus of claim 38, wherein if at least one laser pulse strikes occurs outside a selected area of said target, said controller defines said laser pulse strikes as a miss.

**41**. The apparatus of claim 38, wherein said controller is to display interactive data on said target.

**42**. The apparatus of claim 38, wherein said controller is to activate an automated response associated with said laser pulse strikes.

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