

SHOOTING TRAINING SYSTEM WITH DEVICE ALLOWING INSTRUCTOR TO EXHIBIT EXAMPLE TO PLAYER IN REAL- TIME

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a shooting training system and method for training a player in shooting practice, and more particularly to a shooting training system and method for training a player for a shooting competition which determines shooting skills based on the impact location in which a light beam ejected from a beam gun hits a target.

2. Description of the Related Art:

Heretofore, shooting has been known as one of competition events. In shooting competitions, it has been desired to use beam guns in lieu of real guns which need to be handled with sufficient care for safety. Known beam guns include beam guns which use flash light that have been developed for competition use and beam guns, developed for shooting practice, which are electrically connected by wires to a computer for indicating shot impacts.

The accuracy with which an optical system detects the impact location of a laser beam emitted from a beam gun is required to be on a competition level. Beam guns for emitting laser beams are also required to

be safe in handling. Efforts should be made to meet the above requirements and also to perform a shooting competition score calculating process accurately and with an increased speed.

In accordance with an aspect of the present invention, there is provided a shooting training system comprising: a beam gun for emitting a light beam from a muzzle thereof in response to an action on a manipulating unit thereof; a target for being shot by said beam gun; a shot impact detector for detecting an impact location of said light beam on said target; and timing indicating means for indicating a timing to act on said manipulating unit.

In accordance with another aspect of the present invention, there is provided a method of training a player in shooting practice in a shooting training system having a beam gun for emitting a light beam from a muzzle thereof in response to an action on a manipulating unit thereof, a target for being shot by said beam gun, a shot impact detector for detecting an impact location of said light beam on said target, and timing indicating means for indicating a timing to act on the manipulating unit, said method comprising the step of: indicating the timing to act on the manipulating unit with said timing indicating means.

In accordance with yet another aspect of the present invention, there is provided a beam gun for emitting a light beam from a muzzle thereof in response to an action on a manipulating unit thereof, comprising: an

interface for being supplied with a timing signal which is generated when a timing to act on the manipulating unit is indicated, the arrangement being such that the beam gun emits a light beam distinguishable from said light beam when said timing signal is input to said interface.

In accordance with a further aspect of the present invention, there is provided a display device for displaying an impact location on a target of a light beam emitted from a beam gun in response to an action on a manipulating unit thereof, comprising: an interface for being supplied with a timing signal which is generated when a timing to act on the manipulating unit is indicated, the arrangement being such that the display device displays an impact location on the target when said timing signal is input to said interface, as an exemplary impact location distinguished from the other impact location on said target.

Fig. 1 of the accompanying drawings schematically shows a conventional electronic shooting competition system using beam guns which can be installed in a competition field. As shown in Fig. 1, the conventional electronic shooting competition system has a plurality of shot impact detectors 2 positioned in alignment with respective shooting boxes each defined between two partition panels 3.

In Fig. 1, five sets of shooting boxes and five shot impact detectors 2 are illustrated. However, the number of these sets is not limitative. Basically, one shooting box 1 and one shot impact detector 2 aligned

therewith correspond to each other in position and competition. Light beam 34 is projected from one shooting box 1 toward one shot impact detector 2 aligned therewith.

Square or circular target plate 4 is fixed to a front face of each shot impact detector 2. The front faces of all target plates 4 jointly provide common target plane 5. The faces of all shooting boxes which confront target plates 4 jointly provide common shooting

plane 6. Common target plane 5 and common shooting plane 6 lie parallel to each other and extend vertically.

In Fig. 1, common target plane 5 and common shooting plane 6 are spaced from each other by 10 m or 25 m, for example, depending on the competition event. Target plates 4 differ depending either on 10 m target or on 25 m target.

In Fig. 1, the common shooting plane 6 across each shooting box has a width of 1 m for one-gun to one-target, and a variable width for one-gun to n-target. As exemplified, each shot impact detector 2 has a width of 30 cm, and the two adjacent shot impact detectors 2 is spaced 1 m.

Each shot impact detector 2 emits conical beam 8 from an infrared LED. Emitted conical beam 8 reaches only the shooting box that is positioned directly in front of the shot impact detector from which conical beam 8 is emitted. In principle, emitted conical beam 8 does not reach two shooting boxes at the same time.

Light beam 34 projected from laser gun 7 which is positioned as a beam gun in each of the shooting boxes represents a signal inherent in laser gun 7. Light beam 34 comprises a highly parallel light beam and reaches each target plate 4 as a light spot. Each shot impact detector 2 has an adjustment function to increase the electrical, mechanical, and optical accuracy of a

position detecting optical element used in shot impact detector 2. Therefore, the accuracy with which the impact location of the laser beam emitted from each laser gun 7 is detected can be brought to a competition level.

5 Fig. 2 of the accompanying drawings shows, partly in block form, a structural arrangement of the conventional electronic shooting competition system. Fig. 2 illustrates laser gun 7 used by a player, target plate 4, player PC (Personal Computer) 66, and switching unit 10 96. Switching unit 96 comprises a switching hub of 10BASE-T LAN (Local Area Network) 65. Player PC 66 is electrically connected to shot impact detector 2 through switching unit 96.

 The players each operate laser gun 7 to emit 15 laser beam 34 toward target plate 4 and compete with one another who participate in the electronic shooting competition event according to a score to be added based on the impact location of laser beam 34 on target plate 4. Light beam 34 is emitted from a laser diode mounted in 20 laser gun 7. As with a real bullet shot from a real gun, laser beam 34 is shot from the muzzle of laser gun 7 and travels straight parallel to the line of sight of laser gun 7.

 As described above, shot impact detector 2 25 including target plate 4 which is aligned with laser gun 7 of a player is electrically connected to player PC 66.

Player PC 66 displays on its display screen the player's number, the shot number, the score corresponding to the shot number, the total score, and the impact location in which light beam 34 hits target plate 4, simultaneously or at different times.

Player PC 66 or shot impact detector automatically carries out a shooting competition score calculating process. Since the scores of the players can thus be calculated accurately at a high speed, the electronic shooting competition system can manage shooting competitions smoothly.

As described above, each shot impact detector 2 emits conical beam 8 (see Fig. 1) in the direction of the corresponding shooting box. Laser gun 7 has a photodiode mounted thereon near its muzzle and facing forward. Unless conical beam 8 emitted from shot impact detector 2 is detected by the photodiode on laser gun 7, i.e., unless laser gun 7 in the shooting box is aimed at target plate 4, laser gun 7 is unable to emit light beam 34. Consequently, the electronic shooting competition system provides safety in the handling of laser guns 7 in competitions.

Inasmuch as a signal (conical beam 8) serving as one of conditions for permitting laser gun 7 to emit light beam 34 is generated by shot impact detector 2 combined with target plate 4, the electronic shooting

competition system is more target dominant than gun dominant in competitions. Accordingly, the electronic shooting competition system is a fair system where the will of the competition sponsor (referee) is held in
5 respect.

Laser gun 7 emits a plurality of successive light beams 34 in one triggering action. The emission of plural light beams 34 causes player PC 66 or shot impact detector 2 to calculate not only a score for each light
10 beam 34, but also an average of scores for respective light beams 34. The emission of plural light beams 34 also makes it possible to give different scores due to a slight wobbling of the hand which has triggered laser gun 7, and also to convert body movements of the player into
15 numerical values. Therefore, the electronic shooting competition system can provide novel competition patterns or modes which have not been available in competitions in which a real bullet is shot in one triggering action.

Light beam 34 contains a position detecting
20 signal (second light beam) for use in the detection of an impact location and a light beam distinguishing signal (light beam) for distinguishing the light beam from the other light beams. Insofar as laser gun 7 is receiving conical beam 8, the position detecting signal is
25 continuously emitted from laser gun 7 even when laser gun 7 is not triggered.

When the position detecting signal hits target plate 4, shot impact detector 2 detects the impact location of light beam 34. The impact location is successively transmitted from shot impact detector 2 to
5 player PC 66, which can display a simulated image of target plate 4.

Player PC 66 displays the impact location of light beam 34 as a succession of light spots on the simulated image, showing the impact location as it
10 changes as a trajectory followed by the sight of laser gun 7.

When laser gun 7 is triggered, laser gun 7 emits from its muzzle the position detecting signal and the light beam distinguishing signal which are contained
15 in light beam 34. Shot impact detector 2 detects the position detecting signal and also the impact location of the light beam distinguishing signal on target plate 4, and transmits the impact location to player PC 66. Player PC 66 displays on the simulated image of target
20 plate the trajectory of the position detecting signal and the impact location of the light beam distinguishing signal as distinguished from the trajectory of the position detecting signal.

Fig. 3 of the accompanying drawings shows
25 target plate 4. As shown in Fig. 3, target plate 4 has on its surface ten annular areas, including a central

circular area just around center 0, divided by ten concentric circles around center 0. These areas are also referred to as score areas. Target plate 4 also has an outside area around the annular areas. The player gets
5 no score when light beam 34 hits the outside area. A score for the outermost annular area, i.e., the annular area marked with "1", is 1. Scores for the other annular areas are progressively incremented by 1 toward center 0, and the score for the central circular area is 10.

10 As described above, when the position detecting signal from laser gun 7 hits target plate 4, shot impact detector 2 as PSD (Position Sensitive Detector) detects the impact location (x, y) in a coordinate system on target plate 4. The origin of the coordinate system is
15 aligned with center 0 of target plate 4. When the impact location (x, y) is detected, the distance from center 0 to the impact location (x, y) is calculated, and one of the score areas where the impact location (x, y) is positioned is located to determine the score for the shot.

20 Shot impact detector 2 has an optical system for detecting the impact location on target plate 4. The optical system comprises a condenser lens and a semiconductor device. While a CCD (Charge Coupled Device) or a PSD is available for use as the
25 semiconductor device, the PSD is preferable to the CCD

for its cost and detecting speed. The PSD has a two-dimensional current generating membrane.

If a laser beam is focused by the condenser lens and applied as a beam spot to the two-dimensional current generating membrane at a coordinate position (x, y), then the two-dimensional current generating membrane generates therein currents which are two-dimensionally linearly commensurate with the coordinate position (x, y). Specifically, the two-dimensional current generating membrane generates two currents I_{x1} , I_{x2} flowing in two opposite directions along the x-axis and two currents I_{y1} , I_{y2} flowing in two opposite directions along the y-axis. The coordinates x, y of the coordinate position (x, y) are calculated from the currents I_{x1} , I_{x2} , I_{y1} , I_{y2} according to the following equations:

$$x = k(I_{x2} - I_{x1}) / (I_{x2} + I_{x1})$$

$$y = k(I_{y2} - I_{y1}) / (I_{y2} + I_{y1})$$

The beam spot position where both $(I_{x2} - I_{x1})$, $(I_{y2} - I_{y1})$ are zero is defined as the electrical and mechanical coordinate origin (0, 0) of the PSD. Target plate 4 needs to be positioned two-dimensionally with respect to the PSD within an allowable accuracy range.

In the electronic shooting competition system, laser gun 7 and shot impact detector 2 should preferably operate in synchronism with each other. In order to synchronize laser gun 7 and shot impact detector 2,

conical beam 8 emitted from shot impact detector 2 comprises a pulsed beam which varies periodically.

Laser gun 7 detects the pulsed beam emitted from shot impact detector 2 with the photodiode and generates a synchronizing signal based on the detected pulsed beam. Laser gun 7 emits light beam 34 in synchronism with the generated synchronizing signal.

As described above, there have recently been available electronic shooting competition systems which are safer and more applicable to various competition patterns than real bullet shooting competition systems. Since it is expected that, because of the above advantages, electronic shooting competitions will gain more popularity as general competitions and attract a rapidly growing population of players, it is desirable to construct a scheme for bringing up electronic shooting players.

SUMMARY OF INVENTION

It is therefore an object of an embodiment of the present invention to provide an electronic shooting competition system which is effective in bringing up players for electronic shooting competitions.

A shooting training system according to an embodiment the present invention has a timing indicating means which, when a person who operates a beam gun, i.e., a shooting player, is trained in shooting practice, allows an

instructor or coach for the player to indicate a timing to pull the trigger of the beam gun while confirming the trajectory of the sight of the beam gun which is displayed on a display means. Since the difference
5 between the time at which the player actually pulls the trigger of the beam gun and the time at which the instructor decides for the player to pull the trigger of the beam gun is known to the player, the shooting training system is effective in bringing up the player
10 for electronic shooting competitions.

The display means may display an impact location on a target at the timing indicated by the timing indicating means. The displayed impact location allows the player to visualize the difference between the
15 time at which the player actually pulls the trigger of the beam gun and the time at which the instructor decides for the player to pull the trigger of the beam gun.

The timing indicating means may be connected to the display means to allow the shooting training system
20 to perform a high-speed processing sequence, and can be simplified in arrangement.

The timing indicating means may be connected to the beam gun through a wireless communication link to allow the player to highly concentrate on a shooting
25 competition.

The display means may display, in addition to the trajectory of the sight if the beam gun and impact locations, the difference between the time when the timing is indicated by the timing indicating means and the time when a light beam emitted from the beam gun hits the target. With the above information displayed, the player and others can visibly recognize any triggering timing deviations which serve as useful information in training shooting players.

The shooting training system may have a timing teaching means for teaching the player the timing indicated by the timing indicating means. The timing teaching means allows the player to recognize the timing indicated by the instructor who operates the timing indicating means, and to pull the trigger of the beam gun at the recognized timing. Since the player can reduce the difference between the indicated timing and the actual timing to emit the light from the beam gun, the player can increase the shooting skill efficiently.

The above and other objects, features, and advantages of embodiments of the present invention will become apparent from the following description with reference to the accompanying drawings which illustrate examples of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a schematic view of a conventional electronic shooting competition system using beam guns;

Fig.2 is a view, partly in block form, of a structural arrangement of the electronic shooting competition system;

Fig.3 is a view of a target plate used in the electronic shooting competition system;

Fig.4 is a view, partly in block form, of a structural arrangement of an electronic shooting competition system according to a first embodiment of the present invention;

Fig.5 is a view of a simulated image of a target plate which is displayed by an external PC in an embodiment of the electronic shooting competition system;

Fig.6 is a circuit diagram of an embodiment, partly in block form, of a circuit for generating a trigger signal for a laser gun, the diagram also showing signal waveforms generated in the circuit; and

Fig.7 is a view, partly in block form, of a structural arrangement of an electronic shooting competition system according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

1st Embodiment:

An electronic shooting competition system according to a first embodiment of the present invention

will first be described below. Fig. 4 shows, partly in block form, a structural arrangement of an electronic shooting competition system according to a first embodiment of the present invention. As shown in Fig. 4, the electronic shooting competition system according to the first embodiment comprises, in addition to the elements of the conventional electronic shooting competition system shown in Fig. 2, external PC 101 as a display means and external trigger switch 102 as a timing indicating means. Those parts shown in Fig. 4 which are identical to those shown in Fig. 2 are denoted by identical reference numerals.

External PC 101 comprises a personal computer having a display screen and a keyboard for entering inputs. External PC 101 is electrically connected to shot impact detector 2 through switching unit 96. External PC 101 displays a simulated image of target plate 4 on its display screen.

External PC 101 displays, sequentially on its display screen, the impact locations of the position detecting signal (second light beam) detected by shot impact detector 2, as a trajectory followed by the sight of laser gun 7 held by the player, and also the impact locations of the light beam distinguishing signal (light beam) detected by shot impact detector 2. External PC 101 is placed in such a position as to allow the

instructor to confirm the display screen easily so that the instructor can visually recognize how the player shoots.

When the player aims the muzzle of laser gun 7 at target plate 4, the position detecting signal is emitted (transmitted) consecutively from the muzzle of laser gun 7. The term "consecutively" used herein means either "continuously" or "intermittently". Shot impact detector 2 detects the impact locations of the position detecting signal on target plate 4, and transmits data of the impact location through switching unit 96 to external PC 101 at all times.

When external PC 101 receives the data of the impact location transmitted from shot impact detector 2, external PC 101 calculates a score of the player based on the received data, and displays, sequentially on its display screen, a succession of light spots representing the impact location received from shot impact detector 2 as a trajectory followed by the sight of laser gun 7.

The size of the area of the trajectory, the average distance of the trajectory from the center of trajectory plate 4, and the angular distribution of the trajectory about the center of trajectory plate 4 are strictly representative of relative motions of the barrel of laser gun 7 with respect to target plate 4. The generation and visualization of the trajectory followed

by the sight of laser gun 7 cannot be achieved in the conventional real bullet shooting competition systems. When the instructor instructs the player based on fluctuations of the trajectory, the player can correct
5 its action to trigger laser gun 7.

When the player pulls the trigger of laser gun 7, laser gun 7 generates a trigger signal therein which enables the laser diode to generate a light beam distinguishing signal, which is emitted from the muzzle
10 of laser gun 7. Shot impact detector 2 then detects the impact location of the light beam distinguishing signal on target plate 4, and transmits data of the impact location through switching unit 96 to external PC 101.

External PC 101 calculates a score of the
15 player based on the received data of the impact location, displays the calculated score, and also displays the impact location of the light beam distinguishing signal on the display screen which is displaying the trajectory followed by the sight of laser gun 7, as distinguished
20 from another impact location that is being displayed on the display screen. The impact location should preferably be distinguished from the other impact location by displaying in a color different from the color of the other impact location or highlighting only
25 the displayed spot of the impact location.

External trigger switch 102 serves as a timing indicating means for indicating the timing to pull the trigger with a switch action. External trigger switch 102 is electrically connected to laser gun 7 by a cable.

5 When external trigger switch 102 is pressed, it sends a signal representing the pressing thereof, i.e., a timing signal, to laser gun 7.

In the present embodiment, external trigger switch 102 and laser gun 7 are wired to each other.

10 However, external trigger switch 102 and laser gun 7 may be connected to each other by a wireless communication medium, e.g., a radio communication link according to the bluetooth protocol or an infrared communication system.

The wireless link thus established between external
15 trigger switch 102 and laser gun 7 can relieve the player of undesired obstacles which would otherwise impair mental stability and concentration of the player due to a wired connection from external trigger switch 102 to laser gun 7.

20 External trigger switch 102 is operated by the instructor for the player. While visually confirming the trajectory of the sight of laser gun 7 which is being displayed on the display screen of external PC 101, the instructor presses external trigger switch 102 at the
25 time the instructor decides that the player should pull the trigger of laser gun 7.

Then, external trigger switch 102 sends the timing signal to laser gun 7, which emits a light beam distinguishing signal (third light beam) from its muzzle.

When shot impact detector 2 detects the impact location of the light beam distinguishing signal on target plate 4, shot impact detector 2 transmits the detected impact location as an exemplary impact location to external PC 101. External PC 101 displays the exemplary impact location at the timing indicated by external trigger switch 102 as distinguished from any other impact locations displayed on the display screen.

Fig. 5 shows a simulated image of target plate 4 which is displayed on the display screen of external PC 101. As shown in Fig. 5, the displayed simulated image on the display screen of external PC 101 includes a succession of light spots representing the impact location of the position detecting signal, i.e., a trajectory followed by the sight of laser gun 7, the impact location (exemplary location) of the light beam distinguishing signal which is emitted from laser gun 7 at a timing indicated by external trigger switch 102, and the impact location of the light beam distinguishing signal which is emitted from laser gun 7 when the trigger of laser gun 7 is actually pulled by the player.

In the example shown in Fig. 5, the trajectory of the sight of laser gun 7 starts from a position lower

right from center 0, moves clockwise through the score areas corresponding to the scores 9, 8, 7, passes through center 0 to the area corresponding to the score 7 upper right from center 0, and reaches the final impact location in the area corresponding to the score 7 upper right from center 0. The exemplary impact location of the light beam distinguishing signal at the timing indicated by the instructor is at center 0.

The trajectory, the player's impact location, and the instructor's exemplary impact location are displayed so as to be distinguishable from each other. For example, the trajectory of the sight of laser gun 7 is displayed in green, the player's impact location in red, and the instructor's exemplary impact location in blue. A cross sign is also displayed around the player's impact location for emphasizing the player's impact location.

Fig. 6 shows, partly in block form, a circuit for generating a trigger signal in laser gun 7. Fig. 6 also shows signal waveforms generated in the circuit. As shown in Fig. 6, the circuit has shock sensor 201, comparator 202, input terminals 203, 204, capacitor 205, Schmitt trigger 206, and synchronizing circuit 207.

Shock sensor 201 produces an output signal which is supplied to comparator 202. An output signal from comparator 202 and an input signal from input

terminal 204 are pulled up by a power supply voltage of 3.3 V applied to input terminal 203, and applied to capacitor 205. While the power supply voltage of 3.3 V is applied to input terminal 203 in the illustrated
5 circuit, the power supply voltage is not limited to 3.3 V, but may be of another value.

Shock sensor 201 detects a shock produced when the trigger of laser gun 7 is pulled, and outputs a signal representing the detected shock. A waveform of
10 the shock is shown by way of example below shock sensor 201 in Fig. 6. The waveform of the shock is illustrated as a low-level active waveform (which is active at a low level (0 V (L))).

Comparator 202 is supplied with the waveform of
15 the shock output from shock sensor 201. If the value of the waveform of the shock is higher than a given threshold value, then comparator 202 outputs a high-level signal. If the value of the waveform of the shock is lower than the given threshold value, then comparator 202
20 outputs a low-level signal.

Comparator 202 thus outputs as an output signal a pulsed waveform which is shown below comparator 202 in Fig. 6. The output signal from comparator 202 is supplied to Schmitt trigger 206. Schmitt trigger 206
25 shapes the waveform of the supplied signal, and outputs the shaped waveform.

As described above, laser gun 7 receives conical beam 8 (see Fig. 1) transmitted from target plate 4 by the photodiode. Conical beam 8 is input as a pulsed wave (synchronizing signal) having a period of 5 ms., as shown in a lower right section in Fig. 6. Laser gun 7 generates a trigger signal based on the synchronizing signal input to the photodiode.

Specifically, synchronizing circuit 207 is supplied with the signal output from Schmitt trigger 206 and the synchronizing signal from the photodiode. Synchronizing circuit 207 generates a trigger signal at time t_1 in Fig. 6 when the signal output from Schmitt trigger 206 is low in level at a leading edge of the synchronizing signal.

When the trigger signal is generated, laser gun 7 emits a light beam, i.e., a light beam distinguishing signal, from a semiconductor laser device disposed therein. Since the synchronizing signal has a period of 5 ms., the period of time during which the output pulse from Schmitt trigger 206 is active at the low level needs to be at least 5 ms.

When the timing signal is output from external trigger switch 102, the timing signal is supplied to input terminal 204 of the circuit in laser gun 7. The supplied signal is also applied to Schmitt trigger 206. Therefore, in response to the timing signal from external

trigger switch 102, synchronizing circuit 207 generates a trigger signal, which enables laser gun 7 to emit a light beam distinguishing signal.

As described above, laser gun 7 emits a light beam distinguishing signal both when the trigger of laser gun 7 is pulled by the player and when external trigger switch 102 is pressed by the instructor. Consequently, it is necessary for the light beam distinguishing signal to include information indicative of whether it has been generated when the trigger of laser gun 7 is pulled or it has been generated when external trigger switch 102 is pressed.

Based on such information included in the light beam distinguishing signal, shot impact detector 2 determines whether the light beam distinguishing signal has been generated when the trigger of laser gun 7 is pulled or the light beam distinguishing signal has been generated when external trigger switch 102 is pressed. Accordingly, external PC 101 can display, on its display screen, the exemplary impact location and the player's impact location as distinguished from each other based on a signal from shot impact detector 2.

2nd Embodiment:

A shooting training system according to a second embodiment of the present invention will be described below with reference to Fig. 7. Fig. 7 shows

in block form a shooting training system according to a second embodiment of the present invention. The shooting training system according to the second embodiment differs from the shooting training system according to the first embodiment shown in Fig. 4 in that it lacks external trigger switch 102 as the timing indicating means.

In the shooting training system according to the second embodiment, certain input key 110 on the keyboard, as an input device, of external PC 101 serves as the timing indicating means. According to the second embodiment, therefore, the timing indicating means can be regarded as being directly connected to external PC 101 as a display means, rather than laser gun 7.

The instructor for the player who operates laser gun 7 presses input key 110 of external PC 101 at the time the instructor decides that the player should pull the trigger of laser gun 7, while visually confirming the trajectory of the sight of laser gun 7 which is being displayed on the display screen of external PC 101.

When input key 110 is pressed, external PC 101 displays the impact location of the position detecting signal, which is transmitted from shot impact detector 2, as the exemplary impact location on the simulated image.

According to the second embodiment, a scheme for indicating the shooting timing, e.g., part of the circuit in laser gun 7 shown in Fig. 6 which is used to indicate the shooting timing, is not required in the shooting training system. Therefore, the system arrangement for indicating the shooting timing may be simplified.

In the shooting training system according to the second embodiment, input key 110 on the keyboard of external PC 101 is used as the timing indicating means. However, a pointing device such as a mouse or the like may be used as the timing indicating means. Alternatively, an external switch such as external trigger switch 102 according to the first embodiment may be directly connected to external PC 101, or may be directly connected to shot impact detector 2.

The display screen external PC 101 may display, in addition to the simulated image of target plate 4 on which the trajectory of the sight of laser gun 7 and the impact locations are displayed, a time at which the light beam distinguishing signal emitted when the trigger of laser gun 7 is pulled hits target plate 4, a time at which the shooting timing is indicated by the pressing of input key 110 on the keyboard of external PC 101, and the difference between the time when the light beam distinguishing signal hits target plate 4 and the time

when the shooting timing is indicated. With these times displayed, the player and others can visually recognize any triggering timing deviations which serve as useful information in training shooting players.

5 The shooting training systems according to the first and second embodiments may additionally have a timing teaching means for teaching the player who operates laser gun 7 the timing which is indicated by the timing indicating means. For example, the shooting
10 training system may have a lighting device, such as an LED or the like, disposed in a position that can easily be seen by the player even when the player is aiming laser gun 7, e.g., on laser gun 7 or near target plate 4. The timing teaching means thus arranged can train the
15 player to pull the trigger of laser gun 7 when the lighting device is turned on.

 The above training process allows the player to make efforts to reduce the difference between the indicated timing and the actual timing to emit the light
20 beam distinguishing signal, thus increasing the skill of the player efficiently. The timing teaching means may comprise a means for indicating the shooting timing with sound.

 In the shooting training systems according to
25 the first and second embodiments, the position detecting signal and the light beam distinguishing signal may be

emitted from a single light source in laser gun 7 and travel along a single signal path, or may be emitted from different light sources in laser gun 7 and travel along different signal paths.

In the shooting training systems according to the first and second embodiments, a light beam distinguishing signal is emitted from laser gun 7 when the trigger of laser gun 7 is pulled. However, the present invention is not limited to any particular mechanism and operation for emitting a light beam distinguishing signal from laser gun 7, but any of various structures may be used to emit a light beam distinguishing signal from laser gun 7. For example, laser gun 7 may have a manipulating unit such as a pushbutton, for example, mounted on laser gun 7 for emitting a light beam distinguishing signal in response to a player's action on the manipulating unit.

While preferred embodiments of the present invention have been described in specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the scope of the following claims.

CLAIMS:

1. A shooting training system comprising:
 - a beam gun for emitting a light beam from a muzzle thereof in response to an action on a manipulating unit thereof;
 - a target for being shot by said beam gun;
 - a shot impact detector for detecting an impact location of said light beam on said target; and
 - timing indicating means for indicating a timing to act on said manipulating unit.

2. A shooting training system according to claim 1, further comprising:
 - display means for displaying the impact location of said light beam detected by said shot impact detector.

3. A shooting training system according to claim 2, wherein said beam gun continuously emits a second light beam after it has emitted said light beam as a first light beam, and said display means displays an impact location of said target as it changes with respect to the impact location of said first light beam, as a trajectory of the sight of said beam gun on a simulated image of said target.

4. A shooting training system according to claim 2, wherein said display means displays an impact location on said target at the timing indicated by said timing indicating means, as an exemplary impact location
5 distinguished from the other impact location.

5. A shooting training system according to claim 4, wherein said display means displays said exemplary impact location in a color different from a color of the other impact location.

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6. A shooting training system according to claim 5, wherein said display means displays said exemplary impact location as a displayed spot highlighted against a display spot of the other impact location.

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7. A shooting training system according to claim 4, wherein said timing indicating means outputs a timing signal when said timing is indicated thereby.

8. A shooting training system according to claim 7, wherein said timing indicating means transmits said timing signal to said beam gun.

9. A shooting training system according to claim 8, wherein said beam gun emits a third light beam when said beam gun receives a timing signal transmitted from said timing indicating means, and said shot impact
5 detector transmits an impact location of said third light on said target as said exemplary impact location to said display means.

10. A shooting training system according to claim 7, wherein said timing indicating means transmits said timing signal to said shot impact detector.

11. A shooting training system according to claim 10, wherein said shot impact detector transmits an impact location on said target when said timing signal is input to said shot impact detector, as said exemplary
5 impact location to said display means.

12. A shooting training system according to claim 7, wherein said timing indicating means transmits said timing signal to said display means.

13. A shooting training system according to claim 12, wherein said display means displays an impact location on said target which is received from said shot impact detector when said timing signal is input to said

5 display means, as said exemplary impact location distinguished from the other impact location.

14. A shooting training system according to claim 8, wherein said timing indicating means transmits said timing signal to said beam gun through a wireless communication link.

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15. A shooting training system according to claim 1, wherein said display means displays a time at which the light beam emitted from said beam gun when said manipulating unit is acted on hits said target.

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16. A shooting training system according to claim 1, wherein said display means displays a time at which the timing is indicated by said timing indicating means.

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17. A shooting training system according to claim 1, wherein said display means displays the difference between a time at which the light beam emitted from said beam gun when said manipulating unit is acted on hits said target and a time at which the timing is indicated by said timing indicating means.

18. A shooting training system according to claim 1, further comprising:

timing teaching means for teaching a person who operates said beam gun the timing indicated by said
5 timing indicating means.

19. A method of training a player in shooting practice in a shooting training system having a beam gun for emitting a light beam from a muzzle thereof in response to an action on a manipulating unit thereof, a
5 target for being shot by said beam gun, a shot impact detector for detecting an impact location of said light beam on said target, and timing indicating means for indicating a timing to act on the manipulating unit, said method comprising the step of:

10 indicating the timing to act on the manipulating unit with said timing indicating means.

20. A beam gun for emitting a light beam from a muzzle thereof in response to an action on a manipulating unit thereof, comprising:

an interface for being supplied with a timing
5 signal which is generated when a timing to act on the manipulating unit is indicated, the arrangement being such that the beam gun emits a light beam distinguishable

from said light beam when said timing signal is input to said interface.

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21. A display device for displaying an impact location on a target of a light beam emitted from a beam gun in response to an action on a manipulating unit thereof, comprising:

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an interface for being supplied with a timing signal which is generated when a timing to act on the manipulating unit is indicated, the arrangement being such that the display device displays an impact location on the target when said timing signal is input to said

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interface, as an exemplary impact location distinguished from the other impact location on said target.