

TITLE OF THE INVENTION**A PORTABLE WEAPONS SCORING SYSTEM AND THE METHOD OF
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TITLE OF THE INVENTION

A PORTABLE WEAPONS SCORING SYSTEM AND THE METHOD OF SCORING USING THE SAME

BACKGROUND OF THE INVENTION

(a) Field of the invention

The present invention relates to a weapons scoring system, and in particular, to a portable, fully automatic weapons scoring system which comprises at least two high resolution charge-coupled device (CCD) cameras, wireless transceivers, a computer assembly equipped with software programme, including a scoring computer and a display monitor, and video recording equipment. The present portable weapons system is ideal for deployment to combined arms ranges, trials sites, direct fire target areas, and temporary weapons ranges to determine accurate weapons impact positions and display the results thereof. The present invention also relates to a method of weapons scoring using the system.

(b) Description of the prior art

In conventional weapons scoring systems, such as the BullsEye Television Bomb Scoring System, developed by Marine-Air Systems Ltd, New Zealand, a split screen monitor is used such that the quadrature views of a target can be presented thereon, and dual cursor positioning dials are used as console controls. In such conventional systems, upon weapon impact, the operator of the system has to manually operate a switch in the system in order to manually freeze the television image. The operator places the cursors of each of the split screen over the centroid of the weapon impact before hitting the score button to activate the computer system to calculate the point of impact in relation to the target centre. Such a sequence of manual inputs by the operator is laborious and time consuming and therefore incapable of handling rapid rate of fire. Apart from these, the operator may make judgment errors when he attempts to place the cursor at the centroid of the flash, smoke, or splash created by the weapon impact. Another disadvantage of the



conventional weapons scoring system is that the conventional system requires one television to monitor the camera images and another computer monitor for data entry and results. However, in accordance with the present invention, the present scoring system is designed to be fully automatic and totally hands-off without having the operator to go through the above-mentioned laborious manual input steps. The computer assembly of the present invention is equipped with software programme which automatically freezes the camera images upon weapon impact, and automatically identifies the centroid of the impact flash, smoke or splash, calculates and displays the results instantaneously. In the present system, there is no requirement for the operator to manually control the system before result output. However, the present system is designed with backup manual operation for the verification of scores. Additionally, the system uses only one computer monitor to display the camera images, data entry, results, graphic presentation and tabular presentation.

The conventional weapons scoring system is primarily developed to be used over land, whereas, the present system is developed to be used both over land and water.

Consequently, in view of the drawbacks of the conventional weapons scoring system, a need exists for improvements in the accurate and automatic calculation of bearings for the triangulation of weapons impacts in all weather conditions day and night, capability of visual recording, and in maintaining a complete database of scoring results for all weapons impact images.

SUMMARY OF THE INVENTION

The present invention provides a portable, fully automatic weapons scoring system designed to satisfy the aforementioned needs and a method of scoring using the system. The invention embodies a weapons scoring system comprising at least two charge-coupled device (CCD) cameras, wireless transceivers, a computer assembly, equipped with software programme, comprising a scoring computer, a display monitor and printer, and video recording equipment including a video recorder and a multiplexer. In accordance with the present invention, these cameras are positioned at known survey points and real time images of impacts are relayed



to the computer assembly by wireless transceivers. Upon weapon impact, with the help of the software programme, the computer assembly automatically detects the impacts, processes the images, accurately calculates the impact position and displays the results.

It is a first and major object of this invention to develop a portable weapons scoring system comprising at least two high resolution CCD cameras, wireless transceivers, and a computer assembly, enabling the accurate determination of bearings for the triangulation of weapons impacts.

Another object of this invention is to provide a portable weapons scoring system, wherein the system is able to measure weapons impacts to an accuracy of better than one metre over one kilometre at ranges of several kilometres from the observation station/s.

It is also an object of this invention to provide a portable weapons scoring system which is ideal for deployment to combined arms ranges, trials sites, direct fire target areas and temporary weapons ranges to determine accurate weapons impact positions.

It is a further object of the present invention to provide a portable weapons scoring system, wherein all ranges and/or site installation information can be pre-programmed and stored for rapid deployment.

It is another further object of the present invention to provide a portable weapons scoring system which also offers manual scoring capability for the verification or re-scoring of results.

It is yet another object of the present invention to provide a portable weapons scoring system, wherein the system is fully automatic for reliable hands-off operations at remote locations.

Yet another further object of the present invention is to provide a portable weapons scoring system, which allows post-firing analysis via video tape record, print and graphic display summaries.

It is yet another object of the present invention to provide a portable weapons scoring system, wherein a permanent record of results is kept and may be used for re-scoring and computer based training.

Yet a further object of the present invention is to provide a portable weapons



scoring system which is a proven accurate, cost-effective means for use day and night.

Additional objects will become apparent from the following description of the present invention, its embodiment, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood when consideration is given to the following detailed description of special embodiment thereof. Such description makes reference to the annexed drawing wherein:

Fig. 1 is a schematic block diagram of the portable weapons scoring system in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The embodiment of the present weapons scoring system shown in FIG.1 comprises at least two charge-coupled device (CCD) cameras (20), wireless transceivers (22), a computer assembly (24), equipped with software programme, including a scoring computer (242), a display monitor (241) and a printer (244), and video recording equipment (26) including a video recorder (261) and a multiplexer (262).

Fig 1 is a schematic diagram of the portable weapons scoring system in accordance with the present invention. In accordance with the present invention, two high resolution CCD cameras (20) with perfect linearity and near zero distortion are installed approximately in quadrature at surveyed sites. The cameras (20) provide precise electronic measurement of bearings, for the triangulation of weapons impacts. The cameras (20) are trained onto a target centre (100). A simple routine is established and confirms target centering. Range installation data, such as camera to target, ranges and bearings, may be stored for rapid repeatable setup.

Wireless transceivers (22) comprising a wireless receiver (221) and a wireless transmitter (222), which is in omni-directional wireless transmission mode, are linked in between the cameras (20) and the video recording equipment (26). The video recording equipment (26) having a video recorder (261) and a multiplexer (262) is



then linked to the computer assembly (24). Apart from using wireless transceivers (22), a cable system, including fibre optic cables, can also be used.

The video recorder (261) of the video recording equipment (26), at one end thereof, is connected to the wireless receiver (221) of the wireless transceiver (22) and the other end of said recorder (261) is linked to the scoring computer (242) of the computer assembly (24). The display monitor (241) of the computer assembly (24) is used for displaying camera images from the CCD cameras (20), graphic display, data and scores display. The printer (244) of the computer assembly (24) will print out graphic and tabular summaries.

In operation, the CCD cameras (20) positioned at known survey points are trained onto a target (100), and real-time images of impacts are relayed to the computer assembly (24) via the wireless transceiver (22). The images of weapons impacts are then automatically detected and processed by the computer assembly (24). The scoring computer (242) accurately calculates the impact position and the results are displayed on the display monitor (241). The results can also be printed out graphically or tabulated by the printer (244). In accordance with the present invention, the present scoring system can maintain a complete database of scoring results and all weapon impact images are recorded on the video recording equipment (26) for post-firing analysis, and the graphic and tabular print-outs of the scoring results are available from the database of the computer assembly (24). The present system also offers manual scoring capability for the verification or re-scoring of results.

In accordance with the present invention, only one display monitor (241) is employed to view the camera images, data entry, results, and graphic presentation for the verification of scores.

In one preferred embodiment, the present weapons scoring system can be interfaced with an Acoustic Gunnery Scoring System to provide the Air Force, for example, with Total Weapons Range Instrumentation capability. In another preferred embodiment, a Video Tracker-based Missile and/or Gun Scoring option is also available for shipboard applications and weapons development, wherein, this system comprises two or more synchronized portable high performance Video Trackers and a scoring analysis computer that combines the tracker information to



accurately compute the weapon score. Such a system can also be used to calculate trajectory.

It is thought that the portable weapons scoring system of the present invention and the method of weapons scoring using the same and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, and arrangement of the parts thereof without departing from the spirit and scope of the invention, the form hereinbefore described being merely a preferred or exemplary embodiment thereof.



**CLAIMS**

1. A portable weapons scoring system comprising
 - (a) at least two high resolution charge-coupled device (CCD) cameras (20);
 - (b) wireless transceivers (22) including a wireless receiver (221) and a wireless transmitter (222) coupled to said cameras (20);
 - (c) a computer assembly (24) equipped with software programme and including a scoring computer (242), a display monitor (241), and a printer (244), said scoring computer (242) being mounted to said wireless receiver (221); and
 - (d) video recording equipment (26) including a video recorder (261), and a multiplexer (262), said video recorder (261), at one end thereof, being linked to said wireless receiver (221), and the other end of said recorder (261) being linked to said scoring computer (242) of said computer assembly (24), characterised in that said portable CCD cameras (22) are positioned at known survey points and are installed approximately in quadrature and trained onto a target for weapons impacts, and real-time precise electronic images of weapons impacts are relayed to said computer assembly (24) by said wireless transceiver (22), said computer assembly (24) automatically freezes the camera images upon weapons impact and accurately calculates the impact position and displays the results.
2. A portable weapons scoring system as set forth in Claim 1, wherein said wireless transceivers (22) are in omni-directional wireless transmission mode.
3. A portable weapons scoring system as set forth in Claim 1, wherein the images of impact, data, and scores are displayed in the display monitor (24).
4. A portable weapons scoring system as set forth in Claim 1, wherein said wireless transceivers (22) are linked in between said computer assembly (24) and the remote cameras (20).





5. A portable weapons scoring system comprising
- (a) at least two high resolution charge-coupled device (CCD) cameras (20);
 - (b) wireless transceivers (22) including a wireless receiver (221) and a wireless transmitter (222) coupled to said cameras (20);
 - (c) a computer assembly (24) equipped with software programme and including a scoring computer (242), a display monitor (241), and a printer (244), said scoring computer (242) being mounted to said wireless receiver (221); and
 - (d) video recording equipment (26) including a video recorder (261), and a multiplexer (262), said video recorder (261), at one end thereof, being linked to said wireless receiver (221), and the other end of said recorder (261) being linked to said scoring computer (242) of said computer assembly (24), characterised in that said portable CCD cameras are positioned at known survey points and are installed approximately in quadrature and trained onto a target for weapons impacts, and real-time precise electronic images of weapons impacts are relayed to said computer assembly (24) by said wireless transceiver (22), said computer assembly (24) automatically freezes the camera images upon weapon impact and accurately calculates the impact position and displays the result, and the images of impacts are recorded by said video recording equipment (26) for post-firing analysis.
6. A method of weapons scoring using a weapons scoring system comprising
- (a) at least two high resolution charge-coupled device (CCD) cameras (20);
 - (b) wireless transceivers (22) including a wireless receiver (221) and a wireless transmitter (222) coupled to said cameras (20); (c) a computer assembly (24) equipped with software programme and including a scoring computer (242), a display monitor (241), and a printer (244), said scoring computer (242) being mounted to said wireless receiver (221); and (d) a video recording equipment (26) including a video recorder (261), and a multiplexer (262), said video recorder (261), at one end thereof, being linked to said wireless receiver (221), and the other end of said recorder (261) being linked to said scoring computer (242) of said computer assembly (24),





wherein the improvement comprises (i) positioning said CCD cameras (20) at known survey points and approximately in quadrature; (ii) training said CCD cameras (20) onto a target for weapons impacts; (iii) transmitting real-time precise electronic images of weapons impacts to said computer assembly (24) via said wireless transceivers (22); (iv) automatically freezing the camera images by said computer assembly (24) upon weapons impact and accurately calculating the impact position; and (v) displaying the results of weapons scoring in said display monitor (241).

7. A method of weapons scoring as set forth in Claim 6, characterized by the further step of printing out the results of scoring in graphic or tabular summaries by said printer (244) of the computer assembly (24).
8. A method of weapons scoring as set forth in Claim 6, characterized by the step of displaying the images of impact, data, and scores on the display monitor (241) of the computer system (24).

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