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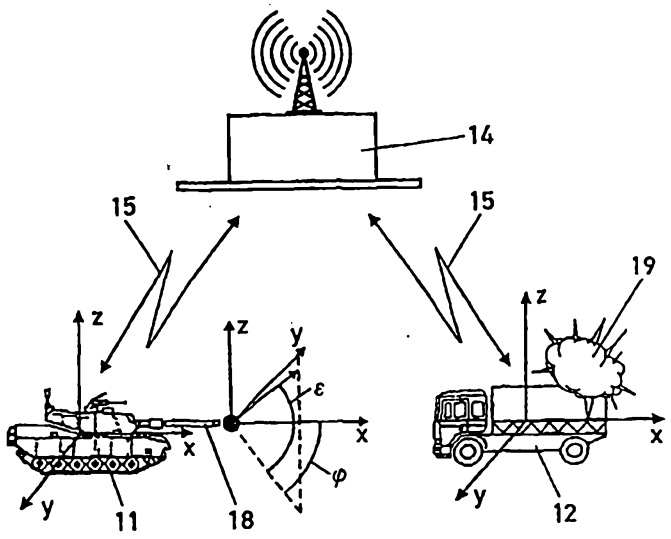
(54) Title: METHOD FOR SIMULATING A BATTLEFIELD

(54) Bezeichnung: VERFAHREN ZUR GEFECHTSFELDSIMULATION

(57) Abstract

The invention relates to a method for simulating a battlefield, whereby real, armed, participants (11), acting on a training range which represents the battlefield, fire simulated shots at targets (12) located on said training range. The hits on the targets (12) which are located in the action zone are transmitted from the hypothetical projectile impacts of the simulated shots. In order to avoid the disadvantages of conventional methods of battlefield simulation which operate with laser light, a central unit (14) maintains exclusive radio contact with the participants (11) and targets (12) and all data relevant to the shooting simulation is exchanged via said central unit (14).



(57) Zusammenfassung

Bei einem Verfahren zur Gefechtsfeldsimulation werden von in einem das Gefechtsfeld darstellenden Übungsgelände agierenden, bewaffneten, realen Teilnehmern (11) simulierte Schüsse auf im Übungsgelände sich befindliche Ziele (12) abgefeuert und von im Wirkungsbereich hypothetischen Geschosseinschläge der simulierten Schüsse liegenden Zielen (12) Treffereignisse gemeldet. Zur Vermeidung der Nachteile herkömmlicher, mit Laserlicht arbeitender Verfahren zur Gefechtsfeldsimulation stehen die Teilnehmer (11) und Ziele (12) ausschliesslich mit einer Zentrale (14) in Funkverbindung, und alle für die Schusssimulation relevanten Daten werden über die Zentrale (14) ausgetauscht.

Method for simulating a battlefield

The invention concerns a method for simulating a battlefield of the type defined in the generic part of claim 1.

The aim of such a simulation of a battlefield is to imitate a real battle situation on a spatially limited training range and consequently make a tactical training feasible. On this occasion all manoeuvres are monitored from a central station and in the case of an emergency the battle situation can be intervened with. At the same time participants and targets can change their roles, so that the targets can become shooting participants and the participants can become targets under fire.

In the case of a known method for the simulation of a battlefield, in particular for the illustration of the battlefield data obtained, in (DE 40 26 207 A1) at least two vehicles, participating in a military training, preferably tanks, are fitted with a duel simulator to determine battle and operating data, like, for example, shooting and hit results, quantities of ammunition and the operational state of the vehicle. To enable an immediate, continuous assessment of the position of all vehicles participating in a training in the form of an overall view in an evaluating central station, the vehicles are in radio contact with the central station and transmit their position data, as well as the battle and operational data prepared by the duel simulator to the central station, where a computer evaluates these to illustrate the intermediate and/or final results and/or an overall view regarding the total picture.

In the case of a known system for the simulation of a battle with battle participants, e.g. tanks, moving on a battlefield, the (US 5 382 958) a central battle station activates by radio a plurality of relay stations that are distributed on the battlefield. Each relay station receives from a GPS a position and time information. Each relay station repeatedly transmits in a time window position information regarding the battlefield, and selected relay stations transmit additional firing information, like the type of ammunition, distance and effect. With the information from at least three relay stations the battle participants can determine their positions relative to a transmitted point of impact.

US 4 744 761 describes a system, that simulates the efficiency of an indirect firing, e.g. of an artillery fire, wherein independently from a selected type of ammunition and a selected target control signals and depending from the control signals a plurality of radio waves are transmitted to the target and it will be indicated as to what has been hit by the selected ammunition in the selected field of targets. For this purpose in the vicinity of the gunner a master station is positioned and in the vicinity of the field of target several remotely controlled sub-stations are positioned as well as indicating units are provided, that are associated with a plurality of objects situated in the field of targets. The master station communicates directly via radio with the sub-stations, and in turn the sub-stations transmit radio waves that are received in the field of targets by the indicating units. A decoding device determines in the indicating units whether the object associated with it has been hit or not.

A known system for simulating a battlefield (US 5 788 500) uses laser for the simulation of shooting, the laser emitting a continuous laser light (CW laser). The laser light is modulated by means of pulse code modulation (PCM) and pulse pause modulation (PPM), so that both the participant triggering the shot and the type of the weapon system delivering the shot are clearly identified. All participants are equipped with optical sensors for the reception of the laser light. The shot participant receives via his optical sensor the information modulated on the laser light and deduces from it corresponding occurrences, e.g. a hit or a recording of a hit or an indication of the effect of the hit.

High-quality shooting simulators, used preferably for barrelled weapons, e.g. tanks, use the laser light of the shooting simulator additionally for the purpose of optically measuring the target before triggering the shot, for which purpose the target is additionally fitted with reflectors to reflect the laser light. From the reflections the distance to the target and the recording of the hit relative to the reflectors can be determined, which then can be additionally transmitted to the target.

The shooting simulators based on laser light have various disadvantages. Thus the optical sensors have to be so fitted externally to the participants, that they can be fought from all directions. At the same time during the battle training it also has

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to be ensured that none of the sensors are covered, for example, by dirt. Between the target and the shooting participants a free optical transmission line has to be present. The determination of the position of the hit by the shooting participant is very complicated, a separation of the targets that are simultaneously illuminated by the laser, is not possible. Because the laser light has to be safe for the eyes, the range of the shooting simulation is limited.

The object of the invention is to specify a method for simulating a battlefield that avoids the disadvantages listed above.

The objective is achieved by the features of claim 1.

The method according to the invention has the advantage, that the radio transmission of data is interference-free to a great extent and is not shielded by objects on the ground, so that the requirement for an unobstructed firing range becomes redundant. The danger of fouling of radio transmission is low both for the sender and receiver, and measures other than those required for lasers are not necessary for the protection of the participants in the battle. Moreover, covered targets can also be fought against, and targets covered, for example, by houses or dense wooded areas can be destroyed, which could not be hit in the case of laser shots, since the actual laser beam always travels to the target along a direct path, whereas the real shot, e.g. with a barrelled weapon, has a parabolic trajectory. When several targets are situated in the region of the impact of the projectile, a separation of the targets can be carried out very simply and various effects of the impact of the projectile on the various targets can be illustrated.

Useful embodiments of the method according to the invention with advantageous developments and the configuration of the invention become apparent from the further claims.

According to a preferred embodiment of the invention the actual position of every participant and every target is continuously reported to the central station and these are stored in the central station, where a data base of the training ground, containing the position data of objects fixed on the ground, like houses, walls,

streets, wooded areas and the like are stored. Thus the central station has a continuous actual overview of the battle situation with all participants and targets taking part in the battle.

According to a preferred embodiment of the invention at least in every target, preferably in every participant and every target, since their roles can be reversed, a data base with ballistic tables of all weapon systems used on the training ground, including the types of ammunition fired by them and with models for the kind and degree of the injuries and damages in the case of a hit as well as a code identifying the participant and the target, is stored. Thus the targets have the necessary equipment to calculate the hits by the projectiles and to determine the effect of the impacts of the projectiles on the relevant target.

According to a preferred embodiment of the invention with the data transmitted by the shooting participant the hypothetical hits of the projectiles are determined in the central station with the aid of the stored ballistic tables and only the targets being in the effective range of the impact of the projectile are addressed for data exchange by the central station. At the same time by virtue of the data base of the training ground stored in the central station covers on the account of houses or trees in the direction of the target are also being considered. By this feature of the method the circle of participants and targets simultaneously communicating with one another will be limited to the necessary minimum.

According to a preferred embodiment of the invention in the case of a simulated shot by the shooting participant, the shooting data, like direction of shooting, elevation, lead and position of the shooting barrel, type of weapon and ammunition, as well as the identification code of the shooting participant are sent to the central station and this shooting data is transmitted from the central station to the endangered targets, which in turn recalculate the position of the hypothetical impact of the projectile and transmit them to the central station together with an identification code of the reporting target. Based on the calculated impact of the projectile and its position and movement at the time of the impact of the projectile, the targets determine the type and the degree of their injuries and damages and report them to the central station. If the position of the

target and the position of the hypothetical impact of the projectile coincide in time and space then the target optically indicates a hit and/or reports it to the central station.

The invention is explained in the following in detail based on an embodiment illustrated in the drawing. The following is shown in schematic illustration:

Fig.1 - a section of a battlefield with a real battle situation,

Fig.2 - a function block diagram of the method for simulating a battlefield.

Fig.1 shows a section of a training ground forming the battlefield, wherein during a battle armed, real participants 11, e.g. soldiers, tanks, guns and the like operate and fire simulated shots at passive participants, called targets 12 in the following, e.g. soldiers, tanks, guns, vehicles and the like. In the embodiment of Fig.1 a tank is illustrated as the armed participant 11 and a commercial vehicle, traversing the ground, is illustrated as the target 12. If the targets 12 have also a weapon system, then the roles can be reversed during the battle, and the target 12 will be now the shooting participant and the armed participant 11 will represent now the target. All participants 11 and targets 12 are fitted with a satellite-supported position determining device, e.g. GPS or DGPS, that continuously determines the position of the participant 11 and of the target 12, with a computer unit and with a data bank or data base (Fig.2), in which ballistic tables of all weapon systems used in the battle field, statistical information of all weapon systems used in the battle field and models for the kind of possible injuries and damages in the case of a hit are stored. Both the participants 11 and the targets 12 have a radio set, with which they communicate with a central station 14.The radio links between the central station 14 and the participants 11 and targets 12 are indicated in Fig.1 by arrows 15.

The central station 14, also fitted with a radio set, has a computer unit with a data base 16 of the training ground, in which position data of objects fixed on the ground, like houses, walls, streets, wooded areas and the like are stored, and with a data base 17, in which the ballistic tables of all weapon systems used on

the training ground, both for the targets 12 and the armed participants 11 are stored, including the types of ammunitions used by them.

During a battle training all participants 11 and all targets 12 continuously report their actual positions determined by the GPS (x, y, z coordinates of the tank and the truck in Fig.1) to the central station 14, that stores them in the data base 16 for the training ground, while these stored values are continuously updated. In the case of a simulated shot fired by a participant 11, the shooting participant 11 transmits the shooting data, like the position of the shooting barrel 18 (x, y, z coordinates in Fig.1), the alignment of the weapon (elevation ε, lead φ), type of weapon, type of ammunition, and an identification code of the shooting participant 11 to the central station 14. From these shooting data the hypothetical, simulated or virtual trajectory and the hypothetical impact of the projectile are determined in the central station 14 with the knowledge from the data base 17. The shooting data is transferred from the central station 14 to those targets 12 which are situated in the effective range of the hypothetical impact of the projectile calculated by the central station 14 and consequently could be hit or damaged, i.e. endangered. With the transmitted shooting data of the shooting participant 11 and the knowledge from the data base 13 the hypothetical impact of the projectile is determined again by the endangered targets 12, while its own movement and the direction of movement during the flight of the projectile is also considered. If its own position and the hypothetical impact of the projectile coincide in time and space, then the target optically indicates a hit, what can be affected, for example, by the triggering of a flash 19, as this is illustrated in Fig.1, and additionally reports the hit to the central station 14. If no direct hit is reported, but the position of the target 12 is only in the direct vicinity of the impact of the projectile, then based on the knowledge from the data base 13 the kind and degree of a possible wounding or damage to the target 12 is determined and this is reported to the central station 14.

Patent claims

1. A method for simulating a battlefield, wherein on a training ground representing the battlefield armed real participants (11), e.g. soldiers, tanks, guns and the like fire simulated shots at the targets (12), e.g. soldiers, tanks, guns, vehicles and the like situated on the training ground, after the evaluation of the shots the results of the hits are reported and the participants (11) and the targets (12) are in radio connection (15) with a central station (14), characterised in that all data relevant for the shooting simulation are transmitted by the participants (11) to the central station (14) and from it to those targets (12) which are situated in the effective range of the hypothetical impacts of the projectiles of the simulated shots and the report of the hit occurrences is carried out by the targets (12).

2. A method according to claim 1, characterised in that the actual position of every participant (11) and of every target (12) is continuously reported to the central station (14) and these are stored in the central station (14) in a data base (16) of the training ground containing position data of objects fixed on the ground, like houses, walls, streets, wooded areas and the like are stored.

3. A method according to claim 1 or 2, characterised in that at least in every target (12), preferably in every participant (11) and every target (12), a data base (13) with ballistic tables of all weapon systems used on the training ground and with models for the kind of its typical injuries and damages in the case of a hit as well as a code identifying the target (12) and the participant (11) is stored.

4. A method according to claim 2 or 3, characterised in that with the data transmitted by the shooting participant (11) the hypothetical hits of the projectiles are determined in the central station (14) with the aid of the stored ballistic tables of all weapon systems used on the training ground and only the targets (12) being in the effective range of the impact of the projectile are addressed for data exchange by the central station (14).

5. A method according to claim 4, characterised in that in the case of a simulated shot by the shooting participant (11), the shooting data, like direction of shooting, (elevation ε, lead φ), position of the shooting barrel, type of weapon, type of ammunition, and an identification code of the shooting participant are sent to the central station (14), that this shooting data is transmitted from the central station (14) to the endangered targets (12) and that the position of the hypothetical impact of the projectile is determined by the endangered targets (12) and is transmitted to the central station (14) together with an identification code of the reporting target (12).

6. A method according to claim 5, characterised in that based on the determined impact of the projectile and its position and movement at the time of the impact of the projectile, the targets (12) determine the type and the degree of their injuries and damages and report them to the central station (14).

7. A method according to claim 6, characterised in that if the position of the target and the position of the hypothetical impact of the projectile coincide in time and space then the target optically indicates a hit and/or reports it to the central station (14).

8. A method according to any one of claims 3 to 7, characterised in that the code identifying the participant (11) or the target (12) is emitted by the central station (14) prior to the commencement of the battle training.

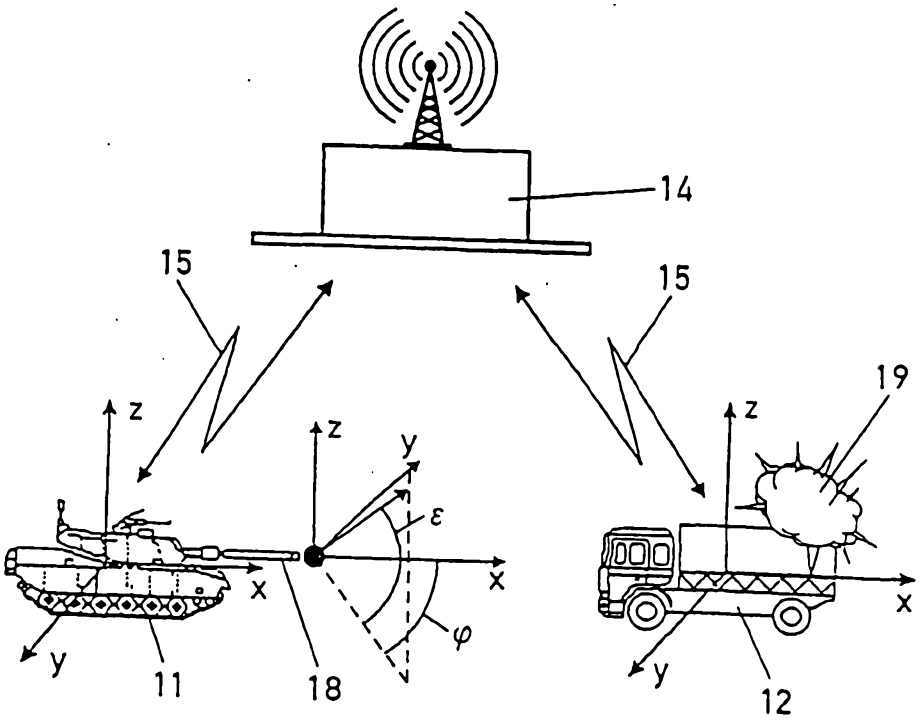
14
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Fig.1

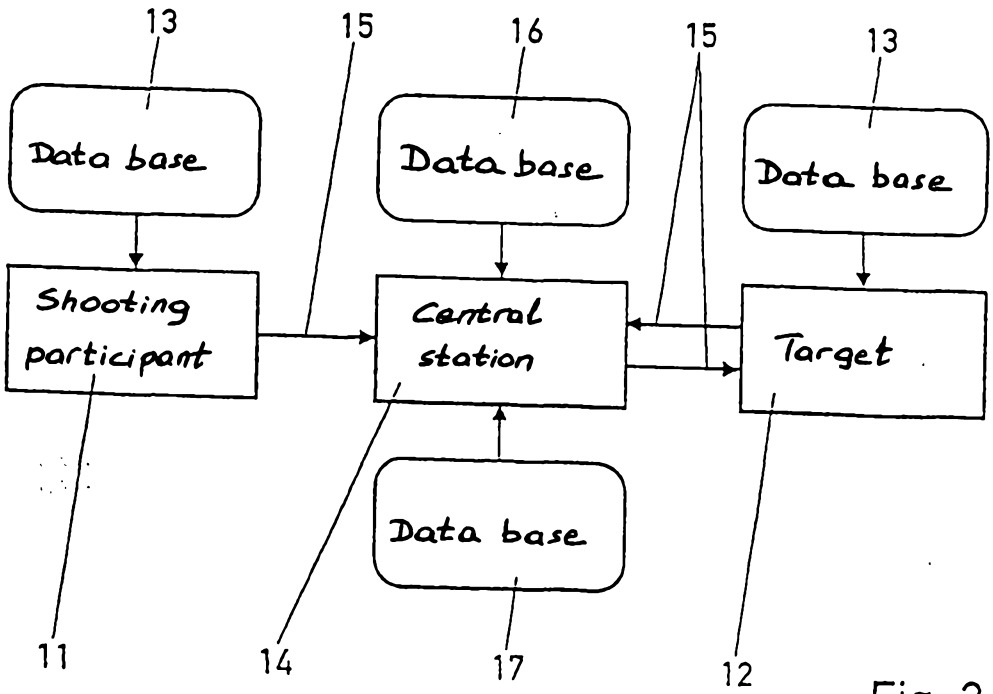
13
15
16
15
13
Data base
Data base
Data base
Shooting participant
Central station
Target
Data base
11
14
17
12

Fig. 2