The present invention relates to a device for measuring the distance to real and virtual objects in an area. The device comprises at least one camera unit arranged to take an image sequence of said area, and a graphics unit arranged to generate virtual objects and to merge said generated virtual objects with the image sequence taken by the camera unit. A display shows said merged virtual objects and image sequence. A tracking unit is arranged to determine the position of the device. The device further comprises a first rangefinder, arranged to measure the distance between the device and said real objects, and a second rangefinder, arranged to measure the distance between the device and said virtual objects.
DEVICE FOR MEASURING DISTANCE TO REAL AND VIRTUAL OBJECTS

TECHNICAL FIELD
The present Invention relates to a display device, for a fire-control officer, for measuring distance to real and virtual objects (simulated indirect fire), which enables the fire-control officer to act broadly as in a real case of indirect fire.

BACKGROUND TO THE INVENTION
An effective defense requires well-trained soldiers who, in the field, can perform in a tactically correct manner, do the most possible good and avoid friendly losses. Effective training ahead of future missions then plays a crucial role. In the training of soldiers, a simulator system is a valuable tool.

In a simulator system, reality is simulated, for example, in the form of different kinds of firing, hits, and results of hits.

The simulator system is either a complex system forming part of an overall network for data at the disposal of an exercise command unit, or a simpler system based on a field computer (laptop type) which can be used by an exercise control officer.

Indirect fire
In the case of indirect fire, targets which lie outside the field of view are fired upon by the firing of a projectile in an arc over long distances and/or over blocking terrain and objects. Usually a fire-control officer observes the target and conveys its coordinates to a gunner or troops manning an artillery gun. A fire-control officer observes how the fire hits in relation to the target and makes corrections in the longitudinal and lateral directions. Indirect fire is most often discharged with mortar, cannon, howitzer or rocket artillery, but indirect fire from aircraft also occurs.

The fire-control officer carries with him, or has access to, a distance instrument in order to be able to measure where the fire from the artillery
lands. The fire results in an explosion with subsequent smoke formation (smoke cloud), for example in the form of a detonation or blast.

The fire-control officer can also with the distance instrument measure distance to a target object, for example a combat vehicle, and/or to various types of fixed points in the terrain.

In the following text, the term "(the) fire" will henceforth be used as a collective term for "explosion", "smoke cloud", "detonation" and/or "blast".

Instrument for surveying indirect fire
Usually the distance to the fire is measured with a distance instrument, for example a laser rangefinder, which, for example, is integrated with a field-glass-like device. There are many different types of distance instruments, certain of which are mounted in various types of combat vehicles and others of which have to be placed on a tripod, or else they are designed to be able to be carried and operated by a single person.

Hereinafter in the text, this person is termed "(the) fire-control officer" and he can form part of, for example, a mobile fire command unit.

Certain types of distance instruments are thus designed for use by mobile fire command units. The distance instrument should in this case be configured like a field glass with respect to weight, size and shape, for example with optical data of 7x50, so as to be able to be carried and operated by a single person, see figure 1 in this connection.

Such a distance instrument is normally used to measure targets from 150 m to 10 km, and with a resolution, for example, of about 1 m at a distance of 1000 m. The resolution can vary, however, with different types of equipment. The maximum distance is naturally dependent on the size and shape of the target and on weather conditions and is therefore generally limited to 5-6 km under field conditions.
An example of a distance instrument for indirect fire is shown in fig. 1 and comprises the following parts disposed in a housing 101 (only the most important parts are touched on here):

- a function switch 106, which connects a battery or external voltage source to the instrument and makes it ready for measurement;
- an adjusting wheel 103, with which the shortest blocking distance, (shortest recordable distance) is determined, see also below in the text;
- an indicator eyepiece 105, in which measuring results and various indications are shown;
- a sight eyepiece 104 (built-in field glass), which is used for observation;
- a laser rangefinder 110, which measures the distance to a real object;
- a firing button 102, which is pressed down when measurement is to be carried out.

The sight eyepiece is connected to an optically magnifying unit, for example a monocular field glass which is used for the actual observation. The telescope can give seven-fold magnification, for example, and the field of view can then, for example, cover 7 degrees in the horizontal and vertical directions. In the field of view for the telescope is found a reticule plate, which, for example, is graduated every fifth m-line and accentuated every tenth m-line, both horizontally and vertically. The reticule plate has in the middle, for example, an opening of 1 m-line size, which then corresponds to the approximate extent of the laser beam. The instrument then conducts measures only on targets which are fully or partially visible within this 1 m-line opening. See figure 2 regarding examples of the look of a reticule plate. In figure 2, 201 indicates a forest background, 202 are markings on the reticule plate and 203 is indicator information.
The indicator eyepiece is connected to an indicator, for example a display unit (panel), in which the measured distance to the target is presented. The distance is shown, for example, with four numerals. The indicator also provides information to the fire-control officer indicating that one or more reflexes within the blocking distance setting have been rejected by the rangefinder. This is realized, for example, by the lighting of a light spot (light-emitting diode) around the numerals which show the distance.

In certain types of distance instruments, an indicator eyepiece and a sight eyepiece are part of a system in which a video camera, sensitive to visual radiation (VIS) and/or to thermal radiation (TIR=TEHERMAL INFRA RED or NIR=NEAR INFRA RED) with magnifying optics, and connected to a display (for example a microdisplay in front of one or both eyepieces) gives the fire-control officer both observation capability and a display of measuring results/indications.

The distance instrument can be used as a normal observation field glass for reconnaissance in the terrain and target identification. When range-findings become necessary, a laser rangefinder integrated in the distance instrument is started, for example, by setting of a function switch into the "ON" position.

A distance measurement is carried out, for example, as follows:

- the fire-control officer adopts a relaxed posture which allows constant elbow support for the distance instrument, for example recumbent according to figure 3;
- the fire-control officer now holds the distance instrument ready, i.e. in a somewhat lowered position, so that the eyes obtain a clear line of sight above the distance instrument, according to figure 4;
- the rangefinder is aimed toward the target area;
- the foreground or other obstacles are noted in due order;
- a function switch is set to the "ON" position;
- a blocking distance wheel is checked so that this is set to zero or to a desired distance;
when the fire-control officer sees the fire/the target, the fire-control officer places the distance instrument in front of the eyes, according to figure 3;

the fire-control officer looks into the eyepiece;

a triggering button is pressed down as the target is observed;

the button is held in the depressed position for at least a second or so (the rangefinder is now held in standby position);

the direction of the distance instrument is checked so that it is correctly aligned with the target;

the firing button is carefully released;

the rangefinding takes place once the firing button is released;

the indicator is read;

the distance presented in the indicator, which is quoted, for example, in meters, is shown for a few seconds and thereafter disappears.

Models for computer graphics

Computer development has resulted in computers being able to handle more and more information. More especially, development has accelerated within computer games by virtue of the fact that computers at ever increasing rate and with ever increasing refinement create a visual experience which gives the user, to a certain degree, a sense of reality. This type of computer experience is termed "Virtual Reality" and is used, for example, in various types of computer games and simulation applications.

Based on input data, the computer handles various forms of virtual three-dimensional objects and puts these together to form so-called 3D models.

3D objects are combined with one another, but also with images/image objects. In simpler terms it might be said that an image is a very thin 3D object, a "film screen", onto which a static or dynamic texture is projected. A dynamic image/texture can also be an animation, i.e. the computer creates a "virtual film sequence", which is placed, for example, as a dynamic texture.
onto the "film screen", it is also possible to make use of a film recording made on an earlier occasion and to use this film sequence as an animation.

A thin 3D object "film screen" is placed in the far distance, from the perspective of a user, in a larger 3D model, and on this "film screen" is placed a texture, static or dynamic, which describes, for example, the area around a horizon.

By using images/image sequences from a real camera, these images/image sequences are placed as dynamic textures, for example, in the far distance in a 3D model. In this way, a mixed reality is created, in which images/objects from reality are mixed with virtually created images/objects. This type of mix is termed "Mixed Reality" or "Augmented Reality".

Figure 5 shows how a mix between the real world and virtual objects comes about, in which, for example, a smoke cloud and a combat vehicle are mixed into an image describing the reality, and in which:

- 501 is a "film screen", thin 3D object (image), on which a camera image is placed as, for example, a dynamic texture;
- 502 is a real sky background;
- 503 is a real forest background;
- 504 is a real field background;
- 505 is an x-axis in a coordinate system;
- 506 is a y-axis in a coordinate system;
- 507 is a z-axis in a coordinate system;
- 508 is a virtual viewing point, the point from which a user regards the mixed world;
- 509 is a virtual smoke cloud, a 3D object, which is placed in front of the "film screen";
- 510 is a virtual combat vehicle, a 3D object, which is placed in front of the "film screen".
Various combat elements are today practiced out in the field with the aid of various types of simulator exercises. It is possible, for example, to simulate attacks involving minings, anti-aircraft defense and, not least, combat with direct or indirect fire. In simulation of indirect fire, a computer/computing unit/simulator system determines/computes where in a terrain the simulated fire shall land.

In order that, in an exercise which includes simulation of indirect fire, the fire-control officer shall acquire greater relevance in the exercise, the fire-control officer should be able to be alerted to the simulated fire through his sense of sight and hearing; align his distance instrument to the simulated fire; or carry out those elements which are relevant to distance measurement and rangefinding.

However, a fire-control officer who is out in the field cannot with present-day simulation systems see the simulated fire in the same way as in reality, since it merely consists of a quantity of data in a system for training.

SUMMARY OF THE INVENTION

Consequently, an object of the invention is to provide a device for measuring distance to both real and virtual/simulated objects (indirect fire or targets) in an area, which device comprises at least one laser rangefinder, a virtual laser rangefinder, a camera unit arranged to take a sequence of images of said area, a graphics unit arranged to generate virtual objects and to merge said generated virtual objects with the image sequence taken by the camera unit, a display on which said merged virtual objects and said image sequence are shown, a tracker unit arranged to determine the position of the device, and a computing unit arranged to determine the position of said virtual/simulated fire or said target object in the area.

If a virtual/simulated object exists and the device is aimed toward this virtual/simulated object and a distance measurement is carried out, then the virtual laser rangefinder is activated.
If a virtual/simulated object exists and the device is aimed toward a real object and a distance measurement is carried out, then the real laser rangefinder is activated.

If no virtual/simulated object exists and the device is aimed toward a real object and a distance measurement is carried out, then the real laser rangefinder is activated.

According to one aspect of the invention, this object is achieved by a device characterized by the distinguishing features defined in the characterizing part of patent claim 1, which states that the device comprises a distance-measuring unit comprising, on the one hand, a real laser rangefinder arranged to measure the distance between the device and a real object and, on the other hand, a virtual laser rangefinder arranged to measure the distance between the device and a virtual/simulated object (indirect fire or target) when the device is aimed toward the virtual/simulated object.

Advantageous embodiments of the invention emerge from the subclaims.

By virtue of the provision of a device in which a fire-control officer is given the chance to visually see the virtual/simulated object (indirect fire or target), the participation of the fire-control officer in a simulator exercise is made possible.

Apart from the fact that a fire-control officer, with the aid of the invention, can participate in a simulator exercise, the invention also provides further advantages:

- Since ammunition is very expensive, the invention saves money;
- Exercises can be carried out in areas in which, for various reasons, for example safety reasons, ammunition cannot be fired and executed;
- Hits on combat vehicles, for example, are realized with visual effects;
• Less environmental load upon the exercise field, owing to virtual ammunition;

• Use of simulated/virtual target objects, for example combat vehicles, is significantly cheaper than when real target objects are used.

Further objects and distinguishing features of the embodiments of the present invention will be made clear in the detailed description in combination with the accompanying drawings. It should be understood, however, that the drawings are not necessarily to scale and are only configured for the purpose of illustrating the invention and not of limiting the invention.

BRIEF DESCRIPTION OF THE DRAWINGS
In the drawings, the same reference notation denotes the same element throughout the various figures, and:

fig. 1 shows an example of a previously known distance instrument;

fig. 2 shows an example of a reticule plate;

fig. 3 shows a typical operating setting in the use of a distance instrument;

fig. 4 shows a typical operating setting during reconnaissance/waiting;

fig. 5 shows a previously known mix of a real world and virtual objects;

fig. 6 shows an example of a device according to the invention;

fig. 7 shows an indicating unit according to a first embodiment of the present invention;

fig. 8a shows an indicating unit according to a second embodiment of the present invention;
fig. 8b shows an indicating unit according to a third embodiment of the present invention;

fig. 9 shows a mix of a real world and virtual objects according to the present invention.

DETAILED DESCRIPTION
The various integral sub-systems/units/devices can all be placed inside the housing of the distance instrument, but can also to some extent be parts of a computer system. For the purpose of facilitating understanding of the invention, a computer system will hereinafter be described as an external unit. According to an embodiment of the invention which is shown in figure 6, the device comprises a housing 101, a firing button 102 and a laser rangefinder 110. The device further comprises a graphics system 603, an interaction unit 604 and a computing unit 605. The device also comprises a video camera system 606, a tracker system 607, a display system 608, a light-generating unit 609, an indicating device 610 and a communication unit 611. The parts integral to the device are described in greater detail below.

The present invention provides a solution to the problem of, for a fire-control officer, being able to present/visualize simulated fire out in real terrain in such a way that the fire-control officer can by and large carry out those elements which he executes in a real case. This means that the fire-control officer, on the one hand, can measure distances to real objects through a real laser rangefinder and, on the other hand, measure distances to a virtual/simulated object, for example fire or target object (e.g. a combat vehicle) with a virtual laser rangefinder.

The invention will be described below as a number of sub-systems, devices, units and components, which mutually interact so that the desired effect is achieved. The invention thus consists of:

A housing
A housing (or shell), from a proper distance instrument or the like a housing from the same.

A laser rangefinder

A laser rangefinder is an active electro-optical system, which measures the distance to an object by emitting a laser pulse and measuring the time until this returns.

A firing button

A firing button which is integrated in the housing and is connected to an interaction unit (which can be a part of a computer). Firing, that is to say execution of a measuring moment, can usually be realized when the firing button is released, but firing when the firing button is pressed down could even also be an option. The firing button can control the laser rangefinder directly, or alternatively via the interaction unit and the computing unit (the computer).

A graphics system

A graphics system, (which can be a part of a computer, computer graphics system), which generates virtual objects/animations/sequences, for example:

- the fire (an explosion, a smoke formation, a detonation or blast),
- one or more target objects (a combat vehicle)
- terrain and terrain objects (trees and bushes which may be required to enable the fire and/or the target objects to be seen to land correctly in the depth direction).

The task of the graphics system is also to mix virtual objects/animations/sequences with the image from the camera (which describes the real terrain) and to mix in reticule plate and indicator information (numerals type). The reticule plate can be mixed in physically, however, by an engraving, for example, on a thin sheet of glass. See also in connection with various mixing methods later in the text.
Interaction unit
The task of the interaction unit (which can be a part of a computer) is to read various forms of input, for example a button pressing or button release from a firing button, a setting of a function switch or a turning of a wheel for setting of a blocking distance.

The interaction unit can also generate output, for example lighting/turning-off of indicators (light emitting diodes) for an indicating device.

Computing unit
The computing unit (which can be a part of a computer) can, from
- the tracker system obtain the orientation and/or position of the fire-control officer, and from
- the communication unit obtain information on where, when and in what form a virtual fire shall be placed in the terrain
- compute if and where in the field of view of the distance instrument the virtual fire shall be presented/shown.

The computing unit also includes a distance-computing part. Once the fire-control officer has aimed the distance instrument toward the simulated fire with the aid of an aligning device, for example cross hairs (reticule plate) and, released (or depressed), firing button, the computing unit works out the distance which a "proper" laser rangefinder would have come up with in a real case.

Video camera system
A video camera with magnifying electronics can be placed inside the housing. The camera image (video stream) is connected to a graphics system (which can be a part of a computer). The camera is usually sensitive in the visible range, but other wavelength ranges, for example near-IR or thermal IR (IR=InfraRed), may also be appropriate, and also a video camera with light-amplifying function. A plurality of video cameras can be included in the
system. These can operate, for example, in different wavelength ranges or be used for surveying tasks for the tracking system.

Tracker system

The tracker system (the tracking unit) is used to compute/survey the orientation and/or position of the distance instrument (the fire-control officer). Computing/surveying of the position of the distance instrument can be carried out in the x, y and z directions in any coordinate system (can be global). Position surveying can be realized, for example, with the aid of a GPS receiver (GPS=Global Positioning System). The position can also be preprogrammed for certain training sites or else it can also be inputted by hand (or be obtained from some other system). Computing/surveying of the orientation of the distance instrument (rotation/direction) is also necessary. This can be carried out, for example, with a gyro-based tracker unit with built-in compass, or a camera-based system which can orientate itself through recognition of objects in the image. See also in connection with various tracker solutions below in the text.

Display system

The display system shows the image from the graphics system. This image can be a camera image (with superimposed reticule plate), which shows, for example, the pertinent terrain, virtual fire in this terrain, but also measuring results in the form of numerals and indicators which show results from a laser measurement (a simulated or real measurement). The display system is usually connected to an eyepiece, but connection to two eyepieces is also possible through the use of two display units (microdisplays). The two eyepieces can show different information, for example the left-hand eyepiece can show measuring results in the form of numerals and indicators and the right-hand eyepiece a camera image with superimposed reticule plate. The images from the two eyepieces can be merged in the brain to form an image.

Sound-generating unit
In order for the exercise with the distance instrument to be as realistic as possible, there is a need for a sound-generating unit (which can be a part of a computer) which emits a sound that imitates proper fire. The sound-generating unit can present sound in a loudspeaker component installed in the distance instrument, in an external unit, for example in a loudspeaker beside the fire-control officer or in a loudspeaker in an exercise computer, or in headphones on the fire-control officer.

The sound-generating unit has the task of ensuring that the fire-control officer is alerts to the fire and, with stereo and/or 3D sound, has an indicating function.

**Indicating device**

In a real case, the fire-control officer can hold the distance instrument directly below their eyes and gaze in a line of sight directly above the distance instrument, see also figure 4. In reality, the fire-control officer can then, with his eyes or ears, assess where the fire is coming from and can thus point the distance instrument in the direction of the fire and subsequently carry out his measuring tasks. That the fire-control officer will be able to see a simulated fire in this manner when he gazes is scarcely feasible. An auxiliary indicating device must therefore be used.

Such an indicating device can, on the one hand, focus on the sense of sight of the fire-control officer and, on the other hand, on the sense of hearing of the fire-control officer. Regarding alertness from the sense of sight, the indicating device can be:

- placed on the distance instrument
- integrated in the housing of the distance instrument
- a part of something which the graphics system shows in the display system, for example auxiliary arrows in the image which show the direction in which the fire-control officer must point the distance instrument
- an external unit beside or in front of the fire-control officer.
Regarding alertness from the sense of hearing, the indicating device can:

- consist of headphones, with stereo or 3D sound presentation, which the fire-control officer has on his head
- consist of sound-generating devices which are integrated in the rangefinder
- consist of external sound-generating devices which are placed externally around the fire-control officer.

An indicating device can consist, for example, of direction indicators, by way of suggestion luminous arrows or dots, up on the distance instrument or integrated in the housing of the distance instrument, which show when and roughly in which direction the simulated fire was executed. The indicating device can show, on the one hand, the lateral direction and, on the other hand, the vertical direction, but also both directions at the same time. A computing unit which has computed/surveyed the position and orientation of the distance instrument, and the position of the simulated fire, can then instantaneously control the indicating device, see also figure 7. The indicating device can blink, for example, until the simulated fire is then executed, after which, with some delay, the fire-control officer hears the bang from the sound-generating unit.

Instead of direction indicators according to the above description, an indicating device can be a display which is placed on the housing of the distance instrument. This display can be tiltable up and down. On this display, graphic direction indicators, for example, can roughly show the direction of the fire, but the display could also show an image over the terrain taken with a video camera with wide-angle lens, so that the simulated fire will appear in the image of this video camera, and thereby make it easier for the fire-control officer to align the distance instrument, see also figure 8.
An indicating device does not need to be integrated in or placed on the distance instrument, but can be an external unit, for example set out in front of the fire-control officer.

As stated above, other embodiments of an indicating device could also be stereo, 3D sound or tactile devices which give the fire-control officer a physical sensation as to the direction in which he must aim the distance instrument.

In figure 7 shows an embodiment of the indicating device in which the distance instrument 703 has a unit 701 showing the lateral direction and a unit 702 showing the vertical direction.

In figure 8a shows another embodiment of the indicating device, in which the distance instrument 703 has a display 801 mounted thereon, which display can show a wide-angle image of the terrain ahead, but also, in addition thereto, other directional information.

In figure 8b shows a third embodiment of the indicating device, in which the distance instrument 703 comprises an angled transparent glass or plastics sheet 802 with certain reflective properties, in which a luminous indicator 803 indicates a direction and the notation 804 shows examples of reflection of the luminous indicator 803 on the angled transparent glass or plastics sheet 802.

Communication unit
The communication unit (which can be a part of a computer) has the task of communicating with the systems/software/operators which/who determine/compute when, where, how and in what form simulated fire shall be presented in the distance instrument and to the fire-control officer.

Systems which can generate such data can be, for example:
- a network system for simulating effects in connection with combat
- a field/exercise computer (having, for example, generating software)
• an exercise controller, who, through some human interaction, sets a process in motion.

The communication unit can obtain external data, for example, via a communication system (by wire or wirelessly).

Various mixing methods
A virtual/simulated fire or target object can be mixed in such a way into a camera image describing a real terrain that a fire-control officer can sense that the fire/the target object lands in the right manner and in the right place as in reality. This is relatively simple to achieve when the fire is executed in the air or on a flat surface, for example a large field or a water surface, or equivalent for a target object. Problems arise when the simulated fire is executed behind, for example, trees, clumps of trees and vehicles, or in natural hollows. In this case, the real objects located in front of the fire must also end up in front of the simulated fire, otherwise the fire-control officer will scarcely sense where the fire lands.

In order to be able to place the virtual fire, depth-wise, correctly in the right terrain, an additional maneuver has to be used. Some examples of such maneuvers are described below.

• To the distance instrument (that which is intended for simulation) is connected a laser radar camera, which in each pixel, picture element, can represent a distance. The distance pixels of the laser radar camera are matched with the camera, which visually represents the terrain, and after this a computing unit can compute which pixels from the camera image (the terrain) shall be laid in front of the simulated fire, viewed from the position of the fire-control officer.

• Since a laser radar camera, at least in the present situation, is a relatively large and expensive piece of equipment, a variant of such a camera can be used, a laser scanner. This can be placed on a preselected exercise site and here can scan in depth information from this site. This depth information can then be used to compute which
pixels from the camera image (the terrain) shall be laid in front of the simulated fire.

- From airborne laser scanning, high-resolution geodata information can be obtained. This information can help to produce, for example, 3D models which illustrate reality. These 3D models (environment models which illustrate the terrain) can be used in part or in full in the image seen by the fire-control officer, so that the fire-control officer gathers where the fire is coming from in the depth direction, see also figure 8. As an additional refinement, the high-resolution geodata information can act as an aid when the fire-control officer aims his distance instrument toward a chosen object in the terrain. Since the position and orientation of the fire control officer/the distance instrument are known, these data can be used as input data to the high-resolution geo information and it is thus possible to compute the virtual distance to the object in question. This virtual distance shall then be able to conform to corresponding real measured distances.

Figure 9 shows how a 3D object, a tree, which stems from a 3D model computed from high-resolution geodata information, can augment the distance evaluation for the fire-control officer.

- 501 is a "film screen", a thin 3D object (image) on which a camera image is placed as, for example, a dynamic texture
- 502 is a real sky background
- 503 is a real forest background
- 504 is a real field background
- 505 is an x-axis in a coordinate system
- 506 is a y-axis in a coordinate system
- 507 is a z-axis in a coordinate system
- 508 is a virtual viewing point, the point from which a user regards the mixed world
- 509 is a virtual smoke cloud, a 3D object, which is placed in front of the "film screen"
• 910 is a virtual tree, a 3D object whose position, type and shape stem from high-resolution geodata information
• 911 shows the image which is seen by the fire-control officer and in which the tree lies in front of the smoke cloud.

Various tracker solutions
There are a number of methods for measuring how the fire-control officer is aiming his distance instrument. Some of these methods are described below.

• Gyro-based surveying. From a gyro, the direction can be obtained. By combining the gyro with a compass, a measurement can be made absolute. The gyro can also be combined with a camera-based (signal processing of images) method, instead of a compass.

• Surveying based on "feature detection" and with the aid of a camera. A number of "markers" (i.e. predetermined objects in terms of shape, colors, formations, brightness) are placed at strategic locations out in the terrain. When the camera (the detection system) locates these, the direction of the distance instrument can be computed. For example, "markers" can be placed out in the terrain at a relatively far distance from the fire-control officer > 10 m, but a "marker" can also be placed, for example, precisely in front of the fire-control officer < 1m. In more sophisticated cases, "feature detection" can be carried out on natural objects in the landscape.

As an alternative embodiment, the above-described device according to the invention can be combined with a laser meter.

Various embodiments of simulator equipment
The embodiment which has been described above has been based on the fact that special simulator equipment is produced. However, there are alternative embodiments for the simulator equipment, in which a preexisting distance instrument is temporarily modified to act as simulator equipment. Some methods are shown below:
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- A camera is placed/is mounted next to/over the output opening of the field glass, and an eyepiece with built-in microdisplay is mounted in front of/on the eyepiece of the distance instrument. Alternatively, the eyepiece of the distance instrument is unscrewed and replaced with the eyepiece with built-in microdisplay.

An existing distance instrument is shown in figure 10a, in which:

- 101 is a housing
- 104/105 is an indicator eyepiece, alternatively a sight eyepiece
- 120 symbolizes an optical lens assembly in an eyepiece 104/105
- 121 symbolizes an optical lens assembly in a field glass (telescope)
- 122 symbolizes an optical axis

A first embodiment of a modified distance instrument is shown in figure 10b, in which:

- 101 is a housing
- 104/105 is an indicator eyepiece, alternatively a sight eyepiece
- 120 symbolizes an optical lens assembly in an eyepiece 104/105
- 121 symbolizes an optical lens assembly in a field glass (telescope)
- 122 symbolizes an optical axis
- 123 is a camera
- 124 is a lens for the camera
- 125 is a mounted eyepiece
- 126 symbolizes a lens assembly in the mounted eyepiece
- 127 is a microdisplay

Another embodiment of a modified distance instrument, in which an existing eyepiece has been replaced with a mounted eyepiece, is shown in figure 10c, in which:

- 101 is a housing
- 121 symbolizes an optical lens assembly in a field glass (telescope)
- 122 symbolizes an optical axis
- 123 is a camera
• 124 is a lens for the camera
• 125 is a mounted eyepiece
• 126 symbolizes an optical lens assembly in the mounted eyepiece
• 127 is a microdisplay
PATENT CLAIMS

1. A device for measuring the distance to real and virtual objects in an area, which device comprises at least one camera unit (606) arranged to take an image sequence of said area encompassing said real objects (502, 503, 504), a graphics unit (603) arranged to generate virtual objects (509, 510, 910) and to merge said generated virtual objects (509, 510, 910) with the image sequence taken by the camera unit (606), a display (608), on which said merged virtual objects (509, 510, 910) and said image sequence are shown, and a tracking unit (607), arranged to determine the position of the device, characterized in that the device further comprises a first rangefinder (110), arranged to measure the distance between the device and said real objects (502, 503, 504), and a second rangefinder, arranged to measure the distance between the device and said virtual objects (509, 510, 910).

2. The device as claimed in patent claim 1, characterized in that said second rangefinder comprises a camera (123), disposed next to an output opening of the device, and an eyepiece (125), having a built-in microdisplay (127) disposed on an eyepiece (104/105) contained in the device.

3. The device as claimed in patent claim 1, characterized in that said second rangefinder comprises a camera (123), disposed next to an output opening of the device, and an eyepiece (125), having a built-in microdisplay (127) disposed next to an opening of the device, through which opening a user looks.

4. The device as claimed in patent claim 1, characterized in that said virtual object is a simulated indirect fire, in which the device further comprises an indicating unit (610), which comprises at least one direction indicator arranged to, when said simulated fire is executed, show the direction thereof, and in that a computing unit (605) is
arranged to measure the distance between the device and said simulated field when the device is aimed toward the fire according to the shown direction thereof.

5. The device as claimed in patent claim 4, characterized in that said direction indicator consists of a luminous arrow or dot showing said direction, so that a user knows in which direction said device shall be aimed.

10. The device as claimed in patent claim 4, characterized in that the indicating unit (610) is a display (801) disposed next to a housing (101) enclosing said device, on which display (801) an image is shown over said area in which the simulated fire is also shown, so that a user knows in which direction said device shall be aimed.

7. The device as claimed in patent claim 4, characterized in that the indicating unit (610) is a sound device, which emits a sound from the direction in which the simulated fire is executed, so that a user knows in which direction said device shall be aimed.

8. The device as claimed in patent claim 2, characterized in that the indicating unit (610) is an angled sheet (802), with reflective properties, disposed on a housing (101) enclosing said device, in which sheet (802) is reflected (804) a luminous indicator (803) which indicates the direction in which said device shall be aimed.

9. The device as claimed in patent claim 1, characterized in that it further comprises a firing button (102) arranged to initiate said rangefinding.

10. The device as claimed in patent claim 1, characterized in that it further comprises an interaction unit (604) arranged to receive at least one input from a user and to generate at least one output.
11. The device as claimed in patent claim 4, characterized in that it further comprises a light-generating unit (609) arranged to emit sound in order to obtain a realistic simulation.
## INTERNATIONAL SEARCH REPORT

**International application No.**

PCT/SE201 0/051 392

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### A. CLASSIFICATION OF SUBJECT MATTER

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

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### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G01 C, G02B, G09B

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC, IBM-TDB, XPESP, XPRD

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>1-1 1</td>
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* Further documents are listed in the continuation of Box C.

## Date of the actual completion of the international search:

21-03-201 1

## Date of mailing of the international search report:

23-03-201 1

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Alexander Lakic

**Telephone No.** +46 8 782 25 00

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International Patent Classification (IPC)

G09B 5/00 (2006.01)
G01C 3/04 (2006.01)

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Cited literature, if any, will be enclosed in paper form.
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