

METHOD AND SYSTEM, AT A GROUND COMBAT VEHICLE, FOR
TARGET DISTANCE MEASUREMENT

TECHNICAL FIELD

5 The present invention relates to a method, at a ground combat vehicle, for target distance measurement. The present invention further relates to a system, associated with a ground combat vehicle, for target distance measurement. The present invention also relates to a ground combat vehicle.

10 BACKGROUND ART

Ground combat vehicles such as infantry fighting ground combat vehicles or tanks may be equipped with a weapon system associated with a turret, wherein the weapon system comprises a weapon attached to the turret. For such ground combat vehicles, it is important to be able to determine distance to potential targets.

Measurement of distance to target of ground combat vehicles may be performed by means of reticules in a sight of the ground combat vehicle, by utilizing that an approximate size of the target at different distances is known.

Measurement of distance to target of ground combat vehicles may also be performed by means of laser distance measurement devices configured to measure the time it takes for radiated laser light to return to a sensor after having been reflected against the target.

There is however a need to provide a method and system, at a ground combat vehicle, for target distance measurement, which facilitates accurate and safe identification of and distance to a target.

OBJECTS OF THE INVENTION

An object of the present invention is to provide method, at a ground combat vehicle, for target distance measurement which facilitates accurate and safe identification of and distance to a target.

- 5 Another object of the present invention is to provide a system, associated with a ground combat vehicle, for passive target distance measurement, which facilitates accurate and safe identification of and distance to a target.

Another object of the present invention is to provide a ground combat vehicle comprising such a system.

10

SUMMARY

- These and other objects, apparent from the following description, are achieved by a method, at a ground combat vehicle, for passive target distance measurement, a system, associated with a ground combat vehicle, for passive
- 15 target distance measurement, and a ground combat vehicle as set out in the appended independent claims. Preferred embodiments of the method, system and ground combat vehicle are defined in appended dependent claims.

- Specifically, an object of the invention is achieved by a method, at a ground combat vehicle for passive target distance measurement. The method is
- 20 performed at an electronic device of the ground combat vehicle by means of: a master image sensor device for observing a target; and at least one slave image sensor device, said master image sensor device and/or at least one of said at least one slave image sensor device being configured to be arranged at the ground combat vehicle, said master image sensor device and said at
- 25 least one slave image sensor device being configured to be arranged spaced apart by an offset distance from each other. The method comprises controlling an orientation of said at least one slave image sensor device. The method further comprises determining whether a line-of-sight of said at least one slave

image sensor device intersects a line-of-sight of said master image sensor device at a location of a target. The method further comprises, in accordance with a determination that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at the
5 location of the target: receiving first angular data representing the orientation of the master image sensor device, receiving second angular data representing the orientation of the at least one slave image sensor device, and, determining a target distance, representing a distance between the ground combat vehicle and the target at the target location, based on the offset
10 distance and the received angular data.

Hereby accurate and safe identification of and distance to a target is facilitated. By thus determining the target distance, there is no revealing of the ground combat vehicle. Such determination of the target distance may be very useful in certain weather conditions such as snowfall, light fog or the like, where it is
15 difficult to obtain laser echo. Such determination of the target distance facilitates silent reconnaissance. Such determination of the target distance may advantageously be utilized as alternative function/redundancy when a laser distance measurement device does not function properly.

According to an aspect of the present disclosure, at least one of said at least
20 one slave image sensor device is configured to be arranged at the ground combat vehicle, spaced apart by an offset distance from a location of the ground combat vehicle at which the master image sensor device is located. According to an aspect of the present disclosure, if at least one of said at least one slave image sensors is configured to be arranged at the ground combat
25 vehicle, said master image sensor may be arranged at the vehicle, or separated from the vehicle, spaced apart by an offset distance from a location of the ground combat vehicle at which said at least one of said at least one slave image sensor device is located.

According to an aspect of the present disclosure, at least one of said at least
30 one slave image sensors may be configured to be arranged separated from

the ground combat vehicle, spaced apart by an offset distance from a location of the ground combat vehicle at which the master image sensor device according to an aspect is located, such that the position of said at least one of said at least one slave image sensor device relative to the master image sensor device is known.

An image sensor device, e.g. a slave image sensor device or a master image sensor device, arranged separated from the ground combat vehicle at which another image sensor device is arranged, may be arranged at an object such as a drone or another vehicle, operably connected, directly or via the object, such that the position and bearing of said slave image sensor device relative to the master image sensor device arranged at the ground combat vehicle is known.

The master image sensor device is configured to detect one or more targets. The master image sensor device is configured to identify one or more targets. According to an aspect of the present disclosure, the method comprises detecting a target by means of said master image sensor device. According to an aspect of the present disclosure, the method comprises identifying a target by means of said master image sensor device. According to an aspect of the present disclosure, the method comprises controlling orientation of said master image sensor device so as to detect a target, providing a line-of-sight of the master image sensor device in the direction towards the target. According to an aspect of the present disclosure, the method comprises determining the orientation of said master image sensor device, when said master image sensor device is detecting a target.

Controlling an orientation of said at least one slave image sensor device comprises, according to an aspect of the present disclosure, physically moving, e.g. rotating, said at least one slave image sensor device, by means of a motor such as a servomotor, so as to redirect its line-of-sight. Controlling an orientation of said at least one slave image sensor device comprises, according to an aspect of the present disclosure, identifying target at an angle

within the field of view of said at least one slave image sensor device covering the target utilizing suitable module, so as to provide a line-of-sight. Said two examples of controlling orientation of said at least one slave image sensor device may be combined.

- 5 The image sensor device acting as a master image sensor device may, during operation of the ground combat vehicle, be changed such that a slave image sensor device of said at least one slave image sensor device becomes a master image sensor device and the master image sensor device then becomes a slave image sensor device, slaved under the new master image
10 sensor device.

- According to an embodiment of the method, the determination that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at the location of the target comprises: receiving first image data from the master image sensor device; receiving
15 second image data from the at least one of said at least one slave image sensor device; and, processing the first image data and the second image data based on image recognition so as to determine that the target is present along the line-of-sight of the at least one slave image sensor device and along the line-of-sight of said master image sensor device. Hereby determination that
20 the target is present along the line-of-sight of the at least one slave image sensor device and along the line-of-sight of said master image sensor device may be efficiently and accurately obtained.

- According to an embodiment of the method, controlling the orientation of the at least one slave image sensor device includes moving the orientation of the
25 at least one slave image sensor device so that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at different distances along the line-of-sight of the master image sensor device. Hereby controlling of orientation of the at least one slave image sensor device so that the line-of-sight of the at least one slave image sensor
30 device intersects the line-of-sight of the master image sensor device at the

target may be efficiently obtained. According to an aspect of the present disclosure, controlling the orientation of the at least one slave image sensor device includes imparting a sweeping movement so that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master
5 image sensor device at different distances along the line-of-sight of the master image sensor device.

According to an embodiment, the method further comprises: moving at least one of said at least one slave image sensor device relative to said master image sensor device and/or said master sensor device relative to said at least
10 one slave image sensor device so as to adapt the offset distance between said master image sensor device and said at least one of said at least one slave image sensor device. By adapting the offset distance between said master image sensor device and said at least one of said at least one slave image sensor device by increasing the offset distance, more accurate determination
15 of the target distance is facilitated.

According to an embodiment of the method, said at least one slave image sensor device comprises at least two slave image sensor devices, arranged spaced apart from said master image sensor device and spaced apart from each other at different locations at the ground combat vehicle with
20 corresponding offset distances, the method comprising determining the target distance based on determining target distances by using the different offset distances and angular data associated with the slave image sensors. Hereby, more accurate determination of the target distance is facilitated.

According to an embodiment, the method further comprises, during vehicle
25 operation of said ground combat vehicle, continuously or intermittently providing information associated with the determined target distance to an aiming module and/or a fire control module and/or a ballistics module of said ground combat vehicle. Thus, according to an aspect of the present disclosure, sai method comprises, during vehicle operation, continuously or intermittently
30 providing information associated with the determined target distance to one or

more of: an aiming module, a fire control module and a ballistics module of said ground combat vehicle. Hereby, information of target distance may be efficiently made available to one or more ground combat vehicle operators, facilitating efficient and safe ground combat vehicle operation.

- 5 According to an embodiment, the method further comprises determining the speed of the ground combat vehicle relative to the ground and/or speed of the target relative to the ground combat vehicle based on continuously or intermittently determined target distances and elapsed time between determined target distances. Hereby, ground combat vehicle speed may be
- 10 efficiently and accurately determined, facilitating efficient and safe ground combat vehicle operation.

- According to an embodiment, the method further comprises determining, based on the determination that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at
- 15 the location of the target, a target line associated with said ground combat vehicle pointing towards said target. Said target line may be any suitable vector line directed directly towards the target from said ground combat vehicle. Said target line may correspond to the line-of-sight of the master images sensor device or the line-of-sight of a slave image sensor device or vector directed
- 20 towards the target.

- According to an embodiment the method further comprises, based on said target line and said determined target distance, controlling the orientation of a weapon of said ground combat vehicle so that the weapon has a line-of-fire for facilitating hitting said target. Hereby, efficient operation of said ground combat
- 25 vehicle is facilitated based on the determination of said target distance.

According to an embodiment of the method, said master image sensor device and/or at least one of said at least one slave image sensor device is a motorized image sensor device. Hereby efficient operation of such image sensor devices is facilitated.

According to an embodiment of the method, the master image sensor device and the at least one slave image sensor device comprises one or more optical and/or electro-optical image sensors.

According to an embodiment of the method, the master image sensor device
5 comprises a gunner camera, a sight camera, an electro-optical sight device or a weapon camera of the ground combat vehicle.

Specifically, an object of the invention is achieved by a system, associated with a ground combat vehicle, for passive target distance measurement. The system comprises a master image sensor device for observing a target; and
10 at least one slave image sensor device, said master image sensor device and/or at least one of said at least one slave image sensor device being configured to be arranged at the ground combat vehicle, said master image sensor device and said at least one slave image sensor device being configured to be arranged spaced apart by an offset distance from each other.
15 Said at least one slave image sensor device has a controllable orientation. The system comprises an electronic device comprising: a control module, and, a target distance determination module. The control module is configured to: adjust the controllable orientation of the at least one slave image sensor device and to determine whether a line-of-sight of said at least one slave image
20 sensor device intersects a line-of-sight of said master image sensor device at a location of a target. The control module is further configured to, upon determining that the line-of-sight of said at least one slave image sensor device intersects the line-of-sight of said master image sensor device at the location of the target, transmit, to the target distance determination module, first
25 angular data representing the orientation of the master image sensor device and second angular data representing the orientation of the least one slave image sensor device. The target distance determination module is further configured to determine a target distance, when the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image

sensor device at the location of the target, based on the offset distance and the received angular data.

According to an embodiment of the system, the control module, when determining that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at the location of the target, is configured to: receive first image data from the master image sensor device; receive second image data from the at least one of said at least one slave image sensor device; and, process the first image data and the second image data based on image recognition so as to determine that the target is present along the line-of-sight of the at least one of said at least one slave image sensor device and along the line-of-sight of said master image sensor device.

According to an embodiment of the system, the control module is configured to control the orientation of the at least one slave image sensor device by moving the orientation of the at least one slave image sensor device so that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at different distances along the line-of-sight of the master image sensor device.

According to an embodiment of the system, the control module is configured to move at least one of said at least one slave image sensor device relative to said master image sensor device and/or said master sensor device relative to said at least one slave image sensor device so as to adapt the offset distance between said master image sensor device and said at least one of said at least one slave image sensor device.

According to an embodiment of the system, said at least one slave image sensor device comprises at least two slave image sensor devices, arranged spaced apart from said master image sensor device and spaced apart from each other at different locations at the ground combat vehicle with corresponding offset distances, wherein the target distance determination module is configured to determine the target distance based on determining

target distances by using the offset distances and angular data associated with the slave image sensor devices.

According to an embodiment of the system, the electronic device further comprises or is operably connected to or comprised in an aiming module and/or a fire control module and/or a ballistics module, wherein said aiming module and/or said fire control module and/or said ballistics module is configured to, during ground combat vehicle operation, continuously or intermittently receive information associated with the determined target distance.

10 According to an embodiment the system further comprises a speed determination module configured to continuously or intermittently receive determined target distances, and determine the speed of the ground combat vehicle relative to the ground and/or speed of the target relative to the ground combat vehicle based on determined target distances and elapsed time
15 between determined target distances.

According to an embodiment of the system, the electronic device is configured to determine a target line associated with said ground combat vehicle pointing towards said target, based on the determination that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master
20 image sensor device at the location of the target. Said target line may be determined by means of e.g. said target distance module of the electronic device, said control module of the electronic device or any other suitable module, control unit or the like.

According to an embodiment of the system, wherein said aiming module and/or fire control module and/or ballistics module, based on said target line and said determined target distance, is configured to control the orientation of
25 a weapon of said ground combat vehicle so that the weapon has a line-of-fire for facilitating hitting said target.

According to an embodiment of the system, said master image sensor device and/or at least one of said at least one slave image sensor device is a motorized image sensor device.

According to an embodiment of the system, the master image sensor device
5 comprises a gunner camera, a sight camera, an electro-optical sight device or a weapon camera of the ground combat vehicle.

The system, associated with a ground combat vehicle, for passive target distance measurement according to the present disclosure has the advantages according to the corresponding method as set out herein.

10 Specifically, an object of the invention is achieved by a ground combat vehicle comprising a system as set out herein.

According to an embodiment, said ground combat vehicle comprises a turret and a turret-mounted weapon system having a weapon. According to an aspect of the present disclosure, said master image sensor device is arranged
15 at the turret. According to an aspect of the present disclosure, said at least one slave image sensor device is arranged at the turret.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present disclosure, reference is made to the
20 following detailed description when read in conjunction with the accompanying drawings, wherein like reference characters refer to like parts throughout the several views, and in which:

Fig. 1 schematically illustrates a side view of a tracked ground combat vehicle, according to an embodiment of the present disclosure;

25 Fig. 2 schematically illustrates a side view of a turret with a weapon system having a weapon, according to an embodiment of the present disclosure;

Fig. 3a schematically illustrates a plan view of a ground combat vehicle and a target at a target distance to be determined, according to an embodiment of the present disclosure;

5 Fig. 3b schematically illustrates a triangle comprising line-of-sight of image sensor device to target, offset distance between image sensor devices and angles for determining target distance, according to an embodiment of the present disclosure;

10 Fig. 4a schematically illustrates a plan view of a ground combat vehicle and a target at a target distance to be determined, according to an embodiment of the present disclosure;

Fig. 4b schematically illustrates a triangle comprising line-of-sight of image sensor devices to target, offset distance between image sensor devices and angles for determining target distance, according to an embodiment of the present disclosure;

15 Fig. 4c schematically illustrates a rear view of a turret of the ground combat vehicle in fig. 4a and a target at the target distance to be determined, according to an embodiment of the present disclosure;

20 Fig. 4d schematically illustrates a side view of the turret in fig. 4c and the target at the target distance to be determined, according to an embodiment of the present disclosure;

Fig. 5 schematically illustrates a block diagram of a system, associated with a ground combat vehicle, for passive target distance measurement according to an embodiment of the present disclosure;

25 Fig. 6 schematically illustrates a flowchart of a method, at a ground combat vehicle, for passive target distance measurement, according to an embodiment of the present disclosure; and

DETAILED DESCRIPTION

Herein the term “ground combat vehicle” refers to any suitable ground combat vehicle comprising: infantry fighting vehicle (IFV), main battle tank (MBT), armoured personal carrier (APC), infantry mobility vehicle (IMV). The ground
5 combat vehicle may comprise a turret and a turret-mounted weapon system having a weapon. The ground combat vehicle may comprise a roof-mounted weapon station comprising a weapon.

Herein the term “weapon” refers to any weapon suitable for a ground combat vehicle comprising: main gun/cannon, gun barrel, missile launcher, grenade
10 launcher, machine gun, directed-energy weapon (DEW), remote controlled weapon station (RCWS).

The ground combat vehicle according to the present disclosure may be any suitable ground combat vehicle such as a tracked ground combat vehicle, i.e. having ground engaging members in the shape of endless tracks, or a wheeled
15 ground combat vehicle, i.e. having ground engaging members in the shape of wheels.

Fig. 1 schematically illustrates a side view of a tracked ground combat vehicle V according to an aspect of the present disclosure. The exemplified ground combat vehicle V is thus constituted by a tracked ground combat vehicle. The
20 tracked ground combat vehicle V comprises a ground combat vehicle body VB, which according to an aspect of the present disclosure comprises the chassis of the ground combat vehicle V and bodywork.

The tracked ground combat vehicle V comprises a track assembly pair TA1, TA2 being suspendedly connected to the ground combat vehicle body VB. The
25 track assembly pair comprises a right track assembly TA1 and a left track assembly TA2 for driving the ground combat vehicle, each track assembly comprising a drive means driven endless track ET arranged to run over a set of wheels of the track assembly.

Even if the illustrated ground combat vehicle V is a tracked ground combat vehicle the ground combat vehicle V may according to other embodiments of the invention be constituted by a wheeled ground combat vehicle.

5 The ground combat vehicle V is equipped with a turret TU. The turret TU is arranged on top of the ground combat vehicle V. The turret TU is rotatable about an axis Y of rotation orthogonal to the longitudinal extension of the ground combat vehicle V and orthogonal to the transversal extension of the ground combat vehicle V.

10 The ground combat vehicle V is configured to be equipped with a weapon system W having a weapon B. The weapon B is mounted to the turret TU. The weapon B of the weapon system W is thus allowed to rotate by means of rotating the turret TU about the axis Y. According to an aspect, the weapon B is constituted by or comprises a gun barrel.

15 The weapon B is configured to be connected to an elevation device E, which according to an aspect of the present disclosure may be or may comprise a so-called weapon cradle, connected to the turret TU. The weapon B is configured to be raised and lowered, i.e. provide an elevation movement, about an elevation axis Z, illustrated in fig. 1 and 2, by means of the elevation device E. The weapon B is configured to be raised and lowered, i.e. provide
20 an elevation movement, about the elevation axis Z.

Said weapon B has a main extension. Said elevation axis Z is orthogonal and transversal to the main extension of the weapon B. Said elevation axis Z is orthogonal and transversal to the main extension of the weapon B.

25 Fig. 2 schematically illustrates a side view of the turret TU with the weapon system W having a weapon B according to an embodiment of the present disclosure.

As mentioned above with reference to fig. 1, the weapon B is configured to be connected to an elevation device E. The weapon B is configured to be raised

and lowered, i.e. provide an elevation movement, about an elevation axis Z by means of the elevation device E. According to an aspect of the present disclosure, the weapon B may be configured to be raised and lowered within an elevation angle α .

- 5 As illustrated in fig. 1 and 2, the ground combat vehicle comprises a system S for passive target distance measurement. The system S comprises a master image sensor device 10, which may be arranged at the turret TU of the ground combat vehicle V, for observing a target. The master image sensor device 10, according to an aspect of the present disclosure, comprises a sight device for
10 identifying a target, said sight device being configured to be controlled by a vehicle operator such as a gunner. The system S further comprises at least one slave image sensor device 20 which may be configured to be arranged, at the ground combat vehicle V, preferably at the turret TU of the ground combat vehicle V, spaced apart by an offset distance from a location of the ground
15 combat vehicle V at which the master image sensor device 10 is located. Said at least one slave image sensor device 20 has a controllable orientation.

- According to an aspect of the present disclosure, the at least one slave image sensor device 20 is configured to adapt its orientation based on the view of the master image sensor device 10, i.e. the target view of the master image sensor
20 device 10, such that the line-of-sight of said at least one slave image sensor device 20 intersects the line-of-sight of the master image sensor device 10 at the target identified by the master image sensor device 10. When said at least one slave image sensor device 20 intersects the master image sensor device 10 at the target, the target distance is configured to be determined based on
25 angular data representing the orientation of the at least one slave image sensor device 20 and master image sensor device 10 relative to an imaginary direction of the weapon pointing directly towards the target.

- According to an aspect of the present disclosure, the ground combat vehicle V and the turret TU of the ground combat vehicle V, is configured such that,
30 based on the target identified by means of the master image sensor device 10

operated by e.g. a gunner, the turret TU rotates based on the identified target direction, and wherein the line-of-fire of the weapon B is adapted based on the thus determined target distance and target direction and possible other data such as weather data comprising wind direction, speed of wind, temperature,
5 and other data such as possible movement of the target, type of ammunition etc.

Such a system S is described in more detail with reference to fig. 5.

The tracked ground combat vehicle V is, according to an aspect of the present disclosure, arranged to be operated in accordance with a method M1 for
10 passive target distance measurement according to fig. 6.

Fig. 3a schematically illustrates a plan view of a ground combat vehicle V and a target T at a target distance TD to be determined according to an embodiment of the present disclosure. Fig. 3b schematically illustrates a triangle comprising line-of-sight of image sensor device to target, offset
15 distance OD between image sensor devices and angles θ , β for determining target distance according to an embodiment of the present disclosure.

The ground combat vehicle V in fig. 3a may be any suitable ground combat vehicle such as a ground combat vehicle V in accordance with the ground combat vehicle V described with reference to fig. 1.

20 Said ground combat vehicle V comprises a turret TU and a turret-mounted weapon system having a weapon B.

Said ground combat vehicle V is associated with a system for passive target distance measurement.

According to an aspect of the present disclosure, a master image sensor
25 device 10 is arranged at the ground combat vehicle V, for observing a target T. Said master image sensor device 10 is configured to be comprised in said system.

According to an aspect a slave image sensor device 20 is configured to be arranged, at the ground combat vehicle V, spaced apart by an offset distance OD from a location of the ground combat vehicle V at which the master image sensor device 10 is located.

- 5 The master image sensor device 10 has identified the target T. Such identification may be performed by means of an operator such as a gunner or a chief operator at the vehicle operating said master image sensor device 10, or automatically by means of said master image sensor device 10. The master image sensor device 10 has a line-of-sight L1 directed towards the target.
- 10 The orientation of said slave image sensor device 20, slaved under the master image sensor device 10, is configured to be controlled so that its line-of-sight L2 intersects the line-of-sight L1 of said master image sensor device 10 at the target T. According to an aspect of the present disclosure, this is obtained by means of processing first image data from the master image sensor device 10
- 15 and second image data from the slave image sensor device 20 based on image recognition.

According to a variant the slave image sensor device 20 is arranged at the weapon 10.

- Based on the determination that the line-of-sight L2 of the at least one slave
- 20 image sensor device 20 intersects the line-of-sight L1 of the master image sensor device 10 at the location of the target T, a target line L associated with said ground combat vehicle V pointing towards said target T is configured to be determined. The target line L may be any suitable vector pointing towards the target T. Here, the line-of-sight L1 of the master image sensor device 10,
- 25 pointing at the target T, constitutes the target line L.

According to an aspect of the present disclosure, said offset distance OD associated with said target line L corresponds to the distance between said master image sensor device 10 and said slave image sensor device 20.

First angular data representing the orientation of the master image sensor device 10 is configured to be determined. According to an aspect of the present disclosure, said first angular data corresponds to the angle θ of the line-of-sight L1 of said master image sensor device 10 relative to said offset distance OD, i.e. relative to the direction of extension of said offset distance OD.

Second angular data representing the orientation of the slave image sensor device 20 is configured to be determined. According to an aspect of the present disclosure, said second angular data corresponds to the angle β of the line-of-sight L2 of said slave image sensor device 20 relative to said offset distance OD, i.e. relative to the direction of extension of said offset distance OD.

The target distance TD, representing a distance between the combat vehicle V and the target at the target location T, is configured to be determined based on the offset distance OD and the determined first angular data and second angular data.

Said line-of-sight L1 of said master image sensor device 10, said line-of-sight L2 of said slave image sensor device 20 and said offset distance OD between the master image sensor device 10 and slave image sensor device 20 provides a triangle in the 3D space with a point at the target T and a base corresponding to the offset distance OD, said first angle data corresponding to the angle θ between the line-of-sight L1 of the master sensor device 10 and the direction of the offset distance OD and said second angle data corresponding to the angle β between the line-of-sight L2 of the slave sensor device 20 and the direction of the offset distance OD. Said first and second angular data, i.e. said angle θ and β may change depending on relative movement of said master image sensor device 10 and slave image sensor device 20 caused e.g. by vehicle movement, image sensor device movement, turret movement or the like.

Such targets may be close or many hundreds of meters to kilometres away. The offset distance OD may be in the range of one to a few meters or greater

distance depending on location of image sensor devices, e.g. utilizing one image sensor device arranged relative to the ground combat vehicle, i.e. at a distance from the ground combat vehicle V.

According to an alternative, said slave image sensor device 20 may be
5 configured to be arranged separated from the ground combat vehicle V, as illustrated in dotted square. This slave image sensor device 20 separated from the ground combat vehicle V may, instead of an alternative, be in addition to the slave image sensor device 20 arranged at the ground combat vehicle V. The slave image sensor device 20 separated from the ground combat vehicle
10 V is spaced apart by an offset distance OD from a location of the ground combat vehicle V at which the master image sensor device 10 is located, hereby obtaining a greater offset distance OD facilitating more accurate determination of said target distance TD. The greater offset distance OD is in relation to the target T, i.e. so that the line-of-sight L1 and line-of-sight L2
15 intersects at the target T with a greater angle ϕ relative to each other, see fig. 3b. The triangle provided by means of the orientation of that slave image sensor device 20 provides other angular data and hence angles θ and β are different compared to the slave image sensor device arranged at the ground combat vehicle V. The position of said slave image sensor device 20, arranged
20 separated from the ground combat vehicle V, relative to the master image sensor device 10 is known by means of operable connection between them. The dotted slave image sensor device 20 has a line-of-sight L3 intersecting the line-of-sight of said master image sensor device 10 at the location of the target T.

25 According to an aspect the target T is a combat vehicle moving in the right direction in fig. 3a, wherein said turret TU and weapon B are configured to be directed with certain ballistics relative to the target line L for obtaining a correct line-of-fire of the weapon B for facilitating hitting the target T.

The slave image sensor device 20, arranged separated from the ground
30 combat vehicle V at which said master image sensor device 10 is arranged,

may be arranged at an object such as a drone or another vehicle, operably connected, directly or via the object, such that the position and bearing of said slave image sensor device 20 relative to the master image sensor device 10 arranged at the ground combat vehicle is known during operation, comprising
5 relative movement of the, from the ground combat vehicle V separated, slave image sensor device 20 and the, at the ground combat vehicle V arranged master image sensor device 10.

The system S for passive target distance measurement described with reference to fig. 5 may be a system of the ground combat vehicle V according
10 to fig. 3a. The method M1 for passive target distance measurement described with reference to fig. 6 may be performed at a ground combat vehicle V according to fig. 3a.

Fig. 4a schematically illustrates a plan view of a ground combat vehicle V and a target T at a target distance TD to be determined according to an
15 embodiment of the present disclosure. Fig. 4b schematically illustrates a triangle comprising line-of-sight of image sensor devices 10, 20 to target T, offset distance OD between image sensor devices 10, 20 and angles θ , β for determining target distance according to an embodiment of the present disclosure. Fig. 4c schematically illustrates a rear view of a turret TU of the
20 ground combat vehicle V in fig. 4a and a target T at the target distance to be determined according to an embodiment of the present disclosure. Fig. 4d schematically illustrates a side view of the turret TU in fig. 4c and the target T at the target distance TD to be determined according to an embodiment of the present disclosure.

25 The ground combat vehicle V in fig. 4a may correspond to the ground combat vehicle V in fig. 3a. The ground combat vehicle V in fig. 4a differs from the ground combat vehicle V in fig. 3a essentially only by the position of the master image sensor device 10 and the slave image sensor device 20. In fig. 4a, the master image sensor device 10 is arranged at a mast, see fig. 4c and 4d, and

the slave image sensor device 20 is arranged at the turret TU of the ground combat vehicle V, separated from the weapon B.

In fig. 4a, said weapon B may have another angular extension than said determined target line L, said target line L being directed directly towards the target T from said ground combat vehicle V. According to an aspect of the present disclosure, said turret TU may be configured to be rotated based on said determined target line L so that said weapon B may be arranged in a line-of-fire towards the target T. Here the target line L, determined based on the determination that the line-of-sight L2 of the at slave image sensor device 20 intersects the line-of-sight L1 of the master image sensor device 10 at the location of the target T, is a target line L directed from the ground combat vehicle V towards the target T.

The system S for passive target distance measurement described with reference to fig. 5 may be a system of the ground combat vehicle V according to fig. 4a. The method M1 for passive target distance measurement described with reference to fig. 6 may be performed at a ground combat vehicle V according to fig. 4a.

Fig. 5 schematically illustrates a block diagram of a system S, associated with a ground combat vehicle, for passive target distance measurement according to an embodiment of the present disclosure. According to an aspect of the present disclosure, said ground combat vehicle comprises a turret and a turret-mounted weapon system having a weapon. According to an aspect of the present disclosure, said ground combat vehicle comprises a roof-mounted weapon system having a weapon.

The system comprises S a master image sensor device 10 for observing a target; and at least one slave image sensor device 20. Said master image sensor device 10 and/or at least one of said at least one slave image sensor device 20 is configured to be arranged at the ground combat vehicle. Said master image sensor device 10 and said at least one slave image sensor

device 20 are configured to be arranged spaced apart by an offset distance from each other.

Said master image sensor device 10 is according to an aspect of the present disclosure configured to be arranged at the ground combat vehicle. Said
5 master image sensor device 10 is according to an aspect of the present disclosure configured to be arranged at a turret of the ground combat vehicle. Said master image sensor device 10 is according to an aspect of the present disclosure configured to be separated from the ground combat vehicle spaced apart by an offset distance from a location of the ground combat vehicle at
10 which at least one of said at least one slave image sensor device 20 is located.

Said at least one slave image sensor device 20 is according to an aspect of the present disclosure configured to be arranged at the ground combat vehicle. Said at least one slave image sensor device 20 is according to an aspect of the present disclosure configured to be arranged at a turret of the ground
15 combat vehicle. Said at least one slave image sensor device 20 is according to an aspect of the present disclosure configured to be arranged separated from the ground combat vehicle spaced apart by an offset distance from a location of the ground combat vehicle at which said master image sensor device 10 is located. Said at least one slave image sensor device 20 has a
20 controllable orientation.

According to an aspect of the system S, said master image sensor device 10 and/or at least one of said at least one slave image sensor device 20 is a motorized image sensor device.

According to an aspect of the system S, said master image sensor device 10
25 comprises a gunner camera, a sight camera, an electro-optical sight device or a weapon camera of the ground combat vehicle V.

According to an aspect of the present disclosure, said master image sensor device 10 and said at least one slave image sensor device 20 are operably

connected to each other so as to determine the relative distance between them.

The system S further comprises an electronic device 100. According to an aspect of the present disclosure such an electronic device 100 may comprise one or more control units. According to an aspect of the present disclosure such an electronic device 100 may comprise at least one of said master image sensor device and said at least one slave image sensor device. According to an aspect of the present disclosure such an electronic device 100 may be operably connected to at least one of said master image sensor device 10 and said at least one slave image sensor device 20.

According to an aspect of the present disclosure, said master image sensor device 10 and said at least one slave image sensor device 20 are operably connected to each other via said electronic device 100 so as to determine the relative distance between them.

According to an aspect of the present disclosure, said master image sensor device 10 is configured to detect one or more targets. According to an aspect of the present disclosure, said master image sensor device 10 is configured to identify one or more targets. According to an aspect of the present disclosure, the electronic device 100 is configured to receive information that said master image sensor device 10 has detected a target. According to an aspect of the present disclosure, the electronic device 100 is configured to determine the orientation of said master image sensor device 20. According to an aspect of the present disclosure, the electronic device 100 is configured to determine the orientation of said master image sensor device 20, pointing towards a target, relative to the direction of extension of said offset distance between said master image sensor device 10 and said at least one slave image sensor device 20.

According to an aspect of the present disclosure, said electronic device 100 comprises a control module CM. According to an aspect of the present

disclosure, said electronic device 100 comprises a target distance determination module TDM.

The control module CM is configured to adjust the controllable orientation of the at least one slave image sensor device 20 and to determine whether a line-
5 of-sight L2 of said at least one slave image sensor device 20 intersects a line-
of-sight L1 of said master image sensor device 10 at a location of a target T.

According to an aspect of the present disclosure, the control module CM is configured to adjust the controllable orientation of the at least one slave image sensor device 20 by means of providing control instruction for physically
10 moving, e.g. rotating, said at least one slave image sensor device 20, by means of a motor such as a servomotor, so as to redirect its line-of-sight.

According to an aspect of the present disclosure, the control module CM is configured to adjust the controllable orientation of the at least one slave image sensor device 20 based on identified target information at an angle within the
15 angle of view of said at least one slave image sensor device 20 covering the target, so as to provide a line-of-sight towards said target. Such a slave image sensor device 20 may have an angle of view so that covering a sufficient field of view within a certain angle interval such that the slave image sensor device 20 may be fixedly arranged, and the view may be controlled by means of the
20 control module so that a line-of-sight towards said target may be obtained.

The control module CM is further configured to, upon determining that the line-of-sight of said at least one slave image sensor device 20 intersects the line-of-sight of said master image sensor device 10 at the location of the target, transmit, to the target distance determination module TDM, first angular data
25 representing the orientation of the master image sensor device 10 and second angular data representing the orientation of the least one slave image sensor device 20.

The target distance determination module TDM is configured to determine a target distance TD, when the line-of-sight of the at least one slave image

sensor device 20 intersects the line-of-sight of the master image sensor device 10 at the location of the target, based on the offset distance OD and the received angular data.

According to an aspect of the present disclosure, when determining that the
5 line-of-sight of the at least one slave image sensor device 20 intersects the
line-of-sight of the master image sensor device 10 at the location of the target,
the control module CM is configured to receive first image data from the master
image sensor device 10, and second image data from at least one of said at
least one slave image sensor device 20. The control module CM is then
10 configured to process the first image data and the second image data based
on image recognition so as to determine that the target is present along the
line-of-sight of at least one of said at least one slave image sensor device 20
and along the line-of-sight of said master image sensor device 10.

According to an aspect of the present disclosure, the control module CM is
15 configured to control the orientation of the at least one slave image sensor
device 20 by moving the orientation of the at least one slave image sensor
device 20 so that the line-of-sight of the at least one slave image sensor device
20 intersects the line-of-sight of the master image sensor device 10 at different
distances along the line-of-sight of the master image sensor device 10.

20 According to an aspect of the present disclosure, the control module CM is
configured move at least one of said at least one slave image sensor device
20 relative to said master image sensor device 10 and/or said master sensor
device 10 relative to said at least one slave image sensor device 20 so as to
adapt the offset distance between said master image sensor device 10 and
25 said at least one of said at least one slave image sensor device 20. According
to an aspect of the present disclosure, the control module CM, when adapting
the offset distance between said master image sensor device 10 and said at
least one of said at least one slave image sensor device 20 is configured to
increase said offset distance, in relation to the target so that the line-of-sight of
30 the master image sensor device and the line-of-sight of a slave image sensor

device intersects at the target with a greater angle relative to each other, facilitating increased accuracy when determining target distance.

According to an aspect of the present disclosure, said at least one slave image sensor device 20 comprises at least two slave image sensor devices 20, arranged spaced apart from said master image sensor device 10 and spaced
5 apart from each other at different locations at the combat vehicle V with corresponding offset distances OD, wherein the target distance determination module TDM is configured to determine the target distance TD based on determining target distances by using the offset distances and angular data
10 associated with the slave image sensor devices 20.

According to an aspect of the present disclosure, said system S further comprising a speed determination module SDM configured to continuously or intermittently receive determined target distances. Said speed determination module SDM further configured to determine the speed of the ground combat
15 vehicle relative to the ground and/or speed of the target relative to the ground combat vehicle based on determined target distances and elapsed time between determined target distances.

According to an aspect of the present disclosure, said system S of said ground combat vehicle comprises at least one processor 110 operatively connected
20 to said master image sensor device 10 and said at least one slave image sensor device 20. According to an aspect of the present disclosure, said electronic device 100 of said system S comprises said at least one processor 110 operatively connected to said master image sensor device 10 and said at least one slave image sensor device 20.

25 According to an aspect of the present disclosure, the electronic device 100 comprises a memory arrangement 120. The memory arrangement 120 may comprise at least one memory. The electronic device 100 thus comprises at least one memory.

According to an aspect of the present disclosure, the electronic device 100 comprises a communication interface 130. The communication interface 130 may also be denoted communication unit.

5 According to an aspect of the present disclosure, said master image sensor device 10 and said at least one slave image sensor device 20 may be operably connected to said electronic device 100 via one or more links.

According to an aspect of the present disclosure, the memory arrangement 120 of the electronic device 100 may be integrated with or embedded into the at least one processor 110, and/or be a separate memory hardware device.

10 According to an aspect of the present disclosure, the memory arrangement 120 of the control device 100 is operably connectable to the at least one processor 110. According to an aspect of the present disclosure, at least one of the at least one memory of the memory arrangement 120 may be integrated with or embedded into the at least one processor 110, and/or be a separate
15 memory hardware device.

The memory arrangement 120 may include a RAM, a ROM, a hard disk, an optical disk, a magnetic medium, a flash memory and/or any other mechanism capable of storing instructions or data.

According to an aspect of the present disclosure, the at least one processor
20 110 of the electronic device 100 may include any physical device having an electric circuit that performs logic operations on input data. According to an aspect of the present disclosure, the at least one processor 110 of the electronic device 100 may include any physical device having an electric circuit that performs logic operations on input data. For example, the at least one
25 processor 110 may include one or more integrated circuits, microchips, microcontrollers, microprocessors, all or part of a CPU, DSP, FPGA, or other circuits for executing instructions or performing logic operations. According to an aspect of the present disclosure, actions and method steps described herein as being performed by the electronic device 100 are performed by the

at least one processor 110 of the electronic device 100 upon execution of one or more computer programs stored in the memory arrangement 120. According to an aspect of the present disclosure, actions and method steps described herein as being performed by the at least one processor 110 are performed by the at least one processor 110 of the electronic device 100 upon execution of one or more computer programs stored in the memory arrangement 120.

According to an aspect of the present disclosure, the communication interface 130 is operably connected to said memory arrangement 120. According to an aspect of the present disclosure, the communication interface 130 may be operably connected to said the at least one processor 110.

According to an aspect of the present disclosure, as shown in fig. 5, the control module CM and the target determination module TDM are stored in the memory arrangement 120. According to an aspect of the present disclosure, instructions for performing the functionality associated with said modules CM, TDM are stored in the memory arrangement 120 for enabling said functionality by means of processing the instruction by the at least one processor 110.

Thus, the below discussed method steps can be performed via execution of said stored instruction by the at least one processor 110. Alternatively, one or more of the control module CM and the target determination module TDM are implemented as separate hardware units.

Said ground combat vehicle comprises a turret and a turret-mounted weapon system having a weapon.

According to an aspect of the present disclosure, the electronic device 100 further comprises or is operably connected to or comprised in an aiming module AM. According to an aspect of the present disclosure, said aiming module AM is configured to, during vehicle operation, continuously or intermittently receive information associated with the determined target distance. According to an aspect of the present disclosure, said aiming module

AM is configured to control aiming of said weapon based among others of said received information associated with the determined target distance.

According to an aspect of the present disclosure, the electronic device 100 further comprises or is operably connected to or comprised in a fire control module FCM. According to an aspect of the present disclosure, said fire control module FCM is configured to, during vehicle operation, continuously or intermittently receive information associated with the determined target distance. According to an aspect of the present disclosure, said fire control module FCM is configured to control firing of said weapon based among others of said received information associated with the determined target distance.

According to an aspect of the present disclosure, the electronic device 100 further comprises or is operably connected to or comprised in a ballistics module BM. According to an aspect of the present disclosure, said ballistics module BM is configured to, during vehicle operation, continuously or intermittently receive information associated with the determined target distance. According to an aspect of the present disclosure, said ballistics module BM is configured to control ballistics of said weapon based among others of said received information associated with the determined target distance.

According to an aspect of the present disclosure, the electronic device 100 is configured to determine a target line associated with said ground combat vehicle V pointing towards said target, based on the determination that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at the location of the target.

According to an aspect of the present disclosure, said aiming module AM and/or fire control module FCM and/or ballistics module BM, based on said target line L and said determined target distance TD, is configured to control the orientation of a weapon B of said ground combat vehicle V so that the weapon has a line-of-fire for facilitating hitting said target T.

The system S of the ground combat vehicle is, according to an aspect of the present disclosure, arranged to be operated in accordance with a method M1 for passive target distance measurement according to fig. 6.

Fig. 6 schematically illustrates a flowchart of a method M1, at a ground combat vehicle V, for passive target distance measurement according to an aspect of the present disclosure.

The method is configured to be performed at an electronic device of the ground combat vehicle by means of: a master image sensor device for observing a target; and at least one slave image sensor device, said master image sensor device and/or at least one of said at least one slave image sensor device being configured to be arranged at the ground combat vehicle, said master image sensor device and said at least one slave image sensor device being configured to be arranged spaced apart by an offset distance from each other. Said ground combat vehicle may be a ground combat vehicle according to fig. 1, fig. 3a or fig. 4a.

According to an aspect of the present disclosure, the method M1 comprises a step S1. In this step, orientation of said at least one slave image sensor device is controlled.

According to an aspect of the present disclosure, the step S1 of controlling the orientation of said at least one slave image sensor device is based on the target identified by means of said master image sensor device and hence orientation of the master image sensor device. The at least one slave image sensor device is thus slave under the master image sensor device, i.e. the at least one slave image sensor device adapts its orientation based on the orientation of the master image sensor device.

According to an aspect of the present disclosure, the method may comprise one or more steps prior to said step S1. In such a step, according to an aspect, a target is detected by means of said master image sensor device. In such a step, according to an aspect, a target is identified by means of said master

image sensor device. In such a step, according to an aspect, orientation of said master image sensor device is controlled so as to detect a target, providing a line-of-sight of the master image sensor device in the direction towards the target. In such a step, according to an aspect, orientation of said
5 master image sensor device is determined, when said master image sensor device is detecting a target.

According to an aspect of the present disclosure, the step S1 of controlling the orientation of the at least one slave image sensor device includes moving the orientation of the at least one slave image sensor device so that the line-of-
10 sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at different distances along the line-of-sight of the master image sensor device. According to an aspect of the present disclosure, the step S1 of controlling the orientation of the at least one slave image sensor device comprises imparting a sweeping movement so that the
15 line-of-sight of the at least one slave image sensor device intersects the line-of-sight of the master image sensor device at different distances along the line-of-sight of the master image sensor device.

According to an aspect of the present disclosure, the step S1 of controlling the orientation of the at least one slave image sensor device comprises physically
20 moving, e.g. rotating, said at least one slave image sensor device, by means of a motor such as a servomotor, so as to redirect its line-of-sight.

According to an aspect of the present disclosure, the step S1 of controlling the orientation of the at least one slave image sensor device comprises identifying target at an angle within the angle of view of said at least one slave image
25 sensor device covering the target utilizing suitable module, so as to provide a line-of-sight.

According to the aspect of the present disclosure, the method M1 comprises a step S2. In this step, it is determined if the line-of-sight of said at least one

slave image sensor device intersects the line-of-sight of said master image sensor device at the location or the target.

According to an aspect of the present disclosure, the step S2 of determining if the line-of-sight of said at least one slave image sensor device intersects the line-of-sight of said master image sensor device at the location or the target
5 comprises receiving first image data from the master image sensor device; receiving second image data from the at least one of said at least one slave image sensor device; and, processing the first image data and the second image data based on image recognition so as to determine that the target is
10 present along the line-of-sight of the at least one slave image sensor device and along the line-of-sight of said master image sensor device. According to an aspect of the present disclosure, said first and second image data are compared, and if there is a certain match, it is determined that the target is present along the line-of-sight of the at least one slave image sensor device
15 and along the line-of-sight of said master image sensor device.

According to the aspect the method M1 comprises a step S2a. In this step, if it is determined if the line-of-sight of said at least one slave image sensor device intersects the line-of-sight of said master image sensor device at the location or the target, the method continues to steps S3a, S3b, and if not step S1, i.e.
20 controlling of orientation of said at least one slave image sensor device, is repeated.

According to the aspect the method M1 thus comprise steps S3a and S3b, performed when it is determined if the line-of-sight of said at least one slave image sensor device intersects the line-of-sight of said master image sensor
25 device at the location or the target.

In step S3a, first angular data representing the orientation of the master image sensor device is received.

In step S3b, second angular data representing the orientation of the least one slave image sensor device is received.

According to an aspect of the present disclosure, the ground combat vehicle comprises a weapon system with a weapon for firing against said target.

According to an aspect of the present disclosure, the method M1 may further comprise the step of determining, based on the determination that the line-of-sight of the at least one slave image sensor device intersects the line-of-sight
5 of the master image sensor device at the location of the target, a target line associated with said ground combat vehicle pointing towards said target.

Said target line may be any suitable vector line directed directly towards the target from said ground combat vehicle. For a ground combat vehicle having
10 a turret configured to be rotatable relative to the vehicle body of said ground combat vehicle, and turret mounted weapon system comprising a weapon, said determined target line, may be directed directly towards the target from said vehicle, wherein said weapon may have another angular extension than said target line, wherein said turret may be rotated based on said determined
15 target line so that said weapon may be arranged in a line-of-fire towards the target. Said target line may according to an aspect correspond to the line-of-sight of said master image sensor device. Said target line may according to an aspect correspond to the line-of-sight of a slave image sensor device of said at least one slave image sensor device. The ground combat vehicle comprises
20 a weapon system with a weapon for firing against said target, wherein said target line, according to an aspect, corresponds to the imaginary direction of the weapon if said weapon would point straight towards said target. According to an aspect of the present disclosure, said slave image sensor device is arranged at said weapon so that its line-of-sight towards a target corresponds
25 to the imaginary direction of the weapon if said weapon would point straight towards said target. According to an aspect of the present disclosure, said target line may correspond to the line-of-sight of an image sensor device such as e.g. a master image sensor device arranged relative to said vehicle.

According to an embodiment the method comprises, based on said target line
30 and said determined target distance, controlling the orientation of a weapon of

said ground combat vehicle so that the weapon has a line-of-fire for facilitating hitting said target.

According to the aspect of the present disclosure, the method M1 comprises a step S4. In this step, a target distance, representing a distance between the
5 combat vehicle and the target at the target location, is determined based on the offset distance between said master image sensor device and said at least one slave image sensor device and the received first angular data and second angular data.

According to an aspect of the present disclosure, the method M1 may further
10 comprise the step of moving at least one of said at least one slave image sensor device relative to said master image sensor device so as to adapt the offset distance between said master image sensor device and said at least one of said at least one slave image sensor device. This step is not disclosed in fig. 6. Such a step may comprise increasing the offset distance between said
15 master image sensor device and said at least one of said at least one slave image sensor device in order to facilitate increasing the accuracy in determining the target distance. Such a step may be utilized when the target is at a long distance away from the ground combat vehicle.

According to an aspect of the present disclosure, said at least one slave image
20 sensor device comprises at least two slave image sensor devices, arranged spaced apart from said master image sensor device and spaced apart from each other at different locations at the combat vehicle with corresponding offset distances. According to an aspect of the present disclosure, the method M1 may further comprise the step of, determining the target distance based on
25 determining target distances by using the different offset distances and angular data associated with the slave image sensor devices.

According to an aspect of the present disclosure, the method M1 may further comprise the step of, during vehicle operation, continuously or intermittently providing information associated with the determined target distance to an

aiming module and/or a fire control module and/or a ballistics module of said ground combat vehicle.

According to an aspect of the present disclosure, the method M1 may further comprise the step of, during movement of the ground combat vehicle,
5 determining the speed of the ground combat vehicle relative to the ground based on continuously or intermittently determined target distances and elapsed time between determined target distances.

According to an aspect of the present disclosure, said master image sensor device and/or at least one of said at least one slave image sensor device is a
10 motorized image sensor device. According to an aspect of the present disclosure, the master image sensor device and the at least one slave image sensor device comprises one or more optical and/or electro-optical image sensors. According to an aspect of the present disclosure, the master image sensor device comprises a gunner camera, a sight camera, an electro-optical
15 sight device or a weapon camera of the ground combat vehicle.

The foregoing description of the preferred embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to
20 practitioners skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated.

CLAIMS

1. A method, at a ground combat vehicle (V), for passive target distance measurement, the method being performed at an electronic device (100) of the ground combat vehicle (V) by means of: a master image sensor device (10) for observing a target (T); and at least one slave image sensor device (20), said master image sensor device (10) and/or at least one of said at least one slave image sensor device (20) being configured to be arranged at the ground combat vehicle (V), said master image sensor device (10) and said at least one slave image sensor device (20) being configured to be arranged spaced apart by an offset distance (OD) from each other, said method comprising:
- controlling an orientation of said at least one slave image sensor device (20);
 - determining whether a line-of-sight (L2) of said at least one slave image sensor device (20) intersects a line-of-sight (L1) of said master image sensor device (10) at a location of a target (T);
 - in accordance with a determination that the line-of-sight (L2) of the at least one slave image sensor device (20) intersects the line-of-sight (L1) of the master image sensor device (10) at the location of the target (T):
 - receiving first angular data representing the orientation of the master image sensor device (10);
 - receiving second angular data representing the orientation of the at least one slave image sensor device (20); and
 - determining a target distance (TD), representing a distance between the combat vehicle and the target at the target location, based on the offset distance (OD) and the received angular data.
2. The method according to claim 1, wherein the determination that the line-of-sight (L2) of the at least one slave image sensor device (20) intersects the

line-of-sight (L1) of the master image sensor device (10) at the location of the target comprises:

- receiving first image data from the master image sensor device (10);
 - receiving second image data from the at least one of said at least one
5 slave image sensor device (20); and
 - processing the first image data and the second image data based on image recognition so as to determine that the target (T) is present along the line-of-sight (L2) of the at least one slave image sensor device (20) and along the line-of-sight (L1) of said master image sensor device (10).
- 10 3. The method according to claim 1 or 2, wherein controlling the orientation of the at least one slave image sensor device (20) includes moving the orientation of the at least one slave image sensor device (20) so that the line-of-sight of the at least one slave image sensor device (20) intersects the line-of-sight (L1) of the master image sensor device (10) at different distances
15 along the line-of-sight (L1) of the master image sensor device (10).
4. The method according to any of claims 1-3, further comprising: moving at least one of said at least one slave image sensor device (20) relative to said master image sensor device (10) and/or moving said master sensor device (10) relative to said at least one slave image sensor device (20) so as to adapt
20 the offset distance (OD) between said master image sensor device (10) and said at least one of said at least one slave image sensor device (20).
5. The method according to any of claims 1-4, said at least one slave image sensor device (20) comprising at least two slave image sensor devices (20), arranged spaced apart from said master image sensor device (10) and spaced
25 apart from each other at different locations at the combat vehicle (V) with corresponding offset distances (OD), the method comprising determining the target distance (TD) based on determining target distances by using the different offset distances and angular data associated with the slave image sensors (20).

6. The method according to any of claims 1-5, further comprising, during vehicle operation, continuously or intermittently providing information associated with the determined target distance to an aiming module (AM) and/or a fire control module (FCM) and/or a ballistics module (BM) of said
5 ground combat vehicle (V).
7. The method according to any of claims 1-6, further comprising determining the speed of the ground combat vehicle (V) relative to the ground and/or speed of the target relative to the ground combat vehicle (V) based on continuously or intermittently determined target distances (TD) and elapsed time between
10 determined target distances.
8. The method according to any of claims 1-7, the method further comprising determining, based on the determination that the line-of-sight (L2) of the at least one slave image sensor device (20) intersects the line-of-sight (L1) of the master image sensor device (10) at the location of the target (T), a target line
15 (L) associated with said ground combat vehicle (V) pointing towards said target (T).
9. The method according to claim 8, based on said target line (L) and said determined target distance (TD), controlling the orientation of a weapon (B) of said ground combat vehicle (V) so that the weapon has a line-of-fire for
20 facilitating hitting said target (T).
10. The method according to any of claims 1-9, wherein said master image sensor device (10) and/or at least one of said at least one slave image sensor device (20) is a motorized image sensor device.
11. The method according to any of claims 1-10, wherein the master image
25 sensor device (10) and the at least one slave image sensor device (20) comprises one or more optical and/or electro-optical image sensors.

12. The method according to any of claims 1-11, wherein the master image sensor device (10) comprises a gunner camera, a sight camera, an electro-optical sight device or a weapon camera of the ground combat vehicle (V).

13. A system (S), associated with a ground combat vehicle (V), for passive target distance measurement, wherein the system (S) comprises:

- a master image sensor device (10) for observing a target (T); and at least one slave image sensor device (20), said master image sensor device (10) and/or at least one of said at least one slave image sensor device (20) being configured to be arranged at the ground combat vehicle (V), said master image sensor device (10) and said at least one slave image sensor device (20) being configured to be arranged spaced apart by an offset distance (OD) from each other, said at least one slave image sensor device (20) having a controllable orientation;
- an electronic device (100) comprising:
 - a control module (CM), and,
 - a target distance determination module (TDM),
- the control module (CM) being configured to:
 - adjust the controllable orientation of the at least one slave image sensor device (20) and to determine whether a line-of-sight (L2) of said at least one slave image sensor device (20) intersects a line-of-sight (L1) of said master image sensor device (10) at a location of a target (T); and,
 - upon determining that the line-of-sight (L2) of said at least one slave image sensor device (20) intersects the line-of-sight (L1) of said master image sensor device (10) at the location of the target, transmit, to the target distance determination module, first angular data representing the orientation of the master image sensor device (10) and second angular data representing the orientation of the least one slave image sensor device (20),

- the target distance determination module (TDM) being configured to determine a target distance (TD), when the line-of-sight (L2) of the at least one slave image sensor device (20) intersects the line-of-sight (L1) of the master image sensor device (10) at the location of the target, based on the offset distance (OD) and the received angular data.

14. The system according to claim 13, wherein the control module (CM), when determining that the line-of-sight (L2) of the at least one slave image sensor device (20) intersects the line-of-sight (L1) of the master image sensor device (10) at the location of the target, is configured to:

- receive first image data from the master image sensor device (10);
- receive second image data from at least one of said at least one slave image sensor device (20); and,
- process the first image data and the second image data based on image recognition so as to determine that the target (T) is present along the line-of-sight (L2) of the at least one of said at least one slave image sensor device (20) and along the line-of-sight (L1) of said master image sensor device (10).

15. The system according to claim 13 or 14, wherein the control module (CM) is configured to control the orientation of the at least one slave image sensor device (20) by moving the orientation of the at least one slave image sensor device (20) so that the line-of-sight of the at least one slave image sensor device (20) intersects the line-of-sight (L1) of the master image sensor device (10) at different distances along the line-of-sight (L1) of the master image sensor device (10).

16. The system according to any of claims 13-15, wherein the control module (CM) is configured to move at least one of said at least one slave image sensor device (20) relative to said master image sensor device (10) and/or said master sensor device (10) relative to said at least one slave image sensor device (20) so as to adapt the offset distance (OD) between said master image sensor

device (10) and said at least one of said at least one slave image sensor device (20).

17. The system according to any of claims 13-16, said at least one slave image sensor device (20) comprising at least two slave image sensor devices (20),
5 arranged spaced apart from said master image sensor device (10) and spaced apart from each other at different locations at the combat vehicle (V) with corresponding offset distances (OD), wherein the target distance determination module (TDM) is configured to determine the target distance (TD) based on determining target distances by using the offset distances and
10 angular data associated with the slave image sensor devices (20).

18. The system according to any of claims 13-17, wherein the electronic device (100) further comprises or is operably connected to or comprised in an aiming module (AM) and/or a fire control module (FCM) and/or a ballistics module (BM), wherein said aiming module (AM) and/or said fire control module (FCM)
15 and/or said ballistics module (BM) is configured to, during vehicle operation, continuously or intermittently receive information associated with the determined target distance (TD).

19. The system according to any of claims 13-18, further comprising a speed determination module (SDM) configured to continuously or intermittently
20 receive determined target distances (TD), and determine the speed of the ground combat vehicle (V) relative to the ground and/or speed of the target relative to the ground combat vehicle based on determined target distances (TD) and elapsed time between determined target distances.

20. The system according to any of claims 13-19, the electronic device (100)
25 being configured to determine a target line (L) associated with said ground combat vehicle (V) pointing towards said target (T), based on the determination that the line-of-sight (L2) of the at least one slave image sensor device (20) intersects the line-of-sight (L1) of the master image sensor device (10) at the location of the target (T).

21. The system according to claim 20, when depending on claim 18, wherein said aiming module (AM) and/or fire control module (FCM) and/or ballistics module (BM), based on said target line (L) and said determined target distance (TD), is configured to control the orientation of a weapon (B) of said ground
5 combat vehicle (V) so that the weapon has a line-of-fire for facilitating hitting said target (T).
22. The system according to any of claims 13-21, wherein said master image sensor device (10) and/or at least one of said at least one slave image sensor device (20) is a motorized image sensor device.
- 10 23. The system according to any of claims 13-22, wherein the master image sensor device (10) comprises a gunner camera, a sight camera, an electro-optical sight device or a weapon camera of the ground combat vehicle (V).
24. A ground combat vehicle (V) comprising a system (S) according to any of claims 13-23.
- 15 25. The ground combat vehicle (V) according to claim 24, wherein said ground combat vehicle comprises a turret (TU) and a turret-mounted weapon system (W) having a weapon (B).