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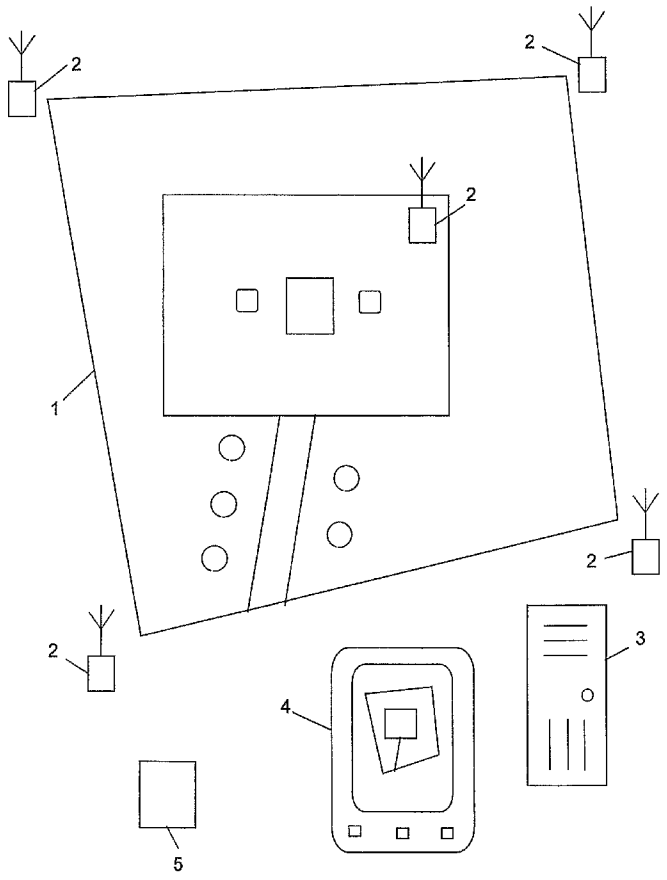
(54) **Title:** A DEVICE FOR POSITIONING A POINT ON A THREE-DIMENSIONAL OBJECT AND FOR PROCESSING PARAMETERS



(57) **Abstract:** The invention is related to a device for positioning the location of a point on a three-dimensional object and for managing information related to the point. The device includes transmitters-receivers placed on exact points on the ground, one or several transmitters-receivers placed above the ground at an appropriate height, one or several mobile devices equipped with a screen, one or several controllers with actuators and a server. The work equipment of the device is a mobile device equipped with a screen. The mobile device is configured to calculate the exact location of the mobile device itself and the desired point and give clear instructions for reaching the exact location of the point in the nature. The data changes in real time as the user moves closer to the location of the desired point.

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A device for positioning a point on a three-dimensional object and for processing parameters.

Technical field

The invention is related to measurement systems used in land surveying, plane determination, positioning the location of a point and other similar measurements. Application possibilities include land surveying, road construction, general building and many other fields related to devices for land surveying.

According to the invention, the device may be used at the same level and with the same accuracy without problems and with (almost) no preparation. Therefore it is meant for unskilled workers employed in various fields as well as managers, geodesists, architects, real estate developers, etc. The described system could be applied not only as an accessory which would replace existing devices and systems, but it would be an extension comprising the entire field, which, with the help of a digital 3D environment, would enable the creation of an unlimited number of software-based innovations and additions according to the original principle.

In road construction, it would be possible to use the device when installing kerbs or processing the surface under the road and the surface of sand and crushed stone in order to make sure that the surface of asphalt was as smooth as possible and with the necessary slope. It would also be possible to attach the device on the plough of a grader that smoothes the surface of the sand and crushed stone under the road. This way the designed planes could be processed as accurately as possible. Therefore, it would be possible to fully automate the constant changes necessary for smoothing made with the plough of a grader. Thanks to this innovation the driver does not have to observe the marks made on the processed surface all the time, instead, a device would do this with the help of data obtained from a 3D virtual environment. Hence, with an integrated device it is possible to fully automate many processes on the construction site as well as other places.

State of the art

The state of the art is represented by GPS (Global Positioning System), where several different points (of satellites) and data acquired from calculating the distances between the digital devices are used in order to position the device user.

CN 1614597 covers the collection, storage and presentation of land surveying information, using the vector drawing of the present state of land, an image resulted from the remote monitoring and a line map, which are entered into a palmtop computer.

JP 10026529 covers three-dimensional coordinates obtained with the help of a GPS system, which are transmitted from many construction machines and a fixed station to an exchange via radio where the three-dimensional location of construction machines and the fixed station is calculated. For this purpose, a cinematic measurement is carried out with a GPS interferometer system and at the same time, the location of moved construction machines is displayed on the screen.

JP 2005017015 covers the system of location authentication, which includes at least one terminal for positioning a satellite (equipped with a receiving device for receiving signals from the satellite), a server analysing the positioning of the satellite and communication tools that are able to communicate with the terminal for positioning a satellite and the above-mentioned server.

Prior art uses positioning systems on the satellites, which presume certain contracts for use between the user and the satellite operator and devices, which limit the user's options in cases when operational action is needed. Furthermore, at the moment, GPS positioning systems in normal use allow positioning relatively inaccurately.

Summary of the invention

The object of the invention is to provide a device for determining the location of a certain point of an object in a certain space in real time. The device includes transmitters-receivers placed on exact points on the ground, one or several transmitters-receivers placed above the ground at an appropriate height, one or several mobile devices equipped with a screen, one or several controllers with actuators, and a server. The distances between the parts of the device according to the invention are considerably smaller than the distance between the GPS device known in prior art and satellites, thus, the system modified according to the invention enables more accurate positioning.

The device according to the invention enables the creation of a spatial working environment which changes in time. The work equipment is a mobile device that resembles a palmtop and is equipped with a screen (if possible, items already on sale are

to be used). If necessary, the switch necessary for using the device modified according to the invention can be built in the palmtop or attached to it as an accessory.

The working principle of the device modified according to the invention is the following: when positioning the exact location of a point of an object in the area displayed on the screen (in the nature there are transmitters-receivers on specified spots in that area), it suffices to press the image of the object on the screen. Then the mobile device is configured to calculate the exact location of the mobile device itself and the desired point and give clear instructions on how to reach the exact location of the point in the nature, whether visually referring towards the location (as a compass) or in a data-based manner, whereas the data changes in real time as the user moves closer to the location of the desired point. When getting close to the desired point, the exact location of the point is found by positioning the mobile device itself or the accessory, according to the instructions.

The object of the device described above is to make the positioning of a point in real time as simple and cheap as possible as compared to laser and optical equipment and systems in use. The use of existing equipment presumes a special training or ordering the service from geodesy companies, which makes the service comparatively expensive and troublesome.

Description of the illustrations

In figure 1 the device according with the invention is shown from above the object.

In figure 2 one alternative for the device in accordance with the invention is shown from above the object.

Example of implementing the invention

In figure 1 there is object 1, which may be a piece of land, a building or both or some other real object. The system modified according to the invention enables to position the location of the entire object or its parts. Receivers-transmitters 2.1–2.5 are placed in the points (preferably on the edges) of the object in the three-dimensional space. In a preferred implementation one transmitter-receiver 2.1–2.4 is placed on the ground in each corner of object 1, which has a quadrangular ground plan, and one transmitter-receiver 2.5 is placed

on the highest point of the object. Transmitters-receivers 2.1–2.4 are placed to points established according to a prior geodetic measurement. The coordinates of the points are converted into a digital form and entered into server 3. The server has a radio interface for wireless communication with transmitters-receivers 2.1–2.5 and with a mobile module equipped with one or several screens. In a preferred implementation the mobile module is mobile device 4. Server 3 is configured to calculate any location of the point of object 1 according to the signals transmitted from transmitters-receivers 2.1–2.5 and transmit and display the location on the screen of mobile device 4. Server 3 is configured to calculate and display (if necessary) the location of the point regardless of the fact whether the user chose the point on object 1 displayed on the screen of mobile device 4 or whether the user chose the point while actually being on the mentioned point on the object.

In case of an alternative for the device in accordance with the invention the mobile module is robot device 5, which is fastened to a machine doing road works or processing the surface. Robot device 5 is connected to server 3 with a radio interface and includes a control unit for receiving commands from the server, carrying out commands and feedbacking with server 3.

When planning an object the implementation of the device is the following: when choosing a certain point or location on mobile device 4, it is immediately and accurately marked in server 3 in a digital working environment. It is possible to add necessary remarks and explanations to all marked conventional signs and points. Therefore projects would become clearer and it would be easier to understand them. This is meant for both main contractors and sub-contractors, enabling greater and more effective co-operation.

In a virtual working environment it is also possible to implement the 4D principle. It would be possible to forward in real time all decisions, changes and agendas but also plan work and design the whole work process in the long run from contracting entities, project managers or supervisors directly to contractors via virtual working environment. This would ensure a faster and more thorough management, overview and supervision of all works done on the project. With the help of possibilities described above it would be possible to achieve greater transparency, comprehensibility, flexibility and productivity of the work process. In case of a fully digital work process the greatest possibilities lie in supervision. If there is exact information about what anyone has done, then it is possible to calculate salaries or amounts of money to be paid to subcontractors.

In order to avoid the theft of the device, a positioning sensor may be installed there, which may activate a software function, which observes the location of the work equipment. In case of theft such a function would register the theft and inform the owner.

Possible development

The palmtop may be replaced by a half-transparent screen which is placed in front of eyes. Already existing screens may be used or models integrated into glasses. Hence, orienting in a digital working environment becomes visual and the design is right before one's eyes. It is not necessary to refer to a certain location. It is enough to look at that direction and everything needed is presented virtually and the location is positioned with millimetre accuracy.

Therefore, it is possible to enter the project and even the agenda and add a long-term schedule, instructions and duties for each worker separately, keeping in mind the entire planning process.

Claims of the utility model

1. A device for positioning the location of a point on a three-dimensional object and for processing the parameters of the point. The device includes an object (1), receivers-transmitters (2.1–2.5), and a server (3), which **differs in that** at least three receivers-transmitters (2.1–2.4) are placed to previously measured points close to the ground on the object (1) and at least one receiver-transmitter (2.5) is placed near the highest point of the object above the ground. Hence a three-dimensional network of base stations is formed on the object (1). A server (3) is configured to calculate any location of the point of object 1 according to the signals transmitted from transmitters-receivers 2.1–2.5 and transmit the location to and display it in the mobile module connected to the server via radio interface. The server (3) is configured to process and store parameters related to the point of object (1) obtained from the mobile module and send the processed data back to the mobile module.

2. A device according to claim 1, which **differs in that** the server (3) and the mobile device (4) are configured to exchange data in real time.

3. A device according to claim 1, which **differs in that** that the mobile module is a mobile device of the type of a palmtop.

4. A device according to claim 1, which **differs in that** the mobile module is a device resembling glasses equipped with a half-transparent screen which are placed before the user's eyes.

5. A device according to claim 1, which **differs in that** the mobile module is a robot device (5) fastened to a machine processing the surface.

6. A device according to claim 1, which **differs in that** the mobile module is configured to display the object (1) or its part on the basis of the data obtained from the server (3).

7. A device according to claims 3 and 4, which **differs in that** the mobile module is configured, on the basis of data obtained from the server (3), to display the location of the mobile module on the image of the object (1) on the screen and the location of the point marked on the screen and the distance between them.

8. A device according to claims 3 and 4, which **differs in that** the mobile module is configured, on the basis of data obtained from the server (3), to display the location of the mobile module on the image of object (1) on the screen and the change of the location of a point marked on the screen in real time.

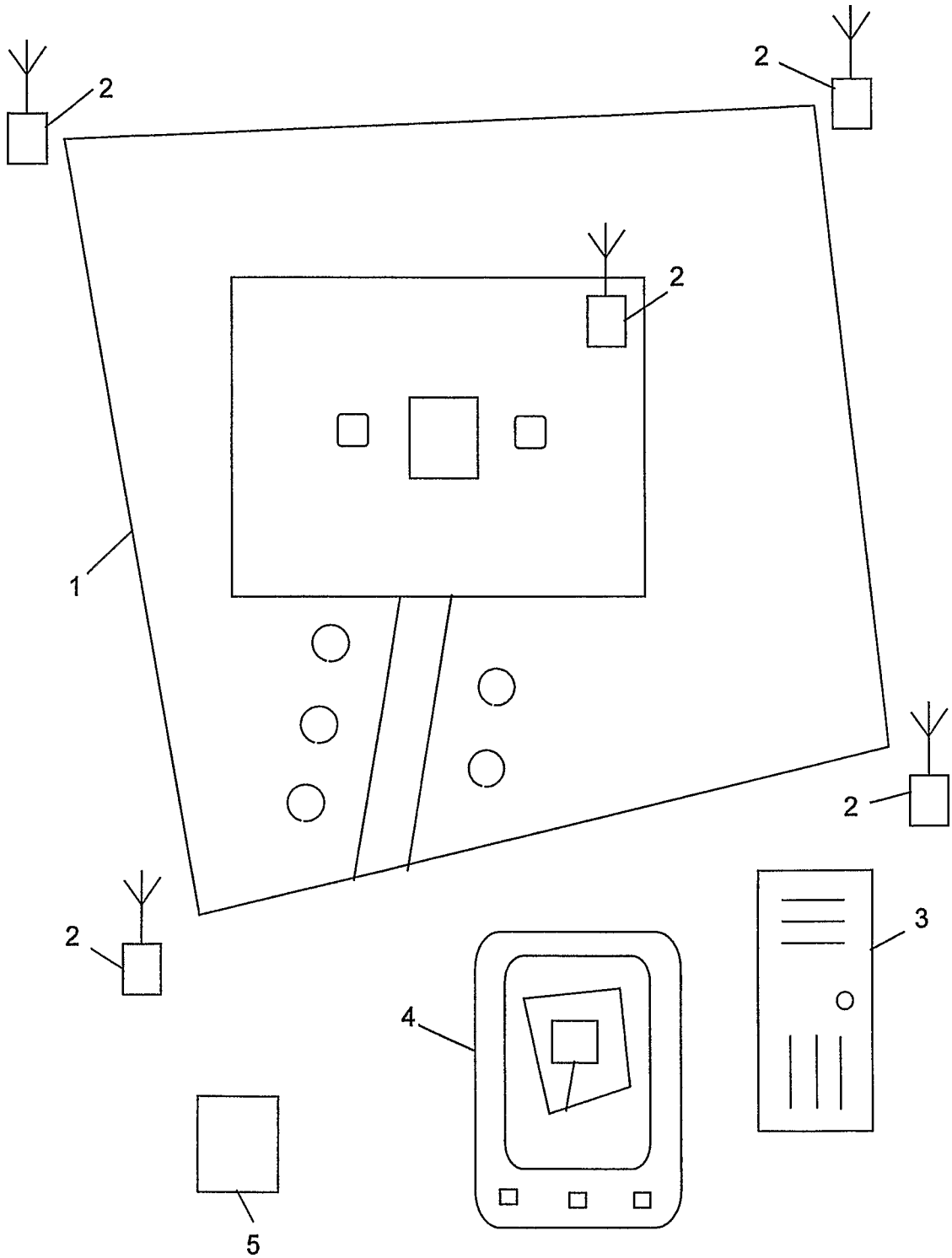

FIG 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/EE2006/000010

A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01S

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 097 337 A (BISIO ROLAND J [US]) 1 August 2000 (2000-08-01) column 2, line 62 - column 3, line 10 column 4, line 3 - line 10 column 1, line 61 - column 2, line 7	1-8
Y	US 2002/160787 A1 (CHEN BYRON HUA [US] ET AL) 31 October 2002 (2002-10-31) paragraphs [0017] - [0028]; figure 1	1-8
Y	US 6 314 295 B1 (KAWAMOTO YOJI [JP]) 6 November 2001 (2001-11-06) column 5, line 12 - column 8, line 62; figures 1,7,8	1-8
Y	US 2005/136845 A1 (MASUOKA RYUSUKE [US] ET AL) 23 June 2005 (2005-06-23) the whole document	1-8

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 February 2007	09/02/2007
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer Johansson, Roland

INTERNATIONAL SEARCH REPORT

International application No
PCT/EE2006/000010

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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