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(73) Patenthaver: **Northwest Instrument Inc., 69 Kings Street Dover, New Jersey 07801, USA**

(72) Opfinder: **SHI, Xin, B2 Building-B No.303 Xinke Road, Qingpu Industrial Zone, Shanghai 201707, Kina**
XING, David, B2 Building-B, No.303 Xinke Road, Qingpu Industrial Zone, Shanghai 201707, Kina

(74) Fuldmægtig i Danmark: **Dennemeyer & Associates S.A, P.O. Box 700425, DE-81304 Munich, Tyskland**

(54) Benævnelse: **SYSTEM OG FREMGANGSMÅDE TIL AFSTANDSBEDØMMELSE**

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DESCRIPTION

TECHNICAL FIELD

[0001] The present invention relates to the field of surveying and mapping, and more particularly, to a ranging system and a ranging method.

BACKGROUND

[0002] Currently, people need to use ranging device to measure and plan the route and the area in all aspects of life and work, such as in the field of construction, road engineering, transportation, pipeline laying, landscape areas etc. The most commonly used ranging device is the measuring wheel.

[0003] The existing measuring wheel usually only has the function of ranging, its basic principle is to calculate the number of rotation based on the rolling of the measuring wheel and with the help of mechanical gear counter or electronic counter, so as to realize distance measurement. This method usually only measures the length of the traveling trajectory between two points, and then the drawings need to be plotted one segment by one segment. Thus, this method wastes time and the measurement accuracy is very low. Therefore, only limited function may be achieved in actual use.

[0004] DE 195 08 264 C1 discloses a method and an apparatus for measuring contours, especially for measuring road. US 2005/219517 A1 discloses a movable light environment measuring system. WO 01/75392 A2 discloses an area measurement device having a support to be moved around a boundary. EP 2 796 832 A1 discloses a distance meter comprising a frame, at least two wheels installed at the front and rear of the frame, rotation detectors and tilt detecting means. US 2009/217542 A1 discloses a measuring device includes a frame, a rolling wheel carried by the frame, measuring means for detennining a distance traveled by the wheel, and signal means responsive to the measuring means for indicating when the wheel has traveled a preselected set distance. The manufacture cost for the measuring apparatus in the above mentioned applications is expensive.

SUMMARY

[0005] The technical problem solved by the present invention is to provide a ranging system which could achieve ranging function and generate a traveling trajectory diagram in real time simultaneously.

[0006] The preferred embodiments of the present invention could mark the actual scene such

as marking line or marking points for a predetermined traveling trajectory on a predesigned drawing, and could prompt direction and distance.

[0007] To achieve the above-mentioned technical purpose, the present invention provides a ranging system according to independent claim 1 and a ranging method according to independent claim 11. Further embodiments are defined by the dependent claims.

[0008] Compared with the prior art, the invention has the advantages that:

1. 1. The invention adopts the cooperation of the electronic counter and the angle sensor to generate the drawing of the traveling trajectory, in real time, on the terminal device by using the data measured by the ranging apparatus, which not only achieves the purpose of measuring the distance, but also generates the drawing of the traveling trajectory in real time, and thus the work efficiency is obviously improved;
2. 2. The terminal device of the invention is further provided with a camera, and the terminal device could combine the information recorded by the camera with the trajectory on the drawing to complete the work of marking line or points for the construction site, and route correction could be applied in the process of marking;
3. 3. The invention has the advantages of simple structure, lightness, flexibility and convenient use.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a schematic structural view of a ranging system according to an embodiment of the present invention;

Figure 2 is a schematic structural view of a ranging system according to another embodiment of the present invention;

Figure 3 is a schematic diagram of a regular traveling trajectory diagram generated by a ranging system according to an embodiment of the present invention;

Figure 4 is a schematic diagram of an irregular and continuous traveling trajectory diagram generated by a ranging system according to an embodiment of the present invention;

Figure 5 is a schematic diagram illustrating how the ranging system according to the present invention calculates an area of a traveling trajectory by using mesh computing;

Figure 6 is a schematic diagram illustrating how the ranging system according to an embodiment of the present invention prompts during a traveling process of a measuring wheel;

Description of Reference Numerals

1 - Measuring wheel	2 - Electronic Counter
3- Terminal Device	4-Marker

DETAILED DESCRIPTION

[0010] The invention will now be described in further detail with reference to the accompanying drawings and specific embodiments, which should not be construed as limiting the invention, which is defined by the appended claims.

[0011] Fig. 1 is a schematic structural view of a ranging system according to an embodiment of the present invention and Fig. 2 is a schematic structural view of a ranging system according to another embodiment of the present invention.

[0012] As shown in Fig. 1, the ranging system according to the present invention comprises a ranging apparatus and a terminal device 3, wherein the ranging apparatus comprises a measuring wheel 1, a rotating shaft disposed on the measuring wheel 1, and an electronic counter connected to the rotating shaft and used to obtain distance information of the measuring wheel. A data processing module is provided in the terminal device 3 and communication modules are arranged both on the terminal device and the ranging apparatus, the ranging apparatus or the terminal device further comprises an angle sensor. By using this communication module, the data processing module receives the distance information from the electronic counter and the angle information from the angle sensor, and performs calculation based on the distance information and the angle information to plot, in real time, a first traveling trajectory diagram which the measuring wheel has already traveled on the displayer of the terminal device. In embodiments of the present invention, the angle sensor may be an electronic compass disposed in the ranging apparatus and connected to the communication module of the ranging apparatus, and also may be a gyroscope disposed in the terminal device and connected to the communication module.

[0013] The present embodiment adopts the cooperation of the electronic counter and the angle sensor to generate the drawing of the traveling trajectory, in real time, on the terminal device by using the data measured by the ranging apparatus, which not only achieves the purpose of measuring the distance, but also generates the drawing of the traveling trajectory in real time, and thus the work efficiency is effectively improved.

[0014] In one embodiment of the present invention, the ranging system may be used to mark lines or points for the construction site. According to the invention, a predesigned traveling trajectory diagram is stored in a storage of the terminal device, the data processing module is configured to determine current traveling trajectory based on the distance information and the angle information, to monitor the determined current traveling trajectory of the measuring wheel on the basis of the predesigned traveling trajectory, and to output the deviation between

the current traveling trajectory and the predesigned traveling trajectory diagram as deviation data when the current traveling trajectory of the measuring wheel deviates from the predesigned traveling trajectory. The deviation data may be, for example, angle and distance data for which the measuring wheel needs to be adjusted from the current location to the predesigned trajectory.

[0015] According to the invention, the terminal device comprises a prompt module which receives the above mentioned deviation data and is configured to perform direction and/or distance prompt based on the deviation data to indicate the user to correct the current traveling route. When the above mentioned predesigned traveling trajectory diagram has marking points or marking lines, the prompt module may prompt or indicate the user to use a separate marker to mark points or lines on the traveling route of the measuring wheel based on the marking points or marking lines.

[0016] In another embodiment of the present invention, the marker is disposed on the ranging apparatus, for example, the marker is connected with the rotating shaft such that the user does not need additional marker, on the contrary, the user could instruct the marker to mark points or lines at the predetermined location when the prompt module prompts that the current location needs to be marked. The marker may also use the data processing module to compare the current traveling trajectory with the predesigned traveling trajectory diagram and if the data processing unit determines that the current location needs to be marked, then the marking instruction is sent to the marker via the communication module, so as to mark points or lines for the measuring site automatically. Referring to Fig. 2, in Fig. 2 a schematic diagram illustrating that the marker 4 is connected to the rotating shaft of the ranging apparatus is shown.

[0017] In the present embodiment, for the predesigned traveling trajectory on the predesigned drawing, marking such as marking lines or points for actual scene can be achieved, and direction and distance are prompted.

[0018] Figure 3 is a schematic diagram of a regular traveling trajectory diagram generated by a ranging system according to an embodiment of the present invention; Figure 4 is a schematic diagram of an irregular and continuous traveling trajectory diagram generated by a ranging system according to an embodiment of the present invention. As shown in Fig. 3 and Fig. 4, the embodiment according to the present invention may measure regular and irregular route continuously and generate the traveling trajectory diagram in real time.

[0019] As shown in Fig. 1 and Fig. 2, a holder for fixing the terminal device 3 and connected to the side end of the electronic counter 2 is provided in the ranging apparatus. The holder may facilitate the measuring process, maintain a stable signal transmission and avoid the measuring error caused by the angle sensor at the same time. In this situation, the communication module in the ranging apparatus and the terminal device 3 may be wired communication module, such as RS 232, RS485, I2C, SPI or CAN. Although Fig.2 shows that the holder is arranged on the side end of the electronic counter 2, the present invention is not

limited thereto; on the contrary the present invention contains all the scope which could stably connect the terminal device 3 to the electronic counter 2.

[0020] Although Fig. 1 and Fig. 2 shows the scene in which the terminal device 3 is fixed on the ranging apparatus via the holder, but the present invention is not limited thereto. Instead, the terminal device does not have to be fixed on the ranging apparatus to obtain distance information and angle information by the way of wireless communication by using the wireless communication module disposed in the ranging apparatus and the terminal device, the communication way of the wireless communication module is Bluetooth , WIFI, Zigbee or RF communication.

[0021] The storage in the terminal device according to the present invention may be further used to store distance information, angle information and the traveling trajectory diagram generated by the data processing module to facilitate retrieving later. The terminal device in the embodiment of the present invention is a smart cellphone, a computer or handheld equipment.

[0022] As shown in Fig. 5, in an embodiment of the present invention, the data processing module is configured to obtain area of a closed graphic by meshing the closed graphic and calculating the area of the meshes contained by the closed graphic, when the generated traveling trajectory diagram is a closed graphic, so that the actual area of the closed graphic enclosed by the measured trajectory may be obtained. Generally speaking, the smaller the mesh used when meshing the closed graphic is, the higher is the computation accuracy of area of the closed graphic.

[0023] The ranging system according to the present invention may further comprise a cloud server, the terminal device and the cloud server are connected to Internet, the cloud server is used for storing and sharing the data sent by the terminal device, the data includes: distance information from the electronic counter, angle information from the angle sensor and/or the generated traveling trajectory diagram and the terminal device is capable of obtaining predesigned traveling trajectory diagram from the cloud server. In this manner, the stored data may be retrieved in real time and the testing data or drawing may be shared with other engineering staff to effectively improve the work quality and efficiency. The traveling trajectory generated by the terminal device and uploaded to the cloud server may be the predesigned traveling trajectory diagram to be obtained.

[0024] According to the invention, the terminal device is further provided with a camera, the data processing module combines the scene image obtained by the camera with the trajectory in the drawing and displays them on the displayer, and the prompt module provides the above-mentioned direction and/or distance prompt on the scene image to indicate the user to correct the traveling route. Additionally, it may be indicated to the user to mark points or lines for the construction site.

[0025] When the predesigned traveling trajectory diagram stored in the terminal device or the

cloud server is retrieved, the staff member may mark on the actual work site based on the traveling trajectory in the drawings. Referring to Fig. 6, a traveling trajectory diagram, direction deviation prompt and distance deviation prompt are combined displayed on the scene image, the traveling trajectory diagram herein may be a predesigned traveling trajectory diagram obtained from the cloud server.

[0026] As mentioned above, the present invention also provides a ranging method according to claims 11-13.

[0027] The present invention adopts the cooperation of the electronic counter and the angle sensor to generate the drawing of the traveling trajectory, in real time, on the terminal device by using the data measured by the ranging apparatus, which not only achieves the purpose of measuring the distance, but also generates the drawing of the traveling trajectory in real time, and thus the work efficiency is effectively improved;

[0028] The described embodiments are merely exemplary embodiments of the present invention and are not intended to limit the scope of the invention as defined in the appended claims. It will be apparent to those skilled in the art that various modifications or equivalent substitutions may be made to the invention within the scope of the invention as defined by the appended claims.

REFERENCES CITED IN THE DESCRIPTION

Cited references

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SYSTEM OG FREMGANGSMÅDE TIL AFSTANDSBEDØMMELSE

PATENTKRAV

1. System til afstandsbedømmelse, kendetegnet ved, at systemet til afstandsbedømmelse omfatter et apparat til afstandsbedømmelse og en terminalanordning (3), hvor apparatet til afstandsbedømmelse omfatter:

et målehjul (1),

en roterende aksel, der er anbragt på målehjulet, og

en elektronisk tæller (2),

der er forbundet til den roterende aksel og bruges til at opnå afstandsinformation i realtid om den rute, som målehjulet allerede har bevæget sig,

hvor

apparatet til afstandsbedømmelse eller terminalanordningen yderligere omfatter en vinkelsensor, der er konfigureret til at opnå vinkelinformation i realtid, når målehjulet bevæger sig,

kommunikationsmoduler er indrettet på henholdsvis terminalanordningen og apparatet til afstandsbedømmelse til at sende data mellem apparatet til afstandsbedømmelse og terminalanordningen,

terminalanordningen indbefatter et databehandlingsmodul, der er konfigureret til at generere et bevægelsesbanediagram for målehjulet i realtid baseret på afstandsinformationen fra den elektroniske tæller og vinkelinformationen fra vinkelsensoren,

terminalanordningen yderligere omfatter et lager, der er konfigureret til at lagre et foruddesignet bevægelsesbanediagram, kendetegnet ved, at databehandlingsmodulet yderligere er konfigureret til på basis af det foruddesignede bevægelsesbanediagram at overvåge den genererede aktuelle bevægelsesbane for målehjulet bestemt baseret på afstandsinformationen og vinkelinformationen og til at udsende afvigelsesdata, når målehjulets genererede aktuelle bevægelsesbane afviger fra det foruddesignede bevægelsesbanediagram, hvor

terminalanordningen yderligere omfatter et promptmodul, der er konfigureret til at udføre retnings- og/eller afstandsprompt baseret på afvigelsesdataene for at indikere, at brugeren skal korrigere målehjulets aktuelle bevægelsesrute, hvor

terminalanordningen yderligere omfatter et kamera, der er konfigureret til i realtid at opnå et scenebillede i målehjulets bevægelsesretning, og promptmodulet er konfigureret

til at tilvejebringe retnings- og/eller afstandsprompten på scenebilledet.

2. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at promptmodulet yderligere er konfigureret til at indikere, at brugeren skal markere på målehjulets bevægelsesrute i overensstemmelse med det foruddesignede bevægelsesbanediagram.

3. System til afstandsbedømmelse ifølge krav 2, kendetegnet ved, at apparatet til afstandsbedømmelse yderligere omfatter en markør, der er konfigureret til at markere på målehjulets bevægelsesrute i overensstemmelse med instruktionen fra brugeren eller i overensstemmelse med instruktionen fra databehandlingsmodulet.

4. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at vinkelsensoren er et elektronisk kompas, der er anbragt i apparatet til afstandsbedømmelse og forbundet med kommunikationsmodulet på apparatet til afstandsbedømmelse.

5. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at vinkelsensoren er et gyroskop, der er anbragt i terminalanordningen og forbundet med databehandlingsmodulet.

6. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at apparatet til afstandsbedømmelse yderligere omfatter en holder til fastgørelse af terminalanordningen.

7. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at kommunikationsmodulet er et trådløst kommunikationsmodul eller kommunikationsmodul via kabel, hvor grænsefladen for kommunikationsmodulet via kabel er RS232, RS485, I2C, SPI eller CAN, og kommunikationsmåden for det trådløse kommunikationsmodul er Bluetooth, wi-fi, Zigbee eller RF-kommunikation.

8. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at systemet til afstandsbedømmelse yderligere omfatter en cloud-server, hvor terminalanordningen og cloud-serveren er forbundet i netværk, og cloud-serveren anvendes til lagring og deling af dataene sendt af terminalanordningen, og dataene sendt af terminalanordningen indbefatter: afstandsinformation fra den elektroniske tæller, vinkelinformation fra vinkelsensoren og/eller et første bevægelsesbanediagram, og terminalanordningen er i

stand til at opnå foruddesignet bevægelsesbanediagram fra cloud-serveren.

9. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at databehandlingsmodulet er konfigureret til at opnå arealet af en lukket grafik ved at maske den lukkede grafik og beregne arealet af maskerne indeholdt i den lukkede grafik, når det første bevægelsesbanediagram er en lukket grafik.

10. System til afstandsbedømmelse ifølge krav 1, kendetegnet ved, at terminalanordningen er en smart mobiltelefon, computer eller håndholdt udstyr.

11. Fremgangsmåde til afstandsbedømmelse, der anvender systemet til afstandsbedømmelse ifølge et hvilket som helst af kravene 1-10, der omfatter en elektronisk tæller, der i realtid opnår information om afstand, som et målehjul allerede har bevæget sig, og en vinkelsensor, der i realtid opnår vinkelinformation om målehjulet, når målehjulet er i bevægelse, hvilken fremgangsmåde omfatter følgende trin:

at sende afstandsinformationen og vinkelinformationen til et databehandlingsmodul,

med databehandlingsmodulet i realtid at generere et bevægelsesbanediagram for målehjulet baseret på afstandsinformationen og vinkelinformationen,

at lagre et foruddesignet bevægelsesdiagram i terminalanordningen,

med databehandlingsmodulet på basis af det foruddesignede bevægelsesbanediagram at overvåge den genererede aktuelle bevægelsesbane for målehjulet bestemt baseret på afstandsinformationen og vinkelinformationen og udsende afvigelsesdataene, når den genererede aktuelle bevægelsesbane afviger fra det foruddesignede bevægelsesbanediagram, hvor fremgangsmåden til afstandsbedømmelse yderligere omfatter:

at prompte retning og/eller afstand baseret på afvigelsesdataene for at indikere, at brugeren skal korrigere målehjulets aktuelle bevægelsesrute, og med kameraet i realtid at opnå et scenebillede i målehjulets bevægelsesretning og tilvejebringe retnings- og/eller afstandsprompt på scenebilledet.

12. Fremgangsmåde til afstandsbedømmelse ifølge krav 11, hvor fremgangsmåden til afstandsbedømmelse yderligere omfatter: at prompte retning og/eller afstand baseret på afvigelsesdataene for at indikere, at brugeren skal markere på målehjulets bevægelsesrute i overensstemmelse med det foruddesignede bevægelsesbanediagram.

13. Fremgangsmåde til afstandsbedømmelse ifølge krav 12, kendetegnet ved, at en markør, der er anbragt i apparatet til afstandsbedømmelse, markerer på målehjulets bevægelsesrute i overensstemmelse med instruktionen fra brugeren eller i overensstemmelse med instruktionen fra databehandlingsmodulet.

DRAWINGS

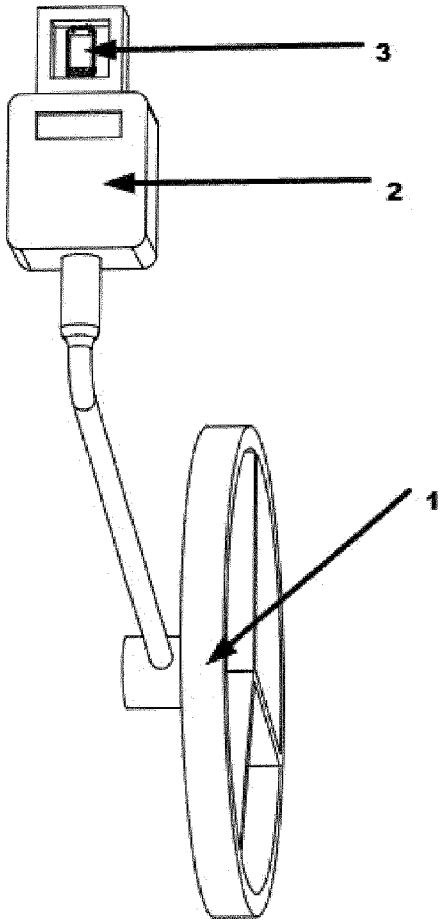

Figure 1

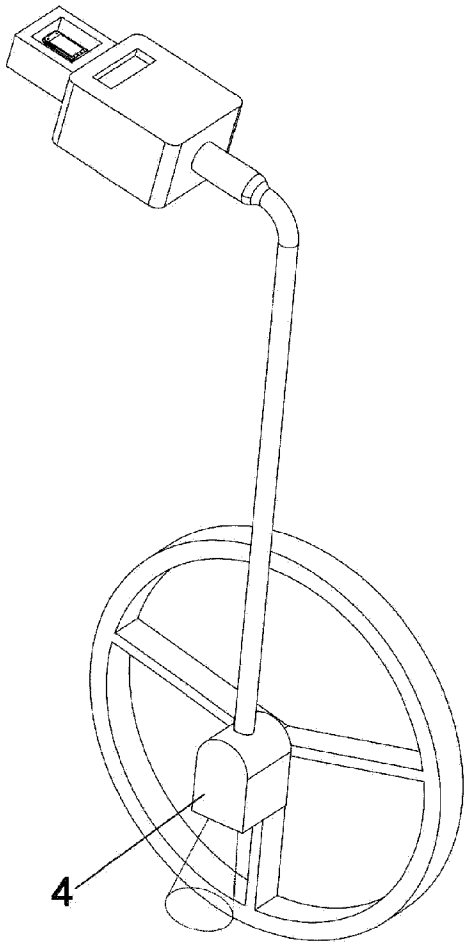

Figure 2

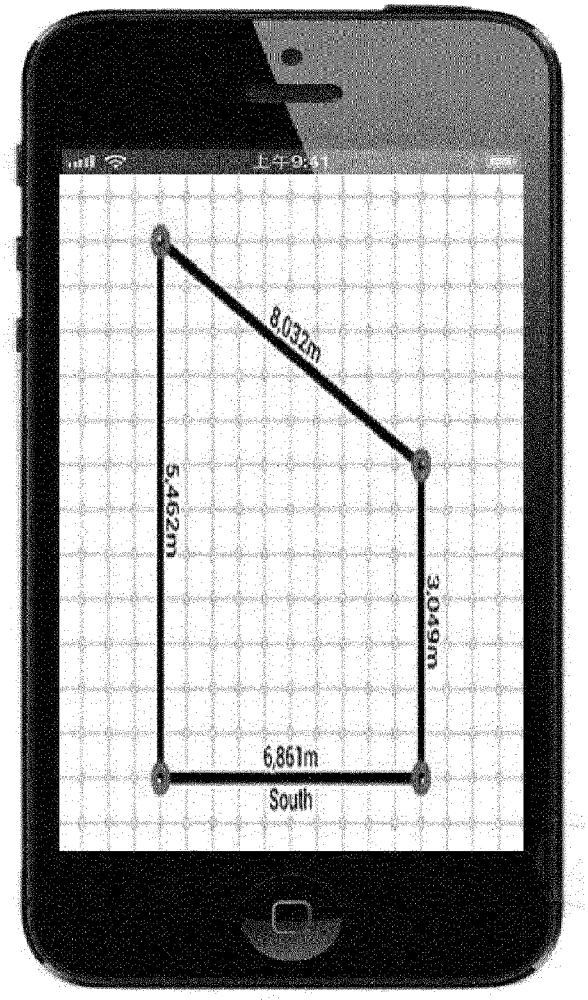

Figure 3

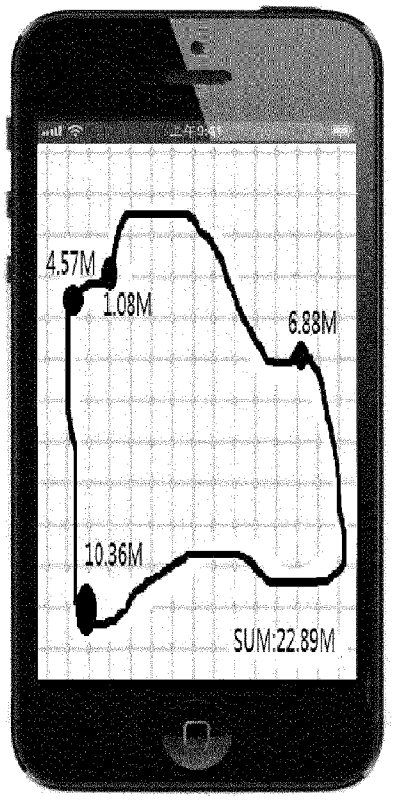

Figure 4

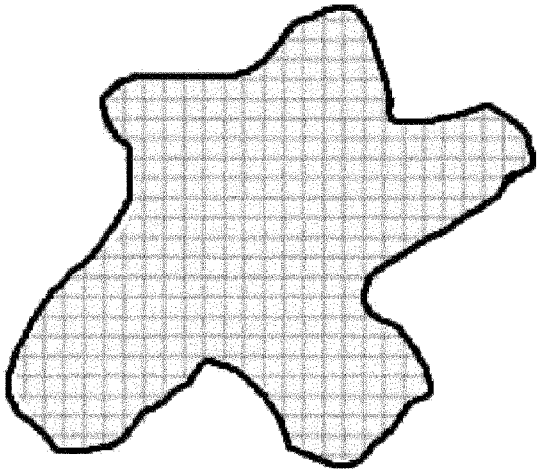

Figure 5

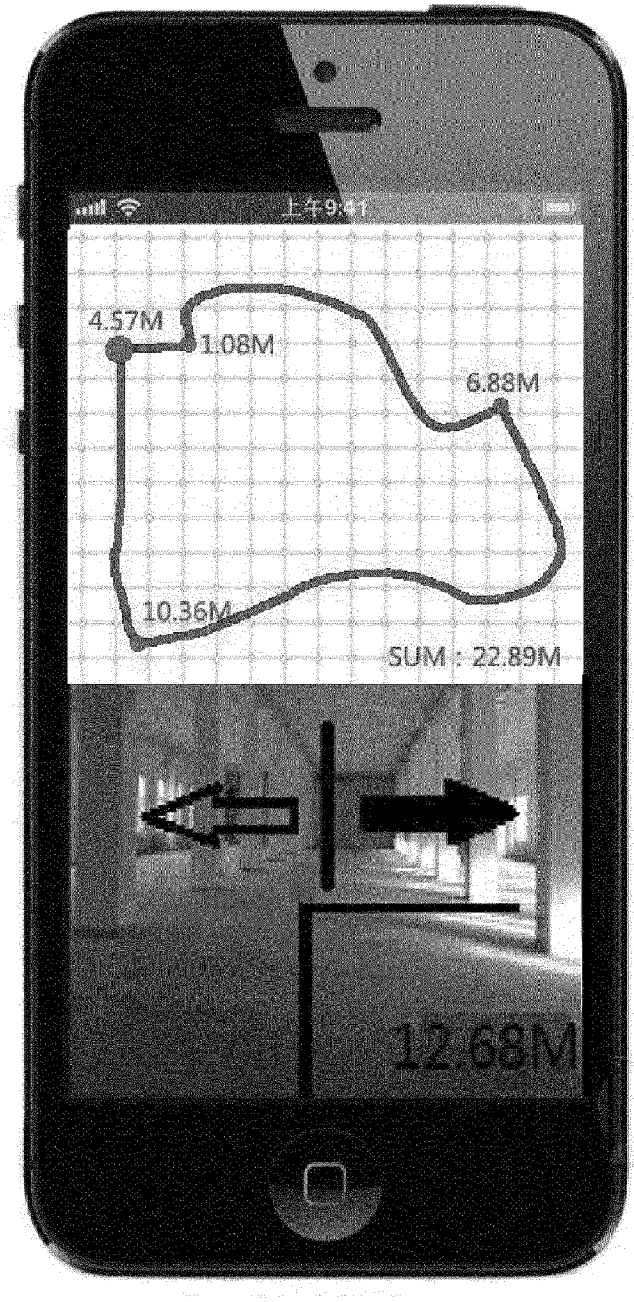

Figure 6