



(51) International Patent Classification:

H04L 12/26 (2006.01) H04W 24/04 (2009.01)
H04L 29/08 (2006.01) H04W 64/00 (2009.01)

(21) International Application Number:

PCT/IL2016/050871

(22) International Filing Date:

10 August 2016 (10.08.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

240678 19 August 2015 (19.08.2015) IL

(72) Inventor; and

(71) Applicant : HATZAV, Daniel [IL/IL]; 12 Hameyased St.,
4937754 Hod Hasharon (IL).

(74) Agent: KATZ, Itzhak; 7 Haim Gilad St., 4937754 Petach
Tikva (IL).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: SYSTEMS AND METHODS FOR DETECTING A MISSING GROUP MEMBER

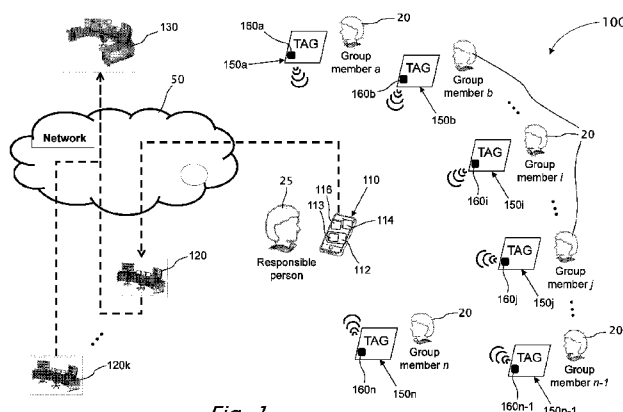


Fig. 1

(57) Abstract: A group-members-counting system for monitoring and detecting the number of present members of a predefined group of individual members participating in a prolonged event. The system includes a computerized master mobile device and a multiplicity of transmitters, wherein each of the transmitters is configured to transmit a unique identifying signal, and wherein each of the transmitters is configured to be in non-paired communication with the computerized master mobile device. The computerized master mobile device includes a communication receiving unit, having a preconfigured reception range and a computer program product embodied. The computer program product operates the communication receiving unit to read each of the unique identifying signals, to thereby determine which transmitters are present within the reception range of the communication receiving unit, and thereby determine if and which of the transmitters are not present within the reception range of the communication receiving unit.

SYSTEMS AND METHODS FOR DETECTING A MISSING GROUP MEMBER

FIELD OF THE INVENTION

5 The present invention relates to systems and methods for detecting a missing group member, and more particularly, a monitoring system for detecting, within a preconfigured distance range, a preconfigured number of transmitting tag devices, each typically coupled with a living being.

10 BACKGROUND OF THE INVENTION

It is often a problem to count all members of a group, for example, in groups larger than 10 people at a gathering area, and in particular in groups of tens of people and more. Such groups of people may include tour participants, school children being in class or outside the school, a group of soldiers, etc.

15 Some prior art solutions include using a GPS device that is coupled with the group member and enables to geographically locate that member. Another system utilizes transceivers, in particular RF transceivers, which have a limited battery life span.

20 The use of Bluetooth (BT) in short range (tens of meters and even more) communication systems has become widely used. However, typically, a first BT device is paired with a second BT device, wherein both devices are used as transceivers, each being both a transmitter and a receiver. As such a BT standard allows pairing of a single BT device with up to 8 other BT devices.

25 There is therefore a need and it would be advantageous to have a monitoring system for detecting a preconfigured number of transmitting-only tag devices, including BT based systems that are not limited in monitoring up to 8 other BT devices.

30 There is a further need and it would be advantageous to have a monitoring system for detecting a preconfigured number of transmitting-only tag devices, situated within a preconfigure distance range from the monitoring mobile device, wherein each tag device is typically coupled with a living being and preferably having a life span of more than a year. Furthermore, it would be advantageous to have a monitoring system for monitoring multiple groups from a control center.

SUMMARY OF THE INVENTION

The principle intentions of the present invention include providing a monitoring system for detecting a preconfigured number of transmitting-only tag devices, respectively associated with a group of individuals, and situated within a preconfigured distance range from a mobile monitoring device, wherein each tag device is typically coupled with a living being and preferably having a life span of more than a year. A further aspect of the present invention includes providing a monitoring system for monitoring multiple groups from a control center.

It is a further aspect of the present invention to provide a monitoring system for detecting a preconfigured number of transmitting only tag devices, including BT based systems that are not limited in monitoring up to 8 other BT devices. In order to do so, a non-paired communication is established. In a non-paired communication, a first BT device continuously transmits a signal, for example an identity signal, but is not configured and/or open to receive any transmittals from another device, including a device that received the transmitted signal. A second BT device is configured to listen to transmittals from other BT devices, but is not necessarily configured to respond to devices from which a transmittal was received.

This document references terms that are used consistently or interchangeably herein. These terms, including variations thereof, are as follows.

A “computer” includes machines, computers and computing or computer systems (for example, physically separate locations or devices), servers, computer and computerized devices, processors, processing systems, computing cores (for example, shared devices), and similar systems, workstations, modules and combinations of the aforementioned. The aforementioned “computer” may be in various types, such as a personal computer (e.g., laptop, desktop, tablet computer), or any type of computing device, including mobile devices that can be readily transported from one location to another location (e.g., smartphone, personal digital assistant (PDA), phablets, mobile telephone or cellular telephone).

A server is typically a remote computer or remote computer system, or computer program therein, in accordance with the “computer” defined above, that is accessible over a communications medium, such as a communications network or other computer network, including the Internet. A “server” provides services to, or performs functions

for, other computer programs (and their users), in the same or other computers. A server may also include a virtual machine, a software based on emulation of a computer.

An "application", includes executable software, and optionally, any graphical user interfaces (GUI), through which certain functionalities may be implemented.

5 According to the teachings of the present invention, there is provided a group-members-counting system for monitoring and detecting the number of present members of a predefined group of individual members participating in a prolonged event. The system includes a computerized master mobile device and a multiplicity of transmitters, wherein each of the transmitters is configured to transmit a unique identifying signal, and
10 wherein each of the transmitters is configured to be in non-paired communication with the computerized master mobile device. The computerized master mobile device includes a communication receiving unit, having a preconfigured reception range, a data repository unit, being a non-transitory computer readable medium, and a computer program product embodied in the data repository unit.

15 Each of the transmitters is coupled with a respective individual member of the group, wherein each coupling of a transmitter with a respective individual member of the group is enlisted by the computer program product. Furthermore, each of the transmitters is configured to be in direct communication flow with the computerized master mobile device. That is, no external network mediates the communication
20 between each of the transmitters and the computerized master mobile device.

 The computer program product operates the communication receiving unit to read each of the unique identifying signals, to thereby determine which transmitters are present within the reception range of the communication receiving unit, and thereby determine if and which of the transmitters are not present within the reception range of
25 the communication receiving unit. Upon determining that at least one of the transmitters is not present within the reception range of the communication receiving unit, providing identifying data of the missing group member associated with the at least one of the transmitters that is not present within the reception range of the communication receiving unit. The identifying data of the missing group member is
30 provided to the operator of the master mobile device and/or to a remote site. The identifying data may also include identifying data of other members of the group, which may be provided regardless of whether any individual member of the group is missing.

Preferably, the computer program product is configured to predefine the group members' identity and the transmitter that is coupled with each the individual members of the group.

5 Preferably, the computer program product is configured to count the transmitters that are activated and within the reception range of the communication receiving unit of the computerized master mobile device. The computerized master mobile device may further include a display, wherein the computer program product is configured to display the counting results on the display.

10 Optionally, at least one of the transmitters is a BT transmitter. Preferably, at least one of the BT transmitters is a BLE transmitter.

Optionally, the transmitters are RF transmitters.

15 Optionally, the master mobile device further includes an image acquisition device, wherein the computer program product is configured to activate the image acquisition device to thereby acquire an image frame of at least one of the individual members of the group and add the acquired image frame to the identifying data associated with the respective individual member of the group.

Optionally, the preceding claims further includes a transceiver configured to receive the unique identifying signals and transmit the received unique identifying signals to the master mobile device.

20 Optionally, the master mobile device, being a leading master mobile device, is configured to communicate over a cellular network with at least one other master mobile devices, wherein each of the other master mobile devices monitors and counts their respective group members individually and transmit the individual identifying data of the missing group member, if any, to the leading master mobile device over the
25 cellular network.

Optionally, at least one individual identifying data of the missing group member is transmitted to a remote server over the cellular network.

Optionally, the transmitters are also configured to read incoming signals and are arranged to intercommunicate in a mesh network.

30 Optionally, the group-members-counting system further includes a first level remote server, wherein the first level remote server is configured to communicate with

the master mobile device, and wherein the first level remote server is configured to receive the identifying data of the at least one missing group member from the master mobile device.

5 Optionally, the group-members-counting system further includes an N level remote server, wherein the N level remote server is configured to communicate with at least one (N-1) level remote server and receive the identifying data of the at least one missing group member from the at least one (N-1) level remote server.

10 According to further teachings of the present invention, there is provided a group-members-counting method for monitoring and counting the members of a pre-arranged group participating in a prolonged event. The method includes the following steps:

- a. Providing a group-members-counting system described here above.
- b. Performing pre-event activity, including the following off-line steps:
 - i. Enlisting the group members.
 - 15 ii. Coupling a transmitter to each of the group members.
- c. Activating the computer program product.
- d. Reading signals transmitted within the range of the communication receiving unit.
- e. Identifying each the transmitters by the computer program product,
20 using the unique identifying signals.
- f. Counting of the identified transmitters by the computer program product.
- g. Comparing the number of the identified transmitters with the total number of the transmitters coupled with all of the group members, by the
25 computer program product.
- h. If the number of the identified transmitters is less than the total number of the transmitters coupled with all of the group members, the method proceeds with the following steps:
 - i. By the computer program product, identifying the group
30 members associated with the missing transmitters;

- ii. Display identifying data of the missing group members; and
- iii. Go to step (d).

It is an aspect of the present invention to provide a group-members-counting method for monitoring and counting the members of a pre-arranged group participating in a prolonged event. The method includes the following steps:

- a. Providing a group-members-counting system described here above.
- b. Performing pre-event activity, including the following off-line steps:
 - i. Enlisting the group members.
 - ii. Coupling a transmitter to each of the group members.
- 10 c. Activating the computer program product.
- d. Identifying each the transmitters by the computer program product, using the unique identifying signals.
- e. Identifying the group members associated with said identified transmitters, by the computer program product.
- 15 f. Counting of the identified group members by the computer program product.
- g. Comparing the number of the identified group members with the listed group members as enlisted in said pre-event activity, by the computer program product.
- 20 h. If the number of the identified group members is less than the total number of listed group members, the method proceeds with the following steps:
 - i. Identifying the missing group members by the computer program product.
 - ii. Display identifying data of the missing group members; and
 - 25 iii. Go to step (d).

Optionally, the pre-event activity further includes the off-line steps of:

- iii. Acquiring an image of at least one group member; and

- iv. Associating the acquired image with the at least one group member.

Optionally, the group-members-counting methods described here above further includes the steps of:

- 5 a. Providing a group-members-counting system, including at least one remote server as described here above.
- h. If the number of the identified group members is less than the total number of the listed group members, the method proceeds with the following steps:
 - 10 i. By the computer program product, identifying the missing group members.
 - ii. Display identifying data of the missing group members.
 - iii. Transmitting the identifying data of the missing group members to the first level remote server.
 - 15 iv. Go to step (d).

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become fully understood from the detailed description given herein below and the accompanying drawings, which are given by way of illustration and example only and thus not limitative of the present invention, and wherein:

Fig. 1 is a general schematic block diagram illustration of the components of a group-members-counting system, according to embodiments of the present invention, typically activated when the group members are situated within a preconfigured distance range from a monitoring mobile device.

Fig. 2 schematically shows an example transmittal layout of the tags of a group-members-counting system with respect to master mobile device group-members-counting system, as shown in Fig. 1, having multiple tag devices monitored by a mobile phone using, for example, BT (BLE) technologies including BLE technologies.

Fig. 3 shows a schematic flowchart diagram of a group-members-counting method, according to some embodiments of the present invention.

Fig. 4 depicts a map of an example track, including marked preset gathering points, at which a group-members-counting system is activated for counting the group members.

Fig. 5 shows a schematic flowchart diagram of a remote-group-members-counting method for simultaneously serving multiple groups of members, according to
5 embodiments of the present invention.

Fig. 6 is a general schematic block diagram of a group-members-counting system, according to variations of the present invention, having multiple tag devices monitored by a mobile phone coupled to operate with a transceiver tag using BT (BLE) technologies including BLE technologies.

10 Fig. 7a is a general schematic block diagram of a multi-groups-members-counting system, wherein a master mobile phone that is coupled to operate with a multiplicity of transmitting-only tag using BT BLE technologies, monitors multiple group-members-counting systems, as in Fig 2.

Fig. 7b is a general schematic block diagram of a multi-groups-members-counting
15 system, wherein a master mobile phone that is coupled to operate with a transceiver tag using BT BLE technologies, monitors multiple group-members-counting systems, as in Fig 6.

Fig. 8 is a general schematic block diagram of a group-members-counting system, according to variations of the present invention, having multiple transceiver tag devices,
20 intercommunicating in a mesh network and monitored by a mobile phone using, for example, BT technologies.

Fig. 9 is a general schematic block diagram of multiple group-members-counting systems, as in Fig. 2, Fig. 6. Fig. 7a or Fig. 7b, interconnected via the Internet, according to variations of the present invention, being monitored in real time by a control center.

25

DETAILED DESCRIPTION OF THE INVENTION

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which the preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should
30 not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided, so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

An embodiment is an example or implementation of the inventions. The various appearances of "one embodiment," "an embodiment" or "some embodiments" do not necessarily all refer to the same embodiments. Although various features of the invention may be described in the context of a single embodiment, the features may also be provided separately or in any suitable combination. Conversely, although the invention may be described herein in the context of separate embodiments for clarity, the invention may also be implemented in a single embodiment.

Reference in the specification to "one embodiment", "an embodiment", "some embodiments" or "other embodiments" means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least one embodiment, but not necessarily in all embodiments, of the inventions. It is understood that the phraseology and terminology employed herein is not to be construed as limiting and are for descriptive purposes only.

Methods of the present invention may be implemented by performing or completing manually, automatically, or a combination thereof, selected steps or tasks. The order of performing some methods step may vary. The descriptions, examples, methods and materials presented in the claims and the specification are not to be construed as limiting but rather as illustrative only.

Meanings of technical and scientific terms used herein are to be commonly understood, unless otherwise defined. The present invention can be implemented for testing or practice with methods and materials equivalent or similar to those described herein.

As will be appreciated by one skilled in the art, aspects of the present invention may be embodied as a system, method or computer program product. Accordingly, aspects of the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, etc.) or an embodiment combining software and hardware aspects that may all generally be referred to herein as a "circuit," "module" or "system." Furthermore, aspects of the present invention may take the form of a computer program product embodied in one or more non-transitory computer readable (storage) medium(s) having computer readable program code embodied thereon.

Throughout this document, numerous textual and graphical references are made to trademarks, and domain names. These trademarks and domain names are the property of their respective owners, and are referenced only for explanation purposes herein.

Reference is now made to the drawings. Fig. 1 is a general schematic block diagram illustration of the components of a group-members-counting system **100**, according to embodiments of the present invention. Group-members-counting system **100** includes a master mobile device **110** that includes a processing unit **112**, a member counting application **113**, operable by processing unit **112**, and a data repository unit **114**.

Group-members-counting system **100** may be used by a responsible person **25** that supervises a group of members **20**, each coupled with a unique BLE tag device **150** having a transmitter **160** that transmits a unique identifying signal. Responsible person **25** operates master mobile device **110** configured to operate as a computer-readable medium having computer-executable instructions (i.e. application **113**) stored in the data repository unit **114**. Master mobile device **110** further includes communication receiving unit **116** configured to read the multiplicity of the unique identifying signals transmitted by each of the transmitters **160** that are individually coupled with each of the group members **20**.

Each of the transmitters **160** is configured to be in a direct device-to-device communication flow with communication receiving unit **116**. That is, no external network, such as Wi-Fi, GPRS, etc., or external systems/devices such as satellites and external transceivers, are used to mediate in the communication between a transmitter **160** and communication receiving unit **116**.

Preferably, with no limitations, transmitters **160** are Bluetooth Low Energy (BLE) transmitters, and the invention will be described hereon as using BLE transmitters. However, the present invention is not limited to use BLE transmitters and any other transmitters may be used instead or in addition to the BLE transmitters, including other types of BT transmitters, RF transmitters, and BLE + RF transmitters. Furthermore, GPS may also be used, including with BLE and/or RF and/or other BT.

It should be noted that although a transmitter **160** is part of a BLE tag device **150**, a non-paired communication is established between transmitter **160** and communication receiving unit **116**. That is, when activated, transmitter **160** transmits regardless of a receiving unit **116** being in its transmitting range, as no pairing is established between transmitter **160** and a communication receiving unit **116**. This allows a communication receiving unit **116** to receive signals from an unlimited number of transmitters **160** and is therefore not limited in monitoring just up to 8 BT BLE tag device **150** as are prior art Bluetooth devices.

Reference is also made to Fig. 2, schematically showing an example transmittal layout of the tags **160** of a group-members-counting system **100**, with respect to master mobile device **110**. It should be noted that a group of members **20** may include any number of members **20**, as long as transmitter **160i** of a tag device **150i** is within the
5 range **111** of receiving unit **116** of master mobile device **110**.

When a group of members **20** is assembled, master mobile device **110** is operated to enter in the form of computer-executable instructions to thereby store each group member **20i** coupled with a unique tag device **150i** assigned to that user. Master mobile device **110** being typically, with no limitations, a smart mobile phone, has an image
10 acquisition device integrated therein. Therefore, an image frame reflecting group member **20i**, may be acquired and associated with the record of group member **20i**. Thereby, enabling the responsible person **25** to visually recognize group member **20i**.

Typically, responsible person **25** performs counting of the group members **20** at preset geographical location. Reference is now also made to Fig. 3, showing a schematic
15 flowchart diagram of a group-members-counting method **200**, according to some embodiments of the present invention. Upon activation of member counting application **113**, typically by responsible person **25**, responsible person **25** then initiates (Step **201**) a new group. Group-members-counting method **200** then proceeds as follows:

Step 210: creating a detailed list of the group members.

20 Responsible person **25** creates a new group and enters all the group members **20** to that group via member counting application **113**.

Optionally, a photo of one or more group members **20** is associated with the respective group members **20** record, wherein the photo may be acquired by the camera of the master mobile device **110**.

25 **Step 220:** Coupling each member with a unique transmitting tag.

Responsible person **25** associates a unique transmitter **160**, transmitting a uniquely identifiable signal, with each entered group member **20**, wherein that unique transmitter **160** is coupled to operate, and thereby identify, with group member **20**.

30 **Step 230:** activating monitoring state.

Responsible person **25** switches member counting application **113** into a monitoring state, typically, at a gathering location.

Step 240: counting the tags.

At a gathering location, member counting application **113** counts all signals received from all transmitters **160**, via communication receiving unit **116**, that are within the reception range but are in a non-paired communication flow with receiving unit **116**. Each signal identifies the particular group member **20** associated with the signal source transmitter **160**.

Step 245: checking if a tag is missing.

Member counting application **113** checks if any group member **20** is missing. If no group member **20** is missing, displaying the counting results and, optionally, other pre-selected available data, related to the missing member, and go to step **240**.

Step 250: displaying present/missing report.

Typically, the number of the present and/or missing group members **20** are displayed. Optionally, displaying the counting results and other pre-selected available data, related to both or either present and missing member.

Step 260: identifying any missing member associated with the respective missing tag.

Member counting application **113** identifies any of the missing members associated with each respective missing tag **150**.

Optionally, the photo of each missing group member **20** is also displayed.

Step 270: displaying missing members' info.

Typically, the identified missing group members **20** is displayed as well.

Optionally, the photo of each missing group members **20** is displayed as well.

Step 275: checking if to continue monitoring.

Member counting application **113** checks if responsible persons **25** wants to continue and monitor for missing group members.

If determined that responsible persons **25** wants to terminate the monitoring process, then Exit.

Else, it is determined that responsible persons **25** wants to continue and monitor for missing group members, go to step **245**.

(end of group-members-counting method **200**)

Referring back to Fig. 1, group-members-counting system **100** may further include a first level remote server **120**, according to embodiments of the present invention. Group-members-counting system **100** may further include a second level remote server **130**, a third level remote server and so on N levels remote servers, wherein
5 each such remote server (**120**, **130**, etc.) monitors the servers reporting to it, down to the respective responsible persons **25** and down to the respective group of members **20**.

First level remote server **120** is configured to monitor one or more responsible persons **25**, each of which supervises a group of members **20**. Second level remote server **130** is configured to monitor one or more first level remote servers **120**, each of which is
10 configured to monitor one or more responsible persons **25**, each of which supervises a group of members **20**. Similarly, a third level remote server **130** is configured to monitor one or more second level remote servers **130**, and so on and so forth.

Example

In one example for utilizing group-members-counting system **100**, group
15 members **20** consist of a group of pupils **20e** of a particular first class of a first school that are on a trip outside the school premises. The group of pupils **20e** is led by a responsible person **25**, being for example the first class master **25e**. The group of pupils **20e** is on a trip taking route **90** to Tiberius, as outlined in Fig. 4. The route is subdivided into segments, whereas at the end of each segment a gathering point (**92**, **94**, **96** or **98**) is
20 preset, in which group-members-counting system **100** is activated and the pupils **20e** are counted to verify that all of the pupils are present at each of the gathering points (**92**, **94**, **96** and **98**).

A first level remote server **120** may be set at a control room of the first school, wherein the counting results, as measured at each gathering point (**92**, **94**, **96** and **98**) is
25 transmitted to the control room of the first school. Should more than one class be outside the school premises, such counting results may be transmitted to the control room of the first school by each of the respective responsible persons **25** in parallel and independently.

A second level remote server **130** may be set at a control room of a first
30 educational district that is responsible for the first school, wherein the counting results, as measured at each gathering point (**92**, **94**, **96** and **98**) is transmitted from the control room of the first school to the control room of the first educational district. Similarly, first educational district may monitor all school under its jurisdiction.

Similarly, a third level remote server may be set at a state level, to monitor all educational districts in the state. Similarly, a fourth level remote server may be set at a federal level, to monitor all educational states.

Reference is now made to Fig. 5, showing a schematic flowchart diagram of a remote-group-members-counting method **300** for serving multiple groups of members **20** simultaneously, according to embodiments of the present invention. Each group of members **20** is monitored by its responsible person **25**, as outlined in method **200**. Remote-group-members-counting method **300** then proceeds as follows:

Step 310: transmitting results to a remote server.

Responsible person **25** transmits counting results, at each gathering point, to a first level remote server **120**.

Step 320: analyzing received results from at least one master mobile device.

First level remote server **120** analyzes the results received from each responsible person **25** to see if any of the group members **20** is missing.

Step 330: displaying results in a preconfigured remote display.

First level remote server **120** displays the analysis results in a preconfigured display unit and/or printing form or any other output means.

(end of group-members-counting method **300**)

Reference is also made to Fig. 6, showing a general schematic block diagram of an example group-members-counting system **400**, according to variations of the present invention, having multiple tag devices **160** monitored by master mobile device **110** coupled to operate with a transceiver tag **162** with BT technologies. This takes advantage of the ability of tags to inter-communicate, and thereby substantially broadening the range **111** of receiving unit **116** of master mobile device **110**, as well as reduce dependency on the wide variety of mobile devices in the marketplace, in particular smartphones, phablets and tablets.

Reference is also made to Fig. 7a, showing a general schematic block diagram of a multi-groups-members-counting system **500**, wherein a leading master mobile phone **510a**, that is coupled to operate with a multiplicity of transmitting-only tags **150** using for example BT technologies, such as BT BLE, monitors multiple group-members-

counting systems **100**. Each master mobile phone **110i** of a group-members-counting system **100i**, counts the members of its group that are within its reception range **111**, independently, as does master mobile device **110** of group-members-counting system **100**. Similarly, leading master mobile phone **510** counts the members of its own group.

- 5 Leading master mobile device **510** includes a processing unit **512**, a member counting application **513**, operable by processing unit **512**, a data repository unit **514** and communication receiving unit **516**.

Member counting application **513** is further configured to monitor multiple group-members-counting systems **100**, wherein each master mobile phone **110i** is
10 configured to transmit the members counting results to leading master mobile device **510** via a cellular network **170** and communication receiving unit **516**. Each master mobile phone **110i** can use cellular technologies such as cellular antennas **70** to transmit the counting data to leading master mobile device **510**. Member counting application **513** then analyzes the received counting data to determine if any members of any of the
15 groups is missing.

Each master mobile phone **110i** may also use cellular technologies such as cellular antennas **70** to transmit the counting data to remote receiving entities such as first level remote server **120**, a second level remote server **130** and other servers. When using multi-groups-members-counting system **500**, a remote server may obtain the data
20 from one or more master mobile devices **110**. Optionally, one or more master mobile devices **110** may collect counting data from other master mobile devices **110** over the cellular network. This enables to cover areas that are not fully covered by the local cellular network.

Reference is also made to Fig. 7b, showing a general schematic block diagram of
25 a multi-groups-members-counting system **501**, wherein a leading master mobile phone **510**, that is coupled to operate with a transceiver tag **152** using for example BT technologies, monitors multiple group-members-counting systems **400**. Each master mobile phone **410i** of group-members-counting systems **400i**, counts the members of its group that are within the reception range **511** of transceiver tag **152**, independently, as
30 does master mobile device **110** of group-members-counting system **400**. Similarly, leading master mobile phone **510** counts the members of its own group. Leading master mobile device **510** includes a processing unit **512**, a member counting application **513**,

operable by processing unit **512**, a data repository unit **514** and communication receiving unit **516**.

Member counting application **513** is further configured to monitor multiple group-members-counting systems **400**, wherein each master mobile phone **410i** is configured to transmit the members counting results to leading master mobile device **510** via a cellular network **170** and communication receiving unit **516**. Each master mobile phone **410i** can use cellular technologies such as cellular antennas **70** to transmit the counting data to leading master mobile device **510**. Member counting application **513** then analyzes the received counting data to determine if any members of any of the groups is missing.

Each master mobile phone **410i** may also use cellular technologies such as cellular antennas **70** to transmit the counting data to remote receiving entities such as first level remote server **120**, a second level remote server **130** and other servers. When using multi-groups-members-counting system **500**, a remote server may obtain the data from one or more master mobile devices **110**. Optionally, one or more master mobile devices **110** may collect counting data from other master mobile devices **110** over the cellular network. This enables to cover areas that are not fully covered by the local cellular network.

In variations of the present invention, RF tags are used instead of BT tags.

In variation of the present invention mesh networking is used to broaden the receiving range of master mobile devices **110**. Fig. 8 illustrates a general schematic block diagram of a group-members-counting system **600**, according to variations of the present invention, having multiple transceiver tag devices **162**, intercommunicating in a mesh network and monitored by a mobile phone **110** using, for example, BT technologies.

In another variation of the present invention, Fig. 9 illustrates a general schematic block diagram of a broad remote system **700** composed of multiple group-members-counting systems **100**, as in Fig. 2, interconnected via the Internet network **50**, according to variations of the present invention, being monitored in real time by a control center such as first level remote server **120**, a second level remote server **130** and other servers.

Although the present invention has been described with reference to the preferred embodiment and examples thereof, it will be understood that the invention is not limited

to the details thereof. Various substitutions and modifications have been suggested in the foregoing description, and others will occur to those of ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A group-members-counting system for monitoring and detecting the number of present members of a predefined group of individual members participating in a prolonged event, the system comprising:

- a. a computerized master mobile device, including:
 - i. a communication receiving unit having a preconfigured reception range; and
 - ii. a data repository unit, being a non-transitory computer readable medium; and
 - iii. a computer program product embodied in said data repository unit;
- and
- b. a multiplicity of transmitters,

wherein each said transmitters is coupled with a respective individual member of the group;

wherein each of said transmitters is configured to be in non-paired communication with said computerized master mobile device;

wherein each coupling of said transmitters with said respective individual members of the group is enlisted by said computer program product;

wherein each of said transmitters is configured to transmit a unique identifying signal;

wherein said computer program product operates said communication receiving unit to read each said unique identifying signals, to thereby determine which said transmitters are present within said preconfigured reception range, and thereby determine if and which said transmitters are not present within said preconfigured reception range; and

upon determining that at least one of said transmitters is not present within said preconfigured reception range, providing identifying data of the missing group member associated with said at least one said transmitter that is not present within said preconfigured reception range.

2. The group-members-counting system of claim 1, wherein said computer program product is configured to predefine the group members' identity and said transmitter that is coupled with each said individual member of the group.

3. The group-members-counting system of claim 2, wherein said computer program product is configured to count said transmitters that are activated and present within said preconfigured reception range from said computerized master mobile device.

4. The group-members-counting system of claim 3, wherein said computerized master mobile device further includes a display, and wherein said computer program product is configured to display the counting results on said display.
5. The group-members-counting system of claim 1, wherein at least one of said transmitters is a BT transmitter.
6. The group-members-counting system of claim 5, wherein at least one said BT transmitters is a BLE transmitter.
7. The group-members-counting system of claim 1, wherein said transmitters are RF transmitters.
8. The group-members-counting system of claim 1, wherein said master mobile device further includes an image acquisition device and wherein said computer program product is configured to activate said image acquisition device to thereby acquire an image frame of at least one individual member of the group and add said acquired image frame to the identifying data associated with said individual member of the group.
9. The group-members-counting system of any one of the preceding claims further comprising a transceiver configured to receive said unique identifying signals and transmit said received unique identifying signals to said master mobile device.
10. The group-members-counting system of any one of claims 1-9, wherein said master mobile device, being a leading master mobile device, is configured to communicate over a cellular network with at least one other said master mobile device, and wherein each said other master mobile devices monitors and counts their respective group members individually and transmit the individual identifying data of the missing group member, if any, to said leading master mobile device over the cellular network.
11. The group-members-counting system of any one of claims 1-10, wherein at least one individual identifying data of the missing group member is transmitted to a remote server over the cellular network.
12. The group-members-counting system of any one of claims 1-11, wherein said transmitters are also configured to read incoming signals and are arranged to intercommunicate in a mesh network.

13. The group-members-counting system of any one of claims 1-12 further comprising a first level remote server, wherein said first level remote server is configured to communicate with said master mobile device, and wherein said first level remote server is configured to receive said identifying data of said at least one missing group member from said master mobile device.
14. The group-members-counting system of any one of claims 1-13 further comprising an N level remote server, wherein said N level remote server is configured to communicate with at least one $(N-1)$ level remote server and receive said identifying data of said at least one missing group member from said at least one $(N-1)$ level remote server.
15. A group-members-counting method for monitoring and counting the members of a pre-arranged group participating in a prolonged event, the method comprising the steps of:
- a. providing a group-members-counting system as in any one of claims 1-12;
 - b. in a pre-event activity, the method includes the following off-line steps:
 - i. enlisting the group members; and
 - ii. coupling a said transmitter to each of the group members;
 - c. activating said computer program product;
 - d. reading signals transmitted within the range of said communication receiving unit;
 - e. identifying each said transmitters by said computer program product, using said unique identifying signals;
 - f. counting of said identified transmitters by said computer program product;
 - g. by said computer program product, comparing the number of said identified transmitters with the total number of said transmitters coupled with all of the group members; and
 - h. if the number of said identified transmitters is less than the total number of said transmitters coupled with all of the group members, the method proceeds with the following steps:
 - i. by said computer program product, identifying the group members associated with the missing said transmitters;
 - ii. display identifying data of said missing group members; and
 - iii. go to step (d).

16. A group-members-counting method for monitoring and counting the members of a pre-arranged group participating in a prolonged event, the method comprising the steps of:

- a. providing a group-members-counting system as in any one of claims 1-12;
- b. in a pre-event activity, the method includes the following off-line steps:
 - i. enlisting the group members; and
 - ii. coupling a said transmitter to each of the group members;
- c. activating said computer program product;
- d. identifying each said transmitter by said computer program product, using said unique identifying signals;
- e. by said computer program product, identifying the group members associated with said identified transmitters;
- f. counting of said identified group members by said computer program product;
- g. by said computer program product, comparing the number of said identified group members with the listed group members as enlisted in said pre-event activity; and
- h. if the number of said identified group members is less than the total number of said listed group members, the method proceeds with the following steps:
 - i. by said computer program product, identifying the missing group members;
 - ii. display identifying data of said missing group members; and
 - iii. go to step (d).

17. The group-members-counting method of claim 15, wherein said pre-event activity further includes the off-line steps of:

- iii. acquiring an image of at least one group member; and
- iv. associating said acquired image with said at least one group member.

18. The group-members-counting method of claim 16, wherein said pre-event activity further includes the off-line steps of:

- iii. acquiring an image of at least one group member; and
- iv. associating said acquired image with said at least one group member.

19. The group-members-counting method of claim 15, wherein said pre-event activity further includes the steps of:

- a. providing a group-members-counting system as in claims 13 or 14;
- h. if the number of said identified group members is less than the total number of said listed group members, the method proceeds with the following steps:
 - i. by said computer program product, identifying the missing group members;
 - ii. display identifying data of said missing group members;
 - iii. transmitting said identifying data of said missing group members to said first level remote server; and
 - iv. go to step (d).

20. The group-members-counting method of claim 16, wherein said pre-event activity further includes the steps of:

- a. providing a group-members-counting system as in claims 13 or 14;
- h. if the number of said identified group members is less than the total number of said listed group members, the method proceeds with the following steps:
 - v. by said computer program product, identifying the missing group members;
 - vi. display identifying data of said missing group members;
 - vii. transmitting said identifying data of said missing group members to said first level remote server; and
 - viii. go to step (d).

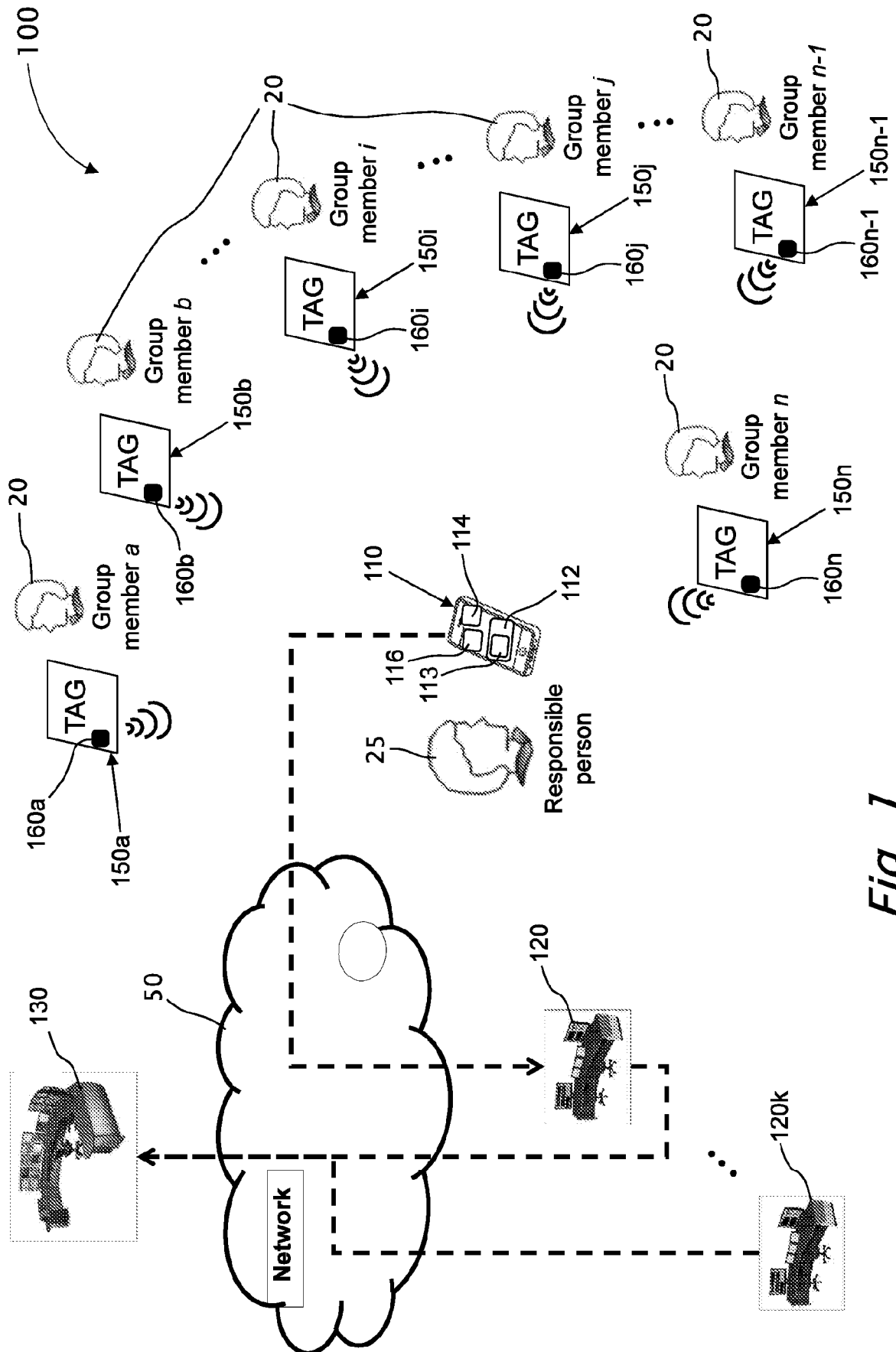


Fig. 1

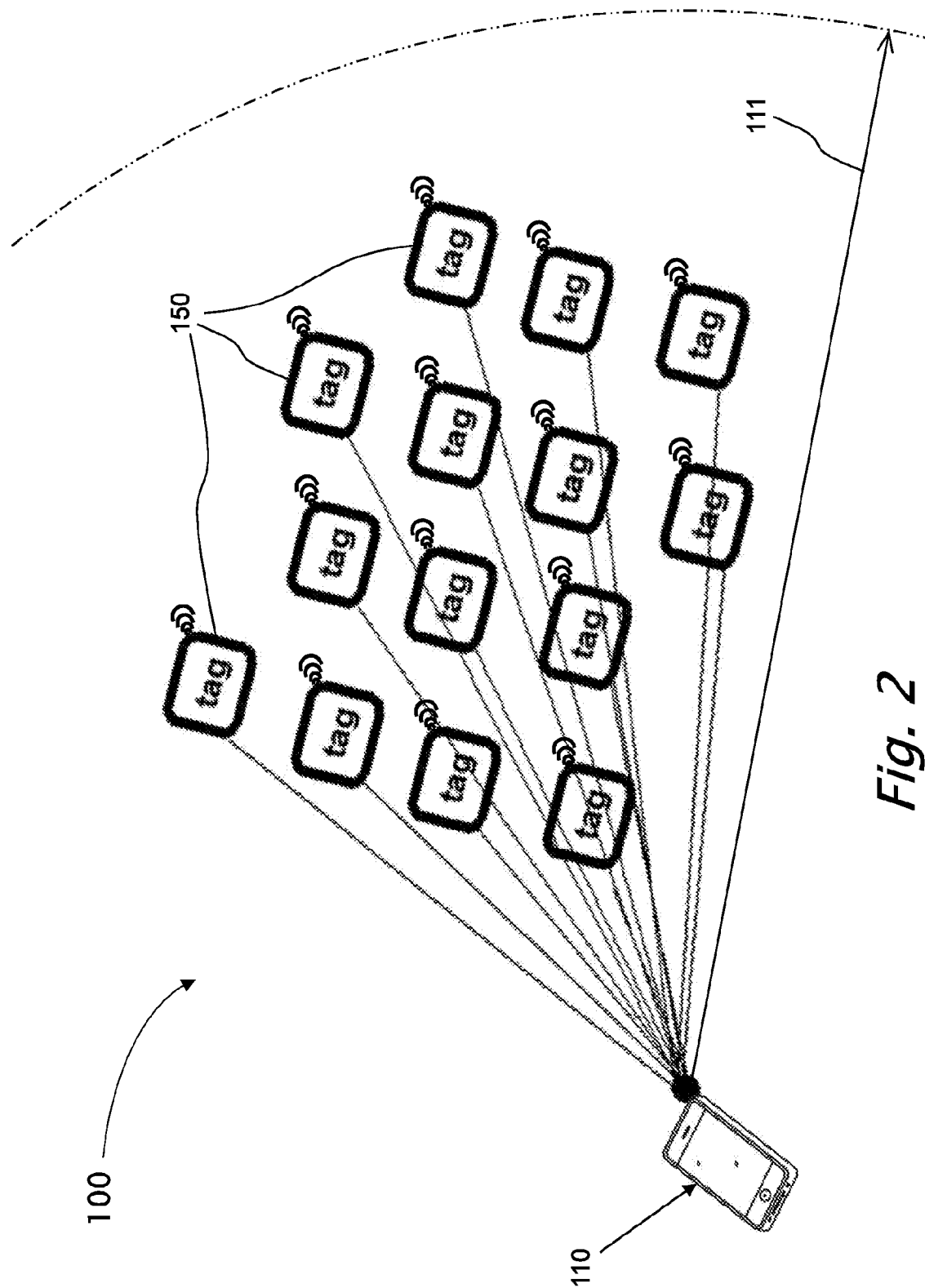


Fig. 2

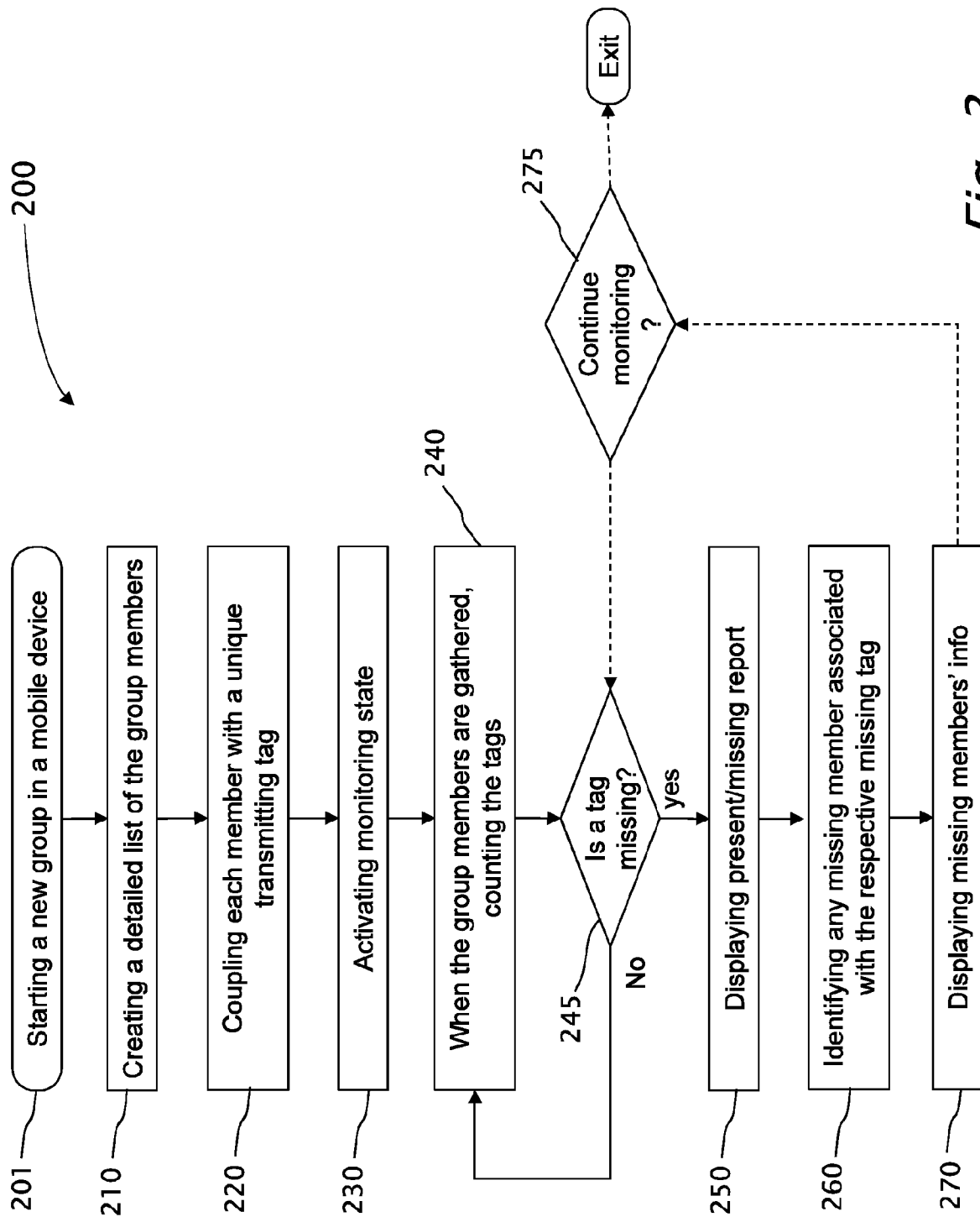


Fig. 3

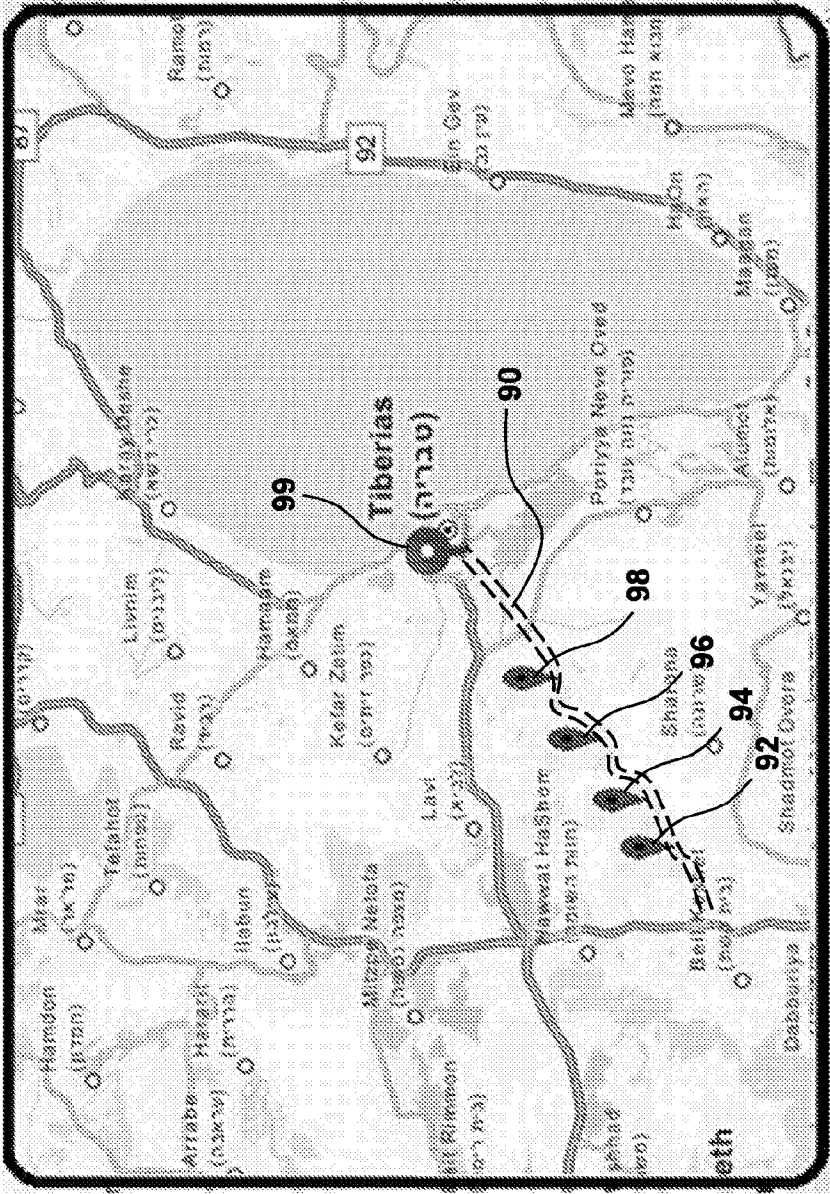
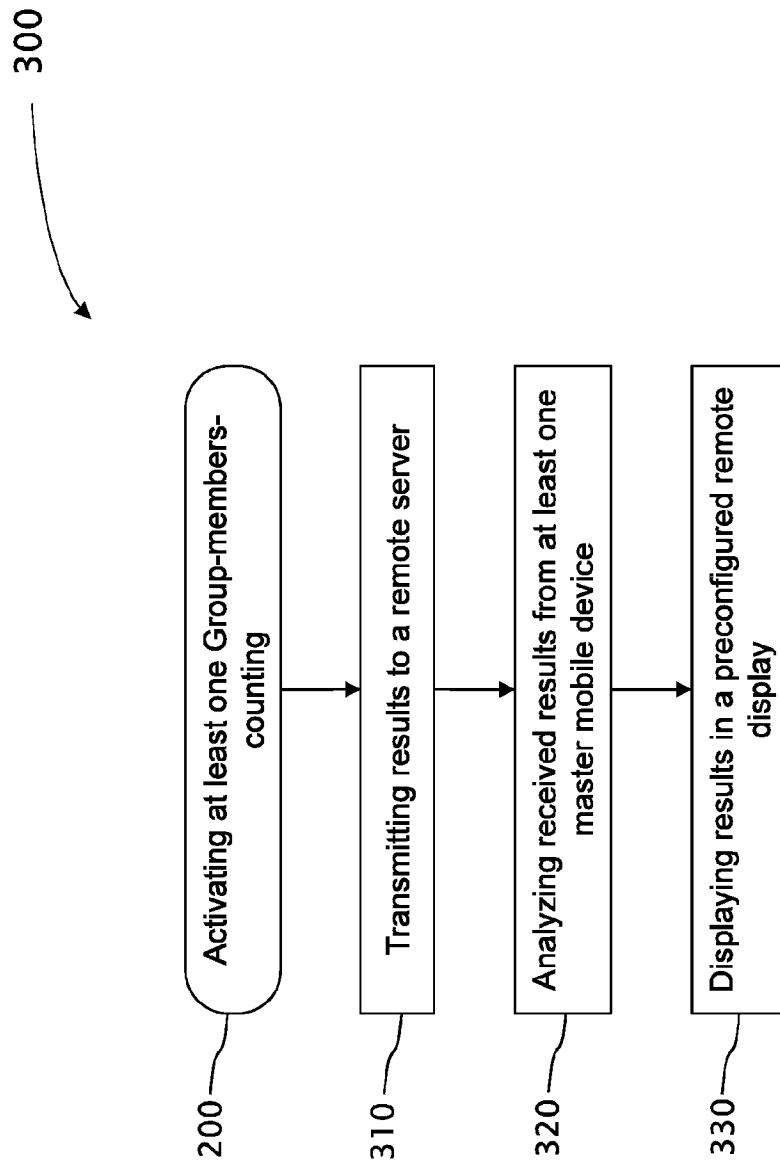


Fig. 4

*Fig. 5*

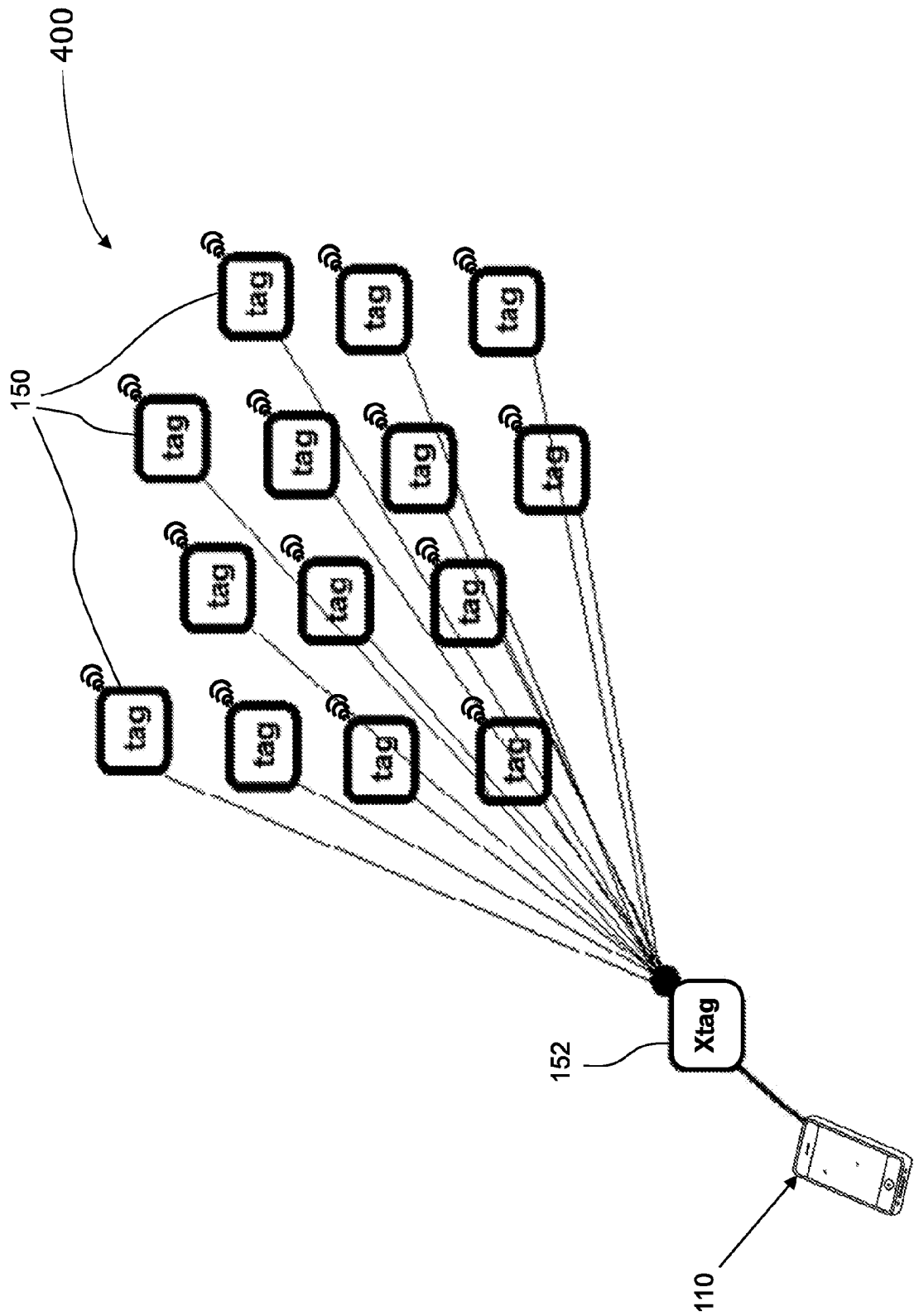
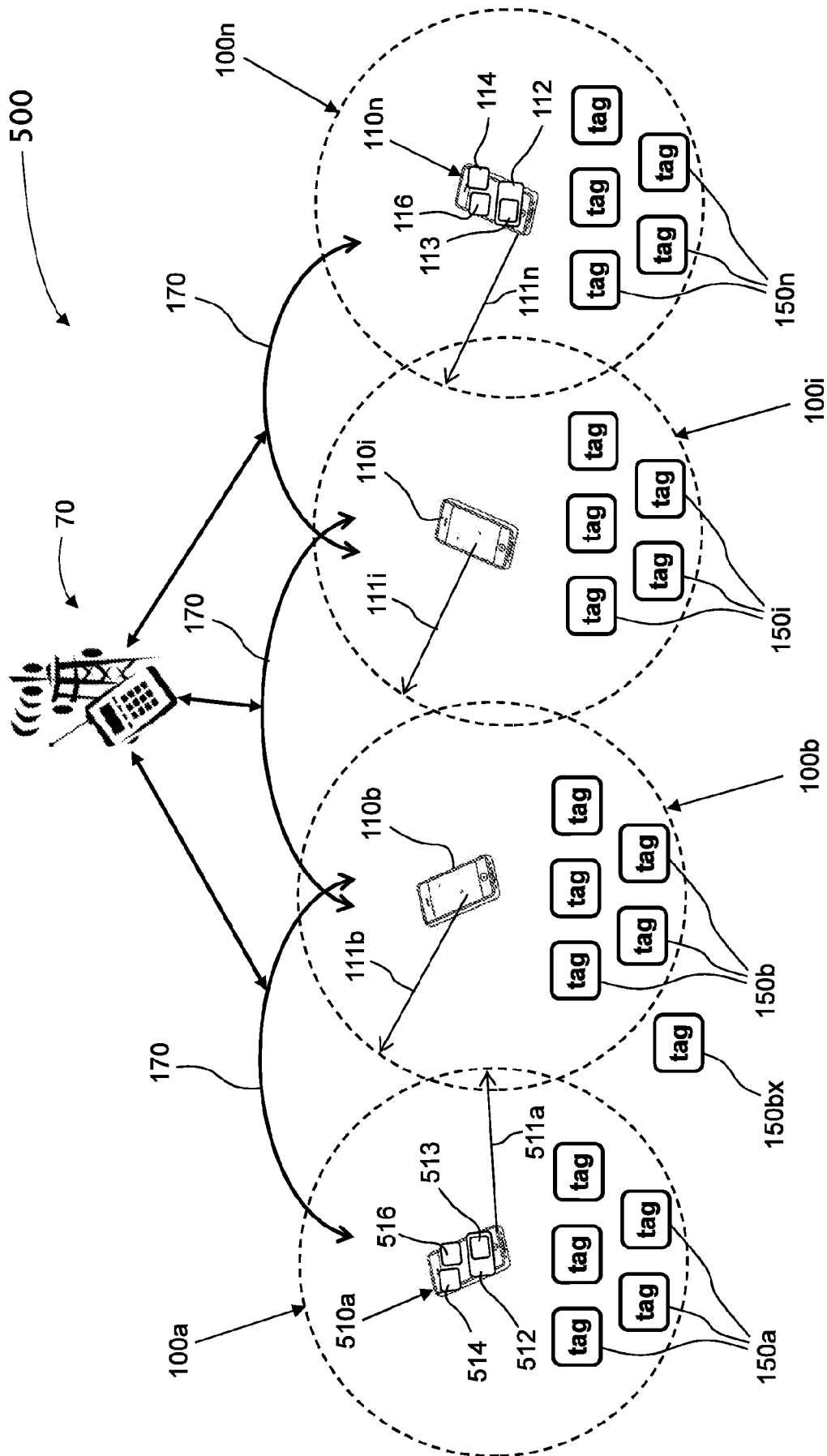


Fig. 6

*Fig. 7a*

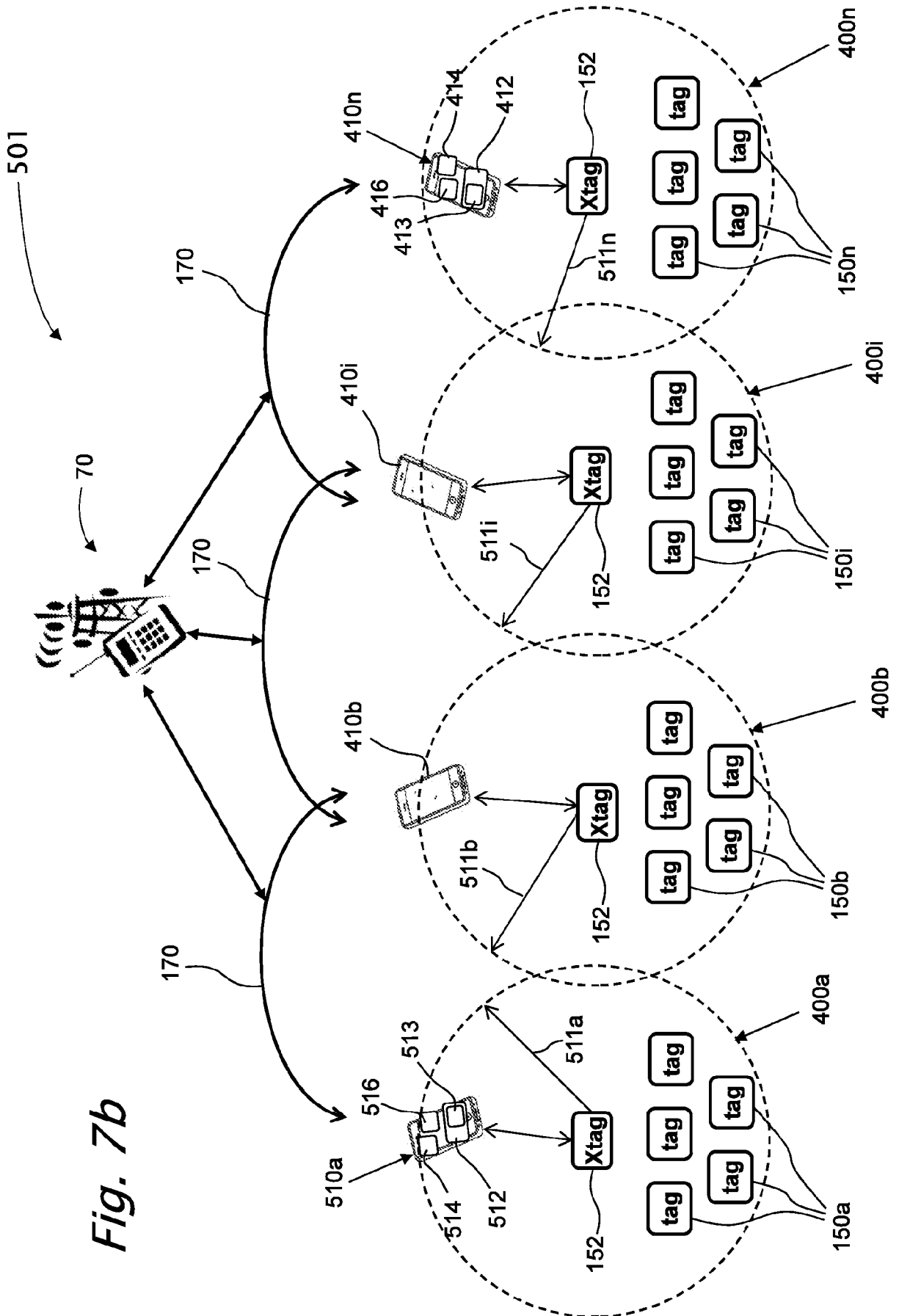


Fig. 7b

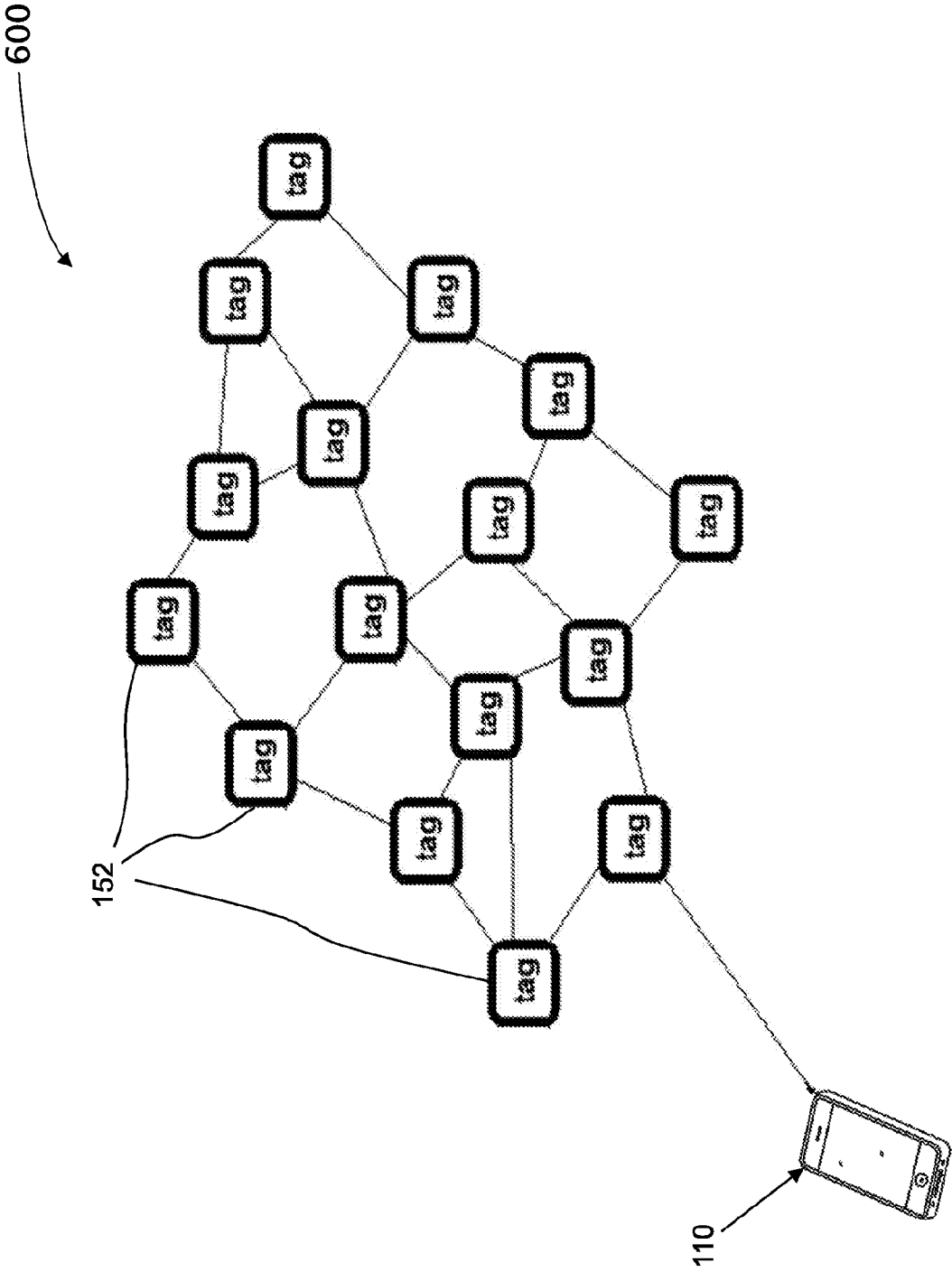


Fig. 8

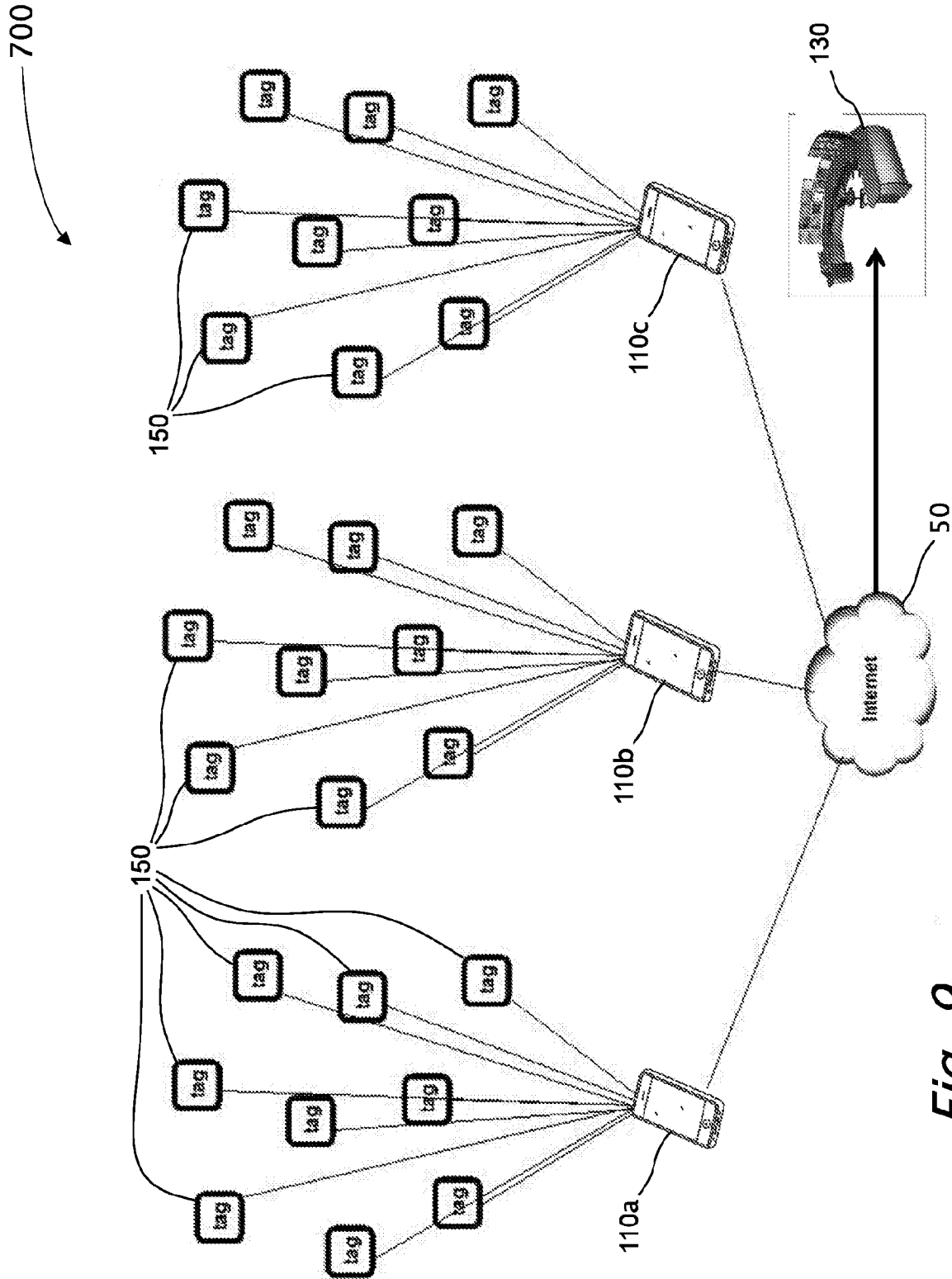


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2016/050871

A. CLASSIFICATION OF SUBJECT MATTER

IPC (2016.01) H04L 12/26, H04L 29/08, H04W 24/04, H04W 64/00

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)

IPC (2016.01) H04L 12/26, H04L 29/08, H04W 24/04, H04W 64/00

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 practicable, search terms used)

Databases consulted: Esp@cenet, Google Patents

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014347973 A1 (YU et al.) 27 Nov 2014 (2014/11/27) Entire document	1-20
A	US 2008146205 A1 (AARON) 19 Jun 2008 (2008/06/19) Entire document	1-20
A	US 2014074747 A1 (GAO et al.) 13 Mar 2014 (2014/03/13) Entire document	1-20
A	US 2014362710 A1 (MUKHERJEE et al.) 11 Dec 2014 (2014/12/11) Entire document	1-20
A	FR 2791452 A1 (COUTELOU et al.) 29 Sep 2000 (2000/09/29) Entire document	1-20

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

07 Nov 2016

Date of mailing of the international search report

14 Nov 2016

Name and mailing address of the ISA:

Israel Patent Office

Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel

Facsimile No. 972-2-5651616

Authorized officer

AKERMAN Albert

Telephone No. 972-2-5651754

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2016/050871

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2005190072 A (AKIMOTO et al.) 14 Jul 2005 (2005/07/14) Entire document	1-20
A	CN 201993782 U (DONGMING et al.) 28 Sep 2011 (2011/09/28) Entire document	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IL2016/050871

Patent document cited search report	Publication date	Patent family member(s)	Publication Date
US 2014347973 A1	27 Nov 2014	US 2014347973 A1	27 Nov 2014
		EP 3005751 A1	13 Apr 2016
		US 2015237477 A1	20 Aug 2015
		WO 2014190279 A1	27 Nov 2014
US 2008146205 A1	19 Jun 2008	US 2008146205 A1	19 Jun 2008
		US 8116748 B2	14 Feb 2012
US 2014074747 A1	13 Mar 2014	US 2014074747 A1	13 Mar 2014
		CN 102903062 A	30 Jan 2013
US 2014362710 A1	11 Dec 2014	US 2014362710 A1	11 Dec 2014
		US 9300555 B2	29 Mar 2016
		US 2014362727 A1	11 Dec 2014
		US 9413621 B2	09 Aug 2016
FR 2791452 A1	29 Sep 2000	FR 2791452 A1	29 Sep 2000
		FR 2791452 B1	18 Jan 2002
JP 2005190072 A	14 Jul 2005	JP 2005190072 A	14 Jul 2005
CN 201993782 U	28 Sep 2011	CN 201993782 U	28 Sep 2011