US007817982B1

(12) **United States Patent**
Chu et al.

(10) **Patent No.: US 7,817,982 B1**
(45) **Date of Patent: Oct. 19, 2010**

(54) **SYSTEM FOR IDENTIFYING NON-IMPACTED AND POTENTIALLY DISASTER IMPACTED PEOPLE AND COMMUNICATING WITH THEM TO GATHER IMPACTED STATUS**

(75) Inventors: **Christopher Chu**, Lakewood, CO (US); **Brijen Doshi**, Thornton, CO (US); **Frederick C. Neff**, Brighton, CO (US); **D. Michael Overmyer**, Golden, CO (US); **Dongliang Wang**, Thornton, CO (US)

(73) Assignee: **Avaya Inc.**, Basking Ridge, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 910 days.

(21) Appl. No.: **11/480,244**

(22) Filed: **Jun. 30, 2006**

(51) **Int. Cl.**
H04M 11/04 (2006.01)

(52) **U.S. Cl.** **455/404.1**; 455/404.2; 455/521; 455/456.1; 455/452.2; 379/45

(58) **Field of Classification Search** ... 455/404.1–404.2, 455/521; 379/45
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,848,193 A * 11/1974 Martin et al. 455/526
5,121,430 A * 6/1992 Ganzer et al. 380/258
5,398,277 A * 3/1995 Martin et al. 379/39
5,596,652 A 1/1997 Piatek et al.
5,793,882 A 8/1998 Piatek et al.
5,910,763 A * 6/1999 Flanagan 340/286.02
6,529,722 B1 * 3/2003 Heinrich et al. 455/404.1
6,574,561 B2 * 6/2003 Alexander et al. 702/5
6,690,932 B1 * 2/2004 Barnier et al. 455/414.1
6,721,553 B2 * 4/2004 Yoshioka 455/404.1
6,721,580 B1 * 4/2004 Moon 455/574
6,745,021 B1 * 6/2004 Stevens 455/404.1
6,761,312 B2 7/2004 Piatek et al.
6,868,340 B2 3/2005 Alexander et al.
6,993,118 B2 * 1/2006 Antonucci et al. 379/45
7,034,747 B1 4/2006 Walters et al.
7,149,533 B2 * 12/2006 Laird et al. 455/456.3
7,184,744 B1 * 2/2007 Schnabel 455/404.2
7,233,781 B2 * 6/2007 Hunter et al. 455/404.1
7,324,804 B2 * 1/2008 Hrastar et al. 455/410
7,343,148 B1 * 3/2008 O'Neil 455/404.2

(Continued)

FOREIGN PATENT DOCUMENTS

EP 00849693 6/1998

(Continued)

OTHER PUBLICATIONS

"Reverse 911. Warn Thousands. Anytime. Anywhere" available at http://www.r911.com, site updated Dec. 11, 2005, 1 page.
"AlertFind™—Emergency Notification & Escalation System" available at http://www.messageone.com/crisis-communications/how-it-works, site updated Jan. 13, 2006, pp. 1-2.

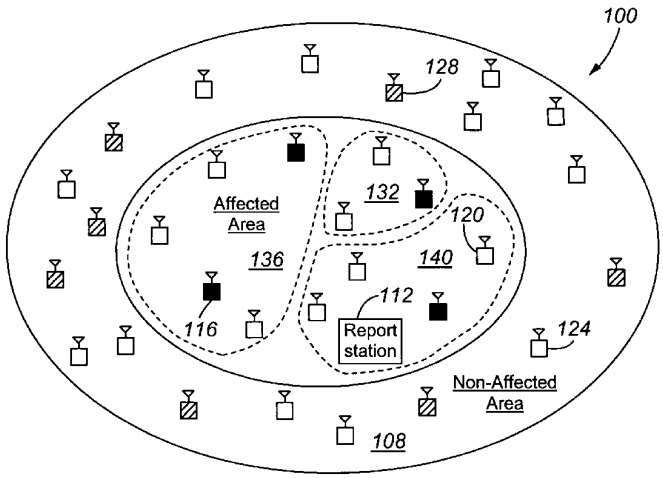
(Continued)

Primary Examiner—Sharad Rampuria
(74) *Attorney, Agent, or Firm*—Sheridan Ross P.C.

(57) **ABSTRACT**

The present invention provides methods and systems for determining the status and/or extent of damage caused by a disaster. More specifically, a disaster status system (DSS) is used to create a backup communication network, in the event that the primary communication network has been damaged, to locate and/or contact users that may be in or around a disaster-affected area.

24 Claims, 5 Drawing Sheets



Meta EX1015
Meta v. SitNet
IPR2026-00100

U.S. PATENT DOCUMENTS

7,412,225	B2 *	8/2008	Islam et al.	455/404.1
7,515,041	B2 *	4/2009	Eisold et al.	340/506
7,515,900	B2 *	4/2009	Van Camp	455/404.2
2002/0077137	A1 *	6/2002	Akhteruzzaman et al.	455/521
2003/0162557	A1	8/2003	Shida	
2004/0029558	A1 *	2/2004	Liu	455/404.2
2004/0102178	A1 *	5/2004	Williams	455/404.1
2005/0003797	A1 *	1/2005	Baldwin	455/404.1
2005/0148317	A1	7/2005	Amano et al.	
2005/0187677	A1 *	8/2005	Walker	701/16
2006/0223494	A1 *	10/2006	Chmaytelli et al.	455/404.2
2007/0202844	A1 *	8/2007	Wilson et al.	455/404.2
2007/0218868	A1 *	9/2007	Schefczik et al.	455/404.1
2007/0298758	A1 *	12/2007	Verma et al.	455/404.1

FOREIGN PATENT DOCUMENTS

WO	9819282	5/1998
WO	2004084532	9/2004

OTHER PUBLICATIONS

"R.E.D. Alert Features" available at http://www.redalertsystem.com/, site updated Dec. 23, 2005, pp. 1-2.

"Communicate better, faster, and more reliably with the 3n mass notification system" available at http://www.3nonline.com, site updated Jan. 5, 2006, pp. 1-2.

"Emergency Alert System—Call Thousands of Households in Minutes", available at http://www.911broadcast.com, site updated Jan. 6, 2006, pp. 1-2.

Ladin "GIS-Enabled Disaster Notification", available at http://www.geointelmag.com/geointelligence/article/articleDetail.jsp?id=211117&&pageID=2, Nov. 1, 2005, pp. 1-2.

"Using the GPS for People Tracking" available at http://www.travelbygps.com/articles/tracking.php, Revised: Jan. 10, 2006, pp. 1-5.

"Hurricane Katrina "I'm OK" Registry" available at http://katrina.im-ok.org, Jan. 10, 2006, pp. 1-3.

"Eyes on Katrina—I'm OK Line" available at http://eyesonkatrina.blogspot.com/2005/08/im-ok-line.html, dated Aug. 30, 2005, pp. 1-21.

* cited by examiner

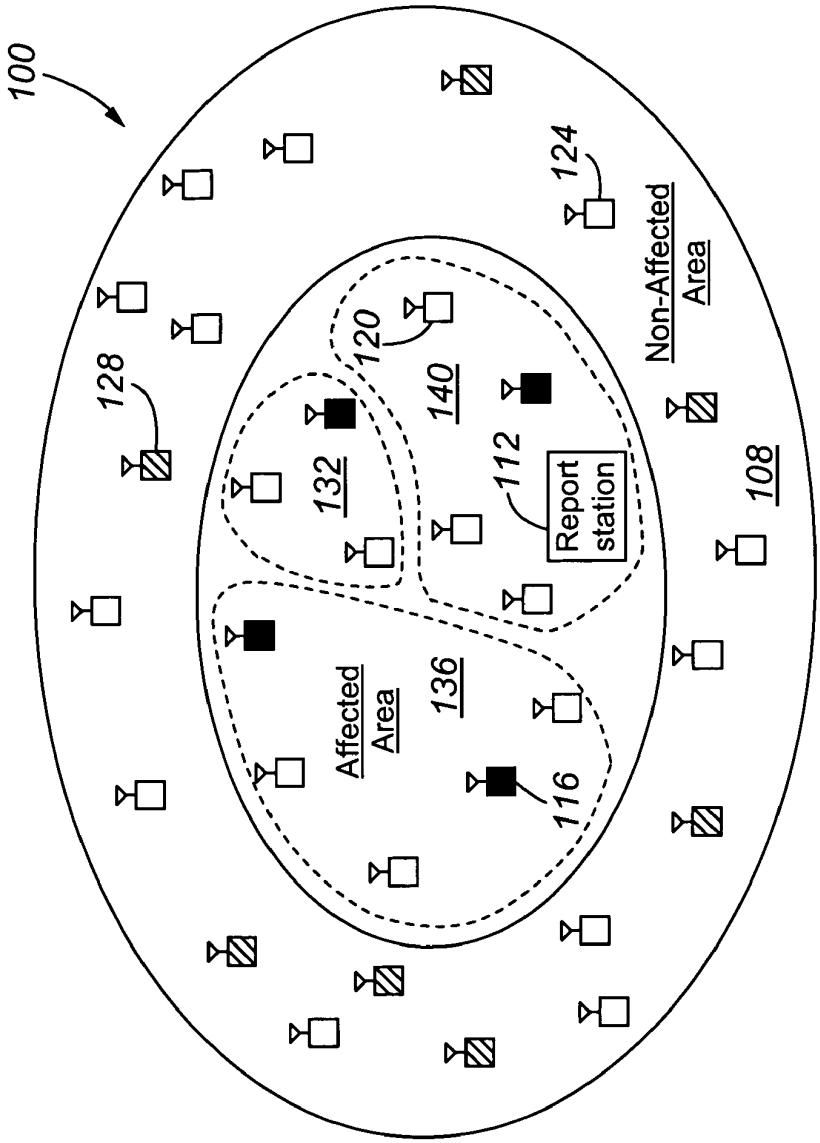

100
128
132
120
140
112
Report station
124
Non-Affected Area
108
Affected Area
136
116

Fig. 1

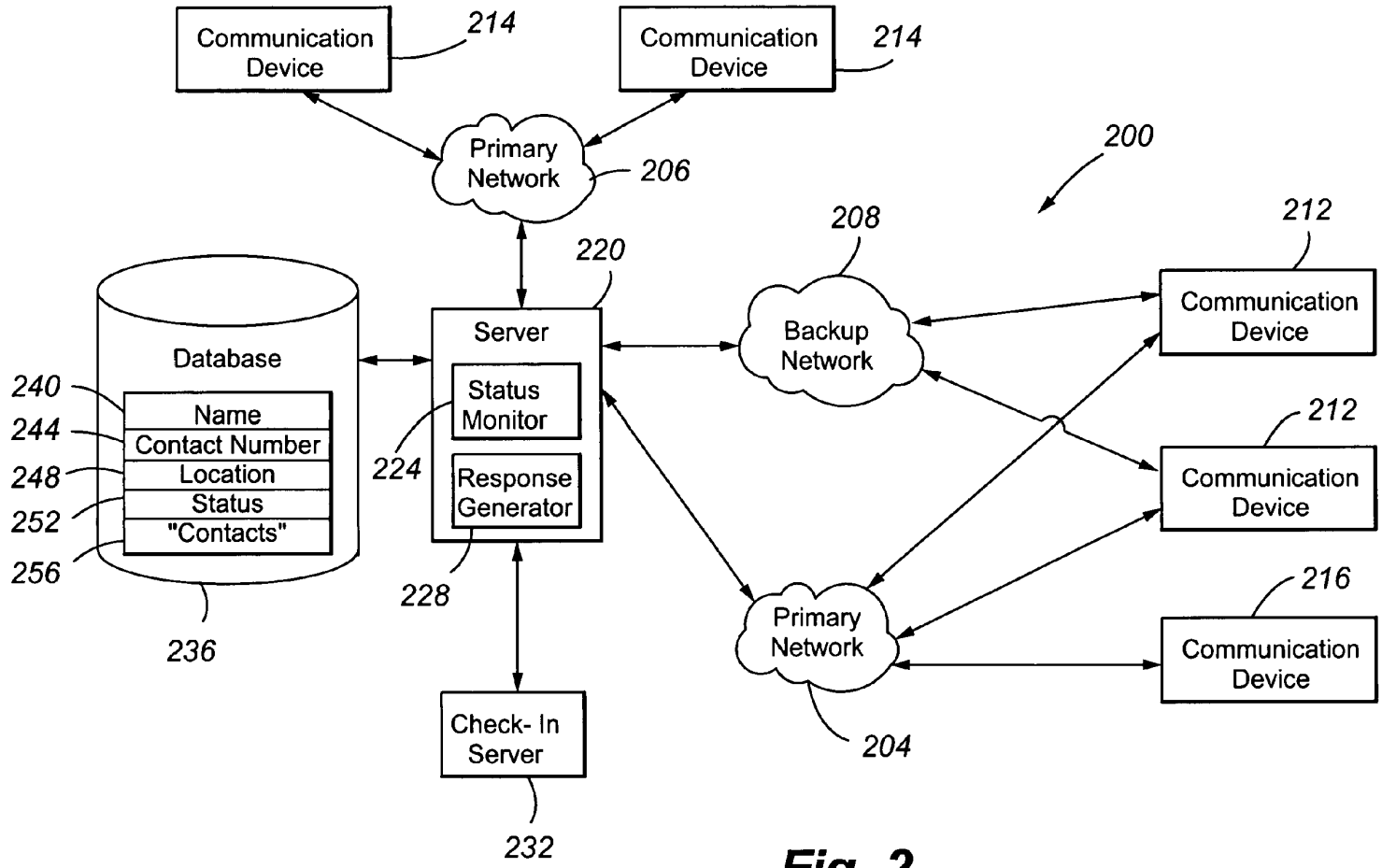

Communication Device
214
Communication Device
214
Primary Network
206
200
208
212
220
Backup Network
Communication Device
Database
Server
Status Monitor
Response Generator
240
Name
244
Contact Number
248
Location
252
Status
256
"Contacts"
224
228
236
212
Communication Device
216
Primary Network
Communication Device
204
Check- In Server
232

Fig. 2

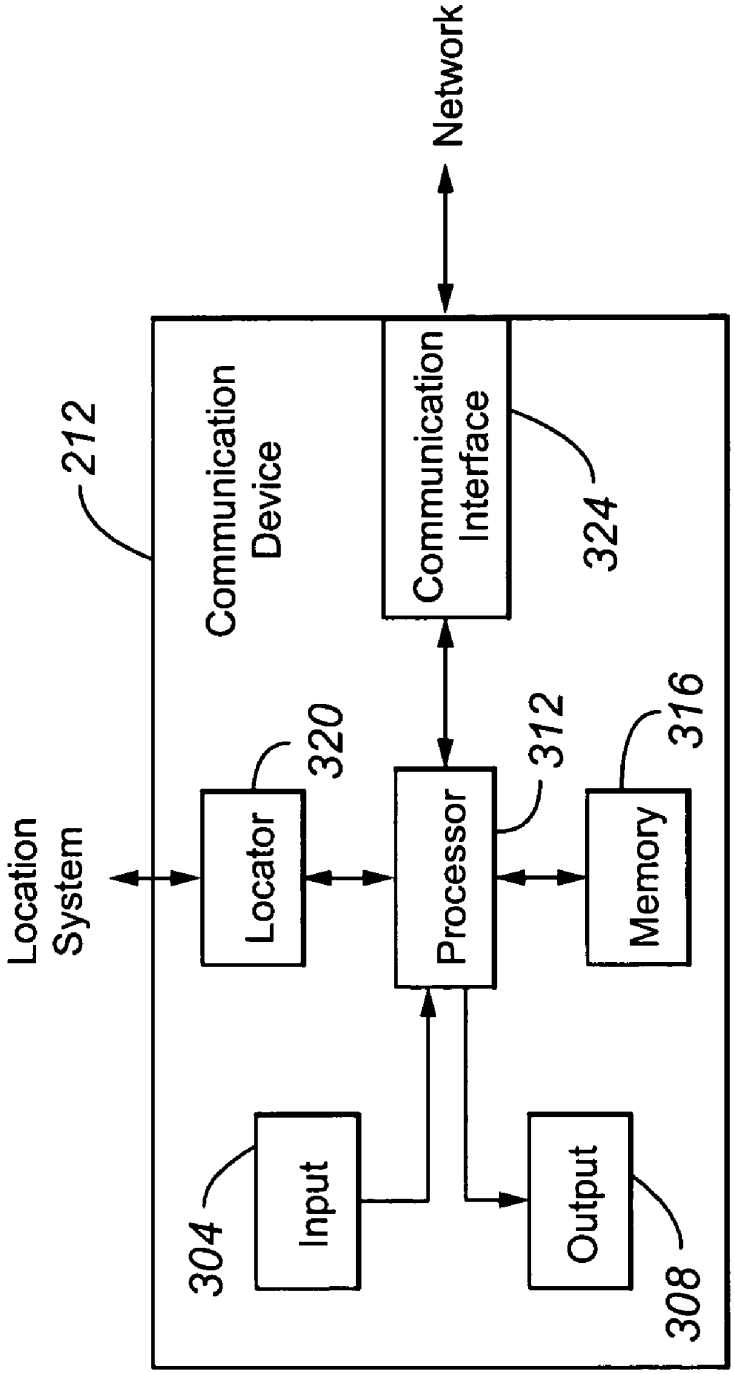

Location System
Network
212
Communication Device
Communication Interface
324
Locator
320
Processor
312
Memory
316
Input
304
Output
308

Fig. 3

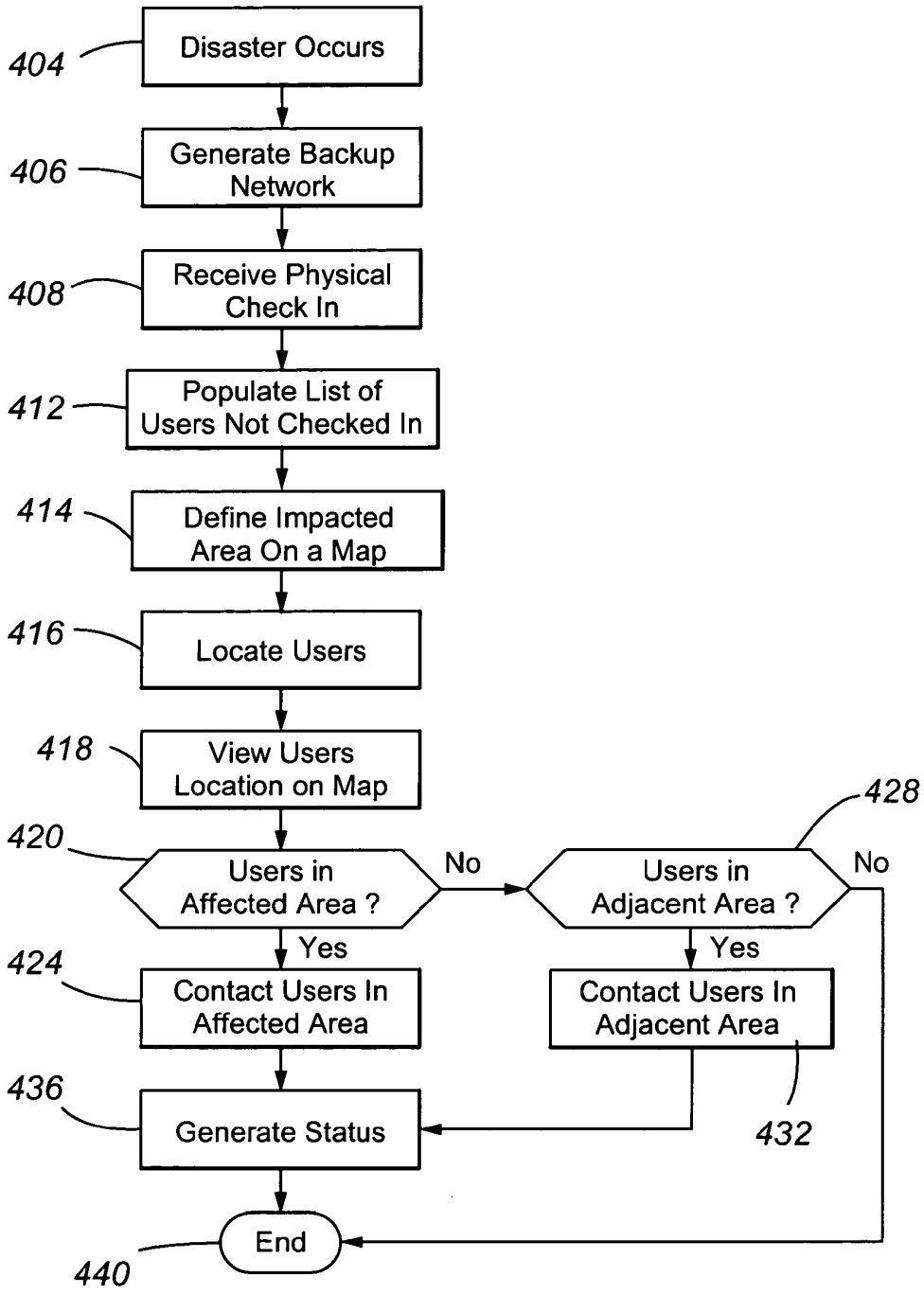

404
Disaster Occurs
406
Generate Backup Network
408
Receive Physical Check In
412
Populate List of Users Not Checked In
414
Define Impacted Area On a Map
416
Locate Users
418
View Users Location on Map
420
Users in Affected Area ?
No
428
Users in Adjacent Area ?
No
Yes
Yes
424
Contact Users In Affected Area
Contact Users In Adjacent Area
432
436
Generate Status
End
440

Fig. 4

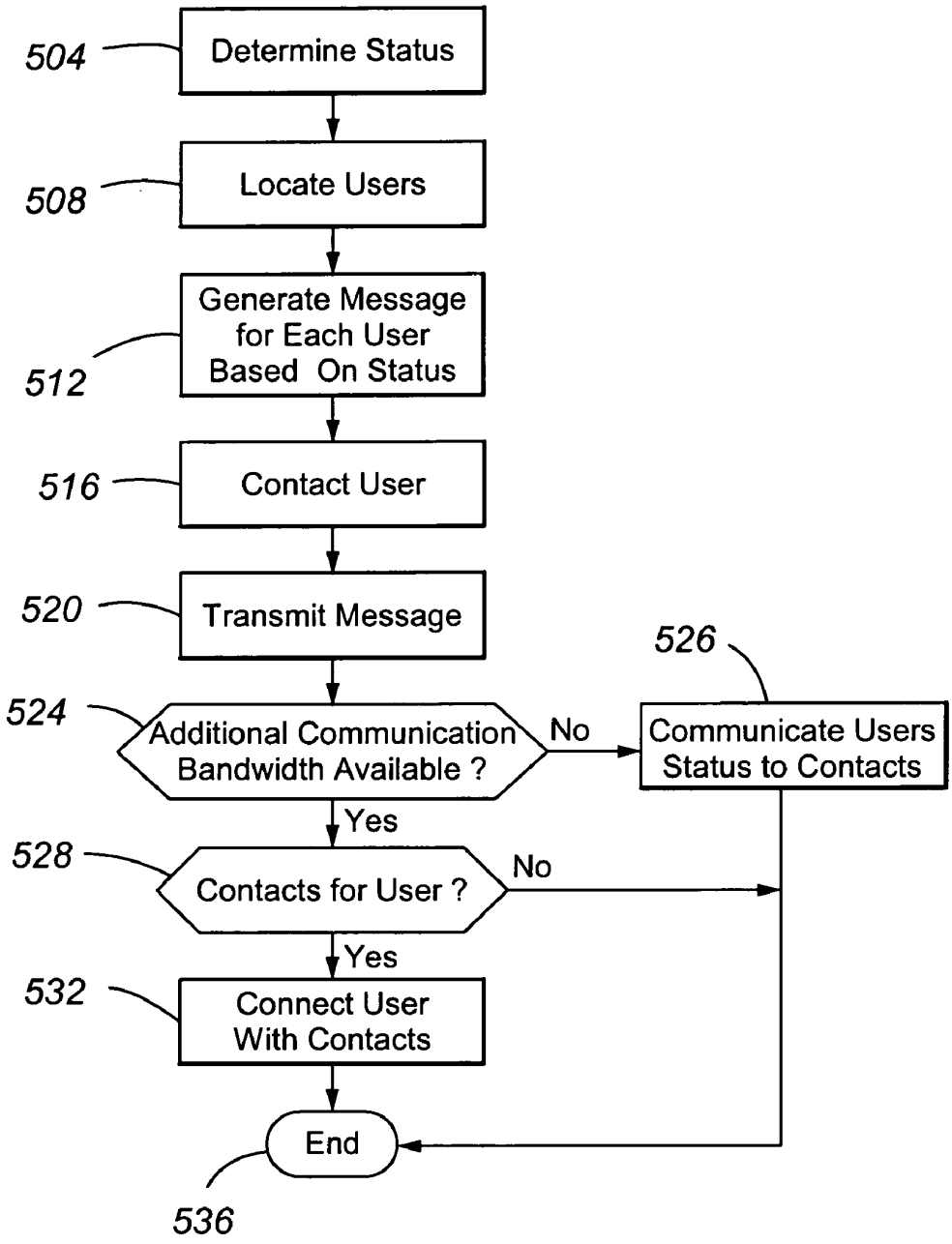

504
Determine Status
508
Locate Users
512
Generate Message for Each User Based On Status
516
Contact User
520
Transmit Message
524
Additional Communication Bandwidth Available ?
No
526
Communicate Users Status to Contacts
Yes
528
Contacts for User ?
No
Yes
532
Connect User With Contacts
End
536

Fig. 5

SYSTEM FOR IDENTIFYING NON-IMPACTED AND POTENTIALLY DISASTER IMPACTED PEOPLE AND COMMUNICATING WITH THEM TO GATHER IMPACTED STATUS

FIELD OF THE INVENTION

The invention relates generally to communication systems. More particularly, the invention relates to disaster status determination methods and systems.

BACKGROUND

In emergency management, as in other time sensitive activities, timely and accurate information is vital for use in allocating resources as well as achieving other emergency management priorities such as field assessment and analysis. Clearly, in the hours immediately following a disaster there is an urgent need for accurate information to manage the relief effort. As used herein, a disaster includes natural disasters such as hurricanes, fires, earthquakes or famine or man-made disasters such as war or terrorism. When such disasters occur, the scope of the damage is generally geographically dispersed and may affect vast numbers of people and extensive damage to infrastructure. However, some disasters may be localized to smaller areas or structures. In the time period immediately following the disaster, local resources such as police, fire protection and heath care are often inadequate to respond to all of the problems related to the disaster, especially when the extent of damage is widely dispersed. Often, outside resources are required to supplement local resources and, since the disaster may be geographically widespread, it is often difficult to determine how best to allocate these outside resources. Moreover, the status of potential victims within the disaster-affected area is difficult to determine.

When a disaster occurs, it is common practice to establish an Emergency Management Center (EMC) in the area hit by the disaster to collect information regarding the damage and manage the allocation of outside resources. When the disaster is widespread, such as occurs after a hurricane or earthquake, several EMCs are established throughout the region so coordinating the aid requests and efficiently allocating resources becomes a major and complicated task. These EMCs must communicate with established EMCs operated by local, state and federal agencies tasked to deal with such disasters. In addition to the EMC, individuals affected by the disaster may need to acquire information regarding their relatives or personal possessions such as a house or boat located in the disaster area.

Often, however, any information that arrives at the EMC is anecdotal, resulting in improper allocation of scarce resources. Indeed, after a major disaster a period of days may pass before a clear picture of the extent and level of damage begins to form at the EMC. In the meantime, crucial decisions on resource allocation are made with only limited information. During the time period immediately following the disaster, individuals may clog the telephone network and harass officials at the EMC and elsewhere for information relating to their personal concerns. There is a great need to determine and provide timely and accurate information to individuals in an automatic manner so that EMC officials are free to concentrate on coordinating disaster relief.

Unfortunately, the EMC that often sends in the first resource requests is the area least affected by disaster while EMCs located in geographical areas with heavy damage are typically overwhelmed and slow to assess the damage, as the

emergency response personnel are occupied responding to immediate lifesaving tasks. Many times EMCs in heavily damaged areas are simply unable to determine what resources are required. Often the damage to the infrastructure, such as by way of example, highways, power transmission grids, communication lines, water supply, condition of medical facilities, public buildings, etc., is so heavily damaged that it is difficult to even establish communication between EMCs to request assistance. Without accurate and timely information, there is a high risk of improperly allocating scarce resources.

When a large hurricane makes landfall, by way of illustrative example, up to forty-eight hours may pass before areas hard hit by the storm are able to re-establish communications. During this period there may be little accurate information available to the EMC as to the extent of the damage, or the exact resources that are required. Because of this information void at the central EMC during the period immediately following the disaster, it is difficult to provide adequate resources in a timely manner. To overcome the information void, Federal Emergency Management Association (FEMA) agents use portable information and communication devices, such as the GSC100 manufactured by Magellan, Inc., to relay information from established emergency locations to the EMC. This vital information, sent via a satellite communication system, includes the functional status of hospitals, the extent of property damage, the state of communications networks, and the condition of other infrastructure in the area affected by the disaster. Thus, the remote emergency centers are able to immediately begin collecting damage information through observation. The agents are able to observe downed bridges, blocked roads, destroyed buildings and numerous other items vital to accurate field assessment and analysis.

A problem with relying on FEMA agents to provide status information is that they must first be placed in the disaster-affected area before they can begin reporting the extent of the damage caused by the disaster. The delays in receiving reports of status may be serious, especially when decisions regarding the allocation of scarce resources must be made almost immediately after the disaster strikes. It would be much quicker and more efficient to contact someone who was in the area when the disaster occurred and is still in the area. Unfortunately, because primary communication networks may be either incapacitated by the disaster or jammed due to increased usage, contacting someone within a disaster-affected area is not an easy task.

SUMMARY

These and other needs are addressed by various embodiments and configurations of the present invention. The present invention is directed generally to a system for determining the status of an area after a disaster has occurred. More specifically, backup communication networks may be generated and employed to contact users within a disaster-affected area.

In accordance with one embodiment of the present invention, a method is provided for responding to a disaster. The method comprises the steps of:

(a) identifying an area affected by a disaster;

(b) generating a backup communication network for at least a portion of the affected area in response to the disaster;

(c) locating locally impacted users that are in and/or adjacent to the affected area; and

(d) attempting to contact the located impacted users via the backup communication network to gather status information.

Users that are contacted via the backup communication network may include public officials that have been given a communication device that is capable of communicating via the backup network, subscribers that have a similar communication device, or non-subscribers that are still reachable via the backup communication network.

The normal/primary network generally provides 2-way voice communication between endpoints in the system. In accordance with one embodiment, the backup network serves a second function of providing the ability to see where the user's device is from a central location. Another function of the backup network is that is provides communication capabilities between the impacted user and the central location. When the backup network is operational, it is mainly used for the location and communication purposes. To simplify the recovery effort, impacted users are generally not allowed to call out to other people or the central system via the backup network. Rather, their communication device must be spotted and can be called by the central system. In a non-disaster situation, a user would not need the location and communication functions of the backup network.

Likewise, in the disaster-impacted areas, if the primary voice network is still operational, then there may be no need to enable impacted people the ability to call someone else or the central system via the back up network because the call volume cannot be fairly estimated with a great amount of accuracy.

In accordance with one embodiment, having the ability to spot devices in an impacted area includes additional functions. One function is the ability to use GPS to determine device location information on earth and by way of radio signals, transmit the location information to be displayed within viewable disaster impacted areas at the central system. If the land-element of the GPS network is corrupted, portables must be brought in to reestablish part of this network. On the other hand, the 2-way radio network for transmitting location information to the central system can be built dynamically in response to the disaster.

In one embodiment, the radio network can also be used to establish 1-way communications between the user's device and the central system. Once a connection is established, the owner of the device can respond to various prompts received from the central system. Thus, in addition to the normal voice communication functionality, the user's device may have a GPS function to locate itself and 2-way radio functions to allow it to (i) transmit the location information to be displayed within GPS perspective and (ii) allow it to be called or otherwise communicate with the central system. In one embodiment, the backup communication network is generated to provide communication capabilities with the communication devices that may be in the affected area. After a disaster has occurred, the communication devices are likely incapable of communicating via the primary communication network because some or all of the communication network has been destroyed or otherwise damaged. The backup communication network may have been placed around potential areas that have a high likelihood of being struck by a disaster (e.g., gulf coast cities that may be struck by hurricanes, mid-west cities that may be struck by tornadoes, west-coast cities that may be struck by earthquakes, or high profile buildings and cities that may be struck by terrorist activities). The backup communication network may be placed or otherwise deployed such that it will not be incapacitated by a disaster that may threaten the primary network. For example, if the primary communication network is mainly above ground, then the backup communication network may be deployed underground or vice versa. In general, the backup communication network provides communication and locator abilities for the affected area; the central system subsequently connects the impacted and non-impacted areas by collecting status information of people in the impacted area via the backup network and providing this information to others in the non-impacted area via the primary network.

In accordance with an alternative embodiment, the backup communication network is generated in response to the occurrence of a disaster. For example, radio signal transceivers that are generally employed on the ground may be adapted for mobilization. In other words, a radio signal transceiver, similar to transceivers used in connection with cellular phone towers or the like, may be deployed on a truck, helicopter, or other type of movable object. The mobile radio signal transceiver can then be used to communicate with users in and around an area where the primary communication network has failed.

The backup communication system, in accordance with one embodiment, is used to contact users that were in an area when the disaster occurred. The users are contacted for several reasons. A first reason for contacting a user is to determine if they are okay or to determine what type of assistance they require (i.e., medical, search and rescue, or the like). A second reason is to ask the user about the status of the affected area surround him/her. The status information collected from one or many users can be employed by an EMC to generate a more accurate picture of the disaster-affected area soon after a disaster has occurred.

In addition, the communication from the central system to different sets of impacted users can be designed differently based on anticipated level of crisis the users may be going through. For example, users who are surrounded by water should be talked to differently from those who are clearly on land but do not have ability to call out or may be trapped under building collapses. Multiple automated sample dialogs from the central system to impacted users can go out at the same time and the responses can be heard and addressed by different recovery teams also at the same time. Most systems that employ disaster response technologies today only allow one dialog to be run at a time but not simultaneously to multiple lists of users as described. It should be noted that a user's location can become well-known once the backup network becomes operational and thus effort can be focused on other important aspects of emergency response like calming down users, generating response teams, and scheduling pickups of users.

In accordance with one embodiment of the present invention, some users within an affected area may be able to check-in and report their status with a predetermined location. These users that have already checked-in do not require another contact confirming their safety and asking for a description of the status of the affected area. The users that have not yet checked-in are those who should be contacted as a confirmation of safety. Thus, in accordance with at least one embodiment of the present invention, only users that have not checked-in are contacted via the backup network. This minimizes the number of people that need to be contacted and thus reduces the amount of network resources required to generate a status of the affected area. With backup communication resources mainly being employed for contacting users that have not checked-in, users who may be in trouble can be contacted more quickly, which may ultimately result in saving a life.

As used herein "area" is understood to mean any area or volume of space. More specifically, an affected area may include an area of land, a building, a floor within a building,

a room within a building, a vehicle, or other type of structure that may be adversely affected by a disaster.

These and other advantages will be apparent from the disclosure of the invention(s) contained herein. The above-described embodiments and configurations are neither complete nor exhaustive. As will be appreciated, other embodiments of the invention are possible utilizing, alone or in combination, one or more of the features set forth above or described in detail below.

As used herein, "at least one", "one or more", and "and/or" are open-ended expressions that are both conjunctive and disjunctive in operation. For example, each of the expressions "at least one of A, B and C", "at least one of A, B, or C", "one or more of A, B, and C", "one or more of A, B, or C" and "A, B, and/or C" means A alone, B alone, C alone, A and B together, A and C together, B and C together, or A, B and C together.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram depicting an affected area in accordance with embodiments of the present invention;

FIG. **2** is a block diagram depicting a communication system in accordance with embodiments of the present invention;

FIG. **3** is a block diagram depicting a communication device in accordance with embodiments of the present invention;

FIG. **4** is a flow chart illustrating a method for gathering information about a disaster-affected area in accordance with embodiments of the present invention; and

FIG. **5** is a flow chart illustrating a method of communicating with users in or around a disaster-affected area in accordance with embodiments of the present invention.

DETAILED DESCRIPTION

The invention will be illustrated below in conjunction with an exemplary communication system. Although well suited for use with, e.g., a system using a server(s) and/or data base(s), the invention is not limited to use with any particular type of communication system or configuration of system elements. Those skilled in the art will recognize that the disclosed techniques may be used in any communication application in which it is desirable to quickly and accurately generate status information as it relates to a disaster-affected area.

FIG. **1** illustrates a location **100** comprising an affected area **104** and an area adjacent to the affected area or a non-affected area **108** in accordance with at least some embodiments of the present invention. The affected area **104** may be divided into a number of different regions **132**, **136**, and **140**, for example. Each region **132**, **136**, and **140** of the affected area **104** may have a different aspect from other regions. During the generation of messages to users in the affected area **104**, messages may be customized for a particular region. In an alternative embodiment, messages may be customized for a particular user and his/her situation.

The location **100**, in one embodiment, further comprises a report station **112** where people from the affected area **104** and/or the adjacent area may go to report their status. People may physically travel to the report station **112** or communicate their status to the report station **112** by some other mechanism (i.e., by word of mouth, on-line, by phone, or the like). Since people can voluntarily check-in at the report station **112**, some users within the affected area **104** and/or the adjacent area may report their status before the system attempts to contact them. Users that have already checked-in at the report station are depicted as users **116**, whereas users that have not yet checked-in are depicted as users **120**. Users within the non-affected area **108** are depicted as users **124** and/or **128**. The users **124** may also be relatives or contacts of subscribing members in the affected area. The users **128** are individuals who are not contacts of people within the affected area **104**. Generally speaking, subscribing members in the affected area **104** can be regarded as locally impacted users. The locally impacted users are individuals who were and still are in the affected area **104** and can either report a status of the affected area **104** or who need assistance.

Each subscribing locally-impacted user is equipped with a communication device that allows them to communicate via a backup communication network. Additionally, the location of each user can be identified through various mechanisms. For example, a user's communication device may be equipped with a Global Positioning System (GPS) receiver. The user's communication device may be located through known satellite triangulation techniques to within a few feet. Alternatively, the activity of a user's communication device may be detected by a cellular phone tower that is still working or by a backup transceiver that has been brought to the affected area **104**. When a communication device is detected by one of these devices, the location of a user can be determined within a certain amount of granularity. Currently, cellular phone providers are required by the FCC to be able to identify the location of a cellular phone within 328 feet and most cellular phones can be located with a higher level of accuracy (i.e., within tens of feet). The location of a user is determined to create a priority list of users to contact. Users **120** that have been located in the affected area **104** and have not yet checked-in should be contacted before users in the non-affected area **108**. Moreover, users who are known to be located in more treacherous or life threatening locations should be contacted before users who are known to be in safer locations, whether both users are in the affected area **104** or not.

In accordance with at least one embodiment, users in both the affected area **104** and adjacent area **108** are contacted to determine a status of the area. The status of the area is important to know so that decisions regarding the deployment of resources can be made for effectively and efficiently. Since users who were in the affected area **104** when the disaster occurred can be contacted, rather than sending people in to the affected area **104**, status information can be obtained more quickly, resulting in quicker and possibly better decisions.

Referring now to FIG. **2**, a communication system **200** will be described in accordance with at least some embodiments of the present invention. The communication system **200** generally comprises a primary communication network **204** and **206**, a backup communication network **208**, one or more communication devices **212**, **214**, and **216**, a server **220** comprising a status monitor **224** and a response generator **228**, a check-in server **232**, and a database **236** operable to store information related to users of the communication system **200**.

The primary network **204** and **206** may be any type of suitable communications network that is operable to transmit data from one communication endpoint to another endpoint, where typical endpoints include the communication devices **108**, the server **220**, and the like. Examples of suitable types of primary communication networks **204** include, but are not limited to, a standard Plain Old Telephone System (POTS), an Integrated Services Digital Network (ISDN), a Public Switched Telephone Network (PSTN), a Local Area Network

(LAN), a Wide Area Network (WAN) like the Internet, a wireless network like a cellular network, and any other type of packet-switched or circuit-switched network known in the art.

The primary network **204** is a portion of the primary communication network that is affected or otherwise rendered temporarily useless by a disaster. When the primary network **204** is affected by a disaster, the non-subscribers using communication device **216** are not able to communicate with other users connected to the functioning portion of the primary network **206**. Users that are able to communicate via the functioning primary network **206** with communication devices **214** are generally those users who are in the adjacent (i.e., the non-affected) area **108**.

The backup communication network **208** may be a suitable communication network that employs wireless-based communications. Any suitable generation (e.g., 1G, 2G, 2.5G, 3G, 4G, etc.) of wireless technology may be employed to generate a backup communication network **208**. For example, the backup communication network **208** may include, without limitation, Global System for Mobile (GSM) technologies, Short Message Systems (SMS) technologies, Time Division Multiple Access (TDMA) technologies, Code Division Multiple Access (CDMA) technologies, General Packet Radio Service (GPRS) technologies, and the like.

The communication devices **212**, **214**, and **216** can be any of a number of packet-switched or circuit-switched devices including, for instance, analog phone, digital phone, Personal Computer (PC), laptop, Personal Digital Assistant (PDA), IP hardphone, IP softphone, wireless phone, cellular phone, and networking equipment.

The first types of communication devices **212** are capable of communicating with the server **220** via the primary network **204** and via the backup network **208**. The first types of communication devices **212** may belong to users that have subscribed to a particular service that allows them to communicate via the backup network **208**. Alternatively, the first types of communication devices **212** may include the necessary hardware that allows the communication device **212** to connect to the backup network **208**. The communication device **212** may be a half-duplex or a full-duplex device when communicating via the backup network **208**. In other words, when the communication device **212** is a half-duplex device it sends and receives information to/from the backup network **208** on a single frequency. Therefore, only one party can transmit a message at a time. This type of functionality is similar to a walkie-talkie or CB radio. Alternatively, the communication device **212** may be a full-duplex device, in which case it sends and receives information on different frequencies. This allows the user of the communication device **212** to talk while the server **220** is sending a message to the user. The use of half-duplex devices may be advantageous to provide more communication bandwidth on the backup network **208** whereas full-duplex devices provide a higher level of service that may be desired during a disaster.

The second types of communication devices **216** are only capable of communicating with the server **220** via the primary network **204**. In the event that the primary network **204** fails, the second type of communication device **216** will not be able to communicate with the server **220**. The second types of communication devices **216** may be circuit-switched, packet-switched, or both, but are not configured to communicate via the backup network **208**. Alternatively, the second types of communication devices **216** may be capable of communicating via the backup network **208**, but will not be contacted by the server **220** because they are not associated with a user that has subscribed to the backup network **208**

The server **220** is capable of communicating via the primary network **204**, **206** and/or the backup network **208**. The backup network **208** is primarily used as the communication network when the primary network **204** fails. Additionally, the server **220** provides a communication bridge between locally impacted users in the affected area **104** and their contacts in the non-affected area **108**. The server connects to subscribing users' communication devices **212** via the backup network **208** and further connects to contacts of the locally impacted users via the functioning primary network **206**.

The server comprises a status monitor **224** that is operable to locate the communication devices **212**, **216** of users in and around the affected area **104**. As previously mentioned, the location of users may be determined by a number of mechanisms including, without limitation, GPS and cellular phone locating techniques. Moreover, the status monitor **224** can identify the communication device **212**, **216** that it has located and further determine what user is associated with the communication device **212**, **216**.

When the server **220** contacts a user, the status monitor **224** is further operable to receive information about the status of the area around the user and the status of the user. The status monitor **224** maintains a record of the status of the area with the information that it receives from each user as they are contacted.

The status monitor **224** is also capable of determining status information from the check-in server **232**. The check-in server **232** may be located relatively close to the affected area **104** and people that were or are in the affected area may report their status to the status monitor **224** via the check-in server **232**.

After the status monitor **224** has obtained a suitable status of the area, the server **220** may contact the communication devices **212**, **216** to let them know what the status is and provide them with any additional instructions. The server **220** may also contact the communication devices **214** to provide an update of the status of a user in the affected area **104**.

As the server **220** determines what user to contact, the response generator **228** identifies the status that the user previously reported to generate a personalized response for the user. The response generated by the response generator **228** may be personalized for the user based on his/her location, perceived health, available resources, action plan, and the like. For example, a user that has indicated they are hurt can be told to stay where they are and someone will be there to help them. The user may also be given instructions on how to treat or maintain their injury until help arrives (i.e., elevate the wound, instructions on how to create a tourniquet, how to create a splint, and so forth). Another user that has indicated they are okay but do not know where to go can be given directions out of the affected area by their personalized message.

In accordance with at least some embodiments of the present invention, a user may wish to speak with some other person, like a relative or loved one, while they are trapped or hurt. To accommodate this, the server **220** may determine if there is enough bandwidth available on the backup network **208** to connect the user to one of his/her desired contacts. If there is available bandwidth, the user may be connected with a contact via the functioning primary network **206** so that the affected user can tell his/her contact that they are okay personally, rather than having a recorded message tell their family members that they are okay.

The response generator **228** may also be capable of determining a disaster response plan that includes the deployment of various resources throughout the affected area **104**. The

response generator **228** is used to help determine what users should be contacted (based on who is already checked-in) and generates personalized responses for each locally impacted user.

The server **220** is in communication with the database **236** where information about the status of the affected area **104** and users is maintained. Specifically, the database **236** can be used to store user name information **240**, contact number information **244**, location information **248**, user status information **252**, and requested contacts **256**. The server **220** can update and reference the information stored in the database **236** as it is generating status information for users and for the affected area **104**.

The status field **252** can be used to store information about the status of the user and/or his requests. The status of a user can include whether they have checked-in or not and if they have checked-in, what their reported status is. Moreover, the status field **252** may include information about the status of the area surrounding the user.

A subscribing user may wish to list a number of contacts that he/she would like to either talk to in case of an emergency or have notified of their status in case of an emergency. In one embodiment, the contacts in the contacts field **256** may be informed, via a communication network other than the backup network **208**, of the user's status as soon as it is known, even if there is no available bandwidth on the backup network **208** that would allow the user to communicate with his/her contacts. If there is bandwidth available on the backup network **208**, or if the primary network **204** is functioning, the user may be connected to one or more of the contacts so that he/she may report his/her status to the contacts personally.

The term "server" as used herein should be understood to include a PBX, an enterprise switch, an enterprise server, or other type of telecommunications system switch or server, as well as other types of processor-based communication control devices such as media servers (i.e., email servers, voicemail servers, web servers, and the like), computers, adjuncts, etc.

It should be emphasized that the configuration of the server, user communication devices, and other elements as shown in FIGS. **1** and **2** is for purposes of illustration only and should not be construed as limiting the invention to any particular arrangement of elements.

With reference now to FIG. **3**, an exemplary communication device **212** will be described in accordance with at least one embodiment of the present invention. The depicted communication device **212** comprises a user input **304**, an output device **308**, a processor **312**, a memory **316**, a locator **320**, and a communication interface **324**. The communication device **212** may comprise the typical functionality of a plain old telephone or PC (i.e., the ability to send and receive contacts via the communication network **204**, **208**). More specifically, the communication device **212** is capable of connecting to the server **220** via the primary **204** or backup **208** networks.

The user input **304** may include, without limitation, a keyboard/keypad, a mouse or other type of pointing mechanism, a microphone or other type of voice transducer, and a video camera. The user input **304** functions to collect data from the user and transmit the received data to the processor **312**. If the collected data is to be transmitted across one or both of the communication networks **204**, **208**, the processor **312** will package the information for transmission, if necessary, utilizing formatting information stored in memory **316** and forward the data on to the interface **324** for transmission across the communication network(s) **204**, **208**.

The output device **308** is operable to display information to the user. Data received at the interface **324** from the communication network(s) **204**, **204** is transmitted to the processor **312**, which subsequently undoes any transmission formatting that may have been present in the message. The processor **312** then forwards the data on to the output device **308** for presentation to the user. The displayed data may be audio, visual, live, recorded, streaming, static, or a combination thereof. The output device **308** may include, without limitation, a speaker, a Light Emitting Diode (LED) or collection of LEDs, an LCD display, a projection screen, a plasma screen, a beeper, or any other device capable of presenting data to a user of the communication device **212**.

The processor **312** is capable of performing predetermined functions that may be stored in memory **316**. The processor **312** controls the functionality of the communication device **212** and further processes incoming and outgoing data according to transmission protocols of the communication network(s) **204**, **208**. The processor **312** may be embodied as a microprocessor or similar type of processing chip. Alternatively, the processor **312** may include an Application Specific Integrated Circuit (ASIC), a programmable logic device (PLD), or a field programmable gate array (FPGA).

The memory **216** is operable to store functions for the processor **212** to execute along with other information including, phone extension information, caller identification information, and user information. The memory **216** may include volatile and/or non-volatile memory. Examples of a suitable type of memory **216** include, but are not limited to, Random Access Memory (RAM), Dynamic RAM (DRAM), Read Only Memory (ROM), Programmable ROM (PROM), Electronically Erasable PROM (EEPROM), buffered memory, Flash memory, and the like.

The locator **320**, in one embodiment, is the device that allows the server **220** to determine the location of the communication device **212**. The locator **320** may comprise a GPS receiver or similar type of location device known in the art. One example of a GPS receiving device is described in U.S. Pat. No. 7,034,747 to Walters et al, the entire disclosure of which is hereby incorporated herein by reference. The '747 patent describes a GPS system that is linkable to a wireless communication device.

The locator **320** may also be embodied as a part of the communication interface **324**. As noted above, various cellular location techniques are known in the art in which the server **220** communicates with the communication device **212** via the interface **324** to determine the device's location. The communication device **212** may maintain its own location in memory **316** and intermittently or continuously transmit that location to the server **220**. The server **220** receives the location of the communication device **212** and subsequently knows whether it is in the affected area **104**, the adjacent area **108**, or neither.

The interface **324** serves as the connection between the communication device **212** and the communication network(s) **204**, **208**. The form of the interface **324** may vary depending upon the type of communication network and communication device. The interface **324** may include a modulation/demodulation unit for modulating data to be sent across the communication network and demodulation data received from the communication network. The interface **324** may comprise, without limitation, a standard telephone interface, a modem, an Ethernet port and Ethernet card, a wireless interface, and so on. The protocols used to communicate with the communication network **204**, **208** may include known wired and/or wireless communication protocols. As can be appreciated by one of skill in the art, the communication device **212** may comprise multiple communication interfaces, each of which is capable of communicating with a

different communication network. Alternatively, in accordance with one embodiment, the communication device **212** may comprise a single communication interface **324** that allows the communication device **212** to communicate with multiple communication networks.

In one embodiment, the primary network **204** and the backup network **208** may be the same type of network that employs the same types of communication protocols. In another embodiment, backup network **208** is the primary network **204** reconfigured to function as backup network **208**. In response to the primary network **204** being incapacitated, the backup network **208** is generated to provide continued communications with the communication devices **212**, **216**. There may be instances where only subscribing communication devices **212** are contacted by the server **220** or are allowed to use the backup network **208**. The second types of communication devices **216** may still be capable of communicating via the backup network **208**, even if they aren't allowed to for whatever reason (i.e., preservation of bandwidth, not paying for the backup network, and the like).

Referring now to FIG. **4**, a method of gathering disaster status information will be described in accordance with at least some embodiments of the present invention. The method begins when a disaster occurs (step **404**). When a disaster occurs, a backup network is generated (step **406**). This particular step may include fixing parts of the primary network that have been damaged, fixing/enabling portions of a GPS or other locating type system, bringing in equipment to generate the backup network and creating a central location for disaster response. Also in response to the occurrence of a disaster, one or more individuals may check-in with the report station **112** (step **408**). The people that check in at the report station **112** may indicate their medical status as well as the status of any portion of the affected area that they saw or heard about.

In an attempt to minimize the number of users that are contacted, the server **220** populates a list of users that have not checked-in with the report station **112** (step **412**). The list of users that have not checked-in may include both subscribers and non-subscribers. In one embodiment, the subscribers may be a priority for the server **220** to contact. Also, the server **220** may not be able to contact the non-subscribers in the event that the primary network **204** has become incapacitated and there is no other way of contacting the non-subscribers.

To determine what users or subscribers are locally impacted and what users or subscribers have not been locally impacted, a map is generated in the disaster response area depicting the location of users in both the affected area **104** and adjacent area **108** (step **414**). This step may include dynamically updating the extent of the affected area **104** as additional status reports are received by locally impacted users and other users that have been placed in the affected area **104**.

As users continue to check-in at the reporting station **112** or by some other voluntary measure, the list of non-checked-in users dynamically updates itself to reflect who should be contacted and who does not need to be contacted. The server **220** then determines the location of users (checked-in and/or non-checked-in), so that it can determine which users should be contacted first (step **416**). Generally, users that are in the affected area **104** are contacted before users in the adjacent area **108**. The location of a user may also be used in connection with the status information the user provides to create a more clear determination of the status of the affected area **104** and certain portions within the affected area **104**. As users are located, their location can be displayed for viewing on the map in the central command station (step **418**). The display of the user location may be displayed on a user display associated with the status monitor **224**.

Another function that can be concurrently performed during the location of locally impacted users is the generation of an initial communication dialog/plan that can be transmitted to locally impacted users when they are contacted.

In step **420**, it is determined if one or more non-checked-in users are in the affected area **104**. In the event that a user (or users) are in the affected area **104**, then the server **220** attempts to contact the users. The server **220** may not be able to contact all of the users on the first attempt, and will therefore continue trying to contact the users until they are contacted (step **424**). The server **220** may determine after a number of attempts (i.e., twenty contact attempts) that the user may be injured and unable to work the communication device **112**. In that instance the status for the user that was not contacted is assumed. Otherwise, the server **220** receives the status for each user and compiles each user's status with the overall status information for the affected area **104**. As status information is updated, workers in the EMC become better equipped to determine how to allocate scarce resources to the affected area.

Once a user is contacted his/her name is removed from the list of users that have not checked-in. In one embodiment, contact with a subscriber may be required based on the agreement between the service provider and the subscriber. For example, the subscriber may have paid for this emergency service and is expecting to be contacted by the server **220**. If the user is not contacted after a certain number of attempts, but the location of the user is known, resources may be allocated for the subscriber to ensure that he/she is okay or to save him/her from any danger they might be in.

If bandwidth is available while the users in the affected area **104** are contacted, the server **220** may determine what users (if any) are in the adjacent area **108** (step **428**). In the event that no users are in the adjacent area **108**, then the server **220** continues to allocate its resources to contacting the users in the affected area **104**. In the event that there are users in the adjacent area **108**, and there is bandwidth available to contact those users, the server **220** begins attempting to contact the users in the adjacent area **108** that have not yet checked-in (step **432**). The users in the adjacent area **108** may be contacted to not only gain more status information about the extent of the affected area, but they may also be contacted and asked if they are willing to help people in the affected area **104**. Resources in the adjacent area **108** may be staged for movement into the affected area **104**, and users in the adjacent area **108** may be contacted and asked to mobilize those resources.

The server **220** continues to attempt contacting non-checked-in users in both the affected and non-affected areas, while generating status information as users are contacted (step **436**). This process continues until either all users have been contacted or a suitable amount of status information has been retrieved, at which point the method ends (step **440**). As can be appreciated, the method may continue to generate new status information as it becomes available and as additional users are contacted.

Referring now to FIG. **5** a method of communicating with users will be described in accordance with at least some embodiments of the present invention. The status of the affected area **104** is determined as the server **220** continues to contact users that had not previously checked-in (step **504**). The status is used in part to determine how to allocate resources and also in part to determine content of messages to send to users. Once enough status information has been determined and the EMC has identified a course of action for

handling the disaster the users are located (step **508**). The users may be located based on their previous known location that is stored in the database **236**. On the other hand, the users may be located again either by GPS or by other locating techniques. Based on the users location as determined in step **508**, a message is generated for each user based on his/her status (step **512**). A user's status may include the user's physical and mental health, age, gender, location, previously reported status (i.e., trapped, stuck, free to move, etc.), and the like. A first message may be generated for a first user that indicates the nearest shelter from harm and how to get there from the user's current location. A second message may be generated for a second user that tells him/her not to worry, that medical teams are en-route to their location and they will be there soon. Again, the content and how the message is delivered may vary from user to user. In one embodiment, a subscribing user may have previously indicated that he/she is in a wheel chair and cannot move very easily. In this situation, with the predefined criteria, the response generator **228** will know that the user will not be able to leave his/her location even if they are okay. Thus the message conveyed to the user may contain instructions on how to stay calm and safe. Each message that is generated for a different region of the affected area **104** may be simultaneously transmitted to locally impacted users in their respective area. In other words, one message may be transmitted to a first user in a first region whereas a second message may be transmitted to a second user in a second region at the same time. The first and second messages may each contain information specific to the region in which the user is. As a user moves between regions, the message to be transmitted for that particular user may change as well.

Battery life may also be of concern during a disaster. Therefore, the message generated for the user may direct the user to turn off the communication device **212** in an attempt to save batteries. The message may further indicate when it will contact the user again thereby letting the user know when to turn the communication device **212** back on.

Once the message for a user has been generated, the user is contacted (step **516**). As can be appreciated, the server **220** may remember what communication network was used to contact the user, and can attempt to contact the user via the same network that was successfully used before. If the user is not contacted, the server **220** will continue trying to contact the user until a successful contact is established, or the user has indicated checked-in at a report station **112**. Once a successful contact is established, the generated message is transmitted to the user (step **520**).

The user may also have indicated contacts that he/she would like to speak with if possible during a disaster. Therefore, after the message is played for the user, it is determined if there is additional bandwidth available on the communication network that will allow the user to speak with his/her predefined contacts (step **524**). In the event that there are additional users that need to be contacted and the full capacity of the network is currently being used, then it is determined that there is no communication bandwidth available for the user. At this point if at least some status of the user is known, that status may be indicated to contacts or relatives of the user via a separate communication (step **526**). As can be appreciated by one of skill in the art, continuous communications with contacts of the locally-impacted user may be sent as new information is retrieved about either the impacted user and/or the region in which the locally impacted user is.

After the status of the locally impacted user has been transmitted to the user's predefined contacts, the method may end or wait to connect the user when adequate bandwidth becomes available. On the other hand, if additional bandwidth is available for use in contacting other users or no other users are left to contact, then the server determines if the currently contacted user has any people that he/she would like to speak with (step **528**). In the event that there are no contacts defined in the database **236** for the user, then the method ends (step **536**). However, if there are contacts that the user has indicated they would like to speak with, then the user is connected with one or more of the defined contacts (step **532**). This allows the user to personally tell the predefined contacts that he/she what the status is and that he/she is okay (assuming the user is okay).

The present invention, in various embodiments, includes components, methods, processes, systems and/or apparatus substantially as depicted and described herein, including various embodiments, subcombinations, and subsets thereof. Those of skill in the art will understand how to make and use the present invention after understanding the present disclosure. The present invention, in various embodiments, includes providing devices and processes in the absence of items not depicted and/or described herein or in various embodiments hereof, including in the absence of such items as may have been used in previous devices or processes, e.g., for improving performance, achieving ease and\or reducing cost of implementation.

The foregoing discussion of the invention has been presented for purposes of illustration and description. The foregoing is not intended to limit the invention to the form or forms disclosed herein. In the foregoing Detailed Description for example, various features of the invention are grouped together in one or more embodiments for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the following claims are hereby incorporated into this Detailed Description, with each claim standing on its own as a separate preferred embodiment of the invention.

Moreover, though the description of the invention has included description of one or more embodiments and certain variations and modifications, other variations and modifications are within the scope of the invention, e.g., as may be within the skill and knowledge of those in the art, after understanding the present disclosure. It is intended to obtain rights which include alternative embodiments to the extent permitted, including alternate, interchangeable and/or equivalent structures, functions, ranges or steps to those claimed, whether or not such alternate, interchangeable and/or equivalent structures, functions, ranges or steps are disclosed herein, and without intending to publicly dedicate any patentable subject matter.

What is claimed is:

1. A method of responding to a disaster, comprising:

identifying an area affected by a disaster;

generating a backup communication network for at least a portion of the affected area in response to the disaster;

locating locally impacted users that are one of in and adjacent to the affected area; and

attempting to contact the located locally impacted users via the backup communication network to gather status information for at least some of the locally impacted users, wherein a server determines an order for initiating contacts with the locally impacted users via the backup communication network based on the status of the locally impacted users, wherein, at least based on band-

width availability, one or more locally impacted users are restricted from initiating a communication via the backup communication network.

2. The method of claim **1**, wherein the status of a locally impacted user includes one or more of checked-in, non-checked-in, mental health information, location, and emergency situation, and wherein attempting further comprises:

determining, by the server, which of the located locally impacted users has been assigned a state of non-checked-in to report a status; and

attempting to contact the locally impacted users that have not yet checked-in to report a status prior to initiating a communication to a locally impacted user that has checked-in.

3. The method of claim **1**, wherein generating the backup communication network comprises:

equipping users with communication devices that are capable of communicating via the backup network prior to the occurrence of a disaster;

moving communication equipment proximate to the affected area; and

connecting with the locally impacted user having the communication device via the communication equipment.

4. The method of claim **1**, wherein the users are located by at least one of Global Positioning Systems (GPS) and cellular location techniques.

5. The method of claim **1**, further comprising:

determining that a locally impacted user associated with the affected area has not been contacted;

continuing to attempt to contact the locally impacted user associated with the affected area until the user has been contacted; and

after the locally impacted user associated with the affected area has been contacted, changing the status of the locally impacted user associated with the affected area to checked-in thereby changing a priority with which communications will be initiated from the server to the locally impacted user associated with the affected area.

6. The method of claim **1**, further comprising:

contacting a locally impacted user in the affected area;

recovering affected area status information from the locally impacted user; and

updating records of the status of the affected area with the status information provided by the locally impacted user.

7. The method of claim **1**, further comprising:

compiling a status of the affected area from information received from a number of locally impacted users that have been contacted;

automatically generating a message at the server for a locally impacted user associated with the affected area, the automatically generated message including at least a part of the complied status of the affected area and further including instructions for responding to the disaster;

initiating contact, by the server, with the locally impacted user associated with the affected area via the backup communication network; and

conveying, by the server, the message to the locally impacted user associated with the affected area.

8. The method of claim **7**, wherein the message generated for the locally impacted user associated with the affected area is substantially unique to the locally impacted user and is based on the user's predefined preferences.

9. The method of claim **7**, further comprising:

determining the backup communication network has sufficient bandwidth available to allow at least one locally impacted user to initiate a communication via the backup communication network;

determining the contacted locally impacted user has at least one contact that they would like to speak to;

initiating, by the server, a communication with the at least one contact on behalf of the locally impacted user;

connecting the server with the at least one contact; and

thereafter, connecting the locally impacted user with the at least one contact via the server and the backup communication network.

10. A computer comprising physical memory that includes processor-executable instructions stored thereon which are operable to perform, when executed by a processor, the method of claim **1**.

11. A system for responding to a disaster, comprising:

a plurality of communication devices each associated with a locally impacted user located proximate to an area affected by a disaster;

a server operable to identify the area affected by a disaster and locate at least some of the plurality of communication devices; and

a backup communication network generated in response to a primary communication network being at least partially affected by the disaster, the backup communication network providing communication capabilities between the server and at least some of the plurality of communication devices, wherein the server determines an order for initiating contacts with the communication devices via the backup communication network based on a status of the users, wherein, at least based on bandwidth availability, one or more communication devices are restricted by the server from initiating a communication via the backup communication network.

12. The system of claim **10**, wherein the server is further operable to determine which locally impacted users associated with the located communication devices have not yet checked-in to report a status and attempt to contact the locally impacted users that have not yet checked-in to report a status via the backup communication network.

13. The system of claim **11**, wherein the server is further operable to continue attempts of contact via the backup communication network with the users that have not yet checked-in until the users are contacted, wherein the attempts of contact with the users that have not yet checked-in is performed before attempts of contact with user that have checked-in.

14. The system of claim **10**, wherein the backup communication network comprises a mobile radio signal generator that is moved within proximity of the affected area and used to generate signals that can be utilized by the server to communicate with the at least one communication device.

15. The system of claim **10**, further comprising a Global Positioning System (GPS), wherein at least some of the communication devices are equipped with a GPS receiver that can be used in connection with the GPS system by the server to substantially determine the location of the communication devices.

16. The system of claim **10**, wherein the server is further operable to contact the locally impacted user, recover status information related to the affected area, and update records of the status of the affected area with the status information provided by the locally impacted user.

17. The system of claim **10**, wherein the server is further operable to compile a status of the affected area from information received from a number of locally impacted users that have been contacted, automatically generate a message for a locally impacted user associated with the affected, the message including instructions for responding to the disaster that

are specific to a known location of the locally impacted user and being one of a plurality of automated sample dialogs, the server being further operable to contact, via the backup communication network, the locally impacted user associated with the affected area, and convey the message to the locally impacted user associated with the affected area.

18. The system of claim **17**, wherein the message generated for the locally impacted user associated with the affected area is substantially unique to the locally impacted user and is based on the user's predefined preferences.

19. The system of claim **17**, wherein the server is further operable to determine the backup network has an adequate amount of bandwidth available to allow at least one locally impacted and contacted user who is not otherwise allowed to initiate communications via the backup communication network to initiate a communication via the backup communication network, determine the contacted locally impacted user has at least one contact that they would like to speak to, and connect the locally impacted user with the at least one contact via the backup network.

20. The system of claim **17**, wherein the server is further operable to determine resources that should be employed in the disaster affected area based on the compiled status of the affected area.

21. A method of generating impacted area status, comprising:

identifying an area affected by a disaster;

generating a backup communication network for at least a portion of the affected area in response to the disaster;

contacting a locally impacted user via the backup communication network;

receiving information relating to the area affected by the disaster from the locally impacted user; and

adding the locally impacted user to a list of contacted users, wherein locally impacted users on the list of contacted users are at least one of (i) at least based on bandwidth availability, restricted from initiating contacts via the backup communication network and (ii) subsequently contacted only after communication attempts with non-contacted users have failed.

22. The method of claim **21**, further comprising:

generating an initial disaster response plan;

analyzing the received information from the locally impacted user; and

updating the initial disaster response plan based on the information provided by the locally impacted user.

23. The method of claim **22**, wherein the initial disaster response plan includes a predetermined communication that is transmitted to locally impacted users, and wherein the updated version of the disaster response plan includes a communication that differs from the predetermined communication.

24. The method of claim **23**, wherein the communication of the updated version of the disaster response plan comprises a message to locally impacted users that is customized for the locally impacted user based on at least one of the user's location, user's status, and user's preferences, the method further comprising transmitting the updated version of the disaster response plan to the users on the list of contacted users at substantially the same time.

* * * * *