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(71) Applicant: TELECOMMUNICATION SYSTEMS, INC. [US/US]; 275 West Street, Suite 400, Annapolis, MD 21401 (US).

(72) Inventors: MITCHELL, Donald, L.; 16220 Se 9th Street, Bellevue, WA 98008 (US). MARSHALL, Roger, S.; 37521 200th Avenue SE, Auburn, WA 98092 (US). TIT-
US, Mark, A.; 1513 White Tail Deer Court, Annapolis, MD 21403 (US).

(74) Agent: BOLLMAN, William, H.; Manelli Selter PLLC, 2000 M Street, NW, 7th Floor, Washington, DC 20036 (US).

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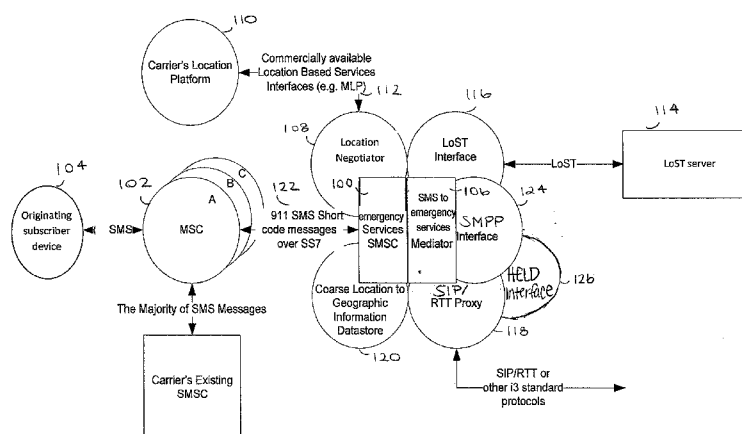


FIG. 1

(57) Abstract: Location determination for a roaming subscriber device using a short message service (SMS) to contact emergency services, wherein location information is obtained from a visited carrier network on which the originating subscriber device is roaming. An emergency SMS message is first routed to a predetermined emergency services SMSC. The emergency services SMSC then forwards data relevant to the emergency SMS message to an SMS to emergency services mediator. The SMS to emergency services mediator uses data received for the emergency SMS message to obtain location information therefor. Location information for an emergency SMS message is obtained from an LBS platform on a network carrier currently servicing the originating subscriber device. A next hop URI is then determined for the emergency SMS message based on relevant location information. The emergency SMS message is routed to the next hop URI and eventually routed to an appropriate PSAP.

LOCATION DETERMINATION OF A ROAMING SUBSCRIBER DEVICE USING SMS FOR EMERGENCY PURPOSES

The present invention claims priority from U.S. Provisional No. 61/645,366, filed May 10, 2012, entitled "Method for Determining the Location of a Roaming Subscriber Device using SMS for Emergency Purposes", the entirety of which is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to telecommunications. More particularly, it relates to messaging systems and emergency services.

2. Background

Short message service (SMS) is a text communication service that enables bidirectional transmission of short alphanumeric text messages to and from a Short Message Entity (i.e. a communication device or system capable of sending and receiving short messages (SMS messages)). Conventional SMS messages contain a maximum of 160 characters of text and are transmitted over digital wireless/mobile networks. Short message service (SMS) is currently the most widely used data application in the world.

Elements essential in providing short message service (SMS) include: a short message service center (SMSC), a short message service (SMS) gateway, and a mobile switching center (MSC).

A short message service center (SMSC) in an SMS network is responsible for the routing of SMS messages. In accordance with conventional SMS technology, a short message service center (SMSC) operates in a store-and-forward manner to guarantee delivery of SMS messages to intended message recipients, e.g., wireless devices, computer systems, etc. A short message service center (SMSC) communicates with external entities via a conventional short message peer to peer (SMPP) protocol.

An SMS gateway in an SMS network allows interconnectivity between short message service centers (SMSC) operating on different network carriers. In particular, each short message service center (SMSC) operates in accordance with a particular SMSC communication protocol. Moreover, short message service centers (SMSCs) on different network carriers may support different SMSC communication protocols. However, to enable inter-carrier text messaging, SMSCs on different network carriers must communicate with one another to ensure proper message routing. Therefore, to enable inter-carrier text messaging, SMS gateways translate between SMSC communication protocols supported on different network carriers.

In accordance with conventional SMS technology, each SMS network contains at least one mobile switching center (MSC). A mobile switching center (MSC) performs switching and call control functions on an SMS network, and transfers SMS messages between a short message service center (SMSC) and a mobile station (MS), e.g., a subscriber device, etc.

Moreover, an SMS network typically includes a location based services (LBS) platform to enable location determination for subscriber devices.

In accordance with conventional SMS technology, short message service (SMS) entities communicate with one another via Signaling System Number 7 (SS7) signaling protocols. In an SS7 system, information is sent back and forth between network entities in SS7 messages (i.e. digital packets). Network entities communicating via SS7 are identified via unique point codes (i.e. unique identifiers). A set of unique point codes is included in each SS7 message to identify a source and a destination node for that message. For example, an originating point code (OPC) is included in an SS7 message to identify a source node (i.e. originating node) on which that SS7 message was originated.

Due to an overwhelming implementation of the short message service (SMS), wireless subscribers often assume that SMS messages may be used to contact emergency services. While this is not yet the case in all areas, the federal communications commission (FCC) has recently required that all

wireless carriers begin efforts to support text to 911 services (in addition to standard voice to 911 services). A text to 911 service allows subscribers to send text messages to public safety answering points (PSAPs) (i.e. 911 call centers) to request emergency services. Initial text to 911 deployments are to be SMS based solutions (i.e. SMS to 911 solutions).

SMS to 911 services are projected to be exceptionally beneficial to the hard of hearing and exceptionally beneficial in situations where voice conversation is not possible and/or not desirable.

SMS to 911 is not yet a standardized call flow, and there are currently many different approaches. However, while many solutions have been proposed for providing SMS to 911 services, there are currently no known solutions for determining a location of a device requesting SMS to 911 services while roaming.

In particular, when a subscriber device (i.e. a device subscribed to services provided by a network carrier) issues an emergency services bound SMS message (e.g. an SMS to 911 message) on a network carrier that is not the device's home/direct network carrier (i.e. the device is roaming), any attempts to determine location information for that roaming subscriber device will fail, because SMS to 911 messages conventionally proceed (via a short message peer to peer (SMPP) protocol) from a short message service center (SMSC) on a device's home network carrier (even when that device is being service by a visited network carrier).

If location information cannot be obtained for a device that initiates an SMS to 911 request, then that SMS to 911 request is less likely to be routed to an appropriate public safety answering point (PSAP) (i.e. a public safety answering point (PSAP) within closest geographic proximity to an originating subscriber device). Since emergency service requests are typically time sensitive, there exists a need for a method of location determination for roaming subscriber devices using SMS to contact emergency services.

SUMMARY OF THE INVENTION

A method and apparatus for determining a location of a roaming subscriber device using a text communication service (e.g. a short message service (SMS)) to contact emergency services (e.g. 911 emergency services), comprises retrieving location information from a visited network carrier on which the subscriber device is roaming.

In accordance with the principles of the present invention, an SMS message addressed to emergency services (e.g. an SMS to 911 message) is routed to a predetermined emergency services short message service center (SMSC). The emergency services SMSC receives the emergency SMS message and sends pertinent data (i.e. a unique identifier for a serving mobile switching center (MSC), a unique identifier for an originating subscriber device, and a message body) extracted therefrom to an SMS to emergency services mediator. The SMS to emergency services mediator receives data for the emergency SMS message and then queries a location negotiator for relevant location information. Location information for an emergency SMS message is obtained from a location based services platform on a network carrier currently servicing the originating subscriber device.

Following location determination, a next hop uniform resource identifier (URI) is determined for the emergency SMS message based on location information obtained therefor. The emergency SMS message is routed to the next hop URI and eventually routed to an appropriate public safety answering point (PSAP) (i.e. 911 call center).

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the present invention become apparent to those skilled in the art from the following description with reference to the drawings:

Fig. 1 depicts an exemplary network structure for determining a location of a roaming subscriber device using a short message service (SMS) to

contact emergency services, in accordance with the principles of the present invention.

Fig. 2 depicts exemplary location determination for a roaming subscriber device using a short message service (SMS) to contact emergency services, in accordance with the principles of the present invention.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The present invention provides a method and apparatus for determining a location of a roaming wireless device using a short message service (SMS) to contact emergency services.

The present inventors appreciated that in conventional proposals for SMS to emergency services messaging (e.g. SMS to 911 messaging), attempts to retrieve location information for a device initiating SMS to emergency services while roaming, fail, because location information is conventionally requested from a device's home carrier network, even when that device is being serviced by a visited carrier network (i.e. roaming).

In accordance with the principles of the present invention, location information is obtained for a roaming subscriber device using a short message service to contact emergency services, from a visited carrier network on which that subscriber device is roaming (or being serviced by).

Fig. 1 depicts an exemplary network structure for determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services, in accordance with the principles of the present invention.

As depicted in Fig. 1, each carrier network comprises a predetermined emergency services short message service center (SMSC) **100** dedicated to servicing SMS to emergency service requests. In accordance with the principles of the present invention, all emergency SMS messages originated on a carrier network are routed (via a mobile switching center (MSC) **102** currently servicing an originating subscriber device **104**) to that carrier network's emergency services SMSC **100**. The emergency services SMSC **100** then

routes data obtained for each emergency SMS message to an SMS to emergency services mediator **106**, via a secure HELD interface **124**.

In accordance with the principles of the present invention, the SMS to emergency services mediator **106** queries a location negotiator **108** for location information relevant to each emergency SMS message. As depicted in Fig. 1, the location negotiator **108** retrieves location information for an originating subscriber device **104** from a location based services platform **110** operating on that device's **104** serving carrier network (via a conventional location based services interface **112**).

In accordance with the principles of the present invention, the SMS to emergency services mediator **106** obtains a next hop uniform resource identifier (URI) for each emergency SMS message, from a conventional Location-to-Service Translation (LoST) server **114** (via a conventional LoST interface **116**). A LoST server **114** determines a next hop URI for an emergency SMS message based on location information retrieved therefor.

The SMS to emergency services mediator **106** sends a next hop URI obtained for each emergency SMS message to a short message peer to peer protocol (SMPP) to session initiation protocol (SIP)/real time text (RTT) proxy **118** (via the HELD interface **124**), to which the SMPP to SIP/RTT proxy **118** (or other standard i3 protocol) subsequently sends a SIP/RTT INVITE message.

As depicted in Fig. 1, the SMS to emergency services mediator may also query a coarse location to geographic information datastore **120** for geographic location information, when location information received for an emergency SMS message is non-geographic.

Fig. 2 depicts exemplary location determination for a roaming subscriber device using a short message service (SMS) to contact emergency services, in accordance with the principles of the present invention.

In particular, as depicted in step **1** of Fig. 2, a subscriber device (i.e. a device subscribed to services provided by a wireless network carrier) **104**

initiates an SMS to emergency services request by addressing an SMS message (a digital message) to an appropriate emergency services short code (e.g. '911').

As portrayed in step **2** of Fig. 2, a mobile switching center (MSC) **102** on a carrier network currently servicing the originating subscriber device **104**, uses short message peer to peer (SMPP) protocol over signaling system number 7 (SS7) protocol **122** to directly route the SMS message addressed to emergency services to a predetermined emergency services short message service center (or SMS gateway) **100**. The emergency services SMSC **100** receives the SMS message (in an SS7 message) from the MSC **102** servicing the originating subscriber device **104**, and identifies therein: an E.164 (i.e. a unique number identifier) affiliated with the originating subscriber device **104**, an originating point code (OPC) (i.e. a unique identifier) identifying the serving mobile switching center (MSC) **102**, and the body of the initiated emergency SMS message.

In step **3**, the emergency services SMSC **100** sends the E.164, the originating point code (OPC) (identifying the serving MSC **102**), and the emergency SMS message body to an inventive SMS to emergency services mediator **106**, via a secure HELD interface **124**.

In step **4**, the SMS to emergency services mediator **106** receives data from the emergency services SMSC **100**, and forwards the E.164 (affiliated with the originating subscriber device **104**) and the originating point code (identifying the serving mobile switching center (MSC) **102**) to an inventive location negotiator **108**.

As depicted in step **5**, the location negotiator **108** queries a location based services platform **110** on the serving carrier network (i.e. the carrier network currently servicing the originating subscriber device **104**) for relevant location information, via a conventional location based services interface (e.g. a mobile location protocol (MLP)) **112**. The location negotiator **108** determines a location based services platform **110** to query, based on an association between the originating point code (OPC) received for the serving MSC **102** and connection information retrieved for the serving location based services platform.

As depicted in step **6**, the location based services platform **110** on the serving carrier network returns a query response to the location negotiator **108**, containing location information in accordance with a particular type of location requested.

As portrayed in step **7**, the location negotiator **108** then returns location information obtained for the originating subscriber device **104** to the SMS to emergency services mediator **106**.

In step **8**, the SMS to emergency services mediator **106** forwards received location information to a standards based LoST server **114**, via a conventional LoST interface **116**.

As depicted in step **9**, the LoST server **114** determines a next hop uniform resource identifier (URI) **200** for the emergency services SMS message, based on location information received for the originating subscriber device **104**. The LoST server **114** then returns the next hop URI **200** to the SMS to emergency services mediator **106**.

If location information received for the originating subscriber device **104** is non-geographic (e.g. a name of a park, museum, etc., as opposed to an address or geographic coordinate), then the SMS to emergency services mediator **106** queries a coarse location to geographic information data store **120** for corresponding geographic information, as depicted in step **10**. The coarse location to geographic information data store **120** then returns requested geographic location information, e.g., location coordinates, etc., to the SMS to emergency services mediator **106** (step **11**).

In step **12**, the SMS to emergency services mediator **106** sends the body of the original emergency SMS message, the E.164 affiliated with the originating subscriber device **104**, and location information retrieved for the originating subscriber device **104** (or a reference to location information) to a short message peer to peer protocol (SMPP) to session initiation protocol (SIP)/real time text (RTT) proxy **118**. In accordance with the principles of the present invention, the SMS to emergency services mediator **106** may either geographic location information, as is.

As depicted in step **13**, the SMPP to SIP/RTT proxy **118** subsequently sends a SIP/RTT INVITE message (i.e. a message requesting that a client partake in a session) to the next hop URI **200** previously selected for the emergency SMS message. The SIP/RTT INVITE message either contains a location by reference (in which the reference is to a record maintained by the SMS to emergency services mediator **106**, and accessible via a secure HELD interface **124**) or a location by value (using an internet engineering task force (IETF) presence information data format - location object (PIFD-LO)).

As depicted in step **14**, each emergency SMS message is eventually routed to an appropriate public safety answering point (PSAP) (i.e. a 911 call center) **220**.

The present invention has particular applicability to wireless carriers, and other SMS to emergency services type application providers. Subscriber devices have access to the subscriber's position if they are using the non-assisted GPS from the device.

While the invention has been described with reference to the exemplary embodiments thereof, those skilled in the art will be able to make various modifications to the described embodiments of the invention without departing from the true spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A method of determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services, comprising:

receiving an emergency SMS message on an emergency services SMSC;

forwarding information regarding said emergency SMS message to an SMS to emergency services mediator;

obtaining location information for said emergency SMS message;

determining an Internet address for said emergency SMS message based on said location information; and

sending said emergency SMS message to said Internet address.

2. The method of determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services according to claim 1, wherein:

said emergency services SMSC receives said emergency SMS message from a mobile switching center (MSC) servicing a roaming subscriber device initiating said emergency SMS message.

3. The method of determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services according to claim 1, wherein said information regarding said emergency SMS message includes:

a unique identifier for a roaming subscriber device initiating said emergency SMS message;

an originating point code (OPC) for an MSC servicing said roaming subscriber device; and

a body of said emergency SMS message.

4. The method of determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services according to claim 1, wherein:

said Internet address is a next hop uniform resource identifier (URI).

5. The method of determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services according to claim 1, wherein:

said location information for said emergency SMS message is obtained from a location based services platform on a carrier network currently servicing a roaming subscriber device initiating said emergency SMS message.

6. An apparatus for determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services, comprising:

means for receiving an emergency SMS message on an emergency services SMSC;

means for forwarding information regarding said emergency SMS message to an SMS to emergency services mediator;

means for obtaining location information for said emergency SMS message;

means for determining an Internet address for said emergency SMS message based on said location information; and

means for sending said emergency SMS message to said Internet address.

7. The apparatus for determining a location of a roaming subscriber device using a short message service (SMS) to contact emergency services according to claim 6, wherein:

said means for receiving receives said emergency SMS message from a mobile switching center (MSC) servicing a roaming subscriber device initiating said emergency SMS message.

8. The apparatus for determining a location of a roaming subscriber device using short message service (SMS) to contact emergency services according to claim 6, wherein said information regarding said emergency SMS message includes:

a unique identifier for a roaming subscriber device initiating said emergency SMS message;

an originating point code (OPC) for an MSC servicing said roaming subscriber device; and

a body of said emergency SMS message.

9. The apparatus for determining a location of a roaming subscriber device using short message service (SMS) to contact emergency services according to claim 6, wherein:

said Internet address is a next hop uniform resource identifier (URI).

10. The apparatus for determining a location of a roaming subscriber device using short message service (SMS) to contact emergency services according to claim 6, wherein:

said means for obtaining location information for said emergency SMS message obtains location information from a location based services platform on a carrier network currently servicing a roaming subscriber device initiating said emergency SMS message.

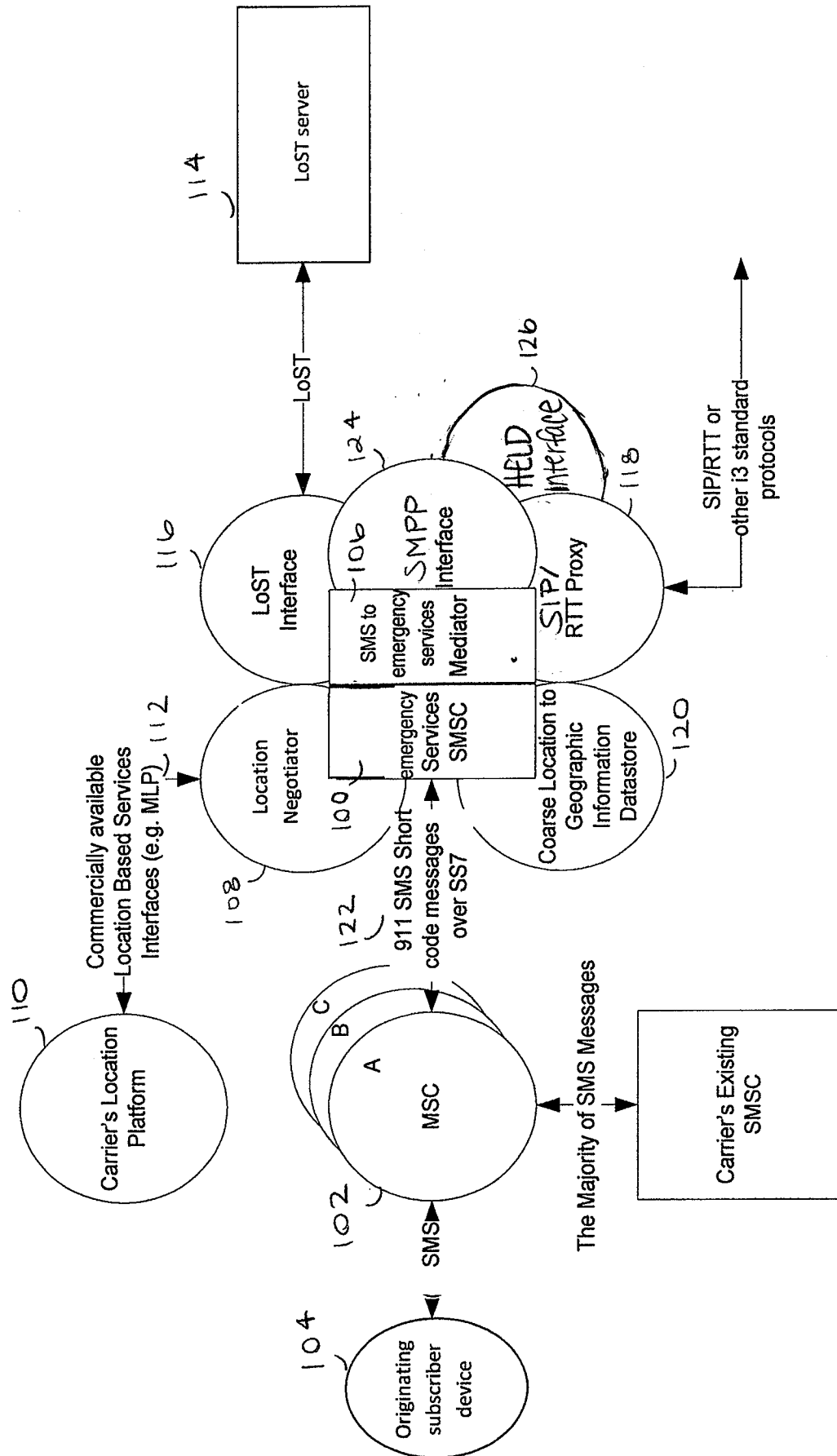


FIG. 1

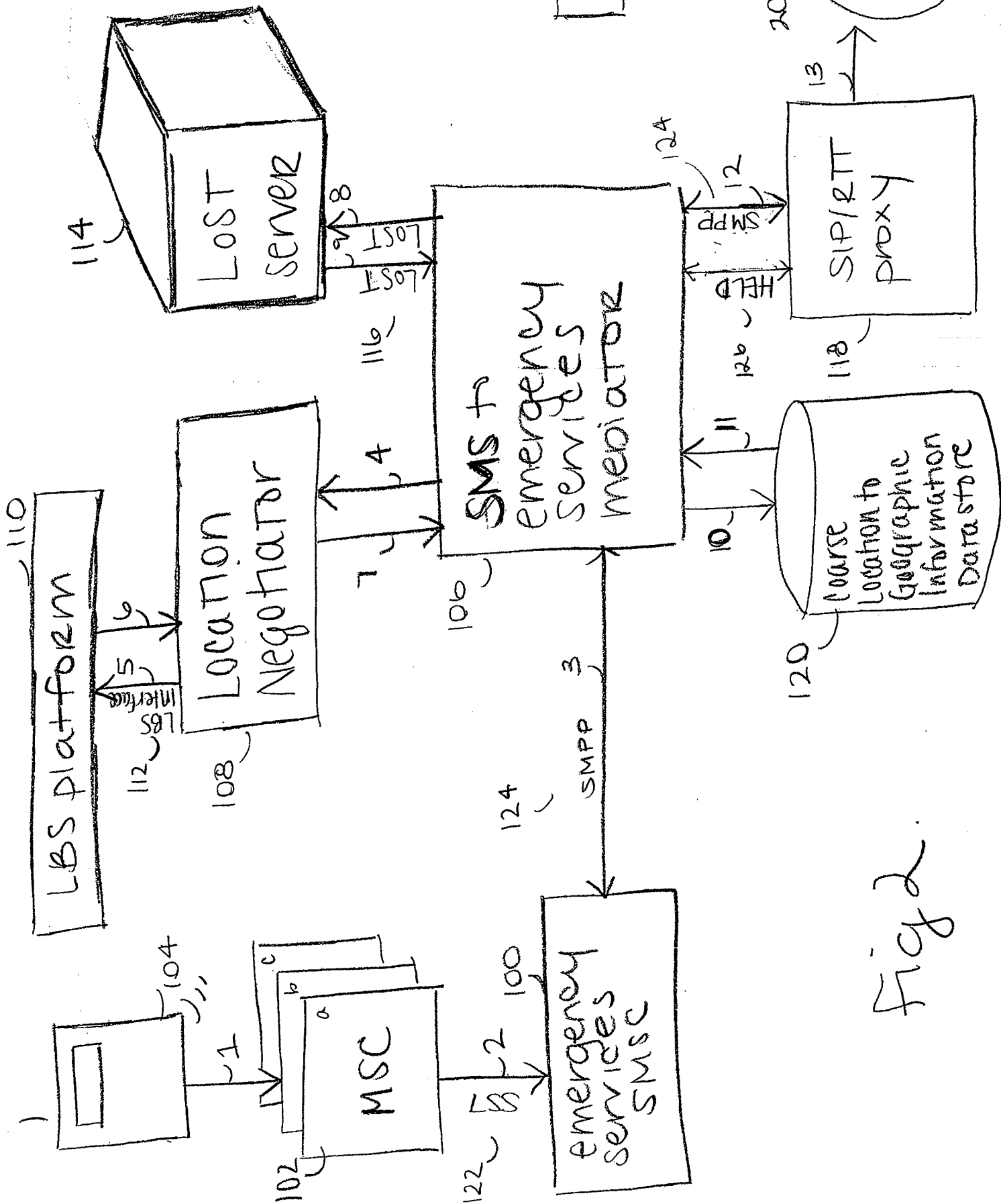


Fig 2.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2013/040569

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H04W 4/22

USPC - 455/404.1

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(8) - H04W 4/00, 4/02, 4/14, 4/22 (2013.01)

USPC - 455/404.1, 404.2, 432.1, 432.2, 456.1, 466

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

CPC - H04W 4/00, 4/02, 4/14, 4/22

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Patbase, Orbit, Google Patent, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/0045250 A1 (HWANG) 21 February 2008 (21.02.2008) entire document	1-10
Y	US 2010/0093306 A1 (HWANG et al.) 15 April 2010 (15.04.2010) entire document	1-10
Y	US 2006/0056419 A1 (EICHLER et al.) 16 March 2006 (16.03.2006) entire document	3, 8
Y	US 2008/0091831 A1 (ROSENBERG) 17 April 2008 (17.04.2008) entire document	4, 9
A	US 2010/0261448 A1 (PETERS) 14 October 2010 (14.10.2010) entire document	1-10
A	US 2009/0227225 A1 (MITCHELL, JR. et al) 10 September 2009 (10.09.2009) entire document	1-10

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"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

09 July 2013

Date of mailing of the international search report

18 JUL 2013

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774