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(71) Applicant and

(72) Inventor: ROUJINSKY, John [IL/IL]; 26 Zalman Shazar
Street, 42493 Netanya (IL).

(74) Agent: REINHOLD COHN AND PARTNERS; P.o.b.
4060, 61040 Tel-Aviv (IL).

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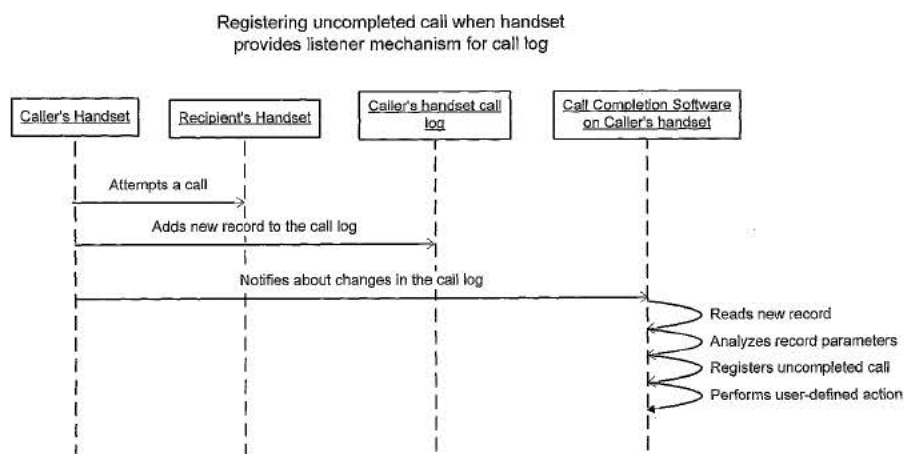
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FROM A TELECOMMUNICATION DEVICE



(57) Abstract: A calling subscriber device (11, 20) capable of operating over independent first (24) and second (25) communication channels registers unanswered outgoing telephone calls made over the first communication channel (24) by periodically reading a call log (22) stored in a memory (26) of the device (11, 20), compiling a list of unanswered outgoing calls over the first communication channel (24), and processing the list of unanswered calls to trigger automatically an action for enabling communication to be initiated over the first communication channel at a later time. Such action may include alerting the called subscriber device (12) that the calling subscriber had tried to initiate a call that was unanswered over the first communication channel (24). This allows call completion without the need for a voicemail server and is particularly beneficial for PTT telephones that receive an indication that a target PTT device (12) is unavailable where conventionally the target device (12) has no way of knowing that the call was originated.

METHOD AND SYSTEM FOR AUTOMATIC CALL COMPLETION OF UNANSWERED CALLS MADE TO OR FROM A TELECOMMUNICATION DEVICE

FIELD OF THE INVENTION

This invention relates generally to the registration of unanswered calls in a cellular or mobile telephone system.

BACKGROUND OF THE INVENTION

5 A well-known feature of cellular telephone systems is the registration of unanswered calls. For the purpose of this application, an 'unanswered' call is a call where there was no communication available between the calling party ('caller') and the called party ('callee') for any of the following reasons:

- a. Out of coverage
- 10 b. Phone turned off
- c. Network problems
- d. Callee's device is busy

Thus, within the context of the following description and the appended claims, the term 'unanswered' refers both to missed calls, which were received but were not
15 answered owing, for example, to the called party's inability to respond; as well as to calls that were not received owing, for example, to a communication failure. An unanswered call can be also a waiting call that has not been picked up. It is therefore to be understood that within the context of the invention and claims the term 'unanswered' can refer to any call that was not answered for any of the above reasons.

20 If a call cannot be established for one of the above reasons a-d, it is known to provide the callee with some audio/visual feedback and to add an appropriate record to the call log of the caller. Such feedback is commonly provided in cellular telephones, for example. If the caller then wishes, he may manually retry the call at the push of a button or he may choose to communicate via different media, for example, via SMS.

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Likewise, if the callee does not reply to a call, his cellular telephone can log the number of the caller and display it on a screen of his cellular telephone. If the callee of the non-answered telephone call wishes, he can dial the number displayed at the push of a button and initiate a call at his leisure to the person who tried unsuccessfully to call him; or he too may choose to communicate via different media, such as SMS.

In order to complete unsuccessful communication between caller and callee various call completion systems have been proposed. Thus Voice Mail Systems (VMS) are well-known for mobile and landline telephone systems, whereby a calling party can leave a message in the event that the called party is unavailable for any reason. Voice mail is a service that is offered by the cellular (or other) telephone provider and usually costs the subscriber an extra service fee. In addition to the service fee, it also requires that the calling party call his voice mail server and this, too, costs money. Voice mail systems usually provide a convenient way to initiate call back to the caller thus completing the initial communication.

By way of example, US Pat. No. 6,754,316 assigned to Varicom Communications Ltd. Tel-Aviv, Israel discloses a method and apparatus for registering unanswered telephone calls. The method includes directing the unanswered call to an external server, recording details of the calling telephone, including the telephone number of the calling telephone (caller ID), the time and the date of the call, and notifying the called telephone of the details of the unanswered telephone call. Another known call completion system allows the sending of an SMS message to a recipient via an external server indicating that the caller has attempted an unanswered call. Upon receiving the SMS message, the recipient can initiate a call back to the caller with the push of a button thus completing the initial communication. An example of such a system is the "Who Called?" service provided by Comverse Ltd. of Tel Aviv, Israel which conveys to a cellular telephone information relating to an unanswered call, including the telephone number of the calling party and the date and time of the missed call. Also known are Push-to-Talk (PTT) systems allowing subscribers to effect wireless communication using a portable device having a push-to-talk actuator and a display that lists the names of registered subscribers. Voice communication proceeds in a half-duplex mode in which only one subscriber talks, i.e. transmits, at one time while holding down a PTT actuator. The recipient of the voice communication is determined

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by the calling party selecting the recipient from among a list of registered subscribers. It is also possible for the calling party to transmit the voice communication simultaneously to a plurality of other subscribers by selecting a group icon that defines a plurality of individual subscribers to receive the communication.

5 Unanswered PTT calls are of particular significance to iDEN systems. iDEN is an acronym for Integrated Digital Enhanced Network developed by Motorola. iDEN allows PTT calls to be made over a first cellular network while permitting regular cellular telephone calls over a second cellular network that is in effect completely separate and independent of the first network. When a PTT call is initiated in iDEN
10 over the first network and the callee is busy with a phone call over the second network or is not available (either owing to inadequate coverage, or because the device is turned off), the caller gets the same reply from the system "user is not available" over the first network. Hence he is not able to determine the actual reason for call failure. The caller might erroneously assume that the recipient is out of coverage, that the phone is
15 switched off, or that there is a network problem. This is a big concern of iDEN operators since any apparent loss of communication reduces customer satisfaction. Also, since no voicemail system or waiting call feature currently exists for PTT calls in iDEN, the recipient has no indication that a call was attempted.

Call completion systems commonly register unanswered calls via equipment
20 centrally connected to the network or via telephony switches. This requires the use of expensive equipment as well as processing of a large amount of signaling events, thus raising scalability and high availability issues and leading to further expenses.

It has also been proposed to use the "SIM Application Toolkit" on the cellular handset of the caller to allow for call completion of busy subscriber (CCBS). The SIM
25 Application Toolkit resides in the SIM card of the cellular handset and defines how the card should interact with the outside world and extends the communication protocol between the card and the handset.

Disadvantages of this approach include:

1. Only certain SIM cards support SIM applications;
- 30 2. Operator needs SIM vendor cooperation in order to insert the application into the SIM;

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3. Operators have to provide subscribers with appropriate SIM cards including the application. This introduces costs and creates logistical problems where an existing subscriber has to replace SIM card;

4. Size and feature set of such applications are very limited owing to memory limitation of SIMs (usually 64-128Kb). This limitation is particularly acute in the case where more than one SIM Toolkit application is needed.

US 2005/164682 discloses a push-to-talk (PTT) communication system wherein an initial voice message associated with the initial PTT incoming call to the called party is temporarily stored at a communication application server and is not transmitted to the called party's mobile terminal. The called party is informed of an incoming call by an alert message from the communication application server causing the called party's mobile terminal to provide an alert. The called party may elect one of several options upon being alerted of an incoming call including transmitting a signal requesting the voice message be played.

US 2003/228006 discloses a method and apparatus for registering unanswered telephone calls. The unanswered call is directed to an external server, which records details of the calling telephone, including the telephone number of the calling telephone (caller ID), the time and the date of the call, and notifies the called telephone of the details of the unanswered telephone call.

US Patent No. 6,259,672 discloses a method of providing call completion by way of delayed communications within a communication system by detecting selection of simultaneous transmission of a message on a communication resource and recording at least a part of the message, yielding a recorded message. A busied resource may be monitored for a free status, thus allowing call completion by transmitting the stored message when a previously busied resource becomes free. The transmitting may begin before the completion of the transmission on the first busied resource.

Likewise, reference is made to my previous WO2007/020627 published February 22, 2007 describing a method and system for obtaining feedback from at least one recipient via a telecommunication network. A communication device has a messaging client in bi-directional communication with a messaging server for receiving one or more events relating to a recipient receiving or responding to a media message sent by a communication device. A Group Management Server stores definitions and

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properties of registered users and user groups of the system, and a templates server stores message templates for access by communication devices connected thereto.

The routing of telephone calls via alternative paths is also known. For example, WO06/129296 (Merlin) discloses a method and device for enabling alternative tele-
5 phony connections, wherein a connection controller coupled to a PSTN device is adapted to receive information corresponding to a called number to which a PSTN device is intending to connect. Upon receiving the information, the connection controller is adapted to automatically search a database for an alternative VOIP destination associated with the called number, to check if the alternative route is
10 available and, if so, to re-route the call. Such re-routing typically serves to convey calls via the less expensive VoIP channel while allowing the PSTN number to be originated and to this end mitigates against the sending of the call over the originating channel.

All of the above mentioned references are incorporated herein by reference.

When a call is made from a source device to an available target device via PTT,
15 the call bursts in by way of sounding an audible buzzer which alerts the target subscriber to the new call. The very act of sounding the buzzer in effect completes the call, and provides the target subscriber with the identity of the source subscriber so that he can call back later if he is not immediately able to take the call for any reason.

But in iDEN if the target device is out of coverage or if the target device is busy
20 on the telephony channel, no signal will reach the target device to provide the audible alert. In either case, the PTT source device merely receives an indication that the target device is unavailable but has no way of knowing the cause. Specifically, if the target device is busy on the telephony channel owing to the independence between the PTT and the telephony channels in iDEN, no mechanism exists at the target device to inform
25 the PTT channel that the telephony channel is in use. And if the PTT channel is out of coverage, the PTT call simply will not arrive. In either case, the target device has no way of knowing that the source device attempted to contact it or of informing the source device as to the reason for the failed call. Even when the target is busy with a PTT call or Packet Data communication, although the caller does know the reason for the call
30 failure, the target still does not know that a call attempt has occurred.

It would clearly be desirable to provide a method, improved handset and software module facilitating call completion in a communication system based on

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registration of an unanswered call on the calling device without requiring a SIM card for its implementation. Preferably, this should provide sufficient capacity for improved feature set and allow operation on a variety of phone models. Such a facility would be of particular benefit for iDEN network, which provides its users the benefits of a
5 trunked radio and a cellular telephone.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a system and method facilitating call completion in a mobile communication system.

This object is realized in accordance with a first aspect of the invention by a
10 method for automatically registering unanswered telephone calls made over a first communication channel from a calling subscriber device capable of operating over independent first and second communication channels, the method comprising:

periodically reading a call log stored in a memory of said device;

compiling from said call log a list of unanswered outgoing calls over the first
15 communication channel; and

processing the list of unanswered calls to trigger automatically a predetermined action so as to enable communication between a calling subscriber device and a called subscriber device to be initiated at a later time.

According to another aspect of the invention, there is provided a telephone
20 subscriber device adapted to automatically register unanswered telephone calls made from said handset over a first communication channel, the handset comprising:

a first communications interface for facilitating calls over the first communication channel;

a second communications interface for facilitating calls over a second communication channel;
25

a memory storing a call log of all calls initiated by said handset over the first communication channel; and

a processor coupled to the memory for periodically reading the call log, compiling from said call log a list of unanswered outgoing calls over the first
30 communication channel; and triggering automatically a predetermined action so as to

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enable communication between a calling subscriber device and a called subscriber device to be initiated at a later time.

In accordance with some embodiments of the invention, the predetermined action may be user-defined.

5 In accordance with some embodiments of the invention, the predetermined action may include conveying a notification to the respective called subscriber device over the second communication channel together with details of the calling subscriber device for alerting the called subscriber device that the calling subscriber had tried to initiate a call that was unanswered over the first communication channel. A particular
10 non-limiting example of such an application is for facilitating call completion in a Push-to-Talk (PTT) communication system. iDEN is an example of a PTT network for which such a call completion is applicable. However, iDEN is mentioned by way of example only owing to its current popularity, it being understood that the invention is not limited to any specific PTT protocol and is thus equally suitable for use with other protocols
15 such as GSM's more recent push-to-talk standard and Qualcomm's Q-chat, for CDMA (IS-95). Thus, the invention allows call completion without the need for a voicemail server and is particularly beneficial for PTT telephones that receive an indication that a target PTT device is unavailable where conventionally the target device has no way of knowing that the call was originated.

20 BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, various embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a pictorial representation of a communication system that allows call
25 completion between a caller device and one or more recipient devices according to a non-limiting embodiment;

Fig. 2 is a block diagram showing functionally a PTT telephone allowing call completion according to a non-limiting embodiment of the invention;

Fig. 3 is a sequence diagram showing how an uncompleted call is registered in a
30 caller device so as to facilitate subsequent completion according to one embodiment of the invention;

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Fig. 4 is a sequence diagram showing how an uncompleted call is registered in a caller device so as to facilitate subsequent completion according to another embodiment of the invention;

Fig. 5 is a sequence diagram showing how a sending device may notify a
5 recipient device of an unanswered call in accordance with one embodiment of the invention; and

Figs. 6 to 11 are sequence diagrams showing how a sending device may notify a recipient device of an unanswered call in accordance with alternative embodiments of the invention.

10 DETAILED DESCRIPTION OF EMBODIMENTS

Fig. 1 shows pictorially a system 10 for facilitating call completion in a mobile communication system between a source telephone 11 and a target telephone 12 interconnected via a wireless network 13 according to an illustrative embodiment. The wireless network 13 may be a cellular telephone network or any other network that
15 permits full-duplex or half-duplex PTT communication. If desired, PTT can be implemented on the cellular handset using the PoC Standard of the Open Mobile Alliance™ as described in their draft Standard OMA-RD_PoC-V1_0-20031204-D available from their website and incorporated herein by reference. Many of the features supported by this standard are amenable to implementation by one skilled in the art
20 based on the information in this standard. Alternatively, the Integrated Digital Enhanced Network developed by Motorola may be used to achieve PPT communication. The system 10 may also include a server 14 that can be called by a handset to direct suitable messages to a callee device.

It is to be understood that the system 10 is shown schematically so as not to
25 obscure the essential features of the present invention, which reside not in the telephone infrastructure but in the telephone handsets. Therefore, it will be appreciated that other telephony systems may also be used such as VoIP, smart PSTN telephones and other wireless telephones. Likewise, it is envisaged that the invention will find application with hybrid telephone networks that include telephones of different types that inter-
30 communicate, for example via gateways as is well known in the art. Similarly, although the invention is described as being particularly beneficial for use with PTT handsets

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(particularly those operating under iDEN), this is not intended to be limiting and the invention may also be used with non PTT handsets and well as PTT handsets that operate under different cellular or other wireless networks. More specifically, the only essential requirement of the invention is that in order for a telephone handset to operate according to the invention it must have a memory that stores a log of outgoing or incoming calls and the ability to discriminate between successful and failed calls.

Fig. 2 is a block diagram showing the functionality of a telephone handset 20 according to a non-limiting embodiment. In this depicted example, the handset 20 is assumed to be a cellular telephone since most of the functionality shown therein (apart from the call completion software, which is the core feature of the invention) is already provided as standard in cellular telephones. But, as noted above, it may be any other suitably modified telephone. Likewise, according to a particularly preferred and advantageous embodiment, it may be a cellular or other wireless telephone having PTT ability and may operate under iDEN. However, although many of the advantages of the invention are particularly applicable in the case of PTT handsets, the invention may also be applied to non-PTT devices. The handset 20 has a processor 21, which is coupled to a call log 22, an address book 23, a first communications interface 24 for facilitating PTT calls, a second communications interface 25 for facilitating telephone calls, a memory 26, display 27 and a user interface 28. As noted above, in mobile telephones designed to operate over the iDEN network, the first and second communications interfaces facilitate PTT and cellular telephone calls, respectively, over independent cellular channels. All of these are standard features in many available cellular and other telephone handsets and so are not described in further detail. Within the context of the present invention and the appended claims, the term "independent" when applied to the two different communication channels to which the subscriber device is coupled is not intended to preclude the possibility of shared data between the two channels, such as control or signaling data, for example. Rather what is meant is that the two channels are used to convey messages in an independent manner such that messages may be transmitted using different protocols along each channel without a communication failure in one channel necessarily being capable of being monitored by the other channel.

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The user interface 28 includes a numeric keypad, scroll keys and command keys as are well-known in telephone handsets. Optionally, these keys may operate under control of software stored in the handset for controlling the manner in which unanswered calls are processed. Thus, in accordance with one basic approach, the handset may be pre-programmed to convey a notification to the called subscriber device over the second communication channel as described above.

However, the user interface 28 may allow for the calling subscriber to select different default options. For example, on receiving notification that a PTT call made over the first communication channel was unanswered, he may prefer to call the target subscriber over the second communication channel. He may select that this be done automatically or in response to a suitable prompt. Alternatively, he may prefer to be prompted to call again after a time interval that may itself be either pre-programmed or selected by the calling subscriber using the user interface 28. When so prompted, he may then call the target subscriber manually over either the first or the second communication channel using the user interface 28. Alternatively, the channel over which delayed communication is to be attempted may itself be pre-selected by the user under control of the user interface.

The user interface 28 also allows for the calling subscriber to select or define different forms and/or formats for the notification that is sent to the target device. Thus, in accordance with some embodiments he can select the protocol under which the notification is sent, for example, SMS or as packet data. In accordance with some embodiments he can select the wording of the notification based on the telephone/PTT number of the called subscriber. For example, he might send a junior member of staff a curt message: 'please phone me'; while to a client he might send a more polite message of the form: 'I tried to get hold of you; let's touch base when you're available'. Likewise, he might pre-select a language of the notification based on the assumed or known preference of the called subscriber; and so on.

The uniqueness of the invention resides in novel call completion software that is stored in the memory 26 of an initiating device and which is operated under control of the processor 21 to read and process the call log 22 so as to compile a list of unanswered calls and to process the list of unanswered calls and trigger automatically a user-defined action so as to enable communication between a calling handset and a

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called handset to be initiated at a later time. For example, a user of a PTT device who initiated an unanswered call may be prompted to complete the unanswered call at a later time. Such prompting may be achieved without requiring manual user initiation. Alternatively, the call completion software may attempt to re-dial in a manner that is transparent to the user and requires no interaction thereby. This functionality is achieved in the handset itself without any requirement for an external server such as a voice mail server, as has been proposed previously. Nor does it require the use of a SIM card or any other proprietary add-on; nor does it require substitution of existing components of the handset since the software may be downloaded to the memory 25 of an existing handset in known manner.

Having briefly described the infrastructure and functionality of the various components in a system according to the invention, there will now be described with reference to Fig. 3 to 11 various scenarios according to the invention where call completion may be delayed following an unanswered call. As will be seen, in different embodiments such call completion is typically initiated by the calling party, whose subscriber device is provided with custom software (to be described) for logging unanswered calls and data identifying the respective called subscriber device. However, in some embodiments, the calling subscriber device may send via an alternative channel data to the called subscriber device for enabling the called subscriber to detect that the calling subscriber tried unsuccessfully to make contact. The called subscriber may then initiate call completion by calling the original calling subscriber device. What all embodiments have in common, however, is the ability for a communication device to periodically read a call log stored in a memory thereof, to compile from the log a list of unanswered outgoing calls over a first communication channel, and to convey a notification to the called subscriber device over a second different communication channel together with details of the calling subscriber device for alerting the called subscriber device that the calling subscriber had tried to initiate a call that was unanswered over the first communication channel. Moreover, this is done utilizing existing assets of the handset and does not require either modification of the handset software or special integration with it, thus enabling deployment of this solution on legacy handsets.

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As will be seen, call completion itself may be manually initiated by the original calling subscriber or by the original called subscriber; or it may be initiated automatically by either device. The trigger can be a message, such as an SMS message that is sent by the calling device to the called device, and which by virtue of its being conveyed via a different medium and routed via an SMS server, may reach its target even in cases where voice communication is not possible. 'SMS' is an acronym for Short Message Service, which is well known and details of which are therefore not provided.

Thus, the following scenarios will describe some non-limiting examples of applications of the invention, usage scenarios and implementations following which particular benefits of the invention for the iDEN network and more general benefits will be presented.

1. Applications of the invention (examples of user-defined action)

1.1. Based on registration of unanswered calls on the caller's handset:

1.1.1. Automatic issuing of predefined message to the recipient with information about call attempt and invitation to call back. The message can be delivered via variety of protocols/systems of which some non-limiting examples include:

1.1.1.1.SMS

1.1.1.2.WAP Push

1.1.1.3.MMS

1.1.1.4.Instant Messaging

1.1.1.5.Voice Messaging

1.1.1.6.Proprietary push message to an application residing on the target device (for example, Java application)

1.1.2. Reminder to call the recipient again at a later time

1.1.3. Automatic prompt for a user to record and send customized voice/SMS message to the recipient or to remind at customizable period of time.

1.2. Based on registration of missed calls on the recipient's handset:

1.2.1. Automatic reminder to call recipient back

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2. Usage scenarios

2.1. Automatic notification of recipient of a call attempt:

2.1.1. Caller initiates a call to the recipient

2.1.2. The call does not complete, for example because the recipient is out of coverage

2.1.3. Software running on the caller's handset registers uncompleted call and issues a notification (for example SMS) to the recipient

2.1.4. At a later time recipient receives the notification and calls the recipient back

2.2. Reminder for calling again:

2.2.1. Caller initiates a call to the recipient

2.2.2. The call does not complete, for example because the recipient is out of coverage

2.2.3. Software running on the caller's handset registers uncompleted call and starts a timer for a configured amount of time

2.2.4. When the timer fires, the caller is prompted with a dialog allowing retry of the call.

2.3. The same as 2.2, but instead of prompting the caller, the software automatically performs additional attempt(s)

3. Implementation:

3.1. The call completion software that analyzes the call log can be developed in variety of platforms (depending on the handset support): J2ME, Brew, Symbian, Microsoft .Net, RIM, etc. These platforms are all known *per se* and so are not described herein in further detail.

3.2. Implementation of the solution requires access to the call log

3.3. In some handsets there is a mechanism that allows registering a listener for call log events. In that case the handset provides a trigger for the process.

3.4. In handsets not supporting such a listening mechanism, the software constantly reads the log file and analyses its record to find calls that are not completed.

3.5. Notification to the recipient can be done either directly from the caller's handset (for example by sending MO (mobile originated) SMS) or via a server that sends the caller a message by any available means to notify the recipient. It will

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thus be understood that the notification may be effected using a different communication channel than the call itself.

4. Particular benefits of the invention for iDEN carriers/operators

- 4.1. In iDEN network, when a caller attempts a PTT call to a recipient device which
5 is busy in a phone call or packet data activity, the caller is notified that the
recipient is not available, but the recipient has no information that the caller
attempted a call (neither call waiting nor voice mail services currently exist for
PTT calls in iDEN). Not only this, but the caller himself has no indication as to
the reason why the called failed. Thus, he is unable to differentiate between the
10 case where the called party was out of coverage or switched off and the case
where the called party was engaged in a communication on the telephony
channel.
- 4.2. The invention allows automatic notification to a recipient of a call attempt by
the caller and provides foundation for a call completion system.
- 15 4.3. In iDEN network there is the possibility to limit the handset to PTT calls only,
without ability to initiate/receive phone calls. Absence of phone capabilities
results in absence of SMS and voice mail services. The method according to the
invention may be used in conjunction with an IP based voice messaging system,
such as those of Netalizer Ltd. (as described in above-mentioned
20 WO2007/020627) to provide voice mail capability for iDEN PTT-only
handsets.
- 4.4. An additional scenario where the notification is very valuable is when the
recipient is roaming. Roaming services do not necessarily include PTT (for
example there is no roaming for PTT in MIRS). This means that an iDEN
25 subscriber can receive phone calls but cannot receive PTT calls while roaming.
A notification delivered via SMS will reach a roaming recipient and will allow
establishment of otherwise lost communication.
- 4.5. Another benefit of the invention for iDEN carriers is completion of unanswered
waiting calls. Most iDEN handsets do not indicate in the call log that the call,
30 while being unanswered waiting call, is a missed call, thus reducing possibility
for the called subscriber to notice such a call and making a call back. The

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invention allows completion of such calls in the same way that missed calls are handled.

4.6. The alternative network-based approach for registering uncompleted PTT calls requires significantly higher investment in both hardware and software.

5 **5. General benefits of the invention**

5.1. Handset-based solution reduces costs and does not require expensive equipment and central processing servers.

5.2. The software according to the invention can be downloaded to variety of phones regardless of SIM version and size.

10 5.3. Since memory on the device available for applications is typically two orders of magnitude larger than on SIM, the invention may provide a client-based application having an extensive feature set.

5.4. The invention allows call completion of all types of unanswered calls regardless of whether they were missed or could not be received owing to communication
15 failures, poor coverage and so on.

5.5. For the caller:

5.5.1. Automatic notification of recipient of a call attempt by the caller with invitation to call back. The notification can be delivered via variety of messaging solutions including but not limited to SMS, MMS, WAP
20 Push, Email, Instant Messaging, Voice Messaging, etc.

5.5.2. Reminder to call recipient again within specified amount of time helps the caller to establish communication with the recipient at a later time.

5.5.3. Automatic establishment of communication with the recipient ("redial") within specified amount of time (the software can perform multiple
25 dialing attempts during that time)

5.6. For the recipient

5.6.1. Being notified of call attempts otherwise not known by the recipient

5.6.2. Reminder to complete calls that previously were not answered by the recipient (also known as "missed calls") helps the recipient to establish
30 communication with the caller at a later time.

Having described the infrastructure and general principles of the call completion software, there will now be described some practical implementations with reference to

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the call flow diagrams shown in Figs. 3 to 11, which are sufficiently detailed to obviate the need for further detailed description.

Fig. 3 is a sequence diagram showing how an uncompleted call is registered in a caller device having a user call log mechanism so as to facilitate subsequent completion according to one embodiment of the invention. The user call log mechanism refers to the ability for a user of the device to read the call log at will. Such user call log mechanisms are commonly provided on cellular telephones by way of a user interface that allows respective call logs of outgoing, incoming and missed calls to be scrolled. Thus, as shown in the figure, when the calling subscriber device attempts to make a call to a called subscriber device, a new record is added to the call log of the calling subscriber device. Call completion software in the calling subscriber device reads the new record, analyzes the record parameters and registers an uncompleted call. This may be done, for example, by determining that insufficient time elapsed after initiation of the call prior to hang-up to have allowed for the call to be answered. By way of particular example, the inventor has discovered that in the iDEN network, the very act of sounding a buzzer in a called subscriber device that is within coverage and not engaged completes the call and registers a non-zero call time in the call log of the calling subscriber device even if the called subscriber does not answer. But if the called subscriber device is either not within coverage or is engaged on the telephony channel, thus preventing the call from being completed, then the call time logged in the call log of the calling subscriber device will be zero. Upon determining that a call was uncompleted, the call completion software performs some user-defined action as will be described in more detail below.

Fig. 4 is a sequence diagram showing how an uncompleted call is registered in a caller device having no call log event mechanism. Thus, when the calling subscriber device attempts to make a call to a called subscriber device, a new record is added to the call log of the calling subscriber device. Call completion software in the calling subscriber device reads the new record, analyzes the record parameters and registers an uncompleted call. Upon determining that a call was uncompleted, the call completion software performs some user-defined action as will be described in more detail below.

Fig. 5 is a sequence diagram showing how a sending device may initiate the sending of an SMS notification to notify a recipient device of an unanswered call in

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accordance with an embodiment of the invention. In the example shown in Fig. 5, the calling device conveys PTT calls over a first network via the first communication channel and has a stored address book that maps the PTT address of the called party to a corresponding address on a second communication network that transports data over the second communication channel. This address may be a regular cellular telephone number allowing an SMS notification to be conveyed in known manner; or it may be an IP address allowing a notification to be sent over the packet network. A similar approach may be employed also in the case that the calling device does not have a stored phone book or the phone book does not contain additional addresses of the called party, although in this case an external server is required that stores an address book that maps the PTT address of the called party to a corresponding address on the second network. The calling device sends the PTT address of the called party to the server and receives therefrom the corresponding cellular or IP address. Subsequent operations are as explained above. Alternatively, of course, the server may compile a suitable notification and forward it to the called party by any suitable additional network, possibly in accordance with a list of preferences pre-established by the called party.

Figs. 6 to 11 are sequence diagrams showing how a sending device may notify a recipient device of an unanswered call in accordance with alternative embodiments of the invention.

In Fig. 6, call completion software on the caller's handset looks up the recipient details based on the number called by the caller's handset so as to determine a corresponding number of the called party in a different network. By way of example, the caller may have tried to contact the called party using PTT and on receiving no answer may now establish the cellular network address of the called party. The software in the caller's handset now compiles an SMS notification, which is sent to the cellular server for conveying to the called party's handset in conventional manner with details of the calling party. In the figure, the notification sent to the called party's handset is shown as an SMS message conveyed over the cellular network, but it will be appreciated that the same principles may equally be applied to the compilation of other types of message sent over different networks such as text, email and so on sent over the IP network and to WAP Push messages sent over WAP as shown in Fig. 10.

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Fig. 7 shows an alternative scenario which is similar to that shown in Fig. 6 except that the call completion software on the caller's handset does not itself compile the SMS notification but rather sends a request to the cellular server to compile a suitable message providing data identifying the calling party and to convey the data to the called party's handset in conventional manner.

Fig. 8 shows an alternative scenario which is similar to that shown in Fig. 7 and depicts one particular manner for compiling the notification that is sent to the called party handset. Thus, the calling party handset stores a list of pre-compiled messages and the call completion software selects one of these messages for sending to the server together with data identifying the calling party for requesting the server to convey it to the called party's handset. In the figure, the messages are shown as pre-recorded voice messages and the server is a voice server; but it will be appreciated that the same principles may equally be applied to the compilation of other types of message using pre-compiled SMS messages, text, email, and so on.

Fig. 9 shows an alternative scenario which is similar to that shown in Fig. 8 except that the message is compiled by the server. Thus, the server stores a list of pre-compiled messages and is responsive to a request from the calling handset for selecting one of these messages for sending to the called party's handset together with details of the calling party. In the figure, the messages are shown as pre-recorded voice messages and the server is a voice server; but it will be appreciated that the same principles may equally be applied to the compilation of other types of message using pre-compiled SMS messages, text, email, and so on. Fig. 10 shows an alternative scenario, which combines features of embodiments described previously. As before, call completion software on the caller's handset looks up the recipient details based on the number called by the caller's handset so as to determine a corresponding number of the called party in a different network. The software in the caller's handset now compiles an SMS message with details of the calling party and sends the SMS message to the cellular server. In this case, however, the cellular server composes a message in a different format for conveying to the called party's handset via a different network. In the figure, the notification sent to the called party's handset is shown as a WAP Push message, but similar principles may be applied to the compilation of other types of message sent over different networks such as text, email, VoIP and so on sent over the IP network.

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The above description of illustrative, non-limiting embodiments has been given by way of an example. The above and other features of the invention including various novel method operations and a system and a device of the various novel components have been particularly described with reference to the accompanying drawings and
5 pointed out in the claims. It will be understood that the particular process and construction of parts embodying the invention is shown by way of an illustration only and not as a limitation of the invention. The principles and features of this invention may be employed in varied and numerous embodiments without departing from the scope of the invention as defined by the appended claims and equivalents thereof.

10 It should also be noted that while some features have been described pertaining to the calling subscriber device and other features have been described pertaining to the called subscriber device or to an external server, these features have been described to illustrate different ways of carrying out the invention. It will be appreciated by those skilled in the art where different features can be combined and while it is not practical
15 to discretely enumerate all possible combinations since they are too numerous, it is to be understood that the invention embraces all combinations within the scope of the claims.

Likewise, it is to be understood that while many features of the invention have been described with particular reference to a calling subscriber device that automatically processes its call log to produce a call-completion trigger, complementary features may
20 also be provided in the called subscriber device. This then allows the called subscriber device to process the notification sent by the calling subscriber device, extract the address of the calling subscriber device and provide a trigger to the called subscriber to complete the call.

It will also be understood that the invention is typically implemented by
25 software code that is readable by a handset or other communication device for executing the method of the invention. Such software may be an add-on program that is downloaded to existing telephones, thus allowing existing telephones to benefit from the invention. Alternatively, the software may be implemented as part of the telephone's operating system during manufacture. The invention further contemplates a machine-
30 readable memory tangibly embodying a program of instructions executable by the machine for executing the method of the invention.

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CLAIMS:

1. A method for automatically registering unanswered telephone calls made over a first communication channel from a calling subscriber device capable of operating over independent first and second communication channels, the method comprising:
5 periodically reading a call log stored in a memory of said device;
 compiling from said call log a list of unanswered outgoing calls over the first communication channel; and
 processing the list of unanswered calls to trigger automatically a predetermined action so as to enable communication between a calling subscriber device and a called
10 subscriber device to be initiated at a later time.
2. The method according to claim 1, wherein the predetermined action is selectable by the calling subscriber.
3. The method according to claim 1 or 2, wherein the predetermined action includes conveying a notification to the respective called subscriber device over the
15 second communication channel together with details of the calling subscriber device for alerting the called subscriber device that the calling subscriber had tried to initiate a call that was unanswered over the first communication channel.
4. The method according to claim 1 or 2, wherein the predetermined action includes calling the called subscriber device over the second communication channel.
- 20 5. The method according to claim 4, including re-dialing the called subscriber device in a manner that is transparent to the calling subscriber and requires no interaction thereby.
6. The method according to claim 1 or 2, wherein the predetermined action includes prompting the caller subscriber after a predetermined time interval to call the
25 called subscriber device.
7. The method according to any one of claims 1 to 6, including compiling said notification.
8. The method according to any one of claims 1 to 6, including conveying a request to an external server to compile said notification.

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9. The method according to claim 8, including sending to the external server data identifying the calling subscriber device and the called subscriber device for enabling the server to compile the notification and to convey the notification to the called subscriber device.
- 5 10. The method according to claim 8, including conveying the data to the server in a first protocol and conveying the notification from the server to the called subscriber device in a second different protocol.
11. The method according to any one of claims 7 to 10, wherein the notification is compiled by selecting a precompiled message.
- 10 12. The method according to any one of claims 7 to 11, wherein compiling the notification includes accessing an address book for mapping an address of the called subscriber device over the first communication channel to a corresponding address over the second communication channel.
13. The method according to any one of claims 7 to 12, wherein compiling the
15 notification includes selecting at least one of a format, or a protocol, or a language of the message based on an identity of the called subscriber.
14. The method according to any one of claims 1 to 13, wherein the telephone call is a Push-to-Talk (PTT) message initiated by the calling subscriber device over the first communication channel.
- 20 15. The method according to any one of claims 1 to 14, including prompting the called party to complete an unanswered call at a later time.
16. The method according to claim 15, wherein the prompt is produced automatically without requiring manual user initiation.
17. The method according to claim 14, wherein the unanswered call is a missed call
25 and the prompt is provided in the called subscriber device.
18. The method according to claim 17, wherein the missed call is an unanswered waiting call.
19. A computer program comprising computer program code means for performing the method of any one of claims 1 to 18 when said program is run on a computer.

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20. A computer program as claimed in claim 19 embodied on a machine readable medium.
21. A telephone subscriber device (20) adapted to automatically register unanswered telephone calls made from said handset over a first communication channel, the handset
5 comprising:
- a first communications interface (24) for facilitating calls over the first communication channel;
 - a second communications interface (25) for facilitating calls over a second communication channel;
 - 10 a memory (22) storing a call log of all calls initiated by said handset over the first communication channel; and
 - a processor (21) coupled to the memory for periodically reading the call log, compiling from said call log a list of unanswered outgoing calls over the first communication channel; and triggering automatically a predetermined action so as to
15 enable communication between a calling subscriber device and a called subscriber device to be initiated at a later time.
22. The telephone subscriber device according to claim 21, wherein the first communications interface is adapted to route PTT calls.
23. The telephone subscriber device according to claim 21, wherein the second
20 communications interface is adapted to route cellular telephony calls.
24. The telephone subscriber device according to claim 21, wherein the second communications interface is adapted to route VoIP telephony calls.
25. The telephone subscriber device according to any one of claims 21 to 24, including a user interface (28) for allowing the calling subscriber to select different
25 default options.
26. The telephone subscriber device according to claim 25, wherein the default options include at least of: a form or format or wording or language for the notification to be sent to the called subscriber.

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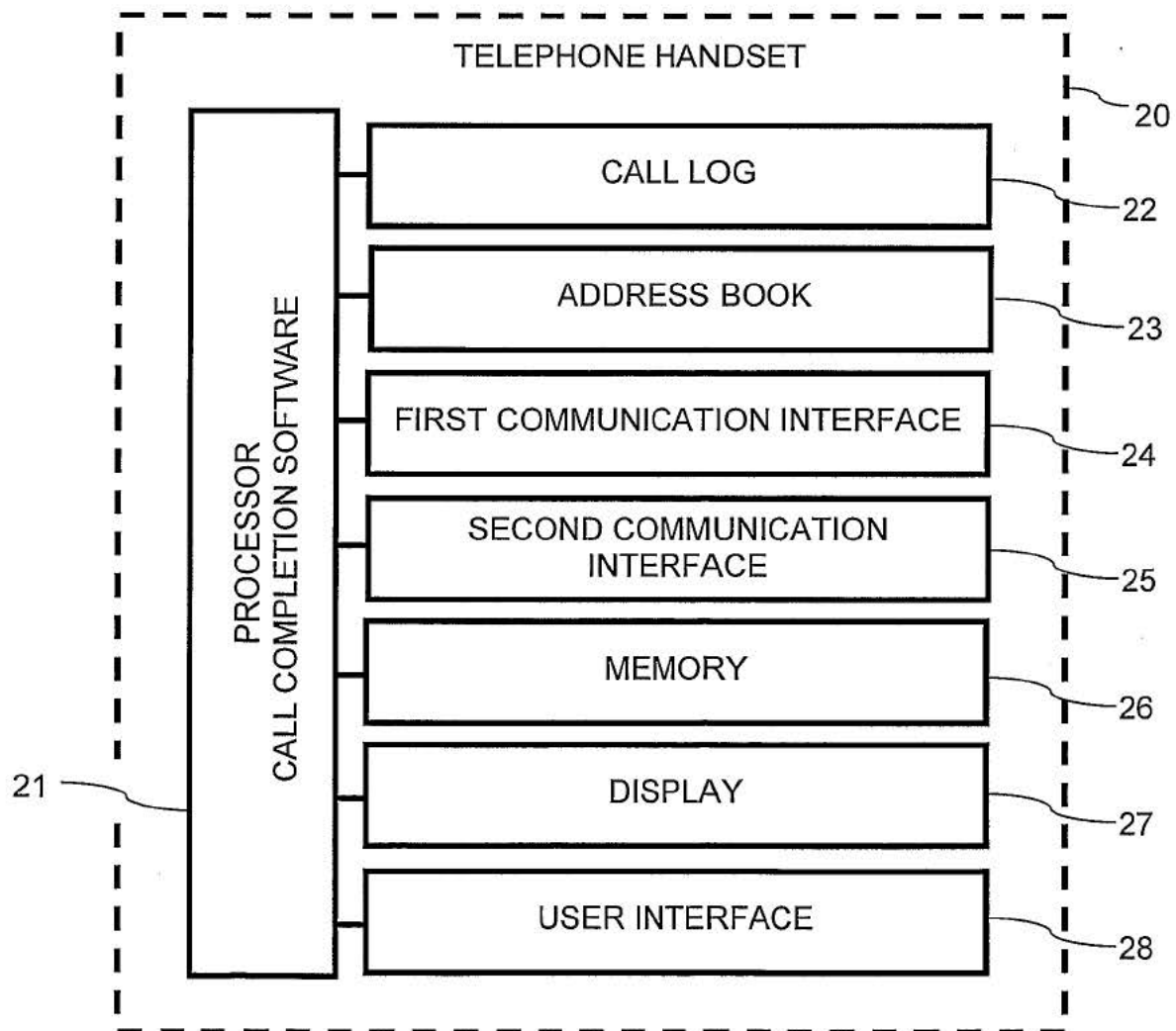
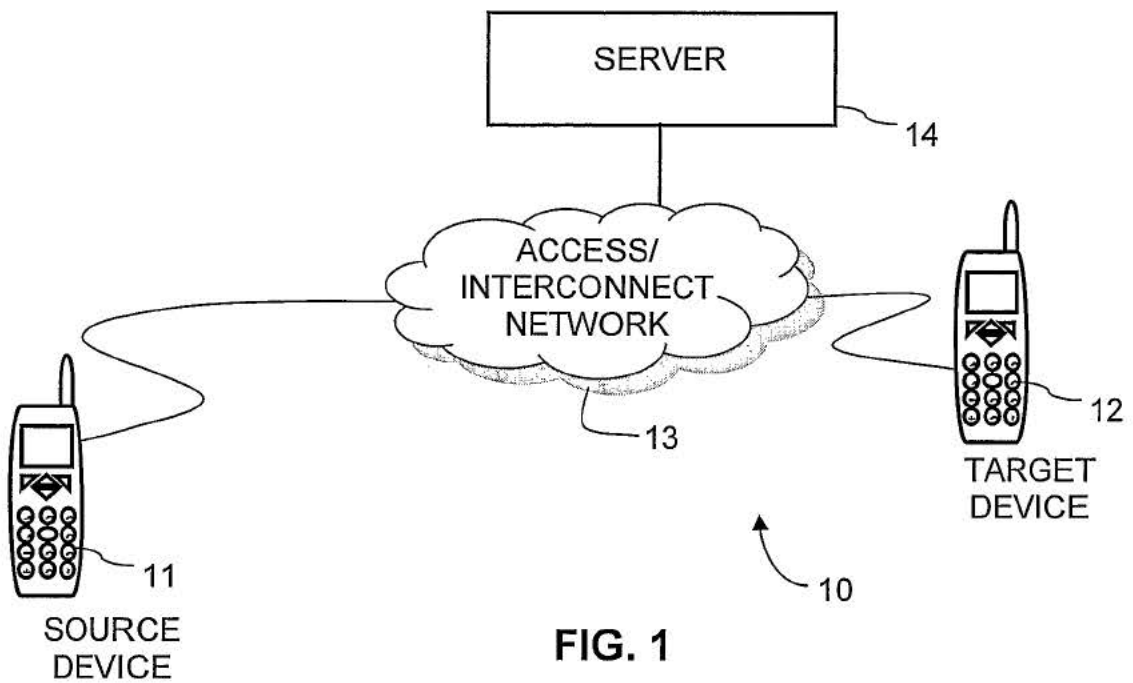


FIG. 2

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Registering uncompleted call when handset
provides listener mechanism for call log

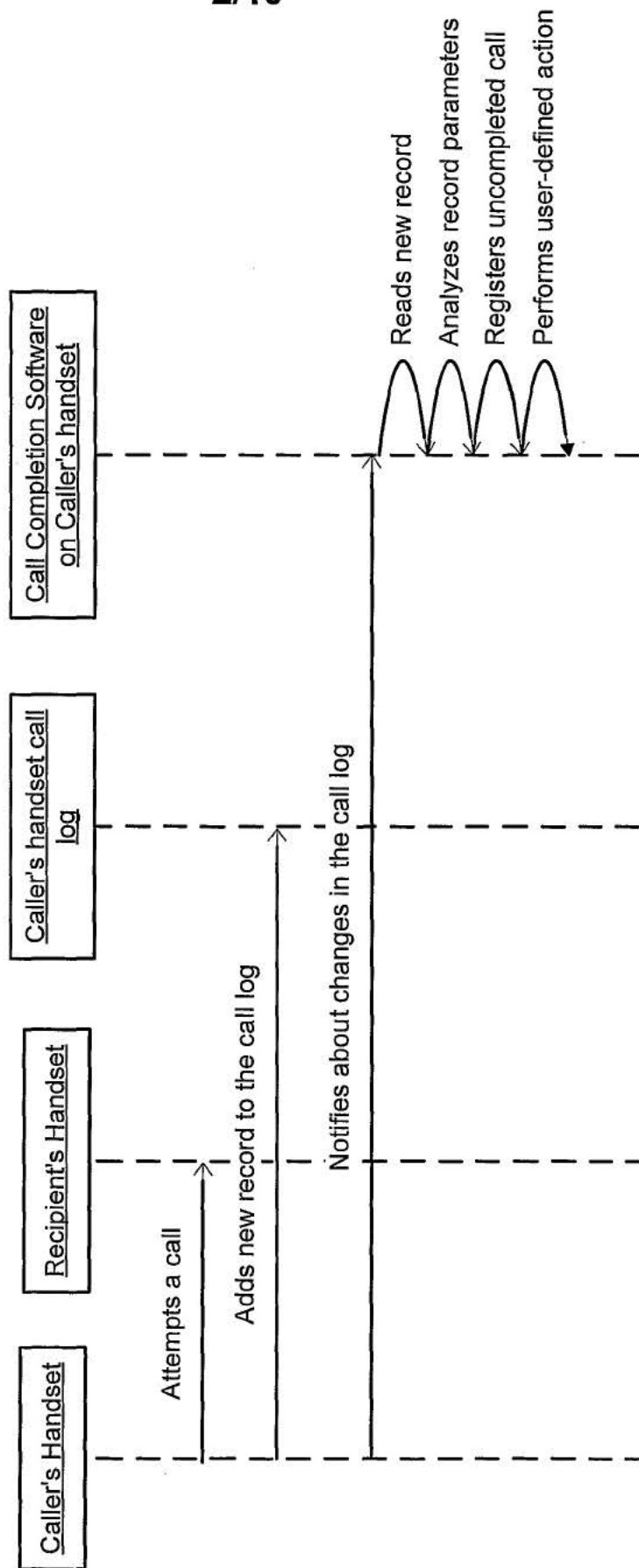


FIG. 3

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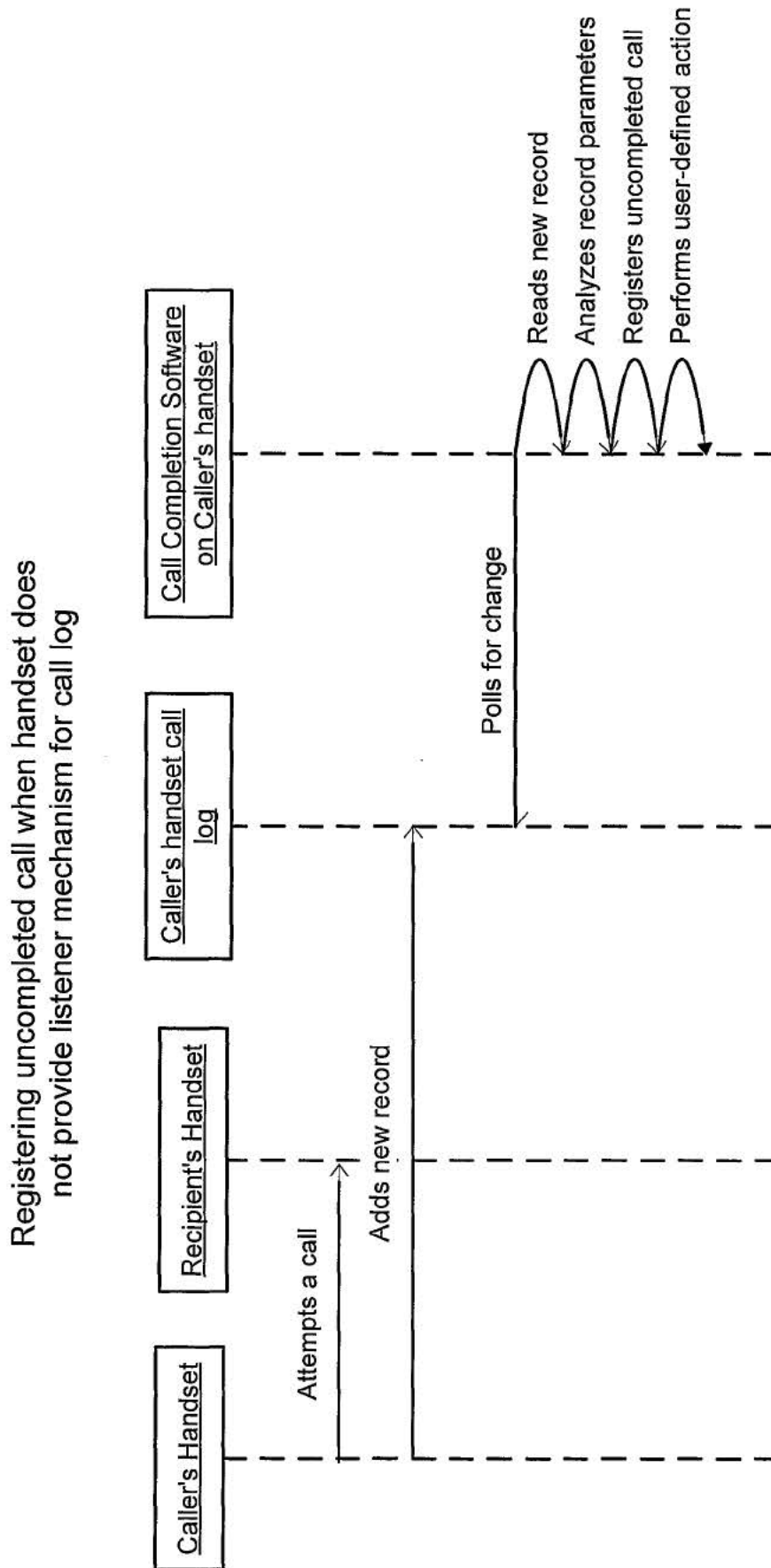


FIG. 4

Sending Automatic MO SMS message as a user-defined action

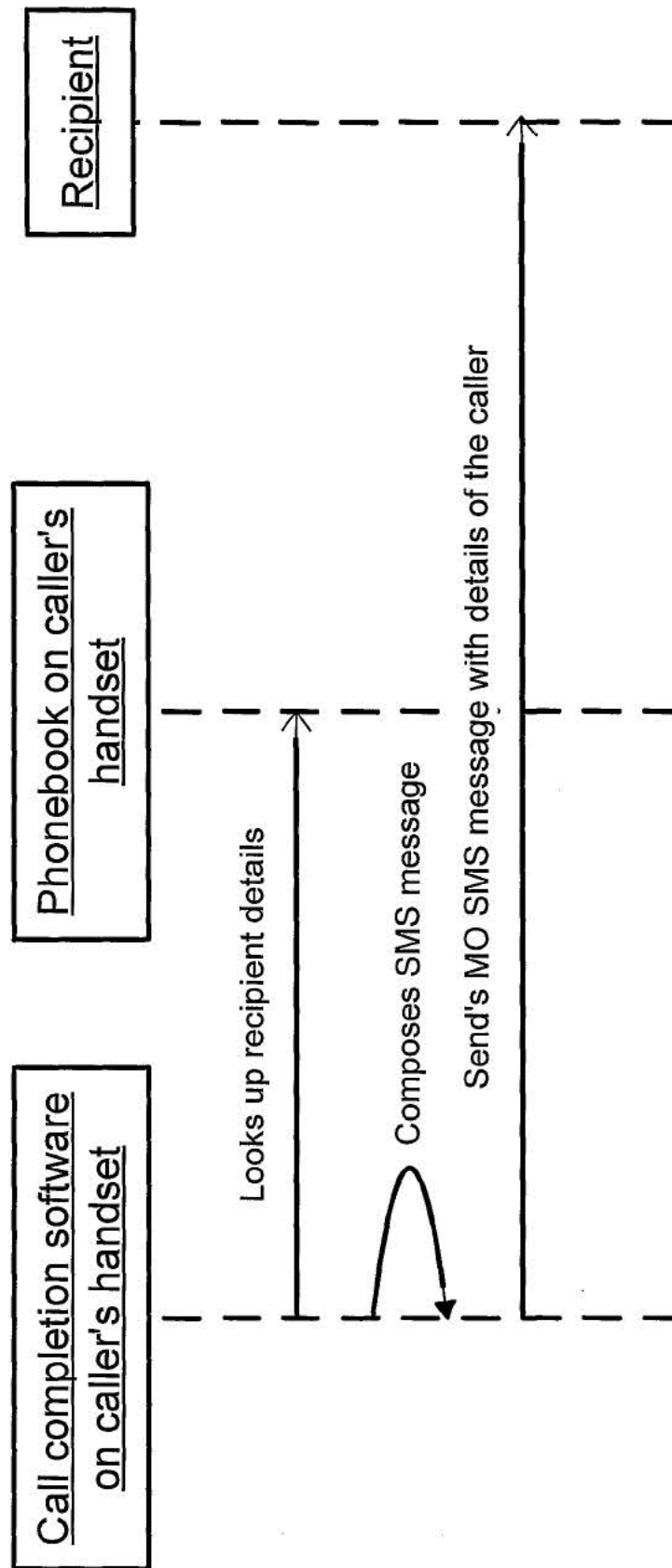


FIG. 5

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Sending Automatic MT SMS message as a user-defined action

1. Message is composed on the caller's handset

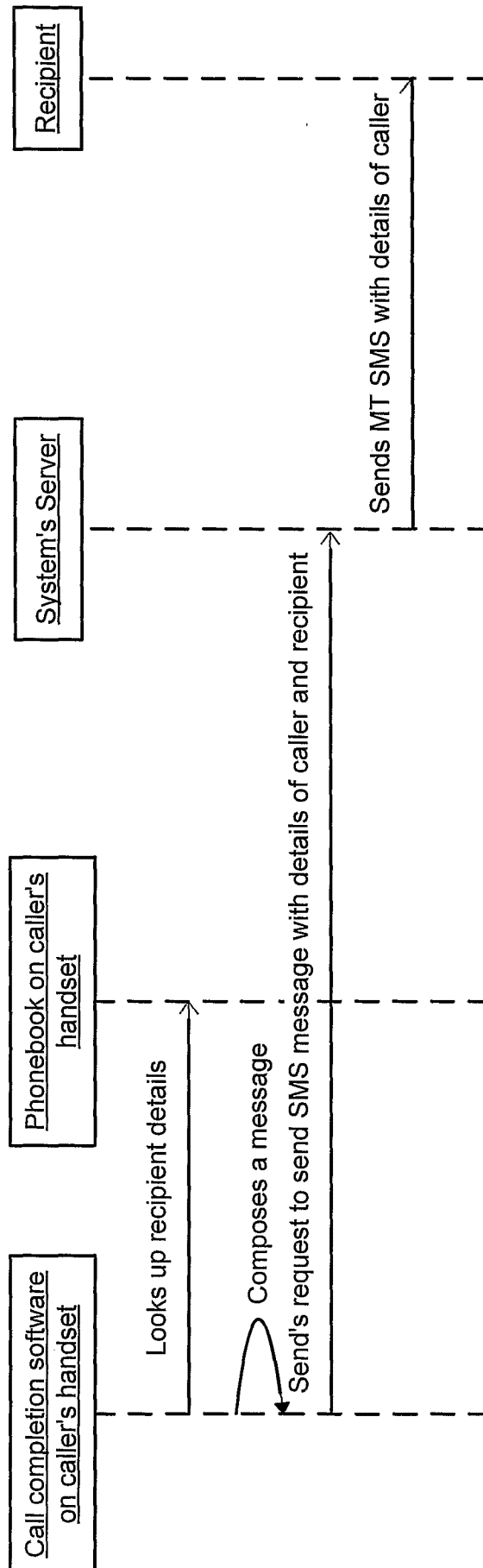


FIG. 6

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2. Message is composed on the system's server

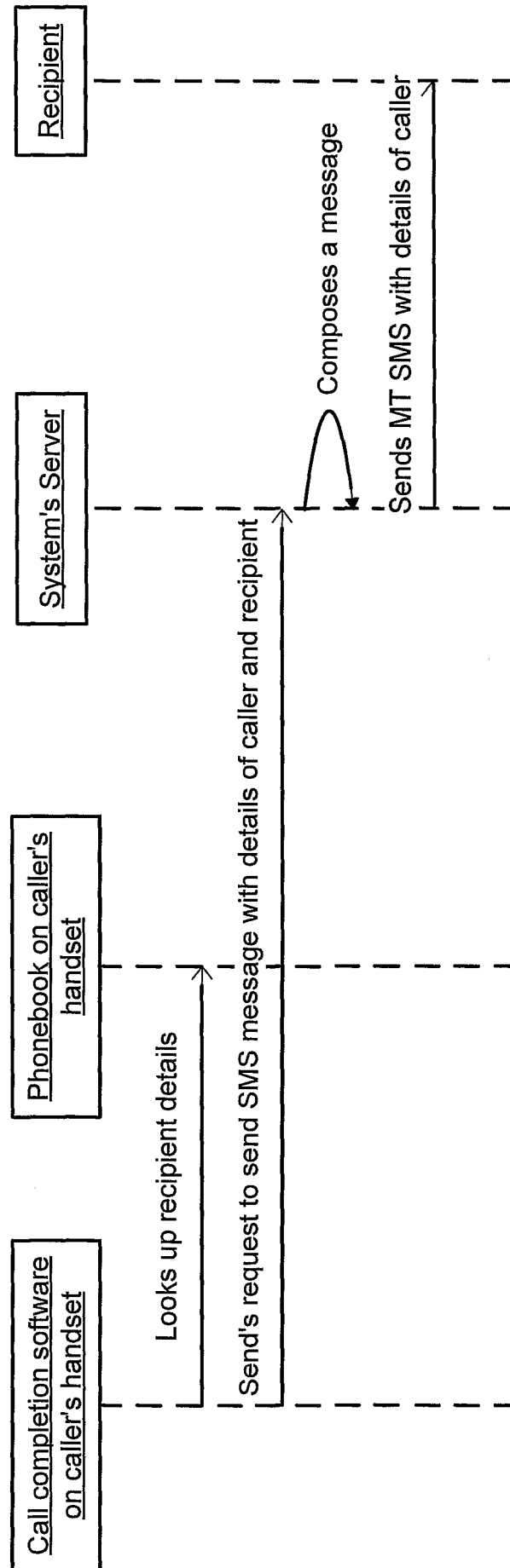


FIG. 7

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Sending Automatic voice message as a user-defined action

1. Message is picked up on the caller's handset

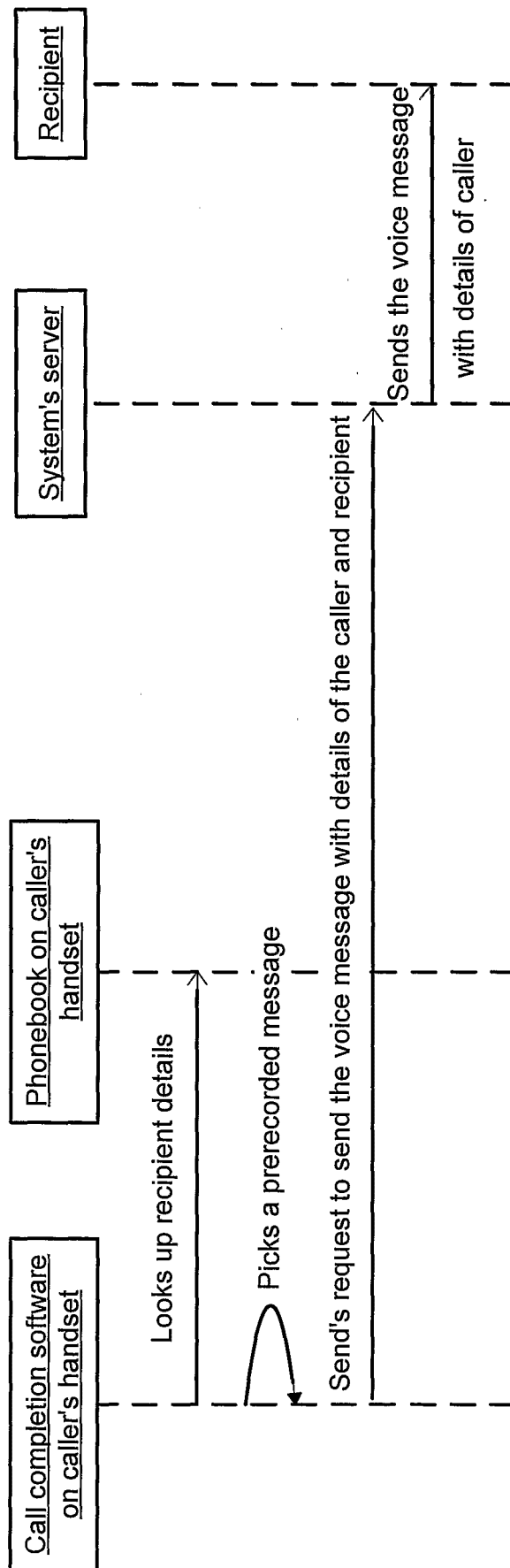


FIG. 8

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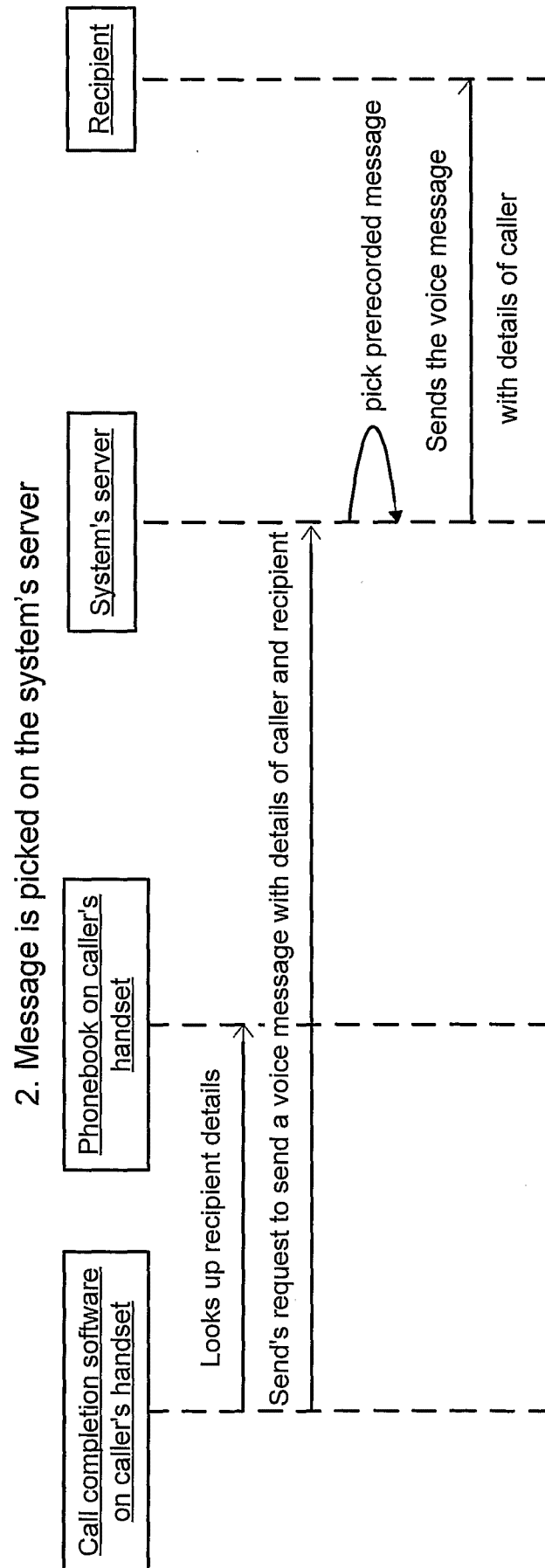


FIG. 9

Sending Automatic WAP Push message as a user-defined action

1. Message is composed on the caller's handset

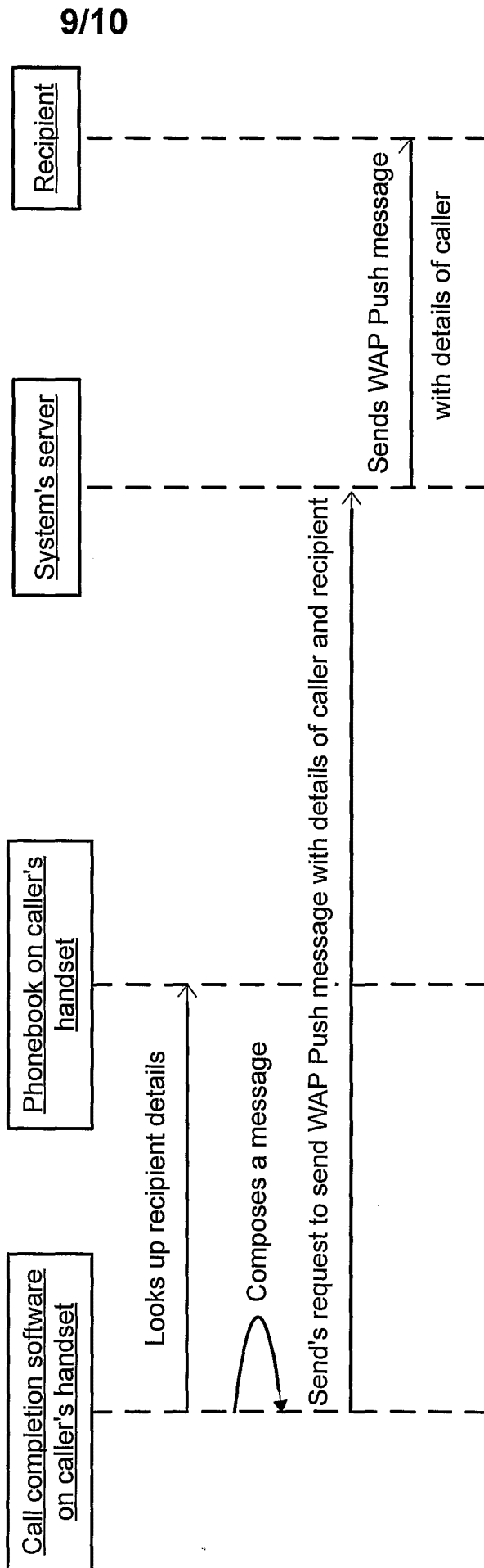


FIG. 10

10/10

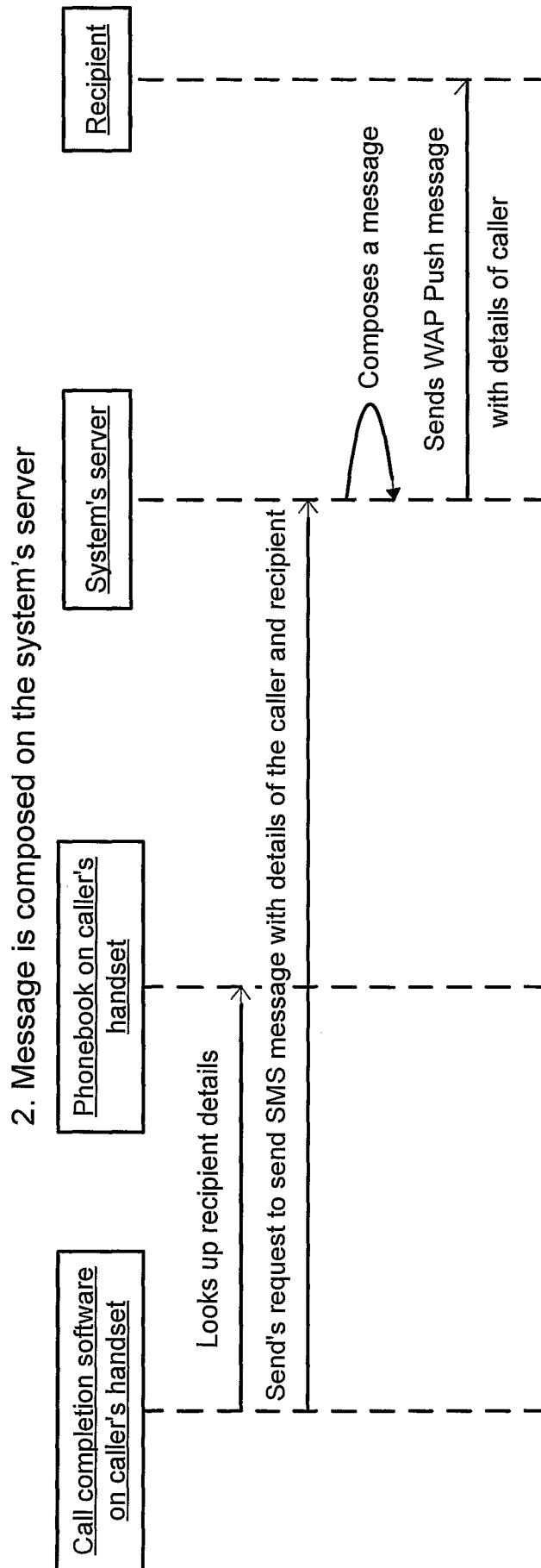


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2007/001273

A. CLASSIFICATION OF SUBJECT MATTER INV. H04M1/2745 H04M1/725 H04M1/247 H04M1/56		
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) H04M		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EP0-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/071292 A (SONY ERICSSON MOBILE COMM AB [SE]; DUNKO GREGORY [US]; HOUSE CHRIS [US] 6 July 2006 (2006-07-06) page 3, line 15 - page 4, line 23 page 6, line 3 - page 7, line 37 page 9, line 33 - page 11, line 11	1,6,14, 19-25
Y	figures 1,3,4,7,8A,8B	2-5, 7-13, 15-18,26
Y	US 2003/202642 A1 (WHEELER JILL C [US] ET AL) 30 October 2003 (2003-10-30) the whole document ----- -/--	2-5, 7-11,13, 26
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
14 February 2008		27/02/2008
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Kanlis, Angelos

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page 1 of 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2007/001273

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004/141599 A1 (TANG JOHN C [US] ET AL) 22 July 2004 (2004-07-22) paragraphs [0008], [0046], [0047], [0054] - [0057]; figures 1B,4,7B,7C,8 -----	12,15-18
A	US 2003/210778 A1 (BATES CARY LEE [US] ET AL) 13 November 2003 (2003-11-13) paragraphs [0015] - [0026]; figures 1-3 -----	1-26
A	US 2005/164682 A1 (JENKINS WILLIAM W [US] ET AL) 28 July 2005 (2005-07-28) cited in the application the whole document -----	1-26

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2007/001273

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2006071292	A	06-07-2006	EP 1832094 A1	12-09-2007
			US 2006141991 A1	29-06-2006
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US 2005164682	A1	28-07-2005	NONE	