

Messaging System And Method For Communicating With Healthcare Personnel In A Healthcare Environment

5 FIELD OF INVENTION

The present invention relates to messaging system and method for communicating with healthcare personnel in a healthcare environment and to a data storage medium having stored thereon code means for instructing a computer system to execute a messaging method for communicating with healthcare personnel in a healthcare environment.

BACKGROUND

15 For many decades, paging devices have been utilised in the medical community to deliver information in the form of numbers or words to healthcare personnel (e.g. Doctors, Nurses, Physiologists or the like). However, pagers have brought about certain process inefficiencies and resource wastages.

20 For instance, the person paged would encounter responding to engaged phone lines and unattended phones. Test results have shown that healthcare house officers spent an average of 86 mins per day answering pages, this is useful working hours put to waste. Furthermore, message senders do not know if their targets received the pages nor can their targets be sure that a message had indeed been sent to them. Also, errant healthcare personnel have the dubious option of claiming that no message has been sent despite having in fact received one.

30 Despite existing problems, the global medical community did not attempt to resolve the problems and chose to accept the shortcomings of the paging technology as a way of life. A need therefore exists to provide a method and system for communicating with healthcare personnel in a healthcare environment that addresses at least one of the above-mentioned problems.

SUMMARY

In accordance with a first aspect of the present invention there is provided a messaging system for communicating with healthcare personnel in a healthcare environment, the system comprising a messaging server for facilitating sending and receiving messages to and from mobile communication devices over a mobile communication network; a message logger database coupled to the messaging server for logging the messages for verification of messages sent and received; and one or more healthcare information databases coupled to the messaging server; wherein the messaging server facilitates the sending and receiving of the messages based on information in the one or more healthcare databases.

The messaging server may escalate the messages autonomously to pre-defined target devices.

The messaging server may utilise heuristic base message escalation algorithms to escalate the messages.

The messaging server may utilise Extensible Messaging and Presence Protocol (XMPP) and employs ubiquitous short message delivery transport support.

The system may further be arranged for connecting to one or more external systems in other healthcare environments.

The system may further comprise authentication means coupled to the messaging server for facilitating security functions associated with the messages.

In accordance with a second aspect of the present invention there is provided a messaging method for communicating with healthcare personnel in a healthcare environment, the method comprising utilising a messaging server for sending and receiving messages to and from mobile communication devices over a mobile communication network; utilising a message logger database coupled to the messaging server for logging the messages for verification of messages sent and received; and utilising one or more healthcare information databases coupled to the

messaging server; wherein the messaging server facilitates sending and receiving of the messages based on information in the one or more healthcare databases.

5 The messaging server may escalate the messages autonomously to pre-defined target devices.

The messaging server may utilise heuristic base message escalation algorithms to escalate the messages.

10 The messaging server may utilise Extensible Messaging and Presence Protocol (XMPP) and employs ubiquitous short message delivery transport support.

The method may further comprise connecting to one or more external methods in other healthcare environments.

15 The method may further comprise utilising authentication means coupled to the messaging server for facilitating security functions associated with the messages.

20 In accordance with a third aspect of the present invention there is provided a data storage medium having stored thereon code means for instructing a computer system to execute a messaging method for communicating with healthcare personnel in a healthcare environment, the method comprising utilising a messaging server for sending and receiving messages to and from mobile communication devices over a mobile communication network; utilising a message
25 logger database coupled to the messaging server for logging the messages for verification of messages sent and received; and utilising one or more healthcare information databases coupled to the messaging server; wherein the messaging server facilitates sending and receiving of the messages based on information in the one or more healthcare databases.

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BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only and in conjunction with the drawings, in which:

Figure 1 is schematic drawing of a messaging system for communicating with healthcare personnel in a healthcare environment according to the example embodiment.

Figure 2 shows a flowchart illustrating a messaging method for communicating with healthcare personnel in a healthcare environment according to the example embodiment.

DETAILED DESCRIPTION

An example embodiment of the present invention provides a mobile point-of-care system 100 in a hospital setting as illustrated in Figure 1.

The system 100 comprises a multi-role Agent Server 102 serving as a Patient Information Agent, a Blood Test Results Agent and a Doctors Schedule Agent. One purpose of Agent server 102 is to retrieve and store records from respective databases. For instance, the Patient Information Agent can be activated to retrieve or store newly created Patient Information. The Agent Server 102 is connected to the Hospital Fast Ethernet Local Area Network (LAN) 104. During operation, on activation, the Agent Server 102 accesses the hospital databases to retrieve or store information. Hospital databases are represented in Figure 1 as Blood Test Results System 106, Doctors Schedule Information System 108 and Patient Information System 110.

The system 100 further comprises two multi-role Servers, a Primary Server 122 and a Secondary Server 124. Both servers 122, 124 serve as a Jabber eXplicit Control Protocol (XCP) Server, an Over-The-Air (OTA) Server and an Application Server. The Primary Server 122 and Secondary Server 124 are connected to the Fast Ethernet LAN 104. One purpose of the Primary Server 122 and Secondary Server

124 is to facilitate interoperability and integration with standard mobile technologies and protocols such as Instant Messaging and Presence Service (IMPS), Short Message Service (SMS), Wireless Application Protocol (WAP), and Session Initiation Protocol (SIP) for Instant Messaging and Presence Leveraging Extensions (SIMPLE), as well as existing Second-Generation (2G) and emerging Third-Generation (3G) networks.

A plurality of messaging clients is connected to the Fast Ethernet LAN 104. Messaging clients are categorised into two categories, namely Desktop Messaging Clients 112 and Mobile Messaging Clients 114. Desktop Messaging Clients 112 are connected in an Ethernet LAN 126, which is in turn connected to the Fast Ethernet LAN 104 backbone. Mobile Messaging Clients 114 are connected to a General Packet Radio Services Network 118 that is in turn wirelessly connected to the Fast Ethernet LAN 104. Examples of Mobile Messaging Clients are, Java 2 Mobile Edition (J2ME) Supported Mobile Phones, Personal Digital Assistants (PDA), Mobile Tablet Computers or Remote Desktop/Laptop Computers with wireless connection support, or the like.

A Message Logger Database 120 is connected in the Fast Ethernet LAN 104 and is used to log sent and received messages from messaging clients.

A firewall 116 in the system 100 is used to provide network security and block out unauthorised material to the hospital Fast Ethernet LAN 104.

The example embodiment may comprise one or more of the following components:

- Jabber Extensible Communications core (XCP)
- Relational Database Management System
- Mobile Message Delivery Engine via Mobile Communications Networks such as GPRS, 3G, WiFi or Text Push transport
- Multi-mode Mobile Messaging Clients – delivered on Desktop Computers, Java 2 Mobile Edition (J2ME) Supported Mobile Phones, Personal Digital Assistants (PDA), Mobile Tablet Computers or the like.
- Web administration and configuration sub-system

- Medical Physicians Rostering and Scheduling sub-system
- Data Warehouse Message Auditing and Reporting sub-system
- Multi-factor Mobile Security and Authentication sub-system
- 5 • Extension of Multi-mode Mobile Messaging Clients – for the automatic display of system specific data (e.g. Blood test results, etc.), reply and routing instructions for workflow.
- Enterprise Integration sub-system via web services
 - Patient Information Agent
 - Blood Test Results Agent
 - 10 ○ Doctors Schedule Information Agent
 - Prescription Order System Agent

15 The system 100 is developed in enterprise Java technology and includes heuristic base message escalation algorithms and quality of care measurement capabilities to attain a reliable and scalable system architecture. Besides GPRS network 118, the system 100 may be extended to deliver messages to Mobile Messaging Clients over 3G networks, Wireless Fidelity (WiFi) wireless network, Bluetooth or the like. Delivery of messages to Desktop Messaging Clients 112 is over the Ethernet networks, but may be over other network technologies in different embodiments.

20 The system 100 provides instant messaging services utilising open Instant Messaging standards and employs ubiquitous short message delivery transport for real-time user communication. The Primary Server 122 and Secondary Server 124 are in control of the messaging functionality of the system 100. The messaging
 25 functionality is implemented using open Instant Messaging standards e.g. Extensible Messaging and Presence Protocol (XMPP) and employs ubiquitous short message delivery transport support.

30 A computer program running on the Primary Server 122 allows messages to be sent to and by Messaging Clients and logs the time and contents of the message replies received from the Messaging Clients. Messages logged are stored at the Message Logger Database 120. Being Ethernet based, the computer program can be accessed by any authorised personnel from any Desktop Messaging Clients 112 in the healthcare environment premises that is connected to the Ethernet LAN 126 or
 35 Fast Ethernet LAN 104. Mobile Messaging Clients 114 can also access the

computer program via GPRS, WiFi, Bluetooth or the like. The computer program also includes an escalation function that autonomously escalates received message to healthcare personnel of higher authority if activated. For example, escalating important messages to a next most senior doctor up to that of a consultant in charge of a team of doctors. Heuristic base message escalation algorithms are utilised in this function.

As such, the example embodiment advantageously replaces conventional paging communication by making available use of messaging technology, for example, Short Messaging Service (SMS) technology, Multimedia Messaging Services (MMS) or the like for real-time communication between healthcare personnel in the healthcare environment. All messages sent and received are logged, hence, the messages, however long, can be read as and when required. No time is wasted on attempting to answer pages through conventional means of calling via telephones only to encounter engaged phone lines or unattended phones. Message logging also confirms that message senders have sent their messages to their targets and a manual reply or a system-initiated response would indicate that the targets have receive the message. As such, errant healthcare personnel cannot claim that no message has been received despite having in fact received one. It is noted that such mobile messaging methodology has not been officially tested or utilised in the healthcare environment due to fallacies of interference of mobile network signals with sensitive medical equipments.

The system 100 may be further extended to a more complete mobile point-of-care solution, for example, by making available decision support functions to healthcare personnel by carrying out system-to-system integration of clinical and enterprise systems of participating hospitals, medical centres and auxiliary clinics, indicated at numeral 128 in Figure 1. The suggested systems of the participants to be integrated together with the messaging services and healthcare personnel's roster include the SAP (Systems, Applications and Products in Data Processing) systems for retrieval of patients' information, the Laboratory Information Systems (LIS) for retrieval of test results and the Prescription Order Systems (POS) for submission and tracking of orders.

Such system-to-system integration may use Health Level Seven (HL7), an International Organization for Standardization (ISO) healthcare standard protocols, and XML messaging/presence Internet services. Each integration point may be built as an agent, which performs tasks (e.g. retrieval of patients' information) autonomously or upon activation, to the respective systems. The advantage of such a modular and standards approach can solve many interoperability, scalability and reliability issues.

A system-to-system protocol may be HL7 to connect to the other healthcare systems, such as LIS for test results and POS for order tracking. The Doctors Schedule Information System can e.g. contain the Doctors' monthly schedule of clinical duties, which are accessible upon request. The system-to-system connection can provide the channel of communication and access to information to the Doctors who are on shift at any moment. Such arrangement provides just-in-time notifications and easy access to Doctor orders and results, including prescription status, laboratory test requests, and reviewing of laboratory test results.

Besides exchanging information via the mobile networks, Internet services may be used to exchange information with SAP for the retrieval of Doctors' work list and patients' information. These along with the Doctors Schedule Information System provide comprehensive information to drive a more complete mobile point-of-care application. Further customization can be made to the system to better suit the specialty and workflow of each hospital as needed.

In the example embodiment, mobility advantage, mobile security and privacy management are also key areas addressed. Mobile security is closely tied to positive authentication of the caregivers on the devices at the point of transaction. Privacy management can ensure controlled access of the patient information to authorized healthcare personnel.

In addressing privacy issues, multi-factor mobile authentication is employed in the example embodiment. Examples of some factors are:

- Patient identification, where the patient's Radio Frequency IDentification (RFID) is automatically pushed to the physician's mobile at the point of care

or the patient's barcode wristband is captured by physician's mobile phone camera device to request the patient's information. In this regard, it is appreciated that the messages sent in the example embodiment maybe picture messages.

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- Physician's identification at critical point of transaction, which may require that the physician enter a private password or security PIN code at the critical point of the transaction.

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- Positive medication identification at the point of administration by authentication of the barcode label of the drug.

Other factors may involve a "challenge and response" approach for randomized personal questions of a caregiver on the mobile device for a particular situation.

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It is appreciated that the appropriate combination of authentication techniques may be set for an effective "remote positive e-verification/signatory" process for the mobile healthcare personnel.

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Figure 2 shows a flowchart 200 illustrating a messaging method for communicating with healthcare personnel in a healthcare environment according to the example embodiment. At step 202, a messaging server is utilised for sending and receiving messages to and from mobile communication devices over a mobile communication network. At step 204, a message logger database coupled to the

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messaging server is utilised for logging the messages for verification of messages sent and received. At step 206, one or more healthcare information databases coupled to the messaging server are utilised, wherein the messaging server facilitates sending and receiving of the messages based on information in the one or more healthcare databases.

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The procedures described in the example embodiment may be implemented as software, such as a computer program being executed on one or more of the components of the system 100, and instructing the system 100 to conduct the method of the example embodiment.

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The application program is typically supplied to the user of the system 100 encoded on a data storage medium such as a CD-ROM or flash memory device and read utilising a corresponding data storage medium drive of one or more of the components of the system 100. The application program is read and
5 controlled in its execution by the processor of the one or more components.

The described embodiment has the following characteristics and advantages.

The described embodiment advantageously utilises mobile telecommunication
10 networks and instant messaging tools to provide a method and system for real-time communication in a healthcare environment with radio wave interference sensitive medical electronic equipments.

The described embodiment is time efficient as the time-to-information during
15 communication is shortened. Variations and unknowns such as whether healthcare personnel have replied or whether messages have been sent are removed. Productivity has increased as any messages logged can be retrieved promptly. Response time for healthcare personnel is decreased due to ability for them to reply messages almost instantly. There is also no occurrence of adverse
20 event in relation to signal interference to sensitive medical devices caused by use of the mobile devices.

The described embodiment can improve quality of care, enhance patient services, increase productivity, lower costs, can improve cash flow, as well as
25 facilitate other critical delivery processes.

The described embodiment takes an integrated approach to refine and expand the mobile point-of-care solution at the cluster wide level. This approach can provide greater synergy and effectiveness. This can help to create a seamless
30 mobile healthcare delivery system.

Observational experimental data from the described embodiment indicated no serious consequence caused by interference with a blood pressure (BP) monitor.

Many modifications and other embodiments can be made to the method and system by those skilled in the art having the understanding of the above described disclosure together with the drawings. Therefore, it is to be understood that the device and its utility is not to be limited to the above description contained herein
5 only, and that possible modifications are to be included in the claims of the disclosure.

CLAIMS

1. A messaging system for communicating with healthcare personnel in a
5 healthcare environment, the system comprising:
a messaging server for facilitating sending and receiving messages to and
from mobile communication devices over a mobile communication network;
a message logger database coupled to the messaging server for logging the
messages for verification of messages sent and received; and
10 one or more healthcare information databases coupled to the messaging
server;
wherein the messaging server facilitates the sending and receiving of the
messages based on information in the one or more healthcare databases.
- 15 2. A system as claimed in claim 1, wherein the messaging server escalates the
messages autonomously to pre-defined target devices.
3. A system as claimed in claim 2, wherein the messaging server utilises
heuristic base message escalation algorithms to escalate the messages.
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4. A system as claimed in any one of claims 1 to 3, wherein the messaging
server utilises Extensible Messaging and Presence Protocol (XMPP) and employs
ubiquitous short message delivery transport support.
- 25 5. A system as claimed in any one of claims 1 to 4, wherein the system is
further arranged for connecting to one or more external systems in other healthcare
environments.
6. A system as claimed in any one of claims 1 to 5, further comprising
30 authentication means coupled to the messaging server for facilitating security
functions associated with the messages.
7. A messaging method for communicating with healthcare personnel in a
healthcare environment, the method comprising:

utilising a messaging server for sending and receiving messages to and from mobile communication devices over a mobile communication network;

utilising a message logger database coupled to the messaging server for logging the messages for verification of messages sent and received; and

5 utilising one or more healthcare information databases coupled to the messaging server;

wherein the messaging server facilitates sending and receiving of the messages based on information in the one or more healthcare databases.

10 8. A method as claimed in claim 7, wherein the messaging server escalates the messages autonomously to pre-defined target devices.

9. A method as claimed in claim 8, wherein the messaging server utilises heuristic base message escalation algorithms to escalate the messages.

15 10. A method as claimed in any one of claims 7 to 9, wherein the messaging server utilises Extensible Messaging and Presence Protocol (XMPP) and employs ubiquitous short message delivery transport support.

20 11. A method as claimed in any one of claims 7 to 10, wherein the method further comprises connecting to one or more external methods in other healthcare environments.

25 12. A method as claimed in any one of claims 7 to 11, further comprising utilising authentication means coupled to the messaging server for facilitating security functions associated with the messages.

30 13. A data storage medium having stored thereon code means for instructing a computer system to execute a messaging method for communicating with healthcare personnel in a healthcare environment, the method comprising:

utilising a messaging server for sending and receiving messages to and from mobile communication devices over a mobile communication network;

utilising a message logger database coupled to the messaging server for logging the messages for verification of messages sent and received; and

utilising one or more healthcare information databases coupled to the messaging server;

wherein the messaging server facilitates sending and receiving of the messages based on information in the one or more healthcare databases.