Instant Notification From Patient To Doctor Using Xmpp Protocol

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Abstract *— There is the need of continous monitoring of vital parameters of patientism at critical situation. The current scenario in hospital has a digital display for such parameters which is observed by person. For such monitoring a dedicated person is required. But looking at the growing population this ratio of one person per patient would be considerably low in future. These issues leads us towards designing the automated system for monitoring patient related parameters. Online monitoring is the center of attraction of many hospitals. It includes the applications which are not only limited up to industrial process monitoring and control but has been extended up to civilian application areas like healthcare application, home automation, traffic control etc. In the proposed system the feasibility of Instant Notification System in Heterogeneous Sensor Network (HSN) with deployment of XMPP Protocol for medical application is proposed. The system aims to provide an environment which enables medical practitioners to distantly monitor various vital parameters of patients. For academic purpose we have limited this system for use of monitoring patient's body temperature and blood pressure. It collects data like body temperature and blood pressure from HSN and converts it to a standard packet and then provides the facility to send it over a network using XMPP. Use of HSN provides the much required platform independence, while XMPP enables the instant notification.*

Keywords: Online Monitoring, Temperature, pressure, HSN, XMPP, Presence.

I. INTRODUCTION

Growing population, lifestyle changes, environmental changes have resulted in an increase in number of diseases and volume of patients suffering from them. To provide the increasing number of patients it's unavoidable for health care industry to bring in efficiency in its operation. while Efficiency always means efficient use of resources, managing costs and maintaining quality. One way of bringing in efficiency in health care operations is use of technology in various directions of health care like diagnosis, monitoring, surgery, post surgery care to preventive procedures. For critical patients continuous monitoring of their condition is of extreme importance. Thus in other words critical care is one such area which takes most of the resources available in the health care system. So an correct use of technology is a solution to efficiently use the resources available for critical care. One such way is continuous online monitoring and wireless reporting of patient's health Continuous online monitoring for a patient provides the means to provide better treatment improves the efficiency and quality of administration even if the doctor is unavailable. Because of online monitoring 24X7 availability of service, prevention of major problems is possible. Wireless sensor network is the best suitable for such implementation. It eliminates the need of any kind of cable, provides the flexibility of operations and enables monitoring of moving object. One major issue related to all the current available online monitoring systems is the heterogeneity. Most of the systems are homogeneous. Heterogeneous sensor network is the requirement of today's world for fusion of various applications thus providing platform independent service. Advancements in communication technology have gain extreme importance in today's world of globalization. Technologies like instant communication have helped us to overcome the geographical, cultural, language obstacle observed in communication. Instant messaging finds application not just in online chatting, but can easily be used in other applications like patient monitoring, industrial process monitoring etc. This is the core idea for developing online monitoring HSN system using XMPP, a very well know protocol of instant messaging. The research focus is to design an instant notification system in heterogeneous sensor network with deployment of XMPP protocol. The system will be designed using XML based configuration. In this paper we present the implementation of a heterogeneous body temperature and pressure monitoring.

II. EXISTING SYSTEM

ALARM NET is architecture of wireless sensor network for assisting living and residential monitoring developed at university of Virginia . As per the specifications provided WSN collects the data providing a continuous record to assist diagnosis. This architecture is multitier. Some tasks like medication

reminders, object location and emergency communication are also provided which makes patient to easily adopt the system. Another significant aspects provided with this architecture are the context awareness protocol which enable smart power management and dynamic alert driven privacy tailored to the individual's patterns of activity, and the query protocol for streaming online sensor data to user interfaces, integrated with privacy, security, and power Management.

SATIRE- A Software Architecture for Smart Attire is a wearable personal monitoring service transparently embedded in user garments. The architecture records the owner's activity and location for subsequent automated uploading and archiving. The advantage of the system is transparency to the user. The prototype records human activities and location using 2-axis accelerometers and GPS respectively, storing the measurements locally until they can be uploaded.

SAPHE i.e. Smart And Aware Personal Healthcare Environment is a pervasive healthcare monitoring system developed at Imperial college London. Readings are collected from patient's body worn and home installed sensors which are then streamed to the SAPHE network platform to carry put the data analysis. If there is difference between the m resulting information and normal behavior then its fed back to perspective stakeholders. All these architectures primarily focus on the hardware and are SMS driven. Accessing the data from patient and feeding it into the network can be done easily using ant one of the system that is available. Hardware implementation is hence not the part of research article. So the challenges are:1)24X7 monitoring 2)Instant action 3)Accessible from anywhere anytime.

III. PROPOSED SYSTEM

The system will send the notification to the doctor for patients' health related parameters. That notification is nothing but a message sent using instant messaging protocol. The messages include the patient id, disease from which he is suffering and physiological signals of the patient like temperature, ECG, blood pressure. For the research purpose we have limited the scope of the physiological signals to patients' body temperature and blood pressure. The system will allow the doctor to access these notifications anytime anywhere. When the patient enters in critical condition monitoring his physiological parameters continuously becomes the main objective. The system aim not only to provide 24X7 monitoring of the patient but it also make it sure to take the corrective action if required by providing the record directly to the online doctor. When the doctor is logged into the system he can choose a patient from the list of available patients under his treatment. Since the doctor can have more than one patient of his under critical condition the system provides the facility to the doctor to access notification of more than two patients simultaneously. Under the notification of one patient doctor can see his current body temperature and blood temperature. More over doctor can access the patients record to check the history. Every hospital has a hierarchy of staff like doctor, nurse working on same patient for providing better service. So the system will allow/restrict the access to itself depending on the role of the accessing person taking care of the security problem of the sensitive data of the patient present on system. Security mechanism used is role based data protection mechanism.

INSTANT MESSAGING AND XMPP

In previous section we have discussed existing systems and the challenges that must be faced by them to sustain. In fast running life everybody wants the service instantly. And so the need is to deploy instant messaging in the available systems only. In instant messaging system when user logged into the system he sets his status as available or busy or not available i.e. signed out of the chat. So if the person, who is logged in, wants to send message to anybody he first set his own status as available and checks the status of the person whom he wan to sent the message. if the second person has also set his status as available two way messaging starts. This is nothing but IM which uses internet as the backbone. The main advantage of IM over SMS based system is the time required to send the message. For SMS GSM/CDMA network is used where as IM uses internet as backbone. So before starting with discussion about the proposed system let us go through instant messaging and some protocols available under IM. A. SIP/SIMPLE SIP for Instant Messaging and Presence Leveraging Extensions is nothing but enhancement of SIP for instant messaging and presence capabilities. And so SIMPLE inherits all the request routing and security features of SIP protocol. Applying IM capabilities on SIP makes it possible for: 1) Registering presence information and on basis on event occurrence receiving notifications 2)Facilitating two way paging 3) Manage a session of near real-time messages (streaming) between two or more participants [9][10][11]. B. MSNP MSNP or mobile status and notification protocol is one more IM protocol supporting presence and messaging plus the facility of file transfer. It is Microsoft's official instant messaging

protocol developed for their official clients. And so it is not open source. MSNP calls upon various servers i.e. Dispatch server, notification sever, switchboard server for its operations. And so the client in the reverse is connected to all these servers for completing its operation C. OSCAR OSCAR i.e. OSCAR, or the Open System for Communication in Real-time, is an IM protocol owned by America Online (AOL). Contradictory to the name OSCAR is not open source. OSCAR is not as much popular as MSNP. Similar to MSNP OSCAR also connects to various servers to serve the different purpose. The various severs connected to OSCAR are: Authorization server, basic OSCAR service server, buddy icon server and chat room server D. XMPP XMPP- Extensible Messaging and Presence Protocol (XMPP) is an open, XML-based protocol aimed at near-real time, extensible instant messaging (IM) and presence information. It is versatile and has many advantages over traditional communication protocols. The protocol uses extensible markup language streaming technology for the transfer of XML elements between any two users over the network. XML elements also referred to as XML stanza is a semantic unit of structured data. The 3 core XMPP parts are:

1) Presence
2) Message
3) IQ(Info/Query)

The aim of the system is to design an architecture for flexible management framework allowing mixing of heterogeneous sensor networks into multipurpose back end applications based on XMPP protocol. The system take readings of the temperature and pressure of the patient and then sends it to the doctor who is currently available. The system support various parameters like reliability, integrity, response time. The system is basically designed to notify the doctor quickly depending on the sensor readings. In the current available system notification is based on SMS oriented which is not instant compared to instance messeging. This system provides a path to notify the changes instantly.

IV. SYSTEM OVERVIEW

Traditional monitoring of patient in hospital consists of a nurse for measuring the body temperature and blood pressure of a patient. The readings observed are manually handled and record is maintained on paper which is accessed later on by doctor for taking the corrective action. That means for observing physiological signals of patient two persons are involved one nurse and one doctor i.e. two persons per patient. To avoid this we propose the instant notification system of WSN using XMPP. To measure physiological signals of patient wireless sensors are used. These sensor nodes send the data to the sink and sink in turn store the collected data from various sensor nodes forwarding it to the actual system. If there is difference between the normal value and the observed reading of patient respective reading is used to create a message to send to the doctor. Message consists of patient id, body temperature, and blood pressure. This message is sent to respective doctor only when he is available online, else a beep occur at the system telling about unavailability of the doctor but if the doctor is available he send reply which is nothing but the corrective action for that patient. Doctor can access the system anytime to check the history of the patient.

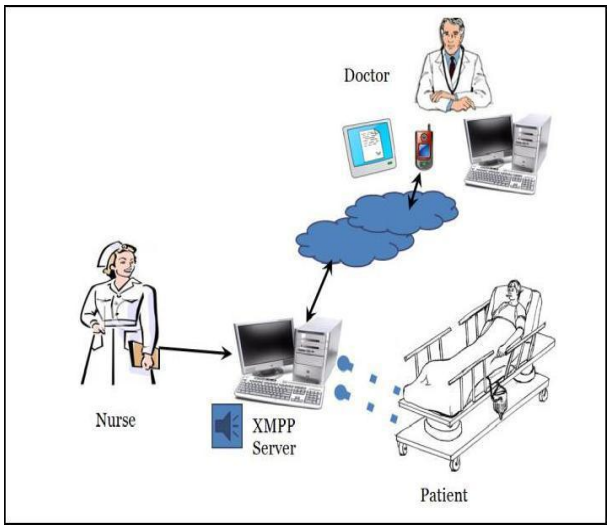

Fig. 1. System architecture

V. SYSTEM ARCHITECTURE

The overview of the proposed system as discussed in previous section can be broadly divided in 4 layers and a database 1 Heterogeneous Sensor Network 2 virtualization layer c) Service Layer d) Presentation Layer e) Database.
Pictorial representation is available in figure

1) Heterogeneous Sensor Network Layer:

As shown in the diagram this layer contains two important components:

Temperature/Pressure Sensor*:* The function of this component is to gather the respective physiological signals from the patient and transmit it to its successive component- Temperature /Pressure sink.

***Sink*:** The function of this component is to collect together different signals from different sensors and transmit these signals to the next layer in the architecture hierarchy along with the respective sensor id. *2) Virtualization Layer:* As shown in the above diagram this is a single component.

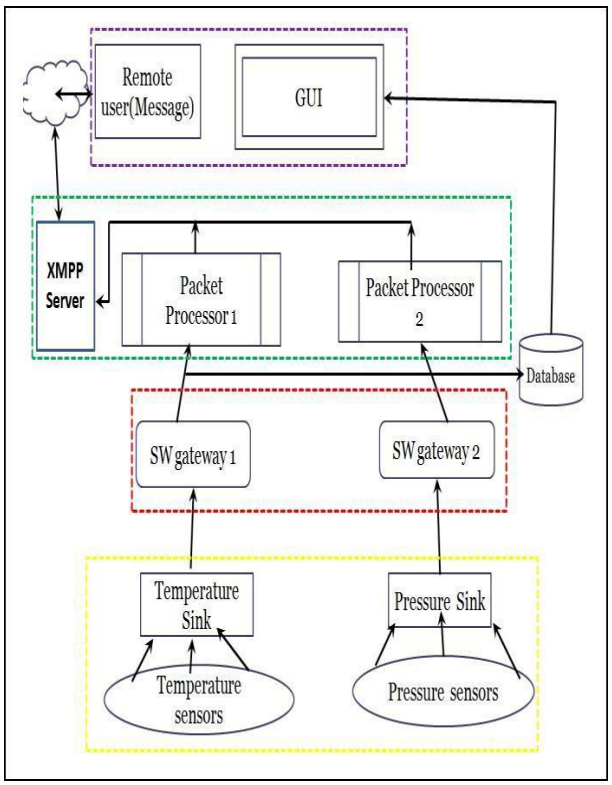

Fig. 2. System Overview

a) SW Gateway 1 / 2: This is the most important component of the whole system. This provides abstraction between low level physical layer and high level application layer. The function of this component is two part; firstly it converts the data collected from the sensors in a common XML format and transmits it to the next layer. Secondly is tores the raw data gathered from the sensors into a database.

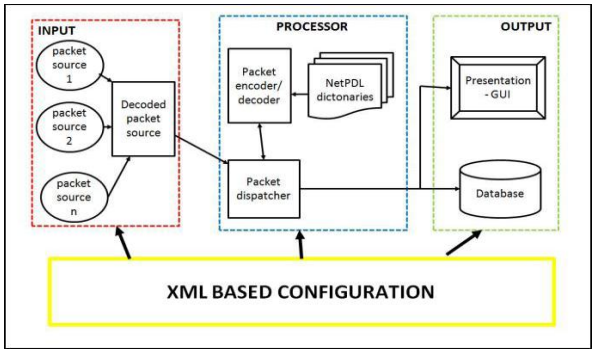

Fig. 3 Packet Processing Architecture

Processing model of the system . It consists of 3 subparts:

1) Input 2) Processor 3) Output.

1) Input: Sensor nodes are connected to sink node. Sink node is connected to the input module. Job of sink node is to collect information from sensor node and provide it to the input module. Hence input module is the actual part of the system which is connected to platform dependent sink nodes. Input module is the system entry point. Unprocessed packets are available at input module.

2) Processor: Packet processor is the main module of this framework which is responsible not only for sending or receiving the packets but also for creating platform independent packets from provided raw packets. It consists of packet dispatcher ,packet encoder/decoder and NetPDL dictionaries for creating the platform independent packets. Dispatcher is nothing but the entity which is responsible for routing data from input module to output module.

3) Output: System provide the output mainly in two format: 1) the message that is sent to doctor 2) database in which all the data related to patients' physiological signals is kept. More than these two format system also provides the output in XML format as it is XML based.

VI. CONCLUSION

A heterogeneous sensor network architecture proposed. It has services to maintain a registry of available sensors, describe the sensors outputs and control parameters, which enables the necessary interoperability. The standard format enables easy integration of heterogeneous sensors and creation of data views for application developers. We added some event based services to the middleware. We propose employing XMPP for Real-time & Notification. We need to conduct further investigations on designing and implementing various module that guarantees reliability and availability of the system. We need to consider compression and sending encrypted messages in our future.

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