Study on Mobile Healthcare System

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***Abstract*—Mobile healthcare provision in the home environment presents many challenges. Mobile Healthcare is a term used for the practice of medicine and public health supported by mobile devices. It is most commonly used in the reference to using mobile communication devices such as mobile phones, tablet & computer PDAs. A wireless sensor network with a large number of sensor nodes can be used as an effective tool for gathering data in mobile healthcare situations. It is an autonomous sensor to monitor the physical or environmental condition. This paper addresses various algorithms and techniques of Mobile Healthcare System. The purpose of this paper is to discuss these algorithms. After analyzing these algorithms and identifying their advantages and limitations, we conclude with several promising directions for future research.**

***Keywords*—** Mobile Healthcare system, Wireless Sensor Network, Bilinear Pairing Technique.

I. INTRODUCTION

1.1 Mobile Healthcare

According to the ITU, the total number of mobile users worldwide as of late 2006 was about 2.7 billion and the number of Internet users was just above 1.1 billion. This means that at least there is 23.6% of world population (and at least 22.2% of developing countries' population) who already have mobile phones but are not yet using the Internet. Mobile services are quickly emerging as the new frontier in transforming government and making it even more accessible and citizen-centric by extending the benefits of remote delivery of government services and information to those who are unable or unwilling to access public services through the Internet or who simply prefer to use mobile devices. In theory, many government services can be now made available on a 24x7x365 basis at any place in the world covered by mobile networks, which today means almost everywhere. Approximately 50%–60% of government services including Primary Health Management can be delivered via mobile channel [1].

Primary Health Care Services using Mobile Devices ensures improved access to primary healthcare and its gate-keeping function leads to less hospitalization, and less chance of patients being subjected to inappropriate health interventions. As mobile health technology gains steam, physicians are increasingly using smart phones, tablet PCs such as the iPad and other mobile devices to view and update patient records, fill prescriptions and even email patients.

First and foremost, mobile healthcare can improve geographic coverage by providing information and connectivity to healthcare professionals anytime and anywhere. Healthcare professionals can use non-integrated systems, such as laptops with mobile broadband, to link emergency response teams and field personnel to a doctor's office or hospital. Alternatively, healthcare-specific applications can enable secure access to information without being tied to an office or desk. Lastly, mobile technologies can aid hospitals and healthcare professionals in reducing paper consumption and waste by digitizing complete patient records and histories. This in turn reduces the risk of error and lost information. Such improvements in information sharing facilitate faster diagnoses and treatment, better management of doctors' time, and expanded access to healthcare information for field workers.

1.2 Wireless Sensor Networks

Wireless sensor networks (WSNs) have gained worldwide attention in recent years, particularly with the proliferation in Micro-Electro-Mechanical Systems (MEMS) technology which has facilitated the development of smart sensors. These sensors are small, with limited processing and computing resources and they are inexpensive compared to traditional sensors. These sensor nodes can sense, measure, and gather information from the environment and, based on some local decision process, they can transmit the sensed data to the user [2].

Smart sensor nodes are low power devices equipped with one or more sensors, a processor, memory, a power supply, a radio, and an actuator. A variety of mechanical, thermal, biological, chemical, optical, and magnetic sensors may be attached to the sensor node to measure properties of the environment. Since the sensor nodes have limited memory and are typically deployed in difficult-to-access locations, a radio is implemented for wireless communication to transfer the data to a base station (e.g., a laptop, a personal handheld device, or an access point to a fixed infrastructure).Battery is the main power source in a sensor node. Secondary power supply that harvests power from the environment such as solar panels may be added to the node depending on the appropriateness of the environment where the sensor will be deployed. Depending on the application and the type of sensors used, actuators may be incorporated in the sensors.

A WSN typically has little or no infrastructure. It consists of a number of sensor nodes working together to monitor a region to obtain data about the environment. There are two

types of WSNs: structured and unstructured [3]. An unstructured WSN is one that contains a dense collection of sensor nodes. Sensor nodes may be deployed in an ad hoc manner into the field. Once deployed, the network is left unattended to perform monitoring and reporting functions. In an unstructured WSN, network maintenance such as managing connectivity and detecting failures is difficult since there are so many nodes. In a structured WSN, all or some of the sensor nodes are deployed in a pre-planned manner. The advantage of a structured network is that fewer nodes can be deployed with lower network maintenance and management cost. Fewer nodes can be deployed now since nodes are placed at specific locations to provide coverage while ad hoc deployment can have uncovered regions.

II. LITERATURE SURVEY

The mobile Healthcare system survey is based on four categories these are:

- Based on Smartphone
- Based on Multimedia
- Based on Wireless communication
- Based on Secure and privacy

2.1 Smartphone Based on Healthcare System

These papers are deals with the healthcare system based on Smartphone.

2.1.1 Alerts in Mobile Healthcare Applications: Requirements and Pilot Study [4]

To deliver an alert signal to the appropriate person at the appropriate time introducing a system called as urgent are referred to as alerts. Alerts have a broader coverage than *alarms*, which refer only to *critical events*. Most medical alarms have to be handled within a time period. So they propose the use of a healthcare alert management system to handle these alert messages systematically. The existing practice tends to use cellular phones and pagers for communications. This is not adequate for seamless integration with existing and future healthcare information systems. The use of personal digital assistants (PDAs) for ubiquitous computing are getting popular, but mainly just for storing addresses, scheduling, and organizing tasks. In advances in mobile technologies, PDAs and portable personal computers (PCs) have also been used for Internet accessibility. Now a days 'smart devices' featured with different software and hardware capabilities are kept introduced into the market. In these mobile devices are used in healthcare Environment called as *Mobile Healthcare Computing Devices (*MHCDs).These devices can be using a part of daily life, thus makes ubiquitous computing a possibility of healthcare environment as well. In this paper to provide a efficient routing and monitoring of alerts are keys to quality and cost-effective healthcare services. So in this paper to provide the two algorithms are used. They are 1) Device role matching algorithm-authorized person of staff/device matching 2) Alert monitoring algorithm-monitoring the patient. To take advantage of the anyplace and anytime characteristics of mobile computing environment, they propose the use of *healthcare alert management system* (HAMS).These techniques to effectively convey these alert messages to the right person(s) at the right time through the right device(s), thus minimizing delays and providing a monitoring system for assuring service quality.

2.1.2 Emergency Response in Smartphone-Based Mobile Ad-Hoc Networks [5]

In mobile healthcare applications include the use of mobile devices in remote monitoring and Collection of patients' vital signs and statistics, delivery of healthcare data to practitioners, researchers, and patients, and direct provision of healthcare (e.g., via mobile telemedicine) and emergency response (ER).Now a day's modern mobile devices present great potential for building large-scale mobile sensing and information sharing systems fastly. There is a growing recognition by governments and private institutions that Mobile Ad-Hoc Networks (MANETs) based ER systems could prove to be highly beneficial to minimize the fatalities of human lives during emergency situation occurs. In this paper demonstrate the breathing rate activities of multiple patients at once using their Smartphone based MANET. These Smartphone introducing a mechanism called BREMON. It uses the Smartphone accelerometer to measure the accelerations during the breathing activities of a patient and processed to calculate the number of Breaths Per Minute (BPM) and periodically sent to the smart phones used by the paramedics over a multi-hop network. BREMON makes use of such an underlying infrastructure, called *Spontaneous Information and Resource sharing Infrastructure* (SPIRIT) which provides support for Discovery and sharing in MANETs. SPIRIT allows mobile devices to spontaneously share their sensor resources as services with other peers in their proximity, where mobile devices can create, discover, subscribe, unsubscribe, invoke, and control the services in an automatic fashion within the SPIRIT infrastructure. Therefore, using Smartphone-based MANET solutions is becoming an attractive option to provide quality patient care in ER systems.

Advantages

- Ubiquitous computing.
- Low power consumption.
- Very portable.
- Flexible.
- Applications, data storage, accessories

Disadvantages

- Limited range.
- It requires pre-existing software to be installed.

2.1.3 Mobile Telemedicine System for Home Care and Patient Monitoring [6]

Recently, with the social trends the senior population and chronic disease has been increased. So patients are being discharged from hospitals early and often require additional Health care services and monitoring of their health status. Nevertheless, the current scenery reflects in long patient and operation waiting lists, shortages in hospital beds, community care and inadequate medical facilities in intensive care and emergency units. In additionally High costs involving the conventional internment and the frequent problems in patient transportation. In this paper to provide the good medical care of telemedicine system Using Mobile telephony. Telemedicine refers to the utilization of telecommunication technology for medical diagnosis, treatment and patient care. It also can be described as the transfer of electronic medical data from one location to another and mainly relevant once it retrieves to the vital signals recording and monitoring the patients of telehomecare systems. The mobile phone has been recognized as a possible tool for telemedicine system. Smartphone offers new devices with some useful resources such as serial port and internet connections. This system takes advantage of the serial port available in new mobile phones to implement a generic interface for patient monitors and to collect the data of patient. The vital signals are acquired from the EMD using the RS232 interface and transmitted through Internet of healthcare system and services.

It proved to be quickly and reliable of telemedicine system.

Advantages

- It reduces cost and increase the quality list of patients.
- It occurs for the elderly or handicapped patients.
- It reduces the need of transporting patients between house and hospital.

Disadvantages

- It has not secured of data for patient details to healthcare system.
- No privacy and security.

2.2 Mobile Healthcare Using Multimedia

These papers are dealing with the mobile healthcare system using multimedia.

2.2.1 An Efficient Emergency, Healthcare, and Medical Information System [7]

An emergency system reduces the risk of an emergency case to health & safety of persons & valuable by providing a field of telemedicine and communication. Existing systems are Momeda that stands for Mobile Medical Data is a demonstrator that can be used from a PDA (Personal Digital Assistant) to access electronic patient record data and provide it to the consulting physician. The Ambulance They develop a portable emergency telemedicine device that supports real time transmission of critical biosignals as well as still images of the patients using GSM link. Emergency-112 They targeted to: reduces treatment times, improve medical diagnosis, and reduce costs by developing an integrated portable medical device for Emergency Telemedicine. Multimedia telemedicine system (MTS) is a client/server architecture that uses TCP/IP over the Internet. Doctor with patient and doctor can communicate each other by exchanging real-time data including audio, video and instant message (IM), and non-real-time data, including vital sign signals, radiological images with DICOM 3.0, file, bio-signal, bio-data etc.

In this paper to purpose the *Integrated Emergency, Healthcare and Medical Information System (IEHMS).*It provides an easy to use, efficient and cost-effective web based system while making use of multimedia environment, real time and mobility technology. The features are

- Creating a virtual global community
- Investigating and overcoming the weaknesses of the current medical emergency systems
- Offering real time communication between the client/patient and the emergency officer through:
    - SMS (Short Message Service)
    - MMS (Multimedia Messaging Service)
    - Live chat (web based)
    - IVR (Integrated Voice Response)
    - E-mail
- Developing a real time agent based medical emergency system by using multimedia, web 2.0 and mobility technology.

The achieved the registered users can log into the system to access or provide medical information based on their accessing privilege. The medical information can be stored in a Variety of multimedia forms such as video, audio, pictures and text. For example, in addition to text description of patients' historical medical information, graphic images such as X-rays or video files of doctors' discussion about the disease can also be saved in patients' record. The system provides mechanisms for exchange of image files, shared discussion lists, textual information exchange, access to images and data exported from local data bases, voice and Video transmission can be easily.

Advantages

- It is easy to use and cost effective.
- It can be used to search the nearest hospital and check for the availability of specialist doctor in that particular hospital with a minimal input from the user.

2.2.2 SparkMed: A Framework for Dynamic Integration of Multimedia Medical Data into Distributed m-Health Systems [8]

The next generation of networking is 4G and the long term revolution (LTE) wireless networks. In this paper to

enable mobile access to multimedia medical data to a wide range of Internet-capable and mobile devices and achieving the SparkMed data integration framework for mobile healthcare (m-Health), which significantly benefits from the enhanced network capabilities of LTE wireless technologies, by enabling a wide range of heterogeneous medical software and database systems (such as the picture archiving and communication systems, hospital information system, and reporting systems) to be dynamically integrated into a cloud-like peer-to-peer multimedia data store. LTE wireless technologies such as WiMAX, which are all IP-based heterogeneous networks aimed at vastly expanding the accessibility and usability of any internet-connected system. LTE technologies are portable, lightweight and nonproprietary, and provide mobile devices with access to integrated communications standards that have low transmission costs and rich multimedia support. The goal of LTE is the provision of personalized, reliable wireless data services that can allow even simple handheld devices to easily make use of multiple multimedia data streams at the same time**.** These techniques are used from mobile technologies such as multimedia Streaming, rich Internet applications (RIA), and remote procedure call (RPC) frameworks to construct a Self-managing, Pervasive Automated network for Medical Enterprise Data. It provides low overhead cost requirements, proving its suitability and effectiveness of multimedia medical data for healthcare systems.

Advantages

- Highly interactive usability.
- Low-Overhead cost
- Effectiveness in m-healthcare (or) hospital systems.
- Rich multimedia support for LTE wireless technologies.
- LTE is a portable & lightweight.

2.3 *Wireless Communication*

This paper is deals with the wireless communication in Health care system.

2.3.1 Wireless Health Care Service System for Elderly with Dementia [9]

In this paper, satellite positioning, wireless communication, and information processing are integrated to develop a wireless emergency health care system for the elderly persons with dementia in a real health care environment. To integrate the technologies of radio frequency identification (RFID), GPS, GSM, and GIS to Construct a stray prevention system for the elderly person suffering from dementia that does not interfere with the elders' daily lives, and problems specific to dementia include memory impairments, behavioral problems, other mental symptoms, and patients' inability to take care of themselves. Due to the problem of memory loss, the elderly with dementia are prone to straying when outdoors. To overcome these problems and improve on the passive and manpowered way of searching the missing patients with the help of GPS and GSM schemes. This system provides four monitoring schemes, including indoor residence monitoring, outdoor activity area monitoring, emergency rescue, and remote monitoring modes. The user interface design allows family members or other caretakers to identify the real-time positions of the missing elderly persons using mobile phones, PDAs, Notebook PCs, and various mobile devices through a health care platform consisting of a web service server, database server, message controller server, and health-GIS (H-GIS) server.

Advantages

- The system performance is high and reliability using different telecommunications.
- Monitoring the patient's latest location information within 34 seconds.

2.4 Secure and Privacy in Mobile Healthcare System

The following papers deals with the secure and privacy in mobile Healthcare system.

2.4.1 A Secure Handshake Scheme with Symptoms-Matching for mHealthcare Social Network [10]

In this paper, they achieved a secure same symptom-based handshake (SSH) scheme. Specifically, in the proposed SSH scheme, each patient is granted with a pseudo-ID and its private key corresponding to his symptom. If two patients have the same symptom, they can use their private Keys to make mutual authentication the healthcare system using PHI. So they demonstrate the proposed SSH is secure in the MHSN (*mHealthcare social network*) scenarios. In SSH schemes, which allows a patient to securely share his PHI with ones who have the same symptom, It Consists of three fold:

- Firstly, they define the notion of mHealthcare social network (MHSN), which provides a platform for those patients who have the same symptom to exchange their experience, and give mutual support and inspiration to each other.
- Secondly, they propose a secure same-symptom-based handshake (SSH) scheme based on bilinear pairings, and apply the provable security technique to validate its security in the random oracle model.
- Thirdly, social-based PHI collaborative reporting in MHSN.

To increase the delivery ratio and latency forwarding the message in PHI.

Advantages

- It is a useful cryptographic mechanism which allows two members of the same group to authenticate each other secretly.
- It is efficient and provably secured of data.

2.4.2 SAGE: A Strong Privacy-Preserving Scheme Against Global Eavesdropping for eHealth Systems [11]

In e-health systems to improving the healthcare through information technology where security and privacy are crucial for its success and its large scale deployment. In BANs, wearable, implantable, or portable medical wireless sensors are deployed in patients to monitor the physiological conditions within the body and then send this patient information to a remote healthcare provider over the Internet for receiving high quality healthcare from their physicians on time but without seeing their physicians in person It could avoid patients' lengthy waiting times and hospital Stay. So Unauthorized persons easily can be hack the data for patient information. To overcome these problems they propose a strong privacy-preserving ***S**cheme **A**gainst **G**lobal **E**avesdropping* for eHealth systems, called SAGE.

- Firstly, they formally define the patient privacy issues in eHealth systems. Specifically, they divide patient privacy into content oriented privacy and contextual privacy. For the contextual privacy threats in eHealth systems.
- They further categorize the eavesdroppers into three classes: non global adversary, weak global adversary and strong global adversary.
- Secondly, the proposed SAGE can achieve not only the content oriented privacy but also the contextual privacy against the strong global adversary, which is the most powerful attack model against patient privacy. So both of these two privacies are formally proved with provable security technique.
- Thirdly, since the time is crucial when dealing with some acute diseases in eHealth systems.

It is quite straight forward: When the PIDB receives the PHIs from patients it broadcasts the PHIs from patients, it broadcasts the PHIs to all physicians. It has provide more security and hackers cannot be easily hack the data for this systems.

Advantages

- It is very efficient.
- Privacy and security for e-health systems

CONCLUSION

In the increasing development of mobile health care system yields the largest growth among mobile users. The study on mobile healthcare system that describes some issues and facts are focused in related areas. Mobile healthcare alert system that delivers the proper timing and emergency case alerts. The mobility devices that enhance the computation based on the ubiquitous nature. Emergency alerts based on Smartphone's are considered in MANETs which provides the advantageous issues related to power consuming, portability and flexibility. The technology based mobile home care and patient monitoring system that made cost efficient and quality based on particular patients which reduces transportations related to patients. Multimedia based healthcare system that supports real time interactive application offers message transformation and easy of use and cost effectiveness. A dynamic integration related to multimedia medical data provides the framework which is low overhead and rich multimedia support. The wireless medium develops a wireless emergency healthcare system for an environment that integrates with several technologies such as RFID, GSM, and GPS. Monitors the location based rapid search for patients and performance related issues are focused. The privacy related issues are focused which provides the authenticated usage by cryptographic mechanism and provable data security. The strong privacy preserving schemes are analyzed which provides the efficient ehealth system by providing privacy and security.

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