Enhancing Health Monitoring Environment with Mobile Technology

Rupali Sharma[1] Maharshi Dayanand[2]
[1,2]Department of Computer Engineering
[1,2]University, Rohtak, India

Abstract— With the advancement in wireless sensor networks and extensive unfold usage of smart phones, mobile healthcare offers enhanced health monitoring environment. In this paper we propose the mobile healthcare system that can be used in emergency situation. In this anticipated project, smart phones are used to assemble and process the healthcare information of patient's situated in far reachable areas. To facilitate highly reliable healthcare information of patient accompanied by the endowment of privacy preserving during the communication in Mobile Healthcare emergency, an effectual patient-centric privacy access control is introduced in this framework. This privacy control is a new privacy preserving product based on computation technique, that offers users to choose who can contribute in the adaptable computing to assist in the processing of individual's health information. Hence, with this security analysis, our proposed mobile healthcare emergency framework could effectually accomplish patient-centric privacy management.

Key words: Wireless Sensor Networks (WSNs), mHealth, Personal Healthcare Information, Patient-Centric Privacy Management

I. INTRODUCTION

Mobile health, or mHealth, uses mobile technologies for healthcare delivery and health research purposes. The mélange of mobile technologies in healthcare is an emergent opportunity [1]. Healthcare providers are making usage of new-fangled mobile technologies to expedite advanced eminence of care to every patient. With the advent of mobile technology in healthcare realm, 24-hour care of patients is not only delimited to hospitals or homes. Instead of patient's waiting for weeks or months to acquire a swift appointment where they have second rate care, healthcare facilities now support the widespread embracing of technologies that will empower doctors to distantly connect, examine and intermingle with thousands of patients. Now patients can be monitored at each and every moment with the help of smart phones and Wireless Sensor Networks(WSNs). The assist of tablets and smart phones has transmuted the state of trade, communication, and entertainment midst of other arenas [2]. According to Dr. Francis Collins, Director at National Institutes of health (NIH), defines the emergence of mobile technology in healthcare as:

"Many opportunities to improve health very much depend upon cell phone technologies, since cell phones are so rapidly expanding in many parts of the world that otherwise don't have much access to communication." - NIH Director Dr. Francis Collins

In the field of healthcare, Mobile technology is facilitating elderly and expectant mothers, patients suffering from chronic disease, extending service to far-reaching areas, prompting patients to take medicine at the proper time, and improving medical system and health outcome efficiency. In this paper, we develop a mobile application to monitor patients in far-reaching areas and to deliver possible treatment using recent technology i.e. ANDROID. This application framework will be privacy conserving adaptable framework. With this projected framework, each medical user in emergency can accomplish the privacy access control to permit users to choose who can contribute in the adaptable computing to assist in the processing of individual's health information. Hence, with this security analysis, our proposed mobile healthcare emergency framework could effectually accomplish patient-centric privacy management.

II. LITERATURE REVIEW

The beginning of mobile technology in healthcare has made healthcare professionals highly movable and self-sufficient in nature, thus empowering them to solve predicaments at the point of action [3,4]. With the perseverance to deliver access to vital resources and information "anytime, anywhere" mobile technologies are making its tactic approach in healthcare at an instant pace. The assistance of "mHealth" or mobile health to transmute the correlation between patients and caregivers is ever-increasing more promptly as compared to access to Internet [5]. From this time, part of mobile/wireless solutions in subsidiary healthcare cannot be disfavored. mHealth have conical the paperwork for physicians, nurses and other community workers by offering assorted uses that could access patient's health records.

The healthcare uses of mobile technology comprise ubiquitous mobile telemedicine, ubiquitous health monitoring, ubiquitous healthcare data access and intellectual disaster management system [6]. One of the foremost application in ubiquitous healthcare, is wide-ranging health monitoring via wireless networking solutions (WNS) such as, adhoc wireless network, wireless LANs and cellular/ 3G/GSM frame oriented networks. Permitting safe service detection in mobile healthcare networks put forward a semantic-based framework for mHealth networks that make use of semantic metadata (profiles and policies) to let secure and flexible service retrieval [7]. As a basic feature, our approach incorporates access control services within the detection framework to make available users with filtered views on accessible services user security credentials [8]. Authors in paper [9] have proposed MICS (Medical Implant Communication Service) based on sensor technologies and its implementation for collecting patient physiological data for health monitoring purposes. The *MICS* support the gain of scale down electronic devices that can either be cast-off as an as an external node or as implanted node. In this framework, a prototype sensor network is realized by integrating pulse rate and temperature sensors on nodes. Each technologically advanced sensor node has the proficiency of acquiring physiological data and its local processing. The sensor node can also communicate data over the air to attached central control unit (CCU) for advance processing and storage. This advanced framework assists hospital staff to attain physiological data of patients

by way of the Internet. The wireless body area network has arisen as a new technology for "*eHealth"* that allows the data of a patient's necessary body parameters to be attained by implantable or small wearable sensors and conversed via short-range wireless communication techniques [10]. In this paper we focused on two significant data security issues: dependable and secure fine-grained distributed data and distributed data storage, access control for private and sensitive patient's medical data.

We will discuss on various issues that need to be considered while accomplishing the confidentiality and security requests. Pertinent solutions in WBANs and sensor networks are surveyed, and their robustness is scrutinized. To explicate the performance of security and privacy mechanism for mHealth frameworks; authors [11] [12] [13] have suggested some criteria's as follows: Firstly, "Adaptable Computing Using Wireless Sensor Networks,". Wireless sensor networks (WSNs) comprises following parts that offers different functionalities. A smart node in WSNs delivers communication competencies, the power module and sensing unit that permits autonomous operations and a processing module with memory. The sensing unit also comprised of an analog to digital converter (ADC). Figure 1 depicts a basic block diagram of WSNs smart node.

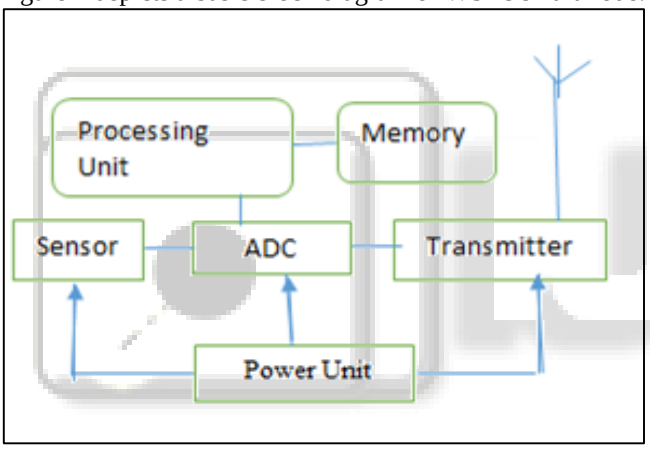

Fig. 1: Basic Components of WSNs Node

This suggested solution is centered on the idea of separating the smart nodes (comprised of number of sensors) into number of resourcefully collaborating modules. Each node adds to the implementation of the original application by executing a subdivision of the application tasks thereby; delivering service to the adjacent nodes [14]. *Secondly,* Social serendipity [15,16] set out a confidential server that encompasses patient's profiles and preferences. Relied on this data, the server figures out the relationship between nearby patient's profiles. Patient's will be alerted when they are adjacent and the relationship of their profiles surpasses a given threshold value. Additionally, the server is capable to learn which two patients are adjacent and have similarities in their profile. Further, the server can also trace out patient's location.

III. Designing Mobile Healthcare System

Mobile Healthcare framework targets at proposal and progress of moveable Healthcare system [17, 18]. In addition, this framework also provides safety and privacy issues, developed for patient-centric access control of adaptable computing in emergency situation. This framework primarily comprises of two basic components 1. one component will be assimilated in patient's Android cell-phone, allied with many sensors to measure heartbeat and sugar level, body temperature, blood pressure and directs this information to diverse hospital's server, where the second component is attached. This component collects data and recommends patients consequently via text or voice calls on cell-phones. And at the time of emergency, this component actuates ambulance call to its nearby hospital. Thus, with Android platform we are able to upsurge the hospital service delivered to patients. Figure 2 illustrates the components of mobile healthcare system.

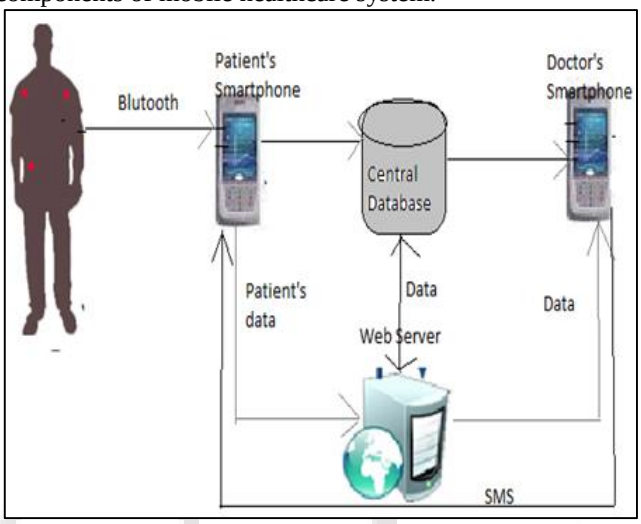

Fig. 2: Mobile Healthcare System

A. System Module

Systems design comprises the process of outlining the components, architecture modules, data for a system and interfaces to fulfill stated requirements [19,20]. Systems design process renders the requests into an exemplification of the software that can be evaluated for excellence before coding starts. Once the requests have been together and analyzed, it is obligatory to classify in facet how the design will be assembled to execute the required tasks. The system design work starts with the specification of system's requirement and during the development process it changes into a physical representativeness [21]. Several design structures are surveyed to change and improve the design. The design requirements refer to the elements or components of the system, features of the system and how the system visualizes to end users. The steps involved in Figure 2can be explained as follows:

1) Patient login: The input values are read from the different body sensor networks existent in the patient's Android cell-phone and then transformed to fuzzy values. These input values are then accumulated by means of Bluetooth. Wireless body sensors evaluate different parameters like heartbeat, blood pressure, body temperature etc.
2) Interface: The facts gathered from the patient's cell-phone are directed to the different hospital's server by the use of 3G network. Then this information is delivered to the accredited professionals who read and make available needed prescriptions and recommendations centered on the patient's profile.
3) Database: Data gathered by different sensors are retained in the hospital database. The data can be

portioned in two sections: Firstly, the standard readings and Secondly, the critical readings.

4) Feedback: Medical professionals diagnose patient's health information based on the statistics collected. Recommendations are provided to the patients via text or voice calls on cell-phones.

IV. Results and Discussion

The screenshot captured as shown in Figure 3 gives clear elucidation of results. Diagnoses are based on patient's health information which includes blood sugar, pulse rate, blood pressure and temperature. The proposed system is J2EE and Android based platform. There are separate logins for admin, and doctor/hospital officials. Admin is in authority for complete management. A key id and authorizations will be assigned by the Admin for all hospital officials those have been registered over the portal. Patients registration is done from Android platform themselves installed in their smartphones. Patient's parameters that have been collected by sensors incorporated within smartphones are directed to the server, where the data based on patient's status is categorized as, NORMAL, SERIOUS etc. and consequently provides for emergency service by dispatching the status report of patient to the concerned doctor/hospital official. It also offers the facility for suggesting the nearby ambulance in emergency situations. The goal of this framework is to make available the emergency service for critical patient's by deducing the various health parameters of patients by the use of sensors arrayed within their smartphones.

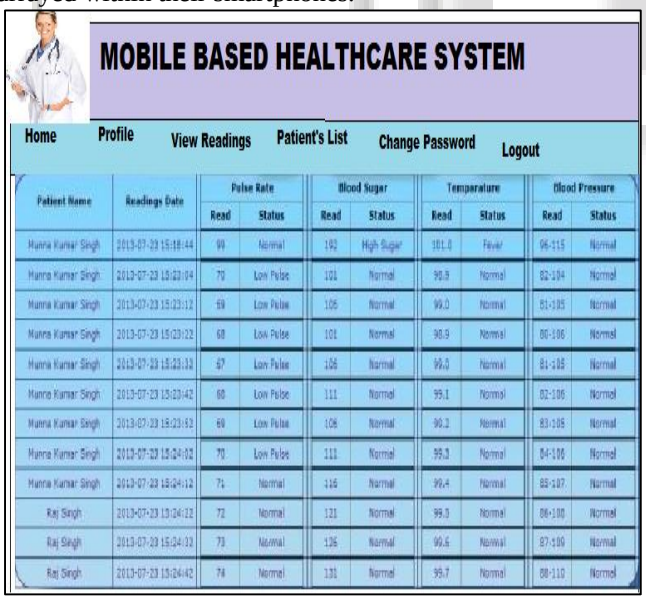

Fig. 3: Screen-Shot of Proposed Framework

V. Conclusion

In this paper, we recommended a mobile phone based healthcare system to scrutinize the patients distantly and relief them in emergency situations. Authorized doctors'/hospital officials examine patients constantly by reading patient's profile on regular basis. Only authorized users could access the patient's profile details. If in any case patient feels unusual or is in serious health condition, then the authorized users can SMS to the adjoining hospital. In future, we propose to carry out the work of our anticipated framework in real time by means of sensors and to test and verify the efficacy of our framework on smartphones. Additionally, we aim to exploit safety and privacy issues using strict security protocols.

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