International Journal of Pure and Applied Mathematics
Volume 116 No. 8 2017, 255-259
ISSN: 1311-8080 (printed version); ISSN: 1314-3395 (on-line version)
url: http://www.ijpam.eu
Special Issue

ijpam.eu

UMBITIOUS HEALTHWARE CONDITION ON ANDRIOD MOBILE DEVICE

K.Sivaraman
Assistant Professor, Dept. of CSE, Bharath Uni versity,
Chennai, Tamil Nadu, India,
sivaraman2006@gmail.com

Abstract: Provision of ubiquitous healthcare solutions which provide healthcare service east anytime anywhere has become more favorable nowadays due to the emphasis on healthcare awareness and also the growth of mobile wireless technologies. Following this approach, an Android™ smart phone device is proposed as a mobile monitoring terminal to observe and analyze ECG (electrocardiography) waveforms from wearable ECG devices in real time under the coverage of a wireless sensor network (WSN). The exploitation of WSN in healthcare is able to substitute the complicated wire technology, move in healthcare away from a fixed location setting. As an extension to the monitoring scheme, medicine care is taken into consideration by utilizing the mobile phone as a barcode decoder, to verify and assist out-patients in the medication administration process, providing a better and more comprehensive healthcare service.

1. Introduction

Chronic diseases are recognized as the leading cause of mortality in the World. According chronic diseases, Having experienced the loss of a beloved one due to a chronic disease such as heart diseases, hypertensive diseases and diabetes, people are now becoming more conscious about healthcare. Long term and quality medication treatment is necessary for chronic disease patients to ensure the disease is under control as chronic diseases are long-lasting and recurrent. Thus, the overall global healthcare costs are exploding as the public's demand for better quality of healthcare increases. The consequence of this growing demand is a shortage of medical professionals and suitable Previously, healthcare was focused on institutional care and on curing diseases, which is diagnosis-based treatment only. Patients only approach medical professionals when they are not feeling well. However, constant monitoring, early detection and management of chronic diseases are important to avoid the occurrence of complications and risks. If the healthcare monitoring and management.

2. Background and Related Works

Ubiquitous healthcare applications may include disease-diagnosis devices, monitoring systems, and even healthcare information systems. In our approach, ECG monitoring is the main focus. ECG is a graphic recording of the heart's electrical activity [3]. In an ECG test, the electrical impulses that occur when the heart beats are recorded in a waveform graph. ECG monitoring is an efficient and important clinical technique in healthcare as in for and regular of heartbeats as well as the size and position of chambers, and also to evaluate the effects of drugs or specialized devices used to regulate the heart. Since ECG is the core reference for doctors in the diagnosis and medication process, there are many types of commercialized ECG mobile monitoring applications available in the market today. Examples include Spyder wireless ECG monitoring [4] and wireless pulse/ECG watches [5].

In ubiquitous healthcare, wireless data communication technologies such as WSN and Bluetooth®

2.1 System Design and Implementation

Medical resources are very precious. Normally hospitalized all-day-long care is only applied to patients who are in critical condition and need urgent medical treatment. Out-patients with chronic diseases that need only intensive care are not advised to occupy a hospital bed, but instead they need intensive home care to ensure their diseases are under control[1,2]

Therefore, self-monitoring, self-management, mobility and flexibility are the key concepts for success of the implementation of aubiquitous healthcare system for out-patients with chronic diseases. A ubiquitous healthcare system must be a robust, reliable and convenient application, so that patients can do around the clock monitoring and go around without any restrictions.

The proposed system is mainly for ECG monitoring and heart rate estimation, which is useful in the detection of the underlying heart conditions of individuals and the rehabilitation of patients recovering from recent heart attacks. Figure 1 presents the system design of the

proposed real time ECG monitoring and analyzing on an Android™ mobile device with hardware examples, communication protocol, and software implementation. There are three architecture layers in the proposed idea: the BSL(body sensor layer), PNL (personal network layer) and GNL (global network layer). The first layer, BSL, consists of ECG sensor nodes worn on the patient's body. The ECG sensor node in the BSL communicates with the PNL which consists of a base station node and an Android™ smart phone exploiting the IEEE 802.15.4 Zig bee based communication protocol, to measure and transmit the real-time quality ECG signal wirelessly from ECG devices on the patient's body to the mobile device for display and analysis. A smart phone with a base station node in PNL acts as a higher level data and communication coordinator, and allows for user-interaction with the body sensor network. An Android™ mobile device with wireless networking capabilities has the ability to communicate with a higher application services layer[6,7,8].

2.2. ECG Monitoring System Implementation

The received sensor data is further processed and interpreted by the ECG monitoring system running on the Android™ mobile device. In the ECG monitoring system, various algorithms are combined and implemented as mobile application software with the Java Android™ language to handle all the query processes in the WSN. The query processes handle the communication between sensor nodes and the ECG device, detect and differentiate the ECG sensory data, interpret, analyze and manipulate the sensory data packet, and then, they proceed to display the data graphically on a mobile screen in real time. Figure 5 shows the data visualization of the GUI of the ECG monitoring system. It includes an ECG waveform display, ECG waveform analysis, real time heart rate estimation and also queries buttons to handle the process to initiate and end a monitoring activity. The ECG monitoring system was developed and tested on an Android™ mobile platform development kit [9,10] as shown in Figure 6(a), running an ARM processor (S5PC100X—ARMCORTEXA8). This development kit comes with a sensor expansion board and an Android™-based smart phone-alike mobile device. Through the serial port, the sensor expansion board is able to connect to different types of hardware devices and various development testing can be performed on it. The specifications of the development kit are similar to the specifications of Galaxy S in Figure 6(b), a market available Android™

2.3 Personalized Medicine Care Assistance

Smart phones have built-in cameras that can take pictures of interesting events but those cameras can also act as scanners. There are numbers of researchers [11,12,13] who have discussed the possibility of decoding a barcode with a mobile phone's built-in camera. This idea is widely applied in many industrial areas as well as healthcare. Applications include asset management and patient administration process. In [14], the utilization of barcode and mobile phones for blinds and visually impaired people to identify objects by decoding the barcode to a URL and directs the phone's browser to fetch an audio file from the web that contains a verbal description of that particular object was proposed. The possibility to decode a barcode with a mobile phone's built-in camera inspired the idea to include personalized medicine care assistance into the ECG monitoring system to provide a more comprehensive ubiquitous healthcare solution. The design of personalized medicine care assistance is to help chronic disease out-patients in their daily medication administration processes.

According to a landmark study on medical errors conducted by the United State Institute of Medicine [15], medication errors and ADR (adverse drug reactions) are the most common cases among all medical errors. Most of these errors are nonetheless preventable [16]. Out-patients with chronic diseases normally need to undergo long term medical treatment and medication process and they are required to take many types of medicine daily to control their diseases. A common cause of medical errors includes irregular medicine in-take due to the patient's busy or erratic lifestyles, complicated in-take due to many medicines and doses taken by the patient, ADR caused by un-reconciled prescriptions obtained from different sources, lack of knowledge about proper use of medicines, lack of consultation with healthcare provides when confusion arises and lack of monitoring mechanisms to keep track of a patient's medicine in-take. Thus, out-patient medication administration has been identified as the most error prone procedure. Various medicine in-take]reminder or support systems are introduced to help this group of patients. Wedjat [17], a mobile phone based medicine in-take reminder and monitor, is one such example.

3. Personalized QR Barcode Generator

Nowadays, most smart phones are come with a free barcode decoding application. This is beneficial for smart phone users as they can fully utilize it without any need for additional hardware devices and charges. In this implementation, a personalized QR (Quick-Response) barcode generator is designed and implemented as shown in Figure 10, to meet the needs of ubiquitous healthcare system's users, and provides a comprehensive healthcare

services to the users. This personalized QR barcode generator is implemented in the C# programming language. Information such as patient name, patient ID, functions of the drugs, in-take instructions, dosage amount and expired date are included in the barcode for the patients' reference. Other than generate the barcode, a copy of the input details will saved at the web server database for reference. The QR barcode is adopted as it has larger and sufficient data capacity to encode all the information needed if compare to the 1 dimension parallel

To implement the personalized generator, QRCode library [18], a .NET component is used to do the data encoding and generate a QR barcode. The QRCode library provides a function to encode the content into a QR code image which can be saved in JPEG, GIF, PNG or Bitmap formats, and also a function to decode a QR code image. The QR barcode generated can be printed out easily and can be attached to the medicine packs easily.

3.1 Experimental Results and Discussions

The algorithms implemented are tested by setting up a physical real time monitoring test bed to test the ability of data collection from an ECG device and from the sensor nodes as well as to evaluate the data transmission over the WSN. Obtained sensory data is manipulated, processed, analyzed and displayed graphically on the smart phone screen. The ability to decode the personalized barcode with smart phone's built-in camera is tested as well.

3.2 Real Time ECG Monitoring Module

In the real time ECG monitoring module, a wearable health shirt is worn on a human body. The ability to provide a real time ECG signal from the wearable health shirt and the capability to capture the signal and present it on an Android™ mobile device is observed. Figure 12 shows the example of a patient wearing the body-fitted ECG health shirt. The figure shows that the sensor node embedded on the wearable health shirt is small and in obtrusive. The sensor nodes on the ECG health shirt and on the mobile device establish a WSN. The yellow light on the wireless dongle indicates that the wireless connection is established and that data transmission is available. When the Start button on the mobile screen is pressed, the wireless dongle attached to the mobile device is ready to receive and process the ECG data packet from the ECG device[19,20].

3.3 Personalized Medication Care Module

The capability to decode our self-generated and personalized QR barcode was tested.

shows the screen capture of the mobile barcode decoder on an Android™ smart phone device trying to decode a barcode image. The decoded data are shown in Figure 14(b). This mobile barcode decoder is available free of charge. By utilizing this mobile barcode decoder, it is proved that the personally generated barcode image earlier is encoded correctly and that it can be decoded easily as well. The extracted information is used as guidance for the patient in his medication administration process. Personalized medicine care assistance: (**a**) Screen capture of mobile barcode decoder trying to decode the personalized QR barcode; (**b**) Display of decoded data on mobile phone.

4. Conclusions and Future Work

Ubiquitous healthcare solutions on Android™ mobile devices are believed to have a significant impact in bringing heart rate management and ECG monitoring to individuals and patients in everyday life. The development of technology has greatly increased our diagnostic power. These developments have been widely reported, creating a widespread acceptance in both society and patients. This has increased the public expectations not only for high technology healthcare but also for rapid and unrestricted high quality healthcare services. Chronic diseases can be effectively controlled if they are regularly monitored with proper medication cares and guides.

WSNs are expected to fulfill the unrestricted conditions of healthcare applications, hoping to reduce the mortality rate caused by chronic diseases. Wirelessly transmitting the ECG signal in a WSN can reduce the hassle of traditional wired ECG machines, provide a clean and stable ECG signal for realtime heart rhythm analysis and achieve self monitoring, mobility and flexibility. Other than moving healthcare from clinical-centric to patient-centric, this idea would also move the healthcare from treatment to prevention. The early detection of diseases might give a recovery chance to the patient. The rise in global expenditures, shortage of medical staffs and equipment problems and growing incidences of chronic illness can be solved as well. WSNs are expected to fulfill the unrestricted conditions of healthcare applications, hoping to reduce the mortality rate caused by chronic diseases. Wirelessly transmitting the ECG signal in a WSN can reduce the hassle of traditional wired ECG machines, provide a clean and stable ECG signal for realtime heart rhythm analysis and achieve self monitoring, mobility and flexibility. Other than moving healthcare from clinical-centric to patient-centric, this idea would also move the healthcare from treatment to prevention. The early detection of diseases might give a recovery chance to the patient. The rise in global expenditures, shortage of medical staffs and equipment problems and growing incidences of chronic illness can be solved as well. With

additional personalized medicine care assistance in a healthcare system, a more comprehensive and affordable healthcare solution is provided to the patient, assisting the patient in the medication administration process, without the need of any extra hardware devices and costs. As a conclusion, the proposed solution is easy to be applied with only an ultra ECG wearable device embedded with a sensor node and an Android™ smart phone device.

References

[1]. Statistics Korea. Causes of Death Statistics in 2009. Available online: http://www.kostat.go.kr (accessed on 28 January 2011).

[2]. Silvio, B. Changes in Healthcare: Towards a "Patient-Centric" Approach. Fimi Philips, S. Banfi 1-210147 Saronno, Italy, 2010. Available online: http://www.oasis-project.eu/downloads/other/3.pdf/ (accessed on 24 June 2011).

[3]. Rick, D. Nursing Fundamentals Caring and Clinical Decision Making; Delmar Thomson Learning: Clifton Park, NY, USA, 2004.

[4]. Udayakumar R., Kaliyamurthie K.P., Khanaa, Thooyamani K.P., Data mining a boon: Predictive system for university topper women in academia, World Applied Sciences Journal, v-29, i-14, pp-86-90, 2014.

[5]. Kaliyamurthie K.P., Parameswari D., Udayakumar R., QOS aware privacy preserving location monitoring in wireless sensor network, Indian Journal of Science and Technology, v-6, i-SUPPL5, pp-4648-4652, 2013.

[6]. Brintha Rajakumari S., Nalini C., An efficient cost model for data storage with horizontal layout in the cloud, Indian Journal of Science and Technology, v-7, i-, pp-45-46, 2014.

[7]. Brintha Rajakumari S., Nalini C., An efficient data mining dataset preparation using aggregation in relational database, Indian Journal of Science and Technology, v-7, i-, pp-44-46, 2014.

[8]. Khanna V., Mohanta K., Saravanan T., Recovery of link quality degradation in wireless mesh networks, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4837-4843, 2013.

[9]. Khanaa V., Thooyamani K.P., Udayakumar R., A secure and efficient authentication system for distributed wireless sensor network, World Applied Sciences Journal, v-29, i-14, pp-304-308, 2014.

[10]. Udayakumar R., Khanaa V., Saravanan T., Saritha G., Retinal image analysis using curvelet transform and multistructure elements morphology by reconstruction, Middle - East Journal of Scientific Research, v-16, i-12, pp-1781-1785, 2013.

[11]. Khanaa V., Mohanta K., Saravanan. T., Performance analysis of FTTH using GEPON in direct and external modulation, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4848-4852, 2013.

[12]. Kaliyamurthie K.P., Udayakumar R., Parameswari D., Mugunthan S.N., Highly secured online voting system over network, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4831-4836, 2013.

[13]. Thooyamani K.P., Khanaa V., Udayakumar R., Efficiently measuring denial of service attacks using appropriate metrics, Middle - East Journal of Scientific Research, v-20, i-12, pp-2464-2470, 2014.

[14]. R.Kalaiprasath, R.Elankavi, Dr.R.Udayakumar, Cloud Information Accountability (Cia) Framework Ensuring Accountability Of Data In Cloud And Security In End To End Process In Cloud Terminology, International Journal Of Civil Engineering And Technology (Ijciet)Volume 8, Issue 4, Pp. 376–385, April 2017.

[15]. R.Elankavi, R.Kalaiprasath, Dr.R.Udayakumar, A fast clustering algorithm for high-dimensional data, International Journal Of Civil Engineering And Technology (Ijciet), Volume 8, Issue 5, Pp. 1220–1227, May 2017.

[16]. R. Kalaiprasath, R. Elankavi and Dr. R. Udayakumar. Cloud. Security and Compliance - A Semantic Approach in End to End Security, International Journal Of Mechanical Engineering And Technology (Ijmet), Volume 8, Issue 5, pp-987-994, May 2017.

[17]. Thooyamani K.P., Khanaa V., Udayakumar R., Virtual instrumentation based process of agriculture by automation, Middle - East Journal of Scientific Research, v-20, i-12, pp-2604-2612, 2014.

[18]. Udayakumar R., Thooyamani K.P., Khanaa, Random projection based data perturbation using geometric transformation, World Applied Sciences Journal, v-29, i-14, pp-19-24, 2014.

[19]. [19]Udayakumar R., Thooyamani K.P., Khanaa, Deploying site-to-site VPN connectivity: MPLS Vs IPSec, World Applied Sciences Journal, v-29, i-14, pp-6-10, 2014.

[20]. [20]Nanjing Pride Technology Co., Ltd. Wireless Pulse/ECG Watch; Nanjing Pride Technology Co.,Ltd.: Nanjing, China, 2010. Available online: http://724pride.en.alibaba.com/ (accessed on 31 January 2011).