Designing of Tele-Health Smart Sensor Device to assist home care staff

V Chandrasekaran1*, D Vijendra Babu2, V Thanikaiselvan3, K Somasundaram4

1Department of Medical Electronics, Velalar College of Engineering and Technology, Thindal, Tamil Nadu, India
2Department of Electronics and Communication Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission’s Research Foundation, deemed to be University, Paiyanoor, Tamil Nadu, India
3School of Electronics Engineering, Vellore Institute Technology, Vellore, Tamil Nadu, India
4Department of Computer Science and Engineering, Chennai Institute of Technology, Malayambakkam, Tamil Nadu, India

Email: 1vc4sachin@gmail.com, 2drdvijendrababu@gmail.com, 3thanikaiselvan@vit.ac.in, 4soms72@yahoo.com

Abstract. The use of mobile devices in the medical and healthcare world has been a determining factor. The whole region has a mobile health sticker (mHealth). For mHealth, it is important to develop and use mobile applications. In turn, mHealth applications have innumerable targets and objectives. As a result, in the app stores, mHealth apps can be found in MediBuddy names, doctors on demand etc. While these applications are readily accessible in the google play store, this creative application’s primary aim is lacking, which is the accuracy of medical details. One does not communicate to the doc who is, on the other hand, exactly with his body temperature or pulse rate or pressure level. Therefore, we propose a prototype in this article that provides the mobile application with the necessary information through serial communication using the Bluetooth, which is sufficient for the doctor to prescribe medicines.

Keywords: MediBuddy, Bluetooth module, E-health, IoT, Sensor modules

1. Introduction

Mobile apps and their data analysis capabilities are only one direction that is important in recent years. Mobile applications are the basis for new data sources & medical perspectives, particularly in the medical field. Mobile applications can be used to guide & educate patients about clinical problems & concerns, and also health-related day-by-day challenges, in addition to the innovative data-gathering opportunities. Oddly, fewer attempts have been made in both science & industry to assess mobile health applications' efficiency & proof. In the global app stores (i.e. the Apple App Store, the Google Play Store), over 300,000 apps are currently available in the mHealth market, where over 200 new applications are frequently launched. Although mobile health apps are exponentially increasing, efforts to systematically prove them are still rare. The following issues are from a wider viewpoint, unique, apparent at the moment:
This paper presents an acquisition concept in the following sections: Literature Review followed by Section 3 Proposed system, Section 4 Hardware & Software tools, Section 5 Results & Discussions and Finally Section 6 Conclusions.

2. Related Work

[1] From 2013, the list of mobile health applications (M-Health APPs) for consumers/elderly has begun to thrive with the growth of smartphones & the public's sense of self-management, indicating growing prosperity. In 2013, the '12th Five-Year Strategy for National Autonomous Development Capacity Building' was released by the State Council, recommending that [5] medical & health information improve public service technologies’ capacity building, suggesting that mobile health care health has reached a rapidly evolving stage. Try to locate cell phone apps by 360 smart assistants, check for "medical" phrases to scan for 1500 mobile client apps, search for "health" up to 5400. (2014). It can be shown that a reasonably significant community already exists that pays attention to this area. Sadly, most apps are basic software, and they also lack flexibility & sophistication. NiuQirun (2014) also claims that the public accepts the specialized healthcare APP only for doctor’s opinion & appointments registration, & the rest of the items are not generally available. [4]

Therefore, this research is intended to examine the elders’ request from the ELDERS research study for APP functions. The findings might justify the course & development of the M-health APP design.

[2] Indonesia is the world's biggest archipelago nation, with far more than 18,000 islands & more than 230 million inhabitants & is split into 33 regions; roughly 60% of its area is projected to be rural. The government uses a referrals health service, with some 9000 community health centres (CHCs) serving as the arrowheads of community health services. [6] To meet the Millennium Development Goals (MDGs) in health, each health centre needs to face many everyday challenges. Also, in less rural or remote populations, many facilities have to accommodate patient health care within the scale of 100 to 200 patients a day. In promoting & enhancing day-to-day health care programmes, electronic health is required for these types of community health centres. Besides that, e-health will have further benefits to improve healthcare facilities, the productivity of healthcare professionals & the healthcare divisions.

Figure 1: Scope of E-Health Industry

[3] Electronic healthcare is one of the biggest healthcare industries today to use information and communication technologies (ICTs). As a recent paradigm in the healthcare sector, it has also been a significant necessity since global culture has transformed into an [7] ageing society & the healthcare costs has risen in the modern era. Since the 1990s, the Korean government has sought to incorporate e-health in Korean society. [15] However, it is difficult to build an e-health infrastructure in operation due to many obstacles, such as regulations, innovations, and awareness of e-health. For these reasons, it has
been difficult for many healthcare system vendors to create & commercialize their e-Health products for the next healthcare platform. These issues will lead to suffering and a significant loss of business. More than ever, little systemic testing has been carried out to educate the practice of e-health. For this reason, through its newly-developed e-health industry survey, the e-Health Research Centre (EHRC), which the Ministry of Trade and Trade funded, Industry and Energy from 2004 to 2007, identified this research as the top priority. [8] This survey has been developed in collaboration with e-Health experts of the Korea E-Health Association. It is intended to provide an image of the e-Health industry and a framework for comparing further research. Scope of E-health is shown in figure 1.

3. Proposed System
Figure 2 shows the simple architecture of E-prescription application. A mobile application links with various users like dentists, pharmacy unit and mother & child unit with deans, etc. [14] The proposed system architecture is shown in Figure 2.

![Figure 2: Simplified Architecture of E-prescription apps](image1)

![Figure 3: Block diagram of the proposed system](image2)

So, this is the path to how the client and a server communicate with each other. In our case, they are doctor & patients. So, we have proposed a prototype which pairs with a user mobile via Bluetooth.
module and transmits some set of data's through the Bluetooth module to the mobile applications (i.e. med buddy, doctor on demand etc.). Here the data are nothing but the required medical values from the human body like body temperature, [9] heart rate and blood pressure level etc., which is required to receive a prescription from the remote doctors.

The Fig.3 shows the block diagram of the proposed system. The prototype is built using the LPC2148 microcontroller with several modules like heart rate sensor, temperature sensor, Barometric Pressure Sensor, Bluetooth module and the power supply unit [13].

3.1. Heart Rate Sensor
The Heart rate sensor is based on the photoplethysmography theory, which tests the difference in blood [10] flow through every part of the body that induces a variation in light's brightness through those organs. Heart rate sensor is shown in fig. 4.

![Figure 4. Heart Rate Sensor](image)

3.2. Temperature Sensor
The voltage around the diode terminals is the underlying theory of the application of temperature sensors. [11] The temperature also varies as the voltage rises, accompanied by a voltage decrease between both the base & the emitter transistor terminal in a diode. Temperature sensor Shown in figure 5.

![Figure 5. Temperature sensor](image)

3.3. Pressure Sensor
A wireless blood pressure sensor uses an air compressor to prop up a cuff with ample pressure around the upper arm or wrist to inhibit blood leakage to the major local artery. The pressure sensor is shown in figure 6.
3.4. Bluetooth module
Attach the ground module pin to the base of the system, which transmits serial details. This pin gives everything that is obtained as serial data through Bluetooth. [12] The status pin on the LEDs can be used to check the proper feature of Bluetooth on boards. Bluetooth module is shown in figure 7.

4. Experimental Results
The fig.8 shows the heart rate of a patient which is obtained from the prototype which we have developed. Here the heart rate sensor provides a digital value to the controller. In the source code, we read the digital value from the interrupt pin. Further, some calculations are done based on the heart rate sensor's datasheet, which will give us the patient's heartbeat. Then obtained decimal value is transmitted via serial communication using UART protocol.
Since the Bluetooth module is connected to the Tx & Rx (UART) pin of the controller, the transmitted serial information is received in Bluetooth. Finally, the Bluetooth module feeds the obtained information to the mobile application connected to the server.

![Figure 9: Body Temperature of a Patient in a mobile app](image)

Figure 9 shows the temperature of a patient obtained from the prototype which we have developed. The only difference with this sensor is that this gives the analogue value compared to the heart rate sensor (that gives the digital value). Hence, before the controller reads the data, an Analog to Digital Conversion occurs. Amplitude Quantization and Time Quantization are two main factors that need to be taken into account. Rest of the data acquisitions are as same as the above one.

5. Conclusion
This paper proposed a model that provides the server with the necessary medical information, its context information. The overarching goal is to guide the quality of apps on mHealth for customers, workers and health care providers as the mHealth software business is a challenge. Thus, a prototype like this is impossible to ignore. It was developed & applied. The program that routinely tests the patients’ health records and communicates with the smartphone app is achieved with ease. However, this is the first creative thing for this domain that is needed to flourish this mobile health app for the next generations. In the end, even more goals must be accomplished and tackled in future work.

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