WEARABLE SMART BAND

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ABSTRACT

Recent advancements in smartwatch technology have led to several applications in fitness and health monitoring. In this paper, a user-friendly smart band, which can sense physical activity is developed that integrates the different sensors with microcontroller and sends data on Android App. Based on the device, a smartphone software is developed, this hardware and software system can gather data and monitor personal health from the aspects of physiological conditions and physical conditions. Compared with other systems, it has the advantage of providing raw sensing data and unobtrusively continuous sensing, which can bring new opportunity to pervasive personal health monitoring, and promote wearable computing research in health monitoring and disease prevention.

Keywords: smart watch, OLED, pulse oximeter sensor, RTC, Arduino pro mini

I. INTRODUCTION

With the aging and growing populations, the prevalence of chronic diseases, it is urgent that ubiquitous computing technology can provide necessary help for personal health. According to report [11], Non-communicable diseases (NCDs) including cancer, heart disease, and diabetes accounted for 71% of the 56.9 million deaths worldwide in 2016; that share increases to over 80% in the most developed countries. Therefore, it would be meaningful if intelligent and convenient systems can be developed to monitor and manage people's health status in daily life instead of rushing to the hospital. People are not good at recording their health condition; sometimes it is even difficult to recall what food they had yesterday, let alone the multi-dimensional health related information for a long time span. While, the development of chips, sensors, and telecommunications accelerates the prevalence of wearable devices, nowadays, intelligent devices, such as wristband (Fitbit, Jawbone, Misfit, MI band, etc.), smartwatch (Apple watch, Samsung Gear, HUAWEI watch, etc.) etc. and other intelligent systems have the ability of sensing users health condition to some extent such as heart rate, sleep monitoring, step-counting etc. While, most of them do not provide raw data to users and developers, but restricts the personalized usage and the potential applications.

This health care scheme is focus on the measurement and monitoring various biological parameters of patient's body like heart rate (pulse monitoring), fall detection and temperature using a WSN and android application where doctor can continuously monitor the patient's condition on his smart phone using an Android application, the patient history will be stored and doctor can access the information whenever needed from anywhere and need not physically present. In this way, it simultaneously improves the quality of care through constant attention and lowers the cost of care by eliminating the need for a caretaker to actively engage in data collection and analysis.

As most people suffer from the sub-health problem or chronic diseases, research on sensing and managing personal health is growing rapidly. In this paper, a user-friendly smart watch, which can sense personal physiological data and physical activity, is presented.

II. LITERATURE SURVEY

In [1], a user-friendly smart watch, which can sense personal physiological data and physical activity, is presented. Based on the device, smartphone software is developed; this hardware and software system can

gather data and monitor personal health from the aspects of physiological conditions and physical conditions. Compared with other systems, it has the advantage of providing raw sensing data and unobtrusively continuous sensing, which can bring new opportunity to pervasive personal health monitoring, and promote wearable computing research in health monitoring and disease prevention.

In [2], the health care system is designed to contain wearable devices and care notification system. Wearable devices include smart clothes, healthy watch, and bodytag to record the users' physiological parameters. The raw data was collected by the wearable devices and updated to the database to turn into the personal health analysis report. Care notification system which can record users' measurement value and proactive inform the users if their thresholds are abnormal. Currently, the system has been set in a long-term care institution in Taiwan since October, 1st, 2018. There are two groups of residents in the institution. One of the groups are the elders who have chronic such as high pressure and high blood sugar. This type of group adopts the care notification system to help them manage their health. The other group is dementia residents. There are 10 dementias about 59 to 89 years old attend the experiment. The data collection of the experiment during 93 days and the result shows that the average steps of 10 subject are 3925 steps per day and the sleep efficiency is 84.425 points. The frequency of abnormal event about stays too long for more than 2 hours is 9.82 times per day. By using the system, the caregivers can monitor the physiological signals and abnormal events in a long time and provide more efficient care services.

In [3], a system structure of mobile personal health management is established, which is divided into three parts: blood pressure blood glucose pulse machine, radio frequency identification (RFID) system and network health information management system. The completed mobile personal health management system allows users to use the wireless network environment to complete physiological measurements and numerical upload records anytime, anywhere, and to easily obtain a list of personal health measurement records using a tablet or smart phone. And the analysis chart, the measurement data of this system is measured and transmitted, combined with the record and analysis of network health information management, can improve the immediacy and accessibility of long-term and long-distance care, and also simplify the operation of medical services process.

In [4], VeenaTripathi et al monitored heart rate and calories burnt per day of a person are. From this research it is expected to monitor the whole body of the patient from remote location and improve the technology to world widely for patient monitoring by providing personalized and optimized services, it will promote a better standard of living.

In [5], a deep review of the state of the art of smart DSSs (Decision Support Systems) is presented. It also elaborates on the latest developments in intelligent systems to support decision-makers in health care. The most promising findings brought in literature are analyzed and summarized according to their taxonomy, application area, year of publication, and the approaches and technologies used. Smart systems can assist decision makers to improve the effectiveness of their decisions using the integration of data mining techniques and model-based systems. It significantly improves the current approaches, enabling the com25 bination of knowledge from experts and knowledge extracted from data.

In [6], ATM based remote health care monitoring system is designed and implemented. The drastic rise in ATM transaction costs which covers telecom, security, network, power management and cash management results in lower operational savings and pressurized profitability. This allows an individual to check the medical parameters such as Blood glucose level, Blood pressure, Heart beat, Body temperature, Height, Weight using

appropriate sensors after swiping the smart card of the person in the smart card reader which is interfaced to the microcontroller. After the check, the money for the particular test is transferred from the smart card. Then the health conditions are sent to the person's mobile phone via GSM. The entire database is stored in the main server. The unit writes patient information to smartcards. Patient information generally comprises patient identifying data, test result, diagnosis information, as well as diagnosis result. Computer stations read the smartcards and establish network connections with health report servers via the Internet. Computers then download patient information to health report servers that prepare comprehensive health reports. In a few minutes, the report is sent back to computer station, wherein it is printed and delivered to patient.

In [7], a smart IoT based healthcare system has been proposed, which contains an intelligence medicine box associated with sensors and server for regular health monitoring. This smart medicine box with wireless internet connectivity helps the patients to get regular health care and create easy communication between doctor and patient without meeting physically. The proposed medicine box helps the patient to take the right medicine at the right time along with an email which will help the patient to take the medicine. A laptop is used as a server where detailed information about doctor and patient are stored along with prescription and appointment date. Both doctor and patient have IDs' and password for accessing the server. Also, the data of medication and temperature of patient are stored on the server for doctor's ease. The Doctor can change the patient's prescription if necessary, which will also be notified via email. Moreover, the doctor can take immediate steps in case of an emergency.

In [8], the creation of a smart healthcare system using artificial intelligence as a means of efficiently solving challenges in the healthcare industry and as a tool for optimizing patient care plans is proposed. This AI-assisted system shows that it can support a patient who is admitted to the hospital through emergency medical services, easily process the patient's data, and offer early detection of serious diseases. It can automatically recognize the complicated patterns which have been obtained from radiologists, can analyze complete human molecular data and genetics in the clinic, and can support doctors by producing AI-generated radiologist reports, clinical laboratory reports, and many other decision-support tools. The proposed architecture can easily handle diverse and complicated healthcare problems and can be used by any modern hospital to save time and money. This work also shows the recent development of AI applications in healthcare, which could be used in the proposed architecture.

Abhinay et al [9] developed an end to end health care workflow comprising three important modules. Firstly, a Bluetooth Low Energy (BLE) enabled portable 5-lead ECG monitor system with small form factor. Next, a smart phone based android application, which receives plots and analyzes the data sent from ECG device. A remote server where the patient data and analysis reports are stored for future reference of a professional medical practitioner. The device was tested using real time data from a rural hospital and further the obtained ECG signatures were compared with standard GE and SIEMENS ECG machines. The results were validated by a cardiologist of a super specialty hospital.

In [10], the authors will present improvement of Health insurance system in Montenegro. Information system as a vital part of any business oriented company, hence the same paradigm can be applied in health insurance fund. Main focus of this IS its user focused component in order to introduce SMART cards, improve and facilitate the process of validation of insurance users and improve the overall security of the system. With this novel approach the authors propose creation of platform that will enable Health Insurance Fund of Montenegro to introduce novel services into health care ecosystem of Montenegro.

III. PROPOSED SYSTEM

For the hardware design of the watch, we use three sensors: tri-axial accelerometer, pulse rate monitoring sensor (MAX3010) and temperature monitoring sensor (LM35), and the block diagram of this hardware circuit is illustrated in Fig. 1. Sensor data are wirelessly transmitted to the MPU (Microprocessor Unit, MPU) Arduino Pro mini for processing. The pulse oximeter sensor can provide information about heart rate, and blood oximetry. And the temperature related sensor provides the real-time temperature of body. The interface for communication with other device is implemented by BLE (Bluetooth Low Energy, BLE). And for the storage, it has 64KB RAM, 512KB ROM, and 4MB Flash. Besides, the MPU collects these sensors' data and calculates the basic vital sign, such as heart beats, steps etc. And the MPU transmits theses sensors' data and the calculated values to the smartphone with virtual UART service of BLE.

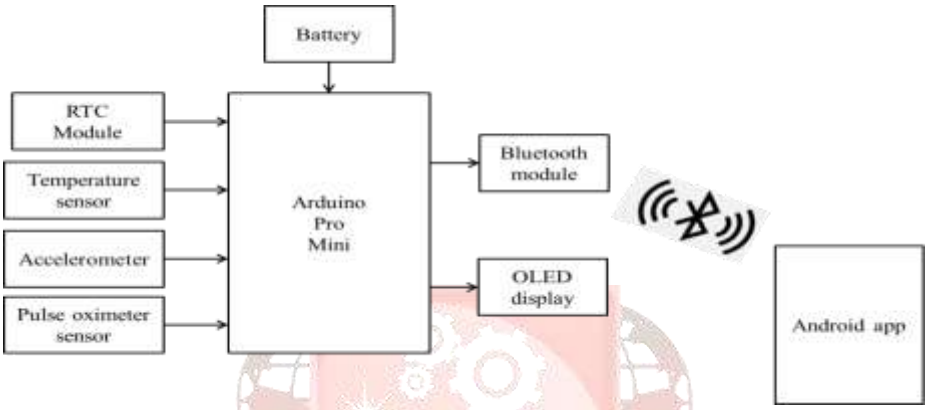

Figure 1: Block diagram of proposed system

To monitor user's health condition, we develop a software application base on the watch, which shows health related data on watch as well as on Android app. We use MIT App Inventor to design Android app. Fig 2 shows flow of system proposed.

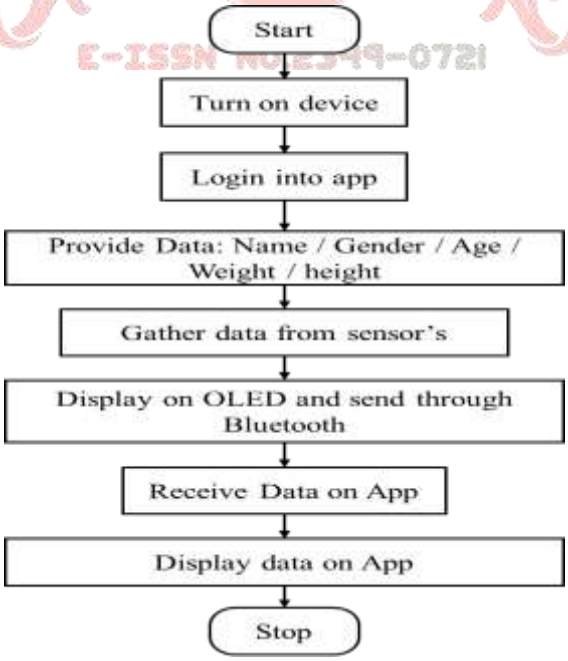

Figure 2: flowchart of proposed system

IV. CONCLUSION

The mobile personal health management system in this study includes study devices on hardware and with the management program as the software. The devices studied include a device for blood pressure, fall detection and temperature measurement, Mobile devices and Bluetooth transceiver; whereas the software management programs include Data sensing and a decision making system, Hardware display system (OLED) health and medical information system (android App).

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