Wearable Health Monitoring System forAthletes-A Survey

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ABSTRACT: The health burden is emerging from and unexpected death caused by cardiac issues. Sudden Cardiac Arrest (SCA) is frequently named "the silent killer". The proposed system is for athlete health monitoring, which collects ECG signals from each person sends through Arduino UNO. For the transmission of data from the person wearing this device to the server, the wireless Radio Frequency Transmitter and Receiver is used. Under critical circumstances to generate warning messages to the doctors the developed system is used. By continuous monitoring and immediate action on the person whose readings are abnormal have a high chance of saving a life.

KEYWORDS: ECG signal acquisition, Arduino UNO, TDM, RF transmitter, receiver.

I. INTRODUCTION

Medical breakthroughs are used in managing our physiological parameters which are about to change for the betterment and which are helping us to live longer and healthier. The efficiency of the medical centers is likely to be increased with the use of IoT. The way the facilities are delivered to maintain our physiological parameters production has changed by IoT. To enable the design of low-cost, lightweight, miniature, and intelligent physiological sensor nodes, the advancement in sensor and wireless communication is used [1]. The evolvement of wearable devices is to ensure the accuracy of bio-signal, interpretation of data, and guaranteeing the privacy of users.

The realistic possibility that they can provide accurate and precise measurements with the advent of smart textiles, energy generators, miniaturization of embedded systems, and the introduction of new communication new protocols. [2]. The CHD (coronary heart disease) results in the burden of SCD (sudden cardiac death) in the total population remain incompletely defined and debated. The American Heart Association states that the number of SCDs annually in the United States is based on retrospective death. Since the early 1980s, the estimates have remained in the range of 300,000 to 350,000 SCDs annually, among the general population, the incidents occur between 1 or 2 deaths per 1000 person-year [4].

During exercise, the abnormal heart rate profiles likely to occur sudden death. However, identifying those changes requires monitoring of the parameters in real-time during extensive activities. These needs are addressed by proposing a wearable ECG monitoring system that can sense ECG and transmit it to a server for monitoring. Because the wearable system constantly monitors the athlete during the sports activity, the athlete, coaches, and medical professionals will be alerted if SCA indicators are detected, allowing timely intervention thus preventing SCA occurrence. On rare occasions, sudden cardiac death may be experienced by the patient with the cardiac condition who engage in athletic competition.

II. LITERATURE SURVEY

[5] In this paper, the automated and intelligent system that measures a patient's physiological parameters. Arduino UNO microcontroller is used for wearable device part which fetches the data from LM35 and piezo sensor, and then the data is sent to the server by SIM900D GSM module every 10 minutes. In the case of emergency contacts the SMS is sent to the concerned person by the microcontroller through GSM module. With a python based micro web framework the server is formed using a flask integrated with SQLite database to store patient's physiological parameters which canalso be viewed later. The web server provides unique id for doctors and patients. So that, doctors are able to see patients' data in the form of a table.

[6] In this paper, the designed system uses WBAN (wireless body area network) and cloud computing to address physiological parameters like blood pressure, sugar level, obesity, etc. They have implemented a CoAP (constrained application protocol) protocol which is used in order to provide web service based on the WBAN prototype. The proposed architecture consists of sensors attached to various wearable garments such as jackets, gloves, shoes, etc. In

This system, the star topology network is implemented. The data is acquired using a smart phone and the data is analysed by transferring it to the web service on the cloud. The IoT using stack-based front end method is integrated with WBAN.

[7] In this paper, the non-instructive biomedical sensor is used in the health monitoring system. It consists of 4 sensors namely:-Temperature Sensor DS18B20; Pulse Sensor SEN11574; Respiration Sensor SA9311M; ECG Sensor AD8232. An ARDUINO MEGA 2560 Controller is used to fetch signals from all these sensors connected to it. An opted ECG signal is displayed on LCD (liquid crystal display 16x2) and data is sent to the server through the Wi-Fi module (ESP8266). The Thing Speak application allows the doctors to view the physiological parameters and data can be saved using an SD card for future study.

[8] In this paper, the HMM (hidden Markov model) chain is used in the health monitoring system. This system mainly focuses on CVD (cardiovascular disease). This system is composed of four main parts (1) patient's path estimation:used for location information; (2) ECG data acquisition: information of 'R' peaks are collected and transmitted to patient's portable device; (3) patient's table management: for every 6 seconds 'R-R' interval deviation information is updated; (4) hospital alert management: used to generate an alert signal for medical staff in case of abnormality. From AP's (access points) and BS's (base stations) the next location is updated.

[9] In this paper, to transmit the real-time ECG signal from system to server, the message queuing telemetry transport protocol is used. The system can work for both LAN (local area network) and WAN (wide area network). Using API the data is uploaded to the cloud through WLAN. Raspberry pi3 hosts MQTT (mosquito message queuing telemetry transport) broker through which the ECG data is published. Doctors can use the android mobile application to view the real-time ECG signal.

[10] In this paper, the diabetes data is collected from the Kaggle data center which is used to implement EHMS (e-health care monitoring system).EHMS application uses a new machine learning algorithm i.e. SVM (support vector machine) algorithm is integrated with IoT (internet of things) to bring out the abnormality, from the observed physiological parameters. The SVM algorithm can perform up to 80.5% of accuracy.

[11] In this paper, the ZigBee module is used to transmit the encoded serial data continuously by attaching the transmitting module. The data is continuously displayed on the user interface after decoded by the receiver unit. The architecture can be stated in 4 module - (1) patient's data input module-converts analog parameters to digital form usingthe ADC of microcontroller ATmega8L; (2) data communication module - ZigBee serial data is converted into USB compatible data using FT2321C; (3)user interface module - this GUI standalone file is developed using MATLAB; (4) processing unit - by programming, the heart rate monitoring can be extended by counting the number of pulses in real-time and display it on doctor's laptop by giving room number of patients who needs immediate attention in case of emergency.

[12] In this paper, the main objective of this system is to continuously monitor the patient's health over the internet using the PIC18F46K22 microcontroller which collects physiological parameters through sensors like MCP6004 used to measure Heart rate, max30100 pulse oximeter used to measure the pulse rate and DSI820B used to measure temperature, then the collected data is sent to the server through ESP8266 WiFi module. The data can be accessed at any time using a unique IP address, the data readings are displayed on LCD and an alert warning message is sent to the doctor's cell through a GSM modem.

[13] In this paper, the health monitoring system includes the measurements of physiological parameters like temperature (sensor LM35), heartbeat (pulse sensor SEN11574 and ECG (ECG sensor AD8232) are connected to Raspberry pi board which transmits the data to the server. Shaner's secrete key sharing algorithm is used, where the data and the key will be split and saved at different locations to maintain the security of patient's data, then the data is retrieved by threshold cryptography method. SVM (support vector machine) algorithm is used for heart disease diagnosis prediction.

[14] The main focus of this paper is to design a continuous health monitoring system using wearable sensors without hospitalization. The implementation of the system is done by using PIC16F877A Microcontroller and PROTEUS 8 (simulation tool for embedded microcontroller) software is used for simulation. The body temperature is measured using LM35. BMP180 is used to measure the systolic and diastolic pressure. SEN11574 is used to measure the pulse rate. With the help of PROTEUS software, the results are easily obtained providing the real-time monitoring of the patient.

[15] In this paper, a Robust healthcare model for the continuous monitoring of the patient while traveling is proposed. Sensors are used to collect the physiological parameters of the patient. 3G or 4G network is used to access the internet when the patient is traveling and collected data is sent to the server from BAN(body area network). The server will provide storage & critical analysis of data. An emergency message with details of patient situation & location is sent toselected people.

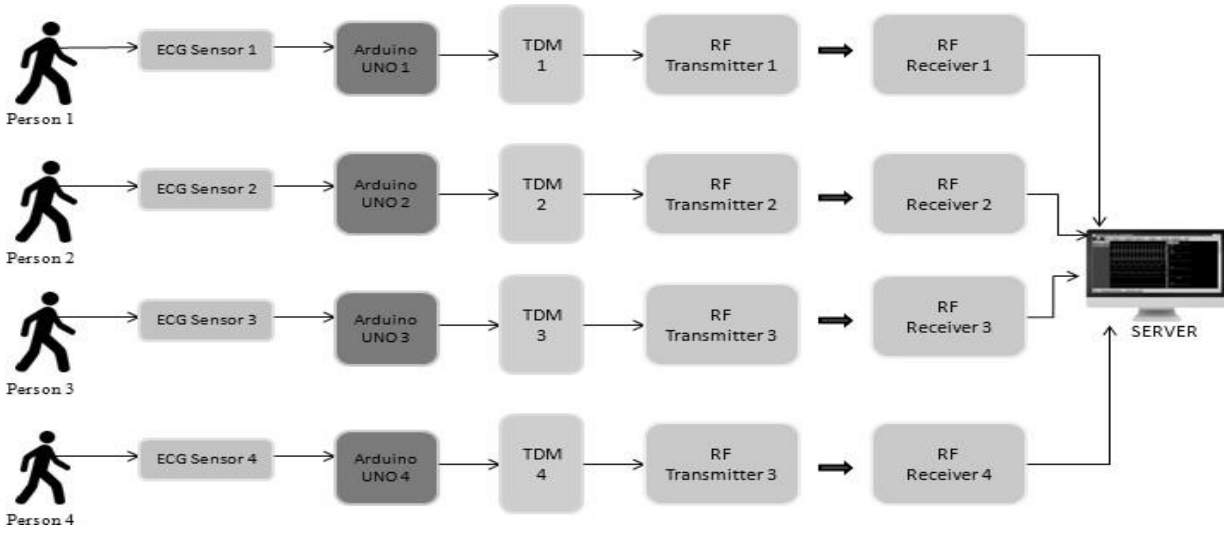
[16] The pulse rate is measured using NodeMCU, which directly transmits the data to the cloud (thing speak). Internet of things (IoT) is more beneficial in the field of healthcare. IoT plays the main role in the monitoring of vital signs of a patient in ICU. As a result, the doctor can examine the patient's data from anywhere and anytime. The data is fetched by node MCU and stored in thing speak. Then the data is sent to the Blynk app where the doctors can view the patients' data from time to time.

[17] In this paper, the author proposed a health monitoring system using IoT for elderly persons. It contains a server to store the collected physiological parameters. Raspberry pi is used to store the data from the server as per patient-ids & forwarded to doctors for analysis. CoAP (constrained application protocol) is used for network performance. While MQTT (mosquito message queuing telemetry transport) is chosen for the sensor-based application and HTTP (hypertext transfer protocol) is used for data transfer & communication.

[18] In this paper, the proposed system will monitor the physiological parameters of a patient remotely. The system is made affordable by using domestically available sensors. The pre-programmed controller receives the parameter readings from the sensors at a certain frequency. The controller used in this system is Arduino UNO. The data is processed and relayed to two places. The two places are one is OLED display which will show the real-time reading and the other one is, data is sent to Thingspeak application through Wi-Fi module ESP8266.

III. PROPOSED CURRENT WORK

Implementation of ECG signal acquisition with high accuracy, always poses challenge to researchers. In our work, we propose to demonstrate ECG signal acquisition in real time considering the condition of each player.



(1) Acquisition (2) Processing (3)Transmitter (4) Receiver

Figure.1 The block diagram of proposed monitoring system.

MATERIALS AND METHODS

The proposed method has following steps.

1. The ECG signals from multiple persons are acquired.
2. The data is fetched by Arduino UNO.
3. To transfer this signal RF transmitter is used.
4. On the other hand the signal is received by RF receiver and observed by the server.

As the work is carried out in real time, the acquisition of ECG signal from each person is the primary requirement.

ECG signal acquisition and pre processing is implemented in MATLAB software. Hardware implementation uses Arduino UNO for real time monitoring.

IV. CONCLUSION

The Internet of things (IoT) is widely used in wearable technologies. Smart homes, security management, educational institutions, and so on, are some of the applications of IoT. To reduce the risk factors in health care applications, IoT devices play an important role. So in this paper, the continuous health monitoring system with wearable sensors for sportspersons is introduced. In this paper, the health clinics for sports person are defined. The further use of this technology in the different fields of sports can help the athletes to return to play. This wearable health tracking device helps to collect health details and to maintain exercise records.

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