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Real-time Heartbeat And Body Temperature Monitoring With Android Application

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Abstract— Enhanced and smart healthcare system is symbol of developed nation. Quality in healthcare means providing care to patient in an affordable, safe, effective manner. The popularity of Internet of Things is rising rapidly in the area of remote monitoring system. The work here illustrates design and implementation of automated and intelligent health monitoring system. In this project Sensors are used for collecting the pulse rate and body temperature of the patient. These real time data are then analyzed and stored in IoT cloud. The doctor can monitor the patient at remote location any time by using an android application. The system can detect the critical condition of patient and can send notification to doctor's smart phone. The doctors can observe their corresponding patients remotely without visiting the person.

Keywords— Arduino, Android application, ESP8266-01, sensors, ThingSpeak, Internet of Things

I. INTRODUCTION

IoT is a network of internet connected devices (Electrical) which can interchange data between them using sensors and actuators. A significant development is noticed in information and communication technologies due to Internet of Things (IoT) over a last decade. IoT opens the door for vast opportunities as physical device is integrated into computer based system. This integration results in reduced human participation, increase productivity, improved safety and security, providing high efficiency along with economic benefit and accuracy [1].

In medical field wireless transmission of data is becoming significant as it is required by every organization in health sector. Nowadays medical world is facing many problems: (i) In remote area most of the people does not get appropriate health facilities. (ii) The healthcare professionals and staff must be on a site of the patient all the time [2]. (iii) People have busy schedule and they hardly get time to wait for a long appointment hours and then get to meet doctor for their regular visit. (iv) It is quite possible that doctor has not been alerted at emergency situation when patient's condition comes down at a critical stage in spite of 24 hours close observation. (v) Sometimes even after getting discharged from hospital, patient often needs to be kept at close observation and report any health injury to doctor.

In order to achieve flexible and friendly patient care, the above mentioned problems can be solved using IoT as the technology [2]. This approach has the potential to reduce workload of health professionals and costs for health care system [5]. The doctor can monitor the health records of the patient at remote location using android application. From patient's point of view, it allows to continue the daily life saving from the requirement to attend the hospitals for regular monitoring and supervisory.

As the bioinstrumentation and telecommunication are advancing, it has become convenient to design a home based vital sign monitoring system to gather, display, record and transmit the physiological data from a human body to any location [2].

The arrangement of the paper is as follows, Introduction is included in Section I. In Section II, IoT in health care related significant works is discussed. Section III deals with the proposed system, Section IV deals with Equipment details, Section V explains about the Experimentation results. Section VI concludes the paper and gives details about future work.

II. RELATED WORKS

The aim of this project is to develop a device to keep on time track on the health status of the patient and updating to doctor at remote location anytime. With this effective device, health status of a critically ill patient can be constantly monitored. The pulse rate and body temperature of the patient will be monitored and diagnosed. The information will be sent to the doctor and patient, both can check health records via android application. In case of emergency if the pulse rate or body temperature goes beyond or below normal value notification will appear on doctor's android phone. Thus, IoT technology can help to improve medical service systems. There are lot of health monitoring systems available having different drawbacks like high power consumption, bulky, slow response, complicate design, data storage and many more. The proposed system is very helpful to overcome these drawbacks. Some significant and related works have been focused in the literature.

Internet of Things Based Patient Health Monitoring System Using Wearable Biomedical Device [1] by Zia Ahmed, Golam Mortuza, Jashim Uddin, Jiabul Hoque, Humayun Kabir, Mahiuddin proposed intelligent system that automatically senses patient's health condition, stores and displays those data on internet and informs doctor when patient's encounters

critical condition. In this project web server is formed using flask and integrated with SQLite database to store the sensor data. A website is prepared to view the real time data by both doctor and patient.

Real time monitoring system for health care using Zigbee [3] by O. Alwan demonstrated the body temperature data transmission wirelessly using two transceivers based on Zigbee. Temperature sensor is connected to arduino, the sensor will sense the temperature of the skin surface in contact and then will transfer the temperature signal from the first transceiver module to the second which is connected to Raspberry Pi. An buzzer is attached to Raspberry Pi, when the body temperature goes beyond the threshold value the buzzer and alarm will turn on. The temperature data will be displayed on LCD connected to Raspberry Pi.

The paper presented by Sarfaz Khan [12] design the effective system for health monitoring using RFID. Different sensors are attached to the patient. The signals generated from the sensor are in analog they are converted to digital using ADC converter. The digital signals from ADC are forwarded to Bluetooth device using microcontroller. The Bluetooth device then wirelessly transmits physiological data to mobile. The data from the android phone can be accessed by providing IP address, email, mobile number. In case of any emergency an alert message will be send directly to doctor.

Android application for Geo location based health monitoring, consultancy and alarm system [5] by Emre Tartan. The main idea of this android application is to provide end to end communication between patient and doctor. The application provides various functionalities such as tracking of patient's current location with built in GPS sensor, consultancy module for communication between health professional and patient. This system transmits the patient's heart rate to the application using Bluetooth wireless connection.

III. PROPOSED SYSTEM

The main focus of this work is to provide compact design, end to end connectivity, user friendly, accurate, data security and privacy. The real time data can be monitored at remote location. This approach can (1) improve healthcare facilities in isolated area where people don't have access to healthcare experts. (2) Prevent delays in arrival of the patient's medical data to the health professionals.

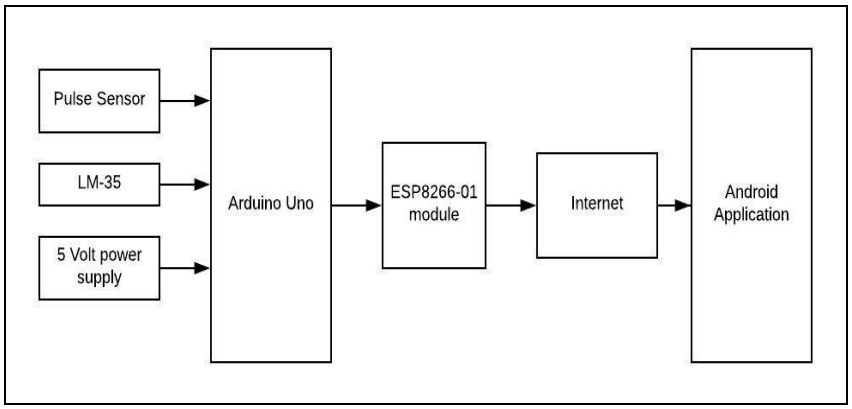


Fig.1: System Representation

Fig.1 depicts about the system representation of patient health monitoring. By applying 5 volt power to ATmega328 the sensors will obtain the value from the patient in analog signal form. Arduino will convert analog signal to digital signal using ADC converter. These sensed values are wirelessly transmitted to android application using ESP8266-01 Wi-Fi module. The values are stored in ThingSpeak and Google Sheets. ThingSpeak is an open source cloud platform that allows data analysis, visualization and real time data collection. Every cloud in ThingSpeak has its own read and write API Key. Thus, One can make own cloud channel private or public as per the choice.

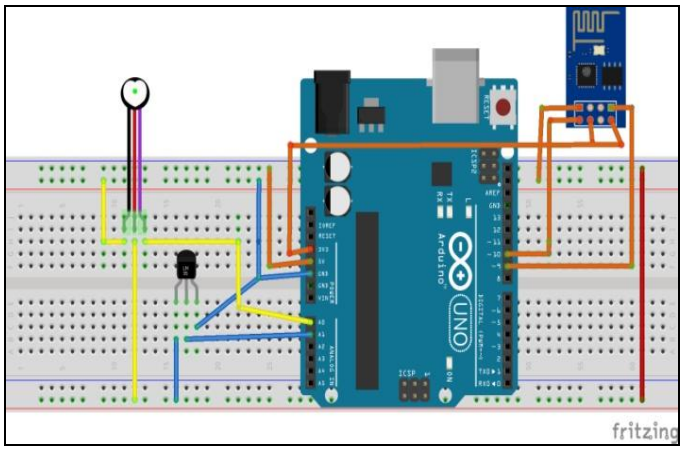


Fig.2. Hardware design of the system

IV. EQUIPMENT DETAILS

Name of the components	Purpose
Arduino Uno	The main controller board
ESP8266-01 Wi-Fi module	Allow arduino to access Wi-Fi network
LM-35 sensor	For body temperature
Pulse Sensor	For calculating beats per minute

V. SYSTEM TESTING

Temperature sensor and pulse sensor are attached with patient's body and power is supplied to microcontroller. Arduino will begin to measure data and will send the data to the IoT platform using ESP8266-01 module.

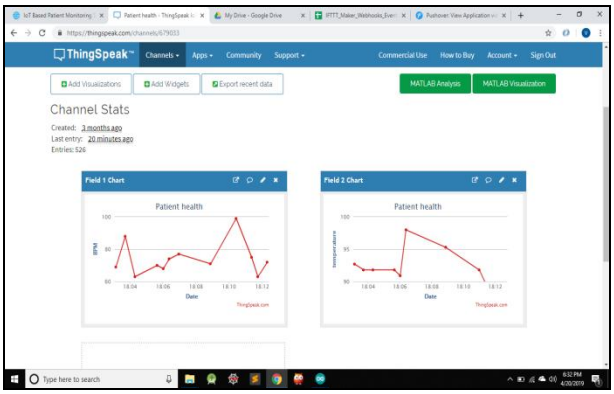
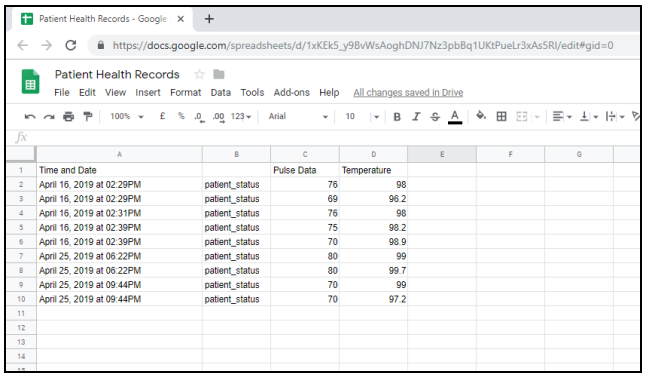


Fig. 3: ThingSpeak IoT cloud platform



	A	B	C	D
1	Time and Date		Pulse Data	Temperature
2	April 16, 2019 at 02:29PM	patient_status	76	98
3	April 16, 2019 at 02:29PM	patient_status	69	96.2
4	April 16, 2019 at 02:31PM	patient_status	76	98
5	April 16, 2019 at 02:39PM	patient_status	75	98.2
6	April 16, 2019 at 02:39PM	patient_status	70	98.9
7	April 25, 2019 at 06:22PM	patient_status	80	99
8	April 25, 2019 at 06:22PM	patient_status	80	99.7
9	April 25, 2019 at 09:44PM	patient_status	70	99
10	April 25, 2019 at 09:44PM	patient_status	70	97.2

Fig. 4: GoogleSheet

Android application design**:**
The android application is designed for both doctor and patient. The doctor can check the patient details and can continuously monitor real time physiological data of the patient. While the patient can also check the health records.

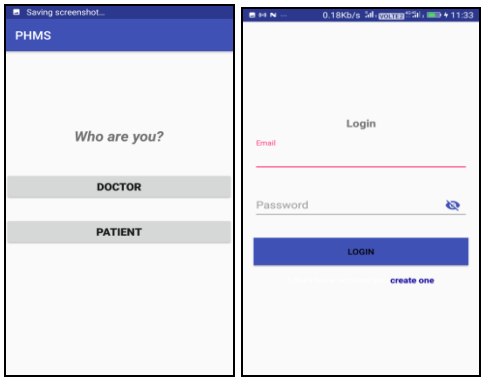


Fig. 5: Initial Activity Fig. 6: Doctor Login

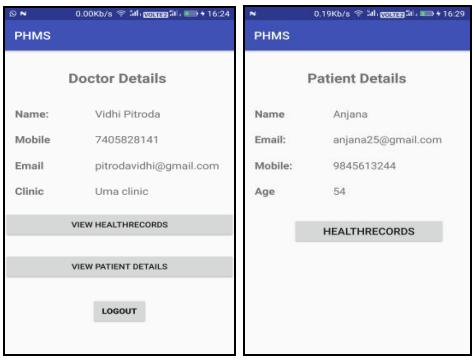


Fig. 7: successful login Fig. 8: Patient details activity

As shown in fig. 5 at the start of the application the user have to select whether he/she is a doctor or patient. After successful login of doctor (fig. 6), it will be directed to next activity where he/she can check details (fig. 7) and on clicking button " view patient details" doctor can view patient details (fig.8) and health records (fig. 9) along with date and time. If user selects patient from initial activity then user will only able to see his/ her own physiological data.

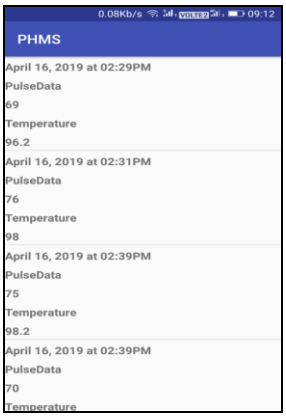


Fig. 9: Health record activity

In case of any abnormalities when patient encounters automatic notification will be pop up on doctor's android phone (fig. 10).

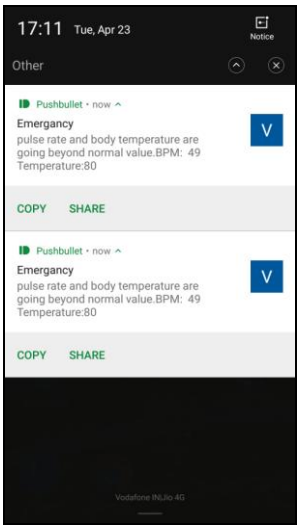


Fig. 10: Emergency Notification

VI. CONCLUSION

Patient health monitoring based system is the enhanced technology as compared to existing technology because it is easy to use, low cost, no distance limitations, accurate and efficient. This system allows health experts to continuously monitor real time patient's physiological data remotely and dynamically in the android application. The data will remain secure as channels in ThingSpeak will be kept private and every cloud has its own unique address and API key. Health experts will have another alternative to monitor patient's data is Google Sheet. The patient can also analyse his/her physiological data by using android application.

In future studies the proposed approach can be extended to more physiological sensors. An voice notification can be added so that whenever the data crosses threshold value a voice notification will be received by doctor. This work is done for single person data collection and in future it can be extended for multiple people.

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