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IOT BASED HEALTH MONITORING SYSTEM USING ANDROID APP

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ABSTRACT

The aim of this project is to create an IOT based application for monitoring patient. The advancement of Body Sensor Network in healthcare applications have made patient monitoring more feasible. We are proposing an Android Mobile application based Health care system using Body Sensor Network (BSN). The nodes of BSN include Temperature, Humidity and Pulse Rate Sensor. The proposed framework is effective in taking care of the issues confronted by patients and doctor by observing human exercises and interfacing with the living condition.

Keywords: body sensor network, internet of things, health care, android application.

I. INTRODUCTION

Internet of things is an incorporated portion of Future Internet and could be characterized as a dynamic worldwide system foundation with self designing capabilities in view of standard and interoperable correspondence conventions where physical and virtual things have identities physical attributes and virtual personalities and utilize shrewd interfaces and are flawlessly coordinated into the data organize.

In the IoT "things" are relied upon to end up noticeably dynamic members in business, data and social procedures where there are empowered to interface and impart among themselves and with nature, while responding self-governing to the 'genuine/physical world' occasions and affecting it by running procedures that trigger activities and make administrations with or without direct human mediation.

Internet of things is having diverse elements which essentially incorporate univocally identifiable and addressable items, manmade brainpower, measure thought, and Geo-restriction. IoT can be actualized through Wi-Fi, Barcode, ZigBee, radio frequency identification technology (RFID), sensors and advanced mobile phones. IoT can be utilized as a part of various applications, for example, activity checking, security, transport and co-ordinations, day by day and domestics and social insurance and so forth. Social insurance checking arrangement of the patients can be viably executed utilizing IoT.

IoT is essentially to settle issue of interconnection, for example, Things to Things, Human to Things and Human to Human. All articles in the physical world can step up with regards to trade data by means of the Internet, to accomplish interconnection each other. Body sensor network (BSN) and advanced mobile phones are critical piece of IoT in medicinal services checking for correspondence. A Secured Mobile Health mind System utilizing Body Sensor Network is proposed with the assistance of android application for ceaseless observing. To read the sensors we have used Raspberry Pi 3 model B which is helping in interfacing cloud.

A raspberry pi is a SBC, with awesome computational control. Raspberry Pi is a Master-card measured single board PC outlined by Raspberry Pi Foundation, which can be connected to a screen or TV. It was basically intended for instructing coding to children of basic school, yet extra time pi has fabricated its notoriety for being a Multitasking Board which is broadly utilized by different specialists and creators for their activities. The board is fit for working as a full desktop and is able of handling top notch video. It even has the capacity to collaborate with the outside world and control the music frameworks, Television and so on. Here we are utilizing Raspberry Pi 3 Model B, which is having 1GB RAM and 32 bit ARMv8 Processor.

ProsantaGope *et al*. [1] explained in the paper "BSN-Care: A Secure IoT-based Modern Healthcare System Using Body Sensor Network" about the Body Sensor Network advancements as one of the center advances of IoT improvements in medicinal services framework. In this framework a patient can be observed utilizing a gathering of modest fueled and lightweight wireless sensor nodes.

Tzonelih Hwang *et al* [2] examined about circulated IoT framework engineering and unknown authentication scheme in the paper "Untraceable Sensor Movement in Distributed IoT Infrastructure". The proposed framework works in three stages: Registration phase, inter-cluster movement phase and inter-network movement phase. It gives greater security includes the confirmation of less computational overhead.

Tae-Yoon Kim *et al* [3] proposed a multi-jump WBAN development conspires that is comprises of 4 operations, the grouped topology setup, versatility support, and transmission proficiency improvement. As an assistant advantage, the proposed plot accomplishes a vitality productive component by lessening the quantity of aggregate control messages.

Charalampos Doukas *et al*. [4] presented platform based on Cloud Computing for administration of portable and wearable human services sensors, showing along these lines the IoT worldview connected on inescapable social insurance.

Tianhe Gong *et al.* [5] analyzed the problems in current smart health care system in the paper "A medical Health care system for privacy protection based on IoT". A lightweight private homomorphism calculations and an

encryption calculation enhanced from DES are intended for security assurance.

Lin Yang *et al*. [6] proposed a paper "A Home Mobile Healthcare System for Wheelchair Users" which clarifies the framework engineering and plan of Wireless Body Sensor Networks. The framework is checking the status of wheelchair and living condition to understand the hazardous condition of wheelchair clients.

Geng Yang *et al*. [7] proposed an intelligent homebased platform, the iHome Health-IoT. The stage includes an open-stage based savvy solution box (iMedBox) with improved network and between variability for the incorporation of gadgets and administrations; shrewd pharmaceutical bundling (iMedPack) with correspondence ability empowered by inactive radio-recurrence distinguishing proof (RFID) and incitation capacity empowered by useful materials; and an adaptable and wearable biomedical sensor gadget (Bio-Patch) empowered by the best in class inkjet printing innovation and framework on-chip. The proposed stage consistently melds IoT gadgets (e.g., wearable sensors and insightful drug bundles) with in-home social insurance administrations (e.g., telemedicine) for enhanced client experience and administration effectiveness. The achievability of the actualized iHome Health-IoT stage has been demonstrated in field trials.

2. PROPOSED SYSTEM

The architecture of Health Monitoring system is shown in Figure-1. Tracking the body Vitals through BSN and smart objects are described in first part. Uploading the data to the cloud are discussed in second part and Application controls is the third part

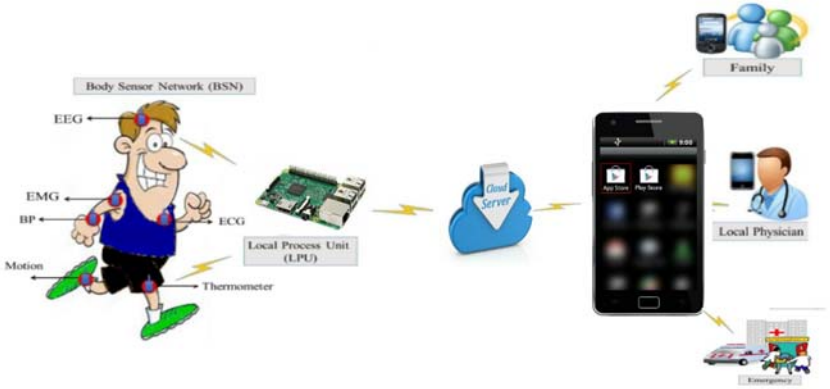

Figure-1. The architecture of health monitoring system.

Body vitals (Pulse\Temperature\Humidity) are crucial factors in determining well being of patient and help monitoring the strategy of treatment as well as record the response of treatment being conducted. While it can be hectic and tedious to go for larger population of patients to collect the vitals information on a strict routine, the accuracy and the time lag as well as the calibration of instrumentation increases the risk of false positives. To solve this problem, we present a digitally calibrated and real time vital measurement device that can operate in real time, record the data and send it for further consultancy of experts. It also notifies with an alarm when vitals need significant attention. While it can improve the efficiency of health tracking records the data generated by measurement can also be used for statistical purpose. Objective of this device is to improve the quality and efficiency of health care. The design and working of the device is as follows:

A. Tracking methods of Body Vital

In our prototype, there are two body vitals that we've chosen to measure. They are:

a) Temperature
b) Real time pulse

Here we are measuring temperature of first patient named ABC and real time pulse of second patient named DEF and apart from these we are also monitoring humidity status of the ward where multiple patients are present. There are so many heart rate sensors available in the market but we have used Pulse Rate Sensor SEN-11574 as shown in Figure-2. We can measure our pulse anytime by putting our finger on the sensor. This is an analog sensor but we have to read it by Raspberry Pi which takes only digital inputs, that's why we have used ADC (ADS1115). We have used digital GPIO ports on Raspberry Pi to connect the ADC then connected the pulse sensor to the ADC on channel A0.

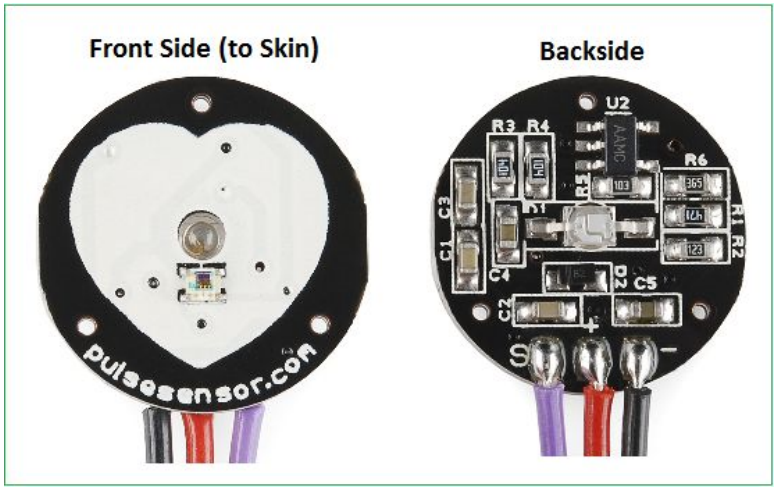

Figure-2. Pulse rate sensor.

In order to measure temperature and humidity, we've used DHT11 as shown in Figure-3. DHT11 works as a temperature and humidity sensor in which temperature range is from 0 to 50^0C with accuracy of +-2^0C and humidity range is from 20% to 80% with +-5% accuracy. The sampling rate of DHT11 is 1Hz means it will read one reading every second. It consists a NTC thermistor, a humidity sensing component and an IC.

There are two electrodes with moisture holding substrate in humidity sensing component. As the humidity changes the conductivity of substrate changes then resistance between electrode changes and this change is resistance measured by IC and send to Raspberry Pi.

NTC thermistor is a variable resistance which changes it's resistance as the temperature changes and because of NTC (Negative Temperature Coefficient) the resistance decreases as the temperature increases. This sensor is made by sintering of semiconductor type materials like ceramics or polymers to provide bigger changes in the resistance with just a small change in temperature.

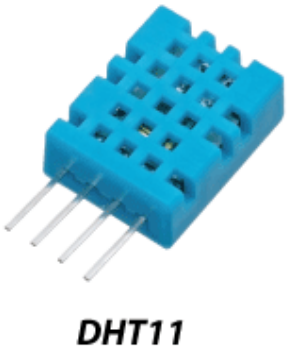

Figure-3. Temperature and Humidity sensor.

B. Uploading the data to the cloud

After we've successfully tracked the above information it needs to be sent to cloud where it can be stored, displayed and transferred to the application. Raspberry Pi uses Internet to send data to the cloud. Database of the application is connected to the cloud. Application accesses the data from the cloud as shown in Figure-4.

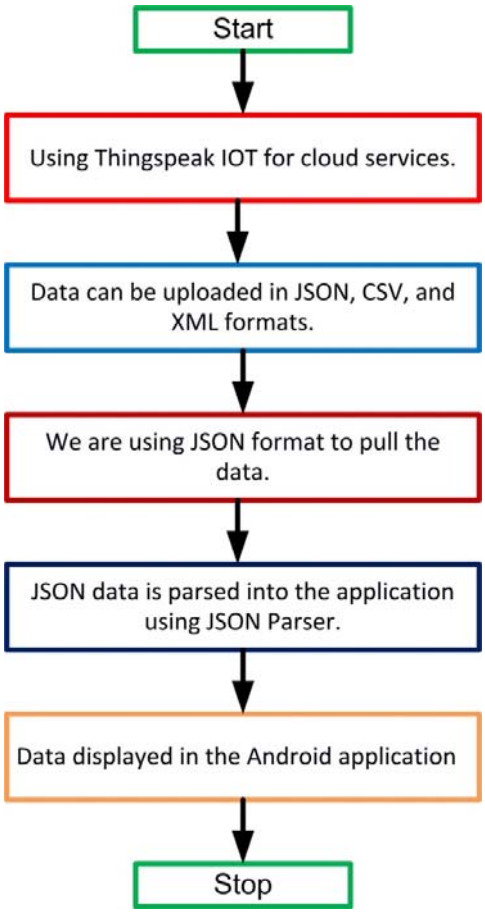

Figure-4. Steps for uploading the data in cloud.

C. Application controls

Once application has the requisite data from the cloud it categorizes and represents the body vitals of individual patients. It then displays the relevant format in an interactive User Interface where experts can easily catch up with the status of referring patients. There are separate login credentials for doctors and patients. Doctors can monitor health status of all the patients assigned to them while patients can only view their own health status by logging in using their respective login credentials while humidity status is accessible to both doctors as well as patients. Screenshots of mocked displays are given below:

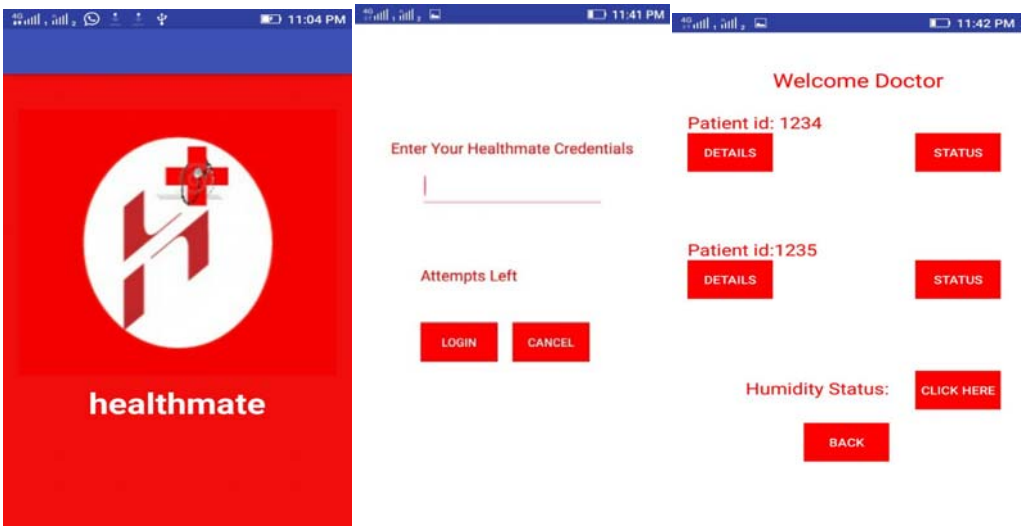

Fig. 5a Fig. 5b Fig.5c

Fig. 5d Fig. 5e

Figure-5. (a, b, c, d, e) - Screen shots of Android Applications.

Table-1. Algorithm of android application.

Algorithm	
Step 1	Launcher Screen consisting of App logo as shown in Figure-5a
Step 2	Login Screen where doctor and patients have to login as shown in Figure-5b
Step 3	Doctor login which includes personal details and health status buttons and also to check humidity status as shown in Figure-5c
Step 4	Patients login which contains personal details and health status buttons as shown in Figure-5d
Step 5	After clicking on the detail or health status button will show the details of prospectus button as shown in Figure-5e

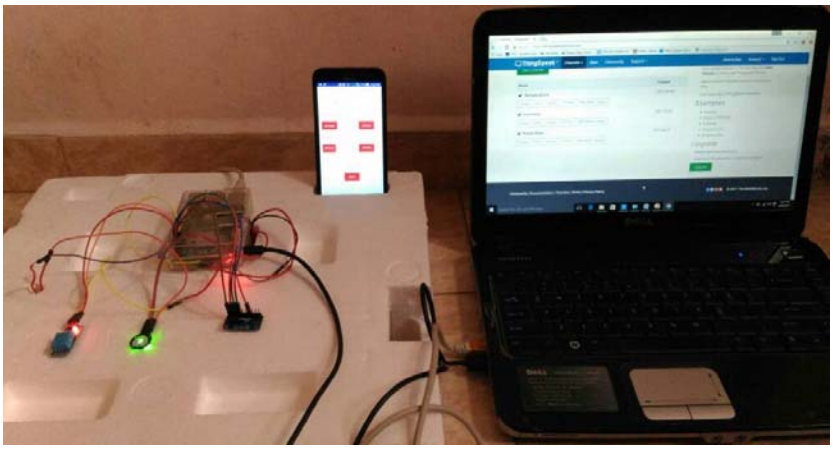

Figure-6. Final setup of our proposed system.

As shown in Figure-6 the raspberry pi is controlling the sensors (temperature, humidity and pulse rate) whose data is uploaded to the cloud which is retrieved in android application which we can see in our smart phone.

Table-2. Boolean table for decision making.

Temperature sensor	**Pulse rate sensor** (per minute)	**Action taken**
< 37^0C	60 to 100	No action
37^0C- 38^0C	40-60 or 100-120	Inform family
>38^0C	40-60 or 100-120	Inform local physician
>38^0C	<40 or >120	Inform emergency

CONCLUSIONS

Aiming at the current problems in Health monitoring system, a secured health care system using body sensor network has been proposed in this paper. This application meets the standards of recording real time body vitals, collecting and displaying it to concerned expert. This can be calibrated in very short period of time and any number of measurements can be performed at any number of times. Since there is a finite record interval for the information from a particular patient, history of patient's treatment, current changes and future recommendations can be made. This project can be extended with more sensors connected to more patients and by providing unique Health mate credential to each patient we can increase functionality. Others extending this project can also use GSM module to get text message to get patients status and GPRS module to check patient's location. This application remarks the digital assistance of health Care.

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