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Modern Electronics Wearable Gadgets for Health Monitoring

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Abstract

IOT is being used to interconnect the accessible medical assets and achieved smart, consistent, and useful healthcare service to the citizens. In this paper, IoT architecture adapted for healthcare applications which collects the data and relays it to the cloud where it is processed and analyzed. User will get the feedback that produced by data analysis. Applications are proved by prototype of the proposed architecture. Patients are monitored by the designed technology and make possible care of patient's health. Using particular sensors, the record is saved and compared with a configurable threshold via microcontroller which is defined by a medical expert who follows the patient; the health of the patient can be monitor anywhere from the world using IoT. Sensors are attached to the body of the patient where it measures the temperature, pulse rate and measured data is given to the controller. The controller compares the measured data with the predefined data in case of emergency if the measured data exceeds the predefined data SMS will be send to the doctor and relatives of the patient.

Keywords: *Wearable gadgets, IoT, Thinkspeak.*

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INTRODUCTION

Remote healthcare has become a vital service with the growing rate of senior citizens. Physical condition monitoring, treatment, and assisted living for the aged and medically challenged humans is a promising challenge because they have need of faultless networking between community, medical devices, and medical and social service providers [1]. This increases the need for reasonable, low-power, reliable, and wearable devices that will improve the quality of life for many elderlies and physically challenged people. The Internet of Things (IoT) platform offers a gifted knowledge to attain the aforesaid healthcare services and can advance progress the medical service techniques [2, 3].

IoT wearable platforms can be used to save the desirable information of the user and its ambient surroundings and commune such information wirelessly, where it is processed or stored for monitor the account of the consumer [4-6]. Such a networking with external devices and services will allow for taking defensive measures. Recently, several IoT systems have been developed for IoT healthcare and assisted living applications [7,8]. A multiple communication standard compatible IoT system for medical devices was designed by Wang et al. in. Xu et al. [9] proposed a resource-based data accessing method (UDA-IoT) that is suitable for healthcare information-intensive applications. Kolici et al. [10] proposed and implemented a medical support system considering Peer-to-Peer (P2P) and IoT technologies. Sandholm et al.proposed an on-demand Web Real-Time Communication (WebRTC) [11] and IoT device tunneling service for hospitals. The proposed system relies on intercepting key parts of the WebRTC Java script Session Establishment Protocol (JSEP) and using local network gateways that can multiplex traffic from multiple concurrent streams efficiently without leaking any WebRTC traffic across the firewall except through a trusted port.

An acquirement and supervision of biomedical data using IoT has been proposed by Antonovici et al. They made an Android application that aims to record the data measured by the electronic sphygmomanometer that communicates via Bluetooth. The projected system offers the possibility of transmitting medical data using any mobile device. Data will be compared with the normal values and when an abnormality is observed, the patient is notified. In the most terrible case, the emergency service and doctors will be notified as well. The patients with vision impairment who are suffering from diabetes, hypertension or obesity is also supported by adapting a "Text To Speech" engine that allows data to be transmitted as type string to the device. Part 2 of paper explains the hardware description of project, part 3 defines working principle, part 4 shows the results and part 5 illustrates the conclusion and future scope of the paper.

HARDWARE DESCRIPTION

Raspberry PI model B +

The system is developed through ARM microprocessor ARM is a registered trademark of ARM Limited. Linux now provides support for the ARM-11 family processors; it gives consumer device manufacturers, commercial-quality Linux implementation along with tools to reduce time-to-market and development costs. Raspberry Pi is a credit card sized computer development platform based on a BCM2835 system on chip, sporting an ARM11 processor, developed in the UK by Raspberry Pi Foundation. Raspberry Pi model functions as a regular desktop computer when it is connected to the keyboard or monitor. Raspberry Pi is very cheap and most reliable to make a Raspberry Pi supercomputer. The Raspberry Pi uses Linux kernel-based [12].

Pulse Sensor

Pulse Sensor is based on Arduino technology. It is a plug and play heart-rate sensor. It is used in academic and commercial applications in which easily incorporate live heart-rate data is required [13]. Figure 1 shows pulse sensor that is available in market. Figure 2 shows pulse sensor with other peripherals. Figure 3 represents internal architecture of sensor.

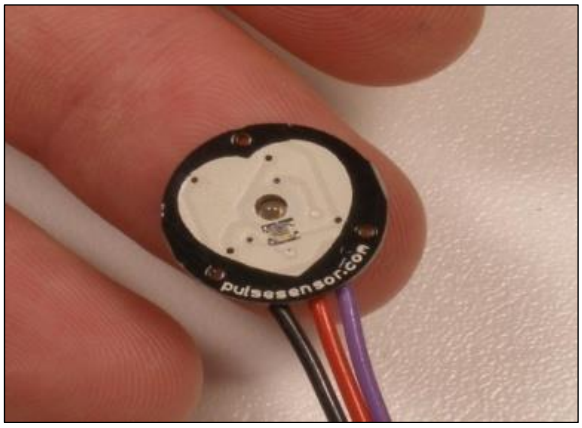

Fig. 1: *Pulse sensor*

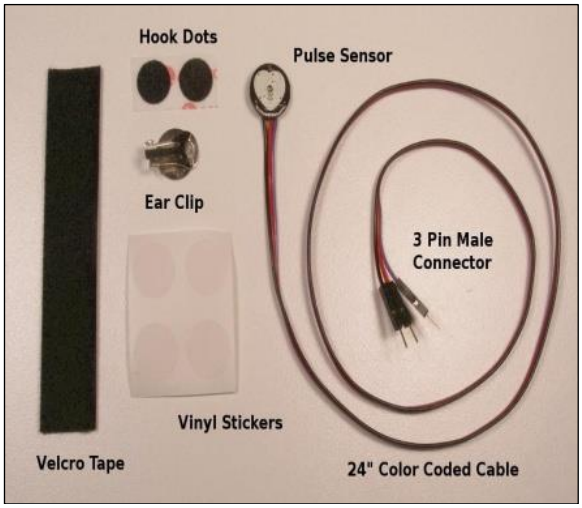

Fig. 2: *Introduction of pulse sensor*

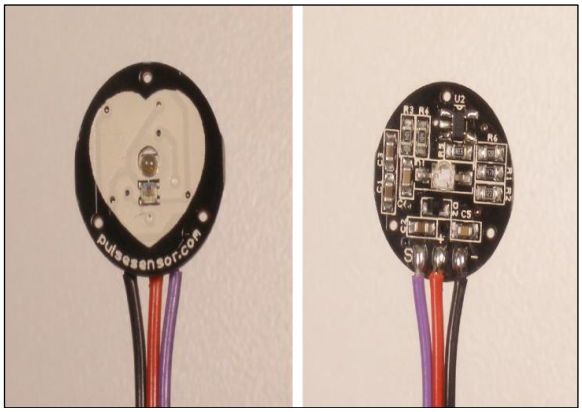

Fig. 3: *Schematic diagram of Pulse sensor*

2.3ADC Circuit

For identification one end of the chip have the mark on it. This mark represents the pin 1. It is usually the first pin on the left-hand side with the mark facing away from user. Analog to digital converter IC uses the Serial Peripheral interface bus and it requires only four pins. It

is relatively easy to communicate because of the SPI Dev library for python. Figure 4 shows the IC with pin names.

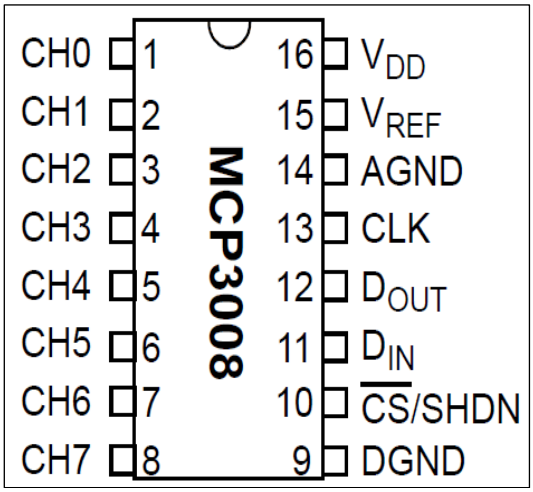

Fig.4: *ADC pin diagram*

LM35-Temperature Sensor

It is used to measure temperature which provides an electrical output proportional to the temperature (in °C). It measure temperature with better efficiency as compare to thermistor. Figure 5 shows the actual temperature sensor available in market. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is 01V/°C.

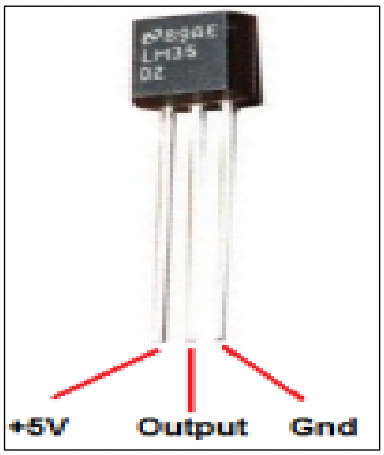

Fig.5: *LM35*

ThingSpeak IoT platform

Thing Speak cloud computing is main backbone of the proposed model. Thing Speak is an open source IoT application and API to store and retrieve data from things using HTTP protocol over the Internet via LAN. It enables the formation of sensor-logging applications, location-tracking applications and a social network of things with status updates. It means, if we send data from the sensors to ThingSpeak at regular intervals, it will create store and display data in a trend automatically. It has Maths modelling inbuilt in the form of MATLAB documentation, which is free to use.

Account and channel set up. Open an account and a channel on www.thingspeak.com. For this, we require to have a valid email account. Mobile app. will send a confirmation email. Click on the link sent in the email to validate your account and create a channel. Now we can create as many channels as you want. The moment you create a channel, you get three Things peak identities: channel ID, write API key and read API key. Note these down, as you will require these in the source program later. Feed up to eight sensor data per channel, such as PM2.5, PM10, temperature, relative humidity, altitude and pressure. Eight data per channel, each channel can take eight data signals from different devices.

WORKING PRINCIPLE

Testing Heartbeat Device

Testing the tool performed before taking the data heartbeat. This investigation aims to ensure the sensor condition works well. The result of the pulse heartbeat 3554 sensor testing show that the output value read on voltmeters of 3.27 volts is not much different from the voltage value on the pulsing heartbeat 3554 sensors of 3.3 volts. The next test performed on the sensor indicator by observing the red led indicator. The red led lights give a sign that the sensor is working correctly and if the red led does not light it indicates that the sensor is not working. This problem caused by the placement of the sensor position on the finger is not appropriate, and the sensor connectors are not connected properly.

Testing Body Temperature

LM35 temperature sensor testing is done by holding the end of the sensor or pair the sensor on the armpit for three minutes. Armpit is a body part that can use as a basis in the sensor readings. The output values of the body temperature sensor on the LCD in the form of Celsius indicate that the sensor works in a proper way. Digital thermometer can be taken, and their results can be compared to get accuracy of the device. The measurement results displayed on the LCD is an indicator that the sensor LM35works appropriately or error.

Testing Transmission signal

Testing of health monitoring module is done in two conditions that is in open space without a wall and closed room with the wall. In free space without barrier where mobile phone device able to read health monitoring sensor data as far as 67 meters and closed room with the wall as far as 13 meters [14]. The outcome of the testing transmission signal of the monitoring module can see on the server computer.

RESULTS

Figure 6 shows actual hardware designed with all tools. Figure 7 shows the output results monitored on desktop or laptop. Figure 8 demonstrate the real time results on Thingspeak mobile application.

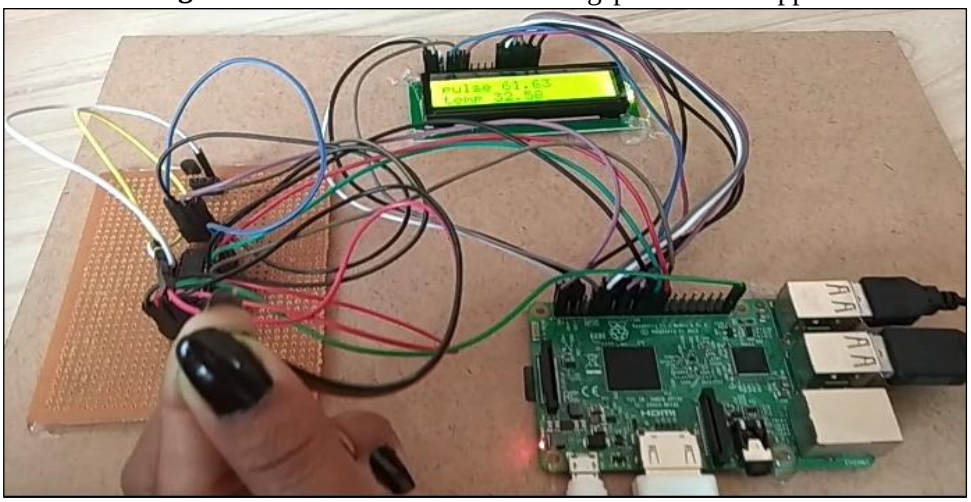

Fig. 6: *IoT based wearable gadgets for health care kit*

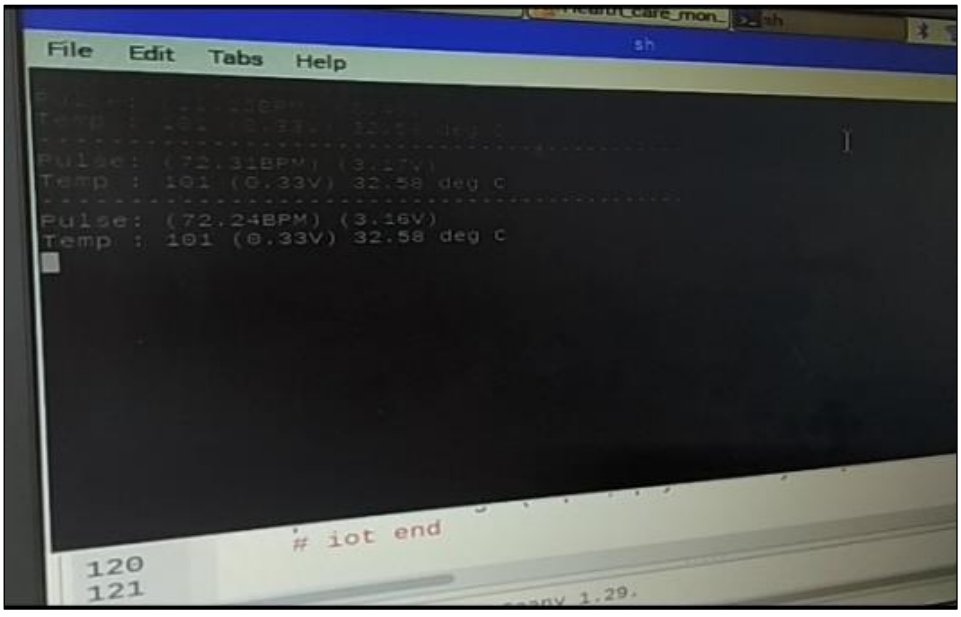

Fig. 7: *The output displayed on the computer desktop*

Fig. 8: *Output is displayed in the Things peak*

CONCLUSION AND FUTURE SCOPE

Conclusion

In this paper, implementation of a heart rate monitoring system and body temperature using the raspberry pi are shown. Liquid Crystal Display and desktop are used to demonstrate the output results in real time. Record of patient's health is stored in the database can display again based on unique id number. Distance range of the projected tool transmission reaches 67 meters for open space conditions without obstructions and 13 meters for enclosed spaces with obstructions. In the advised design tool error rate in detecting the heartbeat is 2.22% and for body temperature is 0.27%.

Future scope

In the future, we plan to redesign the device so that it can be worked like a watch. In addition,

we want to add more sensors. The people who suffering from any illness they know the status of their health and take precautions.

Finally, we plan to add a voice guide as an additional option. For example, some users may want to get more concrete information that could be delivered well via an earphones.

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