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AROA MODULE

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Abstract

Health monitoring system is developed using IOT technology with an objective of giving more comfortable to predict the health condition at the initial state. It helps the user to regularly check his/her health. The entire system is comprised of an IOT device, Android application and Bluetooth module. The device takes the readings of body temperature, heartbeat and movement and sends it wirelessly to android application using Bluetooth / WIFI module. Then accordingly the pre-made notifications with medicine required as per the user's health condition will be notified to the mobile. At a critical health issue, live location of the user is sent to ambulance and nearby hospital. Call services will also be enabled to emergency contacts in case of any emergency. The data received from the device can be saved and viewed for further medical usage. This device improves quality of life and health status. It has ability to capture more accurate data than phones do. It enables the user live monitor his/her own health. The user can be more cautious and it enables the personalized treatment. It helps the reduce of cost of health care.

Keywords – Body temperature, Bluetooth module, Heart Rate, Health monitoring, personalized treatment

1. INTRODUCTION

Today's digital wearables are converged products of smart sensors, AI, IOT, Big data, robots and radar technologies. They can measure the heart rate, body temperature, blood pressure and respiration of the elderly living persons in homes and facilities, by detecting their risk indicators, such as worsening disease conditions, falls, and other life-threatening conditions. Many companies developed wearable smartwatches to monitor patient's health and the trend is expected to increase. Now, it has been widely influenced the young people. Health monitoring devices are expected to support the growing need for remote medical services without spatial and temporal restrictions and increased the demand for medical services among senior citizens who suffer from reduced mobility and lack of access to professional medical services. This wearable technology enables the user to carry on body such as wrist or arm. Demand for these products had been increased and the startups are been developed based on these ideas.

But during this pandemic, health is the major concern for everyone irrespective of their ages. As the world is facing critical and severe situation where no-one is willing to step outside of the houses, it brings out the major demand for usage of these healthcare monitoring systems or devices. So, this Aroa module is a one-step solution for all of the different health monitoring device sources. Using this module for some extent, we could provide the treatment through this device by suggesting them with the required medicine and track them out. This module can be used for any category of people from any age group.

REVIEW OF LITERATURE

Moser L.E et al. This device is designed for monitoring the pulse rate of the patient body. Pulse sensor is connected to the Micro controller then data is collected from the sensor node via Microcontroller. These data are used to send the information to the cloud for the further proceedings. This research paper is to find the reading of the human pulse sensor and alert the user, if the heart beat is abnormal, it alerts the user through a buzzer and sends messages to emergency contacts though GSM, this system uses Thing speak Cloud for the data processing. This device is easing the work for doctors to check his previous medical heartbeats [1].

Turner J et al. This research work has developed a system recently using IOT to monitor individuals and help them to get treated. when a finger is placed on pulse sensor it calculates the heartbeat of the person. And this sensor is interfaced with Arduino UNO microcontroller to check heartbeat value and send them to an AWS server vis bolt cloud. The main advantage of this proposed system is to set limit by client when its heartbeat exceeds the threshold limit then by using Twilio to send an automated SMS to doctor/client according to the heartbeat [2].

Reddy et al. To monitor health of the patient temperature and heart rate sensors are used. The sensors are connected to the ESP32 module. By using Wi-fi connection, client can track the Sensor's data in Web server. In any abnormal conditions in patients' health, an alert is sent to the patient. This system also shows patients temperature and heartbeat tracked via live data with timestamps over the Internetwork [3].

2. EXISTING AND PROPOSED SYSTEM

In the existing system, the device measures the heart rate, temperature of the body and shows the result on the LED display. The data is sent to the android device through Bluetooth/WIFI module. If there are any serious complications in the health, an alert system in the IOT device alerts the user.

In the proposed system, it gets the readings from the IOT device which consists of heart rate sensor, temperature sensor and flux sensors. Then the readings are shown on LED display. The data is sent to the mobile connected through Bluetooth or WIFI based on the convenience of the user. The notifications are shown in mobile through a third-party app ubidots. The system predicts whether the user is going to suffer any illness, if so, then the device alerts the person through SMS and Email and suggests them with the required medicine at the initial stage. If the condition becomes severe, then the module immediately calls the emergency contacts.

Proposed Methodology

The proposed system has the capability to predict the illness at initial stages and could send the text messages and mails with the suggestion of medicine.

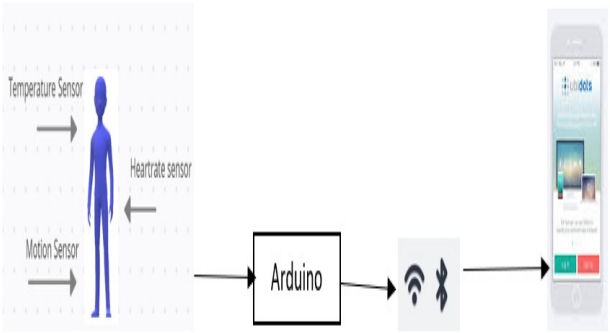

Fig 1: Flow chart of aroa module

Hardware requirements

Arduino Uno board

Arduino Uno is an open-source single board microcontroller board that will be connected to a computer using a standard USB cable. The board is equipped with a set of digital (14 digital) and analog (6 analog) input or output pins. It will be powered by the USB cable or an external source. It is equipped with an 8-bit microchip and EEPROM storage. At mega 328 provides UART TTL (5V) serial communication which is available on digital pins (0 and 1). The hardware of the Arduino uno board is equipped with several plots for communication with several sensors through jump wires.

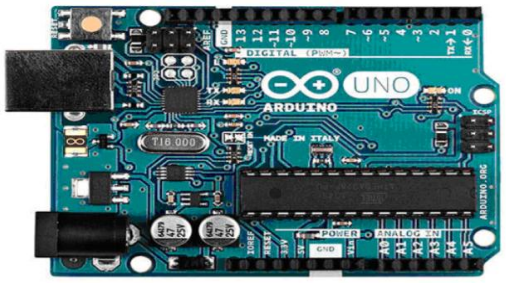

Fig 2 : Aurdino Uno Board

JUMP WIRES

A jump wire is an electrical cable or a bunch of electrical wires connected with pins or connectors of different configurations based on use at the end. The use of these jump wires is to interconnect the sensors with Arduino through bread board. Practically, jump wires are used to test electric circuits internally.

Fig 3: Jump Wires

BREAD BOARD

Bread board is the rectangular easy processed board with a number of holes for connection of sensors and many required sensors like LED. The main advantage of the bread board is that it can be used temporarily without any soldering. This makes the advantage to the beginners for correcting the circuit. The modern bread board is equipped with high parasitic capacitance and high resistance.

Fig 4: Bread Board

LED

In modern IOT projects led are used for indication. In the aroa module LED is used for indicating the fluctuating heart rate, blood pressure, temperature and to display the required medication to the users. As like other sensors LED is also

connected to the bread boards and will be functioning as per the program requirements.

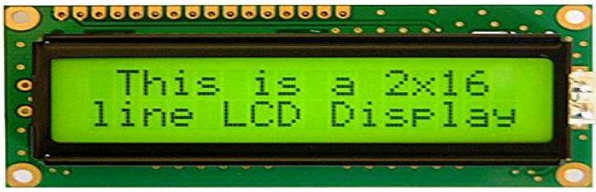

Fig 5: LED screen for display

Alarm

Alarm is used as a sounding beep in case of any emergency. The use of alarm in aroa module is that it sounds a beep when a user is in any emergency situations or if the module recognizes any unsustainable changes in the user's health readings. It can also be used as a beep when the module recognizes any case of fatigue.

Fig 6: Buzzers

GSM Modem

GSM modem or module is a hardware that provides the information of the network or GPS. It accepts the sim card from any network, just like phone. It is reliable and fast way to track any device. The aroa module is equipped with the GSM module from which the user GPS can be shared with the emergency contacts if he/ she is in any dangerous situation. For safety, the module sends messages or information's to emergency contacts in the period interval of 5 minutes.

Fig 7: GSM modem (SIM 900)

ESP WIFI MODULE

ESP WIFI module is a integrated internet protocol stack that can give any microcontroller access to WIFI network. ESP32 is a low cost and reliable ESP WIFI module. It is capable of either hosting an application or off-loading all WIFI networking functions from another application processor. ESP WIFI module has a powerful on-board processing unit and storage capability that allows it to be integrated with the sensors. It will be connected directly to the Arduino for the access of WIFI. This sensor is also equipped with the built-in Bluetooth. It makes an advantage of using both WIFI and Bluetooth simultaneously based on the availability of WIFI or Bluetooth.

Fig 8: ESP WIFI Module

Heart rate sensors

Heart rate sensors are used to monitor the heartbeat of the user. There are many heart rate sensors available in the market. Among those we intended to use MAX30102 sensor. It is an integrated pulse oximeter and heart rate monitor bio sensor module. It is chosen based on the advantage of monitoring the pulse rate and the heart rate from a single sensor. It works by a method called photoplethysmography. This method reflects light on the skin by which perfusion of blood is measured. The photodetectors will convert the light into signals that can be captured again. It uses very low power and has fast data output capability.

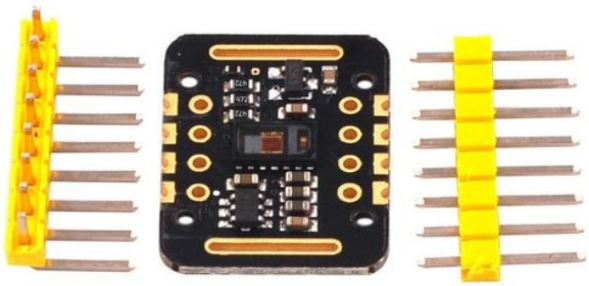

Fig 9 : Heart rate Sensor

Temperature sensors

Temperature sensors are used to measure the temperature of the user. GY-906 MLX90614ESF infrared temperature sensor module is used in this paper. It is a contactless thermometer for use as a temperature sensor for Arduino or any micro controller that can communicate with it through its I2C

interface. It is a low cost and combat thermometer that is mounted on a breadboard with two types of pins. It comes with ease of integration and with high accuracy with an error of 0.5 deg Celsius.

Fig 10 : Temperature Senosor

Movement sensors (accelerometer)

The ADXL355 IS A three axis accelerometer and enables us to know the position in 3 directions.these are equipped with low noise density and low power consumption. It supports ± 2g to ± 4g

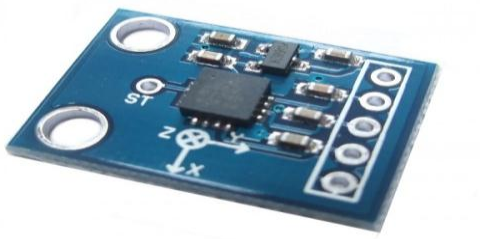

Fig 11: Accelerometer ADXL355

3. SOFTWARE DESCRIPTION

Arduino IDE

The open-source Arduino Software, Integrated Development Environment (IDE) is used to write code easily and upload it to the board. Arduino IDE can be implemented with any Arduino boards. It contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menu.

The Arduino IDE application can run in different operating systems like Windows, Mac OS X, and Linux. It can be supported with C and C++ languages.

The program or code written in the Arduino IDE is often called as sketching.

Ubidots

Ubidots turns sensor data into information. This platform is used to send data to the cloud from any Internet-enabled device. Then it configures the actions and alerts based on the real-time data and unlocks the value of the data through visual tools.

Ubidots offers a REST API that allows us to read and write data to the resources available. Those are data sources, variables, values, events and insights. API supports HTTP and HTTPS.

Device friendly APIs (accessed over HTTP/MQTT/TCP/UDP protocols) provide a simple and secure connection for sending and receiving data in real-time. Ubi-bots time series backend services are performance optimized for IOT data storage, computation and retrieval. The application enablement platform supports interactive, real-time data visualization (widgets), and an IoT App Builder allows developers to extend the platform with their own HTML/JS code for private customization when desired. Ubidots exists to empower the data from device to visualization.

4. CIRCUIT CONNECTIONS

The paper proposes a portable health monitoring system wherein physiological parameters such as heart beat, body temperature and movement of the device user are monitored continuously and enables the user to know their health and at any case of abnormalities the medicine and precautions are advised to take at the initial step. The readings from these sensors can be seen in LED display and this data is sent to Ubidots mobile application through WIFI/Bluetooth which is provided by ESP32 module. ESP32 module is connected to Arduino Uno. Arduino IDE is used to program both Uno and ESP32. GND, Arduino RX and Arduino TX of Arduino board are connected to GND, ESP TX and ESP RX of ESP32 board respectively using jumper wires. Connect Arduino uno and ESP32, to PC with USB wires. Then programs should be uploaded to the boards. In this way, serial communication between Arduino uno and ESP32 is established.

The sensors included in the hardware are heart beat sensor, body temperature sensor and movement sensor. The readings from these are shown on the LED display. The heart rate sensor used in this is MAX30102. The heart rate sensors use two-wire I2C communication to interface with Arduino Uno board. Here, we are using A4 for SDA and A5 for SCL.

The MAX30205 human body temperature sensor is used to measure the temperature in this project. It can easily be interfaced with the device and its accuracy is high. It communicates with I2C protocol so additional pull up resistors are needed but this module has in-built resistors. It works with 5 or 3.5V. It consists of 3 pins SDA, SCL, OS other than VCC and ground. To write the program download sensor MAX30205 library. Here the connection between MAX30205 sensor and Arduino uno established through the connection of VDD to 3.3 volt, SCL to A5, SDA to A4 and GND to common ground. Then the code is written and compiled so that connection established.

The movement of the body is detected using the ADXL335 Accelerometer. It works on the basis of Newton's second law of motion. The sensor has a sensing range of ± 3g. It is used to know the motion, shock or vibration. It works on power between 1.8V to 3.6V. It has 3 analog outputs for X, Y, and Z axis measurements, 2 supply pins and a self-test pin. The connection between Arduino Uno and sensor is made by placing the accelerometer on the bread board. VCC pin of it is

connected to 5V of Arduino uno. X, Y and Z output are connected to A0, A1 and A2 on Arduino. For more accurate results, analog reference (AREF) voltage has to be changed by connecting 3.3V pin on Arduino to AREF pin. Then board connected to PC and code is written and compiled.

To get the exact location of the device the GSM module has to be attached with the Arduino uno. Using that we could track the user when he's in critical condition. Sim-com SIM900 GSM module is used for this project. The TX pin, RX pin and GND pin of GSM module to RX pin, TX pin and GND pin of Arduino uno are connected respectively. A sim with data-plan is to be inserted in the module and lock it. The adapter is connected to GSM module and turned it on. Then the LED blinks continuously for every 3 seconds once the connection is established.

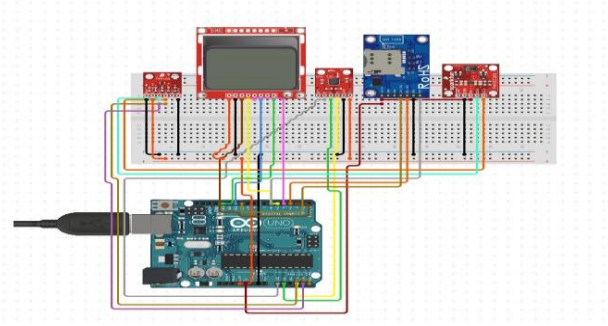

Fig 12: Connection of sensors with Arduino board in circuito.io

5. WORKING

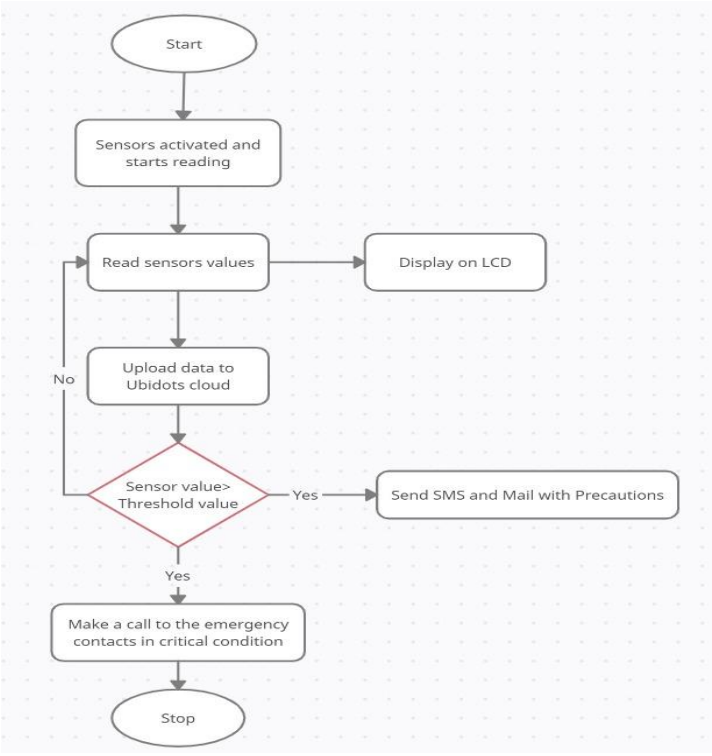

Fig 13: Block diagram

After setting up the system in contact with the user, the sensors will start sensing the heart rate, body temperature and position of the user. The readings from the system are able to seen on LCD screen.

Also, with the use of ESP32 Bluetooth & WIFI Module, the data will be transmitted to the mobile application Ubidots either through the Bluetooth connection or through the WIFI. If the user's mobile phone is nearby the Aroa module, then it is connected through Bluetooth or WIFI. But if the mobile phone is far from the device, then the Bluetooth may not work, in such situation WIFI connection is enabled.

With the help of ADXL355 accelerometer, the movement of the user is being monitored and if he/she has fallen due to fatigue then the alarm system beeps the sound and live location of the user is sent to the guardians using GSM module. The heart rate sensor MAX30102 and temperature sensor MAX30205 measures the heart rate and body temperature of the user and monitors continuously. If there is any abnormality in the health, the user will be notified and advised with a medicine. If there is any critical situation, then the user abnormalities will be sent to the emergency contacts.

6. RESULT

The if-then statements of the sensors with SMS and Mail details are given in Ubidots application.

The Outputs of the device are given according to the different specified conditions for the sensors.

When the sensors are not connected the Ubidots software throws an output saying "Kindly Connect".

Heart rate sensors and the temperature sensors works on certain conditions given below

Table 1: Result that will be displayed on the screen by heart rate sensor according to given conditions

Classed as	Heartbeat	SMS/Mail
Low Heart Rate-Bradycardia	Less than 60bpm	Hi User1, Heart rate is low. Please Consult your doctor for immediate medication.
Normal	60-100 bpm	N/A
Fast Heart Rate-Tachycardia	More than 100bpm	Hi User1, Heart rate is high. Please It's Medical Emergency.

Table 2: Result that will be displayed on the screen by temperature sensor according to given conditions

Classed as	Celsius	Fahrenheit	SMS/Mail
Hypothermia	<35.0°C	95.0°F	Hi User1, Temperature is low. Please take warm fluids or salt water immediately. It's Medical Emergency.
Normal	36.5-37.5°C	97.7-99.5°F	N/A
Hyperthermia	>37.5° or 38.3°C	99.5° or 100.9°F	Hi User1, Temperature is high. Please take Paracetamol tablet twice a day.
Hyperpyrexia	>40.0° or 41.5°C	104.0° or 106.7°F	Hi User1, Temperature is very high. You need to consult doctor immediately.

With the above-mentioned sensors and connections, aroa module can be implemented and a dedicated, reliable health monitor system can be implemented.

REFERENCES

[1] Moser, L.E., Melliar-Smith, P.M. (2015). Personal health monitoring using a smartphone. 2015 IEEE International Conference on Mobile Services, pp. 344-351. http://dx.doi.org/10.1109/MobServ.2015.54

[2] Turner, J., Zellner, C., Khan, T., Yelamarthi, K. (2017). Continuous heart rate monitoring using smartphone. 2017 IEEE International Conference on Electro Information Technology (EIT), pp. 324-326. http://dx.doi.org/10.1109/EIT.2017.8053379

[3] Reddy, G.K., Achari, K.L. (2015). A noninvasive method for calculating calories burned during exercise using heartbeat. 2015 IEEE 9th International Conference on Intelligent Systems and Control (ISCO), pp. 15.http://dx.doi.org/10.1109/ISCO .2015.7282249