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Health Detector Android Application using IOT for Rural Area

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Abstract—Technology is being increasing rapidly day by day. Growing technology make user to use different devices and integrate all of them in one frame, so as to reduce implementation cost and increase functionality of module and that will be implemented. Health Detector application is a good platform to measure different health parameters via sensors. Integrating whole system with android will make it available and useful. Pulse rate sensor and ECG sensors are easily available with the moderate worth hence it is affordable to the end user. This system will be an elixir for the people who are living scurry life. Android platform help to add different functionalities like disease prediction on the basis of symptoms stored into SQLite database, calling ambulance on emergency mode, locating nearest hospitals, medicals and blood bank on an emergency mode via GPS sensors. Regular health check-ups like heartbeat, BMI is also provided.

Keywords- BMI, GPS, Android, Arduino, Server, ECG, IOT, Google API, IDE.

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I. INTRODUCTION

People are living scurrying life, which is the main cause of not getting time for regular check-ups of their health. Many health problems occurred due to not gotten precautions. Mobile is an integral part of human's life, making mobile as intermediate device for the health care check-ups will help in many ways. In the recent age of technology health is monitored by number of ways. Many health parameters can be captured by sensors like heart beat rate, pulse rate via mobile camera; ECG processing using owns electronic gadgets like laptop or any other is a bit time consuming. Android platform make this application useful and any person with the Knowledge of medical system can able to capture health parameters value and suggestions. The require treatments on the basis of captured values.

It is handled by the authority belonging to medical or any other technical field up to some extent and all other modules can be easily accessible to the end user who knows the android application accessing. So, that Health Detector is useful in rural areas. The heart rate can also be measured by using the flash and camera of android mobile phone. There is a function in this application by which any person can locate the nearest blood banks, medicals and hospitals. This is being done using the Google API's and the GPS sensors of the mobile phone. Android application technology for the Measurement of health care parameters is not sufficient completely for the user needs. In some of the cases user of application may want emergency services from hospitals, medicals & blood-banks services. Initially emergency ambulance calling has been done and we will put the entire public contacts list for users. Locating hospitals, blood-banks & medicals will help user for emergency needs. Integration of the health care parameters such as heart beat rate via camera of mobile phone and sensors, BMI calculation and Predicting disease on the basis of symptoms and required treatments for the same has been provided in Health Detector. GPS tracking service all this functionality has been made this application an efficient one. Many uneducated people are also using android mobile phones; they know the accessibility of android mobile and that is so application will be used by all android users efficiently Type Style and Fonts

Wherever Times is specified, Times Roman or Times New Roman may be used. If neither is available on your word processor, please use the font closest in appearance to Times. Avoid using bit-mapped fonts if possible. True-Type 1 or Open Type fonts are preferred. Please embed symbol fonts, as well, for math, etc.

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II. LITERATURE REVIEW

Many android applications are available on Google play store for health and medical use. Some of them are as follows:

1. *Mahabstc website*

Mahasbtc provides blood data across the different hospitals in Maharashtra state. The available data is static and updated after each day. This website has different navigations in it

Features:

- It gives the locations of nearest blood bank from current locations of user.
- This website is available 24x7.

Drawbacks:

- This service is not present on android.
- In this site, dynamic updating of data is not available for blood data. Admin has to done it manually.

In the above system, it has some advantages sand well disadvantage. Many Systems are based mobile and some are web based application. The above one has only one functionality. Another application is Icare health monitor which only monitor the heartbeat, blood pressure etc. it does not give any information related to the blood bank and the data which is been calculated. In this application data is not stored anywhere so we require databases to store data over cloud for future treatment as this facility available in Icare health monitoring system and this system does give any customer support or feedback function for a customer.

Mahasbtc website is the Maharashtra Government website which provides the Nearest Blood bank with respect to our location and also gives the details about the amount of blood available in the blood bank in this website. The website does not have interactive interface, so to overcome this drawback we need to implement such system which includes locating nearest blood banks, hospitals and medicals, heartbeat measure, helping desk therefore the user need not visit different application for better health.

2. *Icare Health monitoring Application*

This is first application for measuring the blood pressure and heart beat, blood lipids, blood oxygen, vision, color blindness, hearing lung capacity, psychological index and other physical data through the phone. This application is developed by Icare fit studio.

Features:

- We can measure blood pressure via it.
- Real time photoplethysmogram graph.
- It also provides the lung capacity measurement.
- We can share our result into the social media.

We have included only a heartbeat measure module based on mobile camera and flash into health detector application.

Drawbacks

This application is totally offline so the recorded result is not store anywhere. Location finder of blood bank is not available.

III. HEALTH DETECTOR APPLICATION SYSTEM ARCHITECTURE

Health Detector application contains various modules which executed manually by human interaction. Architecture diagram of Health Detector is shown next.

Health detector application has been connected with the local network created by Wi-Fi module. Health Detector android application architecture contains the next components given.
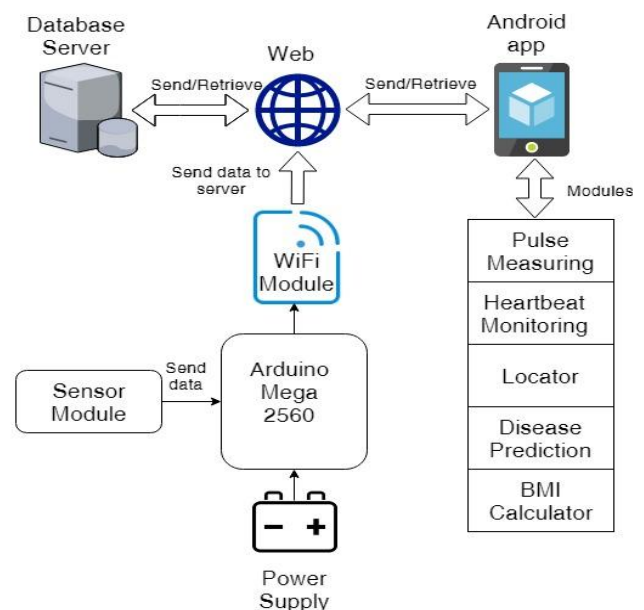

Fig.3 health detector system architecture

1. **Android Application:** Android application contains different modules as follows:

   1.1. **Pulse measuring:** Pulse rate is measured with the help of pulse rate sensor connected to Arduino, a fix value is sent to server where we had database and table. Data from server side is retrieved via Health Detector application's pulse measuring model.

   1.2. **Heart-beat monitoring:** This module is implemented via mobile phone's camera and flash light. Value is generated on next window with the required precautions to be taken by user.

   1.3. **Locator:** It locates nearest hospitals, medicals, blood bank via GPS sensor of mobile phone and user's current location. [1]

   1.4. **Disease Prediction:** On the basis of list of symptoms disease is predicted. Help desk

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contains information about each disease and treatments to be taken on it.

1.5. **BMI (Body Mass Index) calculator**: It takes two parameters from user as one is weight in kg and another one is height in centimetres. BMI is calculated by using formula.

BMI=Weight/ (Height*Height)

The Table 3.1.5 shows the body condition based on the value of BMI.

Table 3.1.5

BMI	Body Condition
<16	Severely underweight
<18.5	Underweight
<25	Normal
<30	Overweight

2. **Arduino MEGA2560:**

Arduino has categorized based on the size of Arduino kit that means the no of serial ports available on it. Arduino Uno, Lily Pad, Mega, Red Board, Leonard etc. Features provided by Arduino MEGA2560 are as follows:

1. It has lots of digital i/o pins.

2. 16 analog inputs, reset button

3. USB connection portability, Power Jack.

3. **Sensor Module:**

Sensor modules are easily available with the affordable worth. Here, we used Pulse Rate and ECG sensor module. Pulse rate sensor module has 3 simple pins with it.

It has 3 pins namely input, output and ground. Pulse rate sensor module has simple connectivity with Arduino. We just have to put our index finger on sensor connected to Arduino with the power supply of 5V.

4. **Wi-Fi Module:**

Wi-Fi module is the main component to establish a network connection between database server, android application and Arduino. Wi-Fi Module ESP8266 is easily available in the market.

5. **WEB:**

It is an internet interface between android application and database server; it is enabled by Wi-

Fi module. Web Portal is there to get data online using login credentials.

6. **Database Server:**

It is a backend portion used to retrieve data which is been stored into database. Database Server and other entities from Health Detector are connected via Wi-Fi network.

7. **Power Supply:**

External Power supply of 5V is needed for Arduino.

IV. IMPLEMENTATION-RESULT & ANALYSIS

1. Health Detector Android application

It has made with the different modules into it. Each individual module is placed over button action.

1.1 Locator:

locating nearest blood banks, hospitals & medicals. We have used google API services which need to be installed into android studio while using google map services. Generated API key is pasted into the <string> tag of xml file. Sample API key generation steps and standard procedure is available on internet

1.2 Pulse Measuring: [2]

Pulse rate measuring is done by following steps:

Connection of Pulse sensor to Arduino Mega 2560

1. Connect VCC +5 of Pulse Sensor to VCC +5 of Arduino mega 2560.

2. Connect GND of Pulse sensor to GND pin of Arduino mega 2560.

3. Connect A0 pin of Pulse sensor to A0 of Arduino mega 2560.

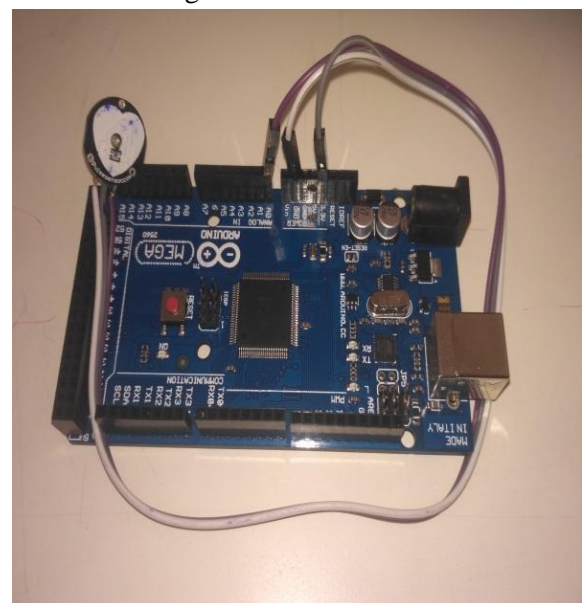4. Connect VCC 3.3V pin of esp8266 to VCC 3.3V of Arduino mega 2560.

Fig 4.1.2.a) Connection of Pulse sensor to Arduino Mega 2560

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Connection of ESP8266 to Arduino Mega2560:
1. Connect TX pin of esp8266 to TX of Arduino mega 2560.
2. Connect RX pin of esp8266 to RX of Arduino mega 2560
3. Connect GND pin of esp8266 to GND of Arduino mega 2560.
4. Connect VCC 3.3V pin of esp8266 to VCC 3.3V of Arduino mega 2560.
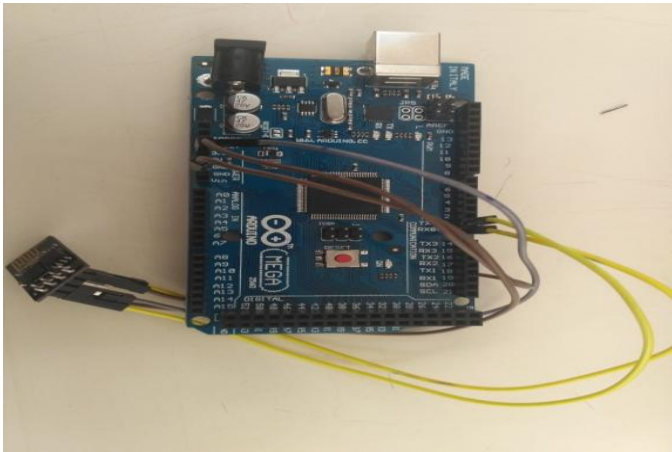

Fig 4.1.2.b) Connection of ESP8266 to Arduino Mega2560

Algorithm and steps:
1) Import SoftwareSerial.h library.
2) Initialize pin variables and other data members.
3) Define Wi-Fi SSID and password.
4) Set time interval between beats to 600.
5) Set peak value to 512 and trough to 512.
6) Define Function setup()
   a) Set baud rate to 115200.
   b) Check Wi-Fi Module is working or not.
   c) Call Connect to Wi-Fi.
   d) Call interrupt Setups function
7) Define loop() Function.
   a) Call serialsetup() function.
   b) If heartbeat was found then
   c) Set fadeRate Variable to 255 to fade LED with pulse.
   d) A Beat Happened, Output that to serial.
   e) Reset the Quantified Self flag for next time
   f) Take a delay of 2 sec.
   g) Call updatebeat() function.
   h) exit
8) Define updatebeat () function
   a) Execute AT commands to connect server by sending IP address and port number.
   b) After connecting successful send BPM to server.
9) Define connectToWifi function()
   a) Print AT+CWMODE=1 command.

b) Print AT+CWJAP with SSID an Password.
c) If serial.find("OK")
d) Then return true else false.
10) Define interruptSetup function()
   a) Initializes Timer2 to throw an interrupt every 2mS.
   b) Disable PWM on digital pins 3 and 11, and go into CTC mode
   c) Don't force compare, 256 prescaler.
   d) Set the top of the count to 124 for 500 Hz sample rate.
   e) Enable interrupt on match between Timer2 and ocr2a
   f) Make sure global interrupts are enabled.
11) Define serialOutput() function.
   a) If serialVisual equals to true then
   b) goes to function that makes Serial Monitor Visualizer
   c) else go to sendDataToSerial function
12) Define serialOutputWhenBeatHappens() function
   a) If serialVisual equals to true then
   b) Print BPM.
   c) Else send heart rate with a 'B' prefix and send time between beats with a 'Q' prefix.
13) Define arduinoSerialMonitorVisual() function
   a) Define constant sensor minimum, discovered through experiment.
   b) Define constant sensor maximum, discovered through experiment
14) Define sendDataToSerial(char symbol, int data) function.
   a) Print symbol.
   b) Print data.
15) Define ISR(TIMER2_COMPA_vect) for triggered when Timer2 counts to 124
   a) Disable interrupts.
   b) Read the Pulse Sensor.
   c) Keep track of the time in mS with sample counter variable.
   d) Monitor the time since the last beat to avoid noise.
   e) avoid dichroitic noise by waiting 3/5 of last IBI
16) If threshold is > Signal and Signal > Peak
   a) Then peak is equals to signal.
17) If N > 250 then
   a) If signal > threshold and pulse equals to false and N >(IBI / 5) * 3) then
      i) Set the Pulse flag when there is a pulse.

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ii) Measure time between beats in mS.

iii) Keep track of time for next pulse.

iv) If secondBeat == TRUE

(1) Clear secondBeat flag.

(2) For i=0 to i=9

(a) rate[i] = IBI;

v) If firstBeat == TRUE then

(1) Clear firstBeat flag.

(2) Set the second beat flag

(3) Enable interrupts again.

(4) IBI value is unreliable so discard it

vi) Clear the runningTotal variable

vii) For i=0 to i=8

(1) Shift data in the rate array.

(2) Drop the oldest IBI value.

(3) Add up the 9 oldest IBI values.

viii) Add the latest IBI to the rate array

ix) Add the latest IBI to runningTotal

x) Average the last 10 IBI values.

xi) Calculate BPM = 60000 / runningTotal.

xii) Set Quantified Self flag

18) if Signal < thresh and Pulse equals true then

a) Reset the Pulse flag to false.

b) Get amplitude of the pulse wave.

c) Set thresh at 50% of the amplitude

d) Reset these for next time

19) If N >2500 then

a) Set thresh default to 512.

b) Set Peak default to 512.

c) Set Trough default to 512.

d) Bring the lastBeatTime up to date

e) Set these to avoid noise

f) When we get the heartbeat back

Result:

Fig 4.1.2.c) Result Pulse rate sensor module

The result shown on arduino board is sent to se XAMP server, and it is accessible for end user via health detector application.

1.3 Heartbeat Measurement

Heartbeat is measured via mobile camera and flash. Algorithm is as follows:

1) max_diff=0;

2) for(i = 5 to number_of_signals)

diff_in_peak[i] = current_peak_value - previous_peak_value;

If (diff_in_peak[i] > max_diff)

max_diff = diff_in_peak[i];

end if

end for

3) threshold_diff=25*max_diff/100;

4) for(i=1 to number_of_signals)

if(diff_in_peak[i] < threshold_diff) then diff_in_peak[i]=-1;

end if

end for

5) for(i = 5 to number_of_signals)

diff_in_adj[i] = distance between two adjacent signals whose diff_in_peak[i] not equal to -1;

if(diff_in_peak[i] == max_diff)

threshold_adj_diff = diff_in_adj[i];

end if

end for

6) for(i = 5 to number_of_signals)

if(diff_in_adj[i] < threshold_adj_diff)

diff_in_adj[i]=1;

end if

end for

7) heart_rate=60*frame rate;

In this way, we can calculate heart beat rate in BPM. Android application permissions of camera and flash must be taken while taking reading. Normally heart beat rate should be in between 80 to 120 BPM.
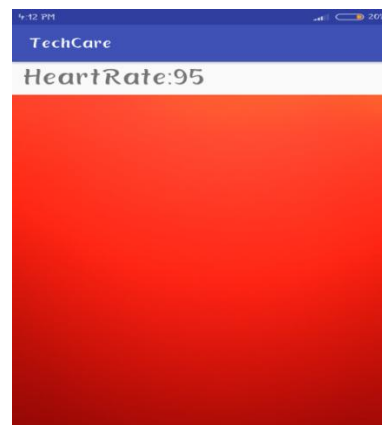
Result:

Fig 4.1.3 heart rate measurement

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1.4 Disease Prediction:

List of symptoms have to be selected from the list given on android application and it will match entered word with the data available already into an application activity.

1.5 Body Mass Index (BMI) calculator:

It is a simple calculator calculates the BMI base on the formula explained in above architecture diagram of Health Detector application [Table 3.1.5].

1.6 Helping Desk:

It gives knowledge of different diseases and treatments over it along with predetermined symptoms of it. It is also consisting of disease and its symptoms, mode of transmission and treatments over it.

1.7 Profile:

All user information after being registered is stored into XAMP which is stored on user profile button. Here we have to log in with credentials.

V CONCLUSION

We conclude that, Android application with the integration of all the health care facilities will help user for the better care of health. The Health Detector Application focuses towards mobile based heart rate measurement, BMI calculator, Emergency ambulance calling, prediction of disease on the basis of symptoms and locating nearest hospitals, medicals and blood banks which help to find it quickly and help to save the life of patient. Pulse rate measures via sensor are included for the correct result.

Health parameters such as pulse rate calculated by sensors are cent-per cent accurate, which make this application usable.

Server enabled system would make Health Detector application a huge storage capacity and efficient system.

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