Study of IOT Based Health Monitoring Devices

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Abstract-Health includes multiple vital parameters which play an important role in everyone's life. The recent development in science and technology has given the patients an opportunity to monitor their health on a daily basis and that too by themselves. Earlier patients would wait for hours to get their health checkup done with the help of bulky machinery and time consuming devices which might or might not be as accurate. This paper explores few such technologies and advancement which provide a support to monitor health on a daily basis. Also the data generated by a local device can be sent over internet, which can be accessed by a doctor anytime and the person can be advised accordingly .A prototype has been implemented to measure the health parameters like pulse rate, body temperature etc. and data to be monitored in real time by a doctor sitting remotely.

Keywords:-Heart monitoring system, GSM, Pulse rate sensor, Temperature sensor

I. INTRODUCTION

Health rate monitoring is necessary in today's fast changing life. In such highly active life people are expected to be able to maintain up with the speed of life. In order to maintain the speed and be active one's health needs to be in control. In today's world people would are constantly working in a 24 x 7 environment they do not find time to pay a regular visit to the doctor and therefore they often ignore the minor health hazards they face which leads on to perhaps a bigger problem. Therefore it is important to have such devices [1-5] which are not at all time consuming so that people can spare out few minutes from their daily lives or even during their travelling hour and keep a check on their health.

The devices which are illustrated or which are available to the public in the market are often wearable devices [6-10] which measure the fitness parameters of a person and display instant results. The wearable devices are plugged in to the body and monitor the internal parameters with the help of sensors and etc. The sensors are often next to accurate and provide a better understanding of the body [11-12].

The 21st century has its very own advancements which not only provides devices to monitor but also provides applications which are built in the mobile such as the apple mobile phones which provide proper maintenance of health such as number of steps taken, pulse rate and etc. These devices and application provides a kind of a support system to maintain a proper health.

In the near future the scientists and the innovators have been endeavoring to bring a constant change in the health care sector of the world. Not only the devices but the theories that are related to the topic have been evolved. Heart attacks have been a constant threat to the man kind and therefore devices to monitor heart rate has also come into play. More and more people are connected to such devices and therefore the health care facilities will also be developing in the near future.

Fig1: - Health care trends

Figure 1 shows the current health care trend scenario. From waiting hours at the doctor's premises to wait for the turn to come to seeking personalized health care at home this figure depicts that categorization. In this paper we will be identifying various different devices that are present in the market that deals with the monitoring of health related parameters and provides mankind real time results of their body. Such health monitoring systems provide a deeper understanding of the fluctuating levels of the human body and to address such changes possible measures that would require to be taken.

II.   EXISTING SYSTEM MODELS

1.   HEALTH MONITORING SYSTEM IN FITBIT

The fitbit is a health monitoring device which has recently come into action. It is a real time system in the form of a wrist watch which is easy to wear along with an application format which keeps a record of the calories burnt, steps taken, sleeping goals and etc. It basically helps a person optimizes the device in such a way that it may help the body follow a particular pattern. For example taking into account the sleeping hours, the person can set up specific sleeping hours and therefore if a person wakes up before that then the device would tell the patient about how to cover it up. The device also has application based support system which helps in maintaining and keeping a track of the steps taken in a day or so. Basically this is a kind of device which comes handy when dealing with the health parameters. This device is something which does not seem to be like a burden on the user and mobility is perhaps extremely easy. Figure 2 shows a fitbit device which is very handy to use.

Fig 2: - Fitbit device

2.   HEALTH MONITORING SYSTEM USING GARMIN FORERUNNER

Garmin forerunner is the second device which is used for the very same purpose. It's is again a wrist band/ sports watch with a colorful LCD which makes the user easy to access. It is one powerful device with longer battery life and at the same time consists of a GPS module inbuilt in it.

3.   HEALTH MONITORING SYSTEM IN APPLE WATCH

Apple Watch adds as one of the most popular devices being used in today's time. It helps one monitor their health and maintain a track of their daily movements and workout and gives a result with the help of connecting the watch to your phone using a Bluetooth.

4.   HEALTH MONITORING SYSTEM IN SAMSUNG GEAR

Samsung Gear , one of the most economical and effective health gear that one can be seen sporting in today's time; Is works on an android platform device with the help of a app in your mobile you can keep track of your daily steps and heart rate. It can be easily accessed and is easy to use for a beginner.

III.   DEVICES ON EXISTING PLATFORMS

1.   HEALTH MONITORING SYSTEM INCORPORATED WITH GSM

GSM modules have been incorporated in heart rate monitoring devices. Basically the device checks the data which is collected by the sensors and transmits it to the micro controller where the microcontroller transmits it over the air with the help of GSM technology. The transmitter transmits the information as a SMS to the concerned persons. Whenever the condition worsens the SMS states the urgency accordingly.
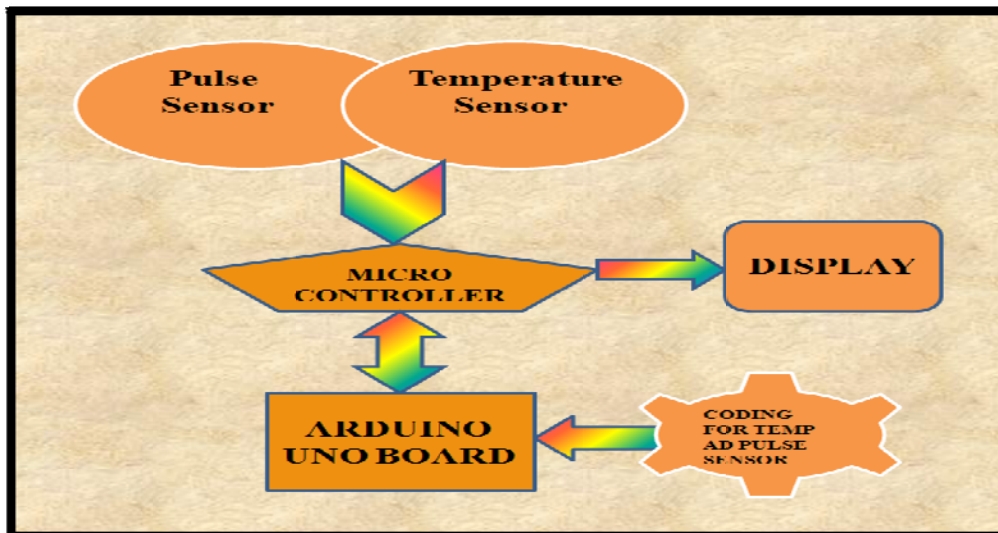
Fig 3: - Basic Heart rate monitoring system

Figure 3 shows one scenario where health monitoring system have been incorporated with GSM and interfaced with the coding using the Arduino Uno board.

2.   HEALTH MONITORING SYSTEM INCORPORATED WITH BLUETOOTH

Bluetooth enabled devices to detect Alzheimer disease was proposed. Different access points can be placed in anywhere around so that the person remains connected to the device with the help of strongest signal received from the access point. With the movement of patient database is collected and tracked with the Bluetooth enables device and are forwarded to respective consent person acquiring the movement recognition software where the database is monitored to review whether the person is suffering from Alzheimer disease or not.

3.   HEALTH MONITORING SYSTEM INCORPORATED WITH MOBILE PHONES

The development of IMHMS can be useful to provide assistance to any individual to monitor the health and concerned issues. Through this system the associated person can know the medical feedback based on the data collected by the bio sensors. As mobile phones have become an important part of our life so it can integrate various health care services seamlessly.

IV.   DISCUSSION

The devices have been only emerging and growing in number with each passing day. Every new device kicking in the market is more technologically advanced and a better version of the already existing ones. The price range varies from 1k- how much ever you can afford. But we realized how with devices that are lower in rates have many facilities missing thus making is less customer satisfactory.

1.   The paper in [1] deals with the body temperature and measures the heart rate with the health of photoplethysmography technique. In which a light of a certain wavelength is incident on the body and the depth of the intensity determines the certain parameters which would be required to produce a result of the heart rate.

   The hardware components such as bluno development board is used which is a combination of Arduino UNO with BLE module. The three hardware components interfaces wtih the computer to display the results, for the same purpose the graphical user interface (GUI) design is developed using Window based application. The reading is taken after regular time intervals and the readings is recorded and displayed on the computer.

2.   The system prescribed in [2] produces heartbeat measurement results detecting abnormalities based on the threshold level and informs the user of the abnormalities. It works after certain time frame.

3.   Another study of "real time wireless health monitoring app using mobile devices'' is a smart phone based system which monitors the health parameters. The biggest drawback of this system is that only health care professionals can monitor and advice their patients about the health concerning issues if any as proposed in [3].

4.   Another device is [5] Health monitoring system- consists of blood pressure sensor, heart beat monitor, temperature sensor, lcd, amplified, GSM module, microcontroller. There are two devices incorporated in one, one using the GSM module and the second one using RFID. The third device consists of FPGA which sends the data serially transmitted to the fixed monitoring station consist of PC with LabVIEW GUI (Graphical User Interface).

5. This device in [6] consists of a GSM module, Microcontroller (MAX232), Temperature sensor, LCD, SMS and commands. The GSM is initialized by the help of (AT+CMGF) command. On the LCD a message is displayed regarding a reminder to check the temperature. After pressing a reset button the heart rate and temperature is calculated and the heart beat sensor gets the beat count and convert it per minute using a certain formula.

6. In the paper [7] they propose a Simple Wireless transmission System using common approach Sensor Platform called The wireless based Patient Sensor platform (WSP, Sensor Node) which has remote access capability. The architecture offers flexibility, easy customization for different vital parameter collecting and sending.
    Vital parameter can be adjusted to meet demand. The wireless transceiver module technology can be suited for short distance limited only about 10 meters.

7. As mentioned in [8] the device Ambient multi prospective system with electronic mails for a residential health monitoring system- The main idea of developing of such a device was to address the patients post operations and how they would be giving out the extra hospital fee and therefore this idea was proposed. The device includes the following materials a HIS experimental platform which gets the data from a body of the patient through a sensor network which is connected to the internet via PC. SMTP is used for exchanging emails.

Additional to that three types of sensors are used such as physiological parameters, environmental parameters, and patient activity. In order to create the home network CAN is used. Software such as java is used and additional to that more complex coding is done on the basic background of java. Automatic restart agent and oxymeter software agent is also used in this device. Overall this system is efficient and fulfills the target audience purpose.

V.   OUR APPROACH AND IMPLEMENTATION

All the devices that we've read about and researched and tried on, we've realized that none of these devices are connected to the internet. Whereas, we designed our prototype keeping in mind the emerging technologies in mind. The main focus of all has been: to connect our device to the internet and make it available to people anytime and anywhere. The prototype that we've designed focuses mainly on measuring the pulse rate and the temperature of a patient and updating the measured details on the database every 30 seconds. This way it becomes easier for the doctor to keep a track of his/her patient and for kids or parents living away from their families to always constantly monitor the health of their loved ones.
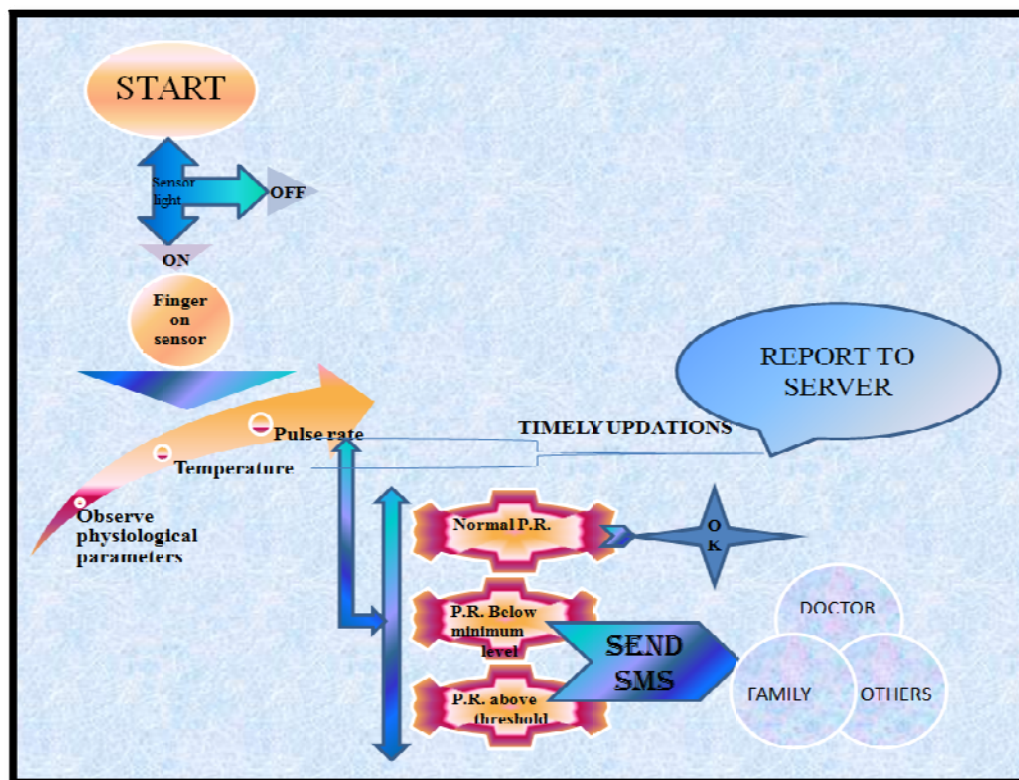

Fig 4: - Implementation flow chart depicting pulse rate and temp measurement technique

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Herein is a description of the device implemented as mentioned in the figure 4.

  i. After making the connections, switch off the power supply.
  ii. The sensor light will be on in case of pulse rate sensor. If the light doesn't gets on check for the faults.
  iii. Once the connections are made keep your finger on pulse rate sensor and temperature sensor.
  iv. Observe your physiological parameters. Along with that, check whether the pulse rate is normal, above threshold or below the minimum level.
  v. In case the pulse rate and temperature is normal, everything is ok.
  vi. If the pulse rate goes above the threshold, there are chances of major heart attack keeping in account the physiological parameters.
  vii. If the pulse rate goes below the minimum level set, then there are chances of minor heart attack noticing physiological parameters herein too.
  viii. In such cases of abnormalities, an SMS will be sent through GSM to doctors, family members or any other concerned person.
  ix. Also, timely updated information will be sent to the server of pulse rate and temperature wherein any authorized person can view the details at any given time by login.

Figure 5 describes the heart rate monitoring system which consists of different components such as temperature sensor, pulse rate sensor, LCD display, battery power supply, and microcontroller.
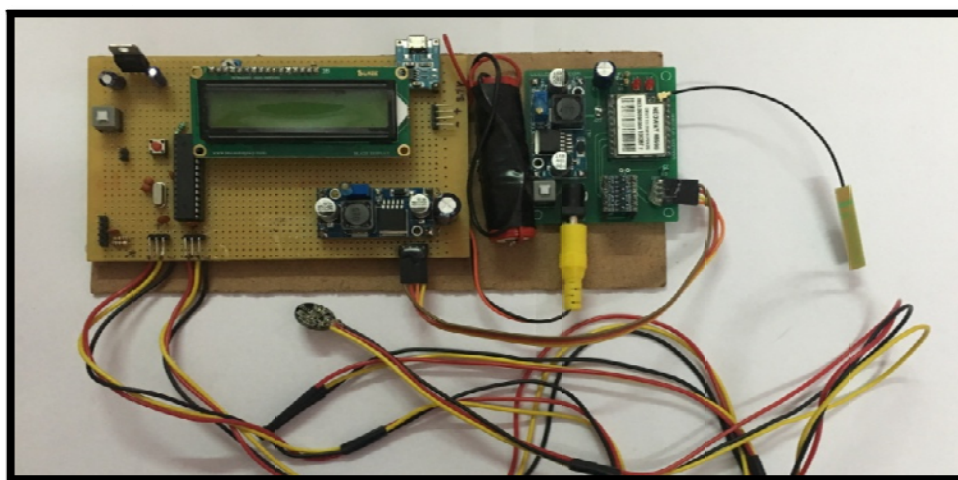

Fig. 5: - Actual heart rate monitoring prototype

The pulseand temperature sensor wires extend along with a platform attached to them in order to avail the results of a patient. All the devices have been carefully soldered onto the printed circuit board making sure that none of the wires collide with each other. The heart rate monitoring system works in the following manner:

Once the switch on button has been pressed, the LCD will display the desired name of the device. Within few seconds the device will be stable & one can place their finger on the pulse sensor and gripping the temperature sensor with the fingers.
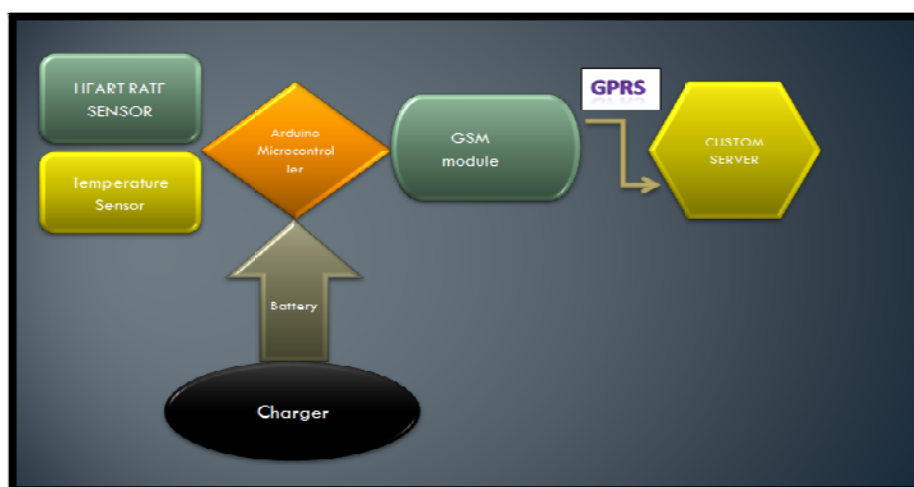

Fig 6 Flow diagram based on the prototype

Figure 6 shows a layout which is based on the prototype to make it easier to understand the flow of each entity.

After waiting for few seconds the results would be displayed on the screen. For instance if a person's pulse is below a certain limit or above the certain limit then in that case the alarm would be generated. Further on by incorporating the GSM module along to this very particular system SOS SMS would be sent out to the concerned people. The GSM module would be programmed along with the microcontroller in such a way that it processes the data in an accurate manner and only process the data whenever required.

VI.   CONCLUSION

As per the study Health monitoring system is an efficient system to monitor the health conditions. It helps to keep a track of one's health and keeps every concerned human in the loop. It helps to minimize the time by providing user friendly devices which senses monitors the patient's health and report the same to the concerned people. The main aim of it is to allow mobility and agility of the device on a human and still be very peculiar with the tracking of all the parameters set.

Hitherto the idea of heart rate monitoring system has kept on evolving ever since the concept of pulse sensor came into action. Heart rate monitoring system has great potential to develop in the near future. The idea that has been proposed in this system requires some basic hardware which can easily be procured. Further on proposing to do some additional changes in the system which requires of a GPS module which is linked to all the hospitals of the city. During such alarming situation stringent measures can be taken.

Futuristic scope to this can be a combined unit which acquires less space and is easier to operate in any environmental conditions and not affecting the results specially in outdoor monitoring.

Also it is an open platform where we can incorporate a large number of sensors.

Also we can create an application that provides us with suggestive measures depending upon the person's vital parameters which have been recorded on the database.

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