International Journal for Modern Trends in Science and Technology, 6(8S): 196-203, 2020

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTSTCIET38
Available online at: http://www.ijmtst.com/ncracse2020.html

Retrieving body temperature and heart rate values using IoT

Kotoju Rajitha[1] | Komatireddy Abhishek Reddy[2]

[1]Computer Science and Engineering, Mahatma Gandhi Institute Of Technology, Hyderabad, Telangana, India
[2]Student , Mahatma Gandhi Institute Of Technology, Hyderabad, Telangana, India

To Cite this Article
Kotoju Rajitha and Komatireddy Abhishek Reddy, "Retrieving body temperature and heart rate values using IoT", *International Journal for Modern Trends in Science and Technology*, 6(8S): 196-203, 2020.

Article Info
Received on 16-July-2020, Revised on 15-August-2020, Accepted on 25-August-2020, Published on 30-August-2020.

ABSTRACT

Internet of things (IoT) is an ecosystem of connected physical objects that are accessible through internet. IoT devices are used in many application fields which make the user's day to day life more comfortable. Health is such issue which has prime importance in our day to daylife.So,theseIoTdevicesareusedtocollecttemperatureandheartbeatlevelsetc.,which are used to evaluate the health condition of the patient. Communicating the collected information to the doctor, making accurate decision on the data collected and notifying the patient is the challenging task in the IoT. In this an IoT based Health Monitoring System using Node MCU is proposed to collect the required parameters such as heartbeat and body temperature. These sensors are interfaced with controller Node MCU Board. Wireless data transmission is done by Node MCU through wi-fi module. ESP8266 is used for wireless data transmission on IoT platform i.e. ThingSpeak. Data visualization is done on ThingSpeak. So that record of data can be stored over period of time. This data is stored on web server so that it can be seen when loggedin.

KEYWORDS: *Iot,wireless,MCU,ThingSpeak,Health*

INTRODUCTION

In the recent years wireless technology has increasing for the need of upholding various sectors.IntheserecentyearsIoTgroupedthemostofindustrialareaspeciallyautomationand control. Biomedical is one of recent trend to provide better health care. Not only in hospitals but also the personal health caring facilities are opened by the IoT technology. So, having a smart system various parameter are observed that consumes power, cost and increase efficiency. In this smart system, this paper is reviewed. In traditional method, doctors play an important role in health check-up. For this process requires a lot of time for registration, appointment and then check-up. Also, reports are generated later. Due to this lengthy process working people tend to ignore the check-ups or postpone it.Thismodern approach reduces time consumption in the process. In the recent years use of wireless technology is increasing for the need of upholding various sectors.Medicalscientistsaretryinginthefieldofinnovationandresearchsincemanydecadestoget betterhealthservicesandhappinessinhumanlives.Theircontributioninmedicalareaisvery important to us and cannot be neglected. Today's automotive structures have the root ideas coming from yesterday's basics. Also, early detection of chronic diseases can be easy with these technologies. The body temperature, heart rate, blood pressure, respiration rate are prime parameters to diagnose

the disease. This gives temperature and heart rate values using IoT.

A. Existing System

ManualOperation:In manual operation the patient needs to visit the doctor, or the doctor need to visit the patient in order to get the health checked of the patient.

LITERATURESURVEY

Ravi Kishore Kodali et al. proposed the healthcare monitoring which is implemented tocheckthetemperatureofthepatient.TheZigBeemeshprotocolisusedwherethe patient24-hourcarerecordsisbeingmonitored.In-hospitalrecordsaremaintainedin the cloud. IoT empowered devices at the same time enrich the quality of care with regular monitoring and collection of data actively and moderate the cost of care and analysis of thesame.

JasmeetChhabra*etal.*proposestheplanandimplementationforemergencymedical services based on IoT health monitoring system. In this the patient health related problems and healthcare cost is reduced. The collection, recording, analyzing and sharing data streams though the internet which reduce the patient problem of visiting the doctor every time to check the health parameter like heartbeat rate, temperature and blood pressure.

ThirumalasettySivakanth*etal.*presentsareconfigurablesensornetworkforessential health checking. The possibility of patients collapses, and the life-threatening consequences is reduced in content and real-time health monitoring system. The 566 International Conference on Signal, Image Processing Communication and Automation-complete information of patient is be mechanically obtained by the doctor by NFC technology. Biosensors interfaced with the microcontroller will screen patient's imperative health. If any of the sensor's preset threshold value is overdone above, a sensor's value will be sent to doctors and the patient's caretaker through message.

Y. T. Zhan *et al.* presents the implementation of telehealth systems for elderly population and discussion on various chronic diseases and its importance. They discussed in detail about wearable technology for remote health caresystem.

A.Murray *et al.* presents the planning of modern medicine, effective and safe use of healthcaretechnologyasessentialforanyhealthcaresystem.Concernsaboutmedical equipment care have been raised up. There is need to discuss the progress of health caresystem,inthispapersignificantprogressintheimplementationofthehealthcare system is proposed. Also, the lack of medical equipment safety measures and the protective steps that need to be taken care to improve the quality of healthcare is discussed.

SaedTarapiah*etal.*presentthepaperwhichguarantee estodecreasethecostofthe system and overall improvement in the quality of health care services. It is a system that can measure heart rate and body temperature and communicate with them in case of accidental behavior to manage medical personnel using GSM, GPS and web technologies to achieve immediate action to save the patient'slife.

Dr.K.N.Muralidharaand**BhoomikaB.K.**,presentsthedesignforIoTsmarthealthcare system using the microcontrollers. In this, the pulse oximeter, the temperature sensorand the heart rate are designed for the patient and the microcontroller to send data through the wireless network protocol and the data also shows the patient displayed on the LCDscreenwhoknowshishealthstatus.Theexpertscanseetheinformationthatlogsthelog totheHTMLsiteofthepageusingIPaddressandpagerecoverymethodsthataresopersisted by the information collection. So, the continuous patients check framework iscomposed.

D. Mahesh Kumar presents health systems based on wireless sensor networks. The wide range of benefits of wireless technology for the medical staff, patients and the continuous monitoring of the community, early detection of abnormal situations and potentialknowledgefoundinthepastdatainsertedalltheinformationcollected.The system helps the health care staff to control the complete state of the patient in a separate, real-time and great way. Through the network can reach every node of the patient at any time as long as the network terminal is available. The patient sends a setofsensorstocollecttheirbodyparameters.Themedicalstaffevaluatestheoverall condition of each patient and checks the collected values of thenodes.

Wiredoperation: In general, we see number of devices being connected to the patient to monitor heartbeat, body temperature, blood pressure levels etc. using wires which are connected to the display units

A. *Proposed System*

Inthisweintroducea newwayofimplementingHealthMonitoringSystemwith Node MCU. Data generated by the sensors are processed by Arduino microcontroller. ESP8266 provides unsurpassed ability to embed Wi-Fi capabilities within othersystems.Itoffersacompleteandself-contained Wi-Finetworkingsolution;itcanbeusedtohost the application or to offload Wi-Fi networking functions from anotherapplication.

HEALTH MONITORING SYSTEM USINGIoT TECHNIQUES BLOCKDIAGRAM

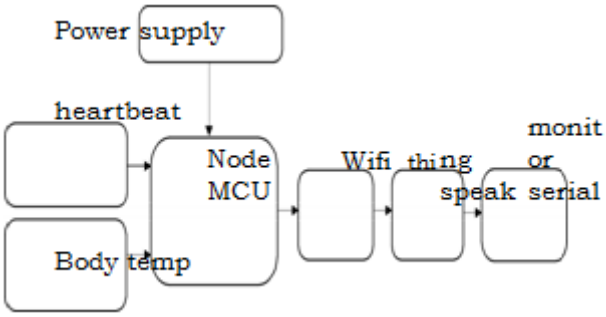


Fig 3.1: Block diagram of Health Monitoring System

Intheabovefigureweobservethatthepowersupply,heartbeatsensorandbody temperaturesensorisconnectedtothe nodeMCUanditisconnectedtotheWi-Fi modem.

- **HARDWARE REQUIREMENTS**

1. NODE MCU

- **Fig 3.2: Node MCU**

Node MCU is an open source LUA based firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip. Node MCU is shown in the above fig 3.2.6

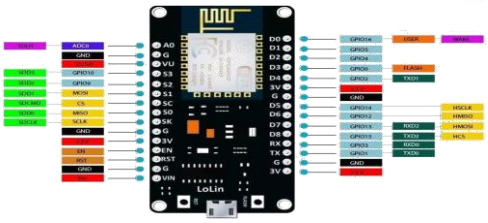


Fig 3.3: Node MCU V3 Pin-Out

Node MCU firmware comes with ESP8266 Development board i.e. Node MCU Development board. Since Node MCU is open source platform, their hardware design is open for edit/modify/build. The pin-out diagram of Node MCU V3 is shown in the above fig 3.3.

NODE MCU PIN DESCRIPTIONS:

Node MCU has general purpose input output pins on its board as shown in above pinout diagram. We can make it digital high/low and control things like LED or switch on it. Also, we can generate PWM signal on these GPIO pins.

ADC PIN DESCRIPTION:

Analog to Digital Converter (ADC) is used to convert analog signal into digital form. ESP8266 has inbuilt 10-bit ADC with only one ADC channel i.e. it has only one ADC input pin to read analog voltage from external device/sensor.

ADC channel on ESP8266 is multiplexwith battery voltage. Hence, we can set it to measure either on board supply voltage or external analog voltage. The input voltage range for ADC pin is 0–1.0V while reading external analog voltage.

HEARTBEAT SENSOR

Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino and Arduino compatibles. It can be used by students, artists, athletes, makers, and game and mobile developers who want to easily incorporate live heart-rate data into their programs. Pulse Sensor adds amplification and noise cancellation circuitry to the hardware. It's noticeably fasterandeasiertogetreliable pulsereadings.PulseSensorAmped workswitheithera3V or 5V NodeMCU.

Specification

Diameter = 0.625"(~16mm)

Overall thickness = 0.125"(~3mm)

Working Voltage = 3V to5V

Working Current = ~4mA at 5V

Fig 3.4: Pulse sensor

You can see the s, + and - on pulse sensor's back view as shown in the above figure 3.4.TEMPERATURE SENSOR

Thereareawidevarietyoftemperaturesensor ICsthata reavailabletosimplifythebroadest possible range of temperature monitoring challenges. These silicon temperature sensors differ significantly in a couple

of important ways. The first is operating temperature range. A temperaturesensorICcanoperateoverthenominalIC temperaturerangeof-55°Cto+150°C. The second major difference isfunctionality.

A silicon temperature sensor is an integrated circuit and can therefore include extensive signalprocessingcircuitrywithinthesamepackageas thesensor.Thereisnoneedtoaddcompensation circuits for temperature sensor IC's. Some of these are analogue circuits with either voltage or current output. Others combine analogue-sensing circuits with voltage comparators to provide alert functions. Some other sensor ICs combine analogue-sensing circuitry with digital input/output and control registers, making them an ideal solution for microprocessor-basedsystems.

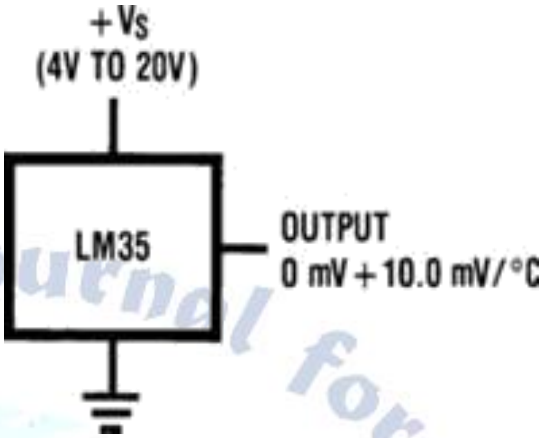
Digital output sensor usually contains a temperature sensor, analog-to-digital converter (ADC), a two-wire digital interface and registers for controlling the IC's operation. Temperature is continuously measured and can be read at any time. If desired, the host processorcaninstructthesensortomonitortemperat ureandtakeanoutputpinhigh(orlow) if temperature exceeds a programmed limit. Lower threshold temperature can also be programmed, and the host can be notified when temperature has dropped below this threshold. Thus, digital output sensor can be used for reliable temperature monitoring in microprocessor-basedsystems.

- **Fig 3.5: Temperature Sensor**

Above temperature sensor has three terminals and required Maximum of 5.5 V supply. This typeofsensorconsistsofamaterialthatperformstheop erationaccordingtotemperatureto vary the resistance. This change of resistance is sensed by circuit and it calculates temperature. When the voltage increases then the temperature also rises. We can see this operation by using adiode.

Temperature sensors directly connected to microprocessor input and thus capable of direct and reliable communication with microprocessors. The sensor unit can communicate effectively with low-cost processors without the need of A/D converters.

The basic centigrade temperature sensor (+2˚C to +150˚C) is shown in the below figure 3.6.



Circuit diagram of LM35

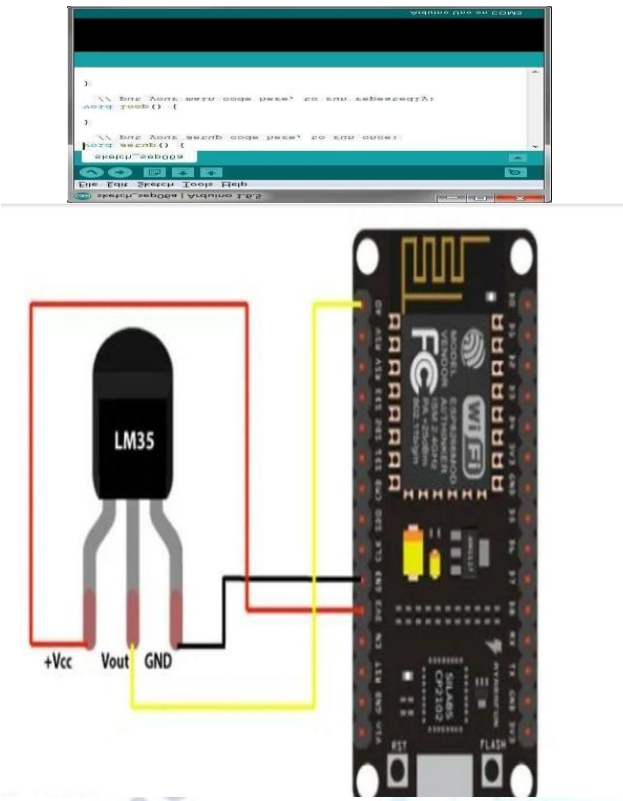
Temperature sensor Features of LM35 Temperature Sensor:

- Calibrated directly in ˚ Celsius(Centigrade)
- Rated for full l −55˚ to +150˚Crange
- Suitable for remoteapplications
- Low cost due to wafer-leveltrimming
- Operates from 4 to 30volts
- Lowself-heating,
- ±1/4˚C of typical nonlinearity

- **Operation of LM35:**

TheLM35canbeconnectedeasilyinthesamewayasot herintegratedcircuittemperature sensors. It can be stuck or established to a surface and its temperature will be within around the range of 0.01˚C of the surfacetemperature.

- This presumes that the ambient air temperature is just about the same as the surface temperature; if the air temperature were much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the airtemperature.



- **Fig 3.7: Temperature sensor interfacing with Node MCU**

The above figure 3.8 shows the interfacing of temperature sensor with Node MCU. The circuit connections are made as follows:

1. **Pin 1** of the LM35 goes into **+3v** of the NodeMCU.
2. **Pin 2** of the LM35 goes into Analog Pin **A0** of the NodeMCU.
3. **Pin 3** of the LM35 goes into Ground Pin (**GND**) of the NodeMCU.

SOFTWARE REQUIREMENTS

ARDUINO IDE Download Arduino Integrated Design Environment (IDE) here (Most recent version: 1.6.5):
https://www.arduino.cc/en/Main/Software.

Fig 3.8: Arduino IDE Default Window

Thefig3.8showstheArduinoIDEonceit'sbeenopened. Itopensintoablanksketchwhere you can start programming immediately. First, we should configure the board and port settings to allow us to upload code. Connect your Arduino board to the PC via the USBcable.

ESP8266 BOARD INSTALLATION FOR ARDUINO IDE

Open ArduinoIDE.

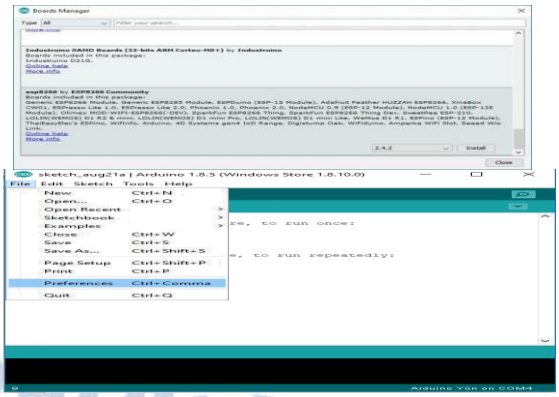


Fig 3.9: Arduino IDE: Preferences

- Select **File** and choose **Preferences.** The below figure 3.9 shows how toselect preferences from file in the Arduino IDEwindow.

Fig 3.10: Preferences window with Additional Board Manager URL

Copy link http://arduino.esp8266.com/stable/package_esp8266com_index.jsonin AdditionalBoardManagerURL's(Itisthelink,whichcontainsesp8266boardpackages for Arduino IDE) and click Ok as shown in the above figure3.10.

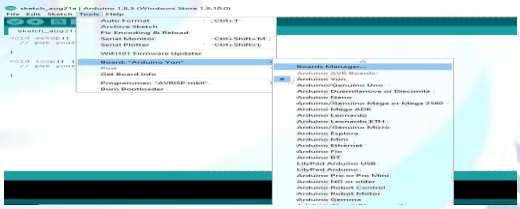


Fig 3.11: Arduino IDE: Board manager to install latest package of ESP8266

Now go to **Tools – Board – BoardManager**
In Board Manager, Scroll down to the end of thewindow
Now **esp8266 by ESP8266 Community** is available. Click that package andclick **install**by selecting latest version as shown in the figure 3.11.

Fig 3.12: ESP8266 Community waiting for installation

Fig 3.13: Arduino IDE: Window showing successful installation of ESP8266 Board.

Test	Heartbeat sensor test
Test purpose	To test the sensor value and functionality
Test environment	Placed betweenthethumband indexfinger
Expected Step	Opentheserial and monitorinArdu .inoIDE see the sensor value for the heartbeat sensor. Place theheartbeat sensorbetween the indexfinger andthe thumbfingeran d check serial values in the monitor in the Aurdino IDE
Expected Result	heheartbeatsensorvaluesaredis playedonthe Serialmonitor

Wait for some time; let it to complete the installation and now it shows the installed message showing that ESP8266 board is successfully installed as shown in the below figure 3.13.

BOARDSETUP

YouhavetotelltheArduinoIDEwhatboardyouareuploadingto.SelecttheToolspulldown menu and go to Board. This list is populated by default with the currently available Arduino Boards that are developed by Arduino. If you are using an Uno or an Uno-Compatible Clone (ex. Funduino, Sain Smart, IEIK, etc.), select Arduino Uno. If you are using another board/clone, select thatboard.

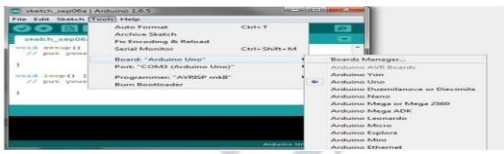


Fig 3.14: Arduino IDE: Board Setup Procedure The above fig 3.14,shows the board setup procedure.

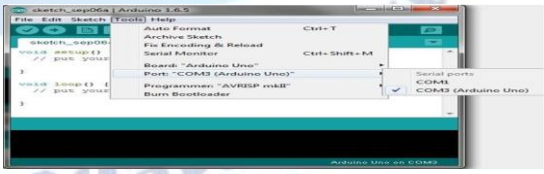
COM PORTSETUP

Ifyou'vedownloaded theArduinoIDE beforeplugginginyourArduinoboard,whenyouplug into the board, the USB drivers should be installed automatically. The most recent Arduino IDE should recognize connected boards and label them with which COM port they are using. Select the Tools pulldown menu and then Port. Here it should list all open COM ports, and if thereisrecognizedArduinoBoard,itwillalsogiveitsname.SelecttheArduinoboardthatyou have connected to thePC.**Note:** the Arduino Uno occupies the next available COM port; it will not always be COM3.At this point, your board should be set up for programming, and you can begin writing and uploading code

Fig 3.15: Arduino IDE: COM Port Setup

If the setup was successful, in the bottom right of the Arduino IDE, you should see the board type and COM number of the board you plan to program as shown in the fig 3.15.

IV.TESTING



Developed system is tested under various conditions. The heartbeat sensor and body temperaturesensorsaretestedbyplacing sensorstothepatientinallconditionsand resultsare interpreted successfully. The heartbeat and body temperature readings at different conditions are taken and updated.The wireless transmission was achieved using wi-fi.

The data is stored in Thing Speak server, the data

is then retrieved successfully from the Thing Speak server which is used for monitoring purpose.

- **HEARTBEAT SENSOR TEST**

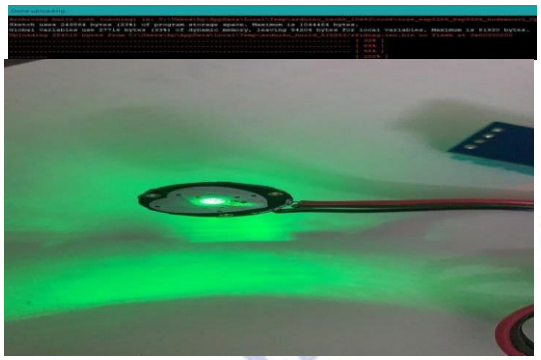


Fig 4.1: Heartbeat sensor test for normal condition

From the Figures 4.1 and 4.2, the test shows how the pulse sensor should be held and how it seems to be.

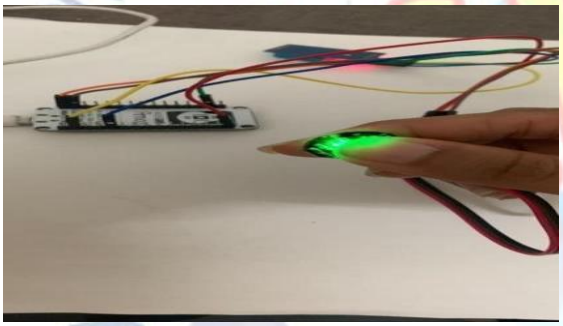
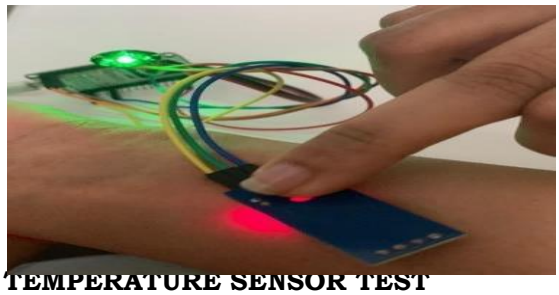


Fig 4.2: Temperature sensor testing

As shown in the figure 4.2 on holding the pulse sensor between the fingers through which the pulse is recorded and the recorded data can be online monitored as show in figure 4.3.

Fig 4.3: Live data from Heartbeat sensor



TEMPERATURE SENSOR TEST

Test	Temperature Sensor Test
Test purpose	To test the sensor value and functionality
Test environment	Placing the sensor in contact withhuman body
Expected Step	1.Opentheserialmonitor inArduinoIDEand see the sensor value tocheckthebody temperature values
Expected Result	seen on the serial monitor display of the Aurdino IDE.

Table 4.2: Temperature sensor testing

Fig 4.4: BodyTemperature Sensor testing

The fig 4.4 depicts how the sensor must be held and how it looks like.

Fig 4.5: Live data from body temperature sensor

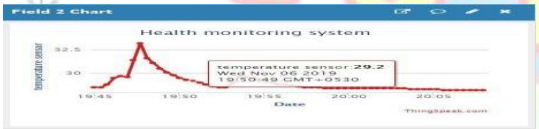
The fig 4.5 depicts how the temperature can be monitored online

CONCLUSION AND FUTURESCOPE

A.conclusion

As health care services are important part of our society, automating these services lessen theburdenonhumansandeasesthemeasuringprocess.Also,thetransparencyofthissystem helps patients to trust it. When threshold value is reached, the alarm system that consists of buzzerandLEDalertsthedoctorsand hecanactmorequickly.Theobjectiveofdeveloping monitoring systems is to reduce health care costs by reducing physician office visits, hospitalizations, and diagnostic testing procedure. The GSM technology helps the server to update the patient data on website. Many further improvements can be made in our system to make it better and easily adaptable such as adding more advanced sensors. The biometric informationofthepatientwhichisstoredandpublishedonlinecanbegiventoscientistsand researchers of medical fields to analyze the value and find patterns or for other research work. To simplify the hardware and reduce wiring we can use wirelesssensors.

A. Future scope



According to the availability of sensors or development in biomedical trend more parameter can be sensed and monitored which will drastically improve the efficiency of the wireless monitoring system in biomedical field. A graphical LCD can be used to display a graph of rate of change of health parameters over time. The whole health monitoring system which we have framed can be integrated into a small compact unit as small as a cell phone or a wristwatch. This will help the patients to easily carry this device with them wherever they go.Inaddition,withmedicalapplicationwecanuseoursysteminindustrialandagricultural application by using sensors like humidity sensors, fertility check sensors,etc.

REFERENCES

[1]. Govinda Swamy, Ravi Kishore Kodali and Boppana Lakshmi," An Implementation of IoT for Healthcare", IEEE Recent Advances in Intelligent Computational Systems (RAICS) 10-12 December 2015.

[2]. Punit Gupta, Deepika Agrawal, Jasmeet Chhabra, Pulkit Kumar Dhir, "IoT based Smart HealthCare Kit",Jaypee University of Information Technology, International Conference on Computational Techniques in Information and Communication Technologies(ICCTICT),, 2016.

[3].Thirumalasettee Sivakanthand S. Kolangiammal, "Design of IoT Based Smart Health Monitoring and Alert System", I J C T A, 9(15), 2016, pp. 7655-7661.

[4]. B. Tai and Hung K., Y.T. Zhan, "Wearable medical devices for tele-home healthcare," IEMBS'04. 26th Annual International Conference of the IEEE, vol. 2, pp. 5384– 5387, 2004.

[5]. A. Murray and Khambete N.D., "National efforts to improve healthcare technology management and medical device safety in India," 7th International Conference on, IET, pp. 1–5, 2012.

[6]. Shadi Atalla, Kahtan Aziz, Salah Haj Ismail and SaedTarapiah," Smart Real-Time Healthcare Monitoring and Tracking System using GSM/GPS Technologies", 2016 3rd MEC International Conference on Big Data and Smart City.

[7]. Dr. K.N. Muralidhara and Bhoomika B.K," Secured Smart Healthcare Monitoring System Based on IoT", International Journal on Recent and Innovation Trends in Computing and Communication. Volume: 3 Issue: 7.

[8]. D. Mahesh Kumar, "Healthcare Monitoring System Using Wireless Sensor Network" Int. J. Advanced Networking and Applications Volume:04 Issue:01 Pages:1497-1500(2012).

[9]. Luciano Tarricone, Luca Mainetti, Luca Catarinucci, Danilo de Donno,Maria Laura Stefanizzi, Luigi Patrono and Luca Palano," An IoT-Aware Architecture forSmart Healthcare Systems", IEEE Internet of Things Journal, Vol. 2, No. 6, December 2015

[10]. Sampada Sathe and Alok Kulkarni," Health care applications of the Internet of Things: A Review" International Journal of Computer Science and Information Technologies (IJCSIT), Vol. 5 (5), 2014, 6229-6232.