IoT based Remote Patient Health Monitoring system

P. Saleem Akram
Dept of ECE
Koneru Lakshmaiah Education Foundation
(Deemed to be University), Guntur, A.P, India
psaleemakram@gmail.com

Ramesha. M
GITAM School of Technology
GITAM (Deemed to Be University), Nagadenehalli,
Bengaluru, Karnataka, India
rameshmalur037@gmail.com

Sai Aamani Sindhu Valiveti
Koneru Lakshmaiah Education Foundation
(Deemed to be University), Guntur, A.P, India

Shaik Sohail
Koneru Lakshmaiah Education Foundation
(Deemed to be University), Guntur, A.P, India

K.Teja Samba Siva Rao
Koneru Lakshmaiah Education Foundation
(Deemed to be University), Guntur, A.P, India

Abstract— Having good health is something everyone wants. It is equally important to monitor a person's health on a regular basis to avoid any kind of abrupt changes in the future. Also, simple monitoring health status for older people is equally necessary, and in this fast and modern world, long hospital queues and ambulatory monitoring is well known. These issues demand the system to develop a basic health monitoring system that can be used in homes or wherever possible with primary health parameters. We know that advanced technology has led to many wireless devices and the internet of things. Using IoT, we can capture data and transmit data through the internet, providing data interoperability methods. Nowadays, IOT plays a vital role in capturing data and monitoring, analyzing a series of data, recording storage, and display. We analyze parameters such as body temperature, blood pressure, pulse sensor, and GPS to track the patient's current location in this project. We use Arduino Board as a processor where the collected data is sent to Arduino and is processed further. We use the WIFI module to transmit data over the internet for analysis. This analyzed data is stored and used for flexible purposes. Results are automatically sent to the doctor when a critical condition is detected.

Keywords— Internet of Things (IOT),Global positioning system(GPS),ATMega 8 Microcontroller, Sensor, Electrocardiogram(ECG),Global system for mobile communications (GSM), Internet Protocol(IP),Arduino UNO, ,Printed circuit board(PCB), Radio Frequency System(RF System).

I. INTRODUCTION

It is essential to stay healthy to lead a happy and comforting life. According to the world health organization having good health is a fundamental right for every individual, and unfortunately, it is a global problem to confront in the future. We use the concept of the internet of things, which is well heard and resourcefully put into application these days. In hospitals there are provisions for continuous monitoring of patients. Their ECGs, heartbeat, are continuously monitored. There is no provision to check the parameters when they return to home [1].Also there is no need for a number of medical personnel for accompanying with patients to be physically present to check the health condition of the coma affected person, The goal is to remotely monitor health condition of any individual [2-3].In the recent days, the health care system is advancing to provide better facilities to the mankind there is a major role played by technology in this marathon of advancement lifestyle always makes things easier for oneself. Integration of technology with the patient health monitoring, facilitates the health care providers and the patients as well. There are multiple health parameters which requires continuous monitoring [4-5] in the hospital setup or at home for a chronically ill patient. These parameters should include body temperature, pulse rate, heart rate and respiratory rate etc. In a hospital setup, we see a monitor is fixed bed-side for each and every patient for continuous vital parameters monitoring. This setup requires manual checking of any change in the parameters [6] which a normal person could not identify but always a health care provider is in need. This is basic drawback of regular health monitoring until recent past the integration of IOT (internet of things) to the health monitoring system would be a boon to both health care providers of the patients [7-8]. It is a centralized system providing wireless transmission of patient data with the help

of sensors, software and exchanging data over the internet. In case of emergencies, when patient is in utmost need of healthcare, "IoT based remote patient health monitoring system" also includes GPS module [9] to locate the patient. Internet of Things (IoT) provides us enough technology and modules to concentrate on healthcare system, introducing the technology to keep patients safe and healthy, and providing available opportunities [10] for supervisor to monitor it continuously.

However, these uses of such modules might achieve greater heights at present and is also omnipresent. It is also true that many other technological advancements might occur along with IOT to monitor health care in a better way [11-12]. This work can be used in hospitals and also for patients who can be under continuous monitoring while traveling from place to place, since the system is continuously monitoring the patient [13]. A wireless sensor network (WSN) consists of structurally distributed autonomous devices, Such technologies ought further bolstering fulfill strict safety, security, reliability [14-15]. We can observe that over a few years Internet of things has taken to accelerate as the Internet of Things is a plays an important role in digital transformation of health sector [16-17] and various stakeholders are stepping up their efforts.

II. LITERATURE SURVEY

As we probably am aware there are numerous ventures dependent on IOT based wellbeing checking framework with the strategies for remote sensors. At first the scientists made patient wellbeing checking framework utilizing Atmega-8 microcontroller with Sensing-Network. In this work, the sensors which are utilized here are Temperature sensor, ECG sensor, Heart beat sensor.
The proposed method of patient monitoring system monitors patient's health parameters using Arduino Uno. Over the last few years, the usage of Arduino increases exponentially, which allows them to exchange information. Here, sensor data is collected, stored and processed. It consists of several sensors that can be either wired type or wireless type. There are additionally disservices, for example, high reach exact identification needs high caliber of data they should be even skilled to foresee in disconnected just like above in arbitrary backwoods.
These sensors are embedded on human body which helps in screening the great state of human body without disturbing the step by step plan of the patient and furthermore exact noticing system involves sensors, microcontroller, show and GSM modem to communicate or get prosperity or any threat times to the trained professional.
Accordingly, at specialist's office comparable sort of GSM modem is used. It requires some investment to tell the patients

and their friends and family about the outcomes and conveys the report straightforwardly with no interference and mix-ups. There are a few gadgets where GSM modules have been consolidated in pulse checking gadgets. Fundamentally these sort of gadget checks the information which is gathered by the sensors and communicates it to the miniature regulator where the microcontroller sends it over the air with the assistance of GSM innovation. The transmitter sends the data SMS to the concerned people consequently a functional response for perception structures at each structure and part level. Checked boundaries are sent by using, GSM. This structure offers office to screen the circulatory strain of patient. The prosperity boundary clearly ships off the expert utilizing GSM Module.
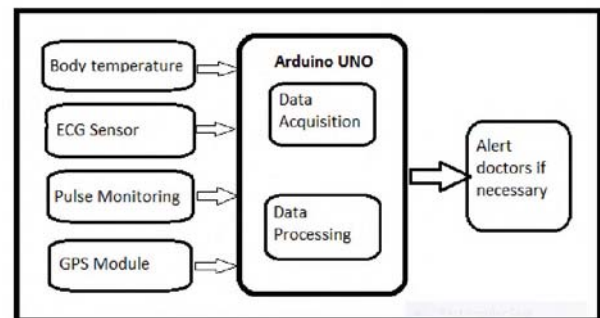
III. ARCHITECTURE AND DEVICES

Figure 1: Basic block diagram of the proposed model

The above figure 1 represents a block diagram of the modules we are to use to make this module. This project requires involvement of many sensor and it application such that it is equally important to know the functioning of each and every sensor and its interfacing with respective micro controller, the data are then received in an authorized personals smart phone with IoT platform. Both the transmitting and receiving end devices communicates to bring out a faster and effective treatment. We need to understand why we are building this module and what kind of applications we can have from this, the following are the sensors used in this module.
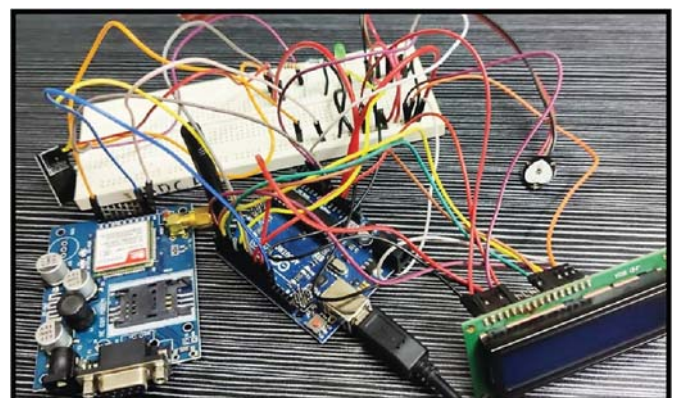

Figure 2: Real time hardware Circuit diagram
The above figure 2 shows the circuital representation of the module connected. We are required to connect the following

1520

sensors and actuators as in the above image here we need to know the specifications and functioning of each component and we need to reassure if the components are compatible enough for the project.

A. Pulse sensor:

Pulse sensor also called as heart rate sensor we use in module is compatible with Arduino and other micro controller It is well designed and in the format of plug and play module. Applications of such sensors includes medical as well as it can be used by pupils and anyone with basic knowledge of the sensor or can be implemented in mobile applications and in other tech related projects in where anyone easily include live heartrate data. Working of this sensor is to clip on the sensor to your finger or an earlobe after connecting it to your micro controller with the help of connecting wires. In order to attain the perfect output for our module it is equally important to know the specifications of the sensors you count in. The front side of the pulse sensor includes an LED and the other side has a circuitry built on it. In order to calculate the pulse we need to place sensor such that the LED sticks on the skin, also by making sure it exactly placed on top of vein. As some amount of light is reflected back at the sensor when the blood flows at a certain interval this change is cordially acknowledged by the LED and it calculates the pulse of the person.

B. Temperature (LM-35) sensor

LM35 is a basic circuit sensor that is widely used to measure temperature of a given body in form of an electrical signal output that is proportional to the body's temperature in Celsius. This electrical output voltage can easily be elucidate in order to obtain temperature reading in Celsius. LM35 unlike many other thermistors does not require any extra calibration in order to obtain output. The outer most layer of the sensor also protects it from self-heating. This sensor provides greater accuracy make it popular among society, DIY circuit makers, and students and colleges.

C. ECG Sensor

ECG (electro cardiograph) is a device which is used graph out all the electrical signals generated by human heart. In order to understand a person's physiological changes and also it can be used to better understand patient's psychological state.

According to the survey related to physiological issues if a person in daily life, it is told tht we often misapprehend the source of these changes. We are often in a state of mind where

we feel that everything is fine in out body mentally and physically, but unfortunately it is not true. It is a common misconception that the effects of a drug will be same as that of epinephrine, or that they might feel similar along with some irritation or with nothing at all. Epinephrine is known to activate the human central nervous system, so taking on such drugs might lead to changes in such as an increased heart rate or pupil dilation. By analyzing or monitoring with the help of ECG signal at the initial stage this disease can be prevented. So AD8232 is an integrated circuit that is fabricated to measure the electrical activity of the heart. The output of this electrical change can be charted as an ECG or Electrocardiogram.

D. GPS Module

GPS is generally termed as geo-positioning satellite, it is a device which has both transmitter and receiver, which transmit a frequency of signal to transmitter in the satellite located in space and this satellite receives the data signal and resends the signal which is received by gps module and it calculates time required by signal to return and then decides its position how far the object was from initial position.

E. ESP8266 WIFI Module

The ESP8266 is a Wi-Fi Module and also a fully integrated system on a chip with along with in built TCP/IP protocol suite that can give any microcontroller device to ingress to your home WIFI network. The ESP8266 device is capable of both hosting and receiving different kind of application like concept of uploading and downloading from a network The ESP8266 sensor consists of AT command set firmware already pre-programmed, i.e. anyone can easily plug this device to their micro controller and get Wi-Fi-ability much equal to that of a router or other WI-FI shield. The ESP8266 sensor is an extremely affordable circuit with huge scope in this interconnected community. This module is fabricated such that it has processing as well as storage capabilities and also it is flexible enough to be integrated with other sensors such specifications that are much required and makes it to be more available for internet of things projects. The integration and fabrication is so subtle making it to occupy less PCB area. The design of ESP8266 also supports for VOIP applications and also Bluetooth along with other interfaces, it contains a self-calibrated RF system allowing it to work under all operating and different conditions and requires no external RF parts.

IV. PROPOSED FRAMEWORK

The project mainly concentrates on two frames which include collection of data and processing of data respectively.

The first one as mentioned has the objective of collecting data in regard to patient such as temperature, ECG and pulse sensor, the user can identify all these characteristics easily and will be able to monitor his health condition regularly.
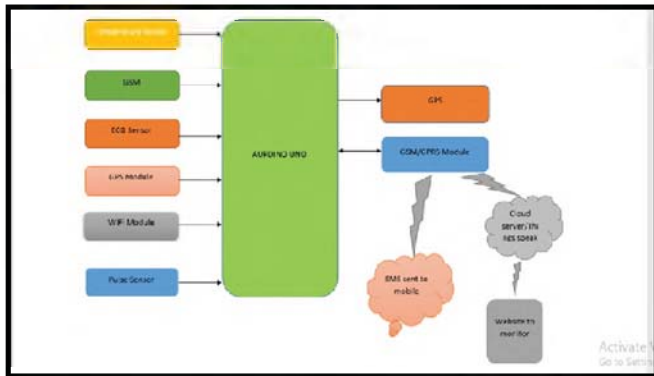

Figure 3: Flowchart of the model

The above figure 3 represents, flow diagram representation of module. The flow chart shows us monitoring using sensor and how data can be transmitted when the sensors cross their threshold values, the device is capable of representing data in serialized manner such that any user will be easily able to get required information. The utilization of microcontroller along with other sensors is really important for the collection of patient's data. Here the micro controller we use is AT Mega 328P UNO Micro controller like a sample is provided for here. Arduino is used here to integrate our heart rate sensor, which in return needs to wrapped to finger in order to obtain the output and those simple energies would more transformed to our system. Similarly Sensor is connected to the microcontroller where it involves transmitting signal and receiving signal and voltage connected to it respectively, when you connect an ECG sensor to human body it measures the electrical activity of body, temperature sensor LM35 is connected to the micro controller as well, all these sensors pull up together to gather the required data of a patient.

After microcontroller collects the data it is kept to itself, ESP8266 offers Wi-Fi services that are required for the micro controller in order to transmit the data from one point to another at different intervals of time. we write the code of microcontroller such that to interface it along with our things speak cloud in things speak cloud we can use n number of inputs and identify their threshold value and mark up to them such that when the data is collected from the micro controller it can be analyzed accordingly, also using things speak platform we can observe the chart form of our data which can also easily be understood by not only doctors but even a

common person as well, as we can see the specific nature of this module is to make a health analyzer accessible to everyone and understandable to everyone, this module can be used on regular basis to monitor their health.

But we might face situations where the data we took in might cross the threshold value in such case using GSM module a message will be sent to a respective number we choose. The module is laid out in a user friendly manner and is easy to use and manage.

V. .RESULTS AND DISCUSSIONS

The project deals with multiple sensors interconnected with an interface Arduino UNO, the first module of the project collects data from the user i.e. patient data such as pulse rate, temperature and ECG values are noted and is flexible enough to be seen in both LCD and can be analyzed in Think speak website as well, along with credentials data can be analyzed by doctors and patient equally along with this a GSM module is attached to the project such that if pulse rate goes down than 70 and if temperature goes up than 38 then a message will go to respective number.

Figure 4: a) The picture denotes the ECG value of a patent

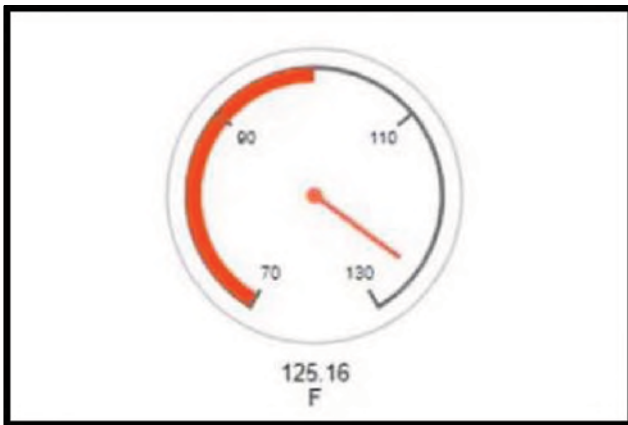**Figure 4**: b) Chart format of human body temperature.

Figure 4: c) Pie Chart format of human body temperature in Fahrenheit

Figure 4: d) Pie chart format of pulse of a human in BDM.

The above figures 4 (a) represents the ECG value of the patient, 4 (b) represents the human body temperature in chart format, 4 (c) represents the human body temperature in pie chart format, 4 (d) represents the pulse of a human in pie chart format. As we can see that the respective data of each sensor has been represented in chart format where anyone of the family and doctor can login and check the patient's condition respectively, There are cases where common man might understand if data values have crossed threshold then the module identifies and sends message as an alert to the specified mobile number. The main purpose of this module is, it is easily portable and can operated by anyone with basic knowledge and also enables the patient to get tested in a happier environment and the data can be analyzed in chart format or in pie diagram making it more flexible in nature.

VI. CONCLUSION

The results of the project is observed in chart format, these values might not precise to the original values but they meet the standards of each respective fields. Evaluation from these results helps to determine the health condition of the patients. The project module of Remote health Monitoring has been effective in monitoring health conditions. It helps everyone in daily routine of health consciousness. It helps in measuring health condition from a toddler to an older person. This module minimizes time of patient and reduces hospital visiting's and also gives a friendly experience with all kinds of sensors. The main aim of this project is to make it mobile and to provide an easy place to accommodate in homes. Futuristic scope to the present are often a combined unit which acquires less space and is simpler to work in any environmental conditions and not affecting the results specially in outdoor monitoring.

REFERENCES

[1] Aieshwarya. B. Chavan Patil "An IoT Based Health Care and Patient Monitoring System to Predict Medical Treatment using Data Mining Techniques: Survey", International Journal of Advanced Research in Computer and Communication Engineering(IJARCCE), ISO 3297:2007 Certified Vol. 6, Issue 3, March 2017

[2] Tamilselvi V, Sribalaji S, Vigneshwaran P, Vinu P, J.GeethaRamani, "IoT Based Health Monitoring System", 2020 6th International Conference on Advanced Computing & Communication Systems (ICACCS)

[3] Taniya Shirely Stalin, Abey Abraham, "IOT BASED HEALTH MONITORING SYSTEM AND TELEMEDICINE", International Research Journal of Engineering and Technology (IRJET),   Volume: 07 Issue: 03 | Mar 2020

[4] Ufoaroh S.U , Oranugo C.O, Uchechukwu M.E , HEARTBEAT MONITORING AND ALERT SYSTEM USING GSM TECHNOLOGY , International Journal of Engineering Research and General Science Volume 3, Issue 4,   July-August, 2015 ISSN 2091-2730

[5] Shivam Gupta, Shivam Kashaudhan, Devesh Chandra Pandey, Prakhar Pratap Singh Gaur, "IOT based Patient Health Monitoring System", International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 03 | Mar -2017.

[6] Shiva Rama Krishnan, Subhash Chand Gupta, Tanupriya Choudhury, "An IoT based Patient Health Monitoring System", 2018 International Conference on Advances in Computing and Communication Engineering (ICACCE-2018) Paris, France 22-23 June 2018

[7] C.Senthamilarasi, J.Jansi Rani, B.Vidhya , H.Aritha, "A SMART PATIENT HEALTH MONITORING SYSTEM USING IOT", International Journal of Pure and Applied Mathematics , Volume 119 | No. 16 | 2018.

[8] V.Akhila , Y.Vasavi , K.Nissie , P.Venkat Rao, "An IoT based Patient Health Monitoring System using Arduino Uno", International Journal of Research in Information Technology, Volume 1, Issue 1, November 2017.

[9] S. Raja Gopal, Patan.SA, "Design and Analysis of Heterogeneous Hybrid topology for VLAN configuration.", International journal of emerging trends in engineering research, vol:7, no:11, pn:487-491, November, 2019

[10] BN. Karthik, L. Durga Parameswari, R. Harshini, A.Akshaya, "Survey on IOT & Arduino Based Patient Health Monitoring System", International Journal of Scientific Research in Computer Science, Engineering and Information Technology © 2018 IJSRCSEIT | Volume 3 | Issue 1 | ISSN : 2456-3307.

[11] Ngo Manh Khoi, Saguna Saguna, Karan Mitra and Christer Ahlund, "IReHMo: An Efficient IoT-Based Remote Health Monitoring System

for Smart Regions", 2015 17th International Conference on E-health Networking, Application & Services (HealthCom)

[12] GLP Ashok, P.S.Akram, "Implementation of smart home by using packet tracer", International journal of scientific & technology research, vol:1, issue:1, pn:1-7. (2019)

[13] Mohd. Hamim, Sumit Paul, Syed Iqramul Hoque, Md. Nafiur Rahman, Ifat-Al-Baqee, "IoT Based Remote Health Monitoring System for Patients and Elderly People", 2019 International Conference on Robotics,Electrical and Signal Processing Techniques (ICREST)

[14] D. P. Tripathi, P. Saleem Akram, "Study and Analysis of Local Area Network by using Packet Tracer.", International journal of scientific & technology research, vol:8, issue:12, pn:1179-1185. (2019)

[15] Prajoona Valsalan, Tariq Ahmed Barham Baomar, Ali Hussain Omar Baabood, "IOT BASED HEALTH MONITORING SYSTEM", Journal of Critical Reviews ,ISSN- 2394-5125 ,Vol 7, Issue 4, 2020

[16] P. Srikanth Reddy, P. Saleem. A, "Study and Analysis of Routing Protocols", International journal of emerging trends in engineering research, vol:7, no:11, pn:434-440, November, 2019.

[17] Dahlia Sam , S.Srinidhi, V. R. Niveditha , S.Amudha and D. Usha, "Progressed IOT Based Remote Health Monitoring System", International Journal of Control and Automation, Vol. 13, No. 2s, (2020), pp. 268-273

1524