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Heartbeat and Temperature Monitoring System

Abhimanyu Bhosikar[1], Rahul Bhure[2], Prof. S. Nikam[3]
[1]Student, [2]Corresponding Author, [3]Assistant Professor, Department of Electronics and Telecommunication, AISSMS IOIT, Maharashtra, India

***Abstract:** A Major subject of concern in the medical field is to save lives of patient as soon as possible. Improper care, late detection, slow diagnosis and expensive machineries are reasons of most deaths of patients. Saving lives had become challenging work without the help of technology. As a remedy to this we came up with a solution of patient health monitoring system which will keep track of various health components of patient. The system is very portable and can be manufactured at low cost. This system is also capable to monitor oxygen level of body. The device will work on Internet of things technology. This device is implemented using NODE MCU board. And the device will be connected to WiFi, with help of which the data will be sent over to internet over to Blynk cloud platform. With which the data can be monitored from anywhere at any time. And also emergency message alerts will be sent as email over registered email address to get emergency updates with help of Blynk app.*
***Keywords:** Internet of things, NODE MCU, Blynk.*

I. INTRODUCTION

Nowadays where the world is suffering from global pandemic COVID-19, lot of deaths were causes by late detection and underdeveloped technology to detect symptoms of the infection in patients. Thus it is necessary to have affordable and a lot of diagnostic medical equipment to battle with the global pandemic like corona. Keeping track of various patients and their health condition is hard and covid workers and doctors had to work tirelessly without caring for their lives. And traditional methods such as thermometers, oxygen measurement kit and ECG machines are needed in bulk and some are even expensive and unaffordable and also in big and bulky size. And it is also not possible for a covid worker say nurse or doctor to stay 24/7 and monitor heath condition of infected patients. Thus with the help of modern technology such as Internet of things we are able to develop a patients health monitoring system capable to keep track of heart-rate, temperature and also oxygen level of patients, and with the help of internet of things technology we made it an ease to monitor health condition parameter of patient through internet at anywhere and anytime. We are using NODE MCU to interface the device with WiFi to send data over internet.

The objective of this work are:

1) To detect patient's temperature
2) To monitor blood oxygen level
3) To keep track of heart-rate of patient
4) To remotely monitor health condition
5) To send SMS alert when the health condition is critical

The system consists of Cloud computing solution known as blynk where the data will be collected and analyzed.

II. LITERATURE SURVEY

Heartbeat and temperature monitoring system for remote patients-This paper describes the construction and working of the heartbeat and temperature monitoring device, which is based on ATmega382 micro-controller , where the Node MCu also called as ESP 8266 is used. Unlike other systems our device can work in online mode to gather and send the patient data over internet using Internet of things technology. The proposed project idea has sensors such as heartbeat sensor and temperature monitoring sensor of the patient and it will be controlled by micro-controller and the readings of temperature, body oxygen level and pulse will be displayed on OLED screen. The pulse sensor will process the data of patient's heart-rate for specific interval, body oxygen monitoring sensor will monitor oxygen level and as well as temperature sensor will take readings of patient's temperature and will take data and send over to micro-controller, which then will be sent over to receiving end wirelessly, so the receiving end can receive data even at remote locations. And this device can be manufactured in affordable price in market. As we are using ESP8266 as micro-controller, the data will be sent over internet and we also integrated it with Blynk app.

The Blynk app is web based platform and can be accessed from any device having any os like windows, linux, mac even the android app is available at free of cost in google play store.

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As risk of suffering from heart attack and risk of Covid infection is major concern nowadays therefore accurate and affordable health monitoring that people can afford and can seek first aid on time in case doctor is not available. They can check their health conditions and even it can be used on bed ridden patients to keep watch on their health.

The health of bed ridden conditions can be monitored by friends and family and major highlight of this device is that people can access the patient's current as well as past health data from mobile itself. And the device has considerable outcomes compared to other health monitoring devices.

Analysis of Heart Rate and Body Temperature from the Wireless Monitoring System Using Arduino

The Intensive Care Unit (ICU) ward situation tend to be very intense since the patients who are placed in the wards are usually critical condition patients. These patients need an intensive care by the nurses and physician since their condition are not very stable. Therefore, the nurses and physicians need to monitor them very frequent. So, the idea of this monitoring system is mainly to ease the nurses work by reducing monitoring frequency. This monitoring system also purposely built to make them alert about their patient thus, can minimize the risk of patients who are monitored. This monitoring system is using the micro-controller (ESP 8266) which is connected to the laptop via Bluetooth to transfer the data of heart rate and body temperature of the respondent. This data was sense through Heart Rate Grove sensor and DHT11 temperature sensor. The data were processed and displayed on the laptop for every minute continuously. Different colour of OLED was used as an indicator to notify the condition of the respondent's pulse or body temperature either it was in high or low condition as a warning. For young adult with fever respondent, it shows the result of 81 bpm of heart rate and 37.63oC of body temperature with 3.83% and 0.65% of the Mean Absolute Percent Error (MAPE) respectively. This monitoring system has successfully built and able to display the data of the heart rate and body temperature of the respondent for every minute and able to facilitate autonomous monitoring tasks in the future.

This paper shows how the sensors will take the health data from the fingertip with the help of sensors and the sensors take and give data to the central processing unit that is micro-controller which is node MCU also called as ESP8266 which will send data over the internet with its inbuilt WiFi module and with the integration of Blynk app the patient's data can be seen remotely.

The hardware uses the Tensilica Xtensa 32-bit LX106 RISC microprocessor for processing the input optical sensors, output result to OLED, and record data into cloud of Blynk app**.** The software programming is done on Arduino IDE and the algorithm is programmed such a way to manage inputs from sensors and send processed output to wifi as well as OLED display. In the Node MCU processes such as analog input is converted in digital, I2C and data grouping is done

With the development of technology, in this project we can digitally sensing body temperature and heart rate using Node MCU**.** We used ESP8266 because it has potential power to control sensors and has inbuilt wifi module, it is also mainly used in IOT projects such as controlling lights remotely**,** motors, and other actuators. The ESP 8266 is programmed using the Arduino programming language". DHT11 is used for the sense body temperature. As the body temperature is mainly a part of health diagnosis and it is checked at first before any tests, so we used DHT 11 which is contact sensor to take temperature readings, and also we use filters to avoid any king of noise such as ambient temperature MAX30100 was used for sensing heart rate.

Issues in wearable computing for medical monitoring applications: a case study of a wearable ECG monitoring device

In this paper discussion covers problems with wearable computing devices used as health monitoring system. Unlike health computing devices that are used generally for data collection . the device mention gives real time data feedback to the patient as warning during exercise.

These medical applications are designed to the the difference from applications of wearable device for medical personal fro medical staff. The monitoring applications differs from other devices in their I/o components, user interface, privacy. This paper describes high efficiency, great performance, low power device, that can be used by absolutely anyone

Accurate Temperature Measurements for Medical Research Using Body Sensor Networks

Medical trials and measurements are carried of and operated in lab settings which limits the duration and efficacy of such studies. In this project the design of a body sensor network with fully efficient and highly accurate measurement of body parameters over weeks in open environments one of them is monitoring the effects of sleep deprivation on the human body called as circadian rhythm which requires highly accurate measurements of human temperature throughout body over a certain period of time and provide real time feedback to a remote patient.

They keep an eye on need of the body sensor network for these kind of application and highlight the necessity for self organizing to keep a track of energy efficiency, strategies for adaptive communication , automatic compensation for surrounding parameters. Putting the first step towards the goal, the prototype of such invasive wireless monitoring system for accurate body temperature and feedback. The accuracy for this system is 0.02 C over in general body range of 16-42 C. With the two parameters come upfront circadian rhythm of mental activity on skin temperature.

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A Brief Study on the Facts And Figures of Body Temperature Heat is yet another form of energy which is required to properly function different parts of the body. The food that we eat contains a certain amount of heat in the form of carbohydrates and glucose. During the digestion of food heat is released in some sort and is being utilized by our heart and lungs to run with full efficiency even during sleep. Heat is the reason for temperature in our body. Heat cannot be measured but can only be sensed during contact. The temperature is mandatory for the survival. If temperature of the body is increased it causes fever and if temperature does down it causes our body to shiver. The temperature in human body is regulated by a mechanism called hypothalamus. In this paper how body temperature is maintained and regulated is discussed and also the reactions and sudden changes that are caused in the body due to them.

A. Internet Of Things

Internet of things is a new cutting edge technology which deals with sensors, actuators, networks, internet. These sensors actuators and microcontroller are embedded into a single device called as embedded system. When this embedded system is connected to internet and major part of communication between the user and the device is internet then it is called as internet of things or IOT. With the help of some software and couple of lines of code uploaded in the microcontroller this internet of things can serve the purpose of connecting and exchanging data over internet and sometimes with the other devices as well. As huge amount of data can be generated through and storage problems can be occurred here so to overcome this problem the internet of things in collaboration with big data and cloud computing can be used to store and analyze the real time data gathered.

B. Node MCU

The Node MCU aslso known as ESP 8266 is 32 bit processor, with16 bit instructions. It uses Haward architecture where instruction memory and data memory are seperate. The Node MCU has in built Read-only memory (ROM) and has code liubrary and first stage bootloader. All the rest of code is stored in external serial flash memory. Flash memory varies according to diffrent Node MCU

As any other microcontroller the Node MCU as has GPIO pins set ie. General Purpose Inpur Output Pins. We can use these pins to connect and control external sensors.

It has total 17 pins but only 11 can be used. It also has analog pin input.

We can also connect Node MCU with WiFi network and use it for IOT applications and to connect to Web servers



Fig. 1. NODE MCU

C. Blynk App

It is a cloud service provider which can be benificial for cutting edge technology like nternet of things. It is a fully functional software which is required to deploy and remotely manage electronic devices.the sacle for this software is starting from one to thousands of eectronic devices at once. With the blynkk web application analyses the real time datat and can store the same on the cloud server at backend. With the helpof id passoword, the authorized user can login and read data. The datta can be monitoried remotely with the help of webapp from all over the world and can receive important notifications from the same. The software can be monitored on android, ios, windows, linux. The UI is readable and easy to use.



Fig.2.BLYNK CLOUD

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D. DHT 11

The dht 11 sensor is an analog sensor which measures both temperature and humidity of the surrounding. It is a low cost sensor. To measure the surrounding temperature this sensor uses capacitive humidity sensor and a thermistor. The output is in digital form. The sensor is easy to use. The accuracy for this sensor is not precise. The delay for the real time data is 2 sec. There are 2 types of dht11 sensor contact and contactless. The sensor used here is contact dht 11 sensor.

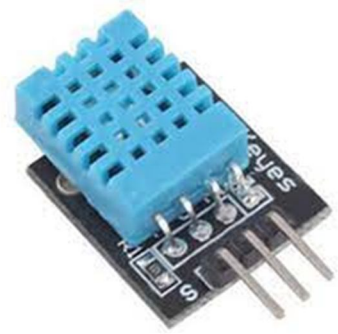


Fig.3.DHT 11

E. Max 30100

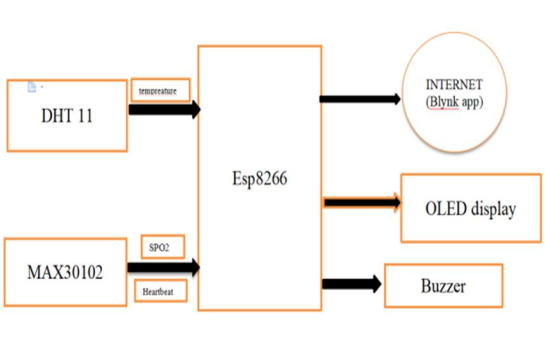
The MAX30100 is acomponent with pule oxymeter and heart reate sensor intehgrated in it. It is combination of two LEDs(IR and red), a photodtector, optics that are optimised adnlow noise analog signal processing for detecting heartrate and oxygen levels. It operates in 1.8V and 3.3V DC power supply. It can aslo be in standby current permitting power suply to remain connected all the time and use power only when sensors are activated. IR LED and Red Led are combined with photodetector to measure puls. Readings can be taken through the finger tips. It uses i2c interface.



Fig.4.MAX30100

III. METHDOLOGY

This device is made for the bed ridden patients at hospital as well as at there respective homes. This device can monitor the real time data of patients pulse rate, temperature, blood oxygen level and real time data can be send over to the internet cloud server BLYNK. Where the patients history can be monitored. With the help of blynk platform real time data can be accessed from anywhere. Also an OLED is attached near bedside of the patient's bedside so that the medical staff can access the data during the visit. Also when the patients heartbeat or oxygen saturation or temperature drops below a certain level or rises above a certain level the buzzer will make sound and with help of blynk app it will send an emergancy signal to the registered email address.



1) *Tracking Health Data:* Capturing health data such as tempreature, heart rate Oxygen level by using thermistor, and MAX30100 sensor. Because these are main things while monitoring health.
2) *Processing The Data:* The data collected by sensors is the sent over to process in NODE MCU. As making analog input into digital output.
3) *Comparing Data:* The data which is processed is compare to the threshold limit. This will tell if the patients's health is normal of it is getting worst.
4) *Sending Over Internet:* The data after processing and comparing is send over internet to the blynk cloud with the help of NODE MCU.
5) *Sending Mail Alert:* E-mail alerts of health getting worst and other emergency alerts will be sent to phone with help of GSM module.

IV. RESULTS AND DISCUSSION

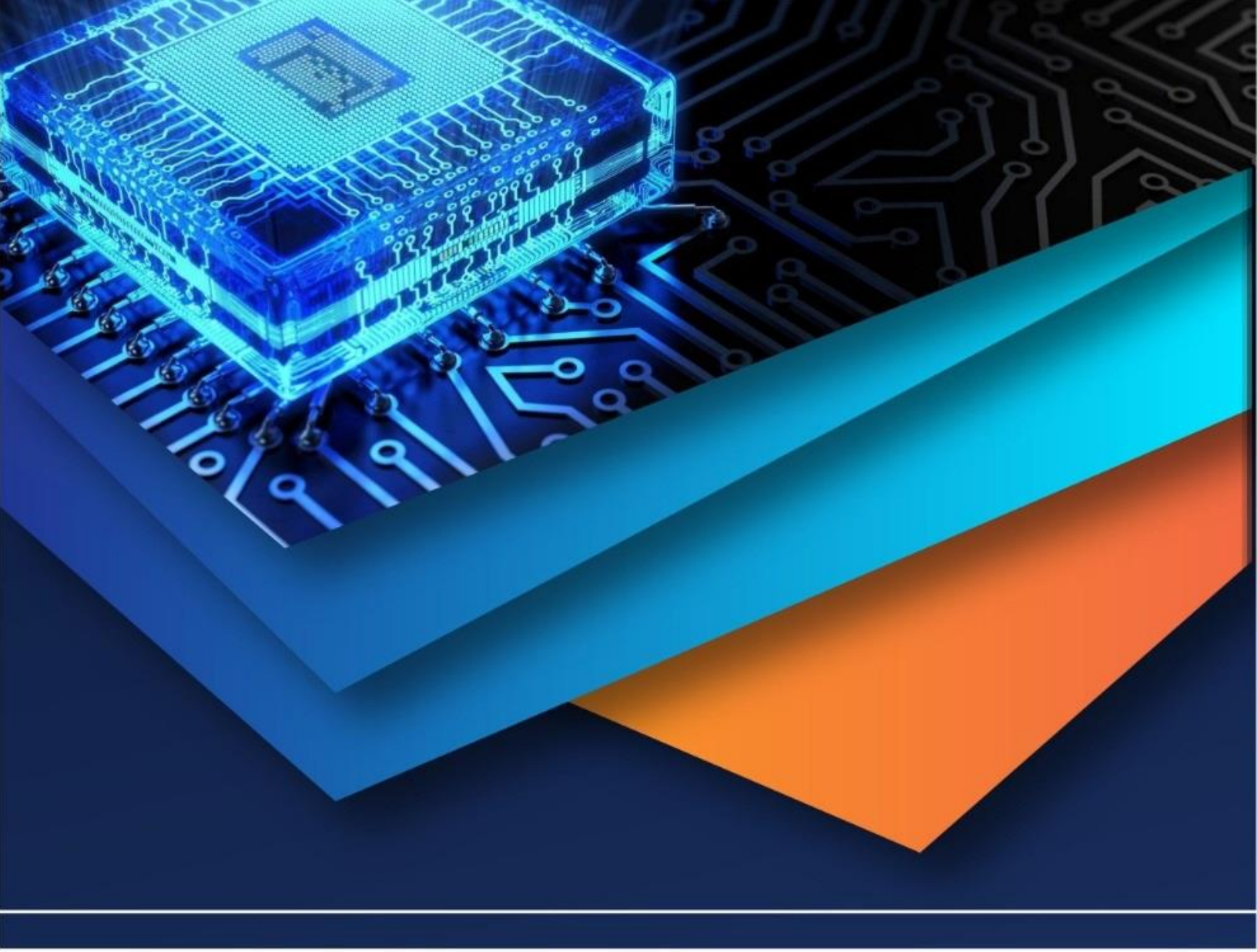
The pruposed design shows the real time data of heart rate of the patient, body temperature , oxygen saturation of the patient, sends the data over internet and also when the heart rate goes below a certain threshold the buzzer make sound as well as send an emergency alert on registered registered email address.

V. CONCLUSION

During these times when a lot of patients die. It has become necessary for the medical staff and patients's family members to keep the record of live data of the patient. With the help of internet of things platform blynk it can be easier to keep track of live data, store the patients history and show at the same time. Also this device will prove to be less bulky and can be made and sold at low cost and will meet easy to use, reliable and portable needs and highly efficient device that can be produced at high rates at low cost.

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