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KOMBOLCHA INSTITUTE OF TECHNOLOGY

SCHOOL OF ELECTRICAL AND COMPUTER

ENGINEERING

COMMUNICATION STREAM

PATIENT HEALTH MONITORING SYSTEM

**Thesis Report to the School of Electrical, Commuter & Biomedical
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for the Degree of Bachlerof Science in Electrical & Computer
Engineering, Communication Stream”**

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DECLARATION

We declare that this project is our original work, on Designing of IOT based patients health monitoring. This project work has not been presented for a project in this or any other universities and all sources of materials that will be used for the project work will be fully acknowledged.

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Abstract

Health is a fundamental element of peoples need for a better life that characterized as a full state of physical, mental and social well-being .But many individuals among us lose theirlives due to heart disease and bad health follow-up .In addition Doctors play a very important role but the process of check-up is quite lengthy and also real-time doctor not able to check the patient health status .To decrease it providing a real-time health monitoring system, to save patients life at acceptable time. The main concept of this project is to create a low cost and can be easily operated by anyone with limited knowledge affordable health monitoring system for people in remote locations. This concept developed a system which gives body temperature and heart rate using LM35 and pulse sensor respectively. Arduino collects real- time health data from a sensor and standard ESP8266 IOT module connects to Arduino via UART is responsible for connecting the machine to the internet and sending health data to the IOT (Thing speak) server for storage and monitoring. Thing Speak is an open-source Internet of Things (IOT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. This IOT device could read the pulse rate and measure the body temperature. It continuously monitors the pulse rate and temperature and will updates them to an IOT platform. The measured values are also displayed in LCD for the patient to see.

Key Words: Health monitoring system, controller, pulse sensor, temperature sensor, Internet of Things.

List of abbreviation

IOT.....	Internet Of Things
ESP8266.....	Wi-Fi Module
LED.....	Light Emitting Diode
LCD.....	Liquid Crystal Display
LM35.....	Temperature Sensor
GND.....	, Ground
GSM	Global System Mobile For Communication
GPS	Global Positioning System
VCC.....	Voltage Supply
API.....	Application Programming Interface

CHAPTER ONE

1.1 Background

Internet of Things (IOT) was first proposed by Kevin Ashton in 1999. It is a communication network in which physical objects are interconnected with each other or with larger systems. This network collects billions of data from the very different devices we use in everyday life and transforms them into usable information. Today, there are about 20 billion devices in the world that interact with each other, and by 2025 it is estimated to go up to 75 billion devices. This shows that in the future cities that we live with IOT will become smart cities that will live with planned life. This transformation will offer us many opportunities to make our life easier. One of these important opportunities is the e-health services that are closely related to all of us.[1]

In the past used for health monitoring is the fixed monitoring system, which can be detected only when the patient is in hospital or in bed. These monitoring devices are only available in the hospitals and are constantly on the patient's body. For many years the standard method for measuring heart rate and temperature value was traditional tests in specialized health facilities. Recently, accessible systems are huge in size and available only in the hospitals in Intensive Care Unit. To monitor these patient's doctors play a very important role but the process of check-up is quite lengthy like first a person need to register then he/she will get the appointment and then later on the check-up reports are generated. Due to this lengthy process working people tend to ignore the checkups.

Unfortunately the global health problem has created a dilemma because of above factors, poor health services, the presence of large gaps between rural and urban areas, physicians, and nurse's unavailability during the hardest time. No happiness can be achieved without health. But at other hand, health related diseases increase time to time.[2]

In developing countries, a large numbers of people have chronic illnesses due to different risk factors like eating habits, inactivity, and alcohol consumption among others. According to World Health organization, 4.9 million people die from lung cancer through snuff use, 2.6 million obese people, 4.4million high cholesterol and 7.1million high blood pressure. Chronic diseases vary greatly in their symptom's evolution and their therapies. If it isn't observed and treated early can end a patient's life . [3]

Heart diseases such as heart attack, coronary heart disease, congestive heart failure, and congenital heart disease are can be causes of death for men and women in many countries. In addition to chronic heart disease, there is a high probability that the patient will lose his or her life as a result of excessive fatigue of the heart during sleep at night, especially in Chronic Obstructive Pulmonary Disease (COPD) and Obstructive Sleep Apnea Syndrome (OSAS). Most of the time, the aged people of the society are more damaged by heart disease. Devices that provide continuous monitoring of these patients are very expensive, sensitive and require trained personnel to use them. [1]

Now a day wireless technology has increasing for the need of upholding various sectors. In these recent years IOT have grabbed the most of industrial area specially automation and control. Biomedical is one of recent trend to provide better health care[4]. Not only in hospitals but also the personal health caring facilities are opened by the IOT technology. This modern approach reduces time consumption in the process.

Medical scientists are trying in the field of innovation and research since many decades to get better health services and happiness in human lives. This contribution towards the society will be very worthy because people can detect the abnormal practice of the body before getting into any serious disease. The person who is worried more about any other loved person can take care and keep the track of his health by sitting in any corner of the world with the help of IOT.[5]

Internet of Things-(IOT) is undoubtedly revolutionizing the health care industry by providing health care solutions with ease and contentment. Before the IOT technology, patient's interactions with doctors were limited to visits and text communications. There was no way doctors or hospitals could monitor a patient's health continuously and make recommendations accordingly. IOT has made remote monitoring in the healthcare sector possible, solve the potential to keep patients safe and healthy, and empowering physicians to deliver superlative care.

On the other hand, the primary goal of IOT is to enhance a cosmology-based response with the ability to track the state of health. One of the important indicators, or important measures of wellbeing in the human body, is heart rate. It counts how many times the heart contracts or beats per minute. Because of continuous work, security threats, and passionate responses, the heartbeat speed changes. The heartbeat state is an irregular rhythm and it is one of the vital signs or the important indicators of health in the human body .(4)

The other important measure of wellbeing in the human body is body temperature. This has to do with the measurement of the body's ability to generate and get rid of heat. Temperature monitoring is one of the chief indicators of the normal functioning of health. The nature of the human body is to keep its temperature within safe range in spite of large variations in temperatures outside the body. Normal human body temperature depends upon the place in the body, from which the measurement is made, and the time and level of activity of the person. Temperature abnormality can be a symptom of so many diseases.[6]

Science and technology are in search to control health related disease. Being electrical engineer, we are also trying to design IOT based patient health monitoring system in order to monitor heart beats of person by using pulse sensor and to monitor the temperature of the body by using LM35 temperature sensor. This project gives temperature and heart rate values using IOT. The data collected by the sensors and sent to the Arduino Uno. The Arduino processes then transmits to cloud through ESP8266 Wi-Fi module.

The patient health monitoring systems is one of the major improvements in the global health care program because of its advanced technology. A patient monitoring system measures the heartbeat and body temperature by using embedded technology. This advancement in technology is highly needed because many sick patients at the hospitals die because of high fever and heart attacks. It has become possible for users to get the necessary physiological information while sitting at home. This system has made life easier for elderly patients. The health monitoring system can prove more beneficial for the people far away from cities and living in villages.

1.2 problem statement

In hospitals patient's status needs to be regularly monitored for the well-being of the people. Monitoring of patients status in hospital is usually done by a physician or other paramedical staff by constantly observing some vital signs such as body temperature and heartbeat. However, this constantly observing of those vital signs is really time consuming and tedious task. In the rural areas of this world due to a lack of proper health centers poor quality of treatment is present. As a result, patients might not get quality treatment or might get treatment after the diseases is changed to a sever stage .And also because of many sick patients at the hospitals die because of high fever and heart attacks. Due to that the Probability that the patient will lose his life increases. Giving care and health assistance to the bedridden patients at critical stage become one of the major problems in the modern world

.Inaddition Because of the absence of doctors, the patient cannot consult the doctors due to which emergency situation may also be created. Remote areas are devoid from hospital, so it is not easy to visit hospitals in big cities due to travelling manpower, and cost issue.

1.3 Objective

1.3.1 General objective

The general objective of this project was to design IOT based health monitoring system using Arduino UNO.

1.3.2 Specific objective

- ❖ To do analysis of collected data of sensor.
- ❖ To implement the stimulated result
- ❖ To interface arduino with ESP8266
- ❖ To make a prototype of the proposed project.
- ❖ To design a system to store the patient data over a period of time using cloud.

1.4 Significance of the thesis

This project has many benefits

- It helps in preventing the spread of disease as well as to get a proper diagnosis of the state of health, even if the doctor is at far distance.
- It used to doctors to monitor the temperature of the patient by reducing the chances of diseases transfer.
- It used to monitor the temperature of patient and heart beat with more accuracy.
- It used to decrease wastage time.
- IOT monitoring proves really helpful when we need to monitor, and keep track of changes in the health parameters of the patient over period time.
- It helps to hospital stays and hospital visits for normal routine checks up are minimized.
- Patient health monitoring parameter data is stored over the cloud.so it is more beneficial than maintaining the records on printed papers kept in the file.
- Providing quick service.

Many people suffer from stroke: and lose their life by lack of immediate medical response.

for stay home patients: this people need constant follow ups, this project has a vital solution for this kind of problems.

In hospitals: where there are lots of patients, the system will make the follow up easier for doctors.

For people who live alone: Elderly's who don't have anyone to take care of them need to be monitored

1.5 Scope and limitations of the thesis

In the future years technology of IoT develop then many other systems develop by referring it. So, as we develop system of health monitoring system using IoT. This paper focuses on a real time pervasive healthcare monitoring system using IoT and cloud computing service which is more beneficial for elders and chronic diseases' patients. In future processor can be change with the compact one latest processor.

According to the availability of sensors or development in biomedical trends more parameters can be sensed and monitored which will drastically improve the efficiency of the wireless monitoring system in the biomedical field. The scope of the project was limited to temperature and heart rate collected data for single patient and we do not use GPS, because it used to find out position and location of the patient.

CHAPTER TWO

2.1 Literature review

P. Vignesh, et .al presented Wireless Sensor Network (WSN) for monitoring patient's physiological conditions continuously using Bluetooth. Here the physiological conditions of the patient are acquired by sensors and the output of these sensors is transmitted via Bluetooth and the same has to be sent to the remote wireless monitor for monitoring the observed patient's physiological signal. The remote wireless monitor is constructed of Bluetooth and Personal Computer (PC). The measured signal has to be sent to the PC, which can be able to monitor. Bluetooth is having a better data transmission rate with less power consumption. The first procedure of the system is that the wireless sensors are used to measure heart rate, temperature and blood pressure from human body using bio sensors. Next procedure of the system is to process the signals using a microcontroller. The final procedure is to transmit the processed signals using Bluetooth and monitoring the signal in a PC.[8]The limitation of this project is he used Bluetooth technology, Because Bluetooth make connection with a small range of area, it is less secure, it has slow connection and it consumes time. In our paper we try to solve these gaps by using Wi-Fi module for wireless data transmission on IOT platform, it is latest version, it is better suited for operating full-scale networks because it enables a faster connection, better range from base station .

M. Babu Prasad ,et .al presented Health care monitoring system nowadays requires instant sensing, precision predictions and of immediate response with medication which contains sensing modules to measure parameters like temperature of body, beat rate of heart, sweat rate and transfer it to the computer so that health condition of a patient can be analyzed remotely. Thus, it reduces the doctor's workload and also gives accurate results. Further this system uses GSM technology which enables the monitoring of all parameters on the mobile phone. The inputs are analyzed through micro controller platform from the patient and any abnormality felt by the patient causes the monitoring system to send a message to the respected caretaker. These are the essential data for the future analysis and review of patient's health condition. This may be added with additional features like monitoring pressure of blood modules, dental screening modules etc. so as to make this a very real time application-oriented device. This will enhance the another stepping stone towards patient care systems.[9]The limitation of this project is he used GSM technology, it is old version, limited rate of data transfer, use SMS, 2G slow connection, price charged by your GSM provider depending on

tariff. Then we try to solve this gap by using latest technology, price usually included unlimited data package, it enables a faster connection.

K. S. Chandragupta and his friends, et.al presented wireless communication devices and systems which have a significant impact on the healthcare industry nowadays. A correct characterization is to handle, analyze the data from the specified sensors fixed in the human body sends it to the microcontroller which transmits the data over the air through Zigbee module and displays it on the LCD screen. At the receiving end, data are received and send to the pc through max232 and these parameters are displayed in the computer by using labview. Thus, Zigbee is used to transmit and receive the data from PIC microcontroller, which connected directly with specified Human body sensors. Both the simulation and experimental results under diverse conditions are presented to clearly describe the process of characterization of our system.[10]The limitation of this project is provides continuous value but it is not able to provide real time values. It uses Zigbee module it is low power , low data rate wireless system and less accessibility. In our paper we try to solve those gaps we can monitor the patient everywhere with internet access and use ESP8266 Wi-Fi module it better for high data rate.

Rahul Patil, et .al presented Health monitoring is an issue for healthcare professionals and patient safety. Bringing accessibility through technological advancement, we developed the IOT based patient monitoring system using Arduino. The sensor measures heart rate along with the SpO2 levels of blood. When monitoring, data is sent to the Arduino device and transmitted to a custom Android app via Bluetooth, syncing data with the IOT platform hosted on Google Firebase, an open-source application that stores and retrieves data over the internet. Information is displayed on a 0.96” OLED screen implemented by an Arduino Sketch which also allows transmission of data to the Bluetooth module. [11]The limitation of this project is he didn't measure temperature, low data rate and it apply on short transmission. But in our paper monitor both temperature and heart beat with faster connection

Purnima, et.al presented Care of critically ill patient, requires spontaneous & accurate decisions so that life-protecting & lifesaving therapy can be properly applied. Statistics reveal that every minute a human is losing his/her life across the globe. In India, everyday many lives are affected by heart attacks and more importantly because the patients did not get timely and proper help. This paper is based on monitoring of patients. We have designed and developed a reliable, energy efficient patient monitoring system. It is able to send parameters of patient in real time. It enables the doctors to monitor patient's health parameters (temp, heartbeat, ECG, position) in

real time. Here the parameters of patient are measured continuously (temp, heartbeat, ECG) and wirelessly transmitted using Zigbee. This project provides a solution for enhancing the reliability and flexibility by improving the performance and power management of the patient monitoring system. In the current proposed system, the patient health is continuously monitored and the acquired data is analyzed at a centralized ARM microcontroller. If a particular patient's health parameter falls below the threshold value, an automated SMS is sent to the pre-configured Doctor's mobile number using a standard GSM module interfaced to the ARM microcontroller. Here, we are using Zigbee for wireless transmission. The Doctor can get a record of a particular patient's information by just accessing the database of the patient on his PC which is continuously updated through Zigbee receiver module.[12]The limitation of this project is it is not designed to support higher data rates, Star network is limited, Replacement with Zigbee compliant appliances can be costly, is not secure like Wi-Fi based secured system. In our project we try to minimize cost and it supports high data rate.

Dogan Ibrahim, et.al presented the design of a simple, low-cost microcontroller-based heart rate measuring device with LCD output. Heart rate of the subject is measured from the finger using optical sensors and the rate is then averaged and displayed on a text-based LCD.[13]The limitation of these project is not use Wi-Fi module to control the patient remotely, it is limited in LCD display. But we designed these projects to monitor patients remotely.

B. Srikanth, et al presented days goes on the lifestyle of the people is also changed. So, they do not have time to take care of their health. Even if they are sick, they go with their own medicine without concerning a doctor which may ends up with some critical situations. IoT is playing a very important role in various fields. It is used in healthcare domain also. This paper describes about the new concept for healthcare using IoT sensors and GSM module. Here the IOT sensors placed in the body of the patient and if any abnormal condition is detected such the temperature, humidity and heartbeat of the patient are the data collected by the sensors. The data collected by these sensors are sent to the microcontroller, where the microcontroller transmits the data to the user in the form of SMS when an abnormal condition occurs. Here GSM module can be used to transmit information to the emergency care and the guardians. Emergency care number and the family people constant numbers are stored in the system. The recordings of the patient's health parameters are received by the caretaker in the form of SMS. If there is any emergency condition based on the information which is collected makes a phone call to the doctor and so the doctor can arrive at the pace. This is very useful technology where the old age people and

physically challenged people can be benefited a lot.[14] The limitation of these project is he used old version GSM technology .We use Wi-Fi module, high data rate.

Neelambike S, et.al presented A mobile monitoring system utilizing short message service with low cost hardware equipment has been developed and implemented to enable transmission of the temperature and HEART BEAT signal of a patient. Communication between a GSM and a mobile phone consultation/server unit is achieved through programming the client using attention commands (at commands), and the protocol description unit (PDU) mode. The experimental setup can be operated for monitoring from anywhere covered by the Cellular (GSM) service by exchanging SMS messages with the remote mobile device. At the consultation unit, a dedicated application software is required to manage the follow of SMS messages from the mobile and display the temperature. [15]The limitation of these project is a short message service, worked in short limited range because of slow data rate and it consumes many time.

khaing Su Waie, et .al presented millions of people in the world are died due to the heart disease because the aging population and the costs for health care are rising .Now a days technologies in the medical electronics and communication have been Heart monitoring system been advancing ,which could support to decrease the cost of health care. Heart rate monitoring system based on Internet of Things by using Arduino UNO and Thing speak is designed in this proposed paper. It is designed to integrate the heart monitoring system controlled by Arduino to the Thing Speak through the ES8266 Wi-Fi module.[16] It has high data rate and use cheap micro controller but the limitation of these project is only measures heart beat .But we measure both temperature and heart rate.

K. Navya, et .al presented physiological conditions of the patient's are monitored by sensors and the output of these sensors is transmitted via Zigbee and the same has to be sent to the remote wireless monitor for acquiring the observed patient's physiological signal. The remote wireless monitor is constructed of Zigbee and Personal Computer (PC). The measured signal has to be sent to the PC, which can be data collection. Although Bluetooth is better than Zigbee for transmission rate, Zigbee has lower power consumption. The first procedure of the system is that the wireless sensors are used to measure Heart rate, temperature and fall monitoring from human body using Zigbee. Next procedure of the system is to measure saline level in bottle using zigbee. The

measured signal is sent to the PC via the RS-232 serial port communication interface..[17] The limitation of this project is less accessibility.

SaiPriya, et.al presented a novel method of measuring the heart rate of premature babies using Zigbee technology. This heart rate monitoring system can be used in hospitals where heart rate has to be monitored continuously over a long period of time. CC2520 offers low power consumption, low cost, high battery life, less interference with other wireless devices and hence is ideal for heart rate monitoring systems. It is capable for remote monitoring and is less expensive than other heart rate monitors available in the market which use Bluetooth technology. The project has overcome major problems like power consumption, flexibility and mobility. In this project, Zigbee aims at upgrading heart monitoring systems such as ECG. The Zigbee wireless network is used to monitor the heart rate of premature babies kept in different locations meters apart. The first stage is to collect the heart pulse and convert it to an acceptable range of the microcontroller (i.e.) conversion of analog input into samples or digitized output to be fed to the microcontroller. How the 8051 microcontroller is used in the computation module forms the second stage. The third stage is the communication module, which is realized through the Zigbee protocol stack to enable the wireless transmission. The low power and highly efficient CC2520 EMK Zigbee module acts as a communication module. Finally, the data collected from the process is to be monitored at the remote location. The limitation of this project is he did not measure temperature, has less network stability.

Jaykaran Singh, et.al presented Statistics reveal that every minute a human is losing his/her life across the globe. More close in India, everyday many lives are affected by heart attacks and more importantly because the patients did not get timely and proper help. There are many emergency response services striving hard to save the lives of people during emergencies, though they are successful at few times. But sometimes they fail to race against time to reach the victim. All over the globe, emergency response service is the need of the hour. India has the highest incidence of heart related diseases in the world and the number of those affected is likely to double in the coming years. If no initiative is taken to check the disease, the most predictable and also preventable among all chronic diseases, India will have 62 million patients with heart disease. So in the future what if due to lack of urgent service we are not able to save the patient? The answer to such a problem is that the patient needs to be “monitored constantly”. Due to which we would be able attend the patient immediately. Therefore by developing a system that can constantly measure the important parameters of

patient's body and which can alert the closed ones and the doctor on any time when the patient's condition gets bad when he is not along with them, this can really provide quick. The limitation of these project is he used zigbee module.

Sugondo Hadiyoso, et.al presented application of IOT as media data transmission for the electrocardiogram (ECG) signal. We developed ECG monitoring system that can be accessed by several users simultaneously via the internet network. The system consists of ECG hardware, transmission module based on Zigbee and web server for data storage and web application. The ECG signal taken from body's patients is acquired by the ECG machine, and then raw data is sent serially to the computer server using Zigbee. Furthermore, the data can be accessed by other authorized parties via the web pages for the purpose of treatment or consultation. By using this application, patients with heart diseases can interact and consult with a cardiologist anytime and anywhere. The testing result shows that the system can handle up to 20 users without errors. Meanwhile for 50–150 user some errors occurred due to insufficient bandwidth or high data traffic on the server.[16]The limitation of this project it is more complex and bulkier, some errors occurred due to insufficient bandwidth or high data traffic on the server, networks are busy because of many users. But our project is easy and simply used by any one and have free network.

CHAPTER THREE

3. Methodology

The IOT-based health monitoring system will develop using Arduino microcontroller which is the brain of the project. Arduino collects real-time health data from a pulse sensor that measures heart rate in minutes or BPM (beats per minute). An Arduino digital temperature sensor measures the patient's body temperature. One temperature sensor is connected to Arduino to measure room temperature so that we can adjust the room temperature according to our health and body temperature. The standard ESP8266 IOT module connects to Arduino via UART is responsible for connecting the machine to the internet and sending health data to the IOT (Thing speak) server for storage and monitoring. This region can not only send patient health data to the server but can also display real-time data on a 16×2 LCD display. This is helpful for health care professionals who actively monitor the patient on site.

3.1. Block diagram

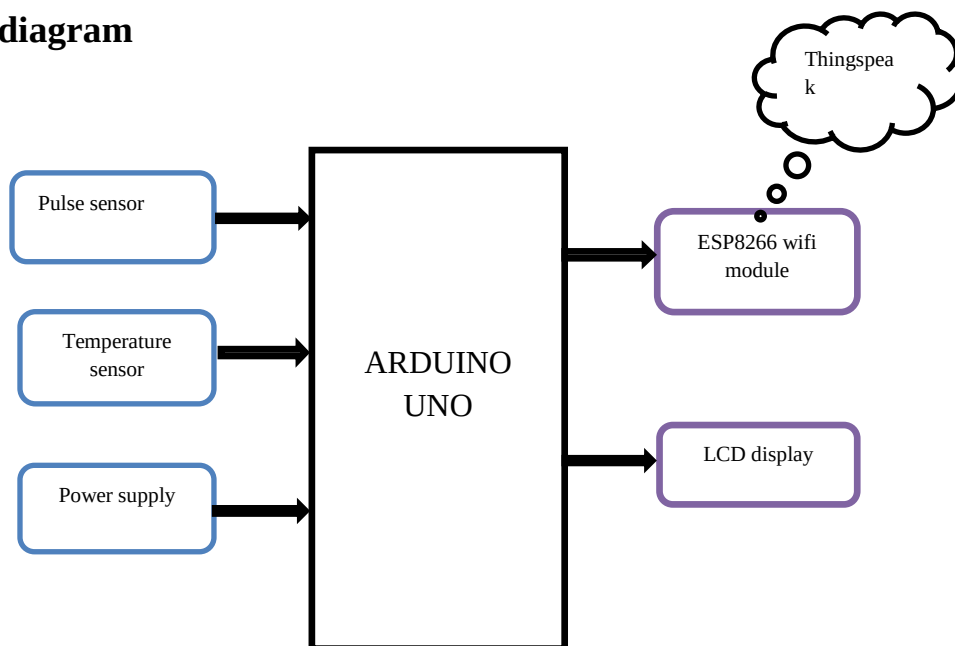


figure 3. 1 Block diagram of the system

3.2. Material requirement

3.2.1 Hardware component and description

There are many parameters that have to be taken into account when designing a .IoT based health monitoring We identify the best option involves choosing technically efficient option.

3.2.1.1 Microcontroller

➤ **Arduino UNO**

Arduino board open source micro controller based on A time328p micro controller. It is one of the most popular development boards used for experimental purposes and serves as an Internet of Things (IoT) link. The board contains other items such as serial connection, crystal oscillator, voltage regulator etc. It contains 2 kB of RAM, 1 kB of ROM, flash memory of 32 kB and can be easily formatted with open source Arduino IDE software. There are many GND pins in Arduino, any of them can be used to ground your circuit. 5V (4) & 3.3V (5): there is one 5V pin provides 5 volts power to Arduino UNO, and the 3.3V pin provides an influence of 3.3 volts. Most straightforward the components used with the Arduino vary jubilantly from five or 3.3 volts. ANALOG (6): subtitle space beneath 'Analog In' label (A0 to A5 in UNO) by Analog In pins ... DIGITAL (7): on the far side the analog pins digital pins (0 to 13 in UNO). This pin is used for each digital input (such as telling once a button is pressed) and digital output (such as semiconductor diode power supply). PWM (8): These anchors act as standard digital pins, however also can be used with one thing referred to as Pulse Width breadth Variation.



figure 3. 2 Arduino UNO[7]

➤ **ESP8266 WIFI module**

The **ESP8266** is a very user-friendly and low-cost device to provide internet connectivity to your projects. The module can work both as an Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making the Internet of Things as easy as possible. It can also fetch data from the internet using API's hence your project could access any information that is available on the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user-friendly.

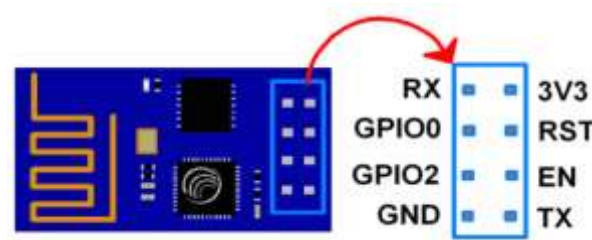


figure 3. 3 ESP8266 (WIFI modulation)[9]

The ESP8266 module works with 3.3V only, anything more than 3.7V would kill the module hence is cautious with your circuits. Here is its pins description.

Pin 1: Ground: Connected to the ground of the circuit

Pin 2: Tx/GPIO – 1: Connected to Rx pin of programmer/C to upload program

Pin 3: GPIO – 2: General purpose Input/output pin

Pin 4 : CH_EN: Chip Enable/Active high

Pin 5: Flash/GPIO – 0: General purpose Input/output pin

Pin 6 : Reset: Resets the module

Pin 7: RX/GPIO – 3: General purpose Input/output pin

Pin 8: Vcc: Connect to +3.3V only

3.2.1.2 Sensor

A sensor is a device that detects and measures a physical quantity from the environment and converts it into an electronic signal. The physical quantity could be heart beat, temperature, motion or any other physical phenomenon. Examples of sensors include: oxygen sensors, temperature sensors, blood pressure sensor , infrared sensors, humidity sensors, level sensors, and motion detection sensors. The output of the sensors is usually current or voltage signal. This project requires pulse rate sensor ,blood pressure and temperature sensor.

➤ **Pulse sensor/ Heartbeat sensor**

Pulse Sensor is a well-designed plug-and-play heart-rate sensor for Arduino. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. It also includes an open-source monitoring app that graphs your pulse in real time.

The front of the sensor is covered with the Heart shape logo. This is the side that makes contact with the skin. On the front you see a small round hole, which is where the LED shines through from the back, and there is also a little square just under the LED. The square is an ambient light sensor, exactly like the one used in cellphones, tablets, and laptops, to adjust the screen brightness in different light conditions. The LED shines light into the fingertip or earlobe, or other capillary tissue, and sensor reads the amount of light that bounces back. That's how it calculates the heart rate. The other side of the sensor is where the rest of the parts are mounted.

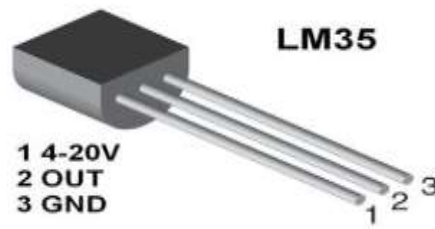


figure 3. 4.1 Pulse sensor /Heartbeat sensor[10]

Before we use this sensor, we need to protect the exposed side of the sensor so that we can get accurate readings and avoid the short circuit due to sweat. For this, you can use Velcro strip or black tape. As shown in the picture.

➤ **Temperature sensor**

The **LM35** series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device



.figure 3. 5LM35[3]

3.2.1.3 Other components

➤ **LCD Display**

LCD is a flat optical display device which uses liquid crystals' light-modulating properties combined with polarizers. Liquid crystals do not directly emit light, but use a backlight or reflector to create color or monochrome images.



figure 3. 6 LCD 16*2 display[16]

➤ **Resistor and variable resistor**

Resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.



(a) 1k

(b) $2k$

(C) variable resistor 10k

figure 3.7 Resistor and variable resistor[4]

➤ Light emitting diode (LED)

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.



figure 3. 8 LED[5]

3.2.2 Software component and description

➤ ArduinoIDE

Arduino IDE is an open source software used to write and upload sketches to Arduino compatible boards. It is cross- platform as it runs on mutiple operating systems [13]. The Arduino IDE is being utilized to upload sketches in the prototype and also to retrieve industrial temperature sensor data through serial monitor.



figure 3. 9 Arduino IDE[9]

➤ Thing Speak

According to its developers, —Thing Speak” is an open source Internet of Things (IOT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates” Thing Speak has integrated support from the numerical computing software MATLAB from MathWorks Allowing Thing Speak users to analyze and visualize uploaded data using Mat lab without requiring the purchase of a Matlab license from Mathworks.



figure 3. 10 ThingSpeak[14]

➤ proteus 8 professional:

Proteus Professional design combines the ISIS (schematic capture) and ARES PCB layout programs to provide a powerful, integrated and easy to use tools suite for education and professional PCB design. As professional PCB design software with integrated shape based auto router, it provides features such as fully featured schematic capture, highly configurable design Designing Of GSM Based Automatic Irrigation System Running By Solar PV 2020 G.C Wollo University KIOT Department Of Electrical & Computer Engineering 21 rules, interactive spice circuit simulator, extensive support for power planes, industry standard CAD/CAM and OD++ output and integrated 3D viewer We use ISIS for simulating Intel response, it has many variety modeling libraries, and its powerful concentrates in MCUs and MPUs modeling, and most PIC's families, also it has a debugger, registers contents viewer and many other features[8].

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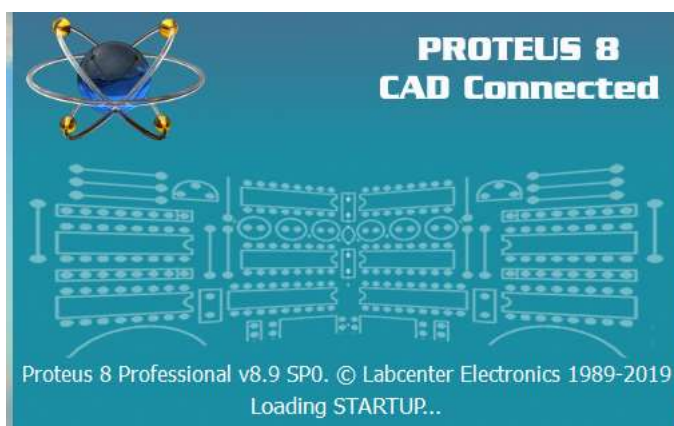
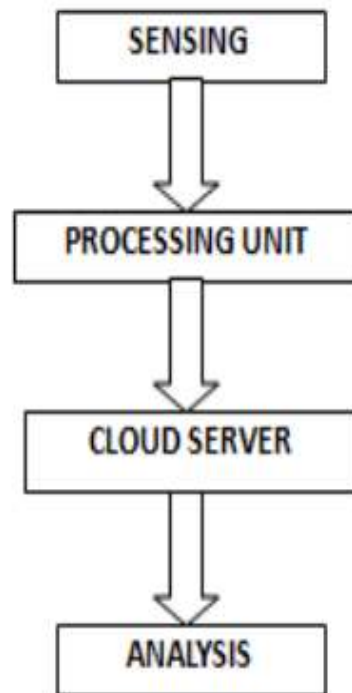
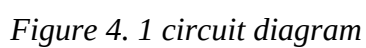


figure 3. 11 Proteus 8 professional[15]

3.3 flow chart



4.1.Circuit Diagram



4.2.List of Components with their specifications

S.r. no	Name of the Component	Roll of component	Quantity
1	Arduino uno	Read the data from the sensors and send data to cloud through esp8266.	1
2	Esp8266 wife module	Connects to internet using Wi-Fi and sends data from Arduino to cloud	1
3	Pulse sensor	Gives a digital output to Arduino when figure is placed on it.	1
4	LM35 temperature sensor	Gives an analog output to Arduino	1
5	2x16 line LCD display	Displays temperature and pulse rate	1
6	Cloud i.e.	Records all the data	1

	thing speak	send from Arduino through Wi-Fi module	
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4.3 Operation of the circuit

Working Steps

1. Start the system
2. The patient would place his/her finger on the sensing unit.
3. Press the push button and measurement begin.
4. The sensors would sense the heartbeat and temperature.
5. The sensed data rates would be sent to Arduino Uno.
6. The Arduino processes the data and sends it to the cloud.
7. At the same time Arduino processes the data and sends it to the LCD to be displayed.

4.4 Sample program

4.5 Simulation Results and their interpretations

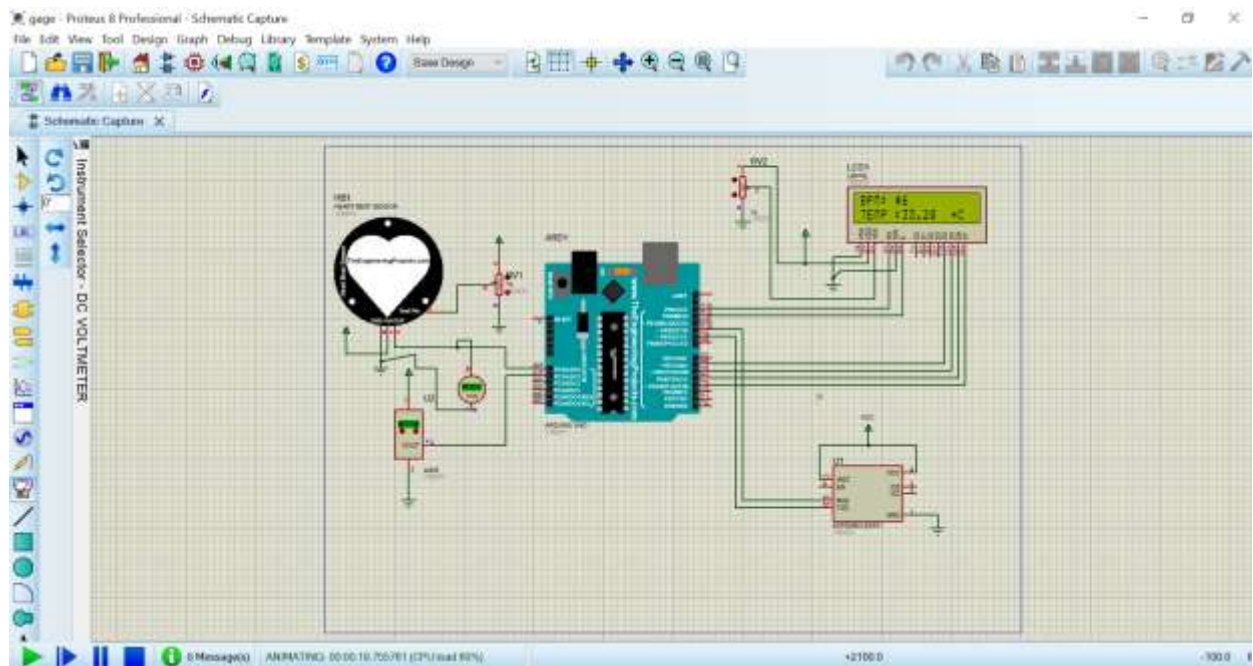


Figure 4. 2 stimulation result

CHAPTER FIVE

Work plan and budget

5.1 Work plan

A work plan is a schedule, chart or graph that summarizes the different components of a research project.

Table 5. 1 Work plan

Activity	July				August				September	
	Weeks				Weeks				Weeks	
	1	2	3	4	1	2	3	4	1	2
Abstract and introduction										
Literature review										
System modeling										
Code learning										
Analysis and interpretation of the result with performance comparison										
Draft report preparation										
Simulation circuit										
Final report preparation										
Improvements &Development										
Proto type										

5.2 Budget

In our project budget is a detailed statement outlining estimated project costs that support a sponsored project. It should include all Direct Costs, as well as the calculated Facilities costs required to carry out or to implement the project.

Table 5. 2 **cost estimation**

Materials	Amount	Individual Cost	Total Cost(in Ethiopia birr)
Arduino UNO	1	1200	1200
LCD display	1	300	300
Pulse sensor	1	450	450
Lm35	1	200	200
Variable resistor 10k	1	100	100
Wifi module (ESP8266)	1	450	450
Resistor 1k and 2k	2	5	10
Jumper wire	25		100
Board	1	200	200
Total			3010

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATION

6.1 Conclusion

This project led to the development of a system which measured heartbeat and temperature of a Patient and send the data to an Arduino UNO microcontroller at a reasonable cost with great effect. It utilized remote patient monitoring system technology which enabled the monitoring of patients outside of clinical settings and leads to increasing access to health care as well as decreasing the health care delivery costs. The project utilized two sensors for measuring heartbeat and temperature of a body. These sensors are controlled by the Arduino microcontroller. For measurement of heartbeat, we used fingertip to measure it accurately The heart beat monitor in our research counts the heart beat rate in beats per minute (BPM) . For the temperature measurement LM35 is used as a temperature sensor which measures the temperature of the body and the measured data is fed to the transmitter module. The calculated temperature and heartbeat will be sent via Wi-Fi module to a remote end where both will be displayed in website called “ThingSpeak.com”. The measured values are also displayed in LCD for the patient to see.

Finally, the data are displayed in the mobile screen or PC at the receiving end where the specialist or physician can analyze the data and will be able to provide aid. In these project we can monitor only one patients in the future we can possible to monitor many patients. Few other parameters like blood pressure and oxygen level can be measured, when create abnormal condition send the message and alarm.

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