EPILEPTICPATIENTCARE

Project report submitted in the partial fulfillment of the requirement for the degree of

BACHELOROFTECHNOLOGY IN ELECTRONICSANDCOMMUNICATIONENGINEERING

by

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UNDER THE GUIDANCE OF
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May,2020

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DECLARATION

I hereby declare that the work reported in the B-Tech thesis entitled **"EPILEPTIC PATIENT CARE"** presented at **Jaypee University of Information Technology, Waknaghat,** is an authentic record of our work carried out under the supervision of **Dr. Rajiv Kumar**. We have not submitted this work elsewhere for any other degree or diploma.

Suresh Arora

161047

This is to certify that the above statements made by the candidate is correct to the best of my knowledge.

Name of Supervisor:

Signature of Supervisor:

Date:

ACKNOWLEDGEMENT

The fulfillment and rapture that go with the finishing of the task would be deficient without the notice of the individuals who made it conceivable.

I might want to accept the open door to thank and communicate our profound feeling of appreciation to our personnel guide, **Dr. Rajiv Kumar,** for giving his important direction at all phases of the examination, his recommendation, productive proposals, positive and steady disposition and consistent consolation, without which it would have not been conceivable to finish the task.

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Date: 15th May, 2020.

LISTOFACRONYMSANDABBREVATIONS

1. IOT — Internet Of Things
2. PWE — Person With Epilepsy
3. HD — High Definition
4. ARM — Advance RISC Machine
5. USB — Universal Serial Bus
6. RAM — Random Access Memory
7. CPU — Central Processing Unit
8. GPU — Graphics Processing Unit
9. GPIO — General Purpose Input Output
10. UART — Universal Asynchronous Receiver/Transmitter
11. SD — Secured Digital
12. OS — Operating System

LISTOFFIGURES

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ABSTRACT

Inside the ongoing years, utilization of remote innovation is expanding for the need of maintaining different divisions, in these ongoing years IoT grabbed the vast majority of business space, particularly robotization and control. Biomedical is one in everything about patterns to deliver better human services. Not exclusively in clinics yet in addition the individual social insurance offices are opened by the IoT innovation, along these lines having a framework like this can be essential with the goal that we tend to devour force, cost and increment strength. It is easier to monitor and control things, devices and instruments from far away/ remote locations because of the development in Internet of Things (IoT). Mointoring and recording various medical of any patient outside hospitals has become more developed. The database containing data about patients would then be able to be handily gotten to by specialists, clinical staff, doctors, drug specialists, authority and so on. This data can further be analyzed to track the improvement of the patient's health, the effect of a particular medicine on the patient, and even predict the time it will take to get completely cured.

In this study i have put our focus to aid the patients suffering from Epilepsy, which is a brain disorder and one the major symptom of which is Seizures. It will help us to monitor the body temperature, state of body while on bed and also provide live video feed of the patient while on bed. We intend for deisgn a mat and observing the patitent's body at any time using piezoelectric sensors.

This project is for patients who have Epilepsy and can suffer from seizures anytime. It can also benefit the senior citizens in our home. This project proves extremely helpful when members of the family need to go out for some emergency. Disable patients who find it tough to go to doctors on daily basis or for those patients who need uninterrupted monitoring from the doctor can also be benefited from this project.

CHAPTER1

INTRODUCTION

1.1 Motivation

Epilepsy or ordinarily known as seizure issue, is an interminable issue of the mind that is described by constant unmotivated seizures. Seizures are caused because of anomalous nerve

cell action. It has neurobiological, mental, psychological, and social results. The epileptic seizures cause a short unsettling influence of engine, tangible, or mental work and may cause diverse medical problems. Epilepsy is one of the first regular neurological issue, and influences people all things considered. Out of the 50 million people with epilepsy around the world, 80% live in creating nations. The dearth of information of anti-epileptic medicines, poverty, cultural beliefs, stigma, poor health infrastructure, and shortage of trained professionals contribute to the treatment gap. Epilepsy is kind of a huge drawback in India. Individuals experiencing epilepsy are named as PWE or Persons with Epilepsy. While 60% of individuals in urban India counsel a specialist once enduring a seizure, just 10% in rustic India would do as such. A significant downside with this is that it can have an affect on PWE at any and all points of time, even when the folks are suffering from some other disease or downside or even meeting an accident and being admitted to the Hospital. This adds on to the spectrum of issues it will cause if any patient also has Epilepsy and he is left unmonitored. Hence, in this study we have place our focus to assist patients suffering from epilepsy by monitoring their Body Temperature, Pulse rate, Body state, occurrence of seizures.

By making this project we are able to scale back the number of deaths and control the situation of any patient and prevent it from worsening at the initial stage itself.

1.2 Objective

With the help of this project we aim to reduce the number causalities occurring due to epilepsy by controlling and monitoring the overall condition of the patient. The system would send an alert message to the family members of the patient in case of a seizure attack to the patient or even in case the patient feels uneasy due to rise or fall in body temperature. It can also notify the family in case of any abnormal and unusual readings of the ECG sensor. This system can not provide any assistant to the patient as in the case of epilepsy or any disorder, there can be multiple reasons for any particular symptoms, but the main objective is to keep a check on the condition of the patient 24X7 even when there is no one to directly assist the patient. The readings of the Heart Rate sensor and the Body Temperature can be seen from anywhere in the world using the technology of IoT. One can even see the Live Video Feed of the Patient in the Hospital or at Home. This way the patient can be provided with a treatment as soon as there is some deviation from the normal condition without losing the time in noticing it for the first time with the naked eye. This would undoubtedly prove helpful and effective in taking care of

not only PWE but also senior citizens at our home who are suffering from any disease which requires complete bed rest.

1.3 Architecture

The main component to make the Patient Monitoring System is a Raspberry Pi, which is an ARM based micro-controller. It is a sort of a mini computer which can run a LINUX based OS. The entire project has been coded on Python is an open source programming language. We have used the Flask framework to make a Graphical User Interface (GUI) to display the sensor readings and the camera feed to the end user. It can be locally or globally hosted as per the requirement of the user. We are be using a web cam to stream the live video of the patient. This video can be used to implement posture and face expression detection using ML and therefore, trigger an alarm if it detects that the patient is feeling uneasy or is not in the correct posture. We are using LM35 to measure the body temperature of the patient, Heart Beat sensor to read the pulse rate and the ECG sensor to plot a Graph of the ECG readings. We are using an array of Piezoelectric sensors to detect the posture of the patient and detect any occurrence of a seizure attack by recording any abrupt changes in the values of the array. All these sensors are connected to the Raspberry Pi using the GPIO Pins present on it and the coding has been done using Python again. The values are then collected and sent to the Flask Server using Socket communication and displayed on the GUI. This webpage is regularly refreshed automatically to update the values regularly and also live stream the video. These values are also collected and stored in a SQL Database for further lookup and analysis to be done. This analysis can be used to predict the recovery time of the patient or monitor the effect of a certain medicine.
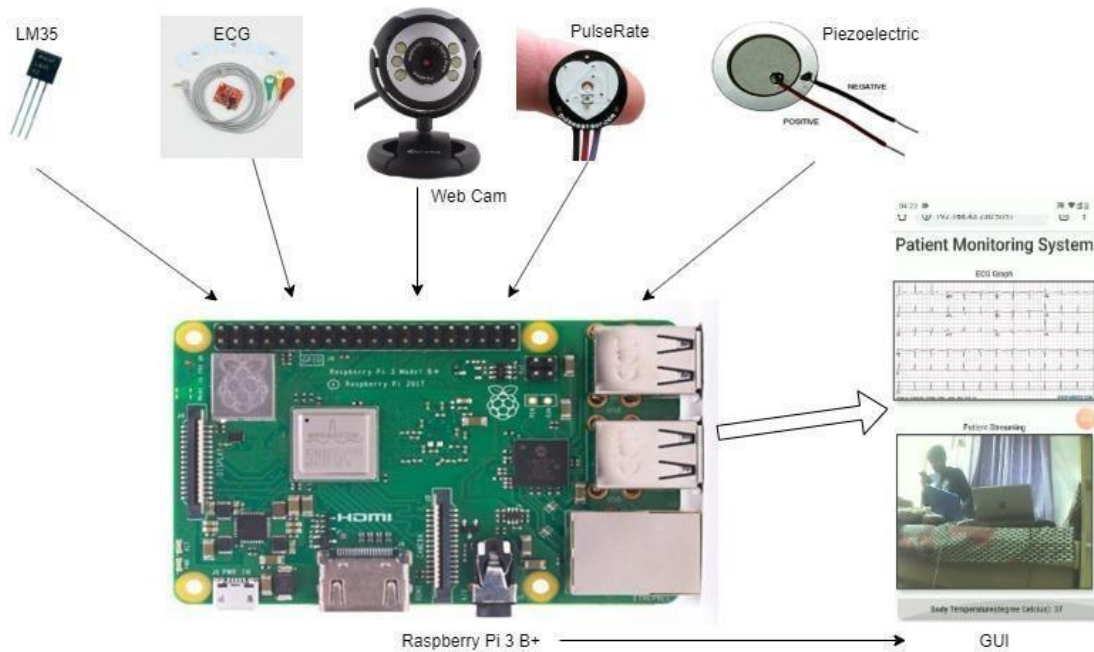
Fig 1.1: Architecture

1.4 Literature Review

☐ **M.Sathya, S.Madhan, K.Jayanth (February 2012) Internet of things (IoT) based health monitoring system and challenges**

Among the applications that Internet of Things (IoT) facilitated to the world, Healthcare applications are most important. In general, IoT has been widely used to interconnect the advanced medical resources and to offer smart and effective healthcare services to the people. The advanced sensors can be either worn or be embedded into the body of the patients, so as to continuously monitor their health. The information collected in such manner, can be analzed, aggregated and mined to do the early prediction of diseases. The processing algorithms assist the physicians for the personalization of treatment and it helps to make the health care economical, at the same time, with improved outcomes. Also, in this paper, we highlight the challenges in the implementation of IoT health monitoring system in real world.

☐ **Justin Turner, Chase Zellner, Tareq Khan, and Kumar Yelamarthi (May 2017) A Smartphone based Continuous Heart Rate Monitoring System**

Health observation is a necessary need of everyday life for several individuals. During this study, the planning of a heart rate monitor with Bluetooth property is mentioned. The AD8232 Single Lead, Heart Rate Monitor is that the centerpiece of the planning. The information is wirelessly transferred to smartphone using Bluetooth.

• **Syed Muhammad Waqas Shah, Maruf Pasha,(October 2016) Iot – Based Smart Health Unit.** The paper aims at evaluating the varied IoT based health care system and their applications to supply intelligent health care. A wise health unit model has been projected during which the country's basic health system are changed into smart health aid system. The projected model presents a superimposed approach, which has sensing elements, network access and service repair layer that build the good communication potential with doctor and patients.

• **Amna Abdullah, Asma Ismael, Aisha Rashid, Ali Abou-ElNour, and Mohammed Tarique, (May 2015) Real Time Wireless Health Monitoring Application Using Mobile Devices.** The prime motive is to develop a reliable patient observation system in order that the aid professionals will monitor their patients, who are either at hospital or having their normal daily life activities. During this work we tend to present a mobile device based wireless aid observing system which will offer real time data about physiological conditions of a patient.

☐ **Yifei Jin, Syed Ayaz Naeem, Holly Shumway (March 2019) Fall Detection and Posture Monitoring System**. The Ihealth Icare Ifield Ican Igreatly Ibenefit Ifrom Ithe Iinclusion Iof Iinnovative Ismart Idevices. ITwo Icommon Ihealth Iconcerns Iaddressed Iin Ithe Iindustry Iare Iinjuries Idue Ito Ifalls Iand Iimproper Iposture. IThis Iproject Iaimed Iat Idesigning Ia Idevice Ito Iprevent Ithe Ioccurrence Iof Ithese Iproblems Iby Imonitoring Ia Iuser's Iwalking Iand Iposture Ibehaviors. IThe Iintent Iwas Ito Ialert Ithe Iuser Ior Ia Inearby Icaregiver Iif Ia Ifall Ior Iabnormal Iposture

were detected. The device integrated sensors along with Bluetooth communication to successfully achieve this task.

 Youngsu Cha, Kihyuk Nam, and Doik Kim (March 2017) Patient Posture Monitoring System Based on Flexible Sensors. Monitoring patients using vision cameras can cause privacy intrusion problems. In this paper, we propose a patient position monitoring system based on a patient cloth with unobtrusive sensors. We use flexible sensors based on polyvinylidene fluoride, which is a flexible piezoelectric material. The flexible sensors are inserted into parts close to the knee and hip of the loose patient cloth. We measure electrical signals from the sensors caused by the piezoelectric effect when the knee and hip in the cloth are bent. The measured sensor outputs are transferred to a computer via Bluetooth. We use a custom-made program to detect the position of the patient through a rule-based algorithm and the sensor outputs. The detectable postures are based on six human motions in and around a bed. The proposed system can detect the patient positions with a success rate over 88 percent for three patients

CHAPTER2

HARDWARESPECIFICATIONS

2.1 Raspberry Pi

A SBC is a finished PC where a solitary circuit board contains memory, input/yield, a microchip, and all other vital highlights. Be that as it may, rather than a PC, it doesn't depend on developments for different capacities. A solitary board PC lessens the framework's general expense on the grounds that the quantity of circuit sheets, connectors, and driver circuits is totally diminished. Single-board PCs are structured uniquely in contrast to a standard work area or PCs, as they're absolutely independent. They ordinarily utilize a wide scope of chip and have overstated thickness for the coordinated circuits utilized.

With that proviso out of the way, one of the most famous of all SBCs, the Raspberry Pi.

Figure 2.1: Raspberry pi

The Rasberry Pi is a solitary PC broad with charge card size, that can be utliized for two or three undertakings that my personal computer does, similar to games, information arranging, spredshets, and furthermore to play YD accounts. It had been created by the Raspberry pi establishment from the United Kingdom. It's been set up for open use since 2012 with making a reasonable edifying microcomputer for understudies and youngsters. The rule motivation driving planning the raspberry pi board is, to invigorate learnig, experimentati, and improvement for varsity level understudies. The rasberry pi board is a preservationist and unimportant effort gadget. The majority of the raspberry pi PCs are utilized in PDAs. In the 21st century, the improvement of helpful getting

ready advncemnts is inconceivably high, an epic portion of this being driver by adaptable undertakings. Ninety-eight percent of the cell phones use ARM advancement.

2.1.1 Raspberry pi Technology

The rasberry pi comes in for models, they're design An and design Bn. The standard division between model An and model B is USB port. Model A block eats less force and doesn't have an Ethernet port. Regardless, the design Bn board has an connectivity holes and composed in China. They continue improving the showcase, benefit and developing the extent of cutoff points with each progressing toward variety. The raspberry pi goes with a party of open-source movements, for example correspdence and sight and sound web drives. In 2014, the foundation of the raspbery pi board pushed the pc module, which packages a model B rasberry pi board into the modulee to be utilized as a bit of introduced large, to enable their use.

2.1.2 Raspberry pi Hardware Specifications

The rasberry pi board combines a program memory (RAM), proocessor, and diagrams chip, CPU, APU, UART, connection holes, APIO pins, power offer coonnector, and swayed various interfaces for outer contraptions. It moreover uses mass storing, for that we have to use a pluck streak pluck boards. With the objective or the raspberry pi board will boost and this pluck card comparably as a PC boots up into windows from its heat plate.

Key important points and interest of the rasberry pi chip in the standard involve SD card having Linux working structure, screen, power nimbly, US reassure, and video interface. Discretionary equipment decisions are controlled USB center point, USB mouse, web organize, the design An or design B: UWB Wi-Fi connections and a main and a internet portability with design B is WLA association or Wi-Fi Adapter.
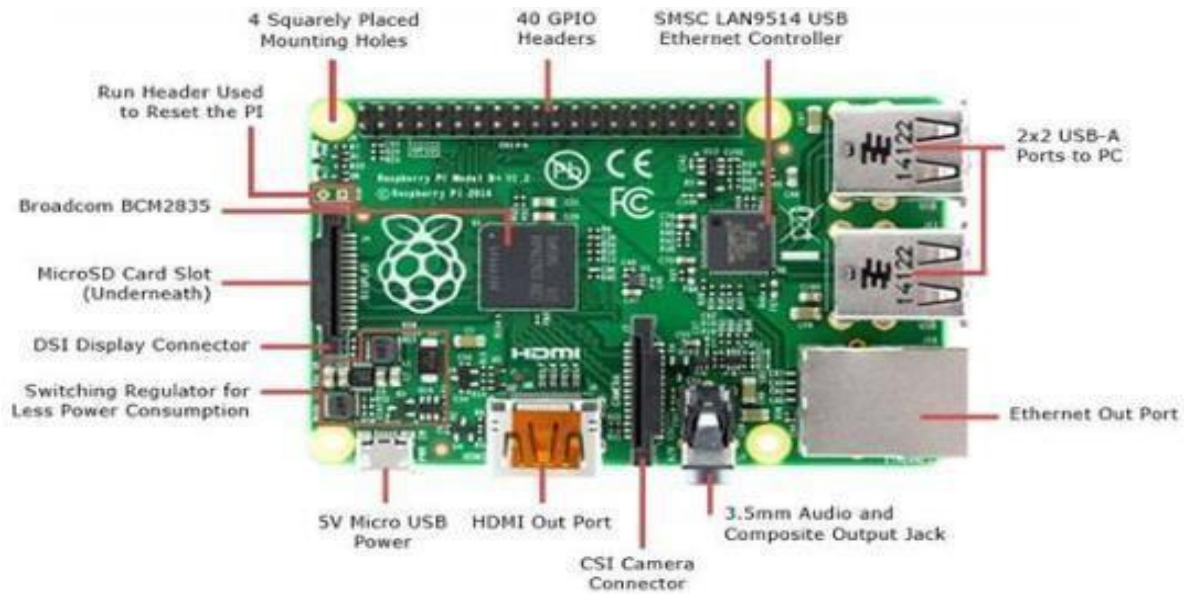
Figure 2.2: Raspberry pi Hardware Specifications

2.1.3.1 Memory

The rasberry pi model An with proposed with 128 MB of AGTRE and design Bn is gathered with 512MB. Raspberry pi is a very size PC as separated and different PCs. The tandard PCs RAM memory is down to earth in gigabtes. Regardless, in the raspberry pi board, the RAM store is possible more than 116MB or 612MB.

2.1.3.2 CPU

At rasberry pi board has a brain called central processing unit which is responsible for taking the instructions of the computer with the help of logical and mathematical operations. The raspberry pi uses ARM11 series processor, that has joined the ranks of the Samsung galaxy phone.

2.1.3.3 GPU

The GPU is a particularized chip in the raspberry pi design which as proposed to quicken the action of picture checks. This design is arranged and a Broadcomm movie-focus V and it reinforces OpenAL

2.1.3.4 Ethernet Port

The main gateway of raspberry pi is the Ethernet port which is used for communicating with external devices. This port is used to access the internet by plugging it with your home router .

2.1.3.5 APIO Pins

The original and important work in-out leads are vary to connect the raspberry pi with the other electronc boards. These pins can accept input as well as output commands based on the humming of rasberry pi. The rasberry pi bears analog APIO leads. The leads can engage the raspberry pi with other different electronic components. For example, for transmitting digital data.

2.1.3.6 Destination Connector

The destination connector is a little button type connector, and this is there on the board. The essential limit of this condenser is to interface with an outer power source.

2.1.3.7 YART

The Univesal synchronous Receiving/Transmitting is a back to back information yield port. This port is utilized to transmit the information successively in the substance structure and it is imperative for changing over the inspecting code.

2.1.3.8 Display

The raspberry pi board can be associated in two different ways. These are HDMI and Composite. A large number of the LCD screens, TFT can be associated utilizing a HDMI male link and with a connector. There are two reinforced variations of HDMI interface is proposed. The L/Ps of the Rasberry Pi video large sound is through HNDI anyway doesn't reinforce HDNI I/p. Earlier TVs can be related using composite maths. While using a cognitional video affiliation, the sound is enabled from the 4.0mm hole connection and may be moved to your watching box. To send sound to your TV, you need a connection that can change from 3.5mm to twofold RCA connectors.

2.2 LM35
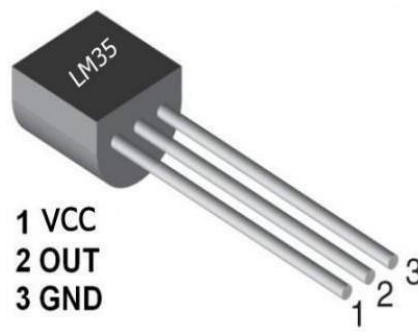
Figure 2.3: LM35 IC

Temperature is one of the most usually estimated parameters on the planet. it is utilized in our day by day family unit gadgets from microwaves, ice chests, climate control systems to all fields of building. temperature sensor fundamentally quantifies the hotness or briskness created through an article to which the sensor it's associated and further gives a corresponding obstruction, current or voltage yield, contingent upon particle what kind of temperature sensor is utilized, which is then estimated or handled according to our application.

Temperature sensor are basically classified into two types

● **Non-Contact Temperature Sensors**: These type of temperature sensors use convection & radiation for monitoring temperature.

● **Contact Temperature Sensors:** Contact temperature sensors are further sub divided into three type:

1. Electro-Mechanical (Thermocouples).
2. Resistive Resistance Temperature Detectors (RTD).
3. Semiconductor based. (LM35, DS1820 etc).

2.2.1 LM35 Temperature Sensor

LM35 is a coordinated simple temperature sensor having an electrical yield that is corresponding to Degree Centigrade. LM35 Sensor indeed brother with any inner adjustment to give precise outcomes. The LM35's small field amplitude, a direct yield, and exact inborn accommodation will readout interlacing and control hardware particularly simple. It is one of the ordinarily utilized gadgets to gauge Temperature in businesses because of its significant level of precision and simplicity of use.

2.2.2 LM35 Sensor Calibration

The main advantage of LM35 is that it is linear i.e. 10mv/°C that means for every degree increase in temperature, the output of LM35 will rise by 10mv. So, if the output of LM35 is 220mv/0.22V, then the temperature measured will be 22°C. So, if the temperature of the room is 32°C, then the output of LM35 will be 320mv i.e. 0.32V.

2.2.3 LM35 Interfacing Circuit

As the yield of LM35 is direct with 10mv/degree scale, no additional parts are required to interface LM35 to ADC. It very well may be straightforwardly interfaced with any i10-or i12bit ADC. be that as it may, on the off chance that you utilize an i8-bit ADC like iADC0808 or iADC0804, a speaker area will be required on the off chance that you have to gauge i1°C change. iLM35 can likewise be associated with Arduino legitimately. the yield of iLM35 temperature can likewise be surrendered to a comparator circuit and can be utilized for huge temperature sign or with the assistance of straightforward transfer we can utilize it as a temperature controller.
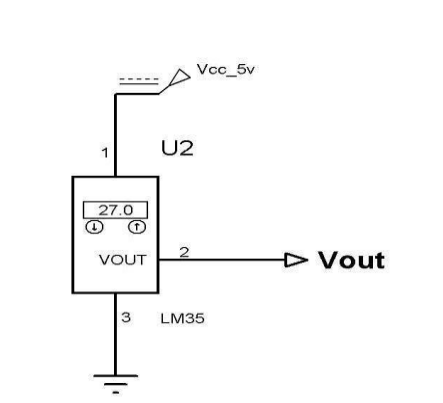
Figure 2.4: LM35 interfacing circuit

2.2.4 LM35 Working

The LM35 involves two transistors within. One transistor has on different occasions the maker region than the other. That infers it has one eight of the current thickness since the current is comparable through the two transistors. This prompts a voltage over the resistor R1 which is comparing to the all-out temperature and is for all intents and purposes direct over the range that we need. The immediate part is managed by an uncommon circuit that fixes the somewhat twisted graph of voltage versus temperature. The intensifier at the top guarantees that the voltage in the base side of the left transistor (Q1) is relating to the through and through temperature (PTAT) by separating the yield of the two transistors. The speaker at the benefit transistor(Q2), changes over all out temperature (in Kelvin) into either Celsius or Fahrenheit, dependent upon the part (LM34 or LM35). The little drift with the "I" in this, is a predictable current source circuit. The two resistors are separate in the plant to create an outstandingly definite temperature sensor. The fused circuit has countless transistors in it two in the inside, some in enhancers, some in the consistent current source, and some in the shape pay circuit. The entirety of the transistors fit into a little group with three leads.

Figure 2.5: LM35 internal circuit
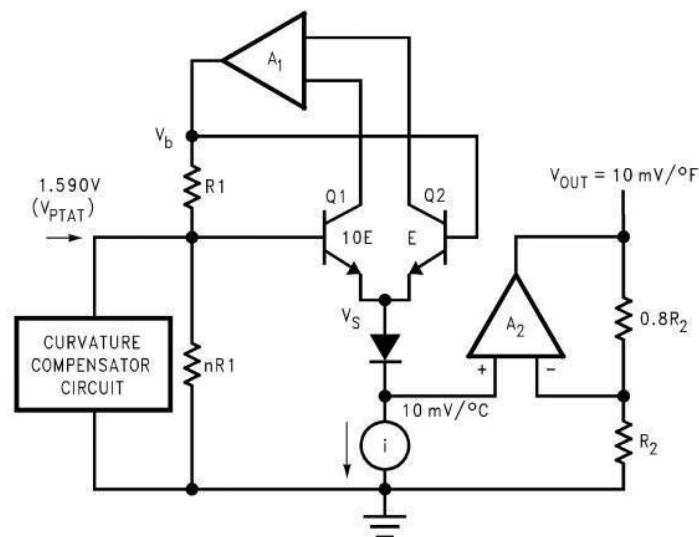
Name	Temperature in °C	Temperature in °F
Hypothermia	<35.0°C	95°F
Normal	36.5-37.5°C	97.7-99.5°F
Fever	>37.5 or 38.3°C	99.5-100.9°F
Hyperpyrexia	>40.0 or 41.5°C	104-106.7°F

Table 2.1: Body Temperature Chart

2.3 Heart Beat Sensor

Figure 2.6: Heart Rate Sensor

2.3.1 Heartbeat Measurement

A son's heatbat is the voice of the structure in a person weight contractor or relaxing, because they push red blood cells with a one part of our body to another. The pump beat rate is the member of returns the gains beats per minute (GPM), and the boats of the pump that is felt in any artery or vein that appears close to the surface is the impulse. There are two methods to Measure a Heartbeat

● **Manually:** This system should be conceivable by truly checking one's pulses at two territories: the first is the wrist (the winding heartbeat) and the ensuing one is the neck (carotid

heartbeat). The procedure is to put the record and focus finger on the wrist (or neck underneath the windpipe) and a short time later counts the quantity of pulses for around 30 seconds and thereafter expanding the got beat member by x to obtain the heartbeat ratio. Regardless, least weight shoulder be applicable, and besides body there be gone to a great extent until the beat is felt.

● **Using a sensor:** Heart Beat can in like be evaluated with the help of optial powerful assortment as the delivery is dispersed or consumed on its way by the blood as the blood beat moves.

2.3.2 Principle of Heartbeat Sensor

The blood beat sensor takes a shot at the guideline of photo plethysmography(an instrument utilized for change in volume inside an organ). It checks the alteration in the volume of blood on any organ of the body which causes the light power to be changed through that organ (avascular district). In specific applications where the heartbeat rate is to be viewed, the more huge thing is the arranging of the thumps. The progression of blood volume is guaranteed by the pace of heart beats and on the grounds that the light is consumed by the blood , the sign heart beats are practically equivalent to the heart beats.

Two types of photo plethysmography:

● **Transmission:** Light that is emitted from the light emitting device , is transferred through any vascular region of the body such as earlobe and then it is received by the detector.

● **Reflection:** Light that is emitted from the light emitting device is reflected by the regions under the blood vessels.
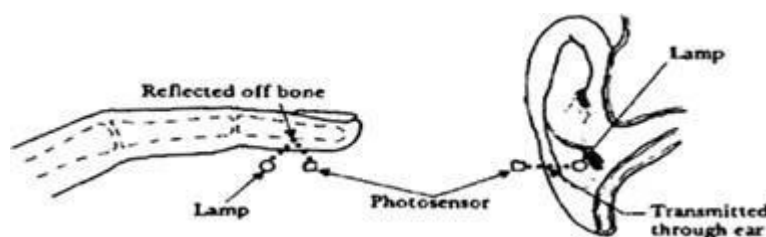

Figure 2.7: Heartbeat Sensor Principle

2.3.3 Heartbeat Sensor's working

The conventional heartbeat sensor includes a light-radiating diode and a pointer same as a light-perceiving resistor or a photodiode. The heartbeat thumps have any sort of impact and the movement of blood to difficult bits of the weight. Right when issue is light up with the weight giver, for instance light released by the drove, it looks reflects (a body tissue) or emits the light (ear ligament) the light. This prompts a bit of the light is devoured by the blood and the remaining transmitted or the reflected light is gotten by the light discoverer. The proportion of light that is ingested depends upon the volume of the blood in that tissue. The got yield is as an electrical sign and is comparative with the heartbeat rate. The common heartbeat sensor includes a light-radiating diode and a pointer same as a light-perceiving resistor or a photodiode. The heartbeat thumps have any sort of impact behind the movement of red cells to twitch bits of the person. Right when issue is light up with the weight giver, for instance weight released by the drove, it almost reflection (a body tissue) or emits the weight (ear ligament) the weight. This prompts a bit of the weight is devoured by the red cells and the remaining emitted or the allocated weight is gotten by the weight discoverer. The proportion of weight that is ingested managing upon the beats of the blood in that issue. The got yield is as an electrical sign and is comparative with the heartbeat rate. To accomplish the task of having the AC signal, the perceived yield is only isolated using a two-stage AP-GP circuit and is where changed to mechanized beats with a circulatory circuit or using customary AHC. The mechanized beats are then sent to a little scope controller for enlisting the glow blood rate, having by this formula1.

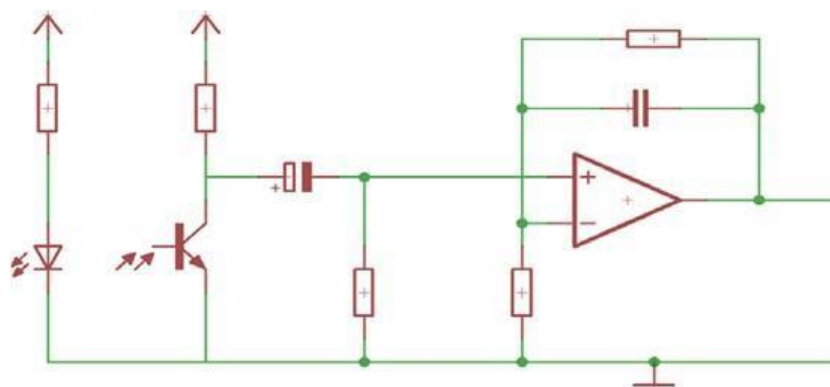RPM(Rates per minute) = 60**f ,where f is the fequency of the pulse.

Figure 2.8: HP LP Circuit

Age	18-25	26-35	36-45	46-55	56-65	65+
Athlete	49-55	49-54	50-56	50-57	51-56	50-55
Excellent	56-61	55-61	57-62	58-63	57-61	56-61
Good	62-65	62-65	63-66	64-67	62-67	62-65
Above Avg.	66-69	66-70	67-70	68-71	68-71	66-69
Average	70-73	71-74	71-75	72-76	72-75	70-73
Below Avg.	74-81	75-81	76-82	77-83	76-81	74-79
Poor	82+	82+	83+	84+	82+	80+

Table 2.2: Pulse Rate in BPM

2.4 Piezoelectric Sensor

2.4.1 Piezoelectric Sensor

A piezoelectric sensor, is a device that works on the piezoelectric effect that is used to measure change in pressure, strain or force, acceleration, temperature,

by transforming these changes into an electrical charge. The ability that a piezoelectric material converts a mechanical change into electrical charge is called piezoelectric effect. The produced piezoelectricity is proportional to the pressure that is applied on the solid piezoelectric crystal materials. It is also known as a piezoelectric transducer,.

There are two main sensing materials that are used in piezoelectric sensors are piezoelectric ceramics (PZT ceramic) and single-crystal materials (quartz). The sensitivity of natural singlecrystal materials is less than the ceramic materials, but the high sensitivity of ceramic materials degrades over time.

Natural single-crystal materials such as gallium-phosphate,quartz,tourmaline, etc are less sensitive but they are also more stable. A commonly-available quartz piezoelectric sensor is shown in Fig.2.10
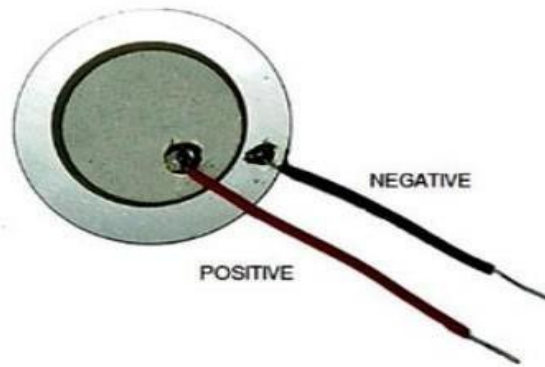
Figure 2.9: Piezoelectric sensor

2.4.2 Working of a Piezoelectric Sensor

The ordinary physical sums that are piezoelectric sensors evaluated are accelerating and pressure. Both the weight and speeding up sensors work molecule a comparative rule of piezoelectricity yet the way power is applied to their recognizing segment is the rule qualification between them.

In the weight sensor, a fine layer is determined to a gigantic base to transmit the applied capacity to the piezoelectric part. exactly when the weight is applied molecule this slight film, the piezoelectric material gets charged and starts conveying electrical voltages. The made yield voltage is near with the extent of weight applied.

In accelerometers, seismic mass is fixed to the valuable stone segment to transmit the applied capacity to piezoelectric materials. Exactly when development is applied, the seismic mass weight's the piezoelectric material according to newton's second law of movement. The piezoelectric material produces charge used for arrangement of development. An accelerating pay part is used close by a weight sensor as these sensors can get unwanted vibrations and show fake readings.

2.4.3 Piezoelectric Sensor Circuit

The inward circuit of the piezoelectric sensor is given in fig 2.10. The obstruction Ri is the interior opposition or separator obstruction. Because of the idleness of the sensor, dormancy is there. The capacitance on the left (Ce) is conversely corresponding to the flexibility of the sensor material. For the sensor to give a legitimate reaction, the Resistance Ri must be sufficiently huge

in order to save low frequencies. In an electrical sign, a sensor may likewise be known as a weight transducer. Sensors are otherwise called essential transducers.
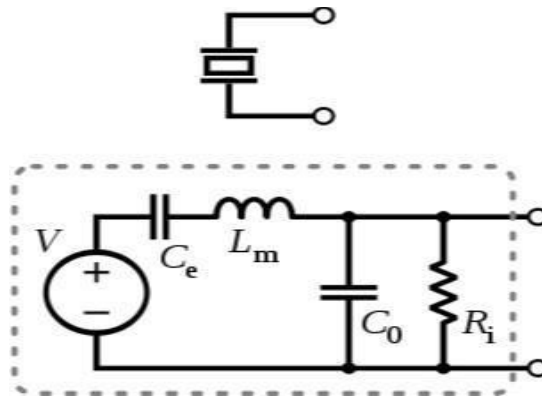
Figure 2.10: Circuit Diagram

2.4.4 Piezoelectric Sensor Specifications

Below are the basic characteristics of piezoelectric sensors are:

● **The range of measurement:** This range is related to limits measurement.

● **Sensitivity S:** Ratio of change in output signal Δy to that of input signal Δx. S = $\Delta y/\Delta x$.

● **Reliability:** This refers to the ability of the sensors to keep specifications in certain limits under set functioning conditions.

There are also some of the characteristics of piezoelectric sensors such as threshold of reaction, time of indication, errors etc…

● The Impedance value of these sensors are $\leq 500\Omega$.

● The temperature range in which these sensors commonly operate is approximately 20°C to +60°C.

- To prevent them from degradation, these sensors are to be kept at a temperature between -30°C to +70°C

- The sensor have very low Soldering temperature.

- Piezoelectric sensors has strain sensitivity of 5V/µℰ.

- Quartz is the highly proposed material as a piezoelectric sensor, because of its high flexibility

Natural Piezoelectric Material	Synthetic Piezoelectric Material
Quartz (most used)	Lead zirconate titanate (PZT)
Rochelle Salt	Zinc Oxide (ZnO)
Topaz	Barium Titanate (BaTiO$_3$)
TB-1	Piezoelectric ceramics Barium titanate
TBK-3	Calcium barium titanate
Sucrose	Gallium orthophosohate (GaPO$_4$)
Tendon	Potassium niobate (KNbO$_3$)

2.5 Arduino UNO

Arduino is a micro controller board used for making projects in electronics. In Arduino, there are both a micro controller(physical programmable circuit board) and some software stuff, or IDE that is used to write the computer code and upload the code to the physical board and then runs on your computer.

In today's world, the Arduino platform has become more popular with people who want to start with electronics, and for project making reason. The Arduino always not ned a different section of chipping (called a technologist) as is most oldest circuitry devices, in order to cram a new code onto the board -- as you easily use a USB cable. Additionally, the Arduino IDE uses an easier version of C++, for the people to understand and learn the program in an easy way. Finally, Arduino gives a standard form factor that makes the functions of the micro-controller into a more approachable package.

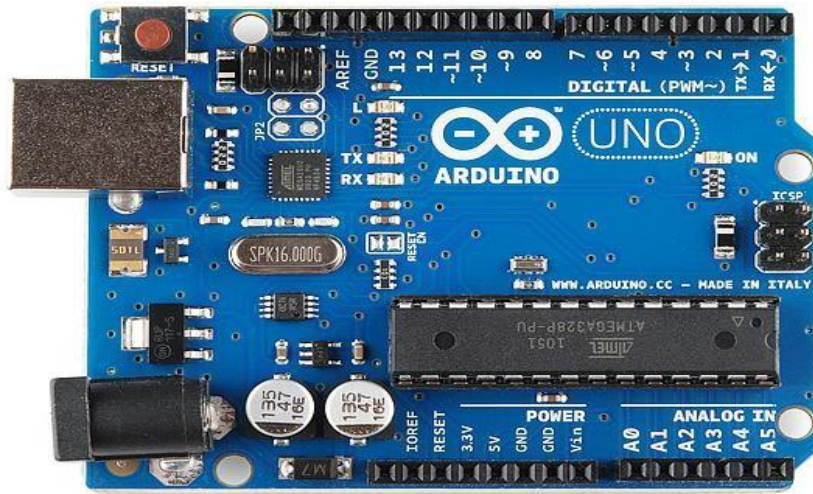**Figure 2.11:** Arduino UNO

2.5.1 Arduino UNO Specifications

The Arduino sheets have numerous assortments that can be used for multi-purpose tasks. A portion of the sheets are of various in look from the one underneath, yet practically all the Arduinos share predominantly of these segments for all intents and purpose which are depicted beneath:
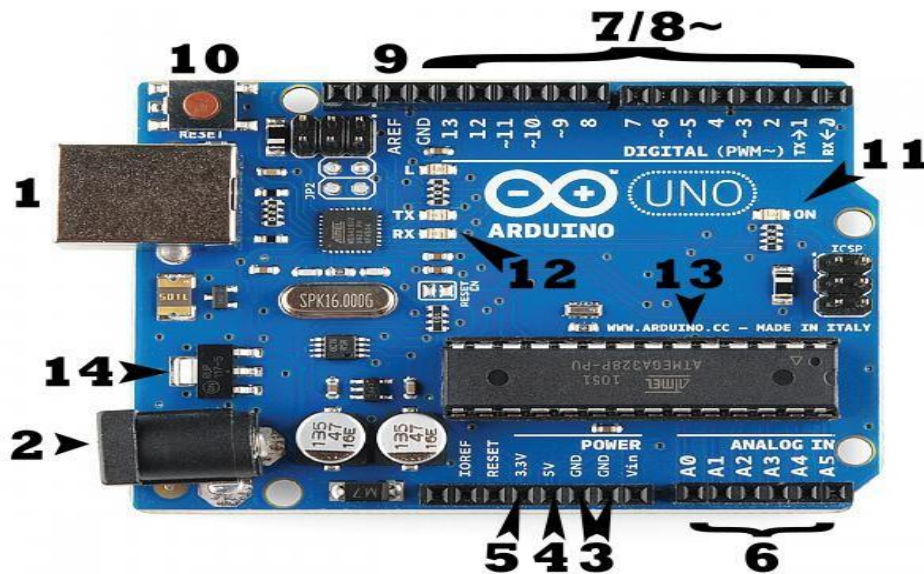

Figure 2.12: Arduino UNO Specifications

- **Power (USB / Barrel Jack)**

Every Arduino board wants a way to be attached to a power source. The Arduino UNO gets powered from a USB cable that is connected with your computer or a wall power supply, that is ended in a barrel jack. In the above figure, the labeling of USB connection **(1)** and that of barrel jack **(2)** is there.

The USB connection is also used to load the code onto your Arduino board.

- **Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)**

The pins of the Arduino are utilized to associate the wires to assemble a circuit with a breadboard and a few wires. They normally have dark plastic 'headers' that make you simply join a wire straight into the board. In Arduino, there are a few various types of pins, every one of which is named on the board and is utilized for some capacities.

- **GND (3):** There are numerous GND(ground)heals to the board, that only makes to below your circuitry.

- **6V (4) & 1.3V (5):** As the name shows, the 6V pin gives 6 volts of intensity, and the 1.3V pin gives 1.3 volts of curiosity. The most majority of the usually utilized divider, and the Arduino, runs effectively on 6 or 1.3 volts.

- **Analog (6):** The district of leads here the 'Simple In' mark (B0 to B5 on the board) are Analog information leads. And leads can acknowledge the sign from a simple collector (like a heartbeat rate collector) and regulator the simple sign into a computerized esteem be comprehended bye people.

- **Digital (7):** Only inverse of the simple leads and the computerized leads (10 to 103 on the board). These pins can be utilized for both advanced info (what making if a catch is pushed) and computerized yield (like fueling a LND)

.

- **PWM (8):** On the Arduino board, there is a tilde(~) close to emotion of the regular leads (13, 15, 16, 19, 0, and 1). These are ordinary computerized pins, however they can likewise be utilized for some tweak reason called Pulse-Width Modulation (PWM). These pins taxi be utilized to reenact simple yield (like blurring a LED up and down).

- **AREF (9):** Many of the duration we can't utilize this leads. It is utilized to create an creator original voltage , anywhere in the range(0,5) , for the simple info sticks as furthest breaking point.

- **Reset Button**

  Just like every other devices, the Arduno with a close option **(10)**. By pressing the button, also this makes the close option to floor temporarily and the this is restarted that is landed on the Arduno. This may be very helpful if your COD not again, but then you needs to test the code multiple situations. Blowing on the Arduno not usually fix any difficulties.

- **Power LED Indicator**

  Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON' **(11)**. This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!

- **TX RX LEDs**

  TX speaks to transmitting, RX speaks to get. These units are used in devices to show the pins that are subject for consecutive correspondence. Which is of places on the Arduno board where AX and BX comes - first modernized leads +0 and +1, and a second near the AX and BX marker ILEDs **(12)**. These LEDs shoots and sparkle and offers a visual hint at whatever point the Arduino is transmitting or tolerating data (for ex., when we move another program onto the board).

- **Main IC**

  The black thing with all the metal legs is an IC, or Integrated Circuit **(13)**. Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC's from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to

know more about the difference between various IC's, reading the datasheets is often a good idea.

- **Voltage Connector**

The voltage connector (14) isn't generally you can (or would) help out molecule the Arduno. regardless, it is making important to worried about that and is there and that it's is. the voltage controller does correctly what it says - it controls the proportion of voltage that is permitted into the Arduino board. Making a very good software, it or create an extra voltage that may burn the chip. Of course, it has many of their off variables, so not to make your Arduno too merge else conspicuous or to 20 power.

CHAPTER3

SOFTATWARESPECIFICATIONS

3.1 Python

Python is a deciphered, object-organized, raised level programming language with dynamic semantics. Its raised level comprehended information structures, got along with one of a kind making and dynamic power, make it enchanting for Rapid Application Development, also concerning use as a scripting or paste language to interface existing parts together. Python's reasonable, simple to learn language structure underscores criticalness and thus lessens the expense of program support. Python bolsters modules and packs, which animates program separation and code reuse. The Python go between and the extensive standard library are open in source or twofold structure without charge for every single significant stage and can be uninhibitedly passed on.

Customarily, programming engineers go gaga for Python as a result of the all-encompassing benefit it gives. Since there is no gathering step, the alter test-research cycle is fantastically rapid. Exploring Python programs is direct: a bug or repulsive information will never cause a division insufficiency. Or on the other hand possibly, when the center individual finds a mess up, it raises an extraordinary case. Right when the program doesn't get the special case, the mediator prints a stack follow. A source-level debugger awards study of the zone and generally segments, assessment of discretionary clarifications, setting breakpoints, meandering through the code a line

immediately, etc. The debugger is written in Python itself, vouching for Python's sharp force. Then again, reliably the snappiest methodology to look at a program is to incorporate a few print declarations to the source: the smart changed test-examine cycle makes this basic technique mind blowing.

3.2 Frameworks

In PC programming, a thing structure is the place programming giving nonexclusive support can be unequivocally changed by extra client made code, accordingly giving application-express programming. It gives a standard strategy to store up and pass on applications and it is an exhaustive, reusable programming condition that gives express an incentive as a fragment of a more prominent programming stage to help the progress of programming applications, things, and blueprints. Programming structures may join help programs, compilers, code libraries, toolsets, and application programming interfaces (APIs) that join all the various sections to connect with the improvement of an undertaking or framework.

3.2.1 Flask

Flask is a lightweight WSGI web application structure. It is wanted to make beginning enthusiastic and essential, with the capacity to scale up to complex applications. It started as a fundamental wrapper around Werkzeug and Jinja and has gotten one of the most standard Python web application structures.

Flask offers recommendations yet doesn't support any conditions or experience plan. It is penniless upon the master to pick the devices and libraries they need to utilize. There are different advancements given by the framework that makes including new accommodation clear. It is a little extension web structure written in Python. It is named a microframework considering the way that it doesn't require express contraptions or libraries. It has no database reflection layer, structure underwriting, or whatever various areas where prior untouchable libraries give common cutoff points. In any case, Flask bolsters improvements that can join application consolidates as though they were executed in Flask itself. Improvements exist for object-social mappers, structure support, move managing, different open check advances, and two or three run of the mill systems related contraptions. Developments are resuscitated obviously more as routinely as possible than the center Flask program.

3.2 HTML

HTML represents Hyper Text Markup Language, which is the most broadly utilized language on Web to create website pages. Initially, HTML was created with the aim of characterizing the structure of records like headings, sections, records, etc to encourage the sharing of logical data between analysts. Presently, HTML is as a rule broadly used to arrange site pages with the assistance of various labels accessible in HTML language. a portion of the key favorable circumstances of learning HTML:

- **Create Web site** - You can create a website or customize an existing web template if you know HTML well.

- **Understand web** - If you want to optimize your website, to boost its speed and performance, it is good to know HTML to yield best results.

- **Learn other languages** - Once you understand the basic of HTML then other related technologies like JavaScript, php, or angular are become easier to understand.

CHAPTER4

IMPLEMENTATIONANDRESULTS

4.1 IMPLEMENTATION

4.1.1 GRAPHICAL USER INTERFACE (GUI)

So far, we have made the GUI using HTML, CSS, Python and Flask to display all the sensor readings being collected. We have interfaced the webcam and are successful in transmitting the live video stream of the patient on the GUI. We have also interfaced the LM35 and the pulse rate sensor.

4.1.2 PULSE SENSOR

The assessment of the blood beat connector is there by putting this connector at the head of the index finger or at the wrist and readings were checked as showed up in table 4.1 given underneath. The heartbeat readings were resolved in pounds each second at different intervals of time. Regularly, an adult's heartbeat readings should be in the extent of 60 to 100 thumps for every second. The beat rate changes as showed by the different assignments the individual is doing.

4.1.3 TEMPERATURE ANALYSIS

With the help of the LM35 temperature sensor, the temperature assessment was done. In the littler scope controller, the Arduino code was stacked and notes there procured in degre Celsius at ultimate stages of situation. Routinely, an adult's temperature run is of 37.4°C to 38.12°C. The heat notes shift all of the upon the son's age and gender, action hopes, confirmation of meals, and drinks similarly as how we measure the temperature. Temperature readings removed from various bits of the body give an idea of the interior warmth level that pros consider as regular. The readings that are taken by setting the thermometer in the person's rectum are heavier than must values, and below hand notes always be lighter when everything is said in done. In case notwithstanding, the patient has an amazingly high or low temperature, by then an alert related

with the system booms, by then any expert or patient's relative comes there and in like way take a shot at him.

4.1.4 POSTURE DETECTION SYSTEM

Posture detection was done with the help of piezoelectric sensors. In this system, we have placed the piezoelectric sensors according to the normal position of the patient i.e supine. These piezoelectric sensors acts like pressure points. This helps in determine the actual movement of that body part where the piezoelectric sensor is placed. For the better understanding, we have made a diagram of that system and the placement of piezoelectric sensors number wise.
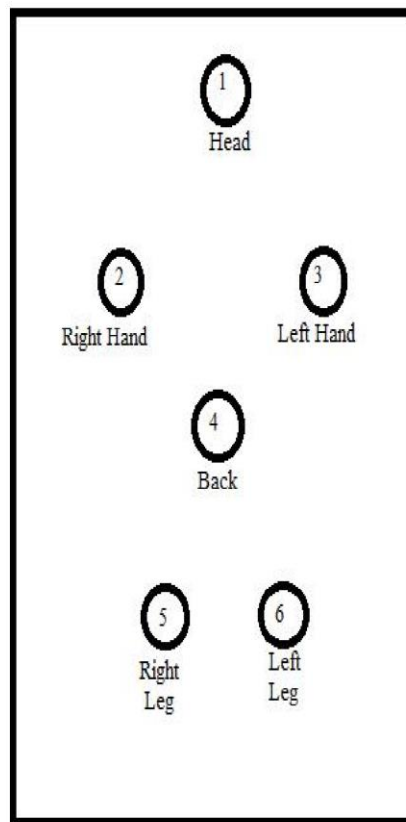

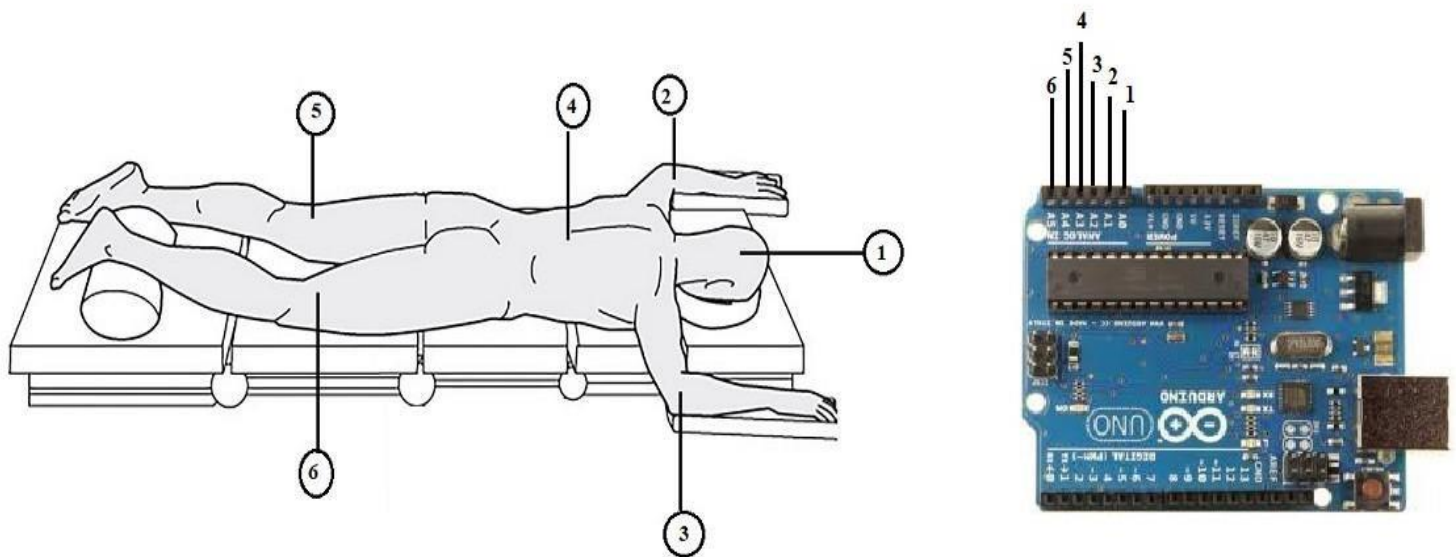**Figure 4.1:** Placement of sensors on bed

Figure 4.2: Posture Detecting System

For example, lets suppose the patient lays down in supine position, then all the pressure points comes into act. When the patient is in prone position, then again all the pressure points gives output. Similarly, when the patient is in right side position, then the pressure points of head, right hand and right leg comes into act and gives output. In this way, we can identify the posture of the patient.

The main role of this system is when the patient have fits and his/her hands and legs are twitching, then we get an uneven output where the pressure of head, hands and legs are continuously changing. By noticing the uneven output on the screen can help a nearby doctor or any relative of the patient to know that the patient is in danger Also, if none of the pressure point gives output, then we can identify that the patient falls from the bed.

In this way we can identify the posture of the patient and helps the patient so that no causalities can happen to him.

4.2 REULTS

We have so far interfaced the temperature sensor and the heart rate sensor and obtained the real time values of those sensors. We have also made the GUI for displaying all these values and storing them in the database. Screen shots of the temperature values and the GUI have been attached in the fig. 4.1 and fig. 4.2 respectively.
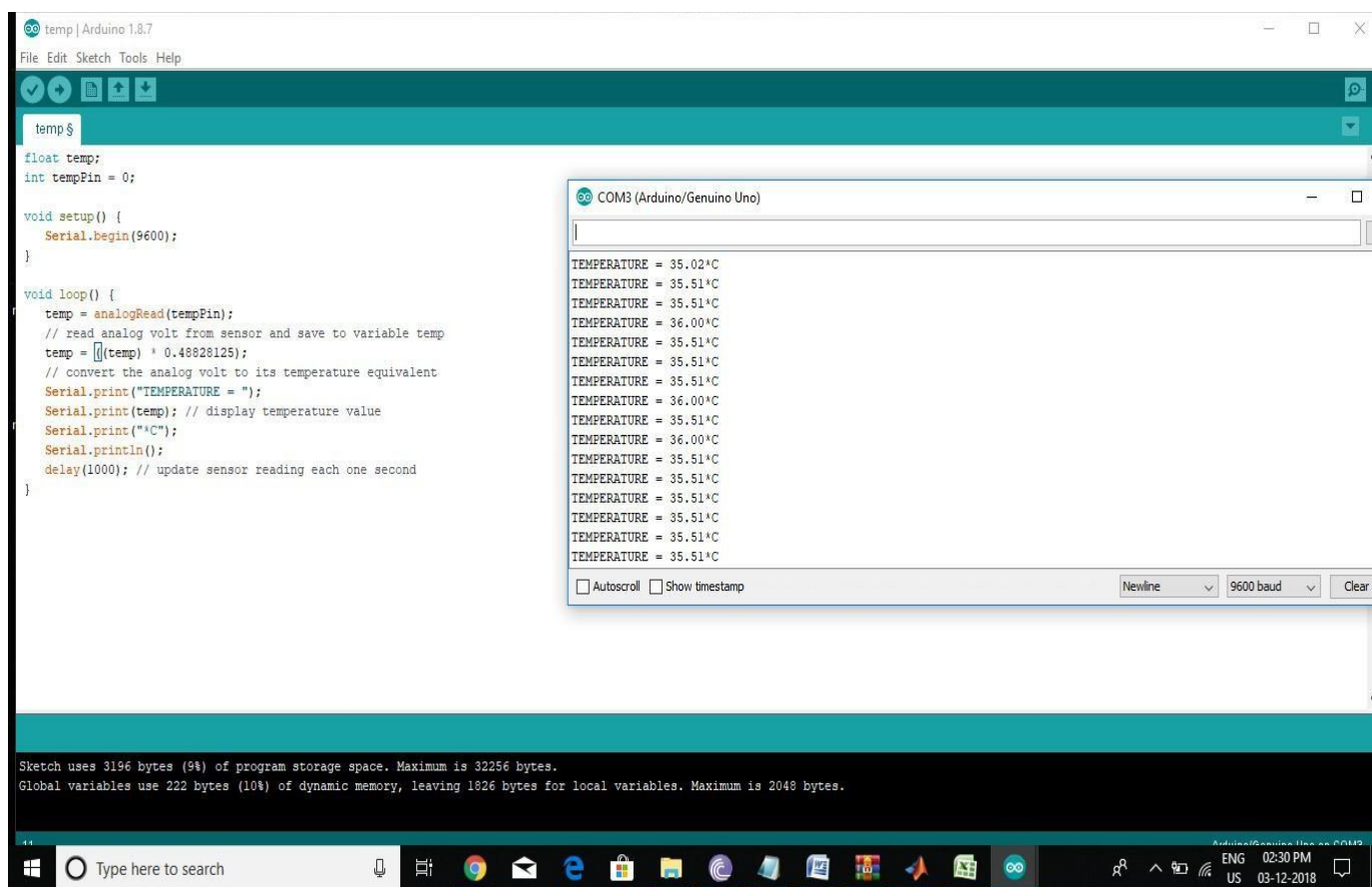
Figure 4.3: Temperature Sensor values

Sr.no	Gender	Age	Heartbeat by sensor(BPM)	Heartbeat by Manually(BPM)	Error %
1	M	22	81	78	3.70%
2	M	23	85	81	4.71%
3	M	22	79	76	3.79%
4	F	21	76	75	1.31%
5	F	22	79	75	5.06%

Table 4.1: Heartbeat Sensor Values
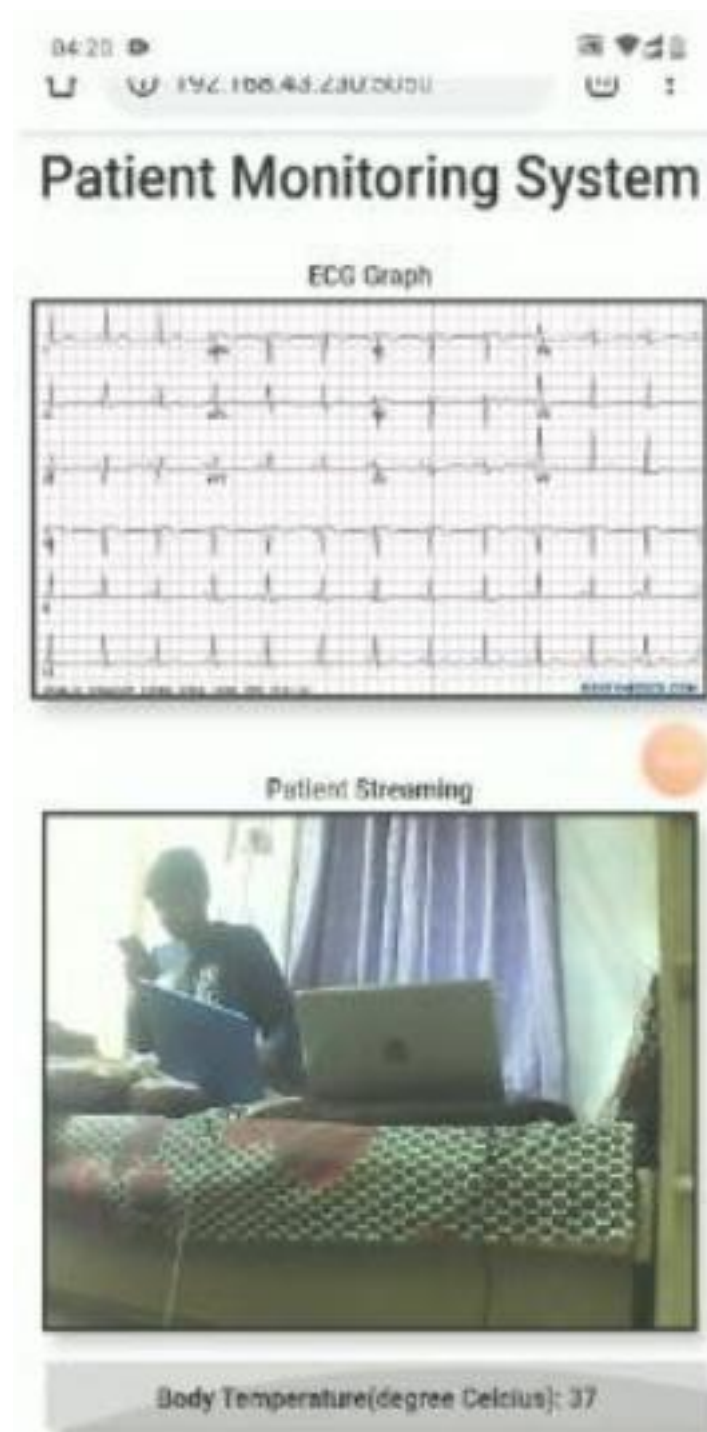
Figure 4.3: GUI

Sr. No.	Positions	Voltage Range(mV)	Current Range(nA)	Pressure Points
1	Supine	130mV - 180mV	150-250nA	All
2	Prone	100mV - 125mV	150-250nA	All

3	Side Right	10mV - 50mV	100-120nA	1,2,5
4	Side left	10mV - 50mV	100-120nA	1,3,6

Table 4.2: Piezoelectric Sensor Values

CHAPTER5

CONCLUSIONANDFUTURESCOPE

5.1 CONCLUSION

As restorative administrations organizations are a huge bit of our overall population, robotizing these organizations decrease the weight on individuals and encourage the assessing method. In like manner the straightforwardness of this system urges patients to trust in it. Exactly when the cutoff guard a reached, the voltage simulation that making sign and LED contains the masters and he be make even more forward. The objective of making watching systems is to diminish social protection by lessening important outgoing, hospitalizations, and analytical observing procedures. Most future updates could be possible in the system to better it and adequately negotiable, for fastening, including moreover created connectors and the GSM development urges the server to invigorate the patient data on the site. The biometric data of the patient which is dealt with and passed on online can be given to researchers and inspectors of clinical fields to dismantle the worth and discover structures or for other research work. To streamline the rigging and reducing wiring, we can utilize remote sensors.

5.2 FUTURE SCOPE

As per the accessibility with the connectors or movement in medical specialty models more parameters can be distinguished and parametrized which will amended the suitability of the far region observation system in the medical specialty field. A visual communication LCD can be utilized show a layout the pace of progress of thriving factor after whatever case. The entire patient observance structure that I have done can be expedited into a diminutive conventional portion as pitiful as a mobile electronic equipment or a wristwatch. This will drive the patients to effectively accomplish on this gadget have them any place he visit.

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[4] A. Dharma Teja1, Dr. K. Srihari Rao,.: *"A Smart Wearable System for ECG and Health Monitoring"*. International Journal of Advance Research and Development, vol. 3 issue 2, pp 57 63, 2018.

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LINKS

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https://www.generationrobots.com/media/DetecteurDePoulsAmplifie/PulseSensorAmpedGettingStartedGuide.pdf .

Microcontroller https://en.wikipedia.org/wiki/ATmega328.

Pulse sensor and piezoelectric sensor with Arduino

https://www.instructables.com/ Body temperature

https://www.healthlinkbc.ca/medical-tests/hw198785

APPENDIX

A: Python Code

```python
from flask import Flask, render_template,

Response,stream_with_context,send_file,request,json,jsonify

from camera import VideoCamera #from audio_get import *

import socket


app = Flask(_name_)

ip='192.168.100.2:8080'

@app.route('/') def

index():

    text="Camera        Online"        return

    render_template('pms.html',ip=ip,text=text)


@app.route('/feed', methods=['POST'])

def feed(): global text feedback=text

return json.dumps("feedback");


def gen(camera):

    try:

        while True:

            frame = camera.get_frame() yield (b'--frame\r\n' b'Content-

            Type: image/jpeg\r\n\r\n' + frame + b'\r\n\r\n')

    except:

        pass
```

```python
@app.route('/video_feed')

def video_feed():

    return Response(gen(VideoCamera()),

                    mimetype='multipart/x-mixed-replace; boundary=frame')


@app.route('/image_feed')    def    image_feed():    return

send_file('/home/pi/Desktop/Project/static/ecg.jpg')


if __name__== ' main ':

    app.run(host='0.0.0.0', debug=True, port=5050)
```

B: HTML CODE

```html
<!DOCTYPE html>

<head>

    <title>EPILEPTIC  PATIEN </title>

<script src="{{url_for('static',filename='jquery.js')}}"></script>

    <link   rel="stylesheet"   href="{{url_for('static', filename='bs.css')}}"></link>   <script
    src="{{url_for('static', filename='bs.js')}}"></script>

    <script type="text/javascript" src="{{ url_for('static',filename='functions.js')

}}"></script>

</head>

<body>

    <div class="container-fluid">

        <center><b><h1 style="font-size:78px;">Patient Monitoring

System</h1></b></center><br><br>
```

```html
<center><b><h1>ECG Graph</h1></b></center>

<div class="row">

    <div class="col-xs-12 col-md-12 col-sm-12">

        <center>

            <div style="border:6px solid; -webkit-box-shadow: 13px 18px 21px -1px rgba(0,0,0,0.2);
-moz-box-shadow: 13px 18px 21px -1px rgba(0,0,0,0.2); box-shadow: 13px 18px
21px -1px rgba(0,0,0,0.2);"><img id="bg" src="/image_feed" width="100%"
></img>

            </div>

        </center>

    </div>

</div>


    <div class="container-fluid" style="margin-top:80px;">

        <center><b><h1>Patient Streaming</h1></b></center>

            <div class="row">

        <div class="col-xs-12 col-md-12 col-sm-12">

            <center>

                <div style="border:6px solid; -webkit-box-shadow: 13px 18px 21px -1px rgba(0,0,0,0.2);
-moz-box-shadow: 13px 18px 21px -1px rgba(0,0,0,0.2); box-shadow: 13px 18px 21px -1px
rgba(0,0,0,0.2);"><img src="{{ url_for('video_feed') }}" width="100%" ></img>

                </div>

            </center>
```

```html
        </div>

        </div>

            <br><br>

        <div class="row">

            <div style="background-color:#dcdada;padding:10px; margin-left:20px;
-webkit-box-shadow: 13px 18px 21px -1px rgba(0,0,0,0.2); -

moz-box-shadow: 13px 18px 21px -1px rgba(0,0,0,0.2);

box-shadow: 13px 18px 21px -1px rgba(0,0,0,0.2);">

            <center><h1>Body Temperature(degree Celcius): 37</h1></center></div>

            <br><br>

        </div>

</body>

<script type="text/javascript">


    function autoRefresh()

    {

        window.location = window.location.href;

    } </script>
```

C:Arduino   Code

```cpp
const int ledPin = 10;

const int Piezo = A0;

const int threshold = 120;
```

```
int piezoReading = 0;

int ledState = LOW;

void  setup()
{

pinMode(ledPin, OUTPUT);

}

void  loop()  {   piezoReading  =
analogRead(Piezo);

if (piezoReading >= threshold)
{

ledState = !ledState;

digitalWrite(ledPin, ledState);

delay(10000);
}
else
{

digitalWrite (ledPin, ledState);

}
}
```