HEALTH MONITORING SYSTEM

A PROJECT REPORT

Submitted to

Amrita Vishwa Vidyapeetham

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING

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BONAFIDE CERTIFICATE

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ABSTRACT

The "Health monitoring system” project represents an innovative approach to modernize health monitoring systems by integrating advanced technologies. This health monitoring system combines IoT, Arduino Tinker Cad, Oscilloscope Photoresistor, Temperature sensor, RGB LED, LED, and LCD to create a versatile platform. Integrated sensors capture health metrics, Arduino processes the data, and Tinker cad aids in simulation. The addition of a function generator, RGB LED, LED, and LCD enhances the system’s capabilities for comprehensive health monitoring and user interaction IoT connectivity enables remote monitoring, offering a comprehensive solution for healthcare applications. This integrated health monitoring system is significant for its ability to provide real-time health data through IoT connectivity. The inclusion of a Oscilloscope, RGB LED, LED, and LCD not only enhances functionality but also offers a user-friendly interface. This comprehensive approach allows for accurate monitoring, timely alerts, and improved user engagement, contributing to more effective and accessible healthcare solutions.

Keywords: Oscilloscope, Arduino, RGB LED, photo resistor, LCD, LED, heath monitoring

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LIST OF SYMBOLS AND ABBREVIATIONS

IDE	Integrated Development Environment
VCC	Voltage Common Collector
GND	Ground
USB	Universal Serial Bus
ICSP	In-Circuit Serial Programming
Trig	Trigger

CHAPTER 1
INTRODUCTION

1.1. Introduction

Historically, India has faced challenges in its health monitoring system, leading to issues in disease tracking and timely intervention. A lack of proper health monitoring can result in delayed responses to health crises and difficulties in resource allocation.

Developing a robust health monitoring system can have several positive impacts on society. It would enable quicker detection and management of disease outbreaks, improving public health. Additionally, a comprehensive monitoring system can enhance preventive care, reduce healthcare costs, and contribute to overall well-being by addressing health issues proactively. The data collected could also aid in evidence-based policymaking, promoting more effective and targeted healthcare strategies.
Using Tinker cad Arduino and IoT for health monitoring improves real-time tracking, allows remote monitoring, ensures accurate data, cuts costs, engages patients, offers scalability, integrates with other systems, and enables early detection, fostering a proactive and efficient healthcare ecosystem.
In summary, leveraging Tinker cad Arduino and IoT for health monitoring offers a transformative approach that not only enhances the efficiency of healthcare delivery but also empowers individuals to take charge of their health and well-being.

1.2. Problem Definition

Title: Development of an IoT-Based Health Monitoring System for Enhanced Healthcare Management.

1.2.1. Problem Introduction: In

the contemporary era, healthcare is evolving with the integration of technology, specifically through the Internet of Things (IoT). The aim of this project is to address the growing need for a comprehensive Health Monitoring System leveraging IoT technologies. The system is envisioned to enhance healthcare management by providing real-time monitoring and analysis of vital health parameters, ensuring timely intervention and personalized care for individuals.

1.2.2. Problem Statement:

1. **Limited Real-Time Monitoring:**

Traditional healthcare systems lack continuous, real-time monitoring of patients' health parameters. This creates a gap in timely detection of health issues and prevents proactive interventions.

2. **Inefficient Data Collection and Analysis:**
   Existing data collection methods often rely on manual entry and are prone to errors. Moreover, the lack of automated analysis tools hampers the efficient extraction of meaningful insights from the collected health data.

3. **Fragmented Healthcare Communication:**
   The communication between patients, healthcare providers, and caregivers is often fragmented. A centralized system for health monitoring is needed to streamline communication and ensure a cohesive approach to healthcare management.

4. **Scalability Challenges:**
   As the number of individuals requiring healthcare monitoring increases, scalability becomes a significant concern. A robust system should be designed to accommodate a large number of devices and users without compromising performance.
5. **Security and Privacy Concerns:**
   IoT-based health monitoring involves the transmission and storage of sensitive health data. Ensuring the security and privacy of this data is crucial to gain trust from both healthcare providers and individuals using the system.
6. **Interoperability Issues:**
   Healthcare systems often use diverse devices and standards for data communication. The lack of interoperability can hinder the seamless integration of various health monitoring devices into a unified system.
7. **Cost and Accessibility:**
   The cost of implementing and maintaining a sophisticated health monitoring system can be a barrier to widespread adoption. Ensuring affordability and accessibility to a broad range of users is essential for the success of the system.

1.2.3. Objectives:

1. **Real-Time Monitoring:**
   Develop a system that enables continuous, real-time monitoring of vital health parameters, such as heart rate, blood pressure, and oxygen levels.

2. **Automated Data Collection and Analysis:**
   Implement automated data collection mechanisms and sophisticated analysis tools to extract actionable insights from health data.

3. **Unified Healthcare Communication:**
   Establish a centralized platform for seamless communication between patients, healthcare providers, and caregivers to enhance collaboration and coordination.

4. **Scalable Infrastructure:**
   Design a scalable infrastructure capable of handling a large number of connected devices and users, ensuring optimal performance under varying workloads.

5. **Security and Privacy Measures**: Implement robust security protocols and privacy measures to protect the confidentiality and integrity of health data transmitted and stored within the system.

6. **Interoperability Standards:**
   Adhere to widely accepted interoperability standards to ensure compatibility with a variety of health monitoring devices and systems.

7. **Affordability and Accessibility:**
   Strive to develop a cost-effective solution that is accessible to a diverse user base, considering both urban and rural healthcare environments.

   By addressing these challenges, the proposed Health Monitoring System aims to revolutionize healthcare delivery, providing a more proactive, efficient, and personalized approach to healthcare management.

CHAPTER-2
LITERATURE SURVEY

2.1. Literature Survey

The study of “IoT” was comprehensive and montages relations and constraints. The main goal of “IoT” is to ensure that, in conjunction with “electronic sensor” devices, Internet-based communications and the sending and reception of information are conventionally accessible. In a report “28.4 billion IoT users in 2017 and by 2020 they are going up to 50.1 billion” remained the result of one report. “IoT”, according to scientific charity, provides a range of services. “Wi-Fi, mobile phone, NFC, GPS etc.” is continuity of contact. The IoT main aim, though, is to incorporate organizations, mechanization so that messages can be transmitted without interruptions, compared to software creation; the start of the programmed is the most frequently recycled sensors with accelerometers, compression-embedding camps such as the “MCUS, MPUs”. The services have improved “intelligent fitness, transportation, grids, parking and intelligent homes.” Therefore, the core goal of IoT is to combine organizations and mechanization in order to provide messages continuously. The initial opinion for the “IoT phase is divided into criteria, specifications and implementation” is comparable to software development overall. An essential method is the final section containing the company process. “H.” In order to understand the specifications of any IoT project Eskelinen submitted two questions and included them in the design phase. These moments of design-based science lead to adequate exploration of the following concepts, before the construction is funded, a strategy needs to be created that blends realistic goals with theory, and one has to bear in mind at the same time that real life is a research centre. Systematic and professional testing methods should be carried out. The designs should always be taken into account for any failure, and the designs chosen should be demonstrated to be durable over time. While Saini et.al developed its healthcare system, the consumer was the subject of the study: the programmed specifications used a basic design methodology similar to typical software development courses. The WSN is a significant part of IoT, and it also plays an important role in its healthcare applications. They are known for their high-end and miscellany wireless control systems over other regular devices. Working on the WSN for pulse rates and oxygen saturation was emphasized by Rotariu and Manta in 2012. Yuehong etc., on the other hand, and ECG and blood pressure sensors mounted on the mobile telephone in 2016. With the IoT approach in the health analogy, the wireless network improves, he said. Tan et.al used Wi-Fi technology for its 2012 work in the control area to relay messages on different body functionality, such as blood pressure, pulse rate, body temperature and oxygen saturation. J.J.R. and Wannenburg. Bluetooth was introduced into the smart phone by Malekianc to track patients further.

2.2. IoT In Health Sector

By introduction of 'IoT' it has been possible to distinguish between 'health data' in the analyzing and diagnostic of a physician after systems of physical sensors. The biggest benefit of the 'IoT in healthcare' is to reduce maintenance burden, followed by an increase in the chance of healthcare. The addition individual and online health care network was great learning experience and anticipated that mobile information and general technology killing applications would lead to the development of cloud health services. IoT is already offered as a primary platform for neurological awareness monitoring. Because effective surveillance devices are not available, it is possible to take many higher risks. Technologies such as IoT are played here. The best interest of the patient is such caution. Multiple sensors are used to analyze patient details. The caregiver can provide adequate guidance on health care. Increased monitoring is required for IoT devices commonly used for disabled patients. Monitoring strategies, through the assistance of the sensors, have been collected to maintain a constant material movement by the patients referred to there for caregivers. In turn, this enhances care quality. In the end, this leads to care costs. The figure below shows how IoT plays a major role in healthcare.

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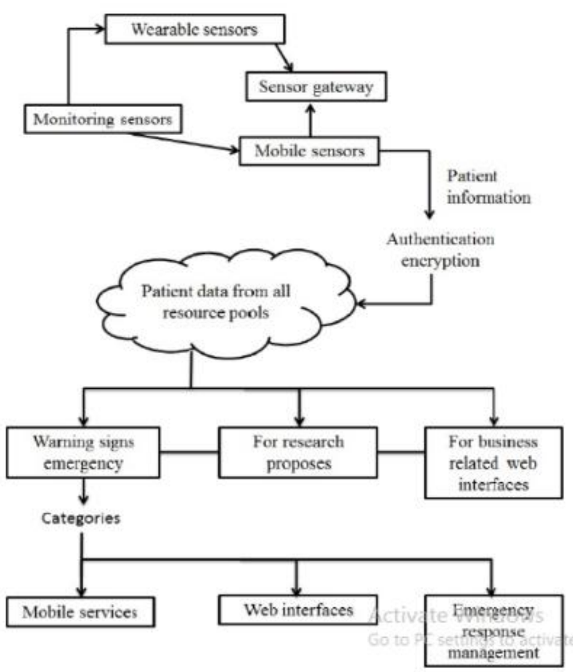

Fig. 1 IoT in Healthcare Monitoring Systems

Fig.2.1. IoT in Healthcare Monitoring Systems

2.3. Motivation for Health Monitoring System

Why We Need a Health Monitoring System:

1. **Catch Problems Early:**

Imagine if we could find out about health problems before they become serious. A Health Monitoring System helps us do just that. It keeps an eye on our body's important signs, so doctors can step in early if something seems off.

2. **Help for Ongoing Health Issues:**

Some people have health conditions that need to be watched all the time. This system can keep track of things like blood sugar or blood pressure, making it easier for doctors to manage these conditions better.

3. **Stay a Step Ahead in Health:**

Instead of waiting for something to go wrong, this system helps doctors be one step ahead. They can take actions before things get really bad, preventing big problems and keeping us healthier.

4. **Get Everyone Involved:**

It's not just for doctors. This system lets us be a part of taking care of our health. When we know what's going on inside our bodies, we can make better choices to stay healthy.

5. **Healthcare from Anywhere:**

Sometimes, people live far from hospitals or can't go there often. This system helps doctors check on us even if we're far away, making sure we get the care we need at home.

6. **Smart Decision-Making with Data:**

The system collects a lot of information about our health. When doctors look at this data, they can make really smart decisions about our care, choosing the best treatments that fit just right.

7. Save Resources, Use Them Better:

Hospitals and emergency rooms can get really busy. By using this system, we make sure that doctors and nurses are helping the people who need it the most. It's like making sure everyone gets the right attention at the right time.

8. Be Your Own Health Expert:

This system helps us understand our own bodies better. We can see how our choices, like what we eat or how much we exercise, affect our health. It's like having a guide to being our healthiest selves.

9. Special Care for Each Person:

Everyone is different. This system helps doctors treat each person in a special way, considering what makes each of us unique. It's like having a health plan that's just for you.

10. Technology Making Things Easier:

We live in a world where things like phones and watches can talk to each other. This system uses this cool technology to make taking care of our health easier and better.

In simple terms, a Health Monitoring System is like having a helpful friend for our health. It keeps an eye on us, helps doctors make smart choices, and makes sure we're doing our best to stay healthy every day

CHAPTER-3
SYSTEMS REQUIREMENTS AND ANALYSIS

3.1. Requirements

To complete our project, we require some software components.

Programming Language: C

Front-End UI: Tinker Cad, Thing Speak

Operating System; Windows Xp,7, 8, 10, 11, MacOS, Linux

3.1 REQUIRED SOFTWARE:

3.1.1Arduino UNO: - The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. It is the most used and documented of the Arduino boards. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button

Fig.3.1. Arduino UNO R3

It is a good choice for beginners as it is easy to use and has a wide range of libraries and tutorials available. The Arduino Uno can be used to create a variety of projects, including robots, home automation systems, and wearable electronics.

The Arduino Uno is powered via the USB connection or an external power supply. The board can be programmed with the Arduino IDE (Integrated Development Environment), via a type B USB cable.

3.1.2. **RGB**:- A white light produce by mixing 3 different colors like RGB- Red, Green, and Blue is an RGB LED. The main purpose of this RGB model is for sensing, representation, and displaying images in the electronic system.

3.1.3. White light can be generated by combining 3 different colors like green, red, blue, or by using phosphor material. This LED consist of 3 terminals (RGB in color) which are present internally and a long lead which is present is either a cathode or an anode as shown below:

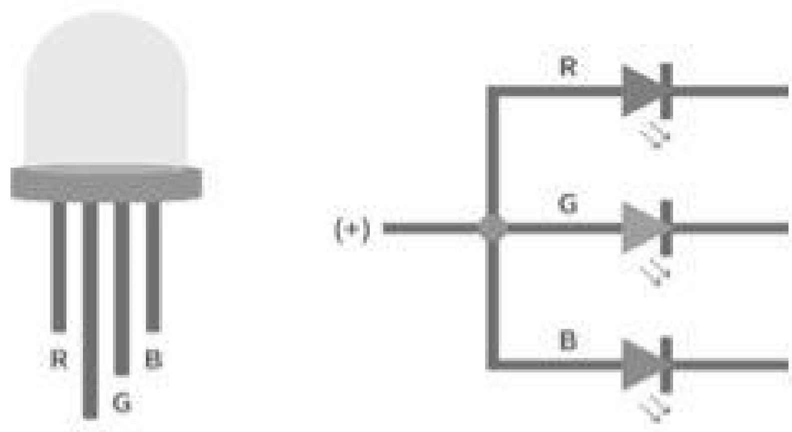

Fig.3.2. RGB LED

The structure of Common Cathode LED consists of 4 terminals, where the first terminal is “R” the second terminal is “Cathode –“, the third terminal is “G ” and the fourth terminal is “B” as shown below:

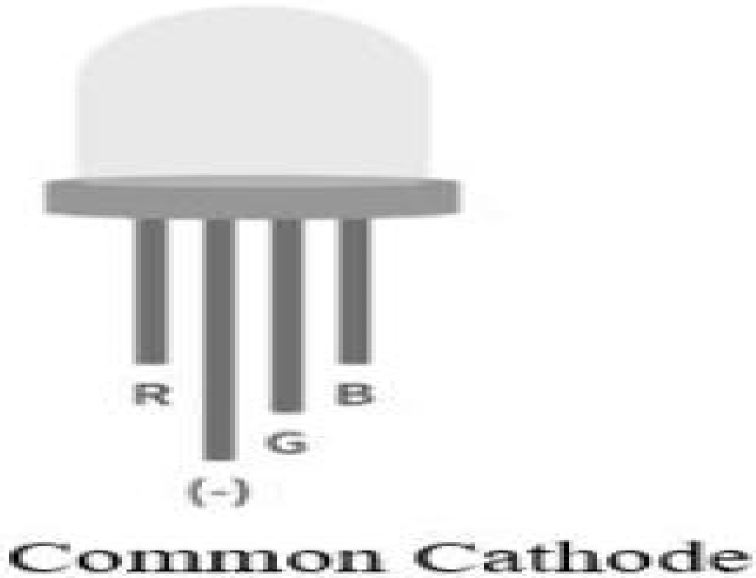

Fig.3.2.1. RGB LED Common Cathode

The Colors can be controlled by applying a high power input to the RGB pins. And connecting the internal cathode to a negative lead of the supply as shown below:-

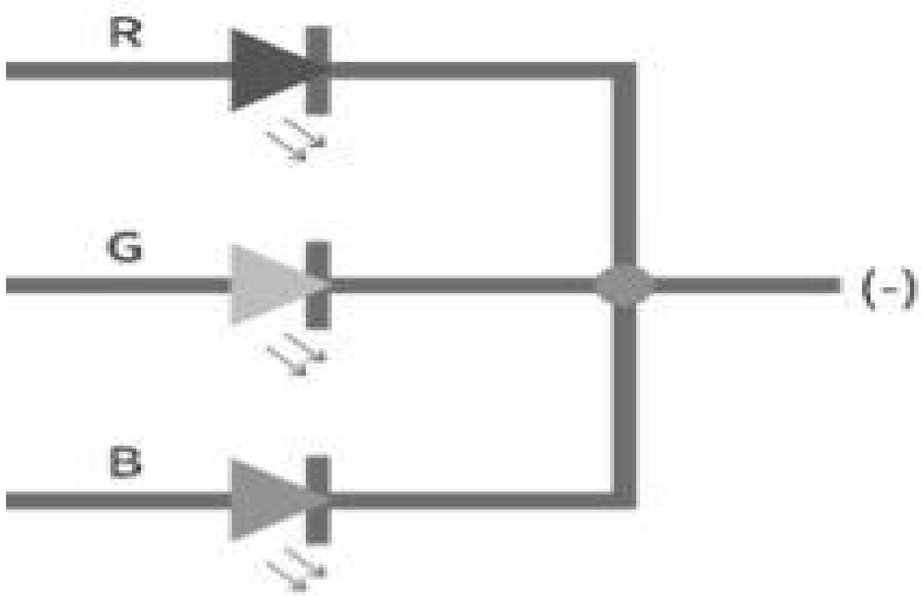

Fig.3.2.2 RGB LED Colour Diode

3.1.4 **Photo resistor: -** The photoresistor is composed of light-sensitive semiconductor Material. Usually, it is made up of cadmium sulphide having negligible free electrons in the absence of any incident radiation. In the absence of light, LDR possesses very high resistance of about several mega ohms. However, in the presence of light, it exhibits low resistance property, having the resistance of about a few hundred ohms.

The figure below shows the basic construction and symbol of photoresistor:

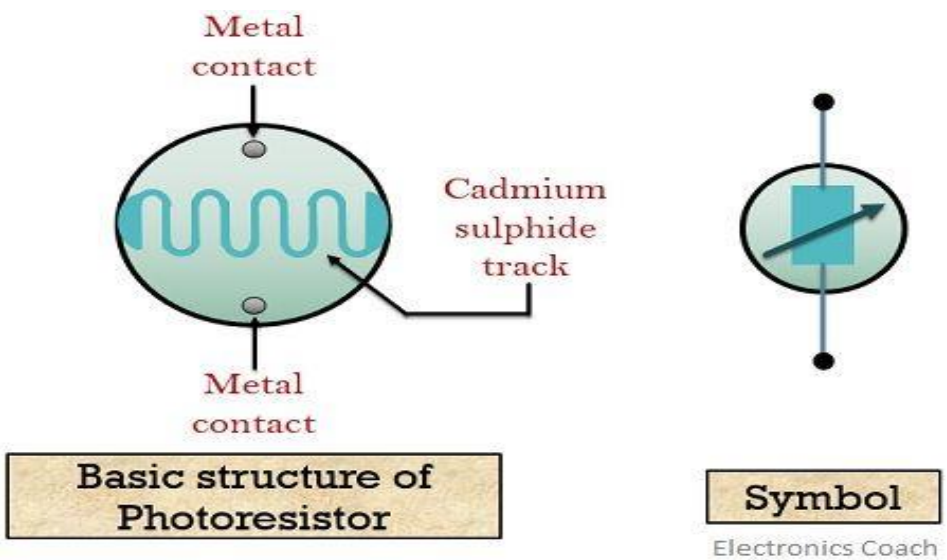

Fig.3.3. Photoresistor

3.1.5 LED: A light-emitting diode (LED) is a semiconductor device 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.[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor.

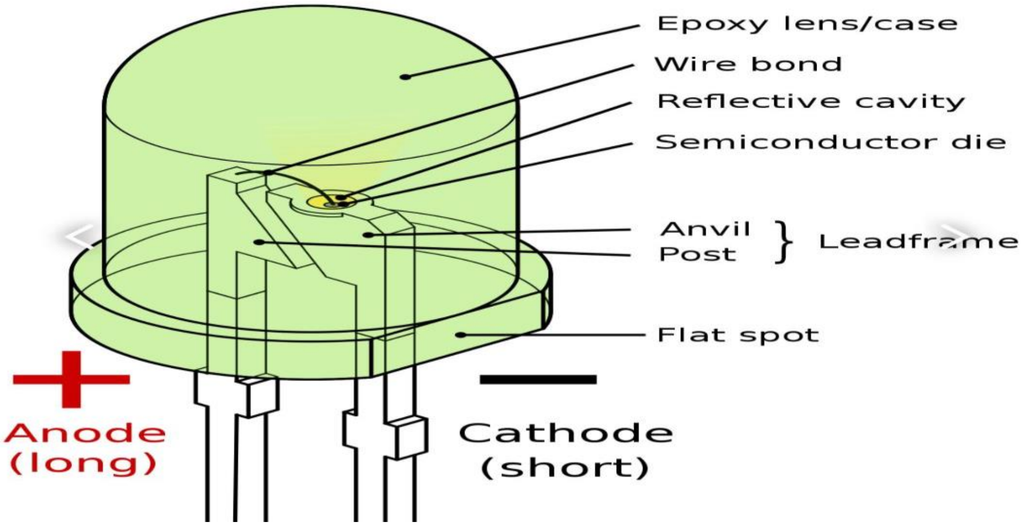

Fig.3.4. Light Emitting Diode (LED

3.1.7 It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

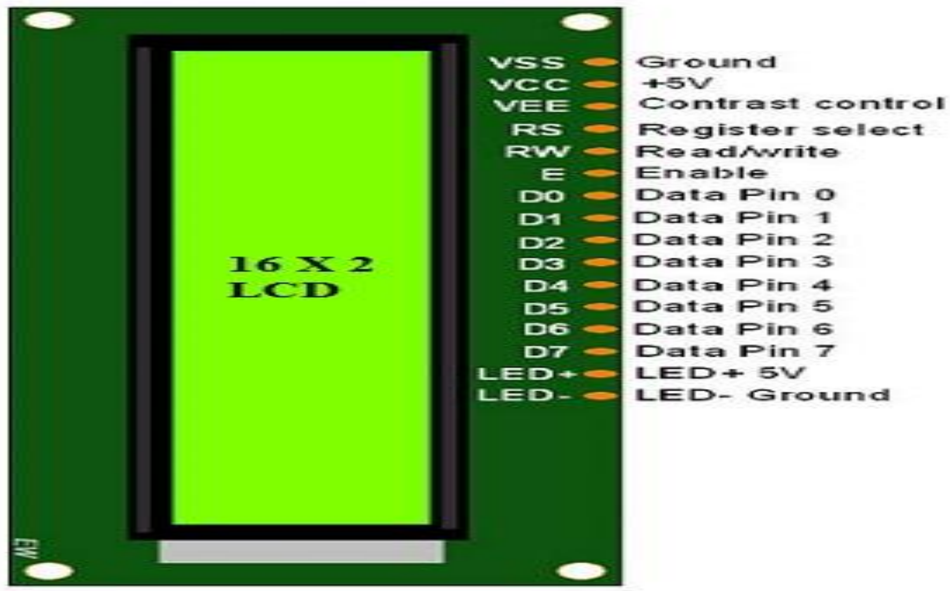

Fig.3.5. Liquid Crystal Display 16x2 (LCD)

3.1.8 **Piezo buzzer:-**Piezo buzzers usually have two pins: a negative pin that connects toGND on the Arduino and a positive pin (connected to one of the digital pin slots on the Arduino that receives control signals from the Arduino. The piezo buzzer can play Sounds at different frequencies to create a melody.

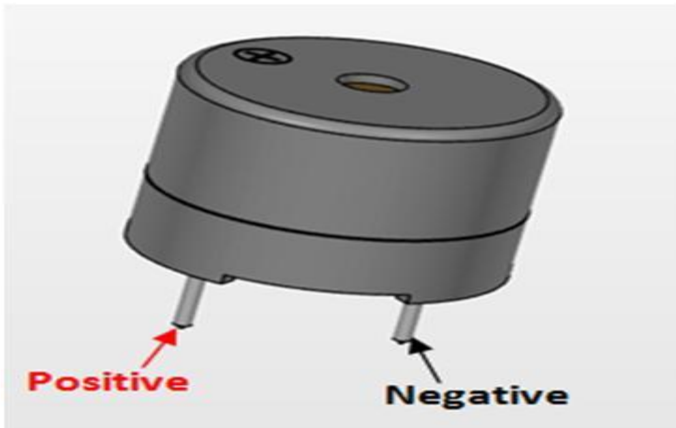

Fig.3.6. Piezzo Buzzer

CHAPTER-4
SYSTEM IMPLEMENTATION

4.1. The Architecture of IoT in HealthCare

IoT is a network of physical object-linked devices that allow remote devices to hear, analyze, and monitor. The computational mechanism for linking computer hardware to allow communication between sensors and smart sewing equipment. IoT implementations in IoT data processing rely heavily on the middleware layer. Smart grid, clever city, clever home, clever agriculture, clever communications... are all other IoT systems. The three-layer IoT architecture is based on the layers of understanding and networking. It is further expanded to include middleware and business applications.

- **Perception layer:**

  The sensory and physical instruments are identified in the cognitive layer. The perceptual layer sensor system points to and then detects an object and collects object information. Information on temperature, mobility, position, moisture, vibrations, distance, speed, chemical changes etc can be collected according to the kind of sensor. The information is then passed to the next processing layer. When a ladywears fixed earrings which are clean to her ears and help diagnose various organ conditions and win a woman's position? The viewing layer transmits the collected data to the processing network layer through the node.

- **Broadcast Layer:**

  The "Broadcast Layer" is often named, with its key purpose being to connect various waiters, intelligent objects and network devices. Collect sensor data on sensor devices transmits. The system of communication can beinfrared, Bluetooth, ZigBee, Wi-Fi, UMTS and 3 G technologies. After network layer coating, the information from thecore is then moved to the middleware layer, which transfers the information from the core to the front of the working layer.

- **Middle wave Layer:**

  Experiencing the enormous amount of data obtained from the network layer is the big processing layer that stores it. The data base communication and resource management are responsible, because it is in the middle layer and provides the lower layers with a service layer. To process vast quantities of data links it with Big Data and Cloud computing. Body temperature analysis and checked is performed on data obtained by earrings. In a sector which is reliable and similar to the customer, if there is a difference in the average temperature.

- **Application Layer:**

  An essential aspect of this layer is to provide end-users with application-oriented services. That is because the layer explicitly interacts with the end user by having application layers. When the information has been obtained on the earrings of a lady, tell you that you have fever and you can contact the lady in question on the application form. This is a layer that communicates with the user by sending a smart phone message about the flu.

- **Business Layer:**
  The corporate layer controls the whole eco-business model of IoT. It helps end users decide more efficiently. For example, a person with fever would suggest details in your closest clinic or hospital.

4.2. Wearable Devices

For things such as bracelets, ornamentation, patches, caps, t-shirts (t-shirts), bands, glasses Wearable processes can be tailored to the "real body." This equipment has been used to contact the person who monitors the disease, personal health and the information gathered which has been sent to the central and internal research centre. Three elements are wearable devices such as cameras, machine buildings and exhibits. Wearable devices may provide natural statistics, including calories, steps, heart rate, blood pressure; time spent exercising, and so on. The effect on these devices is enormous and of course very strong, which has a good focus on monitoring the physical health of our users.

Various wearable devices as given below:

- **Pulse Oximetry:** The unit tests the oxygen saturation level of the human body and monitors the difference in the skin blood flow associated with the cardiac cycle. The pump oximeter, containing an image detector and light-emitting diodes (LEDs), is connected to the finger or ear. The red light sent or carried back into the human body tests infrastructure. The distinction between the level of the installation and the amount of deoxygenated haemoglobin helped to measure oxygen saturation. It is used to calculate the heart rate as Photo Plethysmo Graph (PPG).

- **Electrocardiography (ECG):** A waveform that monitors the heart continues to function provides time information. There is also restricted readiness for automation for ECG calculation based on wireless sensor devices.
- **Temperature sensor:** Temperature sensor measure temperature of body and send the information to IoT cloud with the help of Arduino and Esp8266 module.

4.3. Methodology

- **Objective:** Develop a Health Monitoring System for real-time tracking of vital signs.Technologies: Choose wearable IoT devices and a cloud-based platform for data storage and analysis.
- **User Interface:** Design a user-friendly mobile app displaying individual health metrics with easy-to-understand visuals.
- **Data Collection Setup:** Install IoT devices like smartwatches for continuous monitoring of heart rate, sleep patterns, and physical activity.
- **Connectivity:** Establish secure connections between devices and the cloud platform using Bluetooth or Wi-Fi.

- **Data Storage:** Set up an encrypted cloud database to store health data securely.
- **Real-time Monitoring:** Implement a data streaming mechanism for instant transmission of health data to the cloud.
- **Scalability:** Design the system to accommodate a growing user base and additional monitoring devices.
- **Testing:** Conduct thorough testing to ensure accurate data collection and transmission.
- **User Training:** Train users to use the mobile app and understand their health metrics.

4.4. Analysis:

- **Data Processing:** Collect and preprocess continuous health data to eliminate errors.
- **Feature Extraction:** Identify key features like abnormal heart rate patterns or sleep disturbances.
- **Data Analytics:** Use analytics tools to uncover trends and correlations in health data.
- **Machine Learning:** Implement a machine learning model to predict potential health issues based on historical data.
- **Visualization**: Create user-friendly dashboards displaying health trends and personalized insights.
- **Alerts:** Set up instant alerts for healthcare providers and users in case of abnormal health conditions.
- **Feedback**: Gather feedback from users and healthcare professionals on system performance and usability.
- **Compliance:** Ensure the system complies with healthcare standards and regulations, updating as needed.

This demonstrates the step-by-step process of implementing a Health Monitoring System and analyzing the collected data to provide valuable insights for both users and healthcare providers.

4.5. Blocks Diagram

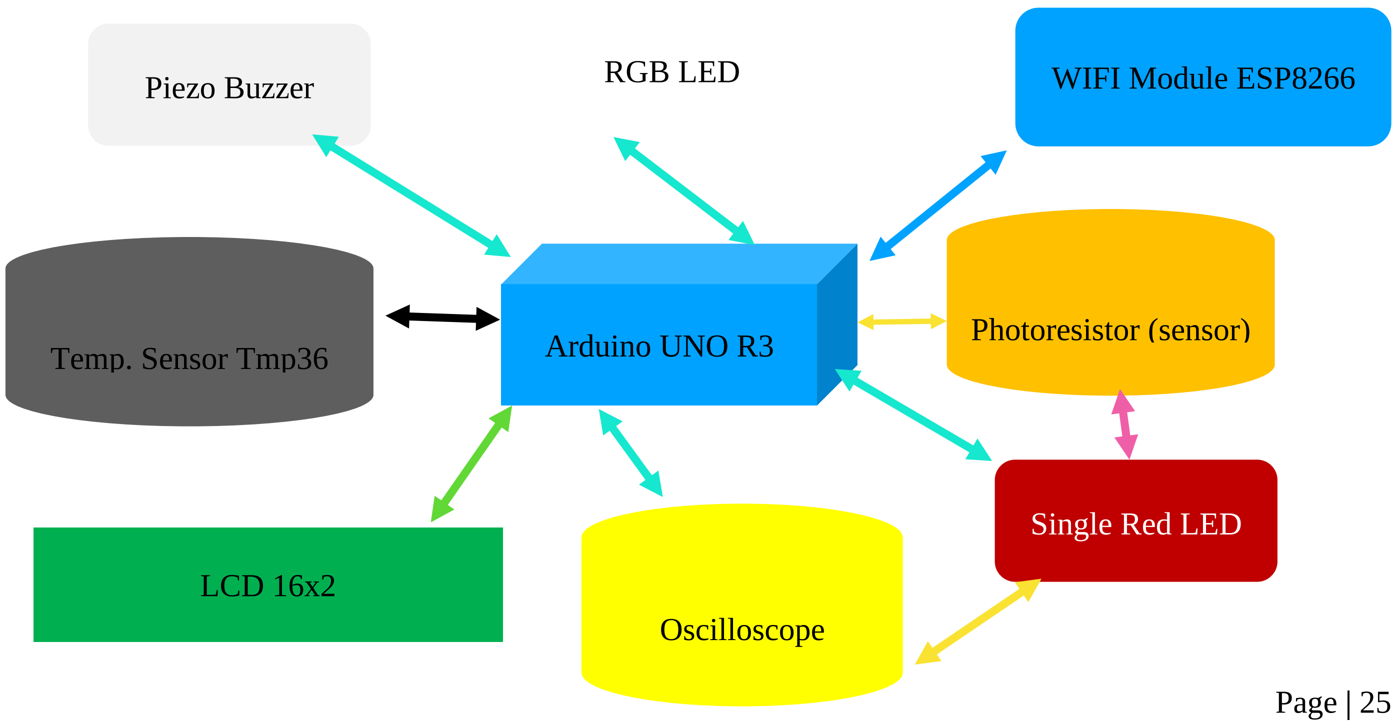

Fig.4.1. Block Diagram

Block diagram shows the connecting to the various block with each other, which are the used in the mini project, together with a functional Arduino UNO. The temperature Sensor is used to sense and measure object/body temperature. Oscilloscope will show the Electro Cardiography (ECG) waveforms and monitor the pulse rate of heartbeat. Photoresistor will help to control the pulse rate because LED had has no any function to generate waveform. LCD will display the real time body temperature and Pulse rate for heartbeat. Piezo buzzer generate different alert sound and RGB led will also indicate the different monitoring condition for patient by glowing in different color. And WiFi ESP8266 module help to connect the Arduino to transfer data to the IoT cloud.

4.6. CIRCUIT DIAGRAM

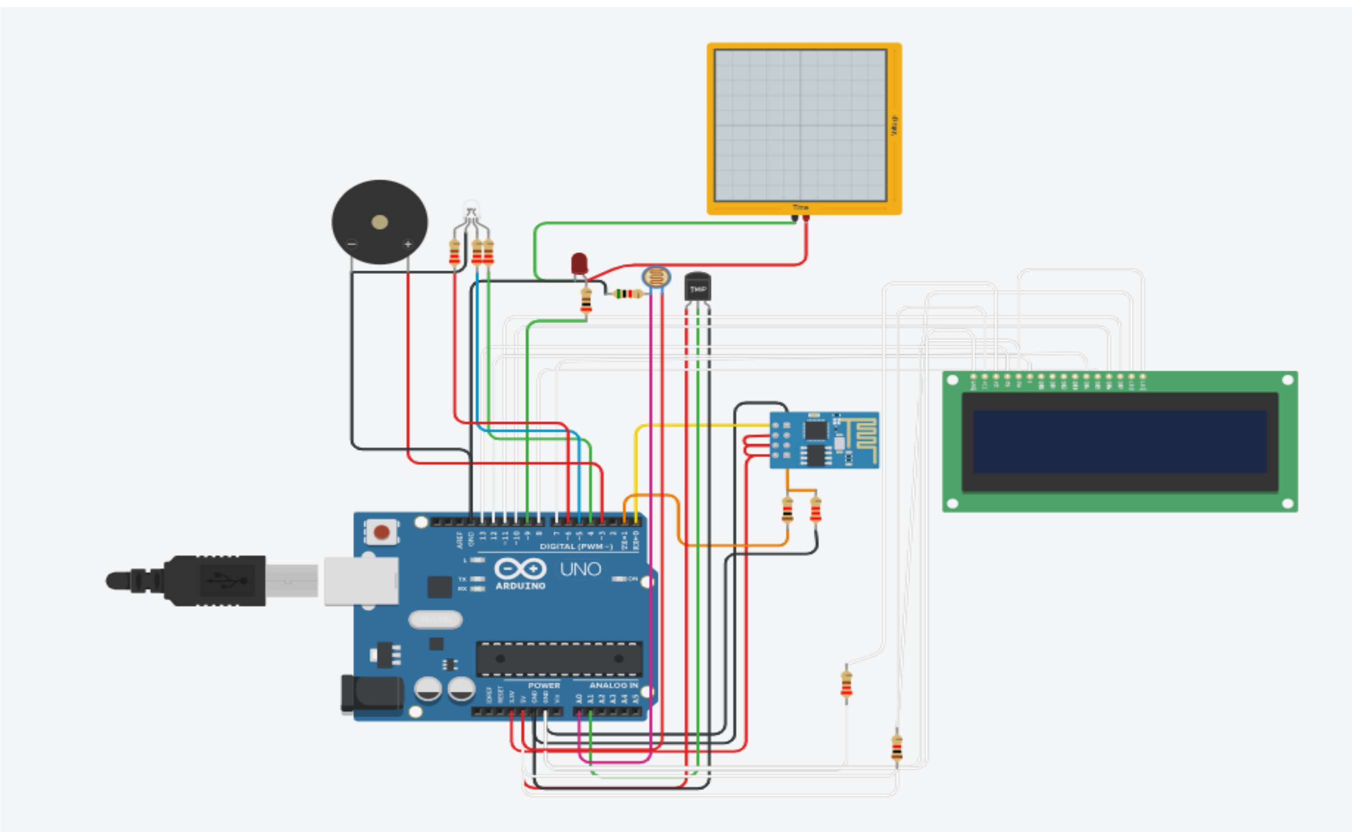

Fig 4.6.1 Circuit Diagram of Health Monitoring System

The circuit diagram shows a simple setup for a Piezo, RGB LED, LED, Oscilloscope, LCD 16x2, Photoresistor Diode, Temperature sensor, Wifi module ESP82666 controlled by an Arduino Uno. The Piezo is connected to Arduino pin 3, which is a digital output pin. The negative terminal are connected to GND pins, respectively.

The circuit diagram also shows an temperature sensor connected to Arduino pins A1 for Input and 5V for powers. Similarly Photoresistor diode connected to Arduino pins A0 input and 5V for powers as shown in circuit Diagram . Similarly LCD pins are connected to Arduino's digital output pin 13,12,11,10,8,7 for Register, Enable, D4,D5,D6,D7 and VCC and Anode Pins of Lcd are connected to 5V for powers. VSS, contrast, Read and write pins are connected to ground respectively. RGB LED red, blue and green are connected to Arduino output pins 6,5,4 respectively. And RED single LED connected to the Arduino digital pins 9 for output. And oscilloscope also connected through same point.

4.7. Schematic Diagram

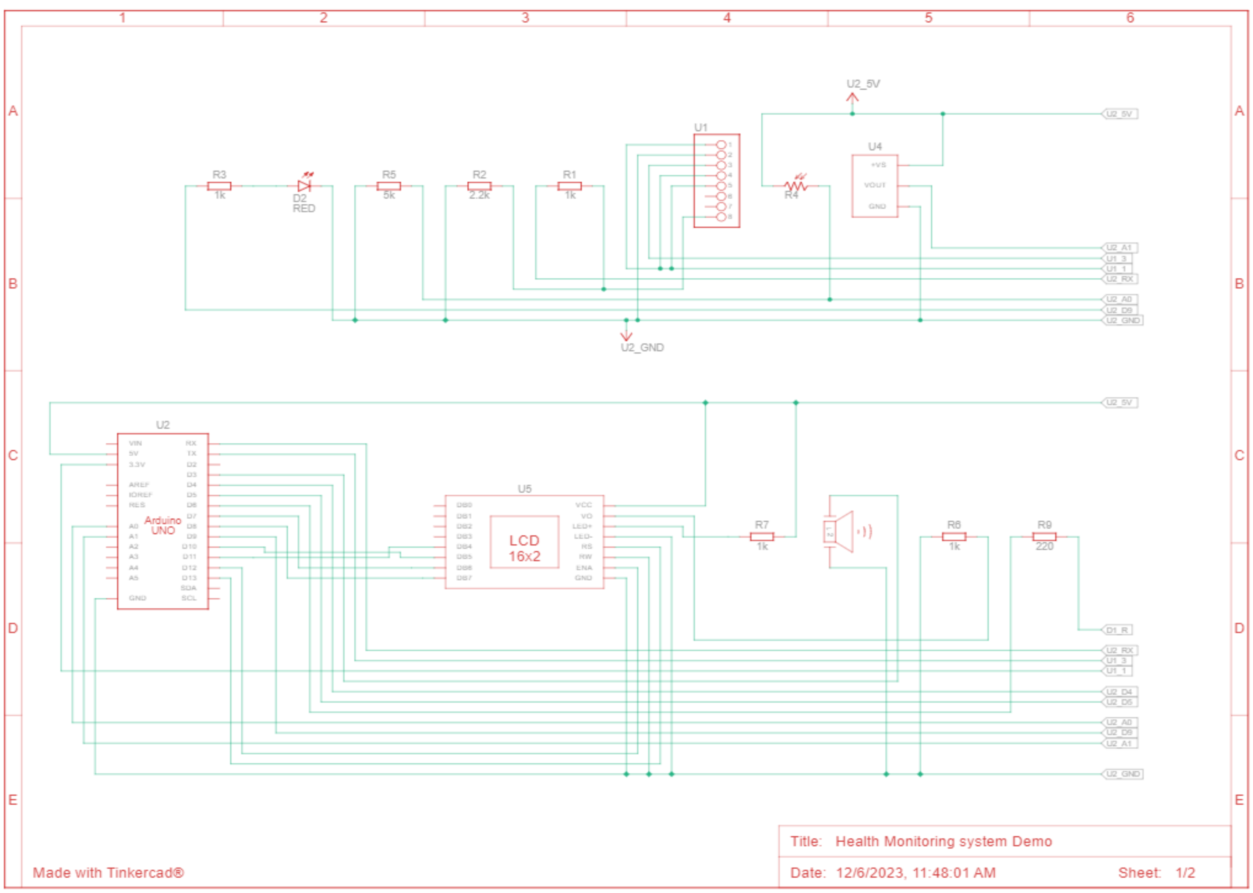

Fig 4.7.1. Health Monitoring System Schematic View Sheet1

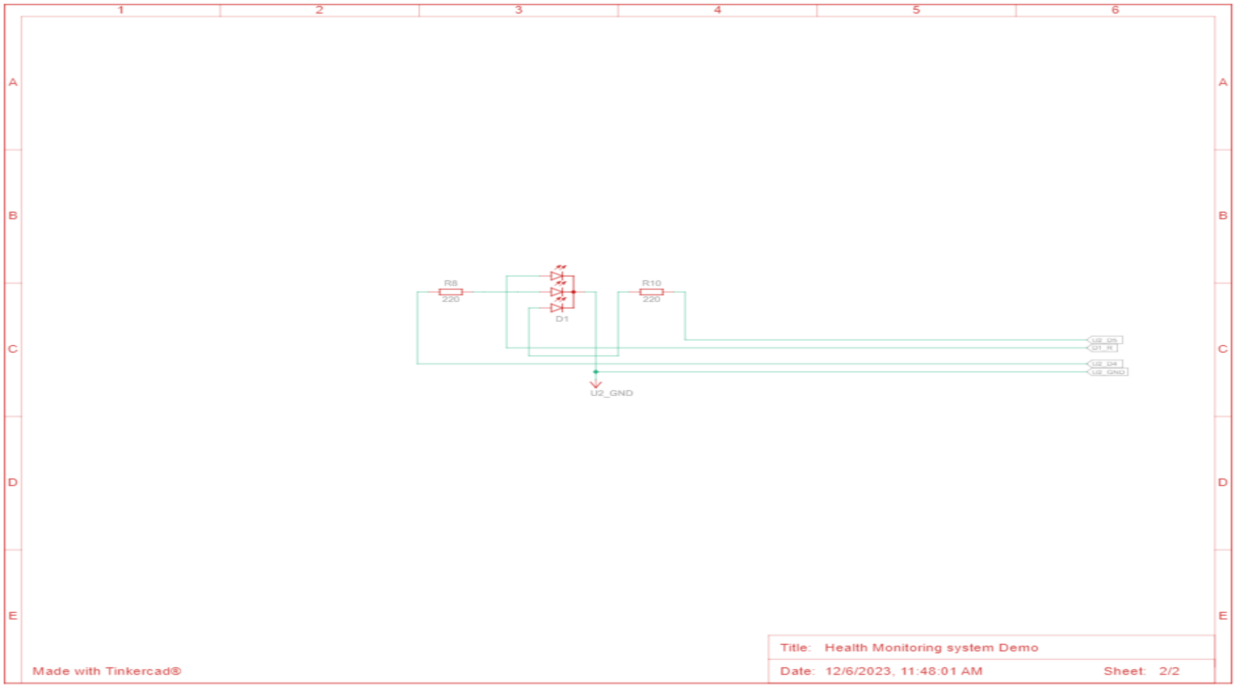

Fig 4.7.2. Health Monitoring System Schematic View Sheet2

A schematic diagram is a graphical representation of a system or process that uses symbols, lines, and connections to convey information visually. It is a way to illustrate the structure and connections within a system in a simplified and easy-to-understand manner. In above Schematic Diagram of all of the Symbols, Lines and Connections, Power Sources and Ground, Labels and Annotations, Blocks and Modules, Arrows, Dot at connection Points, Wiring and connectors have their usual and all are connected as above mentioned in Circuit Diagram.

4.8. Working Mechanisms

Here is shortly describe the working model of each components which make complete simulation.

- Arduino UNO control all of the rest components, it provides Powers, INPUT and Output signal to the devices and share the information to each other.
- Red light is supposed to be like human body which pulse should be controlled with the help of photoresistor diode and Electro cardio graph can be seen in the Oscilloscope. And temperature and sensor measure the temperature of body.
- LCD 16x2 is used to shown the temperature of body in Fahrenheit and pulse rate in BPM.
- Piezo and RGB LED are used to alert or notify different medical situation such as Piezo only two condition as when pulse rate is general condition or it represents as body is life then it produce small and regular beat like really ECG machines produced and otherwise it will produce Long regular Beat Sound which indicates is there is no life in body or dead condition. And RGB LED represents or show

RED colour in medical emergency situation or in dead case, yellow or Orange or purple colour in case of little bad or disturbance in medical condition. While Green colour represents normal condition or all ok.

- And Wifi Module ESP8266 is used to connect the Arduino with router or send data to cloud through router.

CHAPTER-5

RESULTS AND INFERENCE

1.1 Results

The Health Monitoring System with IoT Integration showed success in early detection of pulse rate and body temperature of patient. It reliably transmitted data from sensors to the IoT platform, promptly notifying take care person or doctor or any others through messages or notifications when abnormal conditions were detected. The system's user-friendly remote monitoring interface, accessible via web browsers or mobile apps, proved efficient. Power management features optimized energy use without compromising performance, and security measures effectively protected data transmission. The system demonstrated adaptability to different environments and successfully educated users on its capabilities. Future considerations for improvement include mobile app integration and exploring machine learning algorithms. Overall, the system was successfully deployed in real-world scenarios, contributing to enhanced the Health Monitoring System in various sector. The above mini projects show the result for detecting pulse rate of patient. Here below we can see the result that how it will show the detection and how it works.

5.1.1. Simulation Results in TinkerCad:

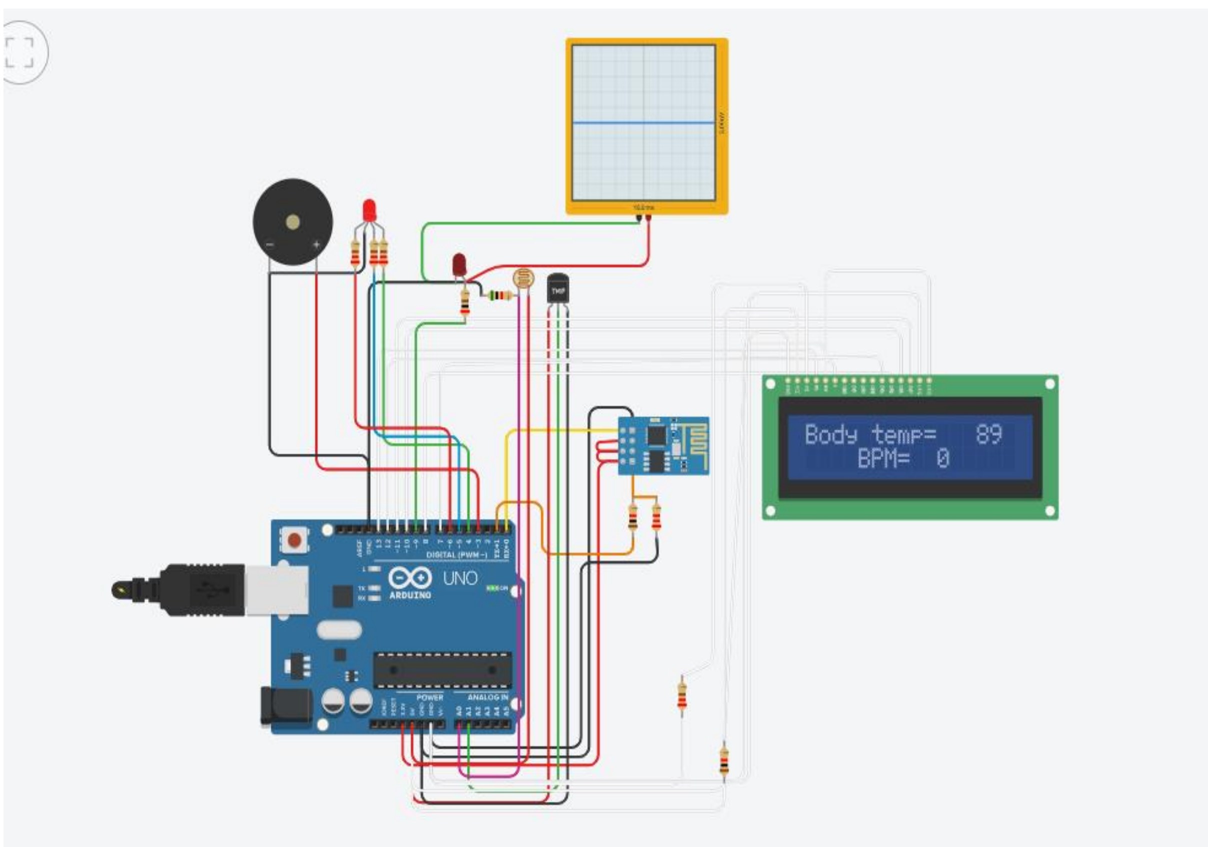

Fig 5.1.1. Simulation image when the pulse rate is about zero or Dead patient

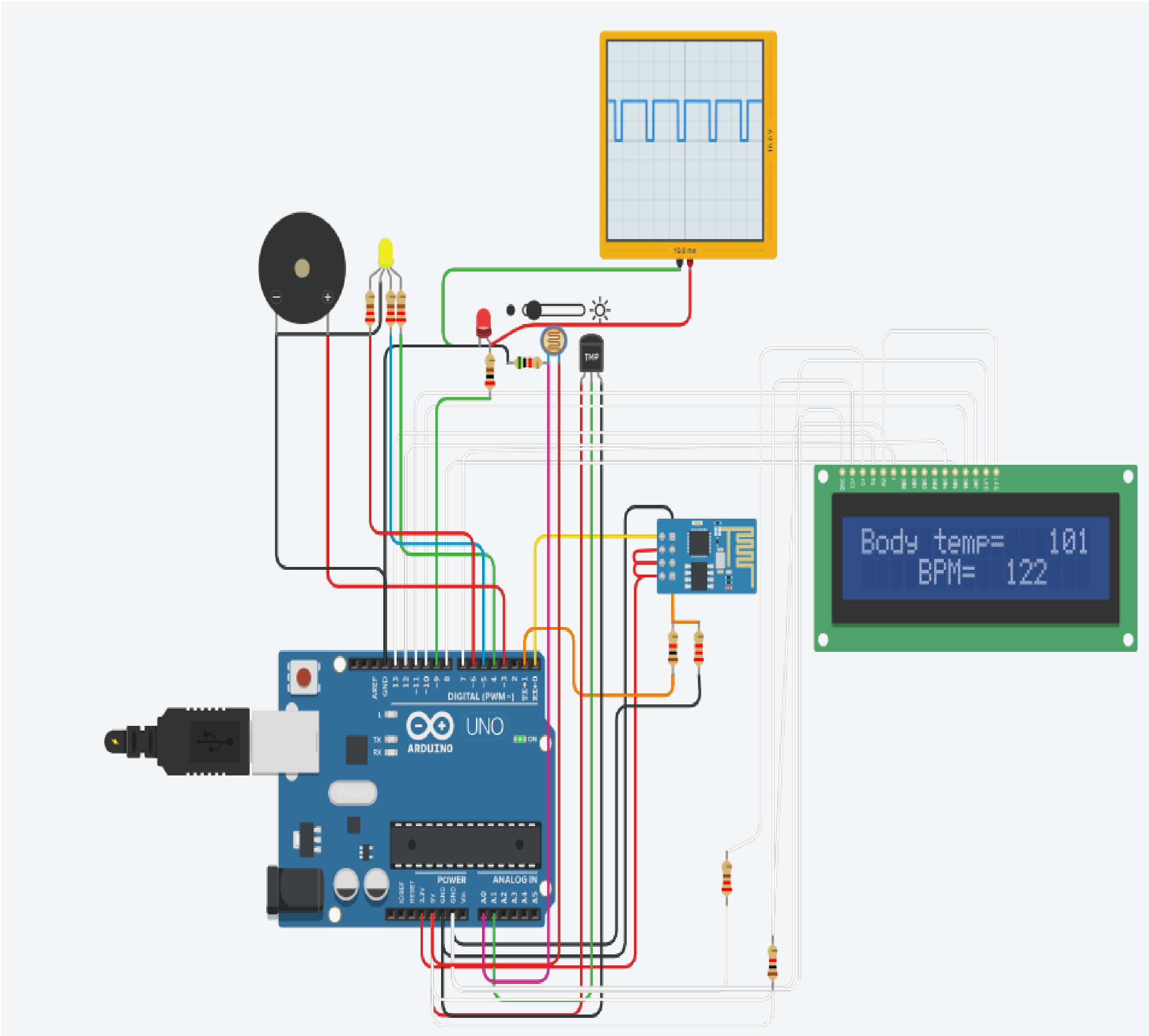

Fig 5.1.2. Simulation image when the pulse rate is at general health disturbance condition

5.1.2. Simulation Results in IoT:

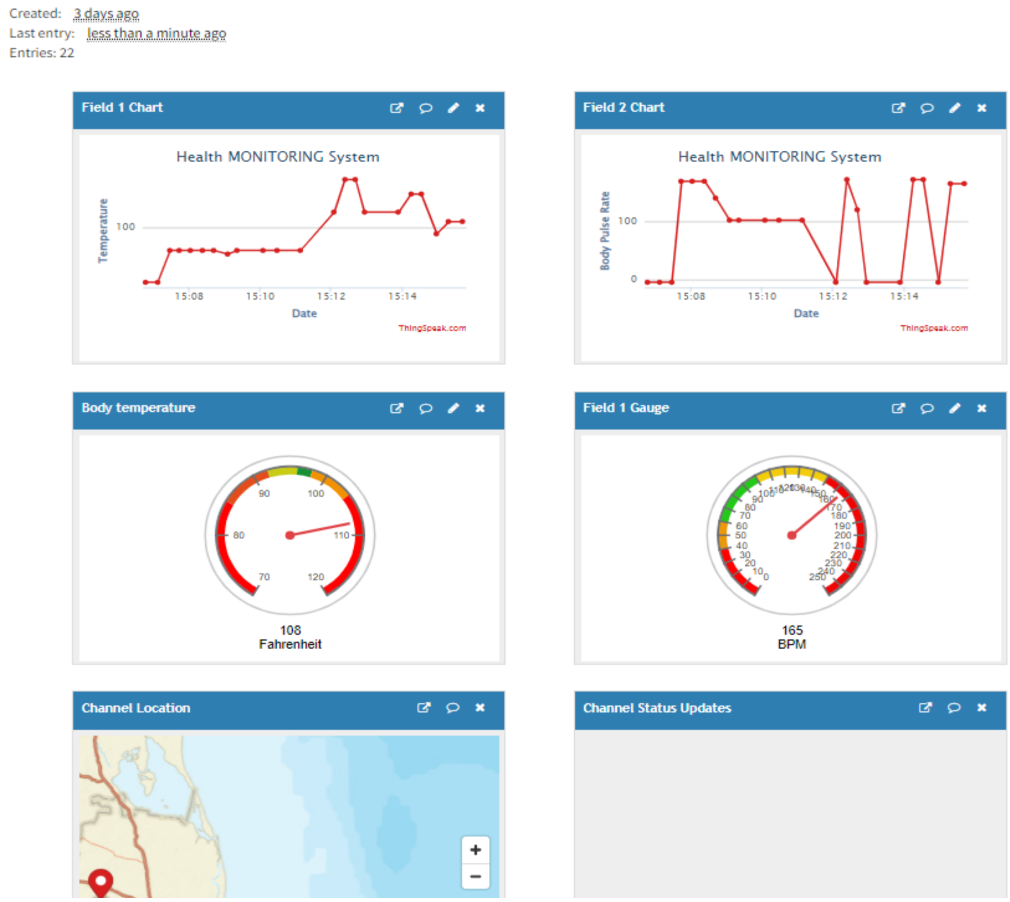

Fig 5.1.3. Simulation image in the IoT

5.2 Inference

The Health Monitoring System with IoT Integration experiment concluded that the developed system effectively detects the real time patient heart pulse rate in unit BPM (beat per minute) and temperature in degree in Fahrenheit (F) early on by monitoring changes in temperature and changes in pulse rate. The reliable transmission of data to the Internet of Things (IoT) platform ensures quick notifications notifying take care person or doctor or any others when abnormal conditions are detected. The user-friendly remote monitoring interface, power optimization, and security measures contribute to the system's overall effectiveness. The successful real-world deployment of the system demonstrates its practical application in enhancing the body temperature and pulse rate measures. The positive outcomes suggest that integrating IoT technologies with Health Monitoring Systems can significantly improve early detection and emergency response, making save the patient life. It is one of the most trending and necessity technology it will help to save life of thousands of patients. It helps to doctor to monitor lots of patient at a time which is much reliable condition in case of emergency and other and deficient Case.

CHAPTER-6

CONCLUSION AND FUTURE ENHANCEMENTS

6.1 Summary of this project

In summary, our project focused on creating a Health Monitoring System with IoT Integration to help the Doctor and Take care person to monitor the patient from far places. By using smart sensors, we developed a system that can detect changes in body temperature and Heart beat rate of real time early to early, helping to prevent patient from any emergency abnormal condition. The system reliably sends this information to the internet, allowing users (doctors or any others) to monitor and receive data and alerts remotely through an easy-to-use interface. We made sure the system uses power wisely and added security measures to protect the data. The experiment's success in real-world situations shows that our system can be a valuable tool in improving fire safety and responding swiftly to potential risks. It is one of the most reliable necessary in recent time and future.

6.2. Future enhancement

Designing a health monitoring system involves continuous improvement and adaptation to meet the evolving needs of users and advancements in technology. Here are some future enhancement ideas for a health monitoring system:

- **Integration with Wearable Devices:**
  Incorporate compatibility with a wide range of wearable devices, such as smartwatches, fitness trackers, and medical wearables, to gather comprehensive health data.
- **Machine Learning and Predictive Analytics:**
  Implement machine learning algorithms to analyze historical health data and provide predictive insights. This can help in early detection of potential health issues and personalized health recommendations.
- **Real-time Data Streaming:**
  Enable real-time monitoring and streaming of health data, allowing healthcare professionals to receive immediate alerts in case of anomalies or emergencies.
- **Blockchain for Data Security:**
  Explore blockchain technology to enhance the security and integrity of health data, ensuring that patient information remains private and tamper-proof.
- **Telehealth Integration:**
  Integrate telehealth features to allow users to consult with healthcare professionals remotely. This can include video consultations, secure messaging, and the ability to share health data during virtual appointments.

- **Smart Health Alerts:**
  Develop intelligent alert systems that provide actionable insights to users based on their health data. Alerts could include reminders for medication, suggestions for physical activity, or notifications about potential health risks.
- **Genomic Data Integration:**
  Incorporate genomic data analysis to provide personalized health recommendations based on an individual's genetic makeup, enabling more targeted and effective healthcare strategies.
- **Social and Community Features:**
  Include social and community features within the system to encourage users to connect with others who share similar health goals. This can foster a supportive environment and promote healthy lifestyle choices.
- **Voice and Natural Language Processing:**
  Implement voice recognition and natural language processing capabilities for hands-free interaction with the health monitoring system. Users can inquire about their health status or receive spoken recommendations.
- **Expanded Health Metrics:**
  Continuously expand the range of health metrics monitored by the system, including factors like sleep quality, stress levels, and nutritional intake, to provide a more comprehensive picture of overall well-being.
- **User-friendly Interfaces:**
  Focus on creating intuitive and user-friendly interfaces for both healthcare professionals and end-users to enhance the overall user experience and encourage regular engagement.
- **Regulatory Compliance:**
  Stay updated on healthcare regulations and ensure the system complies with data protection laws and industry standards to guarantee the privacy and security of user information.
- **Continuous User Education:**
  Provide ongoing education to users about the importance of health monitoring and how to interpret their health data, empowering them to take proactive steps toward better health.
- **Environmental Monitoring:**
  Consider integrating environmental factors (such as air quality and pollen levels) into the health monitoring system, as these can impact individuals with certain health conditions.
- **Customizable and Adaptive Algorithms:**
  Allow users to customize algorithms and parameters based on their specific health goals and conditions, ensuring a personalized and adaptive monitoring experience.
  Regular feedback from users, healthcare professionals, and advancements in technology should guide the evolution of the health monitoring system to address emerging needs and opportunities

CHAPTER-7

APPENDIX

3.2. Code for the project

```
String ssid     = "Simulator Wifi";  // SSID to connect to
String password = ""; // Our virtual wifi has no password
String host     = "api.thingspeak.com"; // Open Weather Map API
const int httpPort   = 80;
String uri      = "/update?api_key=ZV5R0KC6XUHXK13H&field1=0&field2=0";
#include <LiquidCrystal.h>

int a = 0;
int temp=0;
LiquidCrystal lcd(13,12,11,10,7,8);

int setupESP8266(void) {
  // Start our ESP8266 Serial Communication
  Serial.begin(115200);   // Serial connection over USB to computer
  Serial.println("AT");   // Serial connection on Tx / Rx port to ESP8266
  delay(10);        // Wait a little for the ESP to respond
  if (!Serial.find("OK")) return 1;

  // Connect to 123D Circuits Simulator Wifi
  Serial.println("AT+CWJAP=\"" + ssid + "\",\"" + password + "\"");
  delay(10);        // Wait a little for the ESP to respond
  if (!Serial.find("OK")) return 2;

  // Open TCP connection to the host:
  Serial.println("AT+CIPSTART=\"TCP\",\"" + host + "\"," + httpPort);
  delay(50);        // Wait a little for the ESP to respond
  if (!Serial.find("OK")) return 3;

  return 0;
```

```
}

void anydata(void) {

  int temp = map(analogRead(A1),20,358,-40,125);
  int sensorValue= analogRead(A0);
  int a= map(sensorValue,0,1023,0,225);
  // Construct our HTTP call
  String httpPacket = "GET " + uri + "&field1=" + String(temp) + "&field2=" + String(a) + " HTTP/1.1\r\nHost: " + host + "\r\n\r\n";
  int length = httpPacket.length();

  // Send our message length
  Serial.print("AT+CIPSEND=");
  Serial.println(length);
  delay(10); // Wait a little for the ESP to respond if (!Serial.find(">")) return -1;

  // Send our http request
  Serial.print(httpPacket);
  delay(10); // Wait a little for the ESP to respond
  if (!Serial.find("SEND OK\r\n")) return;
}

void setup() {
   Serial.begin(115200);  // Serial connection over USB to computer
  setupESP8266();
   pinMode(A0, INPUT);
   pinMode(A1, INPUT);
  pinMode(9, OUTPUT);
  pinMode(6, OUTPUT);
  pinMode(5, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(3, OUTPUT);
```

```
  lcd.begin(16,2);

}

void loop() {
  anydata();
  int sensorValue= analogRead(A0);
  int i;
  Serial.println(sensorValue);
  int a= map(sensorValue,0,1023,0,225);
  Serial.println(a);
  if (a>40 && a<=210){
  tone(3, 1200, 100); // 1200 Hz frequency for 100 milliseconds (short duration)
  delay(500); // Pause between beats
  noTone(3); // Turn off the buzzer
    for(i=10;i<=200;i+=1){

      analogWrite(9,i);
    }
    for(i=250;i<=10;i-=1){

      analogWrite(9,i);

    }}
    else{ analogWrite(9,0);
    tone(3, 800, 10000); // 1000 Hz frequency for 100 milliseconds (short duration)
  delay(1550); // Pause between beats
  noTone(3);
        }



  int temp = map((analogRead(A1)),0,1023,70,200);
      lcd.setCursor(0,0);
```

```
    lcd.print("Body temp=");
    lcd.setCursor(0,1);
    lcd.print("BPM= ");
    lcd.setCursor(12,0);
    lcd.print(temp);
    lcd.setCursor(6,1);
    lcd.print(a);
  if((temp>96 && temp<=98) && (a>60 && a<=100)){
   digitalWrite(4,HIGH);
   digitalWrite(5,LOW);
   digitalWrite(6,LOW);
  }
  else if((temp>90 && temp<=96) || (temp>100 && temp<=106) || (a>50 && a<=60) ||(a>100 &&
a<=150) )
  { digitalWrite(5,LOW);
   digitalWrite(4,HIGH);
   digitalWrite(6,HIGH);


  }
  else if((temp<=90) || (temp>106) || (a<50) ||(a>150) )
  { digitalWrite(5,LOW);
   digitalWrite(4,LOW);
   digitalWrite(6,HIGH);
  }

delay(2000);


}
```

3.3. Explanation of Code

This Arduino code appears to be for a project that involves an ESP8266 module interfaced with an Arduino board. The project includes temperature and heart rate monitoring, a buzzer for sound feedback, and LCD display for visual feedback.

- **Wi-Fi Configuration:**
  The ‘ssid’ and ‘password’ are defined for connecting to a Wi-Fi network.
  The host variable is set to the address of the Open Weather Map API.
- **Hardware Setup:**
  Pins for the LCD display and buzzer are defined.
  An instance of the ‘LiquidCrystal’ library is created for interfacing with the LCD.
- **ESP8266 Setup:**
  The setupESP8266 function initializes communication with the ESP8266 module over serial.
  It sends AT commands to the ESP8266 for basic setup and Wi-Fi connection.
  It establishes a TCP connection to the specified host.
- **Data Sending Function (anydata):**
  Reads analog values from A0 and A1 pins, representing a sensor and a temperature sensor, respectively.
  Maps these values to meaningful ranges (temperature and a).
  Constructs an HTTP GET request with the mapped values and sends it to the specified host.
- **Arduino Setup (setup):**
  Initializes serial communication and ESP8266 setup.
  Defines pin modes for inputs and outputs.
- **Main Loop (loop):**
  Calls the anydata function to send sensor data to the specified host.
  Reads analog values from A0, maps it to a meaningful range, and triggers actions based on the range.
  Maps the analog value from A1 to represent body temperature and displays it on an LCD.
  Sets the states of three LEDs based on temperature and heart rate ranges.
  Introduces delays to control the loop frequency.
- **Buzzer Feedback:**
  If the heart rate (a) is within a certain range, the buzzer produces a tone, and the LED brightness is modulated.
- **LCD Display:**
  Displays body temperature and heart rate on an LCD screen.
- **LED Feedback:**
  Three LEDs are controlled based on temperature and heart rate ranges.
  Delay:
  A delay of 2000 milliseconds (2 seconds) is introduced at the end of the loop.

It seems like the project is designed to monitor body temperature and heart rate, providing visual and audio feedback based on certain conditions. The ESP8266 is used for Wi-Fi connectivity, and data is sent to a remote server (ThingSpeak) using HTTP GET requests. The Arduino controls the sensors, actuators, and feedback components

CHAPTER 8
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Thank You!!