B.E. PROJECT REPORT

On

Smart Health Detector and Monitoring System

Submitted by

Adwait Patil (B190453105)

Tejas Joshi (B190453056)

Atharva Joshi (B190453009)

UNDER THE GUIDANCE OF

Prof. Shubhangi Joshi (Internal Guide)

IN PARTIAL FULFILMENT OF

B.E. (ELECTRONICS AND TELECOMMUNICATION)

SAVITRIBAI PHULE PUNE UNIVERSITY

2022-2023

MARATHAWADA MITRA MANDAL'S COLLEGE OF ENGINEERING, PUNE- 52

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

MARATHAWADA MITRA MANDAL'S
COLLEGE OF ENGINEERING, PUNE

Permanently Affiliated to SPPU

Accredited with 'A' Grade by NAAC

Recipient of 'Best College' Award by SPPU

Accredited by NBA (Electrical and Mechanical Engineering

CERTIFICATE

This is to certify that the seminar report entitled

Smart Health Detector and Monitoring System

by

Adwait Patil - B190453105

Tejas Joshi - B190453056

Atharva Joshi - B190453009

is Bonafide work carried out by them under the supervision of Prof. Shubhangi Joshi and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University for the award of the degree of Bachelor of Engineering (Electronics and Telecommunication)

This project report has not been earlier submitted to any other Institute or University for the award of any degree or diploma

Prof. Shubhangi Joshi	Dr. G. S. Gawande	Dr. V. N. Gohokar
Department of ENTC	Head of Department of ENTC	Principal

External Examiner Name and Signature:

Date:

Unicore AiMinds
Pvt. Ltd.

Date: 22nd November 2022

BE Project Sponsorship

We are pleased to sponsor following students of Electronics and Telecommunication Engineering from Marathwada Mitramandal College of Engineering Pune for academic year 2022-2023. The title of the Project "Smart Health Detector and Monitoring System".

1. Adwait Patil
2. Tejas Joshi
3. Atharva Joshi

The terms and conditions for the project sponsorship are as mentioned below. The students have to adhere to them to get the final certificate of project completion.

CONFIDENTIAL INFORMATION-

• Unicore AiMinds Pvt. Ltd. would be disclosing to the sponsored students certain technical and commercial information, including but not limited to, methods, data parent, application policies, standard operation procedures, hardware designs, schematics, scientific, commercial technical information, confidential technology, and proprietary information (Confidential Information) either directly or indirectly and which Unicore AiMinds Pvt. Ltd. considered to be privileged, proprietary and confidential.

• The students acknowledge that any confidential information is the sole, exclusively and extremely valuable property of the Unicore AiMinds Pvt. Ltd. Accordingly the students agree not to reproduce any of the confidential information without Unicore AiMinds Pvt. Ltd. prior consent, and not to disclose or divulge all or any part of any confidential information in any form to any third party, either during or after the term of this Agreement.

• The students do not directly or indirectly, in any way, reveal, report, publish, disclose, transfer or otherwise use any of the confidential information except as specifically authorized by Unicore AiMinds Pvt. Ltd. for academic purpose only.

OWNERSHIP OF INTELLECTUAL PROPERTY RIGHTS-

• All rights, title and interest including all type of intellectual property and ownership rights in all developments, inventions, ideas, works, designs, documentation etc. made in the field of computer software, hardware engineering or related activities, by the students during this period of sponsorship shall belong to and vest absolutely in Unicore AiMinds Pvt. Ltd. and the students or any of its associations are not entitled to claim any right title or interest of any nature whatsoever in respect thereof. Upon end of the sponsorship period students shall immediately deliver to Unicore AiMinds Pvt. Ltd. and all equipments made available to them, all records, manual books, forms, documents, plans, notes, stationery, hardware, notebook, reports, data, tables, calculations, summaries, and copied thereof.

Thanks and Regards,
For Unicore AiMinds Pvt. Ltd.

KPatwardhan

UNICORE AIMINDS PVT. LTD. PUNE

Kunal Patwardhan
Founder Director

ACKNOWLEDGEMENT

During the completion of this project, we got inspiration from several people in our institution, MMCOE Karvenagar, Pune. We take this opportunity to express our warm gratitude for letting us explore and provide the knowledge and experience we gained while completing this project.

We thank our principal, Dr. V. N. Gohokar, for always being an inspiration in challenging situations. We are also indebted to our HOD. Dr. G. S. Gawande, for piloting us whenever we faced difficulties at work.

We thank our project guide Prof. Shubhangi Joshi for her moral support and technical support in completing our project. We would also like to thank our External Guide Mr. Kunal Patwardhan from Unicore AiMinds Pvt. Ltd. We also present our sincere thanks to our staff members for their constant unconditional support and care. We also sincerely thank other faculty members of our college who have proved to be instrumental in helping us in various ways and proved inspirational throughout the project work.

We would also like to thank our parents, family members, and friends, who have shown their patience and unwavering support without whom, the project wouldn't have been possible.

Adwait Patil

Tejas Joshi

Atharva Joshi

ABSTRACT

IoT devices are becoming more and more useful in today's interconnected world. In today's era, IoT devices are increasing and it has a huge impact on healthcare. IoT facilitates the early detection of health problems and also reduces the cost of medical care significantly. The healthcare monitoring system is perfect for a patient who needs to be monitored 24 X 7. The IoT-based health monitoring system can always monitor the vital health parameters of a person. Further, IoT-based smart systems enable remote monitoring of the patient by the guardian/ family member which is considered one of the major advantages to save precious human life. This paper provides an overview of one of the many IoT-based health monitoring systems which can help prevent health problems. The proposed system here consists of various medical devices such as sensors and web-based or mobile-based applications that communicate via network-connected devices and helps to monitor and record patients' health data and medical information. The proposed outcome of the paper is to build a system to provide world-class medical aid to patients even in the remotest areas with no hospitals in their areas by connecting over the internet and grasping information about their health status via the wearable devices provided in the kit using an ESP32 micro-controller which would be able to record the patient's heart rate, SpO2 and temperature, and humidity.

Contents

List of Figures

List of Tables

Chapter 1

INTRODUCTION

Health is always a major concern in every growth the mortal race is advancing in terms of technology. The recent nimbus contagion attack that has ruined the frugality of China to an extent is an illustration of how health care has come of major significance. In similar areas where the epidemic is spread, it's always a better idea to cover these cases using remote health monitoring technology. So the Internet of effects(IoT) grounded health monitoring system is the current result for it. Remote Case Monitoring arrangement empowers observation of cases outside of customary clinical settings(e.g. at home), which expands access to mortal services at bringing down charges.

The Smart Health Monitoring System is a technological innovation that has revolutionized healthcare. It is a system designed to monitor and track the vital signs of a patient, providing real-time data that is used to detect and prevent any potential health issues. The importance of the Smart Health Monitoring System in modern healthcare cannot be overemphasized, as it has the potential to save lives and improve the quality of life for patients.

With the advent of the Internet of Things (IoT) and wearable technology, the Smart Health Monitoring System has become more accessible and effective. Smart wearables, such as fitness trackers, smartwatches, and other sensor-equipped devices, have become increasingly popular in recent years. These devices are designed to monitor various health parameters, including heart rate, oxygen saturation, and body temperature, among others. By continuously collecting data, smart wearables can detect early signs of health issues, enabling users to take proactive steps toward improving their health.

One of the most significant advantages of smart wearables is their ability to provide real-time data on a user's health parameters. Users can easily monitor their vital signs, track their physical activity levels, and analyze their sleep patterns, all from a single device. Smart wearables also offer continuous monitoring, allowing users to track changes in their health over time.

In addition to personal health monitoring, smart wearables can also play a significant role in healthcare management. For example, healthcare providers can use smart wearables to remotely monitor patients' health parameters and detect early signs of health issues. This approach can lead to timely interventions, preventing the need for hospitalization or more invasive treatments.

Overall, smart wearables have revolutionized the way we monitor and manage our health. With their ability to provide real-time data, continuous monitoring, and remote healthcare management, these devices are becoming an essential tools in the healthcare industry. As technology continues to advance, we can expect to see even more innovative and sophisticated smart wearables that can help us take control of our health and well-being. Wearable devices such as smartwatches and fitness trackers can be used to monitor a patient's vital signs continuously, providing real-time data that can be analyzed to detect and prevent serious health issues. The core idea of this design is the design and perpetration

of a smart case health shadowing system that uses Detectors to track patient health and the internet to inform loved ones in case of any issues. The idea of developing monitoring systems is to reduce healthcare costs by reducing SMS-grounded case flourishing viewing and IOT grounded case checking frame.
In IoT grounded frame, the subtle corridor of the case flourishing can be seen by different guests. The explanation behind this is the information should be checked by passing by a point or URL. While, in GSM grounded case viewing, the flourishing parameters are transferred exercising GSM by strategies for SMS.

In utmost of the pastoral areas, the medical installation would not be in a hand reach distance for the natives. So typically the people's physician office visits, hospitalizations, and individual testing procedures. Each of our bodies utilizes temperature and also palpitates admitting to reading understanding good. The detectors are linked to a microcontroller to track the status which is therefore connived to a TV screen and also the remote association with the capacity to change alarms.

However, the frame accordingly alarms the customer about the case's status over IoT and likewise indicates subtle rudiments of palpitation and temperature of the case live on the web, If the frame finds any unforeseen changes in understanding heartbeat or body temperature. In this manner IOT set up tolerant good following frame viably utilizes the web to screen quiet good measures and extra persists time. There is a significant capability between neglecting any kind of minor health issues which is shown in the early stages by variation of vital rudiments like body temperatures. 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. "IoT", according to scientific charity, provides a range of services. IoT's main aim, though, is to incorporate organizations, and automation so that messages can are transmitted without interruptions, compared to software creation. The services have improved "intelligent fitness, transportation, grids, parking, and intelligent homes." Therefore, the core goal of IoT is to combine organizations and mechanization to provide messages continuously.

An essential method is a final section containing the company process. These moments of design-based science led to the 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 center. Systematic and professional testing methods should be carried out. The designs should always be considered for any failure, and the designs chosen should be demonstrated to be durable over time.

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. On the other hand, ECG and blood pressure sensors were mounted on the mobile telephone in 2016. We are using Wi-Fi technology for the work in the control area to relay messages on different body functionality, such as blood pressure, pulse rate, body temperature, and oxygen saturation. The demand for personalized and proactive healthcare has led to the development of a wide range of smart health monitoring systems. These systems are designed to collect and analyze real-time data from various sensors, providing insights into the user's health status. The availability of low-cost microcontrollers, sensors, and wireless communication technologies has enabled the development of smart health monitoring systems that are affordable, portable, and easy to use.

In this paper, we present a Smart Health Monitoring System that is built using an ESP32 microcontroller, a MAX30105 SpO2 sensor, a heart rate sensor, and an MLX90614 IR temperature sensor. The ESP32 microcontroller is a low-cost, low-power, and highly programmable microcontroller that offers robust connectivity options, making it an ideal choice for IoT applications. The MAX30105 SpO2 sensor and the heart rate sensor are optical sensors that are designed to measure the oxygen saturation level and heart rate of the user, respectively. The MLX90614 IR temperature sensor is an infrared thermometer that is used to measure the user's body temperature.

The Smart Health Monitoring System is designed to interact with an SQLite database, allowing the storage of the user's temperature, SpO2 readings, and other relevant information. The ESP32 microcontroller uses the MQTT protocol to communicate with the database and transmit data. The MQTT protocol is a lightweight and efficient messaging protocol that is commonly used in IoT applications. The use of an SQLite database ensures that the data is stored securely and can be easily accessed and analyzed. In addition to the hardware components, we have developed a web application using the .NET framework. The web application provides users with real-time access to their health information and enables healthcare professionals to monitor their patients remotely. The .NET framework is a robust and reliable framework that offers a wide range of tools and libraries for developing web applications.

Microcontrollers, such as the ESP32 used in our Smart Health Monitoring System, are low-power and highly programmable devices that offer robust connectivity options. One of the most popular protocols used for communication between microcontrollers and databases is MQTT (Message Queuing Telemetry Transport). MQTT is a lightweight messaging protocol that is ideal for IoT applications, allowing devices to communicate with one another efficiently and effectively.

In our system, the ESP32 microcontroller uses MQTT to interact with the SQLite database, which stores the user's health data. When a sensor reading is taken, the ESP32 publishes the data to the MQTT broker, which then forwards the data to the database. The database then stores the data, allowing healthcare professionals and users to access and analyze it later. By using MQTT, our system ensures that data is transmitted quickly and securely, minimizing the risk of data loss or corruption.
Overall, the Smart Health Monitoring System presented in this paper aims to provide an

efficient and user-friendly approach to health monitoring. By continuously monitoring the user's vital signs, the system can detect early signs of health issues and provide timely intervention. The system is portable, affordable, and easy to use, making it ideal for use in remote areas and in low-resource settings. The web application provides users with real-time access to their health information, promoting proactive healthcare management and enhancing the quality of life for individuals.

Chapter 2

ORGANIZATION OF REPORT

Our project “Smart Health Detector and Monitoring System” is thoroughly explained in all the chapters in this report. Planning and organization of this subject have been done with curiosity and as per the given deadline. So, this project gives the entire overview of this subject.

The report is divided into various chapters to understand each aspect of the subject technically and separately.

- Chapter 1: Gives a brief introduction of the report and what the problem statement is and how we aim to solve it
- Chapter 3: Gives a brief review of the related Literature and the present scenario of the proposed system.
- Chapter 4: Describes Block Diagram and Specification along with a comparison of microcontrollers and a detailed explanation of all the blocks.
- Chapter 5: Describes the implementation of the project with its hardware and software description that is a detailed analysis of each component.
- Chapter 6: Discusses the Result, Conclusion, and Future Scope of the project

Chapter 3

LITERATURE SURVEY

Sr. No	Name of Author	Title of the Paper	Advantages	Disadvantages
1	Kajornkasirat, S., Chanapai, N. and Hnusuwan, B.	Smart Health Monitoring System With IoT	Got an idea about Data Mining and web applications	Paper does not mention anything about connections and hardware
2	Sachin Kumar, Maneesha, Praveen Pandey	Smart Healthcare Monitoring System	Learnt about Zigbee and its advantages	Sufficient information on how to integrate with the project was absent
3	D.Mandal, Organic Nano Piezoelectric Device Laboratory	Human health monitoring system based on piezoelectric smart sensor	Studied about components	Paper does not mention anything about fingerprint sensor
4	Ding Yi, Fan Binwen, Kong Xiaoming, and Ma Qianqian	Design and implementation of a mobile health monitoring system based on MQTT protocol	Got insights about how to build a system with MQTT Protocol	It does not mention anything about hardware and components
5	Divyanshu Tiwari, Devendra Prasad, Kalpana Guleria, Pinaki Ghosh	IoT-based Smart Healthcare Monitoring Systems: A Review	Learnt about how we can implement out system using out configuration	Paper is a bit old and outdated
6	V Tamilselvi, P Vigneshwaran, P Vinu, J.GeethaRamani	IoT Based Health Monitoring System	Got an idea about the C programming we would need for the setup	Paper contains poor knowledge about connections and hardware
7	Nitha V Panicker, A Sukesh Kumar	Development of a heart rate and SpO2 monitoring system for home health application	Got information about heart rate measurement	Paper does not mention anything about fingerprint sensors

Table 3.1: Literature Survey Sem 1

Sr. No	Name of Author	Title of the Paper	Advantages	Disadvantages
8	Mohammad Monirujjaman Khan, Safia Mehnaz, Antu Shaha, Mohammed Nayem, and Sami Bourouis	A comprehensive study on MQTT as a low-power protocol for internet of things application	Got an overview of MQTT Protocols and its working	Does not mention how to implement it accurately
9	Biswajeeban Mishra, Attila Kertesz	The Use of MQTT in M2M and IoT Systems: A Survey	Got an overview of M2M	Information was outdated
10	Vida Rashidi, William Segelström	Evaluating Blazor WebAssembly for the Progressive Web Application Front-End	Got an introduction of how to implement Blazor web app	Insufficient Information about web apps
11	Ding Yi,Fan Binwen,Kong Xiaoming,Ma Qianqian	Altexsoft. (2018, May 10). Progressive Web Apps: Core Features, Architecture, Pros and Cons. Retrieved	Got Deep insight on how blazor technology was built	Got Deep insight on how blazor technology was built
12	Anderson, R., Addie, S. Luke Latham	Build Progressive Web Applications with ASP.NET Core Blazor Web Assembly. Microsoft Docs. Retrieved Mars 10, 2021	Got an idea about ASP. Net Core and Web Assembly	The paper does not mention anything about databases and hardware
13	V Gang Jin, Xiangyu Zhang, Wenqiang Fan	Design of Non-Contact Infra-Red Thermometer Based on the Sensor of MLX90614	Learnt about MLX90614 and its advantages	Sufficient information on how to integrate with the project was absent

Table 3.2: Literature Survey Sem 2

3.0.1 Research Paper Summary

- **Smart Health Monitoring System With Iot -**

  The article discusses the development of an IoT-based smart health monitoring system for COVID-19 patients. The system consists of a number of sensors that collect data on the patient's vital signs, such as temperature, heart rate, and respiratory rate. This data is then transmitted to a cloud server, where it is analyzed by a machine learning algorithm. The algorithm can identify any potential problems and alert the patient's doctor. The system also allows patients to track their own health data and share it with their doctor. This can help to improve the quality of care and reduce the risk of complications.

  The system was tested on a group of 100 COVID-19 patients. The results showed that the system was able to accurately detect and track the patient's vital signs. The system also helped to reduce the risk of complications by alerting the patients' doctors to any potential problems. The system is still under development, but it has the potential to revolutionize the way that COVID-19 patients are monitored and treated. Here are some of the benefits of using an IoT-based smart health monitoring system for COVID-19 patients:

  Early detection of potential problems: The system can identify any potential problems and alert the patient's doctor, which can help to prevent complications. Improved quality of care: The system allows patients to track their own health data and share it with their doctor, which can help to improve the quality of care. Reduced risk of complications: The system can help to reduce the risk of complications by alerting the patients' doctors to any potential problems. Increased patient satisfaction: The system can help to increase patient satisfaction by providing them with a more convenient and efficient way to monitor their health.

- **IoT-Based Health Monitoring System** -

  The article ”IoT-Based Health Monitoring System Development and Analysis” presents a system for monitoring patient’s health using the Internet of Things (IoT). The system consists of three main components: a sensor network, a cloud server, and a mobile app. The sensor network collects data from patients’ wearable devices, such as heart rate monitors, blood pressure monitors, and glucose monitors. The data is then sent to the cloud server, where it is stored and analyzed. The mobile app allows patients to view their health data and communicate with their doctors. The system was developed and tested using a group of 100 patients. The results showed that the system was able to accurately monitor patients’ health data. The system was also able to identify potential health problems early, which allowed patients to receive treatment before the problems became serious. The system has the potential to improve the quality of healthcare by providing patients with more convenient and accurate monitoring of their health data. The system could also help to reduce the cost of healthcare by identifying and treating health problems early. Here are some additional details about the system:

  – The sensor network consists of a variety of wearable devices, such as heart rate monitors, blood pressure monitors, and glucose monitors. The devices are connected to the cloud server using a wireless network.
  – The cloud server stores and analyzes the data collected from the sensor network. The server uses machine learning algorithms to identify potential health problems.
  – The mobile app allows patients to view their health data and to communicate with their doctors. The app also allows patients to set up alerts that will notify them if their health data falls outside of a safe range.

Chapter 4

BLOCK DIAGRAM AND EXPLANATION

4.1 Block Diagram

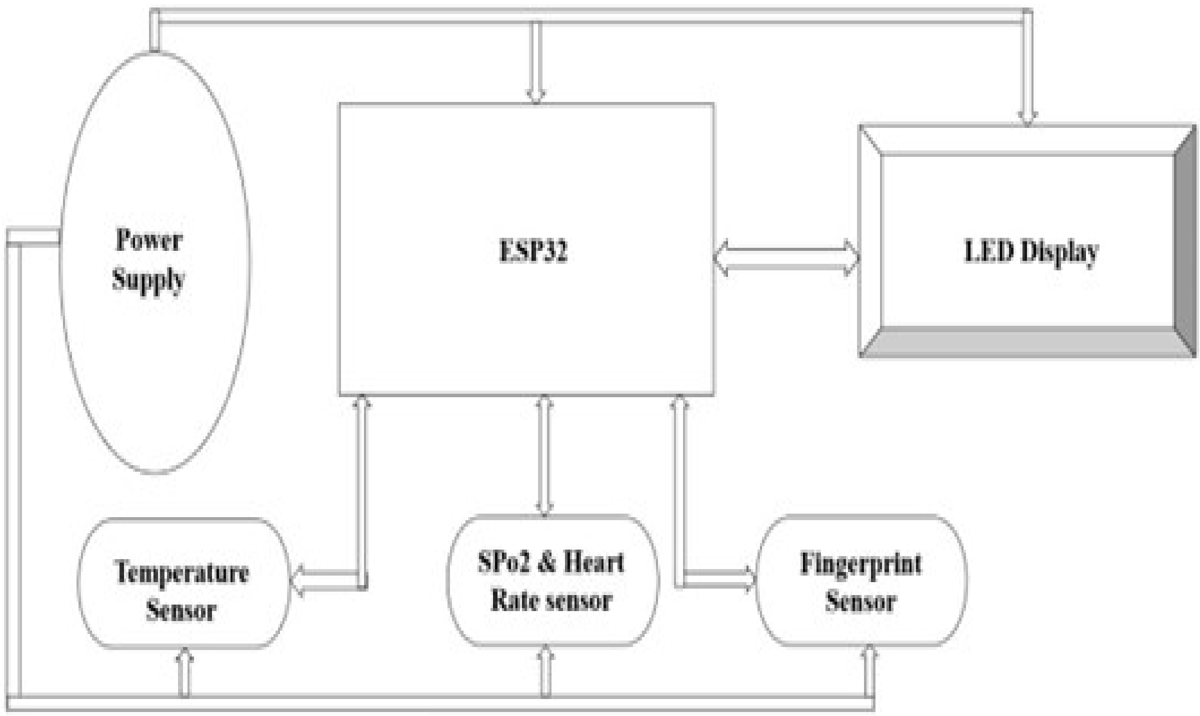


Figure 4.1: System Block Diagram

4.2 Detailed Explanation

The Block diagram Consists of three main sections:-

- Data
- Health and Biometric Monitoring Sensors
- ESP32
- Web Server
- User Interface
- Data Analysis and Prediction

Explanation -

- **Data** - Data collected from all the sensors is collected and sent to the ESP32. The sensors we are using are fingerprint, SpO2, and heart rate sensors.

- **Health and Bio-metric Monitoring Sensors** – This block consists of all the sensors embedded in this system. We have integrated fingerprint, heart rate and SpO2 sensors onto this system. MQTT is an OASIS standard messaging protocol for the Internet of Things (IoT). It is designed as an extremely lightweight publish/subscribe messaging transport that is ideal for connecting remote devices with a small code footprint and minimal network bandwidth.

- **ESP32** – This is the brains of the entire setup. ESP32 handles all the inputs from the sensors and parses all this data to the database using MQTT Protocol. ESP32 is a low-powered microcontroller that is integrated with a WiFi and Bluetooth module, hence making it integral to this IoT setup. Another reason for using the ESP32 over the Arduino UNO is that it is much more powerful since it is 32-bit compared to the 8-bit Arduino UNO.

- **Web Server** - The SQLite central database is where all the processed data from the sensors will be stored. SQLite is a database engine written in the C programming language. It is not a standalone app rather, it is a library that software developers embed in their apps.

- **User Interface** – A web application where all this data stored on the database is going to be displayed. .NET Framework is a software development framework for building and running applications on Windows and the web. Blazor apps are composed of reusable web UI components implemented using C#, HTML, and CSS

4.3 Comparison of microcontrollers in tabular form

Parameters	**ESP8266**	**ESP32**
MCU	XTensa Single Core 32-bit L106	XTensa Single Core 32-bit L106e
Bluetooth	None	4.2 and below
Typical Frequency	80 MHz	160MHz
SRAM	160 KBytes	512 KBytes
Hardware/Software PWM	None/8 Channels	1/16 Channels
SPI/I2C/I2S/UART	2/1/2/2	4/2/2/2
Working Temperature	-40 to -125 degree Celsius	-40 to -125 degree Celsius
Touch and Temperature Sensor	None	Yes

Table 4.1: Comparison of microcontrollers in tabular form

4.4 Working

The system is powered by a combination of hardware components. A total of hardware components are installed during operation. The main purpose of the project is to measure health parameters such as temperature, pulse, and oxygen using wireless technology. For this, we use Esp32, which is chosen because it can be done with Wi-Fi. All sensors capable of measuring data are connected to Esp32.The powers all ground equipment. Sensors detect patients or healthcare workers and output to Esp32.

The Esp32 is wirelessly connected to the LED display and the health parameter reading is displayed on the LED display via I2C communication. In addition, for security, there is a fingerprint sensor where we store the information of people bearing the name of a person. Esp32 is used as a microcontroller in this project. Intelligent health monitoring and monitoring system temperature sensor, SPo2 and heart rate sensor, fingerprint sensor connected to as input, LED display connected to an output, can display text reading of health measured by.

ESP 32 is connected to a power supply via a USB interface. Many sensors and other devices such as SPO2 sensors, heart rate sensors, temperature sensors, and OLED screens on the ESP32 board are connected to two different ICs that run on the Arduino IDE code and write the data from the monitor to the Arduino board. This data is then sent to the SQLite database and then displayed in the web application where it will display all the data collected by each person via the MQTT protocol using the saved connection. This data is then analyzed in software to display the output on the screen or website to monitor the data to improve the health of each individual or employee. When we use the fingerprint sensor, the fingerprint is stored in the memory and the finger is tested by placing the finger back on the screen sensor.

If the finger gets a match from registered fingerprints, it will output ”Photo taken, fingerprint”. Match this ID with 80-90% confidence based on testing”. The heart rate sensor is based on the theory of plethysmography. measures the change in blood volume passing through a body and causes light to pass through the body. is important. The frequency of the heartbeat determines the distribution of blood volume, when the light is used by the blood, the signal beat is equal to the pulse of the heartbeat. We use the MAX30105 for this. This sensor is also used to monitor the SpO2 level. Your blood oxygen level measures how much oxygen your red blood cells are carrying. Your body effectively controls your blood oxygen level.

Maintaining a balanced blood oxygen saturation is important to your health, and people with the disease need to monitor their blood oxygen levels. This includes asthma, heart disease, and chronic obstructive pulmonary disease (COPD). In these cases, monitoring your blood oxygen levels can help determine if treatment is working or if treatment is needed. Similarly, a thermometer begins measuring the person using their body temperature. All of this information is stored in the database and can be used by physicians to identify abnormalities in a patient's body temperature. Heart rate and body temperature are the most important measurements of the patient. Heart rate is defined as heart beats per minute, commonly known as heart rate. A person's standard heart rate is between 60 and 100 beats per minute.

Chapter 5

SYSTEM DESIGN AND IMPLEMENTATION

5.1 Schematic Diagram

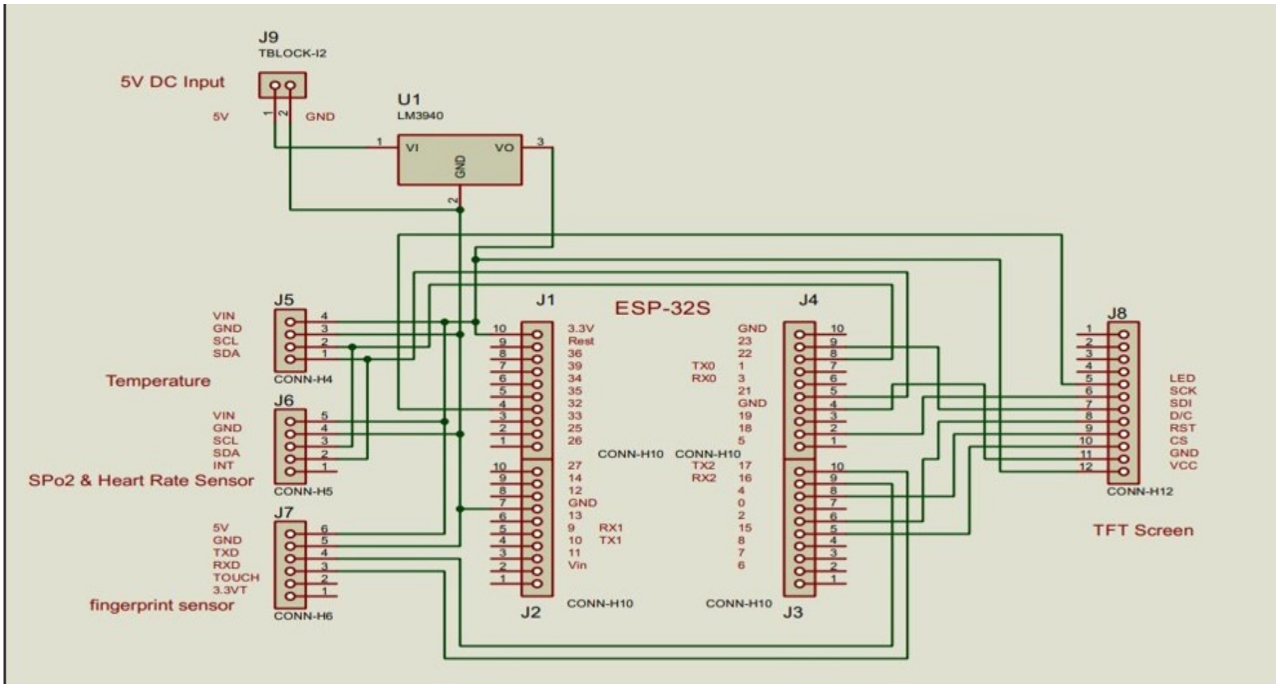


Figure 5.1: Hardware Schematic

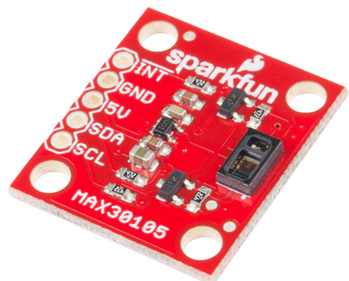
5.2 Design Specification and Hardware Implementation

5.2.1 ESP32

This is the main controller of the entire setup, and it is integrated with a Bluetooth and Wi-Fi module. The ESP32 handles all incoming data from the sensors. This raw data is sent to the database using the Wi-Fi and MQTT Protocol. This is the brain of the hardware and acts as a central point of computation of the entire setup. ESP32 is a low-powered microcontroller that is integrated with a WiFi and Bluetooth module, hence making it integral to this IoT setup. Another reason for using the ESP32 over the Arduino UNO is that it is much more powerful since it is 32-bit compared to the 8-bit Arduino UNO. The ESP32 PLC is specifically designed for industrial applications and this is what makes it the perfect choice for this project. The entire hardware module and all the sensors like Temperature, IR, Heart rate, fingerprint, and SpO2 sensor are controlled using ESP32. It also handles interfacing with 4 Keypad modules, a 1.3-inch OLED Display, and a buzzer also. ESP32 is also used for industrial applications like Generic Low-power IoT Sensor

Hub, Generic Low-power IoT Data Loggers, home automation, and industrial automation.

5.2.2 MAX30105 SpO2 and Heart rate Sensor



The heart rate sensor monitors the heart rate and the SpO2 sensor monitors the Oxygen levels of the user. The integrated particle-sensing module we are using is the MAX30105. It contains internal LEDs, photodetectors, optical elements, and low-noise electronics with ambient light suppression. The MAX30105 provides a complete system solution to facilitate the design process of smoke detection applications including fire alarms. Due to its extremely small size, the MAX30105 can also be used as a smoke detection sensor for mobile and wearable devices. The module contains the MAX30102 - a modern (successor to the MAX30100), integrated pulse oximeter and heart rate sensor IC, from Analog Devices. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry (SpO2) and heart rate (HR) signals. Behind the window on one side, the MAX30102 has two LEDs - a RED and an IR LED. On the other side is a very sensitive photodetector. The idea is that you light one LED at a time, detect the amount of light that shines back onto the detector, and based on the signature you can measure blood oxygen levels and heart rate. The temperature sensor in this experiment is

our second parameter for a smart health detection system. It is used for the detection of the temperature and humidity of the person or the surrounding of the office. The temperature of the individual is detected when the IR sensor detects the object moving in its range. When the correct normal temperature is detected, the sensor acts normally but when the temperature is above a specific level, the buzzer in the hardware module turns on and gives an alert about a higher temperature. The temperature detected by the sensor is displayed on the LED screen for the minimum time reference of that person.
The temperature detected on a daily basis is then stored in the database for the future reference of that particular person in case he or she gets any medical emergency in the future. When the temperature sensor detects the surrounding temperature the output can be used as a reference for maintaining the temperature of air conditioners.

Power Requirements

The MAX30102 chip requires two different supply voltages: 1.8V for the IC and 3.3V for the RED and IR LEDs. So, the module comes with 3.3V and 1.8V regulators.
On the back of the PCB, you'll find a solder jumper that can be used to select between 3.3V and 1.8V logic levels. By default, a 3.3V logic level is selected which is compatible with logic levels for Arduino. But you can also select a 1.8V logic level as per your requirement. This allows you to connect the module to any microcontroller with 5V, 3.3V, or even 1.8V level I/O.
One of the most important features of the MAX30102 is its low power consumption: the MAX30102 consumes less than 600A during measurement. Also, it is possible to put the MAX30102 in standby mode, where it consumes only 0.7A. This low power consumption allows implementation in battery-powered devices such as handsets, wearables, or smart-

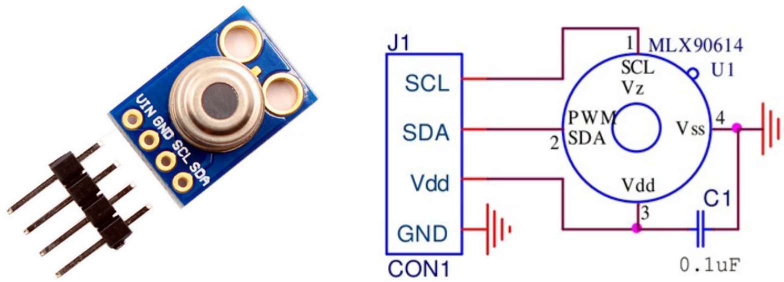
watches. On-Chip Temperature Sensor

The MAX30102 has an on-chip temperature sensor that can be used to compensate for the changes in the environment and to calibrate the measurements. This is a reasonably precise temperature sensor that measures the ‘die temperature’ in the range of 40C to +85C with an accuracy of ±1C. I2C Interface

The module uses a simple two-wire I2C interface for communication with the microcontroller. It has a fixed I2C address: 0xAEHEX (for write operation) and 0xAFHEX (for read operation). FIFO Buffer

The MAX30102 embeds a FIFO buffer for storing data samples. The FIFO has a 32-sample memory bank, which means it can hold up to 32 SpO2 and heart rate samples. The FIFO buffer can offload the microcontroller from reading each new data sample from the sensor, thereby saving system power.

5.2.3 MLX90614 IR Temperature Sensor



It is used to measure the temperature of people and the surrounding environment. It is also used to determine individual soil moisture. In this experiment, we use the fingerprint sensor as a key element for fingerprint registration and measurement. Fingerprints that we scan regularly are stored in these sensors. In this project, the fingerprint sensor will have two modes: registration mode and test mode. In enrollment mode, the fingerprint we tested is regularly registered for daily use. Once fingerprints are registered, a new unique ID will be assigned for future use. In the test, the registered fingerprint is checked with the picture and ID given to the corresponding fingerprint, and the result can be false or correct. The fingerprint sensor in the hardware module is the principle of fingerprint registration and tracking the daily attendance and commute information of the employees.

Feature and benefits

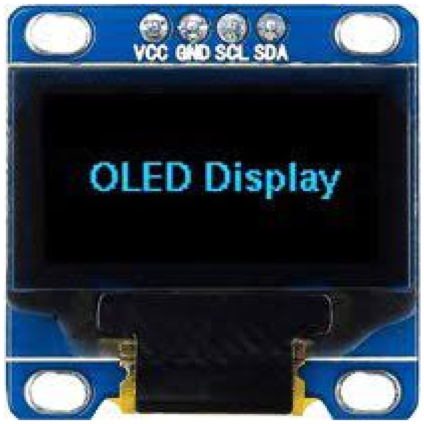
- Small size, low-cost
- Easy to integrate
- Factory calibrated in the wide temperature range - -40 to 125 C for sensor temperature and -70 to 380 C for object temperature.

- High accuracy of 0.5C over wide temperature range (0..+50C for both Ta and To)
- High (medical) accuracy calibration optional
- Single and dual zone versions
- SMBus compatible digital interface
- Customizable PWM output for continuous reading
- Available in 3V and 5V versions
- Simple adaptation for 8 to 16V applications
- Power saving mode
- Different package options for applications and measurements versatility

The MLX90614 is an infrared thermometer for non-contact temperature measurement. Both the IR-sensitive thermopile detector chip and the cold signal ASSP are integrated with the same TO39 box. Thanks to the low-noise, 17-bit ADC and powerful DSP unit, the thermometer's high accuracy and high resolution are achieved. As standard, 10-bit PWM is configured to continuously measure temperature from -20 to 120 C with 0.14 C resolution. The MLX90614 has 2 forms designed and manufactured by Melexis: the infrared thermopile detector MLX81101. Signal ASSP MLX90302 is specially designed to be the output of the IR sensor. The device is available in the industry standard TO-39 package.

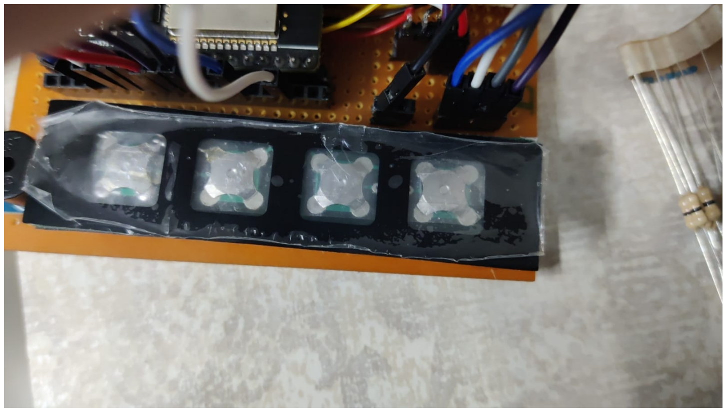
The MLX90302's low-noise amplifier, high-resolution 17-bit ADC, and powerful DSP unit realize high precision and high-resolution measurement. The count and ambient temperature are stored in the RAM of the MLX90302 with 0 resolution. 01C. They can be accessed via a 2-wire serial SMBus over protocol (0.02C resolution) or a 10-bit PWM (Pulse Width Modulation) output device. The MLX90614 is a factory-tested temperature range: -40 to 125 C ambient and -70 to 382.2 C product. 10-bit PWM is fitted as standard to measure temperature continuously with 0.14C resolution in the temperature range from -20 to 120C. The PWM can be easily adjusted for almost anything customers need by changing the contents of 2 EEPROM cells. This does not affect the factory calibration of the device.

5.2.4 1.3-inch OLED Display



We use an OLED screen to display the temperature and output of the SpO2 sensor. The 1.3-inch LED display is used to display the output of sensors such as temperature sensor, SpO2, and heart rate sensor. The output of the sensor will appear according to the model provided by the 4 keypad modules. If the module is in fingerprint enrollment mode, the screen will display the output according to the fingerprint sensor as if a new fingerprint has been registered. It will show the output - ”Fingerprint registered and unique ID assigned to this fingerprint”. If the fingerprint sensor is in test mode, it will display the following output: ”32 No fingerprints to be tested with 100% confidence. If the module is set to a temperature sensor and spo2 sensor mode, output the temperature sensor and spo2 sensor individually. Also, depending on the sensor type, all treatments are checked by the hardware module’s health and OLED. 3-inch is a monochrome graphic display module with a built-in 1.3 inch, 128X64 high-definition display. OLED 1.3 inch can work even in low light. In dark environments, OLED displays have a higher contrast ratio than LCDs. The device is I2C or SPI compatible. Due to its imaging feature, it is frequently used in many applications such as smart watches, MP3s, feature phones, portable health devices, and so on.

5.2.5 4 Keypad Module



When we want to connect the switch to the microcontroller, it needs GPIO pin. However, when we want to connect more keys such as 9, 12, and 16, it can receive all GPIO pins of the microcontroller. We can use a matrix keypad to register some GPIO pins of the microcontroller. A matrix keyboard is nothing more than keys arranged in rows and rows. 4 The keyboard module is used to select the mode the hardware module is designed to operate.

For example, the first button activates the fingerprint registration mode, the second button activates the fingerprint mode, the third button displays the temperature and SpO2 sensor reading on the OLED screen, and the fourth button is reserved for future changes. This keypad module is similar to the 4 x 4 matrix keypad modules used in commercial applications. There are many types of switches, such as membrane switches, color key switches, scissor key switches, and capacitive switches.

5.2.6 Fingerprint Sensor

Fingerprint processing consists of two parts: fingerprint registration and fingerprint matching (the ratio can be 1:1 or 1:N). When registering, the user must enter two fingers. The system will take fingerprints twice and create and store fingerprints while they are being processed. When comparing, the user enters a finger from an optical sensor and the system generates a finger template for comparison with the finger library template. For 1:1 matching, the system compares the fingerprint with the custom pattern specified in the module; For 1:N matching, i.e. searching, the system will search the entire fingerprint library for matching fingerprints. In both cases, the system returns the match whether successful or not.

Fingerprint Section Specifications

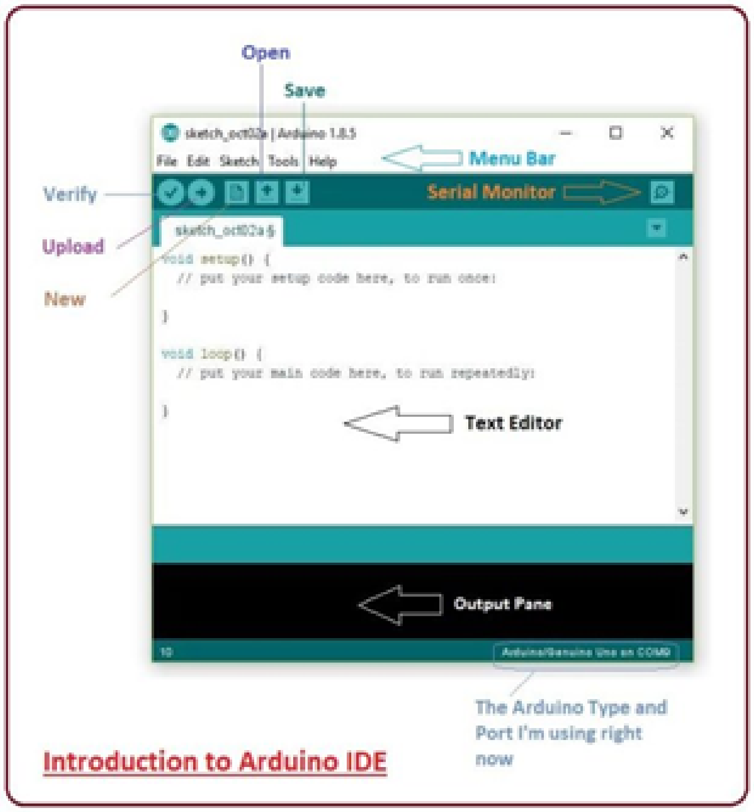
Power	DC 4.2V-6V	**Interface**	UART/ USB 2.0
Baud Rate	9600*N bps, default N=6	**Character file size**	256 bytes
Working current	Typical: 50mA	**Matching Mode**	1:1 and 1: N
Image acquiring time	¡0.5s	**Template size**	512 bytes
Storage capacity	1000	**Security level**	5
FAR	¡0.001%	**FRR**	0.1%
Average searching time	1s (1:1000)	**Window dimension**	19mm*21mm
Outline Dimension	Split type	**Module**	44.1*20*23.5 mm %

5.2.7 Buzzer

A buzzer is a small yet efficient component to add sound features to our project/system. It is a very small and compact 2-pin structure hence can be easily used on breadboards, Perf Board, and even on PCBs which makes this a widely used component in most electronic applications.

5.3 Software Requirements

5.3.1 Arduino IDE



An official software introduced by Arduino. cc, which is mainly used for writing, compiling, and uploading the code in almost all Arduino modules/boards. Arduino IDE is open-source software and is easily available to download and install.

- Arduino IDE is an open-source software, designed by Arduino. cc and mainly used for writing, compiling, and uploading code to almost all Arduino Modules.

- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
- It is available for all operating systems i.e., MAC, Windows, Linux, and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing, and compiling the code.
- A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro, and many more.
- Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.
- The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.
- The IDE environment mainly contains two basic parts: Editor and Compiler where the former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.
- This environment supports both C and C++ languages.

5.3.2 Proteus

It is a software package that includes schematics, simulation, and PCB design. ISIS is software for the realistic drawing of schematics and analog circuits. Simulation allows people to enter real-time operations by giving simulation time. ARES for PCB design. It is possible to see the output of PCB design and equipment in 3D. Designers can also create 2D drawings for products. Functionality The ISIS library contains many components. Real-time monitoring of circuit parameters such as signal sources, signal generators, oscilloscopes, voltmeters, ammeters, and other measurement and analysis tools, as well as discrete components such as probes, switches, indicators, motors, lamps and similar loads, resistors, and capacitors, inductors. , transformers, digital and analog integrated circuits, semiconductor switches, relays, microcontrollers, processors, sensors, etc. ARES provides a PCB design with up to 14 internal layers, including surface and through-hole packages. It embeds packages of different classes of components such as ICs, transistors, headers, connectors, and other discrete components. Provides automatic routing and manual routing options for PCB Designer. Diagrams drawn in ISIS can be sent directly to ARES.

5.3.3 MQTT Protocol

The MQTT protocol is the de facto standard for IoT messaging. MQTT, a standard developed by OASIS and ISO, is a communication/registration protocol that provides an efficient and reliable way to connect devices on the Internet. Many companies today use MQTT to connect millions of devices on the Internet. MQTT is the most common messaging protocol for the Internet of Things (IoT). MQTT stands for MQ Telemetry Transport. A protocol is a set of rules that define how IoT devices can broadcast and subscribe to data on the Internet. MQTT is used for messaging and data exchange between IoT and Industrial Internet of Things (IIoT) devices such as embedded devices, sensors, PLCs, and more. The process is event-driven and uses a publish/subscribe (Pub/Sub) model to connect devices. Publisher and Subscriber communicate through Content and are disconnected from each other. The connection between them is managed by the MQTT assistant

5.3.4 MQTT Broker

An MQTT broker is software that runs on a computer (either locally or in the cloud) and can be created independently or hosted by a third party. It is available in both open-source and custom versions. Post Office as a broker. The MQTT client uses a string named ”Subject” instead of using the recipient’s direct connection. Anyone who registers will receive a copy of the entire message on the topic. Multiple subscribers can subscribe to a topic from one agent (many-to-many capability), and a subscriber can subscribe to topics from multiple agents (many-to-one). All users can create and receive information through advertisement and registration, that is, devices can broadcast sensor information, and also receive configuration information or control commands (MQTT is a two-way communication protocol). This helps to share information, control and manage equipment. A client cannot publish the same information for topics and must send the agent several messages for each topic. With the MQTT agent architecture, the client, and the application server are separated from each other. In this way, customers do not know each other’s information. If configured, MQTT can use TLS encryption with certificates, usernames, and passwords to protect the connection. Optionally, the connection must be validated in the form of a client-supplied certificate, which must match the server’s form. In case of any failure, the software administrator and the customer can switch to automatic backup / automatic backup. The Backup Proxy can also be configured to share client payloads across multiple servers on-premises, in the cloud, or a combination thereof. The agent can support both standard MQTT and specification-based MQTT such as Sparkplug. This can be done from the same server at the same time with the same security level. The agent monitors data for each session when the device is powered on and exits a feature called ”regular session”. This can be done with the same server, at the same time, and with the same levels of security. The broker keeps track of all the session’s information as the device goes on and off, in a function called ”persistent sessions”. In this state, a broker will store connection info for each client, topics each client has subscribed to, and any messages for a topic with a QoS of 1 or 2.

Advantages of MQTT broker:

- It requires minimal resources since it is lightweight and efficient.
- Support bi-directional messaging between the device and the cloud.
- Can scale to millions of connected devices.
- Support reliable message delivery through 3 QoS levels.
- Works well over unreliable networks.

5.4 Flow Chart

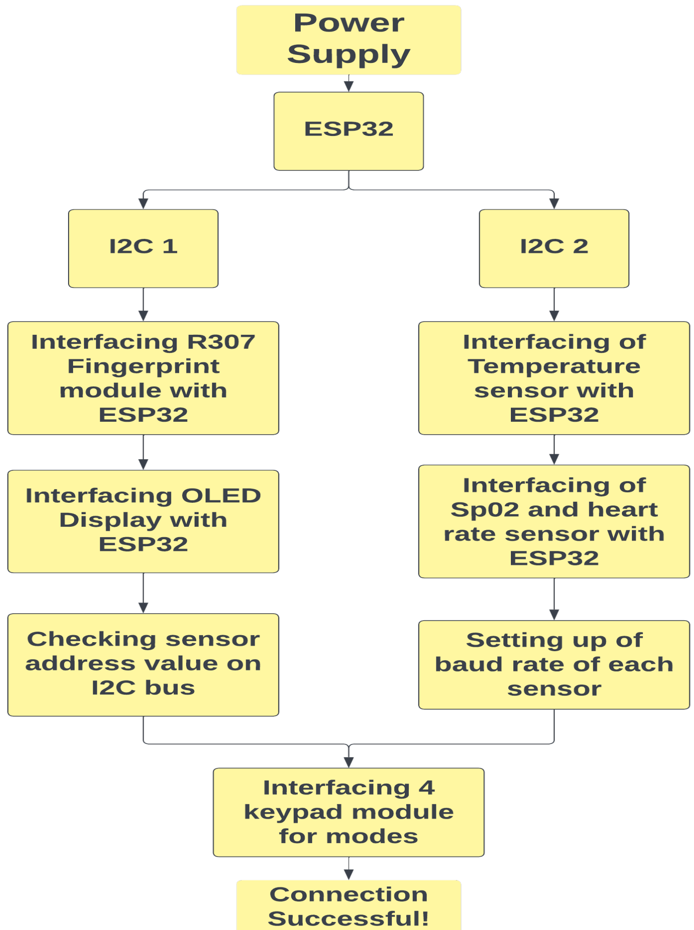


Figure 5.2: Flow Chart Part 1

5.5 Flow Chart (Continued...)

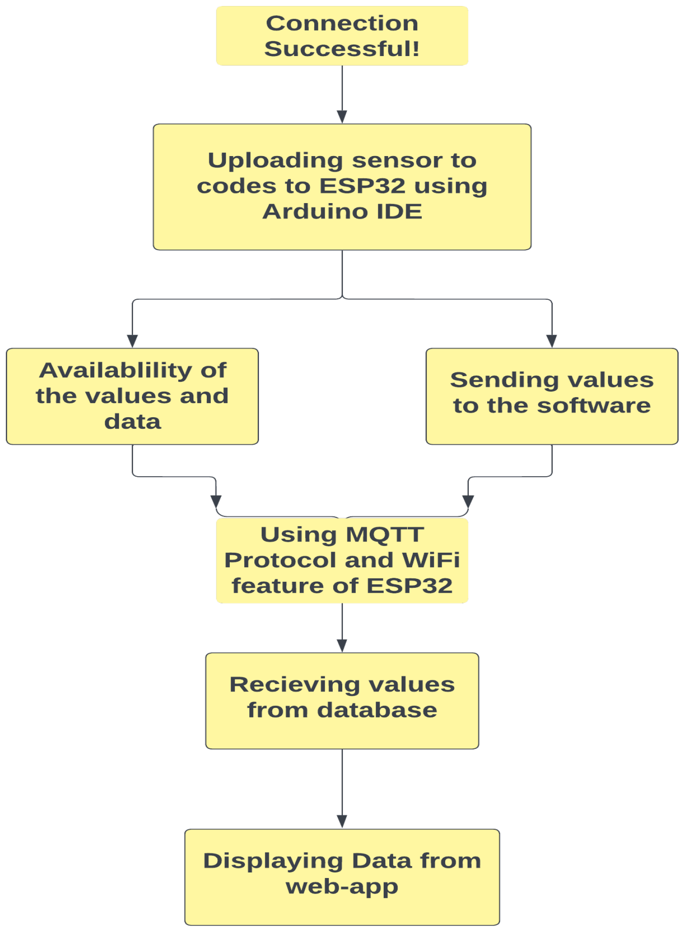


Figure 5.3: Flow Chart Part 2

5.6 Circuit Diagram

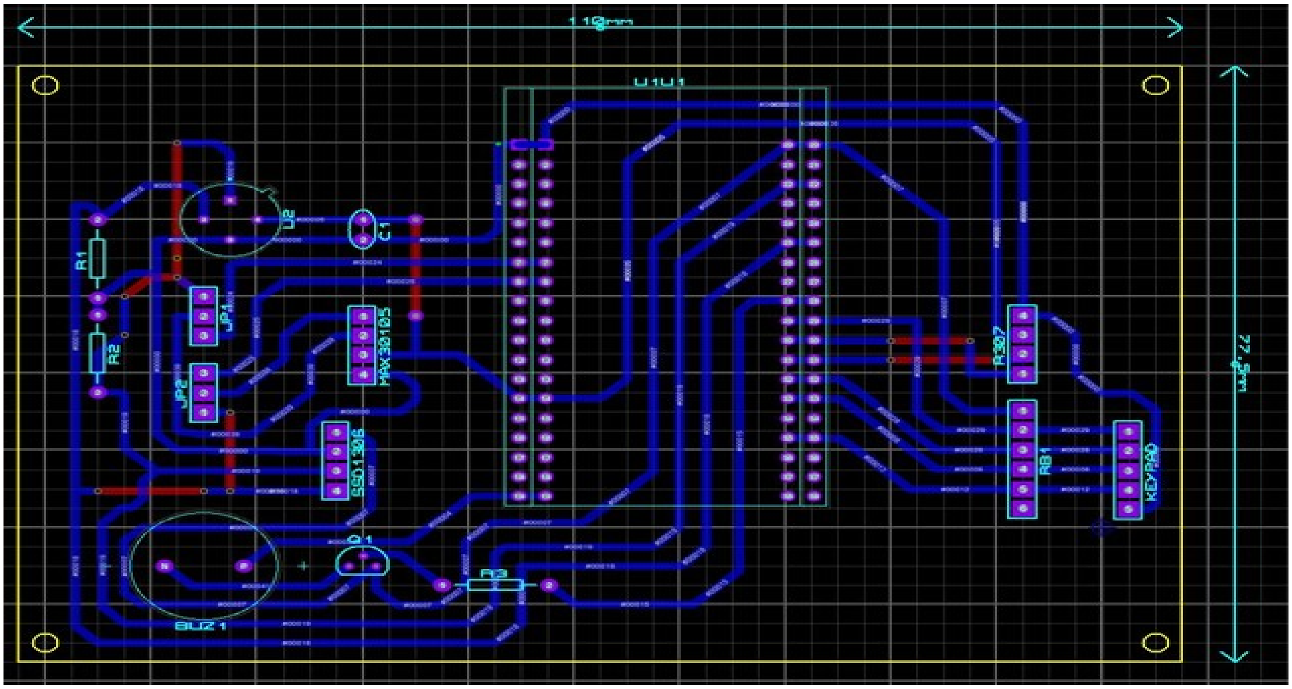


Figure 5.4: Circuit Diagram

5.6.1 Construction of the System

- Esp32 microcontroller is the heart of the Smart Hearth Monitoring System. All sensors are connected with Esp32.
- The power supply 3.3v is given to the components in a circuit through a common terminal and ground.
- All sensors are connected with different GPIO pins for the I2C communication purpose.
- Fingerprint sensor is connected to GPIO 16 and GPIO 17 Pin.

- Max sensor is connected to GPIO 32 and GPIO 33 pins.
- IR sensor and OLED Display are connected to GPIO 21 and GPIO 22 pins.
- Buzzer is connected to GPIO 18 with a 5V supply.
- Keypad module is connected to GPIO 5,4,0,15 pins for the respective 4 keys.

5.6.2 Features of the System

- IoT efficiently links patients, clinics, doctors, and hospitals to organize and orchestrate diagnosis and treatment across a wide variety of locations. During the pandemic, data protection and confidentiality are the key concerns with healthcare systems because it passes across the unsecured system. The patient's scare record is made up of personal records, clinical conditions, diagnosis results, and associated medications, which are considered sensitive data.
- Hackers may change the health-related details resulting in misdiagnosis, or incorrect disease assessment leading to unsuitable treatment, thus increasing the rate of mortality. Medical data transmission tracked through IoT devices is vulnerable to security concerns
- The privacy and security issues are found at the patient's records and hardware level in terms of compatibility due to the needs of each component like storage space, operating system, and network architecture.
- All sensors are connected with different GPIO pins for the I2C communication purpose.

- The researchers of cost analysis need to consider developing low-cost experiments of drug solutions allowed by IoT. During the epidemic, healthcare facilities and clinics also contend with large numbers of patients, with numerous medical personnel undertaking various duties. The accurate deification of patients and personnel is key to ensuring adequate data protection in these cases. IoT on a smaller scale demands that handheld devices incorporate sensors for data collection and that centralized servers handle patient requests to ensure that all patients can access medical facilities using mobile devices such as smartphones.
- IoT is considered as one of the main sources to collect a huge amount of data. With the huge, collected data of patient records, researchers have to pay attention to storage, access, transportation, and processing of the huge amount of data they will produce.
- Software and systems architectures need to be defined, coded, and executed based on the standard such as map-reduce framework and any software frameworks that can reduce the processing time and complexity.

Chapter 6

RESULT AND DISCUSSION

6.1 Result

In conclusion, the Smart Health Detection System is a promising new technology that has the potential to revolutionize the way we diagnose and treat diseases. The system uses a variety of sensors and data analytics techniques to collect and analyze data from patients, which can then be used to identify potential health problems early on. This can lead to earlier diagnosis and treatment, which can improve patient outcomes and reduce healthcare costs.

The Smart Health Detection System has the potential to make a major impact on the healthcare industry. It could help to reduce the number of people who die from preventable diseases, and it could also help to reduce healthcare costs. The system is still under development, but it has the potential to revolutionize the way we diagnose and treat diseases.

Here are some additional benefits of the Smart Health Detection System:

Increased patient satisfaction: Patients can receive more personalized and timely care with the help of the Smart Health Detection System. Improved efficiency: The system can help to reduce the time and resources that are spent on diagnosis and treatment. Enhanced safety: The system can help to prevent medical errors and improve patient outcomes. The Smart Health Detection System is a promising new technology that has the potential to improve the quality and efficiency of healthcare. It is still under development, but it has the potential to revolutionize the way we diagnose and treat diseases.

6.2 Output

6.2.1 Software Photos

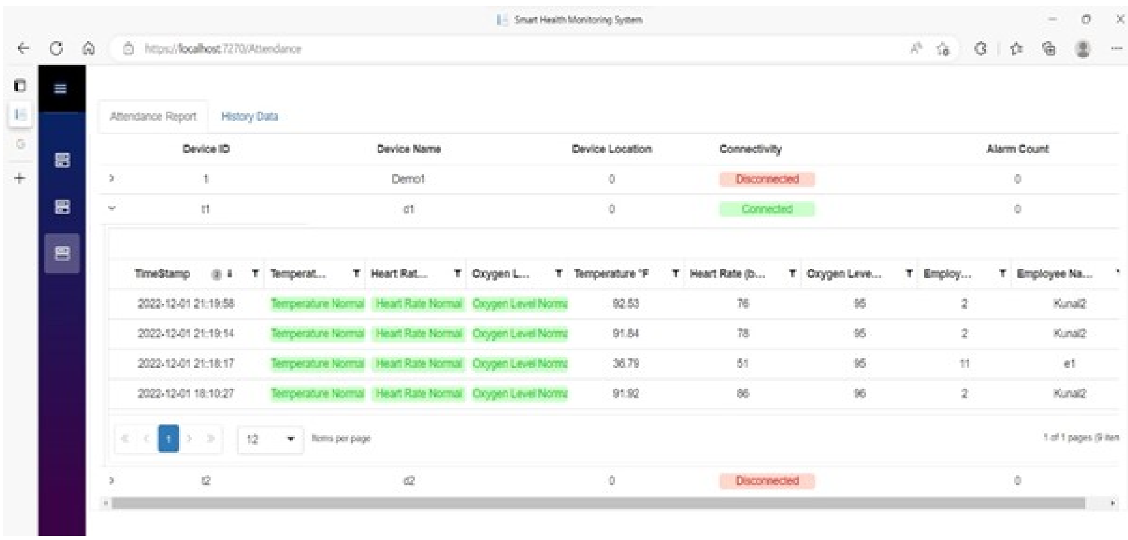


Figure 6.1: Website Screenshot

This is a screenshot of the website which displays the data which gets imported from the SQLite database. This page shows the connectivity status and whether all the parameters of the user are normal.

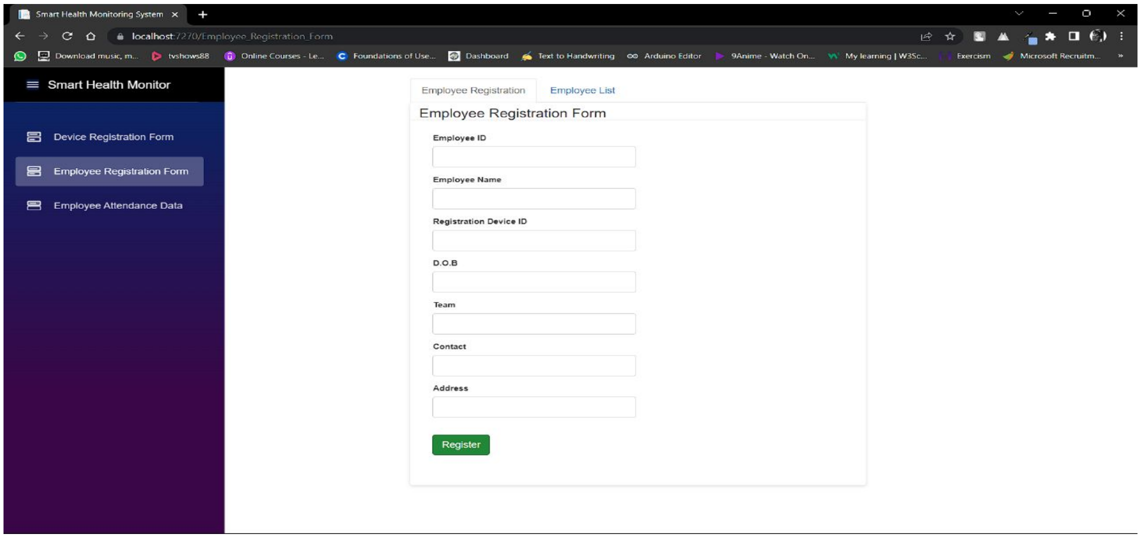


Figure 6.2: Employee Registration Screen 1

These images show the Employee Registration Form of the website. The form is responsible for registering the data from all employees and sending all this data to the backend database.

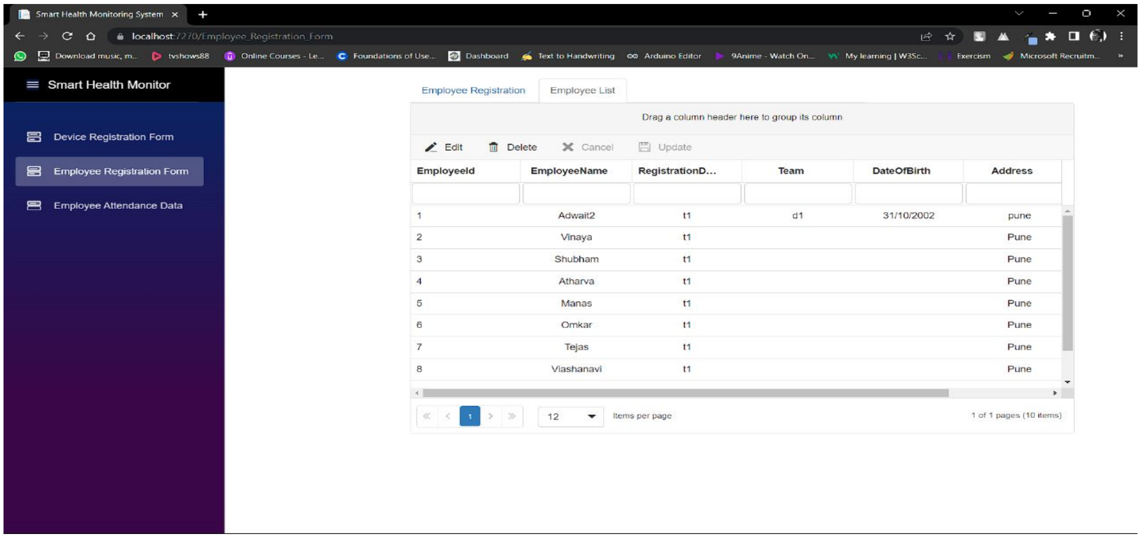


Figure 6.3: Employee Registration Screen 2

This screen shows a table of all the stored employee records. The records include the Employee ID, Employee Name, Registration Device ID, Team, Date of Birth, and Address.

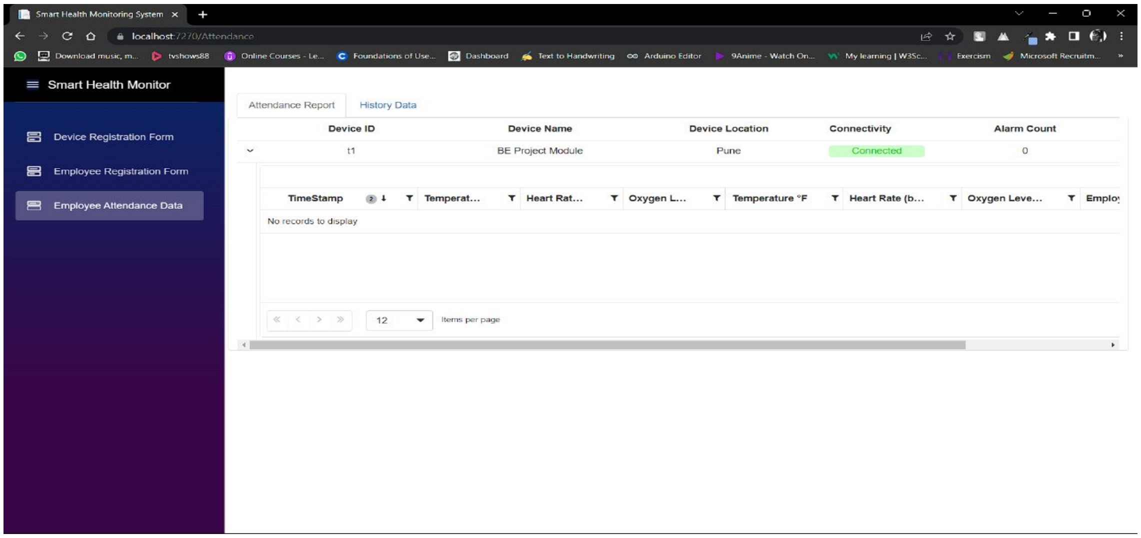


Figure 6.4: Employee Attendance Data

When you access this page, you can expect to see various details and metrics regarding the attendance of employees. It serves as a centralized hub where administrators, managers, or relevant personnel can easily access and analyze attendance information, facilitating effective monitoring and management of employee attendance within the organization.

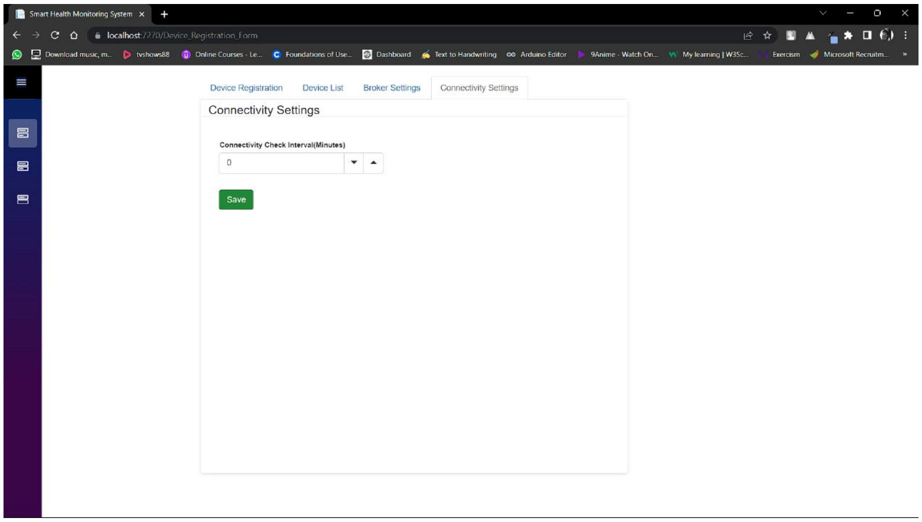


Figure 6.5: Connectivity Check Interval Settings

These images show different pages of the website including the Connectivity Settings Page where we control the interval within which we have to check the connectivity to the device.

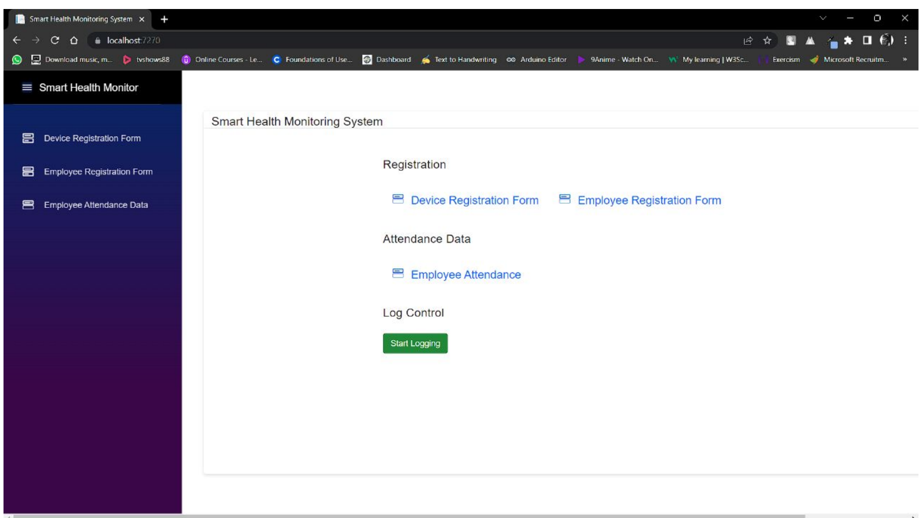


Figure 6.6: Landing Page

This is the landing page of the website. Any administrator who has access to this data will see this as the first page of the web app. From here he can navigate to all the other sections of the web app.

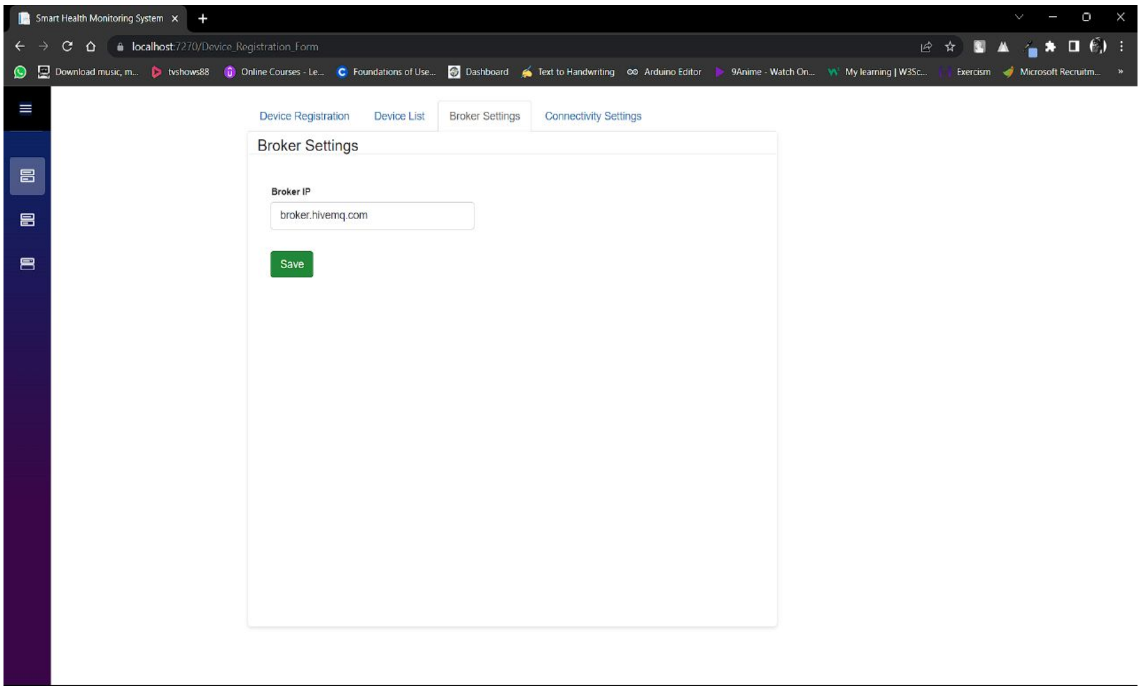


Figure 6.7: Broker Settings Page

This is the page where we can change the broker's IP settings. For MQTT Protocol we use a Broker. The MQTT broker plays a crucial role in the MQTT publish-subscribe messaging pattern. It receives messages published by MQTT publishers (clients) and delivers them to MQTT subscribers (clients) who have expressed interest in receiving those messages. The broker acts as a central hub, responsible for routing and delivering messages to the appropriate subscribers.

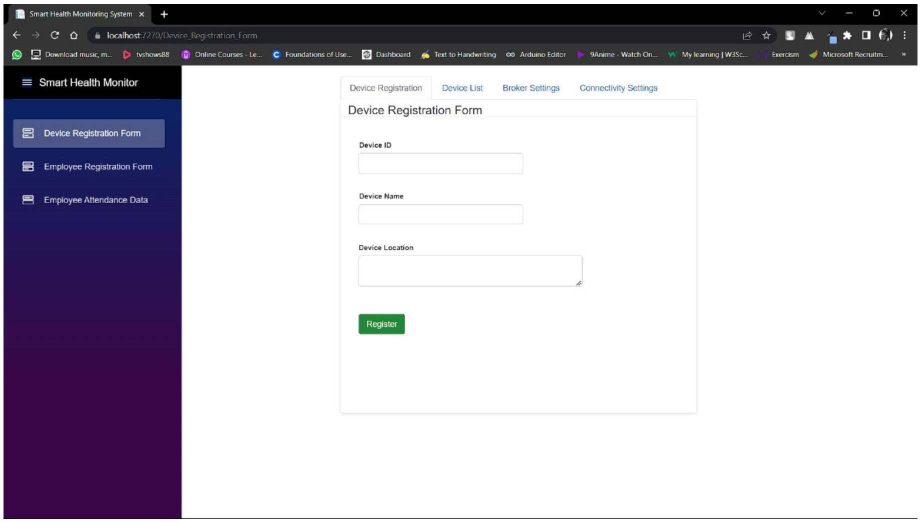


Figure 6.8: Device Registration Page

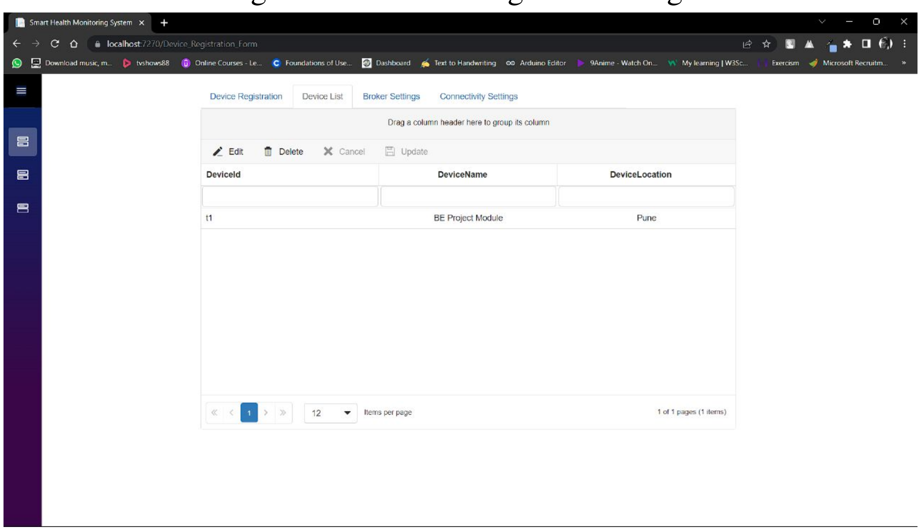


Figure 6.9: Devices list

These images show the Device Registration Form and list of devices registered on the web app

Figure 6.10: Fingerprint Output 1

This image shows the testing output of the R307 fingerprint sensor. The stored fingerprints are tested by keeping the finger again on the sensor's screen. If the finger gets a match from stored fingers it will show an output-like image taken of fingers matched with this ID with a confidence of 80/90 percent according to the testing.

```
.
ets?ets Jun  8 2016 00:22:57

rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
ets Jun  8 2016 00:22:57

rst:0x10 (RTCWDT_RTC_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0018,len:4
load:0x3fff001c,len:956
load:0x40078000,len:0
load:0x40078000,len:13076
entry 0x40078a58
fingertest
Found fingerprint sensor!
Capacity: 300
Packet length: 128
Waiting for a finger...
.
.
.
.
```

Figure 6.11: Fingerprint Output 2

The below image is showing the output for the fingerprint sensor. As the image is taken by the fingerprint sensor of the finger and stored in the database with the unique ID zero for future reference. It shows the output as an image taken image converted and after keeping the same finger it'll show fingers matched and saved as ID 0.

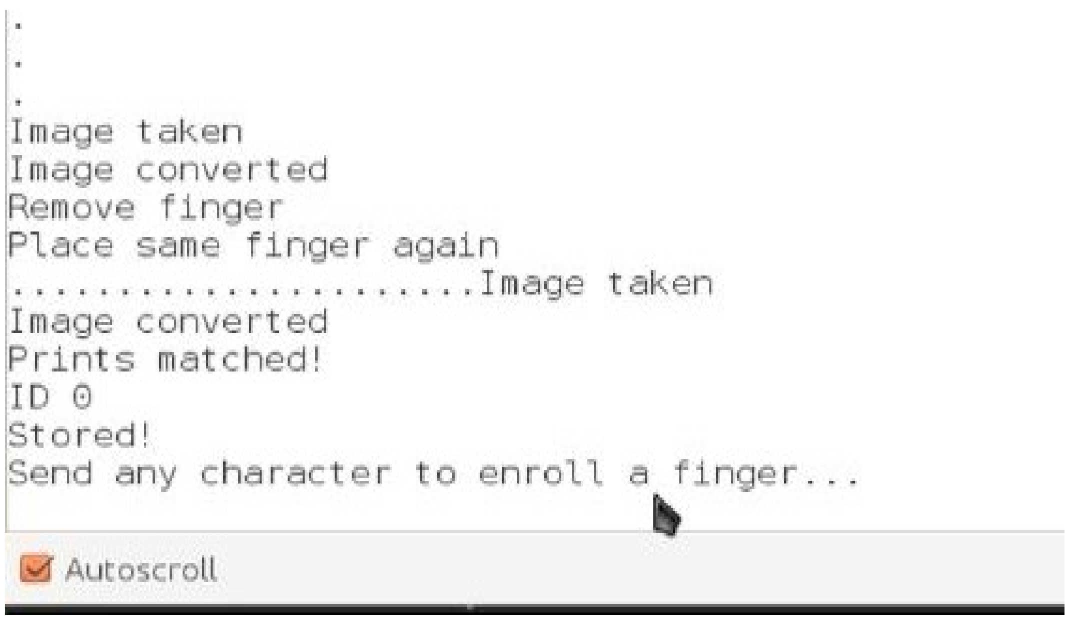


Figure 6.12: Fingerprint Sensor Output

Here the image of the fingerprint has been taken successfully. The sensor makes the user place his finger twice to enroll their finger completely.

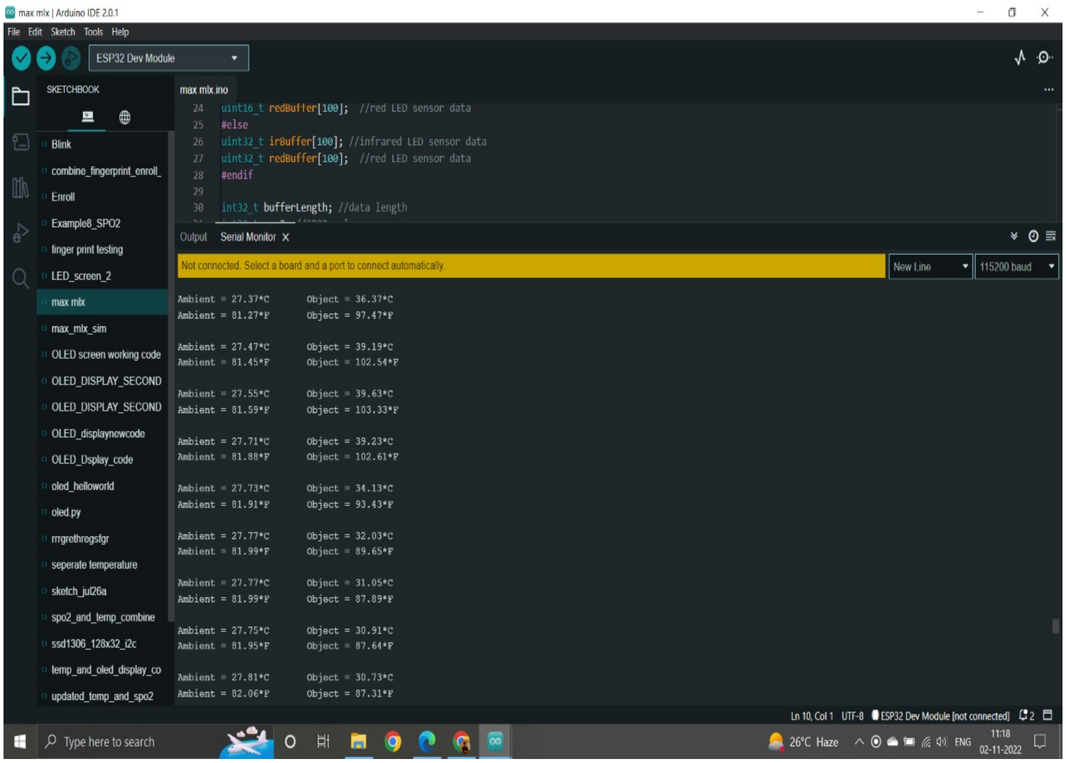


Figure 6.13: Temperature Sensor Output

In the above image the correct outputs of the MLX90614 temperature sensor. As it is showing the temperature of the surroundings and the object at the same time with the humidity of the surroundings as a ambient temperature. Both the outputs are shown at both °C and °F for better reference of the user.

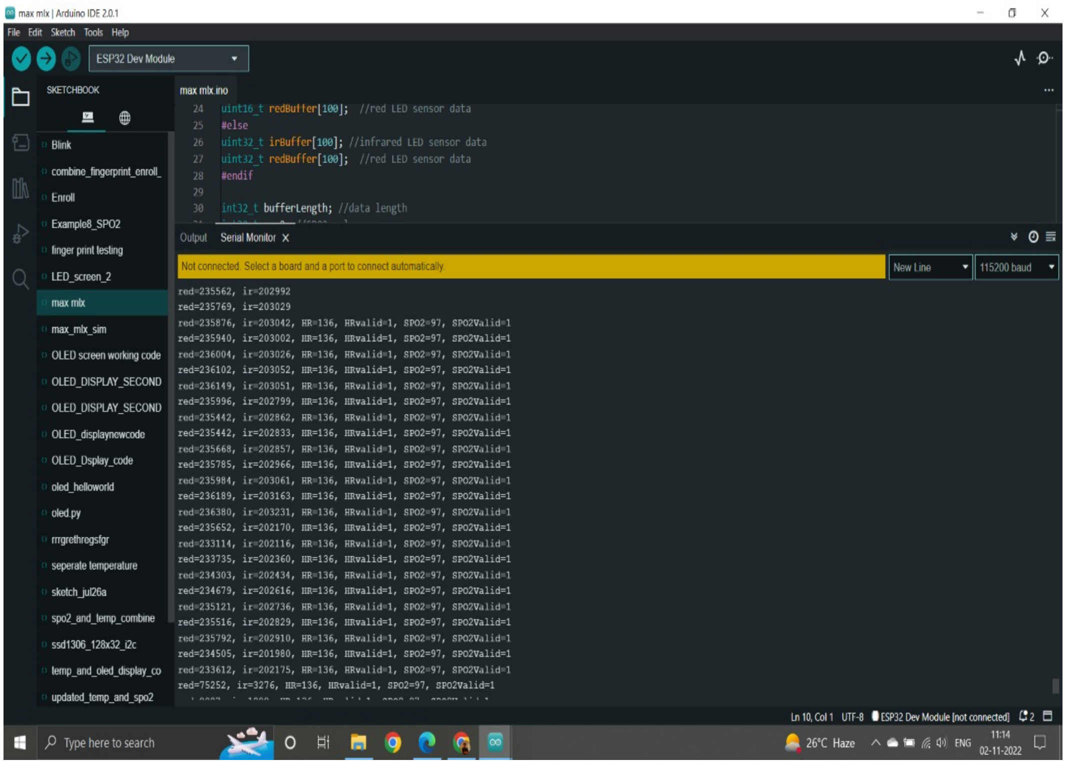


Figure 6.14: SpO2 Sensor Output

In the above image the correct outputs of MAX30105 heart rate and spo2 sensor are displayed in the format referring to HR as heartrate Spo2 as oxygen level and pressure. Showing HR valid equals zero if the readings are invalid and showing HR valid equals 1 if the readings are valid according to global medical parameters.

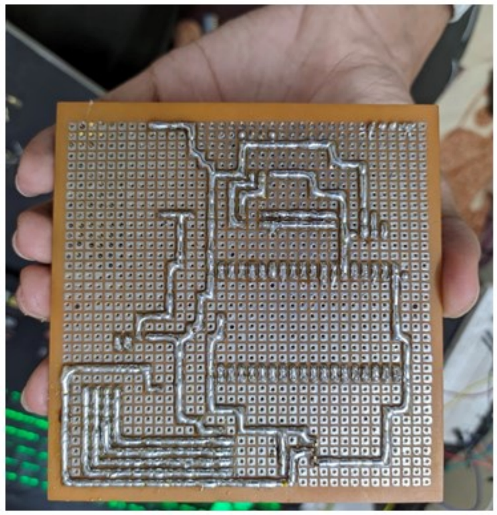


Figure 6.15: Hardware Soldering

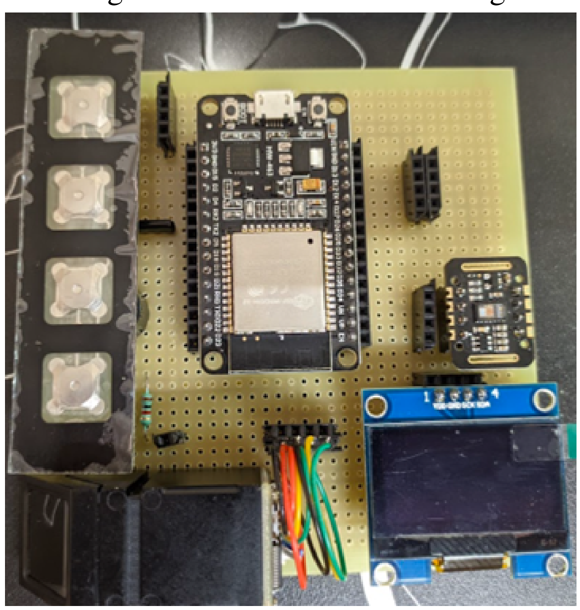


Figure 6.16: Hardware Setup

Figure 6.17: Final Hardware Product

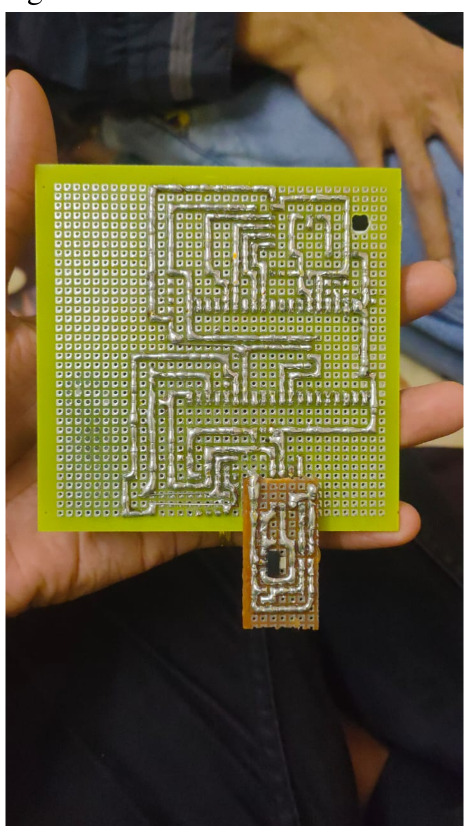


Figure 6.18: Hardware Soldering

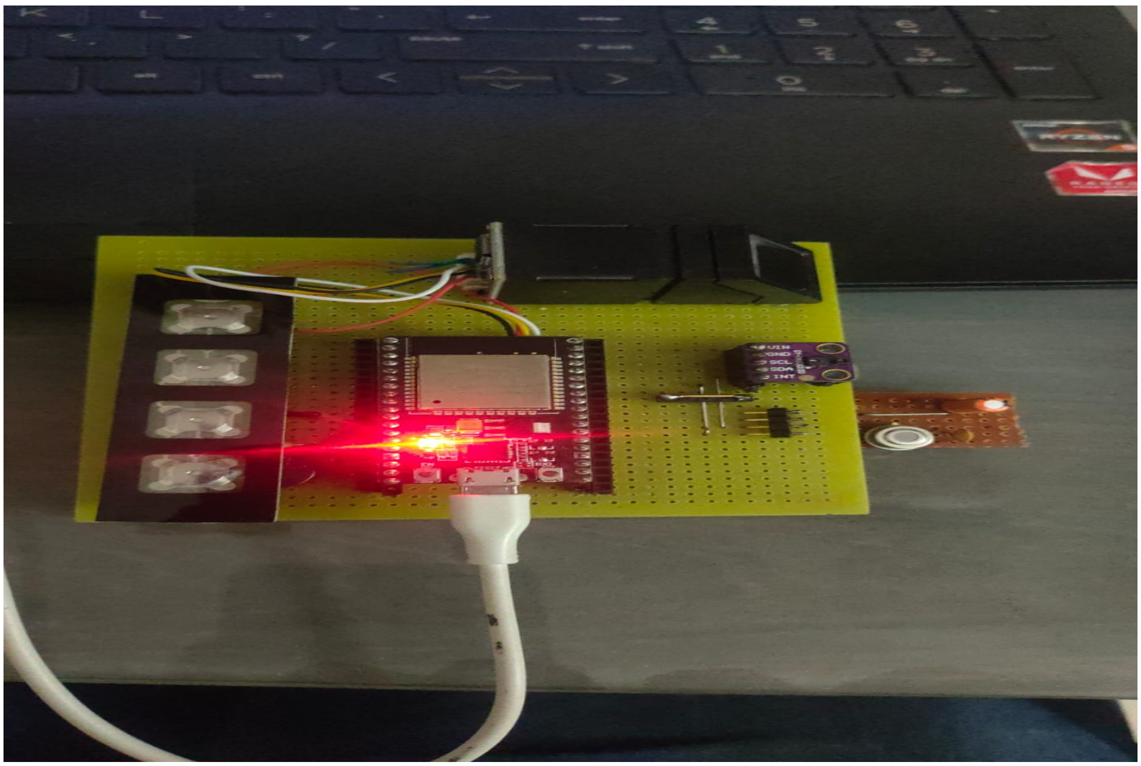


Figure 6.19: Hardware Working

This is an image of the entire setup after all the components of the project were integrated onto the board. Once we tested that all components were working perfectly in synchronization with each, we put the setup inside a plastic casing to abstract the complexity from the users.

Chapter 7

CONCLUSION

7.1 Conclusion

Hence, we can conclude that after following the proposed methodology, we can solve major problems related to monitoring health problems. The above screenshots prove that all the proposed sensors are integrated with each other. This way the module can effectively record, store, analyze, and process the data retrieved from the user.To create a user-centric medical device that can reliably measure Health vitals without any hassle of going to medical clinics or institutes. A well-directed effort, a significant investment for developing products, processes, and technologies. Enhance efficiency and productivity with cost-effective methods through sustainable technologies for scientific and technological empowerment of human resources. After processing the valuable data can be used for a multitude of reasons such as. The prototype for an automatic system guarantees constant monitoring of various health parameters and predictions of any disease that prevents the user from frequent visits to the hospitals. This way we can gather massive amounts of data that can be used for predicting the outcome of the individual's health.

7.2 Future Scope

- The setup can be minimized in size so the users can easily carry it around, hence increasing the portability. Artificial Intelligence can be integrated into the system to increase functionality.
- Multiple parameters can be incorporated into the setup like Blood pressure, retina size, age, and weight can be added as controlling parameters in the future.

- The data, consisting medical history of many Individual's parameters and corresponding results, can be explored using data mining, in search of consistent patterns and systematic relationships in the disease.
- OTP - users can log in using Otp (one-time password).
- Password - users can see their personal information using a password.
- Size - using some advanced components like the advanced version of ESP32 which is small in size and can get 100% accuracy as ESP32 we can reduce the size of the system.
- Scanner – user can store their data by scanning scanner.
- HMI – using HMI we can visually display data, Track production time, trends, and tags, and Monitor machine input and output.
- Storage – we would be increasing the storage capacity on the cloud to record the measured health data.
- Capacity- Now, the capacity of the person IDs which can measure the health parameter is 1000. So, we would be increasing the id's capacity up to 5000 or more as the requirement of the industry.

Chapter 8

REFERENCES

1. Mohammad Monirujjaman Khan, Safia Mehnaz, Antu Shaha, Mohammed Nayem, Sami Bourouis, ”IoT-Based Smart Health Monitoring System for COVID-19 Patients”, Computational and Mathematical Methods in Medicine, vol. 2021, Article ID 8591036, 11 pages, 2021. https://doi.org/10.1155/2021/8591036

2. Islam, M.M., Rahaman, A. & Islam, M.R. Development of Smart Healthcare Monitoring System in IoT Environment. SN COMPUT. SCI. 1, 185 (2020). https://doi.org/10.1007/s42979-020-00195-y

3. B. Mahanty, S. Mondal, U. Sahu, S. Patra, and D. Mandal, ”Human health monitoring system based on piezoelectric smart sensor,” 2016 International Conference on Computer, Electrical & Communication Engineering (ICCECE), Kolkata, India, 2016, pp. 1-4, doi: 10.1109/ICCECE.2016.8009535.

4. Ding Yi, Fan Binwen, Kong Xiaoming and Ma Qianqian, ”Design and implementation of mobile health monitoring system based on MQTT protocol,” 2016 IEEE Advanced Information Management, Communicates, Electronic and Automation Control Conference (IMCEC), Xi’an, China, 2016, pp. 1679-1682, doi: 10.1109/IMCEC.2016.7867503.

5. D. Tiwari, D. Prasad, K. Guleria and P. Ghosh, ”IoT based Smart Healthcare Monitoring Systems: A Review,” 2021 6th International Conference on Signal Processing, Computing and Control (ISPCC), Solan, India, 2021, pp. 465-469, doi: 10.1109/ISPCC53510.2021.9609393.

6. Mohammad Monirujjaman Khan, Turki M. Alanazi, Amani Abdulrahman Albraikan, Faris A. Almalki, ”IoT-Based Health Monitoring System Development and Analysis”, Security and Communication Networks, vol. 2022, Article ID 9639195, 11 pages, 2022. https://doi.org/10.1155/2022/9639195

7. Islam MM, Rahaman A, Islam MR. Development of Smart Healthcare Monitoring System in IoT Environment. SN Comput Sci. 2020;1(3):185. doi: 10.1007/s42979-020-00195-y. Epub 2020 May 26. PMID: 33063046; PMCID: PMC7250268.

8. Masdani, Muhammad & Darlis, Denny. (2018). A comprehensive study on MQTT as a low power protocol for Internet of things application. IOP Conference Series: Materials Science and Engineering. 434. 012274. 10.1088/1757-899X/434/1/012274.

Plagiarism Checker X Originality Report

Similarity Found: 4%

Date: Wednesday, May 17, 2023
Statistics: 328 words Plagiarized / 8889 Total words
Remarks: Low Plagiarism Detected - Your Document needs Optional Improvement.

/ B.E. SEMINAR REPORT On Smart Health Detector and Monitoring System Submitted by Adwait Patil (B190453105) Tejas Joshi (B190453056) Atharva Joshi (B190453009) UNDER THE GUIDANCE OF Dr. Amar Deshmukh (Internal Guide) IN PARTIAL FULFILMENT OF B.E. (ELECTRONICS AND TELECOMMUNICATION) SAVITRIBAI PHULE PUNE UNIVERSITY 2022-2023 MARATHAWADA MITRA MANDAL'S COLLEGE OF ENGINEERING, PUNE- 52 DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

The data, consisting medical history of many Individual's parameters and corresponding results, can be explored using data mining, in search of consistent patterns and systematic relationships in the disease. OTP - users can log in using Otp (one-time password). Password - users can see their personal information using a password. Size - using some advanced components like the advanced version of ESP32 which is small in size and can get 100% accuracy as ESP32 we can reduce the size of the system. Scanner – user can store their data by scanning scanner.

HMI – using HMI we can visually display data, Track production time, trends, and tags, and Monitor machine input and output. Storage – we would be increasing the storage capacity on the cloud to record the measured health data. Capacity- Now, the capacity of the person IDs which can measure the health param- eter is 1000. So, we would be increasing the id's capacity up to 5000 or more as the requirement of the industry.

INTERNET SOURCES:

<1% -
https://www.studocu.com/in/course/savitribai-phule-pune-university/electronics-and-telecommunication-engeenering/5125409
<1% - https://www.coursehero.com/file/124594493/Seminar-sagar-1pdf/
<1% - http://ethesis.nitrkl.ac.in/3565/1/Sarita_thesis.pdf
<1% -
https://circuitdigest.com/microcontroller-projects/how-max30102-pulse-oximeter-and-heart-rate-sensor-works-and-how-to-interface-with-arduino
<1% - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8772261/
<1% - https://www.ijarsct.co.in/Paper9721.pdf
<1% - https://pubmed.ncbi.nlm.nih.gov/23321968/
<1% -
https://www.researchgate.net/publication/340493701_Wearables_and_the_Internet_of_Things_IoT_Applications_Opportunities_and_Challenges_A_Survey
<1% - https://www.tigahealth.com/does-wearable-technology-improve-health/
<1% -
http://ijmrt.in/papers/D.%20Venkatesan%20vol%203%20issue%201%20IJMRT%20paper.pdf
<1% -
https://www.researchgate.net/profile/Prajoona-Valsalan/publication/340665031_IOT_BASED_HEALTH_MONITORING_SYSTEM/links/5f60adb792851c078967a5f3/IOT-BASED-HEALTH-MONITORING-SYSTEM.pdf
<1% - https://ejmcm.com/article_6279_51d459f50975217796e03c4d54bc2e0e.pdf
<1% - https://pubs.rsc.org/en/content/articlehtml/2022/ra/d1ra08608a

<1% -
https://www.aimil.com/blog/data-acquisition-systems-for-environmental-monitoring/
<1% -
https://www.techtarget.com/iotagenda/tip/Top-12-most-commonly-used-IoT-protocols
-and-standards
<1% -
https://www.ecri.org/search-results/member-preview/hdjournal/pages/eval-background
-wearable-vital-signs-monitors
<1% - https://www.academia.edu/9767512/Chapter_6_Conclusion_and_Future_Scope
<1% - https://ieeexplore.ieee.org/document/7867503/
<1% - https://ieeexplore.ieee.org/document/9489207/
<1% -
https://www.readkong.com/page/evaluating-blazor-webassembly-for-the-progressive-
web-2072781
<1% -
https://www.researchgate.net/publication/357988810_IoT-Based_Smart_Health_Monitori
ng_System_for_COVID-19
<1% - https://journalofbigdata.springeropen.com/articles/10.1186/s40537-021-00507-w
<1% - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7897999/
<1% - https://www.sciencedirect.com/science/article/pii/S2666351121000383
<1% - https://cloud.google.com/architecture/connected-devices
<1% - https://www.healthline.com/health/normal-blood-oxygen-level
<1% - https://www.healthline.com/health/what-oxygen-level-is-too-low-covid
<1% -
https://www.industrialshields.com/industrial-esp32-plc-products-family-ideal-for-iot-sol
utions
<1% -
https://www.analog.com/media/en/technical-documentation/data-sheets/MAX30105.pd
f
<1% -
https://www.researchgate.net/publication/363800580_Temperature_Detection_System
<1% -
https://www.researchgate.net/publication/345631136_DEVELOPMENT_AND_EXPERIMEN
TATION_OF_A_SECURITY_DOOR_LOCK_SYSTEM_USING_BIOMETRIC_FINGERPRINT_ARC
HITECTURE
<1% -
https://www.indiamart.com/proddetail/melexis-gy-906-mlx90614esf-contactless-temper
ature-sensor-module-40-to-125-degc-16512179897.html
<1% -
https://www.indiamart.com/proddetail/gy-906-mlx90614-mlx90614-esf-baa-non-contac

t-ir-temperature-sensor-iic-i2c-ir-thermometer-22205426730.html
<1% -
https://www.indiamart.com/proddetail/infrared-thermometer-mlx90614-module-22239
815388.html
<1% -
https://robu.in/wp-content/uploads/2020/12/SeeedStudio-Grove-Thermal-Imaging-Ca
mera-MLX90614-DCC-IR-Array-with-35°-FOV.pdf
<1% -
https://media.melexis.com/-/media/files/documents/datasheets/mlx90616-datasheet-m
elexis.pdf
<1% - https://microchipdeveloper.com/8bit:10bitpwm
<1% -
https://www.spit.ac.in/wp-content/uploads/profkttalele/project/2011-12/Fingerprint%20
Recognition/FingerPrint.pdf
<1% -
https://www.ijert.org/digital-speedometer-using-arduino-board-for-formula-student-car
s
<1% -
https://www.researchgate.net/profile/Mohamed-Fezari-2/publication/328615543_Integr
ated_Development_Environment_IDE_For_Arduino/links/5bd8c6d24585150b2b9206df/In
tegrated-Development-Environment-IDE-For-Arduino.pdf
<1% -
https://stackoverflow.com/questions/59900538/shared-component-library-best-practice
s
<1% - https://www.hivemq.com/mqtt/mqtt-protocol/
<1% - https://cedalo.com/blog/mqtt-connection-beginners-guide/
<1% - https://ourworldindata.org/vaccine-preventable-diseases
<1% -
https://circuitdigest.com/microcontroller-projects/fingerprint-based-biometric-attendan
ce-system-using-avr-atmega32-microcontroller
<1% -
https://testbook.com/question-answer/a-body-has-same-temperature-as-that-of-the-s
urroun--5e60eac1f60d5d332ddc4dfb