Marathwada Mitramandal's
COLLEGE OF ENGINEERING
Karvenagar, Pune
Accredited with 'A' Grade by NAAC

Department of Electronics & Telecommunication Engineering

Final Project Review

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Smart Health Detector and Monitoring System

PROJECT GUIDE :- **Prof. Shubhangi Joshi**

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Outline :-

- Introduction
- Proposed Methodology
- Work done and Photos
- Results and Discussion
- Conclusion
- References

Introduction

Introduction

The objective of this project is to design a system that enables the collection of crucial health data from individuals, including parameters such as heart rate, temperature, and oxygen levels, on a timely basis. The collected data will be processed and displayed on specialized software, aiding healthcare professionals in analyzing the obtained information. This system aims to automate the task of health monitoring, providing accurate and real-time data for improved diagnosis and treatment decisions.

By automating the health monitoring process, healthcare professionals can efficiently track patients' health conditions without the need for frequent physical visits. The software will provide real-time notifications and alerts for abnormal readings, allowing medical practitioners to provide necessary medical attention when required.

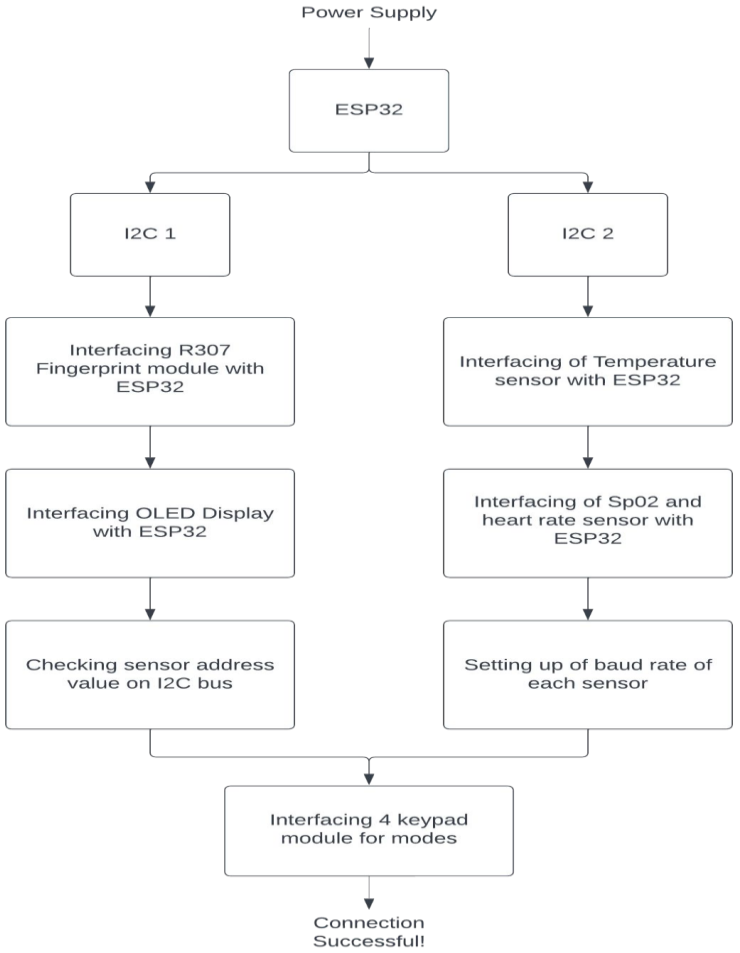
Overall, the development of this system has the potential to revolutionize health monitoring by leveraging technology to collect and analyze individual health data in a timely and automated manner. We aim to use this device for employees working in offices to track attendance, monitor health parameters in-case if the employee asks for a sick leave, and also provide data to medical authorities in-case the employee faces a medical emergency. If the readings of the employee are abnormal then the system will send a notification to the medical authorities so they can take the appropriate steps.

Problem Statement :-

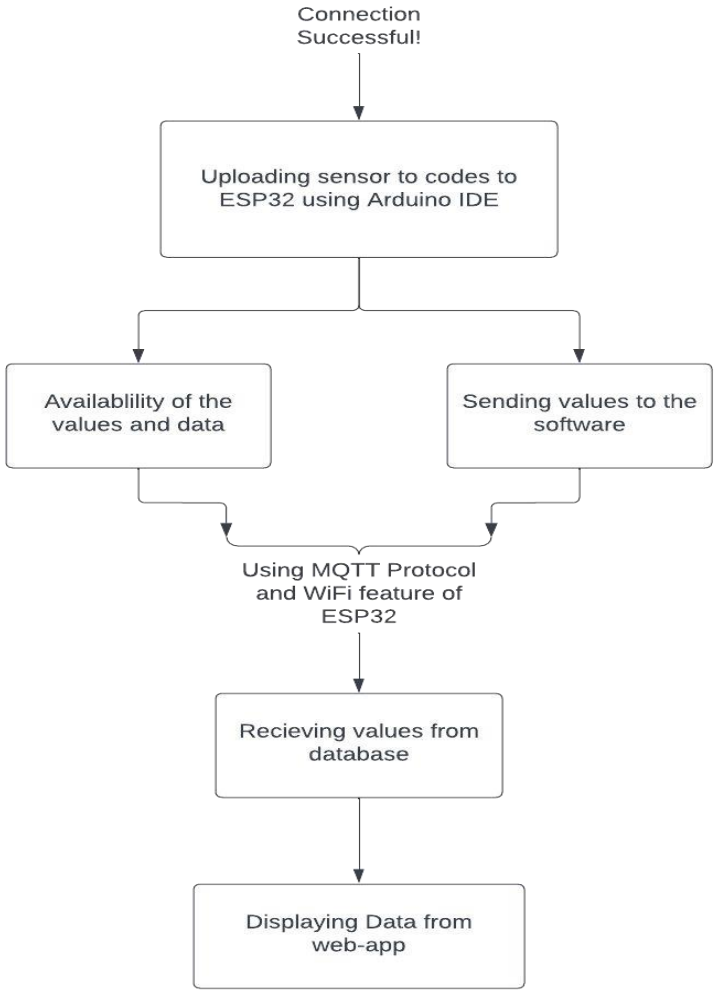
To design a system which can collect an individual's data such as heart rate, temperature, O2 level etc. on timely basis and display the result on a certain software which can help professionals analyse the obtained data, which in turn will help automate the health monitoring task.

Proposed Methodology

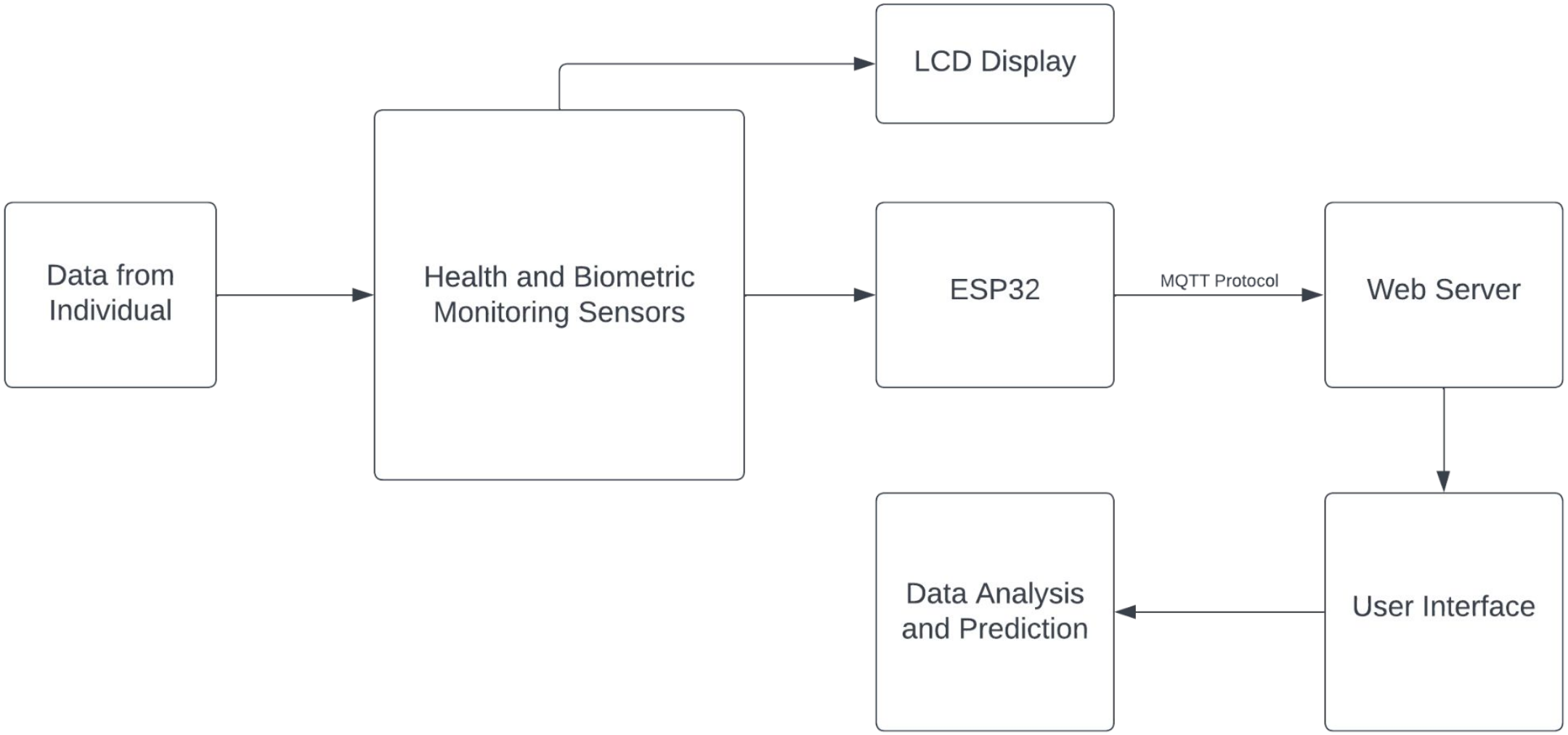
Flow chart


Power Supply
ESP32
I2C 1
I2C 2
Interfacing R307 Fingerprint module with ESP32
Interfacing of Temperature sensor with ESP32
Interfacing OLED Display with ESP32
Interfacing of Sp02 and heart rate sensor with ESP32
Checking sensor address value on I2C bus
Setting up of baud rate of each sensor
Interfacing 4 keypad module for modes
Connection Successful!

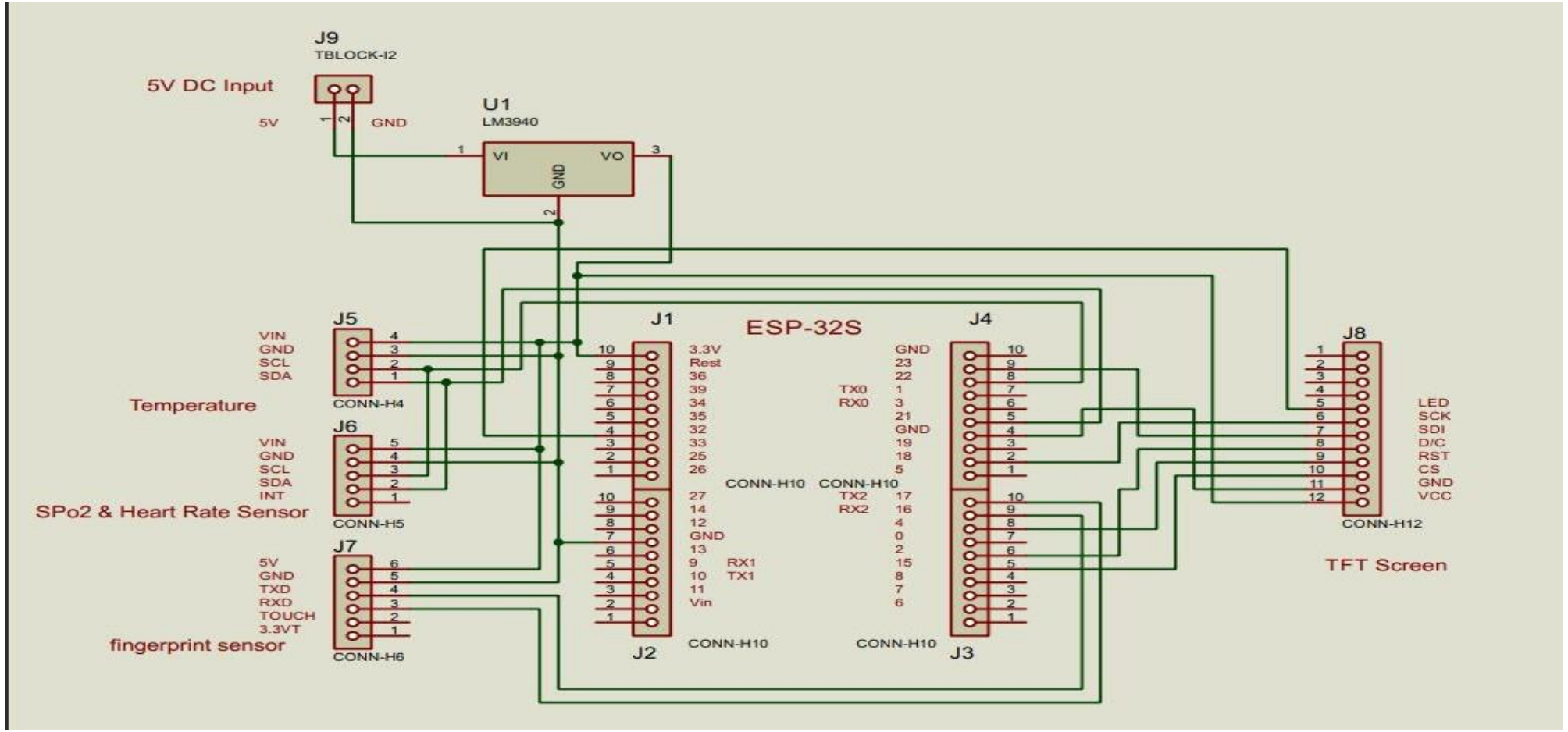
Flow chart (Continued..)



Block Diagram



Hardware Design



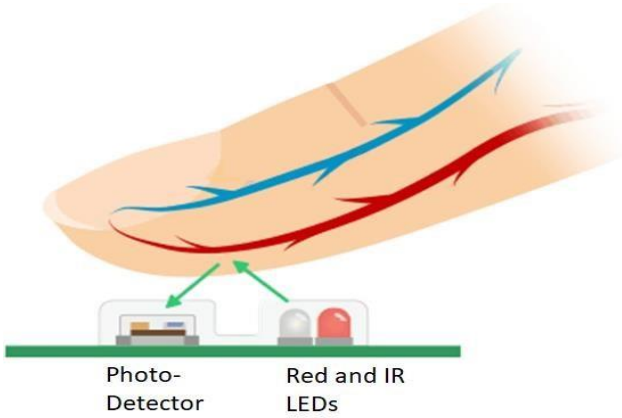
Basic Working:-

- The ESP 32 is connected to the power supply from the USB connection. On the ESP32 board several sensors and other hardware such as SPO2 sensor, heart rate sensor, temperature sensor and OLED display are connected on two different IC's which works on the Arduino code and collects the data through serial monitor in the arduino board

- This data is then transferred to the database and is then displayed on the web app, which will show all the data collected of all individuals through MQTT protocol using broker connection.

- This data is then analysed in the software to show the output on the screen or website to monitor the data for the better health of the each individual or employee.

Working of Heart rate sensor:-

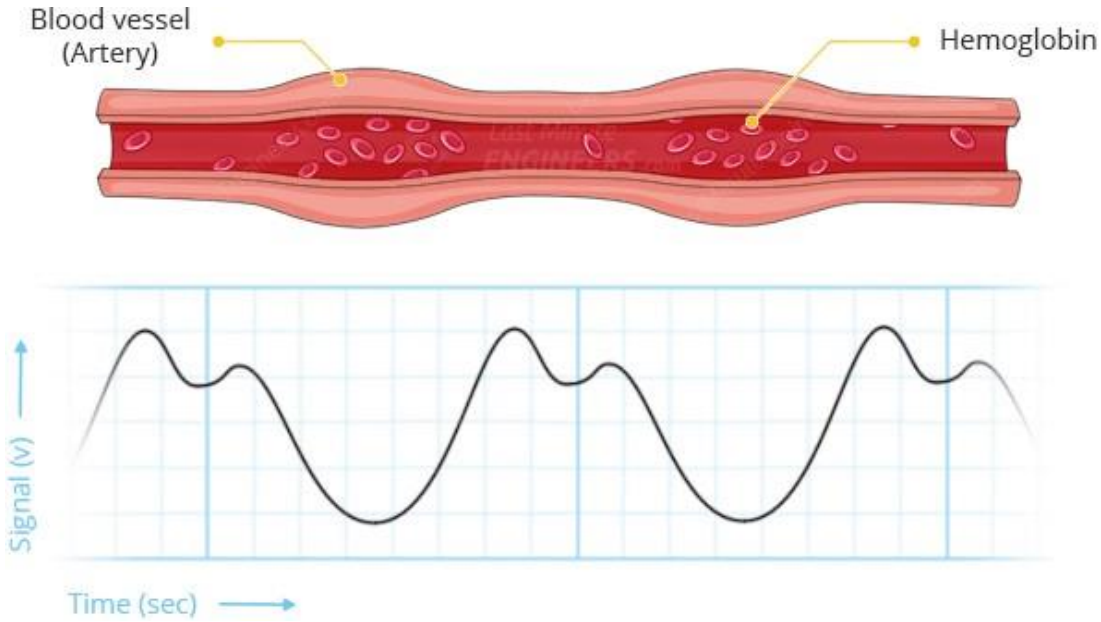


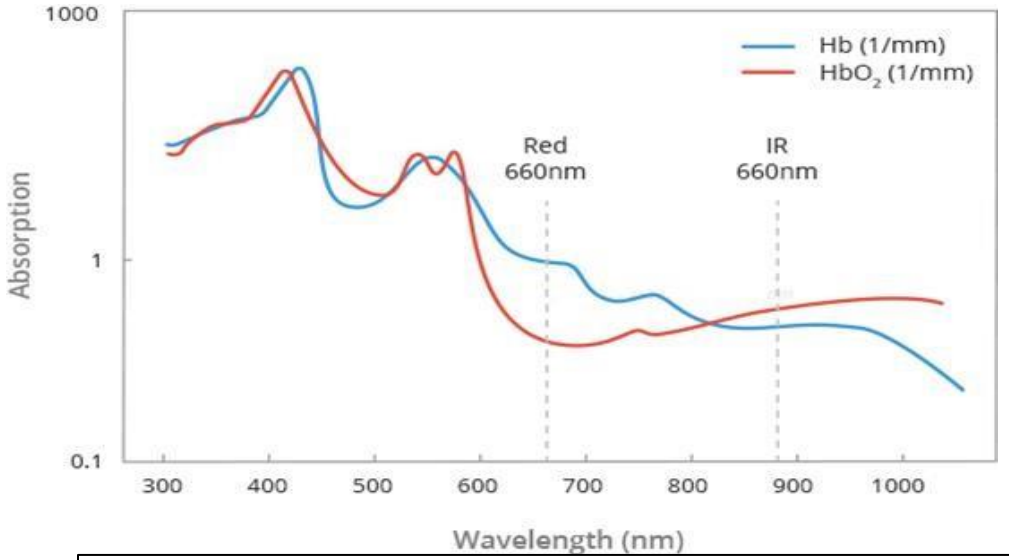
The MAX30102 works by shining both lights onto the finger or earlobe (or essentially anywhere where the skin isn't too thick, so both lights can easily penetrate the tissue) and measuring the amount of reflected light using a photodetector. This method of pulse detection through light is called Photoplethysmogram.

The working of MAX30102 can be divided into two parts: Heart Rate Measurement and Pulse Oximetry (measuring the oxygen level of the blood).

Heart Rate Measurement:-

The oxygenated hemoglobin (HbO2) in the arterial blood has the characteristic of absorbing IR light. The redder the blood (the higher the hemoglobin), the more IR light is absorbed. As the blood is pumped through the finger with each heartbeat, the amount of reflected light changes, creating a changing waveform at the output of the photodetector. As you continue to shine light and take photodetector readings, you quickly start to get a heart-beat (HR) pulse reading.





Pulse Oximetry:-

Pulse oximetry is based on the principle that the amount of RED and IR light absorbed varies depending on the amount of oxygen in your blood. The following graph is the absorption-spectrum of oxygenated hemoglobin (HbO2) and deoxygenated hemoglobin (Hb).

As you can see from the graph, deoxygenated blood absorbs more RED light (660nm), while oxygenated blood absorbs more IR light (880nm). By measuring the ratio of IR and RED light received by the photodetector, the oxygen level (SpO2) in the blood is calculated.

Working of Temperature sensor:-

The MLX90614 infrared sensor is one of the most accurate non-contact temperature sensor in the market. The working principle of the MLX90614 infrared sensor is to transform the infrared radiation signals collected from objects and bodies into electrical signals. These electrical signals are then sent into a converter after undergoing noise amplification processing by an amplifier. Finally, the electrical signals are converted to digital signals.

Comparison of microcontrollers in tabular form

Parameters	ESP8266	ESP32
MCU	XTensa Single Core 32-bit L106	XTensa Dual Core 32-bit LX6 600 DMIPS
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

Software Description

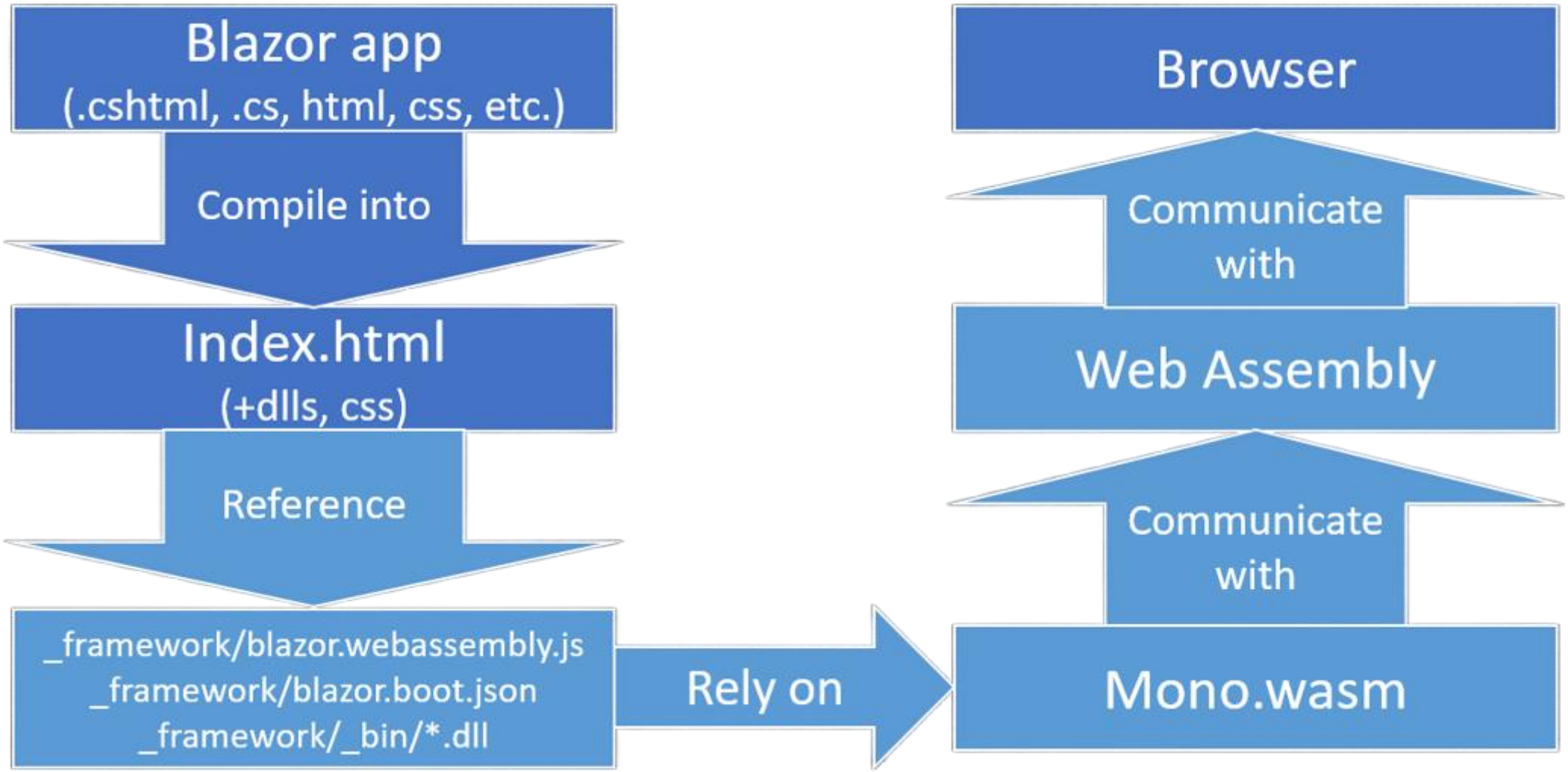
Blazor Framework

- Blazor is a web framework that enables developers to build interactive web UIs using C# instead of JavaScript. It's real .NET running in the browser on WebAssembly.
- Blazor is still under development, but it has the potential to revolutionize the way that web applications are built. Blazor makes it possible to build web applications that are more responsive, more secure, and easier to maintain.

Here are some of the benefits of using Blazor:

- Blazor is a single-page application (SPA) framework, which means that pages are loaded asynchronously and only the parts of the page that change are re-rendered.
- This makes Blazor applications more responsive than traditional web applications.

- **Below is a quick diagram describing behavior of blazor framework.**



SQLite

- SQLite is a self-contained, serverless, zero-configuration, transactional SQL database engine. SQLite is the most widely deployed SQL database engine in the world.
- SQLite is a very versatile database engine. It can be used in a wide variety of applications, including web applications, desktop applications, and mobile applications.

Here are some of the benefits of using SQLite:

- Small size: SQLite is a very small database engine. The entire database can be stored in a single file, which makes it very portable and easy to use.
- Fast performance: SQLite is a very fast database engine. It can handle a large number of concurrent connections.
- Versatility: SQLite can be used in a wide variety of applications, including web applications, desktop applications, and mobile applications.

MQTT Protocol

- The MQTT protocol is the de-facto standard for IoT messaging.
- Standardized by OASIS and ISO, MQTT publishes/subscribes to the protocol, providing a scalable and reliable way to connect devices over the Internet.
- The protocol is a set of rules that defines how IoT devices can publish and subscribe to data over the Internet

MQTT Broker

- The MQTT broker is a piece of software running on a computer (running on-premises or in the cloud) and could be self-built or hosted by a third party. It is available in both open-source and proprietary implementations.
- Multiple clients can subscribe to a topic from a single broker (one-to-many capability),

Merits :-

- Allows user to diagnose themselves on their own without the intervention of a doctor.
- Very easy to operate.
- Comparatively lower in cost than other healthcare monitoring systems.
- Device is Portable.
- Can be used in rural areas.
- Scalable.
- Can be used to monitor attendance with health parameters in certain insitutions

Demerits:-

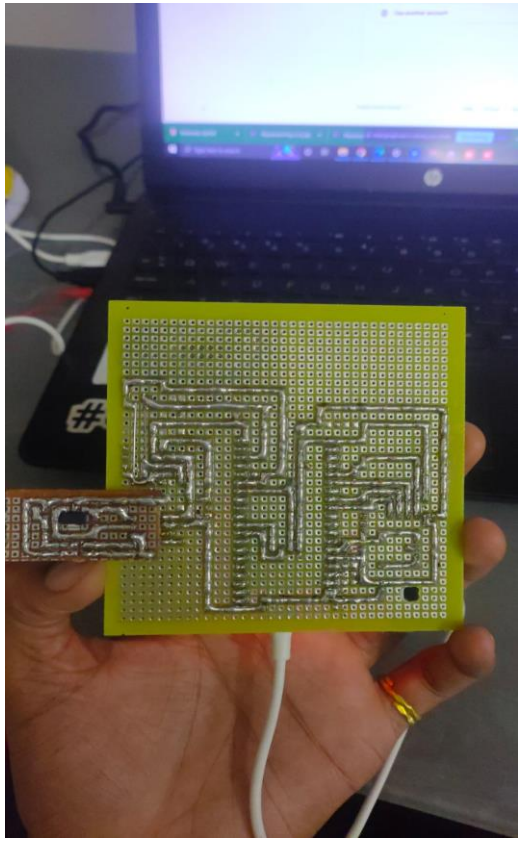
- The biggest concern in an IoT setup is the integrity of the data generated by the sensors from the users.
- Hackers may steal this data and use it for personal gain.
- Setup cannot work without power supply.
- Power supply can act as a single point of failure in an IoT setup like this.

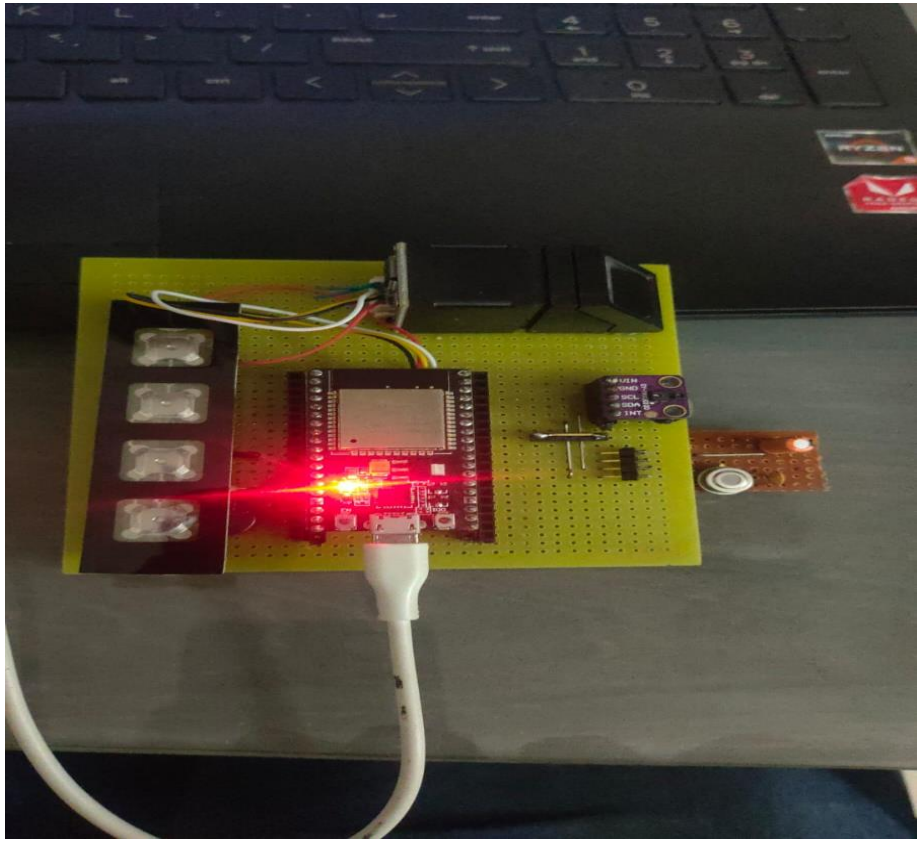
Work Done

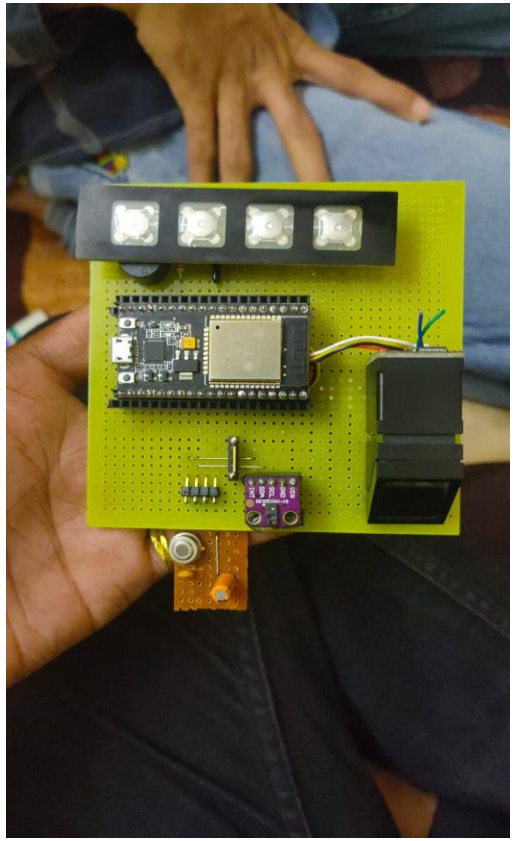
Work Done – Sem 1

- July - Project Started
  - Learning ESP32
  - Gathered all requirements and ESP32
- August
  - Brainstorming about each component of hardware
- September
  - Developing soldering design
  - Soldering all components according to design
  - Testing of all connections and sensors
- October
  - Programming
  - Debugging

Sem 1 Project Photos







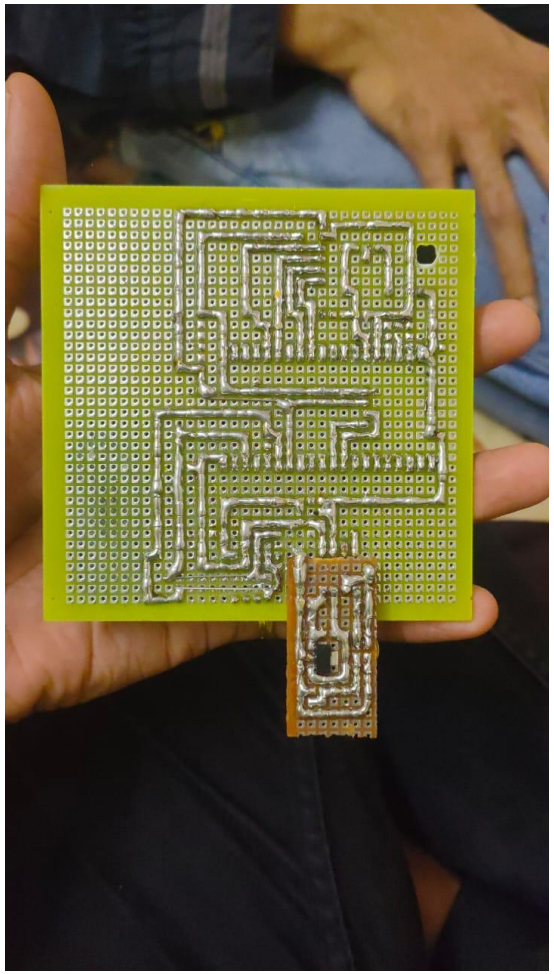
Work Done – Sem 2

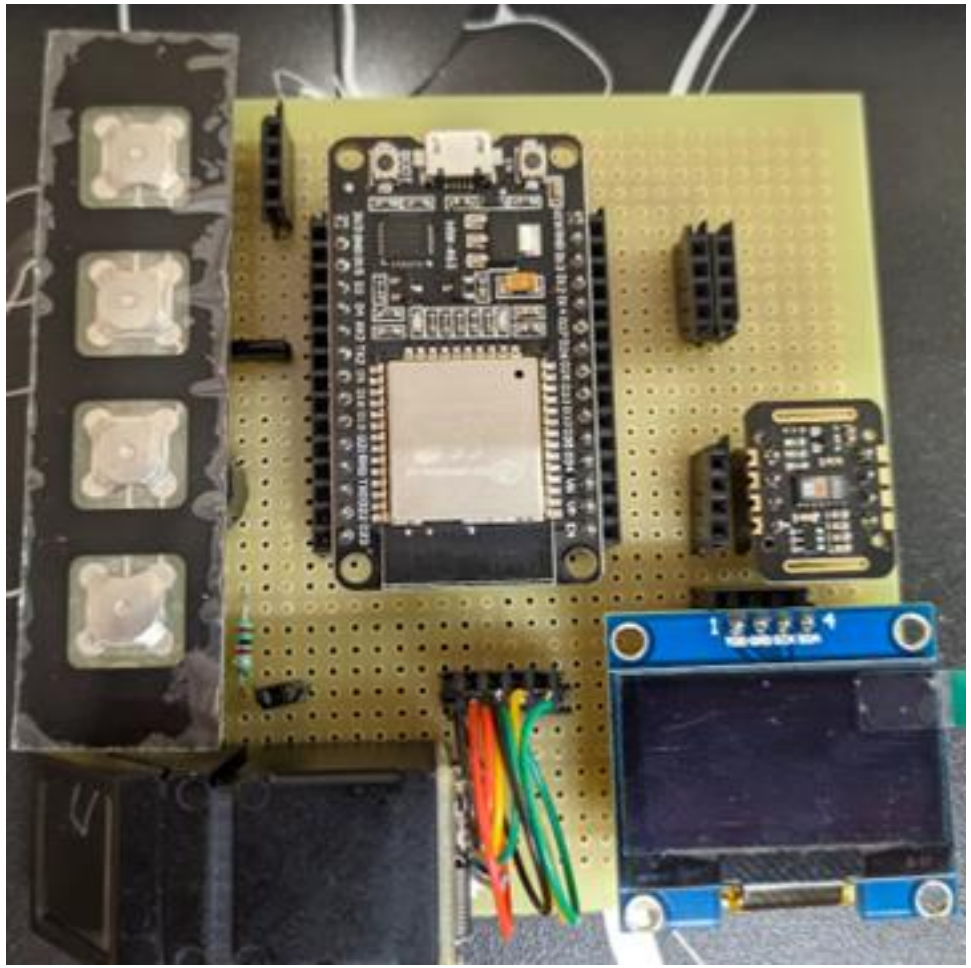
- November
  - Testing out new libraries
  - Debugging
- December
  - Hardware Redesigning
  - Product designing
- January
  - Finalized new design
  - Integrated all the sensors
  - Fine tuning sensor accuracy
- February
  - Brainstorming about landing page
  - Discussed functionality and structure of web application

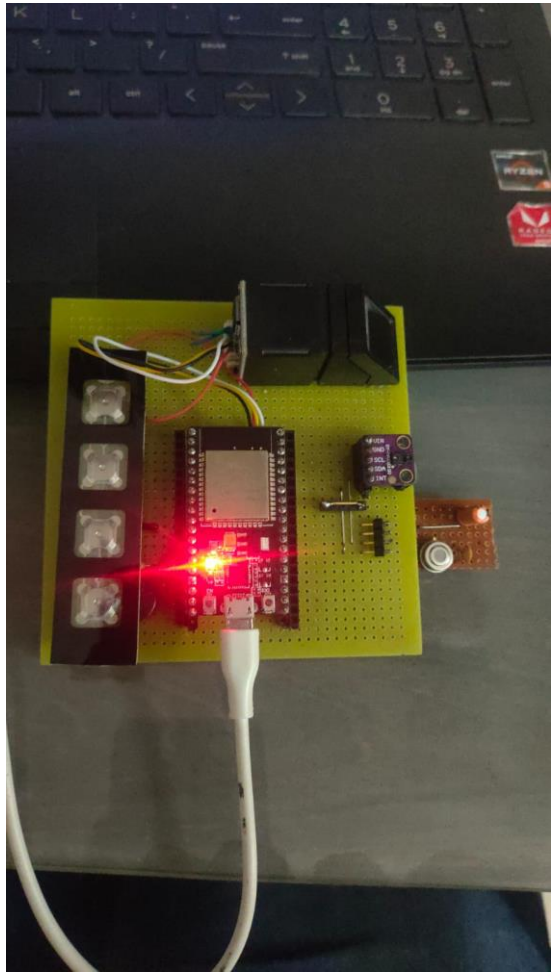
Work Done – Sem 2 (Continued)

- March
  - Developed the web application
  - Debugging
- April
  - Testing overall flow of the project
  - Documentation and PPTs
- May
  - Documentation and Black blook printing

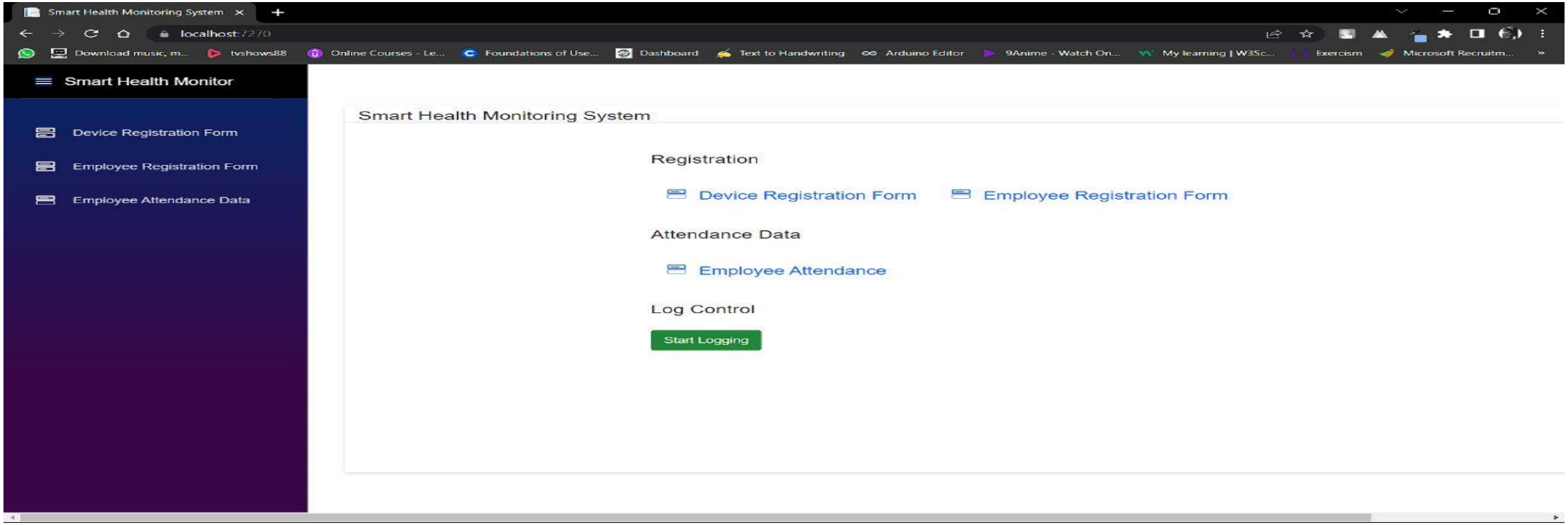
Sem 2 Project Photos



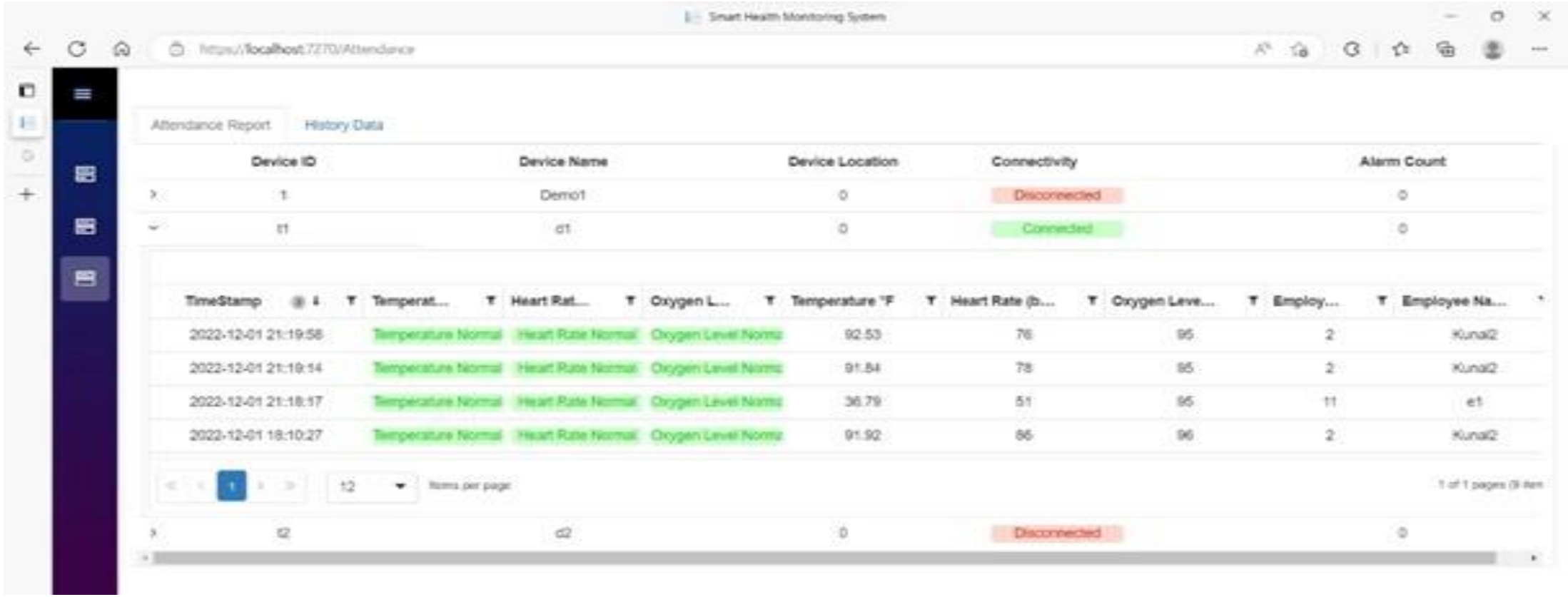




Web App Photos

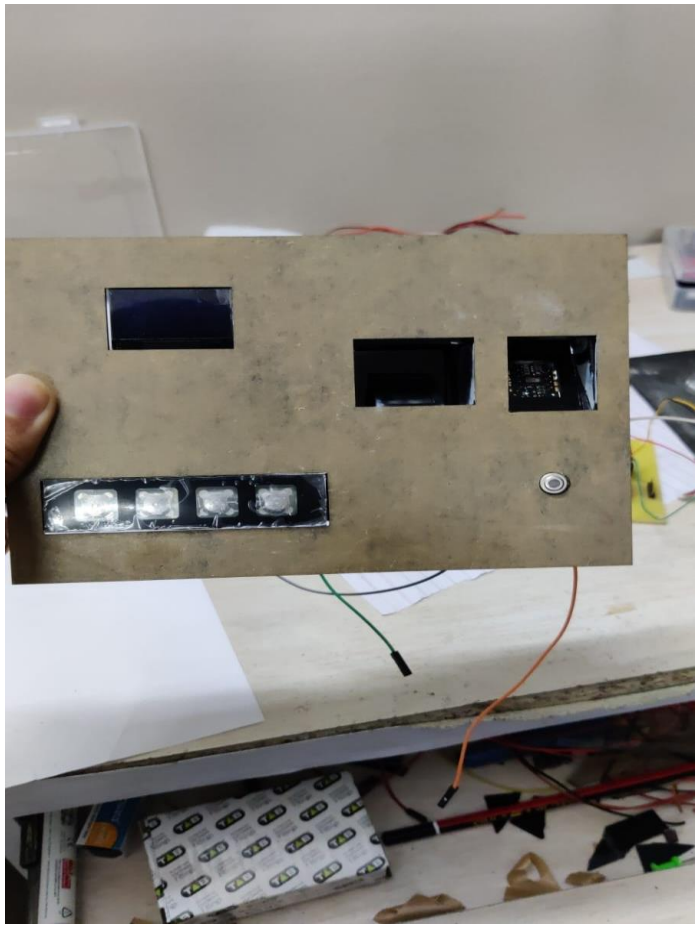


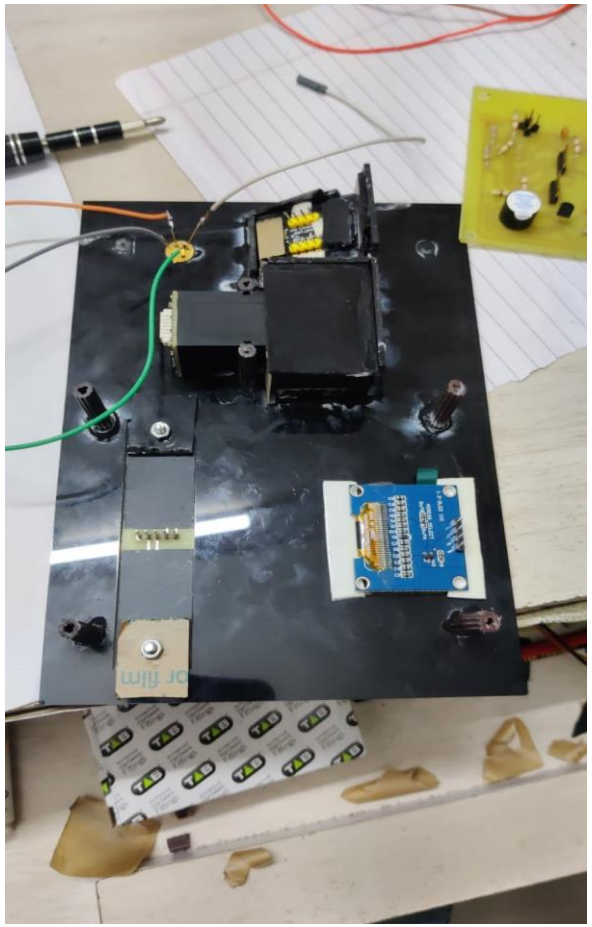
This is the landing page of the website. Any administrator who has access to this data will see this as the first page of the web app. From here he can navigate to all the other sections of the web app

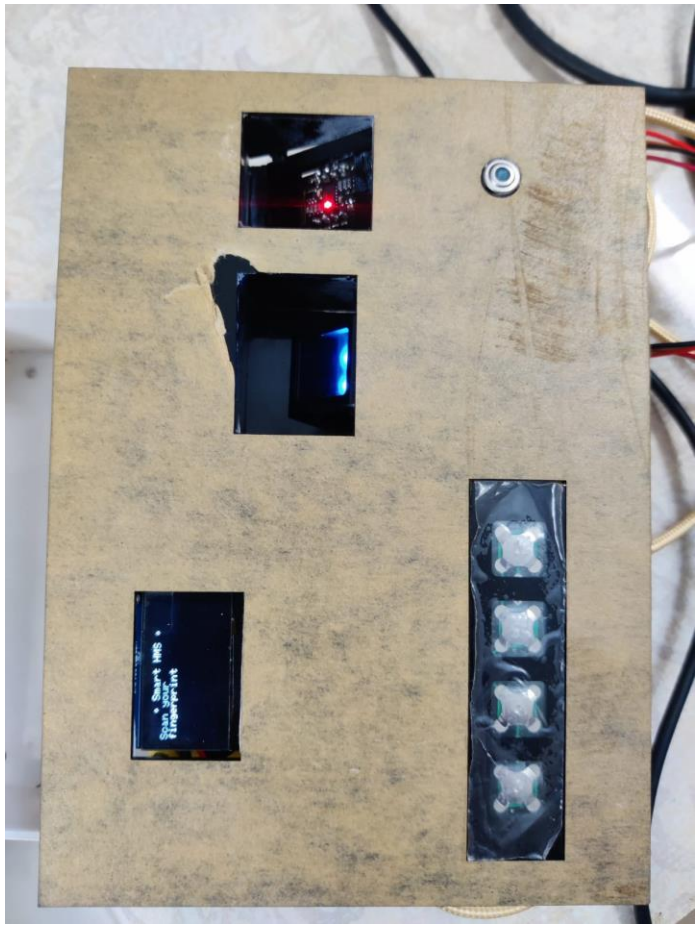


This is a screenshot of the website which displays the data which gets imported from the SQLite database. This page shows the connectivity status and whether all the parameters of the user are normal.

Final Project Photos







Final Product Photo

Results and Discussion

Results and Discussion:-

- Receiving correct data from SpO2, heart rate sensor and temperature sensor also.
- Able to enroll fingerprint through the sensor.
- Able to test the enrolled fingerprints.
- OLED Screen is showing the expected output.
- Integrated all the sensors together in a single code format.
- Fine tuned the accuracy of the sensors by trying out different sensor libraries.

Results and Discussion:-

- We observed that all the sensors gather information from the user and send data to the ESP32 microcontroller.
- Parsing all this data came with its own challenges. Sending all the raw data into the appropriate format was crucial as the data would be useless if its is not cleaned.
- Came across challenges and bugs while incorporating MQTT Protocol with ESP32.
- By comparing with various research papers, we got the expected output as proposed.

Conclusion

Conclusion

Hence, we can conclude that the prototype for an automatic system that guarantees a constant monitoring of various health parameters and predictions of any disease that prevents the user from the frequent visits to the hospitals. This way we can gather massive amounts of data which can be used for predicting the outcome of the individual's health.

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THANK YOU !