“ IOT Based Biometric Fingerprint Attendance System”

PGDCT PROJECT

Submitted to

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

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POST GRADUATION DIPLOMA

IN

Cloud Technology

Submitted by

Ms. Naina Bawane

Ms. Chaitali Ghugal

Ms. Pratiksha Wankhede

Mr. Sumit Parate

Under the Guidance

Prof. Sandeep Sonaskar

Prof. Nitinkumar Choudhary

DEPARTMENT OF POST GRADUATION DIPLOMA IN CLOUD TECHNOLOGY(2022-23)

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

CERTIFICATE

SEAL OF RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

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Certified that the project report entitled **“Iot Based Biometric Fingerprint Attendance System”** has been completed by Naina Bawane, Chaitali Ghugal, Pratiksha Wankhede, and Sumit Parate.under the guidance of prof.Sandeep Sonaskar and prof.Nitinkumar choudhary and it is submitted to the department of Post-Graduation Diploma in Cloud Technology.

Prof.Nitinkumar Choudhary

Project Guide

Prof.Sandeep Sonaskar

Head of Department

DECLARATION

I hereby declare that the project entitled, **Biometric Fingerprint Attendance System** was carried out and written by me under the guidance of **Prof.Sandeep Sonaskar** and **Prof.Nitinkumar Choudhary,** Cloud Technology Department, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. This work has not been previously formed the basis for the award of any degree or diploma or certificate not has been submitted elsewhere for the award of any degree or diploma.

Date: **1)Ms.Naina Bawane**

Place:Nagpur

2)Ms.Chaitali Ghugal

3)Ms.Pratiksha wankhede

4)Mr.Sumit Parate

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ABSTRACT

In all education organizations or institutions taking daily attendance of students and employees in classes and offices, is a very important factor. All most in all educational institutes, the daily attendance is taken in a traditional way. The attendance is taken manually using an attendance register book and then week or month-wise this attendance is filled on server to find the attendance report of each student. This is a very time consuming process and it also wastes some time from lecture period. To overcome this, we have proposed and implemented IoT based student? attendance system for the smart college campus. We have designed a portable device with a fingerprint scanner to recognize the attendance of students on the biometric parameter. The captured attendance of the lecture will be sent to the remote server using Wi-Fi. We have also implemented the windows application which will be provided as a dashboard for faculty and students to view the attendance report remotely anytime, anywhere. Implemented system will improve the accuracy of attendance recording due to biometric features and also save the time of the teacher during the lecture.

CONTENTS

INTRODUCTION

In this smart attendance system, the notion of Internet of Things is put-in into an attendance system of a classroom. Due to increasing development in the area of cloud-based computing, there are various storing systems in which the data is often precisely stored and can be fetched anytime. Basically, fingerprints are considered as the foremost reliable type of thing to be used in biometric systems. The project contains an FPS that identifies the identity of student by scanning the fingerprint. If the biometrics of the fingerprint of a particular student which is scanned get matched with the data records which is present on the database of the cloud, then the attendance of that student is marked as present. This attendance system saves the time and it proves to be highly secured than the usual manual attendance system. The proposed system requires connection to the web, that can be accomplished through a Wi-Fi.

Overview

In this project **IoT Biometric Project**, we will learn how to build I**oT based Biometric Fingerprint Attendance System** using **NodeMCU ESP8266 12E**, 0.96″ **OLED Display** & **R305 Fingerprint Sensor**. The **ESP8266 Wi-Fi Module** will collect the **fingerprint data** from the multiple users and sends it over the internet to a **website**. The Enrolment of fingerprints is done on the Server using **R305** or **R307** or any other compatible Fingerprint Sensor and verification is done on the client with the transmission of fingerprint templates over the network.

The **website** that is coded in **PHP** has a **database** and **records of attendance**. By logging into the website, you can collect all the attendance records of each user including personal details as well as incoming & outgoing timing. The data can also be downloaded and exported to an **excel sheet**.

Conventional authentication technologies like RFID tags and authentication cards have a lot of weaknesses, the biometric method of authentication is a prompt replacement for this. **Biometrics** such as **fingerprints**, voices and ECG signals are unique human characters that cannot be tampered or replicated. This facilitates real-time system implementations. **Biometric Attendance systems** are commonly used systems to mark the presence in offices and schools. This project has a wide application in school, college, business organization, offices where marking of attendance is required accurately with time. Thus, by using the **fingerprint sensor**, the system will become more secure for the users.

You can follow the basic level of the same project here: Arduino Fingerprint Attendance System. In case if you want a better fingerprint sensor with small and light weight, you can use **GT511C3** fingerprint sensor.

METHODOLOGY

This research work is based on the design and implementation of staff biometric attendance system using fingerprint authentication. The proposed system can be used to monitor, identify and check the IN and OUT timings of non-academic staff in tertiary institution. The system requires that all non-academic staff enrol his/her fingerprint for the device to identify and verify if he is a valid staff and also to record daily resumption and closure timings for the staff for a whole month, before payment of salaries are effected. The primary idea behind this is to avoid a situation where staff records fake timings in the manual register and yet receiving full payment for the month. This greatly affects output to input ratio of staffs and in earnest the institution as a whole. The proposed design enhances compilation of each staff's attendance by remote workstations, which are then sent to the central database server at the end of each month for easy processing of salaries and allowances. The result of each staff clocking in and out timing is captured via a fingerprint device at each terminal and stored in the central database server. Each

Department remote terminal is interconnected to the central database server via a shared network.

Bill of Materials

The following are the components required to make IoT Based Biometric Fingerprint Attendance System**. All the components can be purchased from Amazon. The purchase links are given below.**

S.N	COMPONENTS	QUANTITY	PURCHASE LINKS
1	**NodeMCU ESP8266 Board**	**1**	Amazon **|** AliExpress
2	**R305/R307 Fingerprint Sensor**	**1**	Amazon **|** AliExpress
3	**0.96" I2C OLED Display**	**1**	Amazon **|** AliExpress
4	**Connecting Wires**	**10**	Amazon **|** AliExpress
5	**Breadboard**	**1**	Amazon **|** AliExpress

R305 Fingerprint Scanner Sensor Module

This is a finger print sensor module with TTL UART interface for direct connections to microcontroller UART or to PC through MAX232 / USB-Serial adapter. The user can store the finger print data in the module and can configure it in 1:1 or 1: N mode for identifying the person.

The Fingerprint module can be directly interfaced with any microcontroller as well as Arduino Board. This optical biometric fingerprint reader with great features and can be embedded into a variety of end products like access control systems, attendance systems, safety deposit boxes, car door locking systems.

Features

1. Integrated image collecting and algorithm chip together, ALL-in-One

2. The fingerprint reader can conduct secondary development, can be embedded into a variety of end products

3. Low power consumption, low cost, small size, excellent performance

4. Professional optical technology, precise module manufacturing techniques

5. Good image processing capabilities can successfully capture image up to resolution 500 dpi

Specifications

1. Fingerprint sensor type: Optical

2. Sensor Life: 100 million times

3. Static indicators: 15KVBacklight: bright green

4. Interface: USB1.1/UART(TTL logical level)

5. RS232 communication baud rate: 4800BPS~115200BPS changeable

6. Dimension: 553221.5mm

7. Image Capture Surface 15—18(mm)

8. Verification Speed: 0.3 sec

9. Scanning Speed: 0.5 sec

10. Character file size: 256 bytes

11. Template size: 512 bytes

12. Storage capacity: 250

13. Security level: 5 (1,2,3,4,5(highest))

14. False Acceptance Rate (FAR) :0.0001%

15. False Rejection Rate (FRR): 0.1%

16. Resolution 500 DPI

17. Voltage :3.6-6.0 VDC

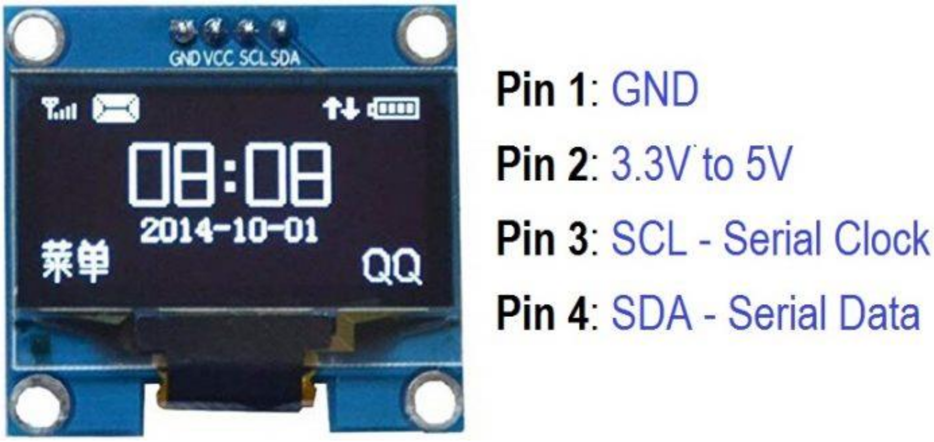
18. Working current: Typical 90 mA, Peak 150mA

19. Matching Method: 1: N

20. Operating Environment Temperature: -20 to 45° centigrade

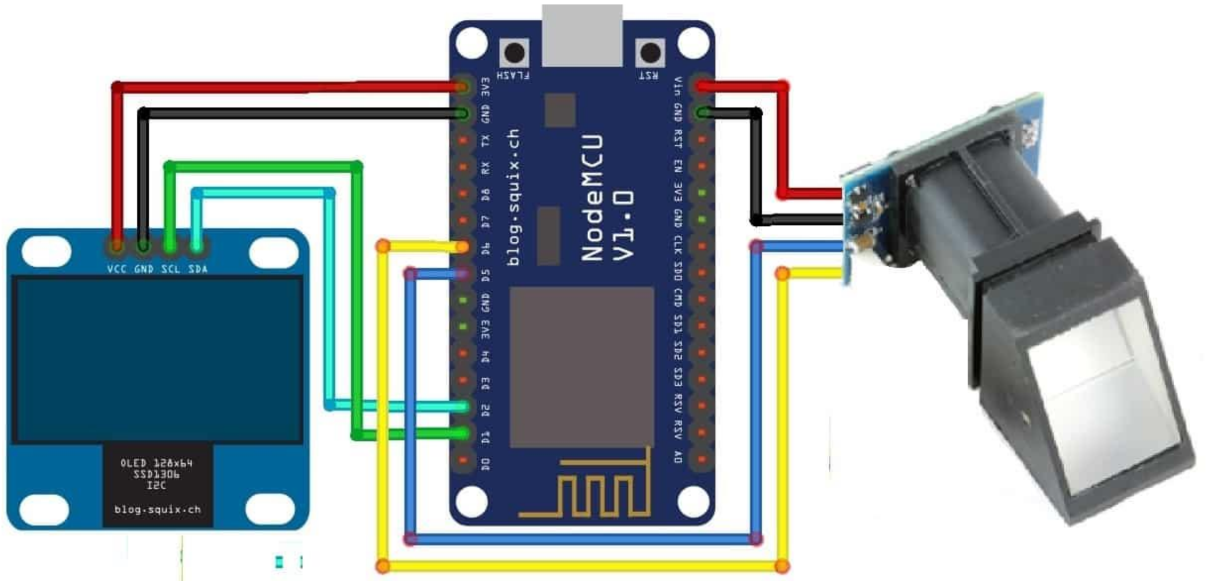
0.96″ I2C OLED Display

This is a 0.96 inch blue OLED display module. The display module can be interfaced with any microcontroller using SPI/IIC protocols. It is having a resolution of 128x64. The package includes display board, display,4 pin male header pre-soldered to board.



OLED (Organic Light-Emitting Diode) is a self light-emitting technology composed of a thin, multi-layered organic film placed between an anode and cathode. In contrast to LCD technology, OLED does not require a backlight. OLED possesses high application potential for virtually all types of displays and is regarded as the ultimate technology for the next generation of flat-panel displays.

Circuit Diagram: IOT Based Biometric Fingerprint Attendance System


VCC GND SCL SDA
OLED 128x64
SSD1306
I2C
blog.squix.ch
FLASH
RST
NodeMCU
V1.0
blog.squix.ch
3V3 GND TX RX D8 D7 D6 D5 GND 3V3 D4 D3 D2 D1 D0
Vin GND RST EN 3V3 GND CLK SDO CMD SD1 SD2 SD3 RSV RSV A0

The above circuit diagram shows how an OLED Display & Fingerprint Sensor is interfaced with NodeMCU ESP8266 12E Board. The I2C pins of OLED Display, i.e SDA & SCL are connected to NodeMCU D2 & D1 pins respectively. Similarly, the fingerprint sensor is connected to UART pins D5 & D6. The fingerprint sensor Tx and Rx wire's color may vary. In my case, the color is yellow and blue where yellow is Tx and Blue is Rx. So connect it by finding appropriate color wires else the module won't be detected by NodeMCU.

The R305 fingerprint sensor is supplied with 5V through Vin pins of NodeMCU. In my case, the sensor didn't work at 3.3V. Similarly, connect OLED Vcc pin to 3.3V of NodeMCU.

Algorithms and Flowchart

1. Starts the process.

2. Select the option to enroll new fingerprint or delete previous ones.

3. If nothing is selected it scans for the wi-fi network and joins if new known network.

Fig: Architecture of fingerprint BAS using IOT

4. If none of the known networks are present than it displays all the available networks.

5. Any of the new network can be selected and joined by entering the password.

6. Once the connection is established it starts scanning for the fingerprints.

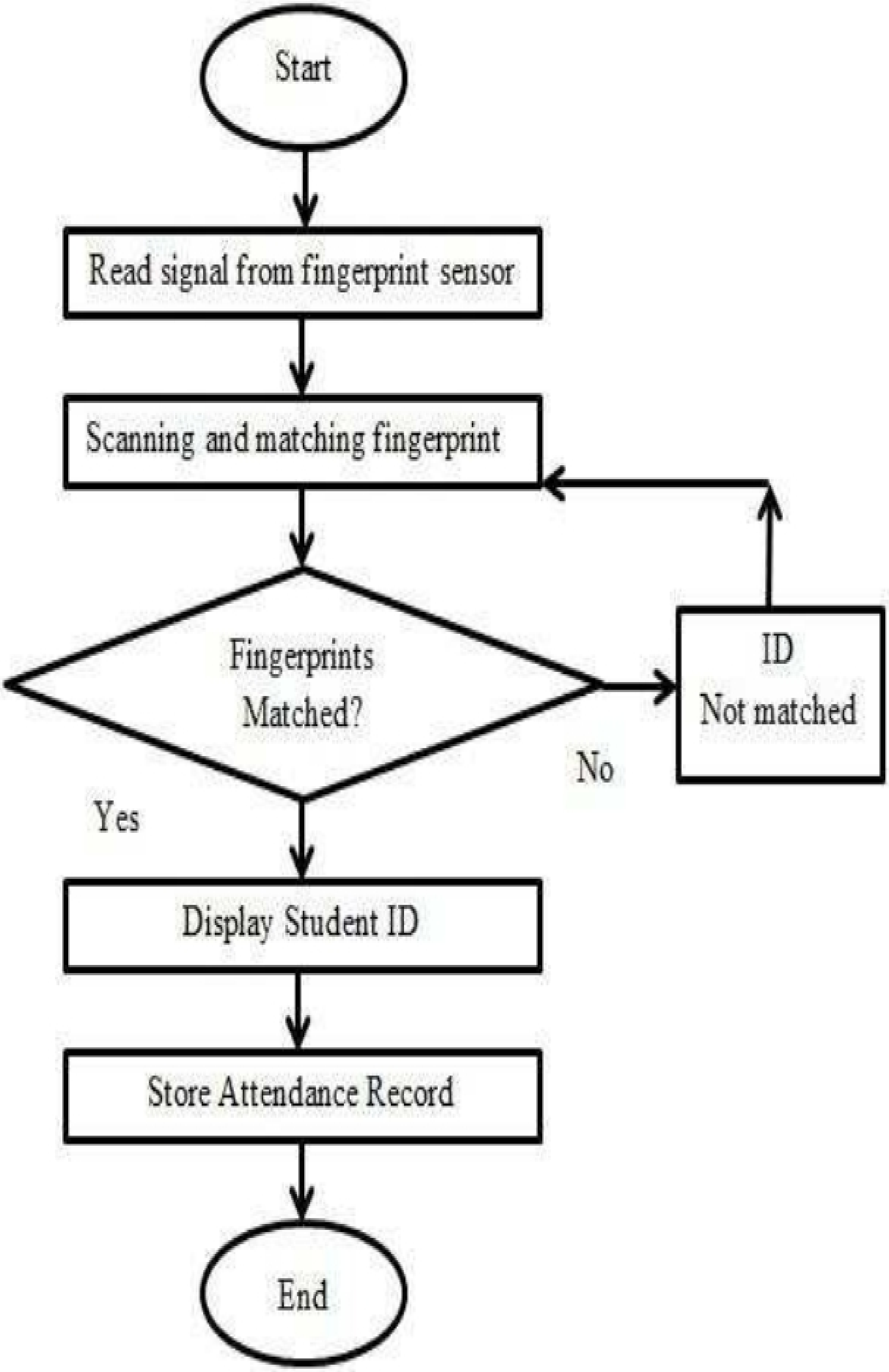
7. When a teacher scans his/her fingerprint it asks for the class and lecture for which attendance is being taken.

8. Now the students can scan their fingerprints.

9. Whenever it recognizes any student it send their fingerprint ID to the server through packet data transmission.

10. When a server receives the data from the system it updates the attendance of the student.

11. When the attendance of all the students is taken, any student can check his/her attendance on the android application.


Start
Read signal from fingerprint sensor
Scanning and matching fingerprint
Fingerprints Matched?
No
ID Not matched
Yes
Display Student ID
Store Attendance Record
End

FUTURE SCOPE

***Security**: biometrics provide an unrivaled layer of security for people's sensitive data and their money. While information-based verification like passwords and PINs are common, they are vulnerable to falling into the wrong hands, either accidentally or through malicious activity. Biometric data is individual, and lives on the person themselves, and so can't easily be stolen or misused.*

- ***Convenience**: despite the level of detail and technology involved in biometrics, the user-facing experience is easy, and in most cases, pretty much instantaneous. Users don't have to remember any credentials or type in complicated passwords, nor do they have to remember all the passwords for the multitude of accounts they have with different businesses and organizations.*
- ***Protection**: biometric information is very hard to fake, and only living, breathing human beings can pass biometric tests such as fingerprint, voice or facial recognition. As well as breeding confidence in people that any security risk to them is minimized, it gives confidence to businesses and organization*

  that they're dealing with the right people in the right ways, and that sensitive data is properly protected and safeguarded.

.***Checkout-free shopping:*** Amazon and other leading retailers are increasingly trialing stores where shoppers simply collect the goods they want and payment is taken automatically. Biometric scanning through AI-driven facial recognition cameras can replace the need to check into stores using a mobile app, and make the retail experience even more seamless.

- ***Multimodal authentication:*** even with innovation as sophisticated as biometrics, it's always better to add further layers of protection where possible (as long as it doesn't cause too much inconvenience or disruption). Multimodal authentication brings several biometric technologies together in a single platform, which businesses can deploy to get the best of both worlds in terms of security and user experience.
- ***Sharing economy:*** peer-to-peer business operations, like people who rent out houses and apartments through AirBnB, don't necessarily have all the security protections that businesses do. Being more able to readily deploy biometric technology can help keep them safe from theft and fraud, and enable the growing 'sharing economy' to continue to prosper in the years to come

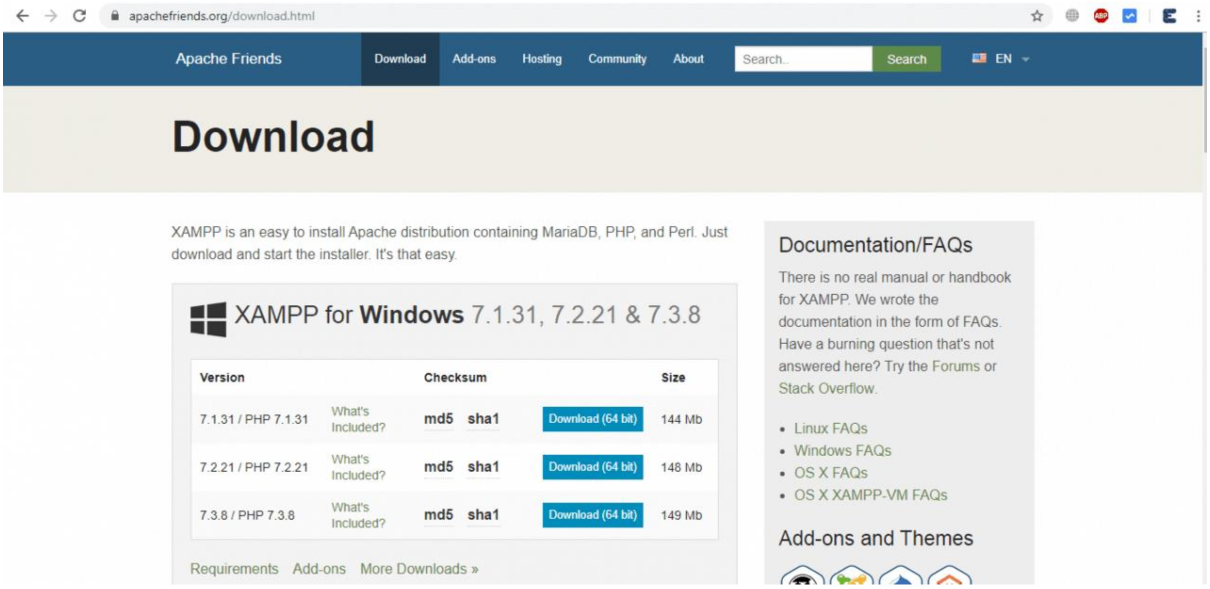
- All of the factors mentioned above are contributing to continued growth in the biometrics market globally. Global Markets Insights has estimated that the global market will be worth more than $50 billion by 2024. Extensive investment by security and governmental bodies in the United States is a primary driver of this growth, along with increased moves towards digital identity in countries like China and India.
- But alongside these major players, growth in biometrics will come through the increased democratization of the sector. This is through the increased rollout of online and cloud-based verification platform many of which can be white-labeled to integrate with a company's existing digital footprint.

Setting Up the Website

Here we can set up a website if you have a website and a server. In case you don't wanna spend money on website management, then you can use your computer IP as a server to store the data locally in localhost.

But in case if you need a website or domain, you can purchase from here at cheap price**:** **Web Hosting Packages**.

First Download and install Xampp from the link here: **Download Xampp**



Download

XAMPP is an easy to install Apache distribution containing MariaDB, PHP, and Perl. Just download and start the installer. It's that easy.

XAMPP for **Windows** 7.1.31, 7.2.21 & 7.3.8

Version		Checksum			Size
7.1.31 / PHP 7.1.31	What's Included?	md5	sha1	Download (64 bit)	144 Mb
7.2.21 / PHP 7.2.21	What's Included?	md5	sha1	Download (64 bit)	148 Mb
7.3.8 / PHP 7.3.8	What's Included?	md5	sha1	Download (64 bit)	149 Mb

Documentation/FAQs

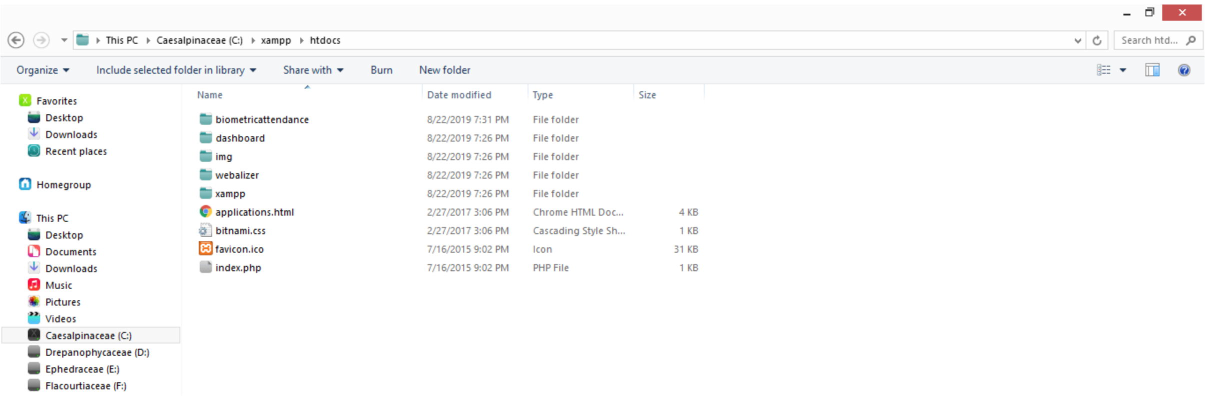
There is no real manual or handbook for XAMPP. We wrote the documentation in the form of FAQs. Have a burning question that's not answered here? Try the Forums or Stack Overflow.

- Linux FAQs
- Windows FAQs
- OS X FAQs
- OS X XAMPP-VM FAQs

Add-ons and Themes

Once the download and installation is completed copy the following folder:

Biometricattendance Folder to **C:\xampp\htdocs**. This is the location of the website in your C drive.



Name	Date modified	Type	Size
biometricattendance	8/22/2019 7:31 PM	File folder	
dashboard	8/22/2019 7:26 PM	File folder	
img	8/22/2019 7:26 PM	File folder	
webalizer	8/22/2019 7:26 PM	File folder	
xampp	8/22/2019 7:26 PM	File folder	
applications.html	2/27/2017 3:06 PM	Chrome HTML Doc...	4 KB
bitnami.css	2/27/2017 3:06 PM	Cascading Style Sh...	1 KB
favicon.ico	7/16/2015 9:02 PM	Icon	31 KB
index.php	7/16/2015 9:02 PM	PHP File	1 KB

The website setting process is a little long which is explained in the video below: You can follow the video to completely set up the website.

Source Code/Program

Below is the source code for IoT Based Biometric Fingerprint Attendance System. The code credit goes to original author of the code: Electronics Tech YouTube Channel

Make Sure to change the wifi username and password from this line below:

```
/* Set these to your desired credentials. */
const char *ssid = "SSID";  //ENTER YOUR WIFI SETTINGS
const char *password = "password";
```

Also, change the IP Address if you are using Xampp or change the website server if you are on real website from the line below:

```
String link = "http://YourComputerIP/biometricattendance/getdata.php"; //computer IP or the server domain
```

Add the following libraries via library manager or simply by adding the following zip files:

1. OLED GFX Library: Download
2. SSD1306 Library: Download
3. Adafruit Fingerprint Sensor Library: Download

```
//Code Credit to orginal Author:  https://www.youtube.com/ElectronicsTechHaIs
//This code created by Electronics Tech channel
//*****************************libraries******************************
#include <SPI.h>
#include <Wire.h>
#include <WiFiClient.h>
#include <ESP8266WiFi.h>
#include <SoftwareSerial.h>
#include <ESP8266WebServer.h>
#include <ESP8266HTTPClient.h>
#include <Adafruit_GFX.h>        //https://github.com/adafruit/Adafruit-GFX-Library
#include <Adafruit_SSD1306.h>     //https://github.com/adafruit/Adafruit_SSD1306
#include <Adafruit_Fingerprint.h>  //https://github.com/adafruit/Adafruit-Fingerprint-Sensor-Library
```

```
//**************************************************************************
//Fingerprint scanner Pins
#define Finger_Rx 14 //D5
#define Finger_Tx 12 //D6
// Declaration for SSD1306 display connected using software I2C
#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 64 // OLED display height, in pixels
#define OLED_RESET     0 // Reset pin # (or -1 if sharing Arduino reset pin)
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, OLED_RESET);
//**************************************************************************
SoftwareSerial mySerial(Finger_Rx, Finger_Tx);
Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);
//**************************************************************************
/* Set these to your desired credentials. */
const char *ssid = "SSID";  //ENTER YOUR WIFI SETTINGS
const char *password = "password";
//**************************************************************************
String postData ; // post array that will be send to the website
String link = "http://YourComputerIP/biometricattendance/getdata.php"; //computer IP or the
server domain
int FingerID = 0;     // The Fingerprint ID from the scanner
uint8_t id;
//*************************Biometric Icons*********************************
#define Wifi_start_width 54
#define Wifi_start_height 49
const uint8_t PROGMEM Wifi_start_bits[] = {
  0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x1f,0xf0,0x00,0x00,0x00
,0x00,0x03,0xff,0xff,0x80,0x00,0x00
,0x00,0x1f,0xf0,0x1f,0xf0,0x00,0x00
,0x00,0x7e,0x00,0x00,0xfc,0x00,0x00
,0x01,0xf0,0x00,0x00,0x1f,0x00,0x00
,0x03,0xc0,0x00,0x00,0x07,0xc0,0x00
,0x0f,0x00,0x00,0x00,0x01,0xe0,0x00
,0x1c,0x00,0x00,0x00,0x00,0x70,0x00
,0x38,0x00,0x07,0xc0,0x00,0x38,0x00
,0x70,0x00,0xff,0xfe,0x00,0x1e,0x00
,0xe0,0x03,0xfc,0x7f,0xc0,0x0e,0x00
,0x00,0x1f,0x80,0x03,0xf0,0x00,0x00
,0x00,0x3c,0x00,0x00,0x78,0x00,0x00
,0x00,0xf0,0x00,0x00,0x1c,0x00,0x00
,0x01,0xe0,0x00,0x00,0x0c,0x00,0x00
,0x03,0x80,0x00,0x00,0x00,0x00,0x00
,0x03,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x3f,0xf8,0x07,0x1e,0x00
,0x00,0x00,0xff,0xfe,0x1f,0xbf,0x80
,0x00,0x03,0xe0,0x04,0x7f,0xff,0xc0
,0x00,0x07,0x80,0x00,0xff,0xff,0xe0
,0x00,0x0e,0x00,0x00,0xff,0xff,0xe0
,0x00,0x0c,0x00,0x00,0x7f,0xff,0xc0
,0x00,0x00,0x00,0x00,0xfe,0x07,0xe0
,0x00,0x00,0x00,0x03,0xf8,0x03,0xf8
```

```
,0x00,0x00,0x07,0xe7,0xf9,0xf1,0xfc
,0x00,0x00,0x1f,0xe7,0xf1,0xf9,0xfc
,0x00,0x00,0x1f,0xe7,0xf3,0xf9,0xfc
,0x00,0x00,0x3f,0xe7,0xf3,0xf9,0xfc
,0x00,0x00,0x3f,0xe7,0xf1,0xf1,0xfc
,0x00,0x00,0x3f,0xe3,0xf8,0xe3,0xfc
,0x00,0x00,0x3f,0xf3,0xfc,0x07,0xf8
,0x00,0x00,0x1f,0xf0,0x7f,0x0f,0xc0
,0x00,0x00,0x0f,0xe0,0x7f,0xff,0xe0
,0x00,0x00,0x07,0xc0,0xff,0xff,0xe0
,0x00,0x00,0x00,0x00,0x7f,0xff,0xe0
,0x00,0x00,0x00,0x00,0x3f,0xff,0x80
,0x00,0x00,0x00,0x00,0x1f,0xbf,0x00
,0x00,0x00,0x00,0x00,0x03,0x18,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00
};
#define Wifi_connected_width 63
#define Wifi_connected_height 49
const uint8_t PROGMEM Wifi_connected_bits[] = {
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x03,0xff,0xff,0x80,0x00,0x00
,0x00,0x00,0x3f,0xff,0xff,0xf8,0x00,0x00
,0x00,0x01,0xff,0xff,0xff,0xff,0x00,0x00
,0x00,0x0f,0xff,0xff,0xff,0xff,0xe0,0x00
,0x00,0x3f,0xff,0xc0,0x07,0xff,0xf8,0x00
,0x00,0xff,0xf8,0x00,0x00,0x3f,0xfe,0x00
,0x03,0xff,0x80,0x00,0x00,0x03,0xff,0x80
,0x07,0xfe,0x00,0x00,0x00,0x00,0xff,0xc0
,0x1f,0xf8,0x00,0x00,0x00,0x00,0x3f,0xf0
,0x3f,0xe0,0x01,0xff,0xff,0x00,0x0f,0xf8
,0x7f,0x80,0x0f,0xff,0xff,0xe0,0x03,0xfc
,0xff,0x00,0x7f,0xff,0xff,0xfc,0x01,0xfe
,0xfc,0x01,0xff,0xff,0xff,0xff,0x00,0x7e
,0x78,0x07,0xff,0xc0,0x07,0xff,0xc0,0x3c
,0x00,0x0f,0xfc,0x00,0x00,0x7f,0xe0,0x00
,0x00,0x1f,0xf0,0x00,0x00,0x1f,0xf0,0x00
,0x00,0x3f,0xc0,0x00,0x00,0x07,0xf8,0x00
,0x00,0x7f,0x00,0x01,0x00,0x01,0xfc,0x00
,0x00,0x7e,0x00,0x7f,0xfc,0x00,0xfc,0x00
,0x00,0x3c,0x03,0xff,0xff,0x80,0x78,0x00
,0x00,0x00,0x07,0xff,0xff,0xc0,0x00,0x00
,0x00,0x00,0x1f,0xff,0xff,0xf0,0x00,0x00
,0x00,0x00,0x3f,0xf0,0x1f,0xf8,0x00,0x00
,0x00,0x00,0x3f,0x80,0x03,0xf8,0x00,0x00
,0x00,0x00,0x3f,0x00,0x01,0xf8,0x00,0x00
,0x00,0x00,0x1c,0x00,0x00,0x70,0x00,0x00
```

```
,0x00,0x00,0x00,0x01,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x0f,0xe0,0x00,0x00,0x00
,0x00,0x00,0x00,0x1f,0xf0,0x00,0x00,0x00
,0x00,0x00,0x00,0x3f,0xf8,0x00,0x00,0x00
,0x00,0x00,0x00,0x3f,0xf8,0x00,0x00,0x00
,0x00,0x00,0x00,0x3f,0xf8,0x00,0x00,0x00
,0x00,0x00,0x00,0x3f,0xf8,0x00,0x00,0x00
,0x00,0x00,0x00,0x1f,0xf0,0x00,0x00,0x00
,0x00,0x00,0x00,0x0f,0xe0,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
};
#define FinPr_start_width 64
#define FinPr_start_height 64
const uint8_t PROGMEM FinPr_start_bits[] = {
  0x00,0x00,0x00,0x1f,0xe0,0x00,0x00,0x00
,0x00,0x00,0x01,0xff,0xfe,0x00,0x00,0x00
,0x00,0x00,0x03,0xff,0xff,0x80,0x00,0x00
,0x00,0x00,0x0f,0xc0,0x0f,0xe0,0x00,0x00
,0x00,0x00,0x1f,0x00,0x01,0xf8,0x00,0x00
,0x00,0x00,0x3c,0x00,0x00,0x7c,0x00,0x00
,0x00,0x00,0x78,0x00,0x00,0x3e,0x00,0x00
,0x00,0x00,0xf0,0x3f,0xf8,0x0f,0x00,0x00
,0x00,0x01,0xe0,0xff,0xfe,0x07,0x80,0x00
,0x00,0x03,0xc3,0xff,0xff,0x03,0x80,0x00
,0x00,0x03,0x87,0xc0,0x07,0xc3,0xc0,0x00
,0x00,0x07,0x0f,0x00,0x03,0xe1,0xc0,0x00
,0x00,0x0f,0x0e,0x00,0x00,0xe0,0xe0,0x00
,0x00,0x0e,0x1c,0x00,0x00,0xf0,0xe0,0x00
,0x00,0x0c,0x3c,0x1f,0xe0,0x70,0xe0,0x00
,0x00,0x00,0x38,0x3f,0xf0,0x38,0x70,0x00
,0x00,0x00,0x78,0x78,0xf8,0x38,0x70,0x00
,0x00,0x00,0x70,0x70,0x3c,0x18,0x70,0x00
,0x00,0x00,0xe0,0xe0,0x1e,0x1c,0x70,0x00
,0x00,0x03,0xe1,0xe0,0x0e,0x1c,0x70,0x00
,0x00,0x0f,0xc1,0xc3,0x0e,0x1c,0x70,0x00
,0x00,0x3f,0x03,0xc3,0x8e,0x1c,0x70,0x00
,0x00,0x3e,0x03,0x87,0x0e,0x1c,0x70,0x00
,0x00,0x30,0x07,0x07,0x0e,0x18,0xe0,0x00
,0x00,0x00,0x0e,0x0e,0x0e,0x38,0xe0,0x00
,0x00,0x00,0x3e,0x1e,0x1e,0x38,0xe0,0x00
,0x00,0x00,0xf8,0x1c,0x1c,0x38,0xe0,0x00
,0x00,0x03,0xf0,0x38,0x3c,0x38,0xe0,0x00
,0x00,0x3f,0xc0,0xf8,0x78,0x38,0xe0,0x00
,0x00,0x7f,0x01,0xf0,0x70,0x38,0xf0,0x00
,0x00,0x78,0x03,0xe0,0xe0,0x38,0x70,0x00
,0x00,0x00,0x0f,0x81,0xe0,0x38,0x7c,0x00
,0x00,0x00,0x3f,0x03,0xc0,0x38,0x3e,0x00
,0x00,0x00,0xfc,0x0f,0x80,0x38,0x1e,0x00
,0x00,0x07,0xf0,0x1f,0x1c,0x1c,0x04,0x00
,0x00,0x3f,0xc0,0x3e,0x3f,0x1e,0x00,0x00
```

```
,0x00,0x7f,0x00,0xf8,0x7f,0x0f,0x00,0x00
,0x00,0x38,0x01,0xf0,0xf7,0x07,0xc0,0x00
,0x00,0x00,0x07,0xe1,0xe3,0x83,0xf8,0x00
,0x00,0x00,0x3f,0x87,0xc3,0xc0,0xfc,0x00
,0x00,0x01,0xfe,0x0f,0x81,0xe0,0x3c,0x00
,0x00,0x0f,0xf8,0x1f,0x00,0xf0,0x00,0x00
,0x00,0x1f,0xc0,0x7c,0x00,0x7c,0x00,0x00
,0x00,0x1e,0x01,0xf8,0x00,0x3f,0x00,0x00
,0x00,0x00,0x07,0xe0,0x78,0x0f,0xc0,0x00
,0x00,0x00,0x3f,0x81,0xfe,0x07,0xf0,0x00
,0x00,0x01,0xfe,0x07,0xff,0x01,0xf0,0x00
,0x00,0x07,0xf8,0x0f,0x87,0x80,0x30,0x00
,0x00,0x07,0xc0,0x3f,0x03,0xe0,0x00,0x00
,0x00,0x06,0x00,0xfc,0x01,0xf8,0x00,0x00
,0x00,0x00,0x03,0xf0,0x00,0x7e,0x00,0x00
,0x00,0x00,0x0f,0xc0,0x00,0x3f,0x80,0x00
,0x00,0x00,0x7f,0x00,0xf8,0x0f,0x80,0x00
,0x00,0x00,0xfc,0x03,0xfe,0x01,0x80,0x00
,0x00,0x00,0xf0,0x1f,0xff,0x80,0x00,0x00
,0x00,0x00,0x00,0x7f,0x07,0xe0,0x00,0x00
,0x00,0x00,0x00,0xfc,0x03,0xf8,0x00,0x00
,0x00,0x00,0x03,0xf0,0x00,0x78,0x00,0x00
,0x00,0x00,0x0f,0xc0,0x00,0x18,0x00,0x00
,0x00,0x00,0x0f,0x01,0xf8,0x00,0x00,0x00
,0x00,0x00,0x00,0x07,0xfe,0x00,0x00,0x00
,0x00,0x00,0x00,0x1f,0xfe,0x00,0x00,0x00
,0x00,0x00,0x00,0x1e,0x0e,0x00,0x00,0x00
,0x00,0x00,0x00,0x18,0x00,0x00,0x00,0x00
};
//-------------------------------------------------------------
#define FinPr_valid_width 64
#define FinPr_valid_height 64
const uint8_t PROGMEM FinPr_valid_bits[] = {
  0x00,0x00,0x03,0xfe,0x00,0x00,0x00,0x00
,0x00,0x00,0x1f,0xff,0xe0,0x00,0x00,0x00
,0x00,0x00,0x7f,0xff,0xf8,0x00,0x00,0x00
,0x00,0x00,0xfc,0x00,0xfe,0x00,0x00,0x00
,0x00,0x03,0xe0,0x00,0x1f,0x00,0x00,0x00
,0x00,0x07,0xc0,0x00,0x07,0x80,0x00,0x00
,0x00,0x0f,0x80,0x00,0x03,0xe0,0x00,0x00
,0x00,0x0e,0x03,0xff,0x01,0xe0,0x00,0x00
,0x00,0x1c,0x1f,0xff,0xe0,0xf0,0x00,0x00
,0x00,0x3c,0x3f,0xff,0xf0,0x78,0x00,0x00
,0x00,0x78,0x7c,0x00,0xf8,0x3c,0x00,0x00
,0x00,0x70,0xf0,0x00,0x3c,0x1c,0x00,0x00
,0x00,0xe1,0xe0,0x00,0x1e,0x1c,0x00,0x00
,0x00,0xe1,0xc0,0x00,0x0f,0x0e,0x00,0x00
,0x00,0xc3,0x81,0xfc,0x07,0x0e,0x00,0x00
,0x00,0x03,0x83,0xff,0x07,0x8e,0x00,0x00
,0x00,0x07,0x07,0x8f,0x83,0x87,0x00,0x00
,0x00,0x0f,0x0f,0x03,0xc3,0x87,0x00,0x00
,0x00,0x1e,0x0e,0x01,0xc3,0x87,0x00,0x00
,0x00,0x3c,0x1c,0x00,0xe1,0x87,0x00,0x00
,0x00,0xf8,0x1c,0x30,0xe1,0x87,0x00,0x00
,0x07,0xf0,0x38,0x70,0xe1,0x86,0x00,0x00
,0x07,0xc0,0x78,0x70,0xe3,0x8e,0x00,0x00
```

```
,0x02,0x00,0xf0,0xf0,0xe3,0x8e,0x00,0x00
,0x00,0x01,0xe0,0xe0,0xe3,0x8e,0x00,0x00
,0x00,0x03,0xc1,0xe1,0xc3,0x8e,0x00,0x00
,0x00,0x0f,0x83,0xc3,0xc3,0x8e,0x00,0x00
,0x00,0x7f,0x07,0x83,0x83,0x0e,0x00,0x00
,0x07,0xfc,0x0f,0x07,0x83,0x0e,0x00,0x00
,0x07,0xf0,0x1e,0x0f,0x03,0x0e,0x00,0x00
,0x07,0x80,0x7c,0x1e,0x03,0x07,0x00,0x00
,0x00,0x00,0xf8,0x3c,0x03,0x87,0x80,0x00
,0x00,0x03,0xf0,0x78,0x03,0x83,0xc0,0x00
,0x00,0x1f,0xc0,0xf0,0x02,0x00,0x00,0x00
,0x00,0xff,0x01,0xe1,0xc0,0x0c,0x00,0x00
,0x07,0xfc,0x03,0xc3,0xe1,0xff,0xc0,0x00
,0x07,0xe0,0x0f,0x87,0xc7,0xff,0xf0,0x00
,0x07,0x00,0x3f,0x0f,0x0f,0xff,0xfc,0x00
,0x00,0x00,0x7c,0x3e,0x3f,0xff,0xfe,0x00
,0x00,0x03,0xf8,0x7c,0x3f,0xff,0xff,0x00
,0x00,0x1f,0xe0,0xf0,0x7f,0xff,0xff,0x80
,0x00,0xff,0x83,0xe0,0xff,0xff,0xff,0x80
,0x01,0xfc,0x07,0xc1,0xff,0xff,0xe3,0xc0
,0x01,0xe0,0x1f,0x01,0xff,0xff,0xc3,0xc0
,0x00,0x00,0xfe,0x01,0xff,0xff,0x87,0xe0
,0x00,0x03,0xf8,0x13,0xff,0xff,0x0f,0xe0
,0x00,0x1f,0xe0,0x73,0xff,0xfe,0x1f,0xe0
,0x00,0x7f,0x81,0xf3,0xff,0xfc,0x1f,0xe0
,0x00,0xfc,0x03,0xe3,0xef,0xf8,0x3f,0xe0
,0x00,0x60,0x0f,0xc3,0xc7,0xf0,0x7f,0xe0
,0x00,0x00,0x3f,0x03,0xc3,0xe0,0xff,0xe0
,0x00,0x00,0xfc,0x03,0xc1,0xc1,0xff,0xe0
,0x00,0x07,0xf0,0x13,0xe0,0x83,0xff,0xe0
,0x00,0x0f,0xc0,0x7b,0xf8,0x07,0xff,0xe0
,0x00,0x0f,0x01,0xf9,0xfc,0x0f,0xff,0xc0
,0x00,0x00,0x07,0xf1,0xfe,0x1f,0xff,0xc0
,0x00,0x00,0x1f,0xc0,0xff,0x3f,0xff,0x80
,0x00,0x00,0x7e,0x00,0xff,0xff,0xff,0x80
,0x00,0x00,0xfc,0x00,0x7f,0xff,0xff,0x00
,0x00,0x00,0xf0,0x1f,0x3f,0xff,0xfe,0x00
,0x00,0x00,0x00,0x7f,0x1f,0xff,0xfc,0x00
,0x00,0x00,0x01,0xff,0x8f,0xff,0xf8,0x00
,0x00,0x00,0x03,0xe0,0xe3,0xff,0xe0,0x00
,0x00,0x00,0x01,0x80,0x00,0x7f,0x00,0x00
};
//--------------------------------------------------------------
#define FinPr_invalid_width 64
#define FinPr_invalid_height 64
const uint8_t PROGMEM FinPr_invalid_bits[] = {
 0x00,0x00,0x03,0xfe,0x00,0x00,0x00,0x00
,0x00,0x00,0x1f,0xff,0xe0,0x00,0x00,0x00
,0x00,0x00,0x7f,0xff,0xf8,0x00,0x00,0x00
,0x00,0x00,0xfc,0x00,0xfe,0x00,0x00,0x00
,0x00,0x03,0xe0,0x00,0x1f,0x00,0x00,0x00
,0x00,0x07,0xc0,0x00,0x07,0x80,0x00,0x00
,0x00,0x0f,0x80,0x00,0x03,0xe0,0x00,0x00
,0x00,0x0e,0x03,0xff,0x01,0xe0,0x00,0x00
,0x00,0x1c,0x1f,0xff,0xe0,0xf0,0x00,0x00
,0x00,0x3c,0x3f,0xff,0xf0,0x78,0x00,0x00
```

```
,0x00,0x78,0x7c,0x00,0xf8,0x3c,0x00,0x00
,0x00,0x70,0xf0,0x00,0x3c,0x1c,0x00,0x00
,0x00,0xe1,0xe0,0x00,0x1e,0x1c,0x00,0x00
,0x00,0xe1,0xc0,0x00,0x0f,0x0e,0x00,0x00
,0x00,0xc3,0x81,0xfc,0x07,0x0e,0x00,0x00
,0x00,0x03,0x83,0xff,0x07,0x8e,0x00,0x00
,0x00,0x07,0x07,0x8f,0x83,0x87,0x00,0x00
,0x00,0x0f,0x0f,0x03,0xc3,0x87,0x00,0x00
,0x00,0x1e,0x0e,0x01,0xc3,0x87,0x00,0x00
,0x00,0x3c,0x1c,0x00,0xe1,0x87,0x00,0x00
,0x00,0xf8,0x1c,0x30,0xe1,0x87,0x00,0x00
,0x07,0xf0,0x38,0x70,0xe1,0x86,0x00,0x00
,0x07,0xc0,0x78,0x70,0xe3,0x8e,0x00,0x00
,0x02,0x00,0xf0,0xf0,0xe3,0x8e,0x00,0x00
,0x00,0x01,0xe0,0xe0,0xe3,0x8e,0x00,0x00
,0x00,0x03,0xc1,0xe1,0xc3,0x8e,0x00,0x00
,0x00,0x0f,0x83,0xc3,0xc3,0x8e,0x00,0x00
,0x00,0x7f,0x07,0x83,0x83,0x0e,0x00,0x00
,0x07,0xfc,0x0f,0x07,0x83,0x0e,0x00,0x00
,0x07,0xf0,0x1e,0x0f,0x03,0x0e,0x00,0x00
,0x07,0x80,0x7c,0x1e,0x03,0x07,0x00,0x00
,0x00,0x00,0xf8,0x3c,0x03,0x87,0x80,0x00
,0x00,0x03,0xf0,0x78,0x03,0x83,0xc0,0x00
,0x00,0x1f,0xc0,0xf0,0x02,0x00,0x00,0x00
,0x00,0xff,0x01,0xe1,0xc0,0x00,0x00,0x00
,0x07,0xfc,0x03,0xc3,0xe1,0xff,0xc0,0x00
,0x07,0xe0,0x0f,0x87,0xc7,0xff,0xf0,0x00
,0x07,0x00,0x3f,0x0f,0x0f,0xff,0xf8,0x00
,0x00,0x00,0x7c,0x3e,0x1f,0xff,0xfe,0x00
,0x00,0x03,0xf8,0x7c,0x3f,0xff,0xff,0x00
,0x00,0x1f,0xe0,0xf0,0x7f,0xff,0xff,0x00
,0x00,0xff,0x83,0xe0,0xfe,0xff,0xbf,0x80
,0x01,0xfc,0x07,0xc0,0xfc,0x7f,0x1f,0xc0
,0x01,0xe0,0x1f,0x01,0xf8,0x3e,0x0f,0xc0
,0x00,0x00,0xfe,0x01,0xf8,0x1c,0x07,0xe0
,0x00,0x03,0xf8,0x13,0xf8,0x00,0x0f,0xe0
,0x00,0x1f,0xe0,0x73,0xfc,0x00,0x1f,0xe0
,0x00,0x7f,0x81,0xf3,0xfe,0x00,0x3f,0xe0
,0x00,0xfc,0x03,0xe3,0xff,0x00,0x7f,0xe0
,0x00,0x60,0x0f,0xc3,0xff,0x80,0xff,0xe0
,0x00,0x00,0x3f,0x03,0xff,0x00,0x7f,0xe0
,0x00,0x00,0xfc,0x03,0xfe,0x00,0x3f,0xe0
,0x00,0x07,0xf0,0x13,0xfc,0x00,0x1f,0xe0
,0x00,0x0f,0xc0,0x79,0xf8,0x08,0x0f,0xe0
,0x00,0x0f,0x01,0xf9,0xf8,0x1c,0x0f,0xc0
,0x00,0x00,0x07,0xf1,0xfc,0x3e,0x1f,0xc0
,0x00,0x00,0x1f,0xc0,0xfe,0x7f,0x3f,0x80
,0x00,0x00,0x7e,0x00,0xff,0xff,0xff,0x80
,0x00,0x00,0xfc,0x00,0x7f,0xff,0xff,0x00
,0x00,0x00,0xf0,0x1f,0x3f,0xff,0xfe,0x00
,0x00,0x00,0x00,0x7f,0x1f,0xff,0xfc,0x00
,0x00,0x00,0x01,0xff,0x8f,0xff,0xf8,0x00
,0x00,0x00,0x03,0xe0,0xe3,0xff,0xe0,0x00
,0x00,0x00,0x01,0x80,0x00,0x7f,0x00,0x00
};
//---------------------------------------------------------
```

```
#define FinPr_failed_width 64
#define FinPr_failed_height 64
const uint8_t PROGMEM FinPr_failed_bits[] = {
0x00,0x00,0x3f,0xe0,0x00,0x00,0x00,0x00
,0x00,0x01,0xff,0xfe,0x00,0x00,0x00,0x00
,0x00,0x0f,0xc0,0x1f,0x80,0x00,0x00,0x00
,0x00,0x1e,0x00,0x03,0xc0,0x00,0x00,0x00
,0x00,0x78,0x00,0x00,0xf0,0x00,0x00,0x00
,0x00,0xe0,0x00,0x00,0x38,0x00,0x00,0x00
,0x01,0xc0,0x00,0x00,0x1c,0x00,0x00,0x00
,0x03,0x80,0x00,0x00,0x0e,0x00,0x00,0x00
,0x07,0x00,0x7f,0xe0,0x07,0x00,0x00,0x00
,0x06,0x01,0xff,0xf8,0x03,0x00,0x00,0x00
,0x0c,0x03,0xc0,0x3c,0x03,0x80,0x00,0x00
,0x1c,0x0f,0x00,0x0e,0x01,0x80,0x00,0x00
,0x18,0x0c,0x00,0x03,0x00,0xc0,0x00,0x00
,0x18,0x18,0x00,0x01,0x80,0xc0,0x00,0x00
,0x30,0x38,0x00,0x01,0xc0,0xe0,0x00,0x00
,0x30,0x30,0x0f,0x00,0xc0,0x60,0x00,0x00
,0x30,0x30,0x3f,0xc0,0xe0,0x60,0x00,0x00
,0x70,0x60,0x78,0xe0,0x60,0x60,0x00,0x00
,0x60,0x60,0x60,0x60,0x60,0x70,0x00,0x00
,0x60,0x60,0x60,0x60,0x60,0x30,0x00,0x00
,0x60,0x60,0x60,0x60,0x30,0x30,0x00,0x00
,0x60,0x60,0x60,0x30,0x30,0x20,0x00,0x00
,0x60,0x60,0x60,0x30,0x30,0x01,0xe0,0x00
,0x60,0x60,0x60,0x30,0x30,0x0f,0xfc,0x00
,0x60,0x60,0x60,0x30,0x30,0x3f,0xff,0x00
,0x60,0x60,0x60,0x30,0x18,0x78,0x03,0x80
,0x60,0x60,0x60,0x30,0x1c,0x60,0x01,0x80
,0x60,0x60,0x30,0x38,0x0c,0xc0,0x00,0xc0
,0x00,0x60,0x30,0x18,0x00,0xc0,0x00,0xc0
,0x00,0x60,0x30,0x18,0x00,0xc0,0x00,0xc0
,0x00,0xe0,0x30,0x0c,0x01,0xc0,0x00,0xe0
,0x00,0xc0,0x18,0x0e,0x01,0xc0,0x00,0xe0
,0x01,0x80,0x0c,0x01,0xc1,0xc0,0x00,0xe0
,0x03,0x80,0x0e,0x00,0xf1,0xc0,0x00,0xe0
,0x0f,0x00,0x06,0x00,0x01,0xc0,0x00,0xe0
,0x3e,0x01,0x03,0x00,0x01,0xc0,0x00,0xe0
,0x30,0x03,0x83,0x80,0x1f,0xff,0xff,0xfe
,0x00,0x03,0x81,0xc0,0x3f,0xff,0xff,0xff
,0x00,0x07,0xc0,0xe0,0x30,0x00,0x00,0x03
,0x00,0x0e,0xc0,0x78,0x30,0x00,0x00,0x03
,0x00,0x3c,0x60,0x1e,0x30,0x00,0x00,0x03
,0x00,0x78,0x70,0x0f,0x30,0x00,0x00,0x03
,0x03,0xe0,0x38,0x03,0x30,0x00,0x00,0x03
,0x07,0x80,0x1c,0x00,0x30,0x00,0x00,0x03
,0xc0,0x00,0x0f,0x00,0x30,0x00,0x00,0x03
,0xc0,0x00,0x03,0x80,0x30,0x01,0xe0,0x03
,0x00,0x18,0x01,0xe0,0x30,0x03,0xf0,0x03
,0x00,0x18,0x00,0x7c,0x30,0x07,0x38,0x03
,0x00,0x0c,0x00,0x1f,0x30,0x06,0x18,0x03
,0x18,0x0e,0x00,0x07,0x30,0x06,0x18,0x03
,0x0c,0x07,0x80,0x00,0x30,0x07,0x38,0x03
,0x0e,0x03,0xc0,0x00,0x30,0x03,0x30,0x03
,0x07,0x00,0xf0,0x00,0x30,0x03,0x30,0x03
```

```
,0x03,0x00,0x7e,0x00,0x30,0x03,0x30,0x03
,0x01,0x80,0x1f,0xc0,0x30,0x03,0x30,0x03
,0x01,0xc0,0x03,0xe1,0x30,0x07,0xf8,0x03
,0x00,0xf0,0x00,0x01,0x30,0x03,0xf0,0x03
,0x00,0x38,0x00,0x00,0x30,0x00,0x00,0x03
,0x00,0x1e,0x00,0x00,0x30,0x00,0x00,0x03
,0x00,0x07,0xc0,0x00,0x30,0x00,0x00,0x03
,0x00,0x01,0xff,0x80,0x3f,0xff,0xff,0xff
,0x00,0x00,0x3f,0x80,0x1f,0xff,0xff,0xfe
};
//-------------------------------------------------------------
#define FinPr_scan_width 64
#define FinPr_scan_height 64
const uint8_t PROGMEM FinPr_scan_bits[] = {
  0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x1f,0xf8,0x00,0x00,0x00
,0x00,0x00,0x00,0x7f,0xff,0x00,0x00,0x00
,0x00,0x00,0x01,0xfc,0x7f,0xc0,0x00,0x00
,0x00,0x00,0x03,0xc0,0x03,0xe0,0x00,0x00
,0x00,0x00,0x07,0x80,0x00,0xf0,0x00,0x00
,0x00,0x00,0x0e,0x00,0x00,0x3c,0x00,0x00
,0x00,0x00,0x1c,0x1f,0xfc,0x1c,0x00,0x00
,0x00,0x00,0x38,0x7f,0xfe,0x0e,0x00,0x00
,0x00,0x00,0x78,0xf8,0x0f,0x87,0x00,0x00
,0x00,0x00,0x71,0xe0,0x03,0xc7,0x00,0x00
,0x00,0x00,0xe3,0x80,0x01,0xc3,0x80,0x00
,0x00,0x00,0xc3,0x83,0xc0,0xe3,0x80,0x00
,0x00,0x00,0xc7,0x0f,0xf0,0x71,0x80,0x00
,0x00,0x00,0x06,0x1f,0xf8,0x71,0xc0,0x00
,0x00,0x00,0x0e,0x1c,0x3c,0x31,0xc0,0x00
,0x00,0x00,0x1c,0x38,0x1c,0x31,0xc0,0x00
,0x00,0x00,0x38,0x70,0x0e,0x39,0xc0,0x00
,0x00,0x01,0xf0,0x71,0x8e,0x39,0xc0,0x00
,0x00,0x03,0xe0,0xe1,0x86,0x31,0xc0,0x00
,0x00,0x03,0x81,0xe3,0x8e,0x31,0x80,0x00
,0x00,0x00,0x03,0xc3,0x8e,0x33,0x80,0x00
,0x00,0x00,0x07,0x87,0x0c,0x73,0x80,0x00
,0x00,0x00,0x1f,0x0e,0x1c,0x73,0x80,0x00
,0x7f,0xff,0xff,0xff,0xff,0xff,0xff,0xfe
,0xff,0xff,0xff,0xff,0xff,0xff,0xff,0xff
,0xff,0xff,0xff,0xff,0xff,0xff,0xff,0xff
,0x7f,0xff,0xff,0xff,0xff,0xff,0xff,0xfe
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x03,0xf0,0x1e,0x3e,0x1c,0x00,0x00
,0x00,0x03,0x80,0x7c,0x77,0x0f,0x00,0x00
,0x00,0x00,0x01,0xf0,0xe3,0x07,0xc0,0x00
,0x00,0x00,0x07,0xe3,0xc3,0x81,0xf0,0x00
,0x00,0x00,0x3f,0x87,0x81,0xc0,0x60,0x00
,0x00,0x01,0xfc,0x1f,0x00,0xf0,0x00,0x00
,0x00,0x01,0xe0,0x3c,0x00,0x7c,0x00,0x00
```

```
,0x00,0x00,0x00,0xf8,0x78,0x1f,0x00,0x00
,0x00,0x00,0x07,0xe0,0xfc,0x0f,0xc0,0x00
,0x00,0x00,0x3f,0x83,0xef,0x03,0xc0,0x00
,0x00,0x00,0xfc,0x0f,0x87,0x80,0x00,0x00
,0x00,0x00,0x70,0x1f,0x03,0xe0,0x00,0x00
,0x00,0x00,0x00,0x7c,0x00,0xf8,0x00,0x00
,0x00,0x00,0x01,0xf0,0x00,0x3e,0x00,0x00
,0x00,0x00,0x0f,0xc0,0xf8,0x0f,0x00,0x00
,0x00,0x00,0x1f,0x03,0xfe,0x02,0x00,0x00
,0x00,0x00,0x0c,0x0f,0x8f,0x80,0x00,0x00
,0x00,0x00,0x00,0x3f,0x03,0xe0,0x00,0x00
,0x00,0x00,0x00,0xf8,0x00,0xf0,0x00,0x00
,0x00,0x00,0x01,0xe0,0x00,0x30,0x00,0x00
,0x00,0x00,0x01,0xc0,0xf8,0x00,0x00,0x00
,0x00,0x00,0x00,0x07,0xfe,0x00,0x00,0x00
,0x00,0x00,0x00,0x0f,0x8e,0x00,0x00,0x00
,0x00,0x00,0x00,0x06,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00
};
//**********************************************************************
void setup() {
Serial.begin(115200);

 //----------initiate OLED display------------

 // SSD1306_SWITCHCAPVCC = generate display voltage from 3.3V internally
 if(!display.begin(SSD1306_SWITCHCAPVCC, 0x3C)) { // Address 0x3D for 128x64
  Serial.println(F("SSD1306 allocation failed"));
  for(;;); // Don't proceed, loop forever
 }
 // Show initial display buffer contents on the screen --
 // the library initializes this with an Adafruit splash screen.
 // you can delet these three lines if you don't want to get the Adfruit logo appear
 display.display();
 delay(2000); // Pause for 2 seconds
 display.clearDisplay();

 //--------------------------------------------

 connectToWiFi();

 //--------------------------------------------

 // set the data rate for the sensor serial port
 finger.begin(57600);
 Serial.println("\n\nAdafruit finger detect test");

 if (finger.verifyPassword()) {
Serial.println("Found fingerprint sensor!");
  display.clearDisplay();
  display.drawBitmap( 34, 0, FinPr_valid_bits, FinPr_valid_width, FinPr_valid_height, WHITE);
  display.display();
 } else {
  Serial.println("Did not find fingerprint sensor :(");
  display.clearDisplay();
  display.drawBitmap( 32, 0, FinPr_failed_bits, FinPr_failed_width, FinPr_failed_height, WHITE);
  display.display();
  while (1) { delay(1); }
 }
 //---------------------------------------------

 finger.getTemplateCount();
 Serial.print("Sensor contains "); Serial.print(finger.templateCount); Serial.println(" templates");
 Serial.println("Waiting for valid finger...");

 //------------*test the connection*------------

 //SendFingerprintID( FingerID );

}
//************************************************************************
void loop() {

 //check if there's a connection to WiFi or not
 if(WiFi.status() != WL_CONNECTED){
```

Results

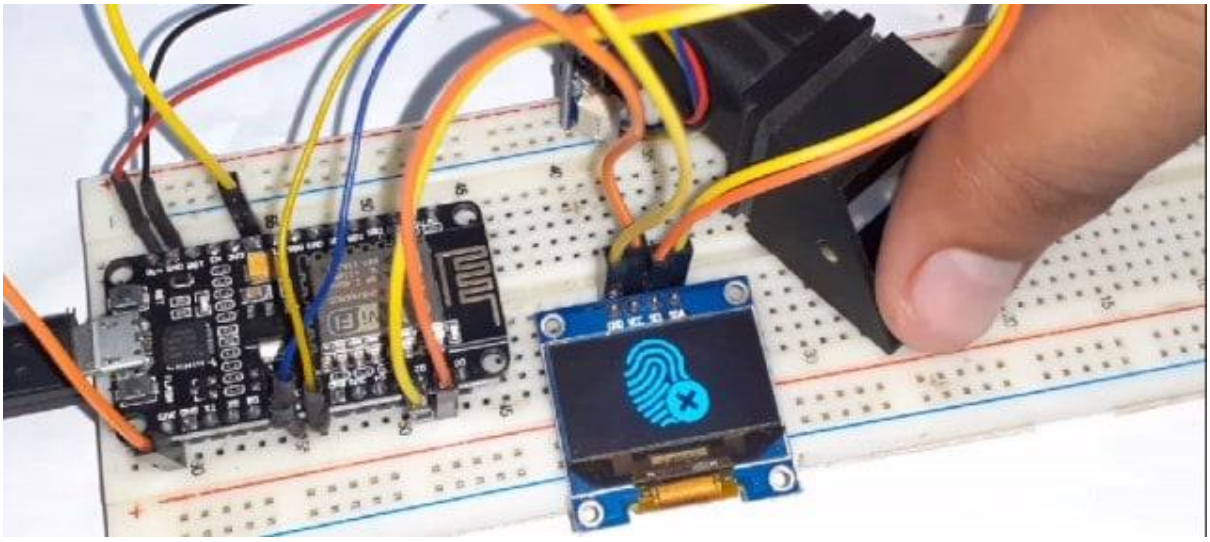
Once the Code is uploaded the NodeMCU will boot up with the Adafruit logo.

And then it will try the connection to the wifi. Once it gets Connected it will display Connected. This log can be viewed on Serial Monitor as well as in OLED Display

So now you can start registering the user using the website. The whole process of registration is explained in the video below. You can follow the video for the registration process. The user fingerprint is taken twice and stored in the EEPROM of the Fingerprint Sensor. It is to be noted that only 127 fingerprints can be stored in this R305/R307 module.

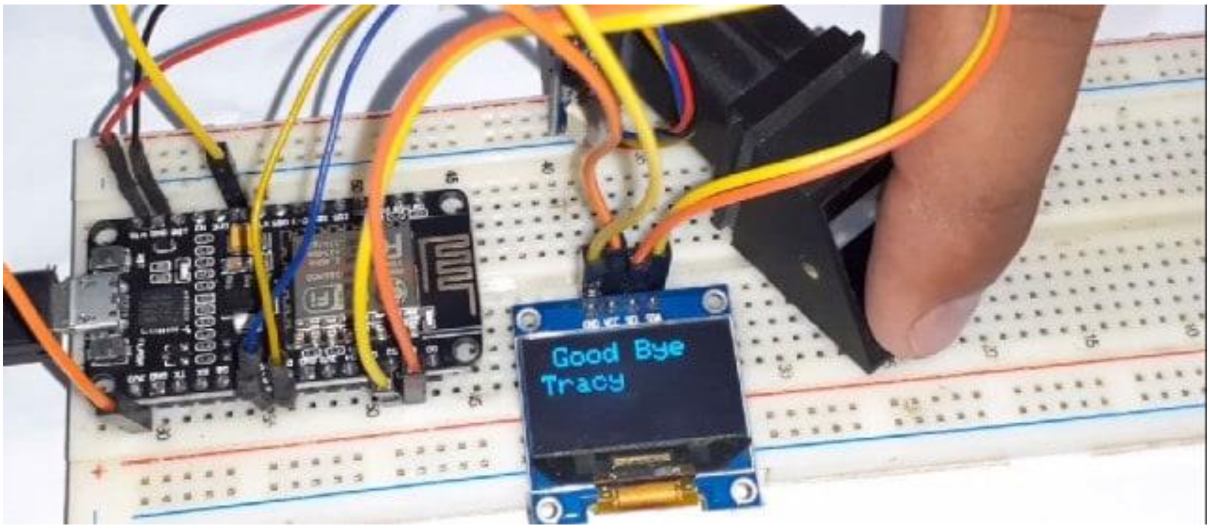
So once the fingerprint of multiple users is stored, you can start scanning and registering the

attendance. In case the fingerprint is not matched it will display an error message as shown in the figure below.

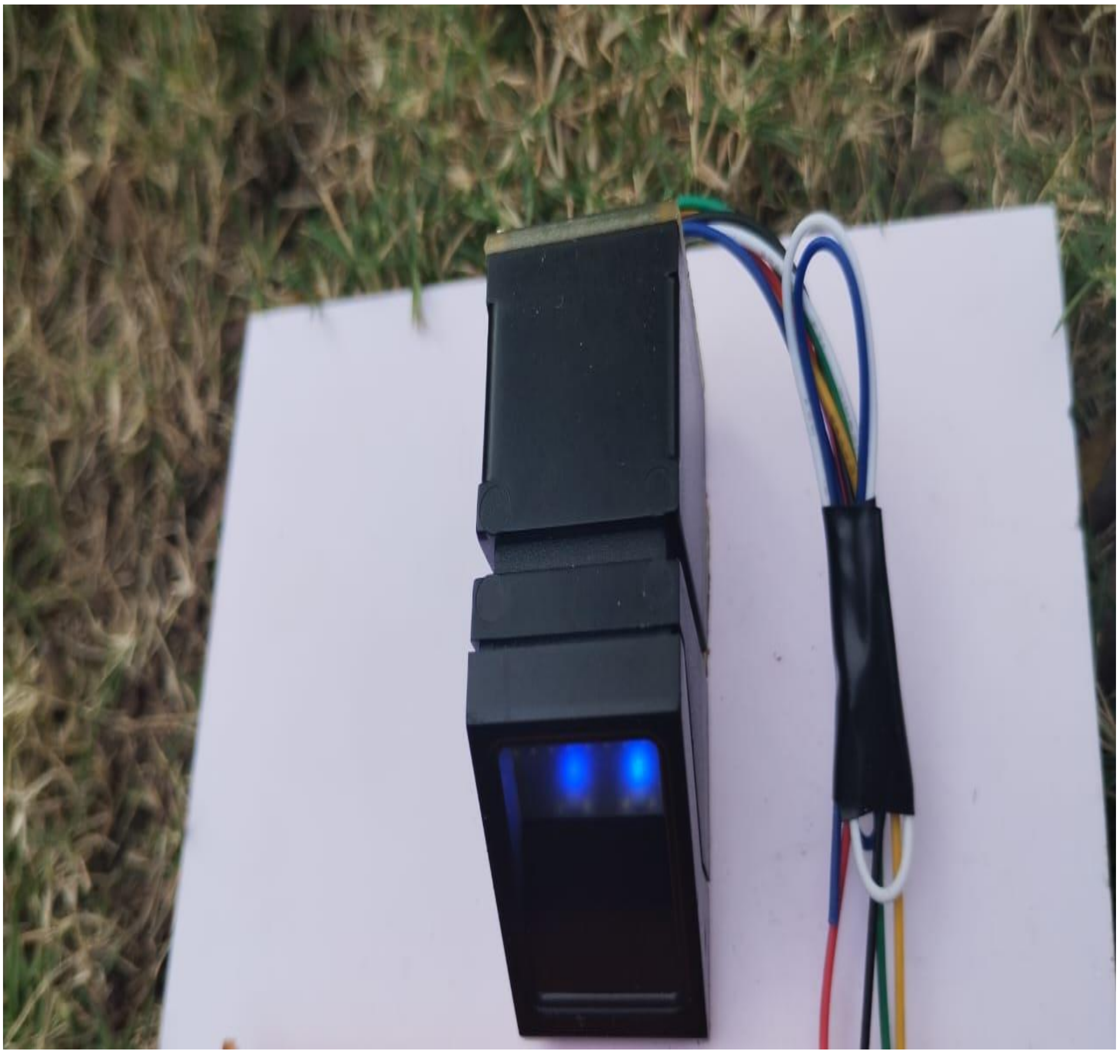


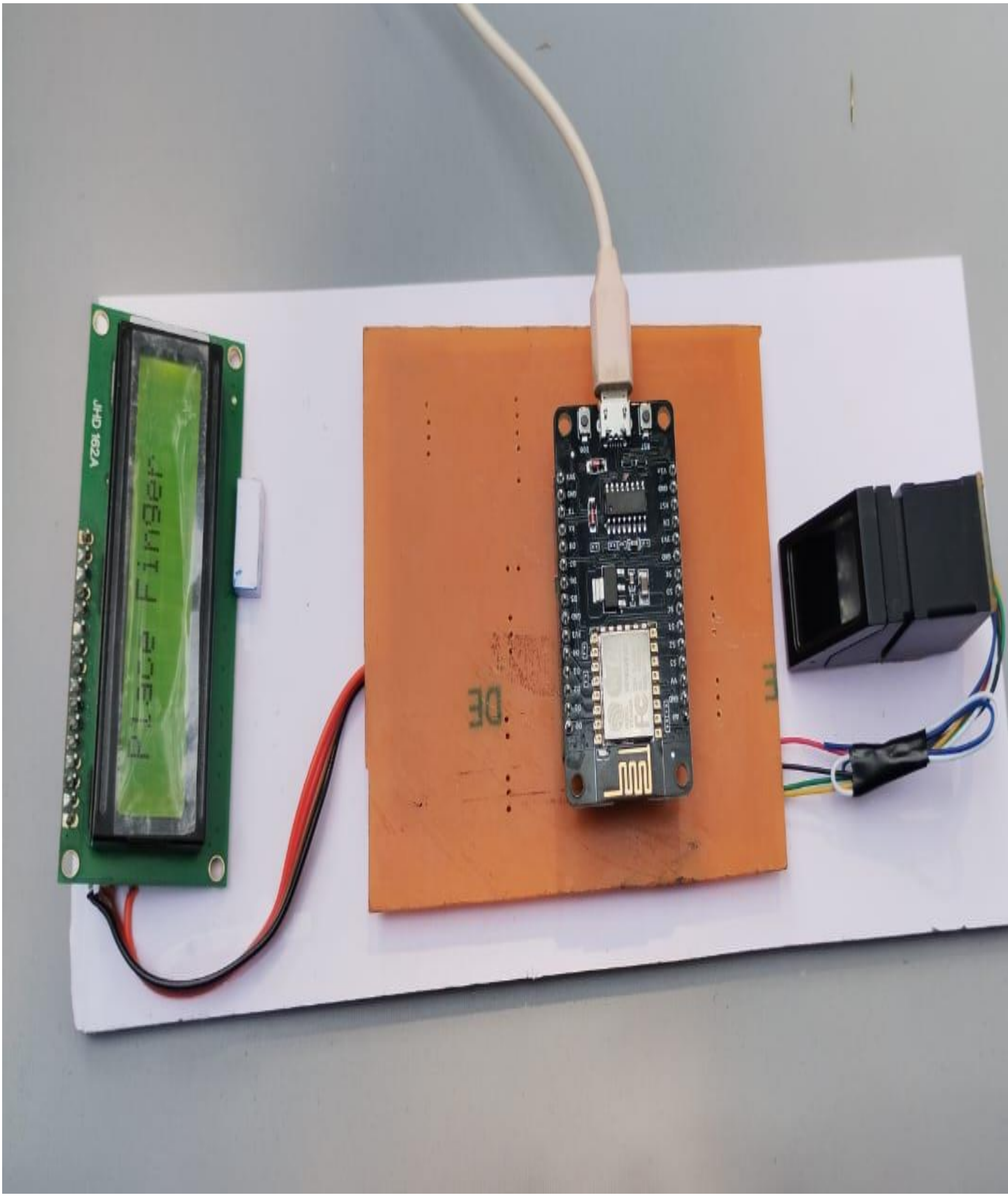
When a registered user scans his finger for the first time it will display the welcome message.

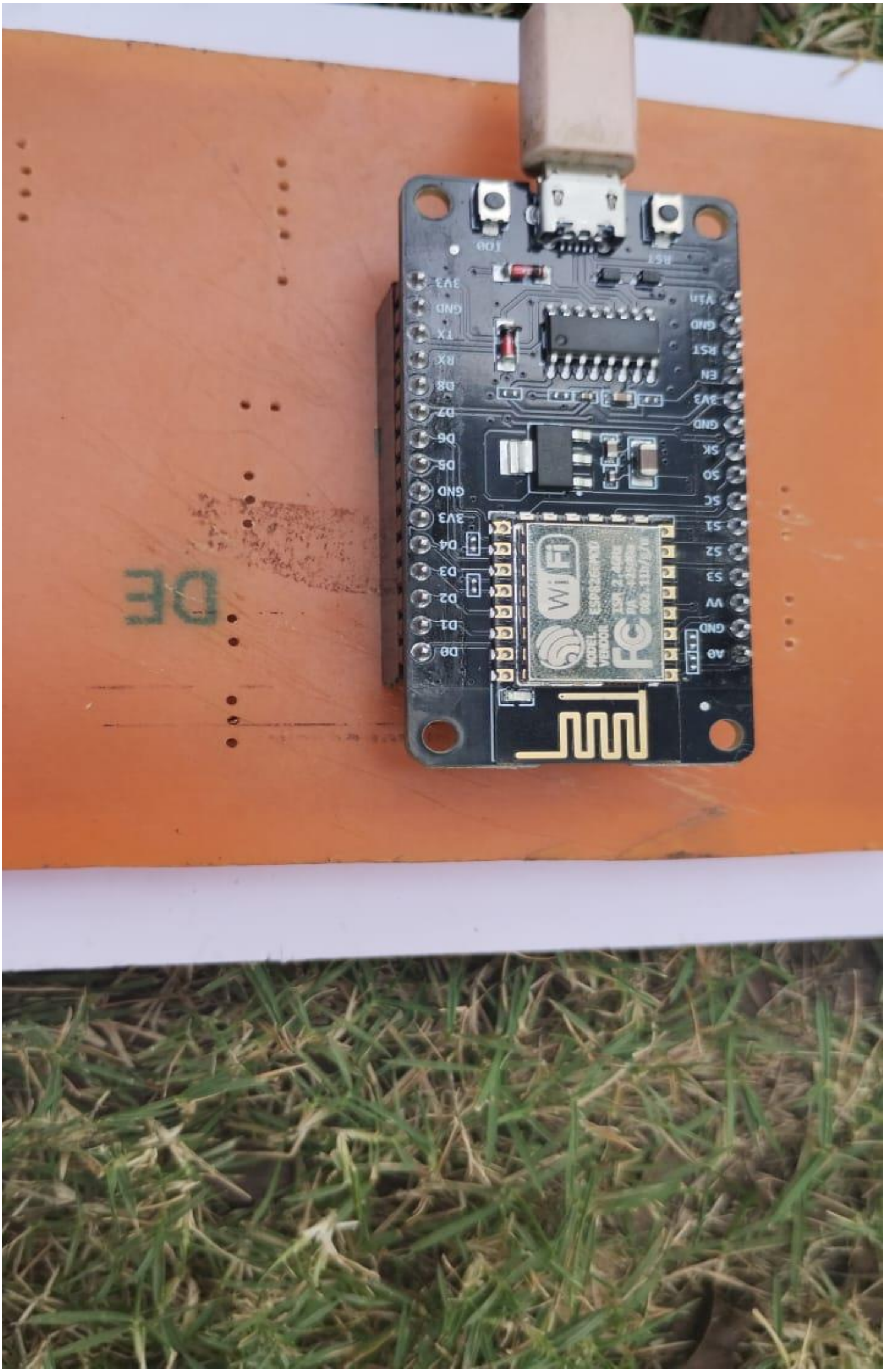
When a registered user scans his finger for the second time it will display the Good-Bye message.

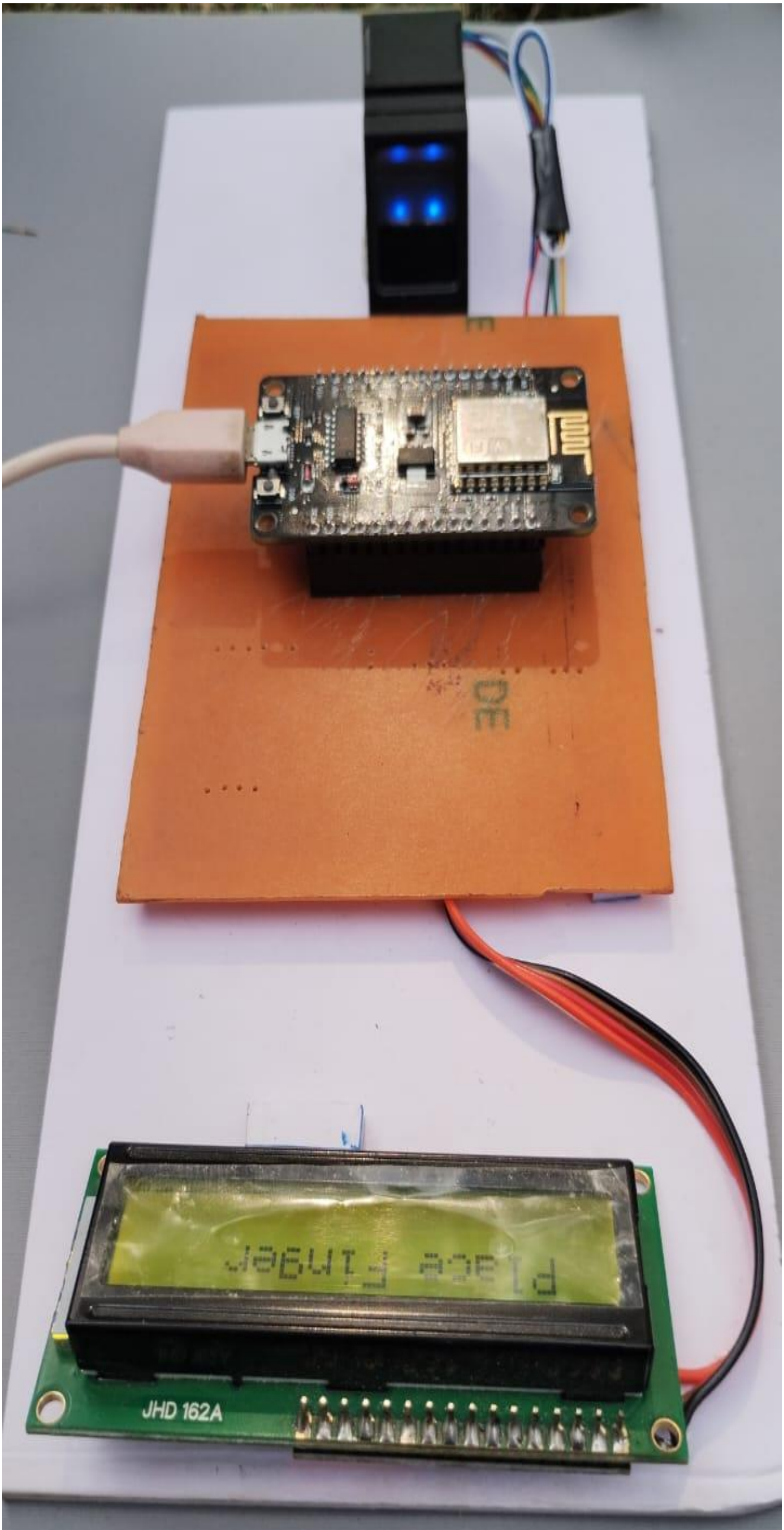


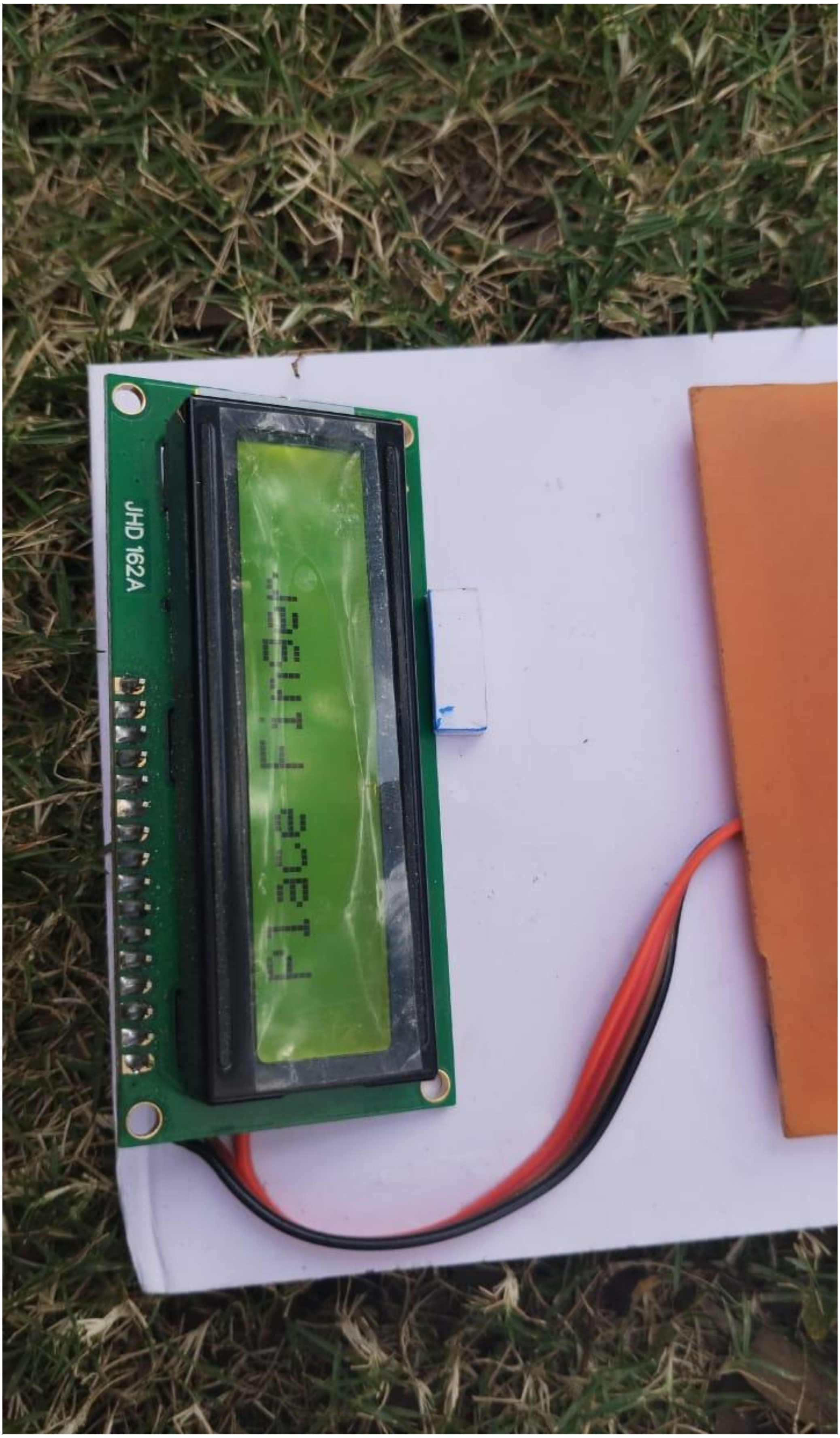
Finally you can see the entire data of the users on the website as shown in below:

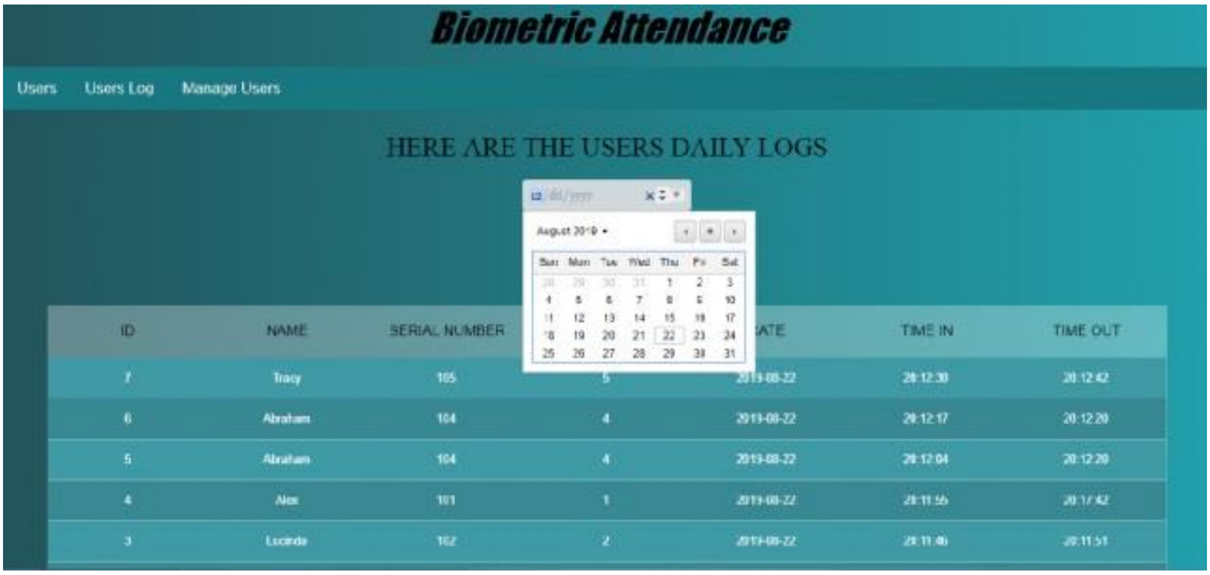



Place Finger
JHD 162A


IO0
RST
3V3
GND
TX
RX
D8
D7
D6
D5
GND
3V3
D4
D3
D2
D1
D0
Vin
GND
RST
EN
3V3
GND
SK
SO
SC
S1
S2
S3
VV
GND
A0
WiFi
DE


DE
Place Finger
JHD 162A


JHD 162A
Plate Empty

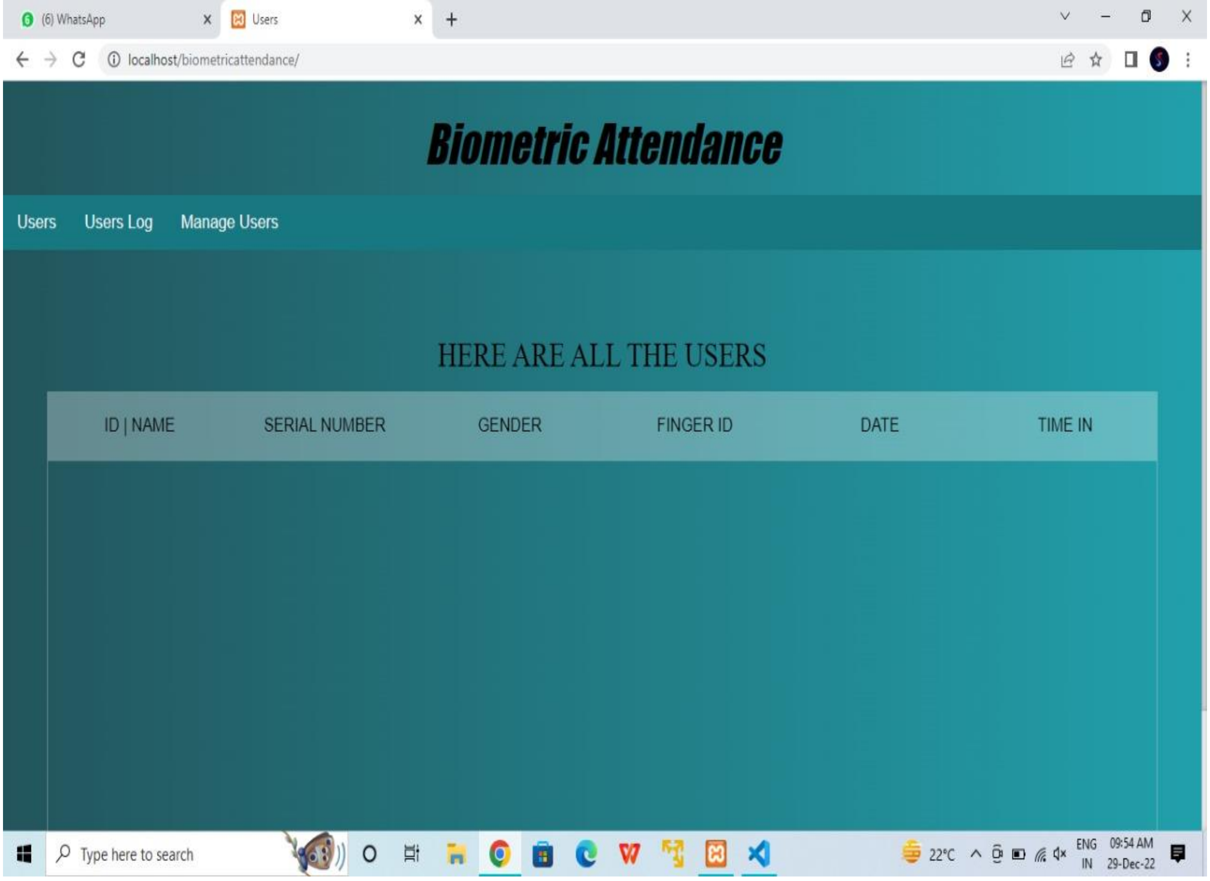


Biometric Attendance

HERE ARE THE USERS DAILY LOGS

ID	NAME	SERIAL NUMBER		ATE	TIME IN	TIME OUT
7	Tracy	105	5	2019-08-22	20:12:30	20:12:42
6	Abraham	104	4	2019-08-22	20:12:17	20:12:20
5	Abraham	104	4	2019-08-22	20:12:04	20:12:20
4	Alex	101	1	2019-08-22	20:11:56	20:17:42
3	Lucinda	102	2	2019-08-22	20:11:46	20:11:51

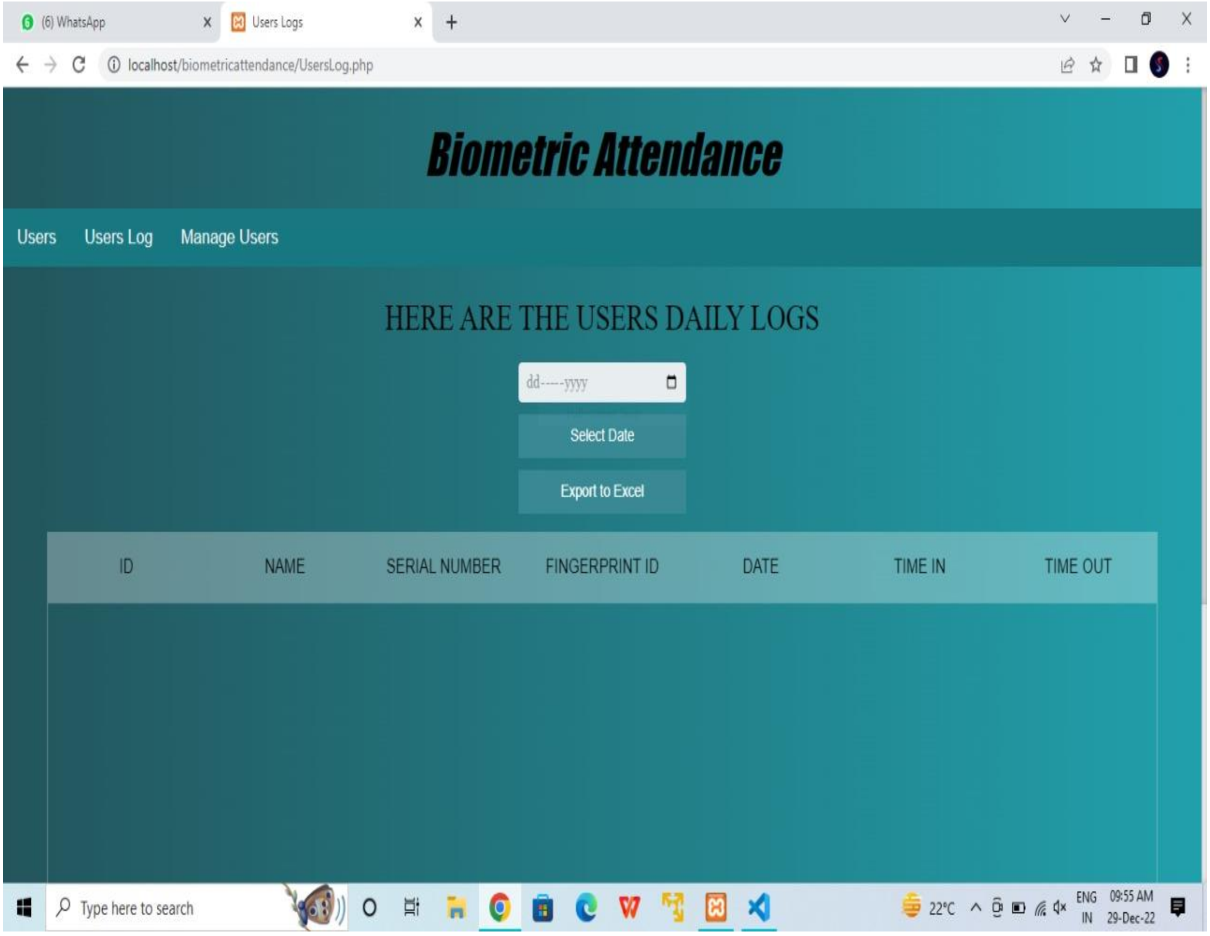
For understanding the whole process: how to add, update and remove the users from the database follow the video tutorial below.



Biometric Attendance

HERE ARE ALL THE USERS

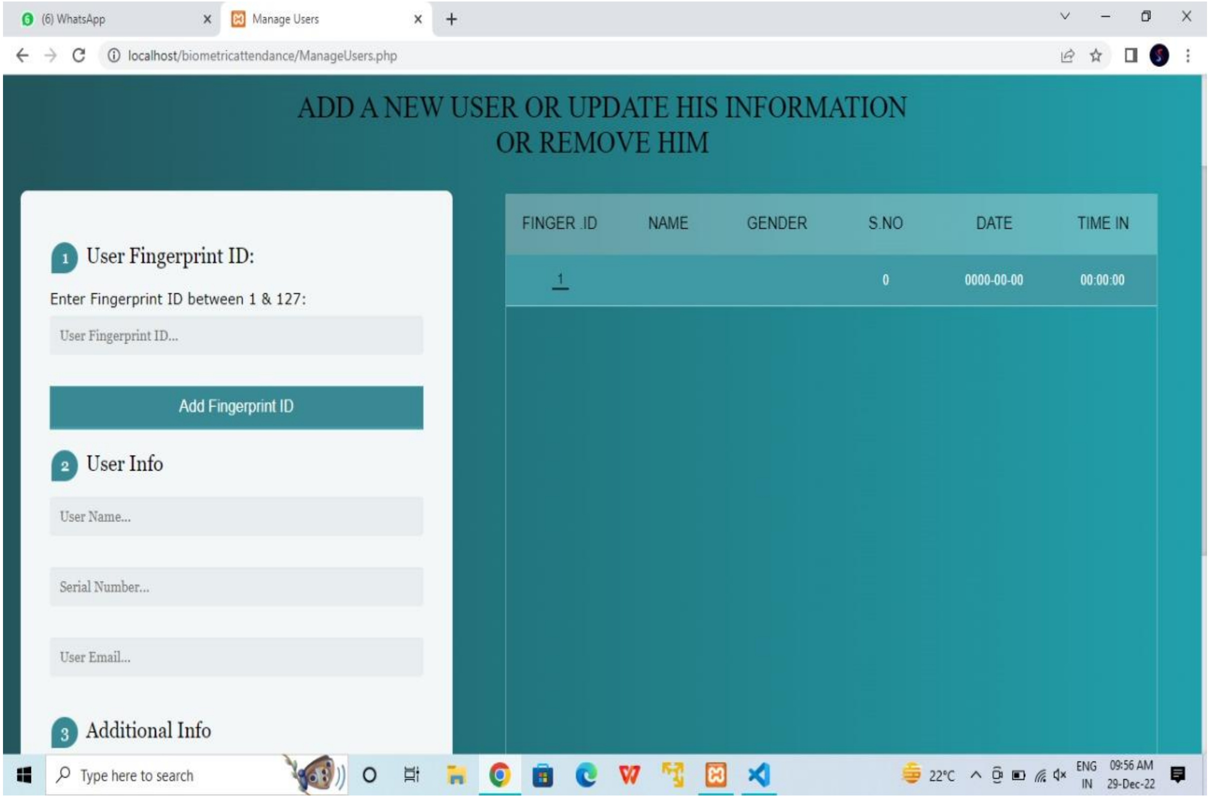
ID | NAME	SERIAL NUMBER	GENDER	FINGER ID	DATE	TIME IN



Biometric Attendance

HERE ARE THE USERS DAILY LOGS

ID	NAME	SERIAL NUMBER	FINGERPRINT ID	DATE	TIME IN	TIME OUT



ADD A NEW USER OR UPDATE HIS INFORMATION OR REMOVE HIM

1 User Fingerprint ID:

Enter Fingerprint ID between 1 & 127:

2 User Info

3 Additional Info

FINGER .ID	NAME	GENDER	S.NO	DATE	TIME IN
1			0	0000-00-00	00:00:00

CONCLUSION

The usual procedure of taking manual attendance and keeping students' attendance is very difficult, inefficient and highly time-consuming task. The IOT based biometric attendance system is supported with biometric identification features which has the capability to automatize whole process. An attendance system with 3 broad features i.e. Internet of Things (IoT), Cloud computing and FPS yields a huge value to various institutions. Due to these considerations, it manifests that it is highly reliable with high security. This system is user friendly due to its lack of complexity.

Traditionally, staff attendance is taken using the manual method, which involves pen, and paper registers. The implementation of an electronic biometric-based method of attendance management system will greatly assist institutions or any organization and thereby prevents time-consuming processes.

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Thank you