

Library Management System Using Nodemcu & Biometric Sensor

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ABSTRACT

In the World of Technology, Biometrics plays an effective role in identifying Human beings. Through this project, you will develop a unique system that can identify students for attendance purpose using their finger prints. In this project, we are going to design a Fingerprint Sensor Based Biometric Attendance System using Arduino. Simply we will be interfacing fingerprint sensor with Arduino, LCD Display & RTC Module to design the desired project. In this project, we used the fingerprint Module and Arduino to take and keep attendance data and records.

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. By using the fingerprint sensor, the system will become more secure for the users. You will need an Arduino Uno board for interfacing microcontroller with the Finger Print Scanner R307/R305. So with the help of Finger Print Scanner R307/R305, we will store the finger prints of all the students and once they are stored, the Finger Print Scanner will compare the present finger print on the scanner and previously stored finger prints. If any finger print is matched, the microcontroller will print the concern data stored for the particular finger print on the LCD Display. In addition to this, we can add Wi-Fi module, to upload the data into remote cloud, so as to access the entire unit from the sole system of it from anywhere in the world. Keyword - NodeMCU, Finger Print Sensor, Biometric Attendance, R307 biometric Sensor, Library Management system, LMS.

1. INTRODUCTION

Attendance plays a major role in educational institutions. The most common means of taking attendance in the classroom is by calling out the roll numbers of students or asking the students to manually sign the attendance sheet, which is passed around during the lecture. The process of manually taking and maintaining the attendance records becomes highly cumbersome

In this project IoT Biometric Project, we are going to build IoT based Biometric Fingerprint Attendance System using NodeMCU ESP8266 12E, LCD 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.

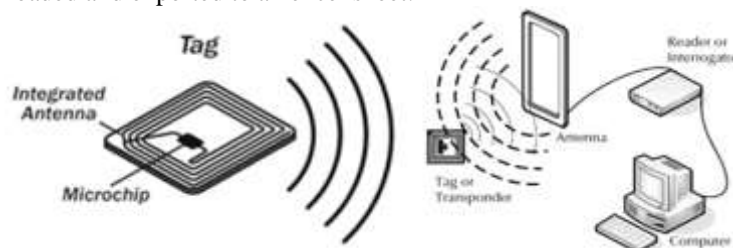


Fig-1 Conventional attendance System

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.

It will be helpful to the librarian to maintain the record of students visited daily, librarian can see detail log and any time. This system will overcome manual writing work of librarian and will help to improve the efficiency.

1.1 Problem identification

It is very important to keep the record of student's attendance but it is very difficult to do it manually using entry register and pen. A conventional system uses RF-ID for attendance purpose. Using RF-ID it is possible to use ID of one student by another. Librarian need to check the device every time to get record information.

1.2 Proposed System

The objective of this project is to help librarian to get the students attendance in one click using computer system, system will not allow to proxy of student as like possible in case of RF-ID based system. System will take advantage of existing Wi-Fi network to connect biometric attendance system with computer system situated at librarian's desk; it will also help to keep historical record of student's attendance

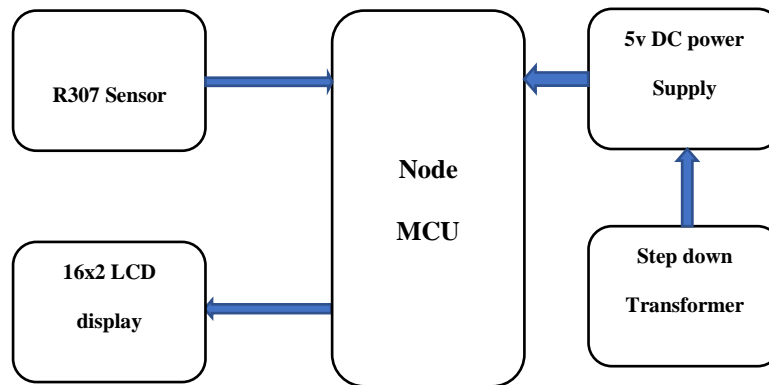


Fig-2 Blok Diagram of proposed system

2. HARDWARE OF PROPOSED SYSTEM

2.1 NodeMCU

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

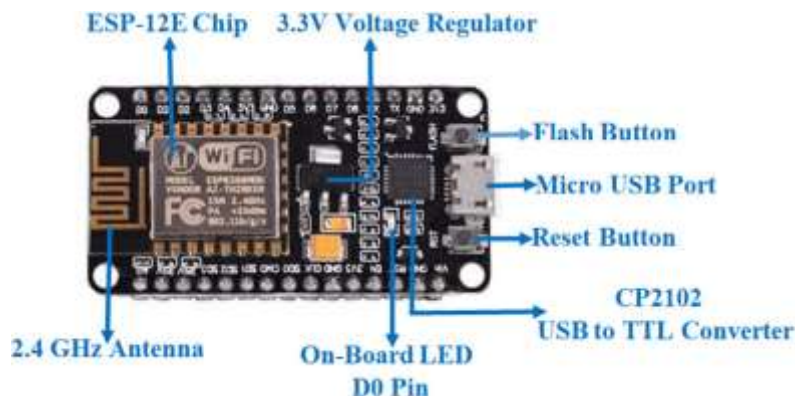


Fig-3: NodeMCU top view

2.2 R307 Finger Print Sensor

Fingerprints are one of the many unique biometric signatures which we can use to identify people very accurately. But just by holding someone's hand and staring at their fingers can't be practical [grins]; we're not good at it. But computers are good at recognizing and matching patterns very fast and accurately. Before we can process a fingerprint pattern with a computer, we must "capture" it.

There exists many methods to digitize fingerprints; from forensic methods to ultrasound scanning. In this tutorial, we will learn how an Optical Fingerprint Scanner works and how we can interface the R307 fingerprint scanner module to Arduino or NodeMCU. R307 is an optical fingerprint scanner module from R30X series produced by a Chinese vendor called Hangzhou Grow Technology Company Limited. Other sensors in the series are R300, R301T, R302, R303, R303T, R305, R306, R308, and R311, some of which are capacitive sensors. Despite having different sensing techniques and form-factors, they all share the same interface and command set. Therefore it is easy to adapt the library that you find here for other models as well.

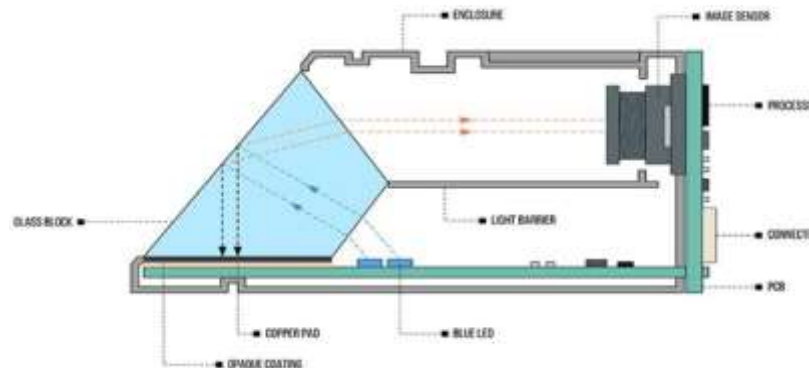


Figure-4: Cross Section of Fingerprint Scanner.

R307 Fingerprint Module consists of optical fingerprint sensor, high-speed DSP processor, high performance fingerprint alignment algorithm, high-capacity FLASH chips and other hardware and software composition, stable performance, simple structure, with fingerprint entry, image processing, fingerprint matching, search and template storage and other functions.

2.3 16x2 LCD display

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

Command register stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register.

3. SOFTWARE IMPLEMENTATION

The fingerprint attendance system code for Arduino is given in the subsequent sections. Although the code is explained well with comments, we are discussing here few important parts of the code. We used fingerprint library for interfacing finger print module with Arduino board.

First of all, we include the header file and define input and output pin and define the macro and declared variables. After this, in setup function, we give direction to defined pin and initiate LCD and finger print module after it, we have to write code for downloading attendance data. After that, we have to write code for clearing attendance data from EEPROM. After it, we initiate finger print module, showing welcome message over LCD and also initiated RTC module. After it, in loop function, we have read RTC time and displayed it on LCD After it, waiting for the finger print to take input and compare captured image ID with stored IDs. If a match occurs then proceed with next step. And checking enrol/del keys as well Given Function is used to taking finger print image and convert them into the template and save as well by selected ID into the finger print module memory. Given function is used for storing attendance time and date in the allotted slot of EEPROM Given function is used to fetching data

from EEPROM and send to serial monitor. 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
```

4. RESULT

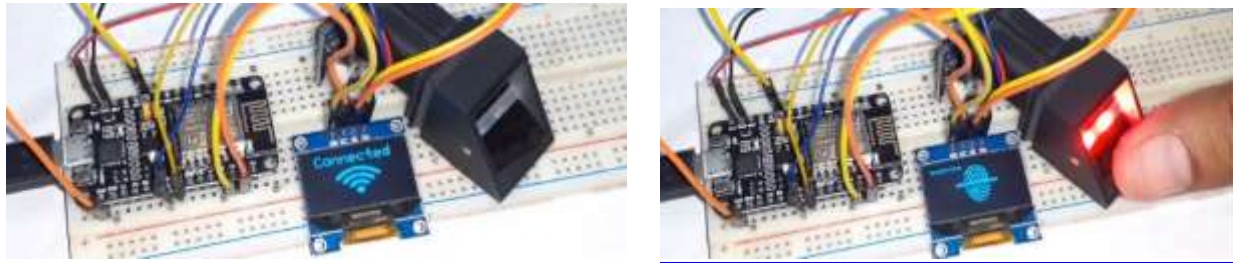


Fig-5: Result Window-1&2

Once the Code is uploaded the NodeMCU will boot up with the Adafruit logo. And then it will try the connection to the Wi-Fi. Once it gets connected it will display Connected. This log can be viewed on Serial Monitor as well as in OLED Display.

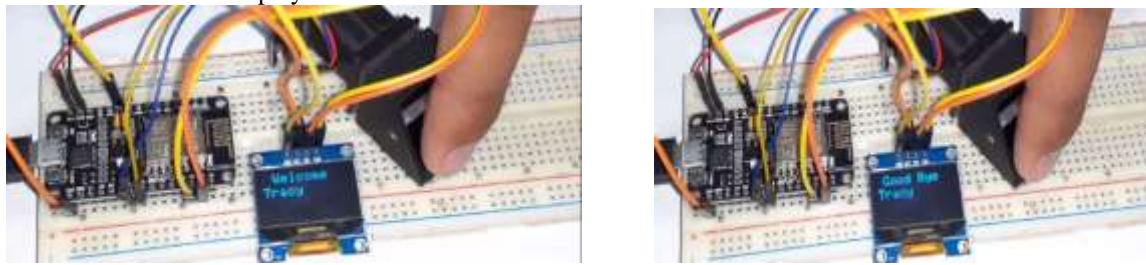


Fig-6: Result Window-3&4

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. 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.



Fig-7: Final Result Window

5. CONCLUSION

The traditional process of manually taking and maintaining student attendance is highly inefficient and time consuming. The attendance monitoring system based on biometric authentication has a potential to streamline the whole process. An Internet of Things (IOT) based portable biometric attendance system can prove to be of great value to educational institutions in this regard as it proves to be highly efficient and secure. The cost involved in making this system is quite less, when compared to conventional biometric attendance system. The use of cloud computing to store the attendance records makes all the data easy to access and retrieve as and when required by the teachers. The use of fingerprint scanner ensures the reliability of the attendance record. The system, due to its lack of complexity, proves to be easy to use and user friendly.

6. REFERENCES

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