

A REPORT ON
**“SMART SCHOOL ATTENDANCE USING NODEMCU
AND FINGERPRINT SENSOR”**

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE

OF

**BACHELOR OF ENGINEERING
(COMPUTER ENGINEERING)**

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CERTIFICATE

This is to certify that the project report entitles

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Abstract

The combination of Electrical Engineering (EE) and Information Technology (IT) has played a significant role in developing several aspects in academic and professional sectors such as student or employee monitoring. It is a critical subject to track and to manage employee attendance in work places urging employees to attend on time to increase efficiency of work, so is at schools or colleges for students. Hence, an attendance system can be useful to reduce administrative complexity and cost. The conventional pen-paper based attendance system is not absolutely flawless. In this paper we have designed an attendance system using RFID and Wi-Fi Module. Radio Frequency Identification (RFID) is an extensive application to yield maximum advantage of this technology with minimal effort for management and attendance monitoring. But it is hard to keep track of every individual only through monitoring. At such times we need an online solution. We have used Node MCU for this purpose. It is a complete and self-contained Wi-Fi network solution that can carry software applications as a stand-alone device or connected with a microcontroller.

The register based conventional attendance system for the students in our educational institution is laborious, time consuming and kind of boring task for the educators. An intelligent system based on fingerprint scanner have been designed and implemented that supplanted the traditional mundane attendance system. The system can acquire, store, crosscheck the fingerprint of individuals and export the data in the form of Microsoft excel spreadsheet in a memory module. The entire procedures are supervised by a microcontroller. This smart attendance kit is portable, handy, cheap and reliable

Keywords:- ESP8266, Ease, Low power consumption, Security, Scalability, etc.

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CHAPTER 1

INTRODUCTION

IoT could be a combination of knowledge, web associated items, which is an integral component of the long run Internet. IoT focuses on the automation of processes to cut back human intervention. IoT in schools attendance system methods to form them more efficient and effective. It reduce the pen paper work to get attendance manaully. The use of a Wifi Module is finished during this project which collects the information from different Id and sends it to the most server using wireless protocols. the info that's collected during the enter the class. The data about different environmental factors which is employed to watch the complete process.

Attendance monitoring is an indispensable part of any institute or office. Monitoring of attendance helps increasing quality outcome, be it an educational institute or be it an office. The pen-paper based manual attendance system had too many fallacies. Moreover, it had a possibility of manipulation of the original data. So, we have tried to make an automatic attendance system that would be to some extent free from some of the drawbacks of the pen-paper based attendance system.

A database is created in both the cases which contain the employee/student details along with their corresponding RFID card address. Whenever a card is scanned the corresponding attendance is marked and stored in the database. 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. verification or identification.

We have proposed an attendance system with fingerprint scanner. But the process is bit complex. We have tried to overcome complexity by making our system simpler. Authors have also proposed another attendance system with fingerprint scanner. But here, the data must be transferred to computer in order to update the database. But in our system, the database is automatically updated and written on memory module.

1.1 MOTIVATION OF THE PROJECT

We are going to build a IoT based Smart Attendance System. The objective of this project is to offer assistance to teachers in getting Live Data (Attendance) for reduce human effort.

When the IoT-based Attendance system starts, it checks the Students active Ids. It then sends this data to the PHP Web Server for live monitoring. If the student enter into class, it automatically starts the Id and collect attendance.

1.2 PROBLEM DEFINATION

To develop IoT-based Smart Attendance System. For some applications, process variables (Students, Staff, Resources) vary with time and this should be noted to allow control action.

1.3 OBJECTIVE STATEMENTS

- To provide institution a ease on managing record and attendance.
- To transfer data over internet through Wi-Fi module to server.
- To implement Peer-to-Peer network and multipoint network can be established by configuring each module to operate as a sensing node.

1.4 BUDGET OF THE PROJECT

To achieve reliable costs and effort estimated, the estimation was delayed until late in the project and using one or more empirical models for software costs and effort estimates. Cost estimates must be providing up-front. However, we should recognize that longer we wait, the more we know and the less likely we are to make serious errors in our estimates. Cost estimation models can be used to completed decomposition techniques and offer a potentially valuable estimation approach in their own right. An estimation model for computer software uses empirically derived formulae to predict effort as a function of LOC (Line of code). For the estimation of software development effort as a function of program size expressed in estimated lines of code. The equation of this model takes the form.

$$E = a b \text{ KLOC} b b$$

$$D = c b E d b$$

Where,

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E is the effort applied in the person months.(3 Months * 30 Days) 4person [1500 / month]

D is the development time in chronological months and KLOC is the estimated number of delivered lines of code for the project (expressed of thousands).

The approximate cost of this system comes out to be Rs. 3,000/-

Hence, in this chapter clear idea about problem statement, objectives and the activities carried out in the proposed system is given. It also describes schedule of the project and budget of the project.

CHAPTER 2

LITERATURE SURVEY

Short information about Project ex. analysis, techniques.

2.1 LITERATURE SURVEY

Attendance is a must for students. Without the attendance process, the lecturer or teacher cannot assess the participation of a student. But in the process now, attendance is still done manually using paper. The first problem is the use of excess paper and the second problem is the difficulty for the administration to recapitulate student attendance results. This is because so many attendance papers must be analyzed by the administration.

Therefore, a student attendance system is needed that can collect data quickly, efficiently and accurately. This student attendance system is done by conducting data collection, system analysis, system design, and system implementation. This system is created using the HTML, CSS, JavaScript and Java Android programming languages. This work introduces a new paradigm of monitoring student attendance using ESP266 wifi module based on the Internet of Things (IoT).

Educational institutes are concerned about student irregular attendance. Truancy can affect a student's overall academic performance. The traditional method of taking attendance by calling names or signing on paper is very time consuming and inefficient. ESP266 wifi module based attendance system using IoT system is one of the solutions to handle the problem. The proposed work comprises of two most popular trend in technology research; IoT and ESP266 wifi module.

CHAPTER 3

SOFTWARE REQUIREMENTS SPECIFICATION

3.1 PURPOSE

Existing systems sensor network deployed in each section will keep updating the parameter readings in the cloud through a Wi-Fi communication module. Any changes with the data that can trigger set the attendance will also be recorded and notified at the server room. The concerned authorities or the locals can access the data and the warning notifications are the same. The data is stored in the cloud called ThingSpeak server, where it can be used to make some analyses on fields.

3.2 SCOPE OF DOCUMENT

The span of this project will consist of many fields of study including device communication, signal processing, hardware manipulation and many others. Device communication will be used in order to send the signals from one component to another. Without this knowledge, it will be impossible to accomplish the main task of the project. Signal processing will be used in the software aspect of the project. The signal received from the ID, fingerprint sensor, will be processed and categorized as being either cognitive or effective. Once this classification is done, the signals will be further processed into useful signals for the esp8266 to use. Hardware manipulation will be a very important aspect of this project. The esp8266 that we use in this project will be a very important aspect of this project. The esp8266 that we use in this project will have a custom PCB attached to it which will contain many sensors and components that will specifically be used for the intention's of receiving signals from the motherboard and transmitting the correct voltages to the correct wires on the esp32. This PCB will control the Display as well as the Fingerprint on this esp8266. There

will also be a custom PCB connected to the motherboard that will be used in the signal processing aspect of the project. This PCB will be made to mimic an Arduino Board and will convert strings into 8-bit streams of data that will then be used by the esp8266 to determine which command it should execute.

3.2.1 Overview of Responsibilities of Developer

- Understand exact Problem Definition.
- Gather requirements of the project.
- Analyze requirements and design model.
- Efficient coding with use of appropriate.
- Data structure and algorithms.
- Test project for set of algorithms.
- To complete the project successfully and scale it depending on the time.

3.3 NON - FUNCTIONAL REQUIREMENTS

No safety and security requirements are specified in the user needed requirements. But on the same time, the application should be efficient, manipulative, self-adaptable and self-constrained.

- Performance Requirements: Better performance than existing system.
- Interface Requirements: User friendly.
- Safety Requirement.
- System should process data safely and in secure manner that is it should be safe.
- Software quality attributes

Reliability Application must be clear, informative, easy to use and secure.

- Software And Hardware Quality Attributes:
 - a. Reliability: System should give required data modified format. Also the data should be in secured manner.
 - b. Performance: Performance of this system is good if CPU is properly utilized.

3.3.1 Design Constraint

- Design of user interface for proper execution where users have to provide proper input.
- Design of micro-controller module.
- Design of power supply module.

3.3.2 Software Interface Description

- Software interface of the system is user friendly.
- Once any task is completed system will notify to the user.

CHAPTER 4

HARDWARE REQUIREMENTS AND SPECIFICATIONS

4.1 SYSTEM ARCHITECTURE

The initialization and installation of the system is done by Hardware Installation and Software Installation separately. The hardware connections can be made in a Bread board or in Vero board by connecting the junctions using Jumper cables. The primary hardware components used are ESP8266 or Wi-Fi module and Fingerprint and it is shown in Figure.

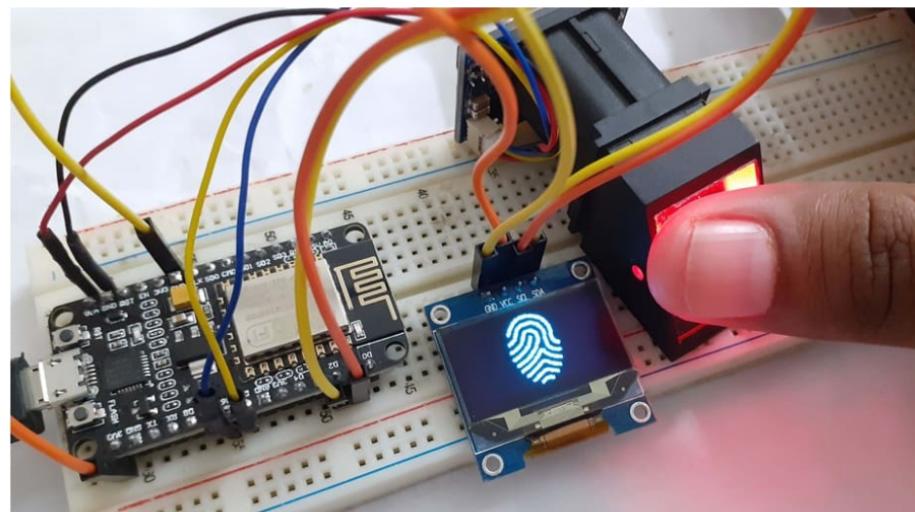


Figure 4.1: Hardware Installation

The below circuit diagram shows how an OLED Display Fingerprint Sensor is interfaced with Node MCU ESP8266 12E Board. The I₂C pins of OLED Display, i.e SDA SCL are connected to Node MCU 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 Node MCU.

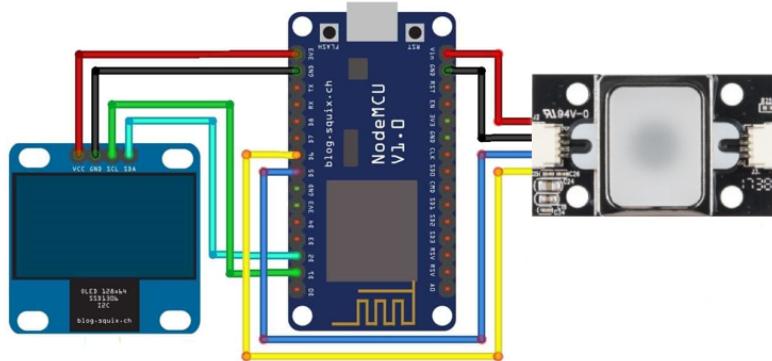


Figure 4.2: Circuit diagram of hardware installation

4.1.1 NodeMCU ESP8266 wifi module



Figure 4.3: NodeMCU ESP8266 wifi module

In our design, Fig.1 Node MCU is used which is a high speed and accurate Object Connector. It has an onboard optical sensor to capture the image, internal 32-bit processor that process the captured image and make it in a stream of bits and stores it in an on board memory. The memory can save up to 200 different fingerprints. The processor communicates with its master in simple UART protocol.

4.1.2 OLED Display



Figure 4.4: OLED Display

The OLED (Organic Light-Emitting Diode) display is an alternative for LCD display. The OLED is super-light, almost paper-thin, flexible, and produce a brighter and crisper picture. SPI is generally faster than 12C but requires more Arduino pins. While 12C requires only two pins and can be shared with other 12C peripherals. It's a trade-off between pins and communication speed. The choice is up to you. For OLED with 12C interface, there are several types of driver such as SSD1306, SH1106 driver. This tutorial uses SSD1306 128x64 12C OLED Display.

4.1.3 Fingerprint Sensor



Figure 4.5: GT521F32 Optical Fingerprint Scanner Module

The GT521F32 Optical Fingerprint Scanner Module with JST SH Connector is a high-performance fingerprint scanner. Which is useful for to access control, security, identification, and convenience. This optical sensor module is designed for easy integration into applications with serial interface (UART). We need two wires are for TX and RX and two wires for power supply (5V).



Figure 4.6: TP4056 1A Li-Ion Battery Charging module

4.1.4 TP4056 Charging Moduler

This TP4056 1A Li-Ion Battery Charging Board Micro USB with Current Protection is a tiny module, perfect for charging single cell 3.7V 1 Ah or higher lithium-ion (Li-Ion) cells such as 16550s that don't have their own protection circuit. Based on the TP4056 charger IC and DW01 battery protection IC this module will offer 1A charge current then cut off when finished. Furthermore, when the battery voltage drops below 2.4V the protection IC will switch the load off to protect the cell from running at too low of a voltage and also protects against over-voltage and reverse polarity connection (it will usually destroy itself instead of the battery) however please check you have it connected correctly the first time.

4.1.5 Battery



Figure 4.7: Li-Ion Battery

This is 3.7V 500mAH (Lithium Polymer) Lipo Rechargeable Battery also known as Lipo or Lipoly batteries are thin, light and powerful. This battery has a capacity of 500mAH. These Batteries are widely used in GPS, DVD, ipod, Tablet PC, MP4 Player, Power Bank, Mobile Backup Power Supply, Bluetooth Speaker, IOT and other DIY and Industrial applications.

CHAPTER 5

SYSTEM DESIGN

5.0.1 Use Case Diagram

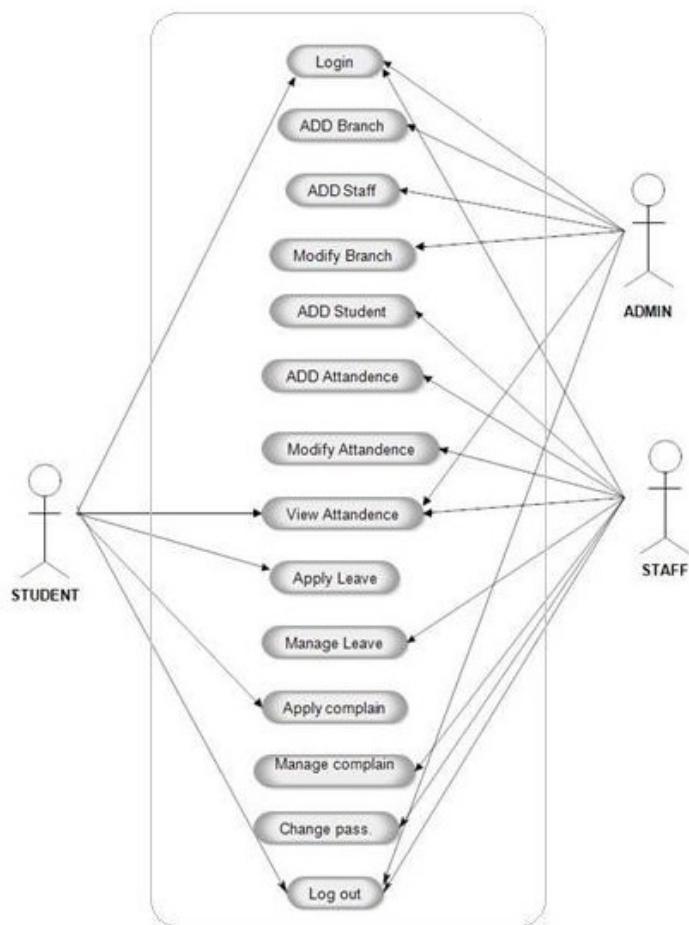


Figure 5.1: Use Case Diagram

5.0.2 Activity Diagram

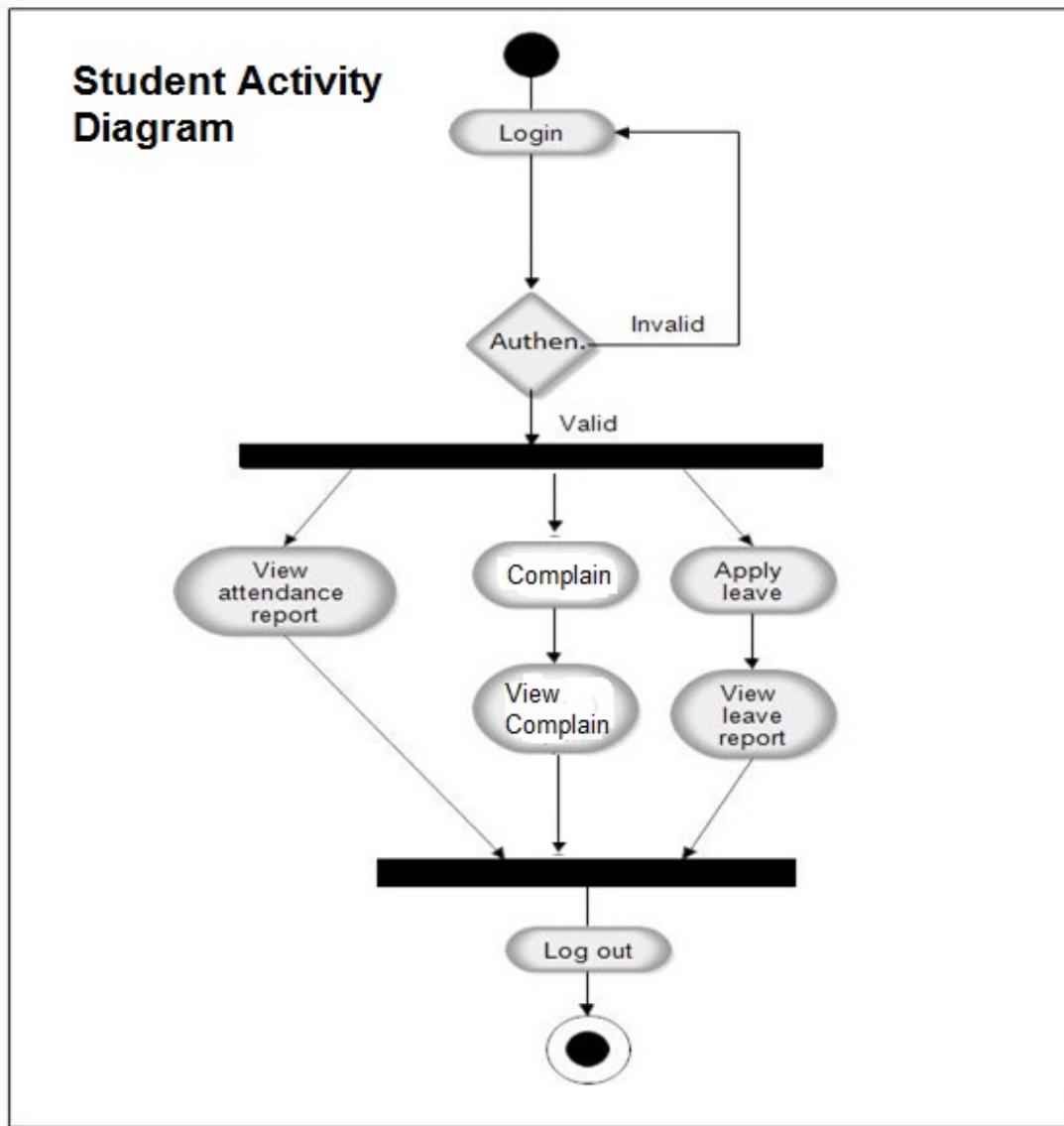


Figure 5.2: Activity Diagram

5.0.3 Component Diagram

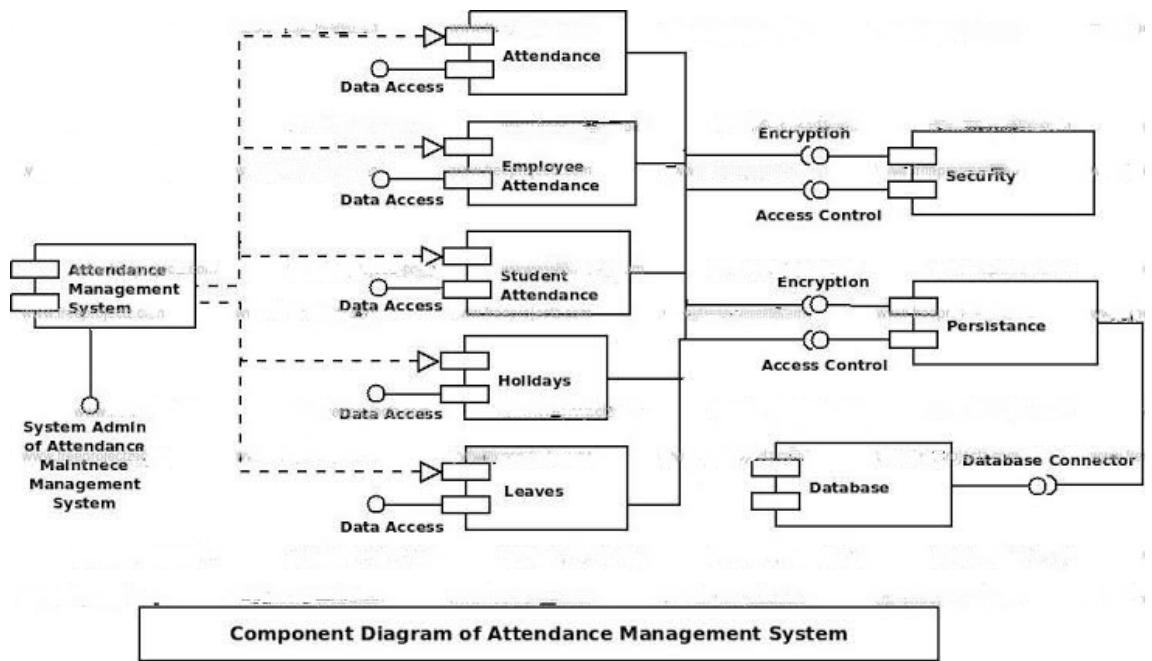


Figure 5.3: Component Diagram

5.0.4 Class Diagram

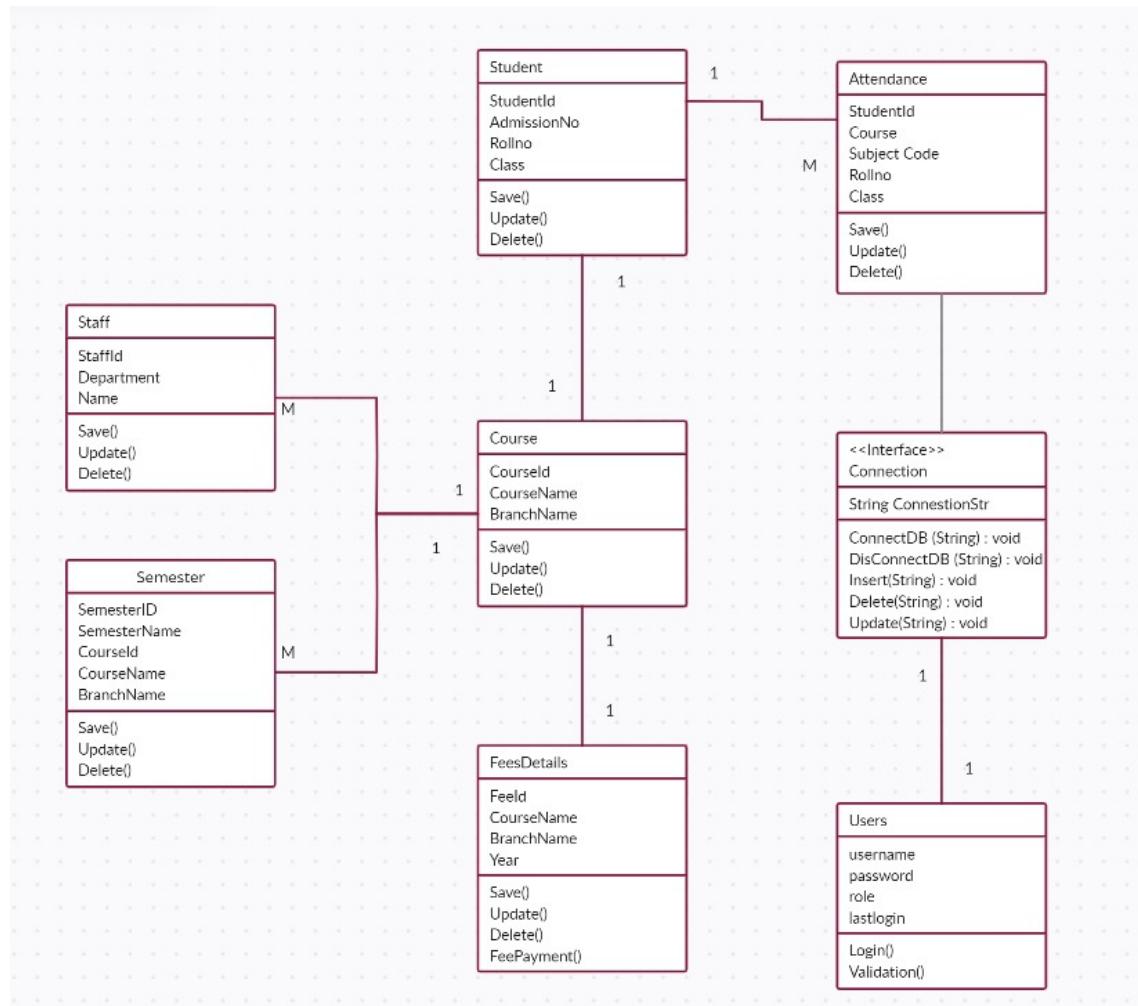


Figure 5.4: Class Diagram

CHAPTER 6

OTHER SPECIFICATIONS

6.1 ADVANTAGES

- Reduce paperwork and save time
- Real-time status tracking
- Eliminate duplicate data entry and errors in time and attendance entries
- Auto-generate various types of reports of class or student attendance
- Track the attendance of teachers and staff, assign work and manage the allocation

6.2 LIMITATIONS OR CHALLENGES

- By un proper use of the device (ID) is prone to damage
- In case of a large strength of students, purchasing tags for everyone is costly
- Replacing the microchip, display and battery in the device(ID) is tiresome and costs money
- The System is expensive because a lot of technology goes into making it

6.3 APPLICATIONS

- Attendance Monitoring
- Smart Attendance Website
- Resources Management

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Hardware Requirement :

- ESP8266
- Fingerprint Sensor
- Charging Module
- Battery
- OLED Display
- WIFI Module

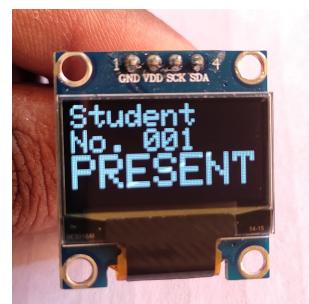
Software Requirement :

- Arduino IDLE
- Visual Studio Code IDLE

CHAPTER 7

RESULT

7.0.1 Id Result



7.0.2 Website Result

The screenshot shows a web page with three main sections:

- Left Section:** Displays a placeholder image of a student, the text "Name of student", and a paragraph of placeholder text: "Lorem ipsum dolor sit, amet consectetur adipisicing elit. Sit omnis voluptatem error impedit assumenda". Below this is a "Join me" button.
- Middle Section:** Shows a blue arrow pointing from the left section to a placeholder image of a student labeled "Head of Department". Below the image is another paragraph of placeholder text: "Lorem ipsum dolor sit, amet consectetur adipisicing elit. Sit omnis voluptatem error impedit assumenda".
- Right Section:** Displays the text "Computer Department" and "Bachelor Of Engineering". Under "Computer Department", there are four buttons: "FE CLASS", "SE CLASS", "TE CLASS", and "BE CLASS". Under "Bachelor Of Engineering", there is a 5x6 grid of numbered buttons (1-30) arranged in five rows and six columns, with colors alternating between green, red, and blue.

CHAPTER 8

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Appendices

APPENDIX A

BASE PAPER

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Face Recognition Attendance System Based on Real-Time Video Processing

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ABSTRACT With the advent of the era of big data in the world and the commercial value of face recognition technology, the prospects for face recognition technology are very bright and have great market demand. This article aims to design a face recognition attendance system based on real-time video processing. This article mainly sets four directions to consider the problems: the accuracy rate of the face recognition system in the actual check-in, the stability of the face recognition attendance system with real-time video processing, the truancy rate of the face recognition attendance system with real-time video processing and the interface settings of the face recognition attendance system using real-time video processing. By analyzing the situation of these problems, the concept of attendance system based on face recognition technology is proposed, and the research on face recognition attendance system based on real-time video processing is carried out. Experimental data shows that the accuracy rate of the video face recognition system is up to 82%. Compared with the traditional check-in method, the face recognition attendance system can be reduced by about 60%. The rate of skipping classes has greatly reduced the phenomenon of students leaving early and skipping classes. The face recognition time and attendance system with real-time video processing through the above experimental certification can quickly complete the tasks of students in the time and attendance check-in system, get rid of the complex naming phenomenon, greatly improve the efficiency of class, and play an important role in guiding the development of the time and attendance system.

INDEX TERMS Video processing, face recognition technology, face recognition attendance, attendance system, video recognition.

I. INTRODUCTION

In this era of Internet explosion, computer technology has involved many areas of people's lives and work. The occasions where people come into contact with computers are gradually expanding. The frequency with which people use computing is also increasing. One of the most challenging projects in the field has a broad application prospect because of its huge sense of innovation. As an important identity label for people to distinguish different individuals, face recognition technology has gradually entered people's lives. Face recognition is the combination of artificial intelligence and computer. Because of its huge challenging innovation and broad application prospects, it has become the most challenging topic in this field.

The associate editor coordinating the review of this manuscript and approving it for publication was Zhihan Lv.

In recent years, the face recognition application system has developed rapidly as a computer security technology in the world, especially today, when terrorist activities are rampant, this technology has received more and more attention. Face recognition technology has many typical applications in the field of public safety, civil economy, and home entertainment [1], [2]. The pipeline of general enterprises needs to record the attendance of personnel, which has become a basic requirement of the company. However, when these attendance systems are formulated, unnecessary errors often occur. Taking the current fingerprint attendance system as an example, the study has found that the fingerprint attendance system has an error rate of about 5%, and there will be a phenomenon that fingerprints cannot be hit, which seriously affects the efficiency of attendance, especially in large attendance sites, which is more likely to cause congestion. However, the card attendance system has the phenomenon of employees swiping

cards for someone else, and it is difficult to achieve the purpose of real time attendance. Compared with the two attendance systems, the face recognition system has higher accuracy and stability, because there are more points for face recognition, which is more accurate than other systems. Greatly improved, it is difficult to congestion [3], [4]. Although China's research on face recognition technology started late, our scientific researchers have caught up and some leading figures have established their own industry positions in the field of face recognition. With the advent of the era of big data in today's world and the commercial value of face recognition technology, the prospect of this technology research is very bright and has great market demand [5].

Faces in surveillance videos often suffer from serious image blur, posture changes, and occlusion. In order to overcome the challenges of video-based face recognition (VFR), Ding C has proposed a comprehensive framework based on convolutional neural network (CNN). First, in order to learn a fuzzy and robust face representation, Ding C artificially blurs the training data composed of clear still images to make up for the lack of real video training data. Using training data composed of still images and artificial fuzzy data, CNN is encouraged to automatically learn fuzzy insensitive features. Second, in order to enhance the robustness of CNN features to pose changes and occlusion, CNN has proposed a trunk branch CNN model (TBE-CNN), which extracts complementarity from the overall face image and the patches around the face parts Information [6]. Scholars such as Nemirovskiy V B have studied the featureless face recognition problem. The recognition is based on clustering the proximity between the cardinal distributions of the luminance clusters of the divided images. As a proximity measure, Nemirovskiy V B uses three types of distances: Euclidean distance, cosine distance, and Leibler distance. Recursive neural network software model is used for image segmentation and proximity measure clustering [7].

The design of face recognition attendance system with real-time video processing is conducive to the development of enterprises and has a positive effect on the development of enterprises in the future. This article aims to design a face recognition time and attendance system based on real-time video processing. In this experiment, four investigation experiments were carried out: the accuracy rate of the face recognition system in actual check-in; the stability of the face recognition time and attendance system with real-time video processing; analysis of the skip rate of face recognition attendance system using real-time video processing; interface settings of face recognition attendance system using real-time video processing. The experimental results prove that the time and attendance system achieves the expected time and attendance results through face recognition technology and with the help of a computer, which fully reflects the feasibility design of the overall algorithm. The students who completed the attendance sign-in system quickly completed the tasks, got rid of the complicated sign of roll call, and soon realized the sign of operation and function. The future

system time and the form of attendance system conversion have made tremendous innovations, greatly improving the attendance rate and the reliability of face recognition technology. It is worthy of further exploration and realization by our scientists.

II. PROPOSED METHOD

A. REAL-TIME VIDEO FACE IMAGE RECOGNITION

1) FACE RECOGNITION

Face recognition is the core of the entire recognition process. Face recognition is a computer vision technology that analyzes facial feature information for identity identification. In a broad sense, face recognition is divided into two parts: face detection and face recognition matching. Face recognition technology is based on the facial features of the person, and the input face image or video stream. First determine whether there is a human face, if there is a human face, then further give the position, size of each face and the position information of each major facial organ. Based on this information, the identity features contained in each face are further extracted and compared with known faces to identify the identity of each face [8], [9]. Face recognition technology belongs to biometric recognition technology, which mainly includes four parts: face image collection, face image pre-processing, face image feature extraction, matching and combining hard recognition, combined with hardware cameras, network lines and computing device. The calculation method is as follows:

$$T = \min \{T_1, T_2, \dots, T_n\} \quad (1)$$

The principle of face recognition. Face recognition technology is a kind of biometrics technology, through the acquisition of camera equipment face information and pre-processing. Face detection. The main purpose of face detection is to collect information to determine whether there is a human face image in the image, and to determine the size and position of the image, and segment the detected human face image into the adult face area. The last link is face recognition, extracting facial feature information and image information to determine whether it is in the repository. If it is, it has matching identity information, otherwise there will be no recognition results [10]–[12].

2) FACE FEATURE EXTRACTION BY LDA METHOD

The meaning of LDA is linear discriminant analysis. This algorithm is to find a set of linear transformations that minimize the intra-class dispersion between each category and maximize the inter-class dispersion. Fisher is a linear judgment method in LDA. The name is called because Fisher function is often used for calculation. LDA can also be used very well in face recognition, but when using this method to extract face features, some small sample problems often occur. As long as a training sample of the face can be given, and the sample belongs to the other four categories, the total

number of faces in the sample is:

$$N = \sum_{t=1}^M M_t \quad (2)$$

The average value among these categories is calculated as follows:

$$\bar{Z} = \frac{1}{M} \sum_{t=1}^M Z_t \quad (3)$$

The dispersion within the sample is denoted as S_w , and the dispersion between the samples is denoted as S_b . The calculation formula is:

$$S_b = \frac{1}{N} M_t (\bar{Z}_t - \bar{Z}) (\bar{Z}_t - \bar{Z})^T = \Phi_B \Phi_B^T \quad (4)$$

$$\Phi_B = (M_t / N)^2 (\bar{Z}_t - \bar{Z}) \quad (5)$$

$$\Phi_b = [\Phi_{b1}, \Phi_{b2}, \dots, \Phi_{bn}] \quad (6)$$

$$S_w = \frac{1}{N} \sum_{t=1}^M \sum_{i=1}^M (Z_{ti} - \bar{Z}_{Ti}) (Z_{ti} - \bar{Z}_{Ti})^T \quad (7)$$

3) MAIN FACE RECOGNITION METHODS

a: GEOMETRIC FEATURE METHOD

Since the facial features such as eyes, nose, ears, mouth, etc. are different in structure, different human faces are represented according to different characteristics of the characteristic shapes of these organs. Geometric features were first used in the description and recognition of the side profile of a human face. It determines a number of feature points based on the profile line of the person's side, and then derives a set of feature quantities for recognition such as angle and distance based on these feature points. Its advantage is the use of simple geometric information, so the time cost of storage space and classification is small, and it can still be used when the image recognition rate is low; it is not sensitive to changes in lighting. Its disadvantage is that it is difficult to extract stable features from the image, it is greatly affected by changes in posture and expression, and the stability is not high [13].

b: SUBSPACE ANALYSIS METHOD

The analysis method of subspace is to use spatial transformation to map face image data into a certain subspace to achieve dimensionality reduction of face data. It is a huge face data that becomes simple to calculate, and then to the dimensionality reduction data classification. Different subspace analysis methods use different criteria, and different subspaces can be obtained. Common subspace analysis methods for face recognition include: principal component analysis, linear discriminant analysis, independent element analysis, etc.

c: NEURAL NETWORK METHOD

Neural network is a commonly used method in membrane recognition. Its principle is to use a large number of simple calculation units to form a certain hierarchical structure. Each

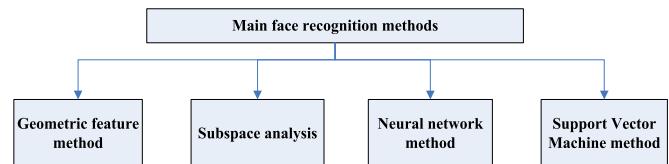


FIGURE 1. Main face recognition methods.

simple unit can only solve simple calculations, but the system composed of units in complex structures can be a complicated question. The neural network algorithm has also achieved good results in face recognition. For example, commonly used BP networks, self-organizing networks, convolutional networks, etc. As long as the network is large enough, there are enough training samples to theoretically recognize all faces. Although neural networks have some advantages in face recognition, they also have considerable defects. The structure of neural networks is huge and complex, and their training requires a huge sample library. The training time often takes days or even months. The speed is not fast enough. Therefore, neural networks are not commonly used in the actual application of face recognition.

d: SUPPORT VECTOR MACHINE (SVM) METHOD

Support vector machine is a research hotspot of pattern recognition. The basic principle of the algorithm is to use samples to form a lattice in the high-level feature space, select sample points as the support vector near the boundary between the two types of sample points, and use the support vector to make the decision. And finally achieve the purpose of classification and identification. The method of projecting into a high-dimensional space makes it possible to solve many problems that are difficult to linearly classify in the status space. But support vector machines also have their shortcomings. First, support vector machines are a two-class classification algorithm. Although some methods can be used to solve multi-classification problems, their efficiency is often greatly reduced. Secondly, support vector machines want high-dimensional space projection, which requires the support of kernel functions, but choosing kernel functions is indeed a lot of trouble. Finally, although support vector machines can classify independently, the effect of directly classifying faces is not good, and often feature extraction is required for faces.

The dimensionality reduction process is performed before recognition, and the basic flow is shown in Figure 1 [7].

4) VIDEO IMAGE RECOGNITION SYSTEM

The face detection technology is used to locate and segment a partial face image from the image; the feature extraction technology extracts the amount of data that can characterize the face image, and forms the features to be stored in the feature database. Face recognition process: face positioning and image processing in the image; feature extraction and selection; detecting and recognizing the image, and returning

the recognition result. First create a facial image file of the face. That is, use the camera to collect facial image files of the person's face or take their photos to form a facial image file, and store these facial image files to generate faceprint codes. Get the current human face. That is, use the current facial image captured by the camera, or take a photo input, and generate a facial texture code from the current facial image file. Compare with the current facial texture encoding and file inventory. That is, to retrieve and compare the current facial texture code with the facial texture code in the file inventory. The above-mentioned "face coding" method works according to the essential characteristics of the human face and the beginning. This facial coding can resist changes in light, skin tone, facial hair, hairstyle, glasses, expression and posture, and has strong reliability, so that it can accurately identify a person from millions of people. The face recognition process can be completed automatically, continuously, and in real time using ordinary image processing equipment [14]. The video image recognition system is mainly composed of four parts: login module, recognition module, check-in module and background management module [11]. Taking the school system as an example, the functions of each module are as follows:

- 1) The login module is where the lecturer or background administrator logs in with an account and password to view attendance information.
- 2) The main function of the recognition module is to receive a face picture, call the system application programming interface (Application Programming Interface, API) to perform face recognition on the picture, and obtain an identification code that uniquely determines the picture.
- 3) The check-in module receives the identification code obtained in the identification module and compares it with the student information in the database to find and confirm the student information; by querying the current time and the schedule information in the database, the current course information is obtained. After obtaining the student and course information, it is logical to determine whether the student has checked in for this class, if it has been checked in, ignore it; if it has not been checked in, add the check in information to the database check in table. The module will return check-in information, including: whether the check-in is successful; the student's name; the student's student ID; the course that is checked in; if the check-in is unsuccessful, what is the reason.
- 4) The background management module is responsible for the background administrator, which mainly includes the functions of counting sign-in information, entering or deleting student information, etc.

B. BASIC FACE RECOGNITION ALGORITHM

When designing a system to select a face recognition algorithm, we have to consider the following factors: recognition rate, algorithm robustness, and matching time [12], [15], [16].

To sum up, the system selects Gabor features plus Fisher based discriminant analysis method based on orthogonal basis to become a linear discrimination method [17], [18]. Face image feature representation is a key part in face recognition, and good feature representation can improve the robustness of image matching. Gabor wavelet feature description method is a comprehensive method that combines gray and local descriptions. It has the advantages of gray-based and feature-based methods [19].

Gabor kernel definition of wavelet transform:

$$\Psi_j(\vec{x}) = \frac{\vec{k}_j^2}{\sigma^2} \exp\left(-\frac{\vec{k}_j^2 \vec{x}^2}{2\sigma^2}\right) [\exp(i\vec{k}_j \vec{x}) - \exp(-\frac{\sigma^2}{2})] \quad (8)$$

$\vec{x} = (x, y)$ is a spatial domain variable, and \vec{k}_j is a frequency vector that determines the scale and direction of the Gabor kernel. We selected an image $I(\vec{x})$, and the Gabor transform at the \vec{x}_0 point at a specific position in the picture can be realized by convolution with Gabor kernel at this point. The face image is $I(z)$, and the $z = (x, y)$ picture scale direction is μ, ν , there is a formula:

$$G_{\mu, \nu}(z) = I(z) * \psi_{\mu, \nu}(z) \quad (9)$$

With $z = (x, y)$, the calculation formula can be obtained:

$$G(x, y) = \frac{\mu^2 + \nu^2}{\sigma^2} \exp\left(-\frac{(\mu^2 + \nu^2)(x^2 + y^2)}{2\sigma^2}\right) \times [\exp(i(\mu x + \nu y)) - \exp(-\frac{\sigma^2}{2})] \quad (10)$$

Among them, $k = (\frac{\mu}{\nu})$, $\mu = \frac{k_{\max}}{f^N} \cos(\frac{\pi M}{8})$, $\nu = \frac{k_{\max}}{f^N} \sin(\frac{\pi M}{8})$, $k_{\max} = \frac{\pi}{2}$, $f = \sqrt{2}$, $\sigma = 2\pi$

Fisher discriminant analysis is an improved algorithm based on PCA. It adopts the method of dimensionality reduction to effectively reduce the amount of calculation, thereby improving the calculation speed [20]. This method can ensure that the projected samples have the smallest intra-class distance and the largest inter-class distance in the new space, that is, the best separability in the space. Introduce Fisher discriminant criteria table:

$$I_{fisher}(\varphi) = \frac{\varphi^T S_b \varphi}{\varphi^T S_w \varphi} \quad (11)$$

where φ is any n -dimensional column vector. Fisher's linear discrimination method selects the vector φ that maximizes $I_{fisher}(\varphi)$ as the projection direction, so that the projected samples have the largest inter-class dispersion and the smallest intra-class dispersion. Among them, S_b is the inter-class separation matrix, and S_w is the intra-class separation matrix. Let $F_k^0, k = 1, 2, \dots, L$ be the average of the training samples of class φ_k after PCA and LDA transformation. Use the nearest domain classifier for face recognition classification:

$$\delta(Y, F_k^0) = \min \delta(Y, F_k^0), \quad Y \in \varphi_k \quad (12)$$

Among them, δ is judged as the distance. If the distance between Y and F_k^0 is smaller than the distance between the two face images in class F_k^0 , then Y and F_k^0 can be regarded

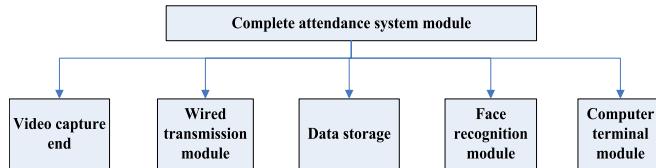


FIGURE 2. Complete attendance system module.

as a class of pictures, and the recognition is successful; otherwise, they are not classified as similar pictures and Y is a non-training sample image.

C. BASIC MODULE OF FACE RECOGNITION ATTENDANCE SYSTEM BASED ON REAL-TIME VIDEO PROCESSING

The complete attendance system consists of a combination of multiple modules, each of which performs different functions. In order to reduce the complexity of the program and facilitate the reuse of codes, it is conducive to maintain and manage the entire system. The design of the face recognition time and attendance system in this system mainly includes several modules of video acquisition terminal, cable transmission module, data storage, face recognition module and computer terminal module [21], [22], as shown in flow chart2.

III. EXPERIMENTS

A. EXPERIMENTAL SETUP

1) EXPERIMENTAL BACKGROUND

In order to deeply study the application of face recognition attendance system for real-time video processing, from the accuracy of actual recognition of face recognition system, the stability of background application system of face recognition attendance system, the face recognition system faces some problems; the development status of the role played by the face recognition system in the actual check-in, the factors restricting the development, and the difficulties faced by the development are considered, and many problems are found.

2) EXPERIMENT SETUP PROCESS

The experiment sets up a control group and an experimental group, the control group uses traditional fingerprint check-in, and the experimental group uses a real-time video processing face recognition attendance system. Choose two universities from a province, choose the same number of students for the experiment, collect, count and analyze the experiment, analyze the application space, development prospects of the face recognition system in the actual check-in, and the face recognition system in some problems with the actual check-in.

B. EXPERIMENTAL PROCEDURE

(1) Accuracy rate of face recognition system in actual check-in

The face recognition attendance system using real-time video processing is used to count the sign-in rates of students from two colleges and universities, and to compare and analyze the sign-on accuracy rate of

the face recognition attendance system using real-time video processing.

- (2) The stability of face recognition attendance system with real-time video processing

Taking the manual punch card as the control group, the face recognition attendance system using real-time video processing is used for the check-in statistics, and the number of check-in punch cards is used as the main observation parameter to detect the stability of the face recognition attendance system.

- (3) Analysis of the truancy rate of face recognition attendance system using real-time video processing

Taking the manual punch card as the control group, and using the real-time video processing face recognition attendance system to perform real-time check-in statistics, observe the students' skip-rate rate of the two methods.

- (4) Interface settings of face recognition attendance system using real-time video processing

By identifying the student's face as the attendance interface, the successful student attendance and time information will be displayed on the screen. By selecting face detection and recognition, the video images of the attendance students can be described by the face recognition attendance system multi-person video.

C. DATABASE DESIGN

This system uses mysql database for data storage. MySQL has the advantages of fast speed, low cost, small size, open source, support for multi-threading and multi-processor, good portability, and at the same time can use ODBC (open database connection) and SQL (structured query language) to increase the data (create), delete (delete), query (select), modify (update) operations.

D. FACE RECOGNITION MODULE DESIGN

This system uses a variety of popular programming languages-Python (Interpretive Language), Java, C ++ and other languages to develop. Python is used for real-time video data collection and face recognition processing. C ++ is used to complete the related system running components such as file operations and client running interface design. Java is used to build a face recognition WEB platform service. Combined with the third-party library Open CV to realize the writing of face recognition module, OpenCV provides rich visual processing and image processing algorithms to analyze and process the facial features captured by the classroom camera. The system is divided into three modules: front-end operation, real-time video face recognition module, and background data management.

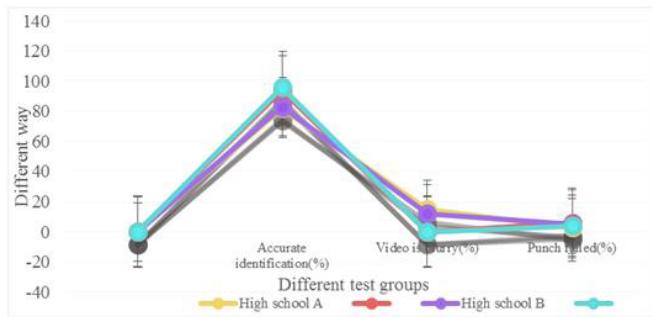
IV. DISCUSSION

A. REAL-TIME VIDEO PROCESSING FACE RECOGNITION ATTENDANCE SYSTEM IN THE ACTUAL SIGN-IN ACCURACY RATE

By investigating two colleges A and B in a province, we conducted experiments in colleges based on the application of

TABLE 1. Video face recognition accuracy.

Video face recognition accuracy	High school A		High school B	
	Test group	Control group	Test group	Control group
Accurate identification (%)	82	94	83	96
Video is blurry (%)	15	0	12	0
Punch failed (%)	3	6	5	4

**FIGURE 3.** Video face recognition accuracy.

face recognition attendance system accuracy, and selected 200 college students who need to punch cards. The statistical results of the survey are shown in Table 1 and Figure 3. According to the experimental results, the accuracy rate of face recognition in the classroom video of the two colleges is currently high, and the accuracy rate of face recognition in the college video is about 82%. About 15% of the failed card punches due to video blur and other reasons, About 3% of the staff failed to punch in, it can be seen from these data that the accuracy rate of the video face recognition system is relatively high.

B. STABILITY ANALYSIS OF FACE RECOGNITION ATTENDANCE SYSTEM BASED ON REAL-TIME VIDEO PROCESSING

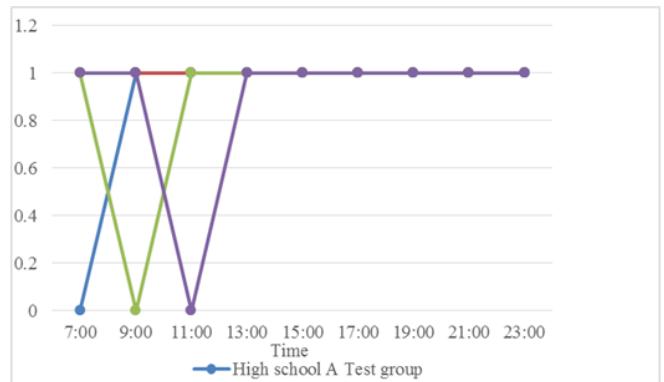
The face recognition attendance system for real-time video processing performs video punching every two hours. Comparing the data of the face recognition attendance system and manual fingerprint punching, the sign-in success is 1 and the failure is 0. The data collection results are shown in Table 2 and Figure 4. An error occurs in the face recognition attendance system from 7 am to 9 am; from 13 noon to 21 pm, the face recognition attendance system and manual fingerprint punch card can correctly identify the check-in. The experimental results show that the length of time when the smart machine is turned on may bring some experimental errors, indicating that the human-machine interactive testing instrument needs to be pre-powered on for two to four hours before the accuracy of the testing data can be guaranteed.

C. ANALYSIS OF THE SKIPPING RATE OF FACE RECOGNITION ATTENDANCE SYSTEM BASED ON REAL-TIME VIDEO PROCESSING

Because the face recognition attendance system has a real-time video function, it can count the number of people

TABLE 2. Stability analysis of face recognition attendance system based on real-time video processing.

Time	High school A		High school B	
	Test group	Control group	Test group	Control group
7: 00	0	1	1	1
9: 00	1	1	0	1
11: 00	1	1	1	0
13: 00	1	1	1	1
15: 00	1	1	1	1
17: 00	1	1	1	1
19: 00	1	1	1	1
21: 00	1	1	1	1
23: 00	1	1	1	1

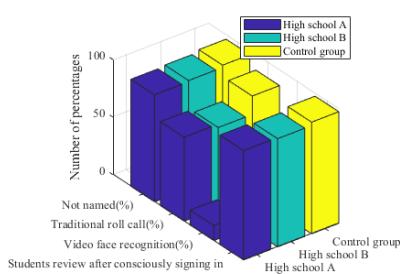
**FIGURE 4.** Stability analysis of face recognition attendance system based on real-time video processing.**TABLE 3.** Statistical table for checking student attendance.

Check student attendance	High school A	High school B
Not named	93 (93%)	94 (94%)
Traditional roll call	73 (73%)	70 (70%)
Video face recognition	13 (13%)	12 (12%)

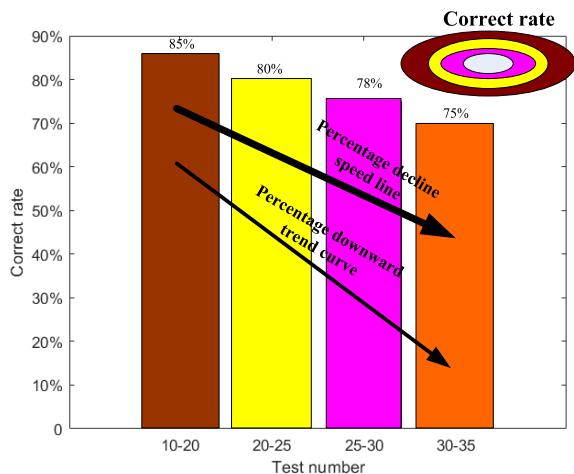
online in real time. Compared with the traditional fingerprint check-in, students' rate of skipping classes will change. The survey data is shown in Table 3 and Figure 5. The results showed that after using the face recognition system, the skipping rate of the two universities was significantly lower than that of the control group, only about 13%. Therefore, the face recognition attendance system can effectively increase the attendance rate of university classrooms, and is an effective method to restrain students from skipping classes.

D. FACE RECOGNITION ATTENDANCE SYSTEM INTERFACE SETTINGS

From the amount of change in Table 4 and Figure 6, it can be seen that by recognizing the student's face as the attendance interface, the successful attendance and time information of the confirmed student is displayed on the screen. By selecting face detection and recognition, the video images of the attendance students can be described by the face recognition attendance system multi-person video. Compared with the traditional punch card signing, this method greatly improves

**FIGURE 5.** Statistics chart for checking student attendance.**TABLE 4.** Test number and accuracy rate table.

Test number	Correct rate
10~20	85%
20~25	80%
25~30	78%
30~35	75%

**FIGURE 6.** Test number and accuracy rate chart.

the efficiency, and can prevent early leave and skip class. By regularly extracting images, seeing that the students 'handling of the case is transparent, the inspection method is an imperceptible process to a process where the user perceives no signs, it is a sign of an automated way. After repeated testing, the test results of the system under different test sample numbers are as follows: when the input student is 10 ~ 20, the recognition and sign-in correct rate is 85%; when the input student is 20 ~ 50, the correct rate is 80%. There is an error rate of about 20% in the test results. Most students face information errors that will change, such as changes in facial features, accessories, cosmetics and lighting caused by medical plastics, making it impossible to extract the correct logo from the picture; Another main reason is the accuracy of identification code comparison. The system fails to correctly judge that the two identifiers are very similar. Under various perfect conditions, make sure to adapt to various situations.

V. CONCLUSION

(1) College attendance management for students has become one of the hot issues in the society, so the management of college students should be strengthened. However, most college students still use traditional manual attendance for daily attendance, using paper signatures or teacher orders, but now with the gradual rise of technology, some new methods point out that gradually, a few colleges and universities will use punch card fingerprints and smart attendance methods. Although there are some ways to stimulate attendance, the effect is not so effective. Attendance and these methods have a common shortcoming, fraud will occur, thereby increasing the rate of absenteeism. This repeated phenomenon not only has a negative impact on students' psychology and physiology, but also maintains the normal order of university teaching and hinders the quality of teaching. At the same time it will have a very unfavorable situation training and the formation of university spirit and discipline.

(2) In this article, a face recognition attendance system based on real-time video processing is designed, and two colleges in a province are selected for real-time check-in and inspection of student attendance. This article mainly sets four directions to consider the problems: the accuracy rate of the face recognition system in the actual check-in, the stability of the face recognition attendance system with real-time video processing, and the truancy rate of the face recognition attendance system with real-time video processing. It is difficult to analyze the interface settings of the face recognition attendance system using real-time video processing. By analyzing the situation of these problems, the concept of attendance system based on face recognition technology is proposed, and the research on face recognition attendance system based on real-time video processing is carried out. Research data shows that the accuracy of the video face recognition system is about 82%. The face recognition time attendance system and manual fingerprint punching are more stable and correctly identify check-ins, and the rate of skipping classes is significantly reduced compared with the control group, only about 13%. Compared with the control group, the efficiency is greatly improved, which can prevent students from leaving early and skipping classes.

(3) The attendance system realizes the expected attendance results through face recognition technology with the help of a computer, which fully reflects the feasibility design of the overall algorithm. The students who have completed the attendance sign-in system quickly completed the tasks, got rid of the complicated sign of roll call, and soon realized the sign of operation and function. The system has made tremendous innovations, greatly improving the attendance rate and the

reliability of face recognition technology. It is worthy of further exploration and realization by our scientists.

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APPENDIX B

SYNOPSIS

A
SYNOPSIS FOR DISSERTATION STAGE I
ON
“SMART SCHOOL ATTENDANCE USING NODEMCU AND
FINGERPRINT SENSOR”

SUBMITTED BY

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University of Pune

**SAVITRIBAI PHULE PUNE UNIVERSITY
Year: 2022-2023**

Abstract

The combination of Electrical Engineering (EE) and Information Technology (IT) has played a significant role in developing several aspects in academic and professional sectors such as student or employee monitoring. It is a critical subject to track and to manage employee attendance in work places urging employees to attend on time to increase efficiency of work, so is at schools or colleges for students. Hence, an attendance system can be useful to reduce administrative complexity and cost. The conventional pen-paper based attendance system is not absolutely flawless. In this paper we have designed an attendance system using RFID and Wi-Fi Module. Radio Frequency Identification (RFID) is an extensive application to yield maximum advantage of this technology with minimal effort for management and attendance monitoring. But it is hard to keep track of every individual only through monitoring. At such times we need an online solution. We have used Node MCU for this purpose. It is a complete and self-contained Wi-Fi network solution that can carry software applications as a stand-alone device or connected with a microcontroller.

The register based conventional attendance system for the students in our educational institution is laborious, time consuming and kind of boring task for the educators. An intelligent system based on fingerprint scanner have been designed and implemented that supplanted the traditional mundane attendance system. The system can acquire, store, crosscheck the finger-print of individuals and export the data in the form of Microsoft excel spreadsheet in a memory module. The entire procedures are supervised by a microcontroller. This smart attendance kit is portable, handy, cheap and reliable.

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Chapter 1

Introduction

Attendance monitoring is an indispensable part of any institute or office. Monitoring of attendance helps increasing quality outcome, be it an educational institute or be it an office. The pen-paper based manual attendance system had too many fallacies. Moreover, it had a possibility of manipulation of the original data. So, we have tried to make an automatic attendance system that would be to some extent free from some of the drawbacks of the pen-paper based attendance system.

Whenever the person enters from the main entrance, he/she has auto scan her ID card and the corresponding attendance with Entry time is marked. The same thing one has to do while leaving the premises to mark the Exit time. However, for student attendance system the later part may not be necessary. Now, the attendance storing process via Wi-Fi can be done in two ways.

1. Using Local Server and MFRC522 and ESP8266 connected in same Wi-Fi network.
2. Using a website which is accessible via Internet.

A database is created in both the cases which contain the employee/student details along with their corresponding ID card address. Whenever a card is scanned the corresponding attendance is marked and stored in the database. 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. verification or identification. Authors have proposed an attendance system with fingerprint scanner. But the process is bit complex. We have tried to overcome complexity by making our system simpler. Authors have also proposed another attendance system with fingerprint scanner. But here, the data must be transferred to computer in order to update the database. But in our system, the database is automatically updated and written on memory module. Authors in have proposed another system where the attendance system send to parents via SMS. But in our system, the information will be updated in a memory module.

Chapter 2

Problem Statement

In this project IoT Biometric Project, we will learn how to build IoT based Biometric Fingerprint Attendance System using Node MCU 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.

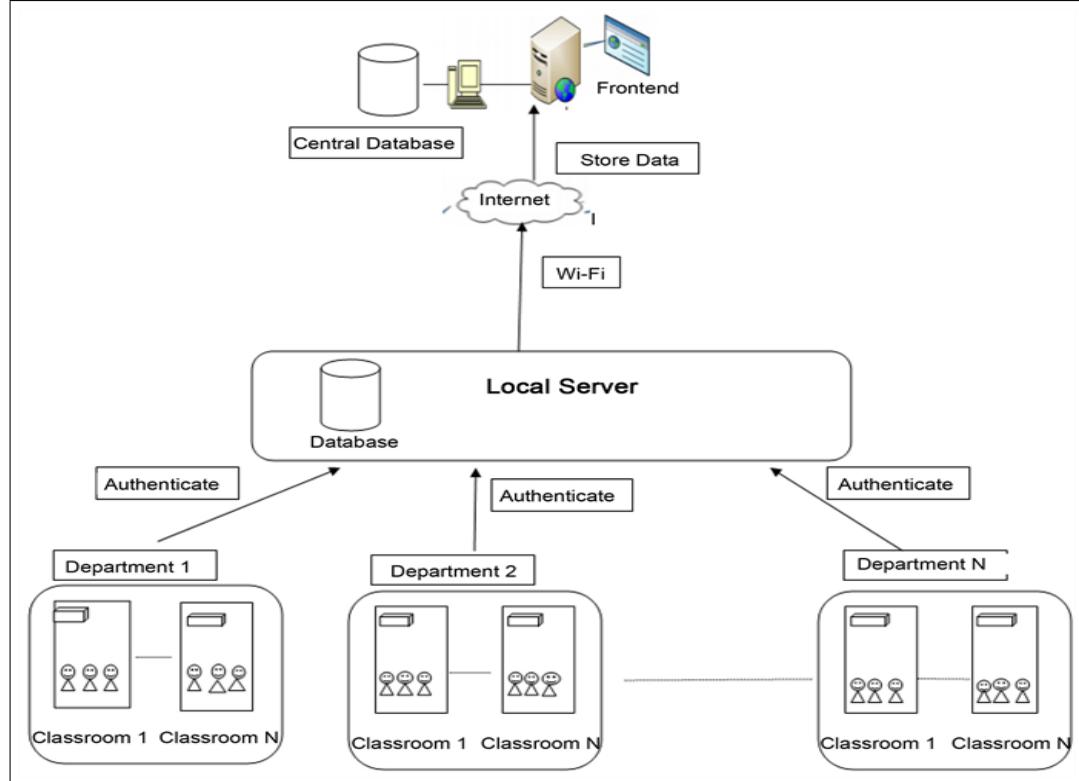
Conventional authentication technologies like RFID tags and authentication cards have a lot of weaknesses, the biometric method of authentication is a prompt replacement for this. Biometrics such as fingerprints, voices and ECG signals are unique human characters that cannot be tampered or replicated. 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.

Chapter 3

Mathematical Modeling

1. Front End Site Work Using HTML, CSS And JavaScript
2. Connecting Central Database to the server
3. Store Wifi Collected Data on Internet
4. It will be sent to local Server
5. Presented on Excel Sheet



Chapter 4

Technical Details

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.

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.

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. Verification Speed: 0.3 sec
7. Scanning Speed: 0.5 sec
8. Character file size: 256 bytes
9. Storage capacity: 250
10. Security level: 5 (1,2,3,4,5(highest))
11. False Acceptance Rate (FAR) :0.0001
12. False Rejection Rate (FRR): 0.1
13. Resolution 500 DPI
14. Voltage :3.6-6.0 VDC

Chapter 5

Technologies Used

5.1 NodeMCU

In our design, Fig.1 Node MCU is used which is a high speed and accurate Object Connector. It has an onboard optical sensor to capture the image, internal 32-bit processor that process the captured image and make it in a stream of bits and stores it in an on board memory. The memory can save up to 200 different fingerprints. The processor communicates with its master in simple UART protocol.

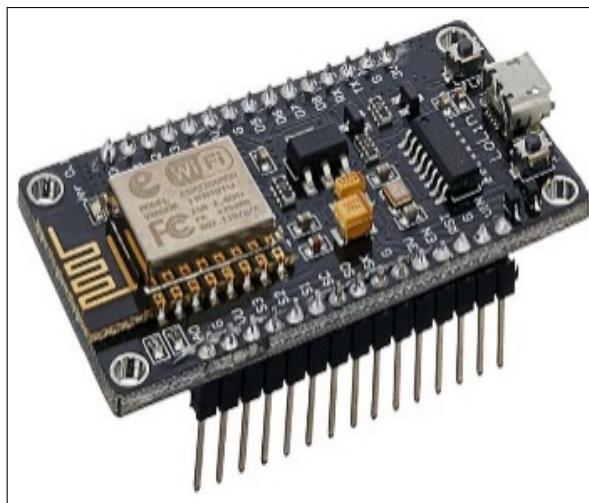


Figure 5.1: NodeMCU ESP8266 wifi module

5.2 OLED Display

The OLED (Organic Light-Emitting Diode) display is an alternative for LCD display. The OLED is super-light, almost paper-thin, flexible, and produce a brighter and crisper picture. SPI is generally faster than 12C but requires more Arduino pins. While 12C requires only

two pins and can be shared with other 12C peripherals. It's a trade-off between pins and communication speed. The choice is up to you. For OLED with 12C interface, there are several types of driver such as SSD1306, SH1106 driver. This tutorial uses SSD1306 128x64 12C OLED Display.



Figure 5.2: OLED Display

5.3 Fingerprint Sensor

The GT521F32 Optical Fingerprint Scanner Module with JST SH Connector is a high-performance fingerprint scanner. Which is useful for to access control, security, identification, and convenience. This optical sensor module is designed for easy integration into applications with serial interface (UART). We need two wires are for TX and RX and two wires for power supply (5V).



Figure 5.3: GT521F32 Optical Fingerprint Scanner Module

5.4 TP4056 Charging Module

This TP4056 1A Li-Ion Battery Charging Board Micro USB with Current Protection is a tiny module, perfect for charging single cell 3.7V 1 Ah or higher lithium-ion (Li-Ion) cells such as 16550s that don't have their own protection circuit. Based on the TP4056 charger IC and DW01 battery protection IC this module will offer 1A charge current then cut off when finished. Furthermore, when the battery voltage drops below 2.4V the protection IC will switch the load off to protect the cell from running at too low of a voltage and also protects against over-voltage and reverse polarity connection however please check you have it connected correctly the first time.



Figure 5.4: TP4056 1A Li-Ion Battery Charging module

Chapter 6

Innovativeness and Usefulness

This application holds a huge scope of future enhancement and modification. Like in voice recognition technique has been used, instead of that we can install a voice announcement system in this project. So whenever you logs in a message like “your attendance has been logged in or card is invalid” will be announced. A Paper Display screen can be installed with the system to display a message same as the voice announcement. Password protection of the website for Global server will be major incorporation to this system. Even person specific web account can be created so that one person can view his attendance records only and not of others’, to increase privacy of the data for Remote servers.

So, in conclusion we have developed a smart attendance system which is Wi-Fi enabled that will help the authorities of private sector or organizations even government sectors to maintain the security and integrity of its vital data like employee attendance, office hours of employees etc., as the data is immediately transferred to a server thus getting saved into a database. The authorities need not to worry about data getting misplaced or misused which will in terms help the organizations to build a better work ethics.

Nothing is perfect in this world. We all are also no exception. Although, I have tried to present system in modern technology with small scale and smart way. Yet, there can be further enhancement by developing mobile app. According to hardware need, we can use GSM modem to send SMS for notice alert. Thingspeak can be used for data analysis. Use of unique identity with biometric technology like iris sensor or fingerprint sensor or image processing improves more authorization for RFID tag misuse. SD card modem for memory

Chapter 7

System Architecture

The initialization and installation of the system is done by Hardware Installation and Software Installation separately.

The hardware connections can be made in a Bread board or in Vero board by connecting the junctions using Jumper cables. The primary hardware components used are ESP8266 or Wi-Fi module and Fingerprint and it is shown in Figure.

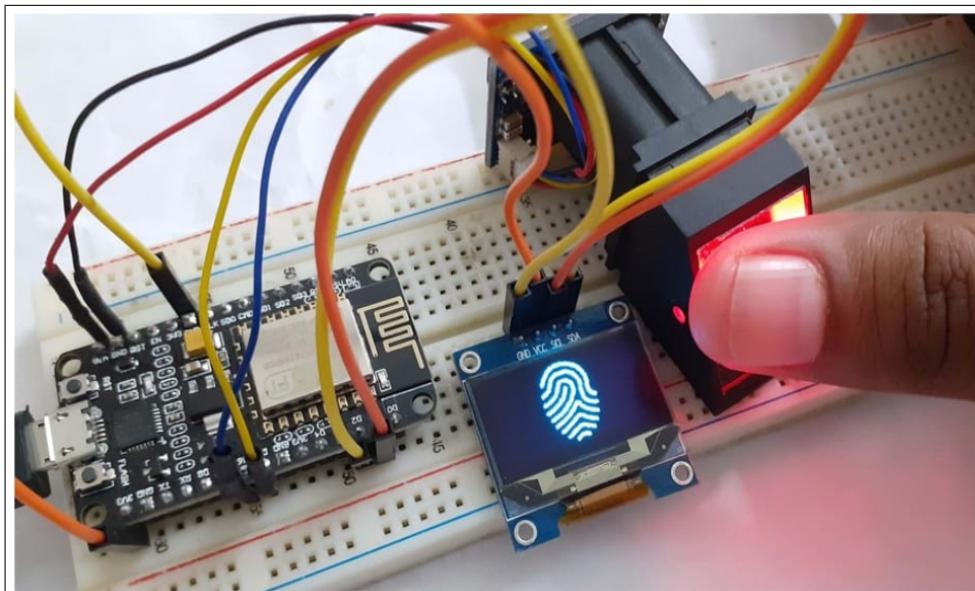


Figure 7.1: Hardware installation

The below circuit diagram shows how an OLED Display Fingerprint Sensor is interfaced with Node MCU ESP8266 12E Board. The I₂C pins of OLED Display, i.e SDA SCL are connected to Node MCU 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 Node MCU.

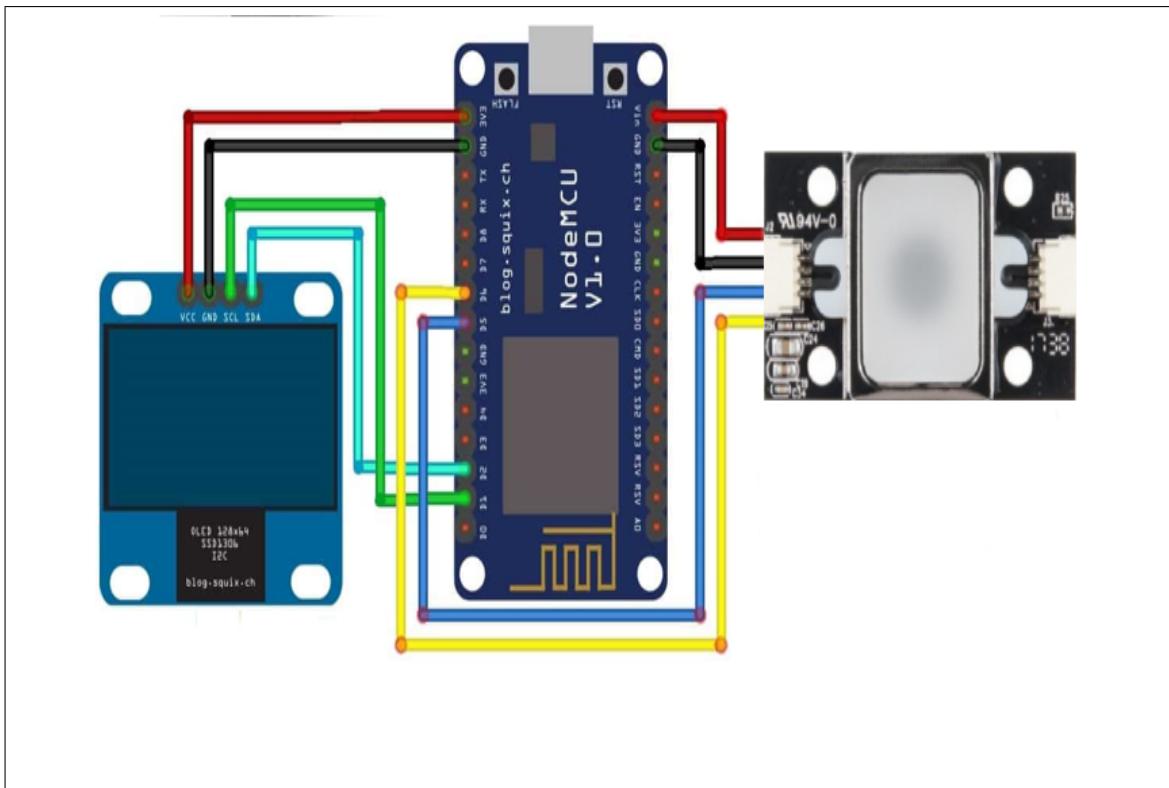


Figure 7.2: Circuit diagram of hardware installation

Chapter 8

Modules Description

For hardware design, NODE MCU module and ESP8266 module are used as the main hardware component in research project. RFID tags used for registration and later on for attendance. ESP8266 Wi-Fi module has Wi-Fi feature for data transfer from RFID tag to the local website in web browser of web server. Internet connection require to establish Node MCU connection via router, phone or any hotspot network in LAN area.

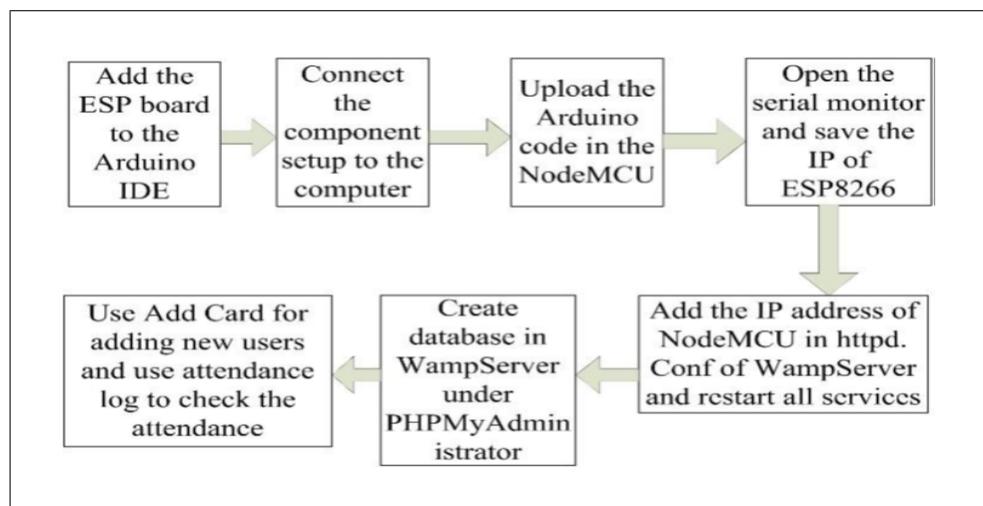


Figure 8.1: Circuit diagram of hardware installation

When the Smart Attendance Kit is activated it will show a welcome message After a while it will seek for a course code number. When the correct code is entered the fingerprint scanner will activated and gets ready for scanning the fingerprints. When enrolled student pressed his/her finger the kit will show a message in the LCD that attendance has been completed. At last when attendance procedure has been completed, the fingerprint scanner is deactivated and data are written to the SD card.

Chapter 9

Literature survey

Author	Title	Source	Description
Li Jian-po, Zhu Xuning(May 2010)	Wireless Fingerprint Attendance System Based on ZigBee Technology	Intelligent Systems and Applications (ISA)	The system includes terminal fingerprint acquisition module and attendance management module in computer.
S. Bhattacharya, G.S. Nainala, P. Das and A. Routray(July 2018)	Smart attendance monitoring system	18th International Conference on Advanced Learning Technologies (ICALT)	FaceRecognition system is used to create a portable device by integrating various components to examine the student's data for attendance.
X. Wei, A Manori, N. Devnath, N. Pasi and V. Kumar (2017)	QR Code Based Smart Attendance System	International Journal of Smart Business and Technology	The professor in charge for handling the attendance process will be given the student QR code.
K. Mohammed, A.S. Tolba and M. Elmogy(2018)	Multimodal student attendance management system (MSAMS)	Ain Shams Engineering Journal	Among the most common applications of RFID in education, there are access control and student classroom attendance management
P. Patil and S.G. Chaudhari (2017)	Online attendance management system using RFID with object contradict	International Journal of Computer Science and Mobile Applications	Online attendance management system using RFID with object contradict

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APPENDIX C

PUBLISHED PAPER - I WITH

CERTIFICATES



SMART SCHOOL ATTENDANCE USING NODE MCU AND FINGERPRINT SENSOR

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Abstract : The combination of Electrical Engineering (EE) and Information Technology (IT) has played a significant roles in developing several aspects in academic and professional sectors such as student or employee monitoring. It is a critical subject to track and to manage employee attendance in work places urging employees to attend on time to increases efficiency of work, so is at schools or colleges for students. Hence, an attendance system can be useful to reduce administrative complexity and cost. The conventional pen-paper based attendance systems is not absolutely flawless. In this paper we have designed an attendance systems using RFID and Wi-Fi Module. Radio frequency Identification (RFID) is an extensive application to yield maximum advantage of this technology with minimal effort for management and attendance monitoring. But it is hard to keep track of every individual only through monitoring. At such times we need an online solution. We have used Node MCU for this purpose. It is a complete and self contained Wi-Fi network solution that can carry software applications as a stand-alone device or connected with a microcontroller.

Keywords--- ESP8266, Ease, Low power consumption, Security, Scalability, etc.

INTRODUCTION -

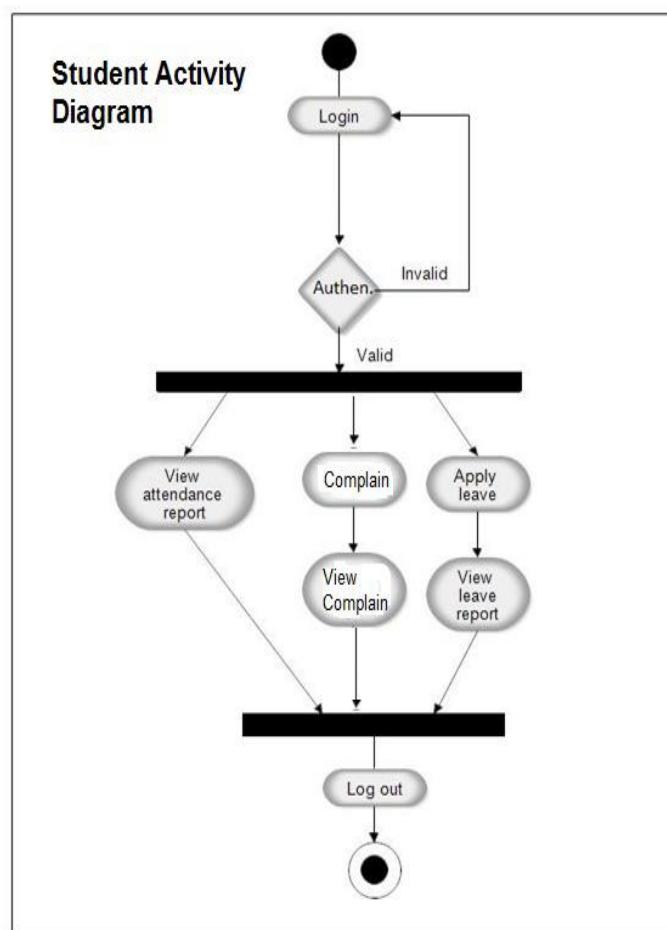
IoT could be a combination of knowledge, web associated items, which is an integral component of the long run Internet. IoT focuses on the automation of processes to cut back human intervention. IoT in schools attendance system methods to form them more efficient and effective. It reduce the pen paper work to get attendance manaully. The use of a Wifi Module is finished during this project which collects the information from different Id and sends it to the most server using wireless protocols. the info that's collected during the enter the class. The data about different environmental factors which is employed to watch the complete process.

Attendance monitoring is an indispensable part of any institute or office. Monitoring of attendance helps increasing quality outcome, be it an educational institute or be it an office. The pen-paper based manual attendance system had too many fallacies. Moreover, it had a possibility of manipulation of the original data. So, we have tried to make an automatic attendance system that would be to some extent free from some of the drawbacks of the pen-paper based attendance system. A database is created in both the cases which contain the employee/student details along with their corresponding RFID card address. Whenever a card is scanned the corresponding attendance is marked and stored in the database. 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.

METHODOLOGY

The initialization and installation of the system is done by Hardware Installation and Software Installation separately. The hardware connections can be made in a Bread board or in Vero board by connecting the junctions using Jumper cables. The primary hardware components used are ESP8266 or Wi-Fi module and Fingerprint. an OLED Display Fingerprint Sensor is interfaced with Node MCU ESP8266 12E Board. The I2C pins of OLED Display, i.e SDA SCL are connected to Node MCU 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 Node MCU.

Fig: Student Activity Diagram



MODULES

- NodeMCU ESP8266 wifi module**

Node MCU is used which is a high speed and accurate Object Connector. It has an onboard optical sensor to capture the image, internal 32-bit processor that process the captured image and make it in a stream of bits and stores it in an on board memory. The memory can save up to 200 different fingerprints. The processor communicates with its master in simple UART protocol.

- OLED Display**

The OLED (Organic Light-Emitting Diode) display is an alternative for LCD display. The OLED is super-lights almost paper-thin, flexible and produce a brighter and crisper picture. SPI is generally faster than 12C but requires more Arduino pins. While 12C requires only two pins and can be shared with other 12C peripherals. It's a trade-off between pins and communication speed. The choice is up to you. For OLED with 12C interface, there are several types of driver such as SSD1306, SH1106 driver. This tutorial uses SSD1306 128x64 12C OLED Display.

- Fingerprint Sensor**

The GT521F32 Optical Fingerprint Scanner Module with JST SH Connector is a high performance fingerprint scanner. Which is useful for to access control, security, identification, and convenience. This optical sensor module is designed for easy integration into applications with serial interface (UART). We need two wires are for TX and RX and two wires for power supply (5V).

- **TP4056 Charging Modular**

This TP4056 1A Li-Ion Battery Charging Board Micro USB with Current Protection is a tiny module, perfect for charging single cell 3.7V 1Ah or higher lithium-ion (Li-Ion) cells such as 16550s that don't have their own protection circuits. Based on the TP4056 charger IC and DW01 battery protections IC this module will offer 1A charge current then cut-off when finished. Furthermore, when the battery voltage drops below 2.4V the protection IC will switch the load off to protect the cell from running at too low of a voltage and also protects against over-voltage and reverse polarity connection (it will usually destroy itself instead of the battery) however please check correctly if you are inserting for the first time ever.

- **Battery**

This is 3.7V 500mAH (Lithium Polymer) Lipo Rechargeable Batteries also known as Lipo or Lipoly batteries are thin, light and powerful. This batteries has a capacity of 500mAH. These Batteries are widely used in GPS, DVD, ipod, Tablet PC, MP4 Players, Power Banks, Mobile Backup Power Supply, Bluetooth Speakers, IOT and other DIY and Industrial applications.

LITERATURE SURVEY

[1] Attendance is a must for students. And without the attendance process, the lecturer or teacher cannot assess the participation of a student. In the process now, attendance is still done manually using paper. First problem is the use of excess paper and the second problem is the difficulty for the administration to recapitulate student attendance results. It is because so many attendance papers must be analyzed by the administration. Therefore a student attendance system is needed that can collect data quickly, efficiently and accurately. The student attendance system is done by conducting data collection, system analysis, system design, and system implementation. This system is created using the HTML, CSS, JavaScript and Java Android programming languages. This work introduces a new paradigm of monitoring student attendance using ESP266 wifi module based on the Internet of Things (IoT). In the Educational institutes are concerned about student irregular attendance. The truancy can affect a student's overall academic performance. In the traditional method of taking attendance by calling names or signing on paper is very time consuming and inefficient. ESP266 wifi module based attendance system using IoT system is one of the solutions to handle the problem. The proposed work comprises of two most popular trend in technology research; IoT and ESP266 wifi module. If we talk about the current scenario of our education system than we found that we have lot of technologies to use but still we are following the traditional system. If we talk about attendance system in universities and schools, lecturers did that work manually. Lecturer took the attendance and updated it manually in the database. If we talk about technology than we have found that there is lot of tools to use and reduce the burden of lectures. Using Node MCU ESP8266 wifi module is the one example of that. We if combine the Node MCU ESP8266 wifi module and IOT (Internet of Things) than we can do it automatically and there is no need to do it by lectures. Here we are planning to use cloud storage for better performance. Using IoT and cloud we can access it from anywhere and anytime which will provide us the better proficiency and flexibility.

[2] Arduino Based Smart Security and Attendance System with Audio Acknowledgement" is developed by Yashi Mishra et al. module with ESP8266 which carry different voice codes is used in this system. If it matches then door will be opened and the attendance will store in excel sheet. Student can view the attendance detail using the OLED placed in Arduino. Here Arduino working as microcontroller to connect OLED, ESP8266 reader, wifi module and so on. Implemented an attendance system with the combination of and Web-Based system. This system uses a Node MCU ESP8266 wifi module and reader for getting students" attendance and read particular student.

CONCLUSION

An automatic attendance management system aims at solving the issues of manual methods of existing systems. This project of Smart attendance system based on ESP8266 wifi module smart ID card and finger print sensor for two factor authentication has been created. The concept of Smart attendance is to implement a system that marks the attendance of a particular person within a range of a classroom in limited time period. We have made the device portable for easy use even when the sessions are on, without disturbing the class. There are future scopes to make a more compact ergonomics to make it a more userfriendly product and to make an impact in building a more healthier academic environment.

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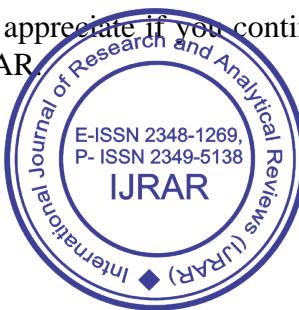
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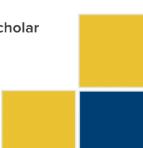


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APPENDIX D

PUBLISHED PAPER - II WITH

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SMART SCHOOL ATTENDANCE USING NODE MCU AND FINGERPRINT SENSOR

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Abstract: The combinations of Electrical Engineering(EE) and Information Technology(IT) is played a significant roles in developing several aspects in academic and professional sectors such as students or employees monitoring. It is a critical subject to track and to manage employees attendance in work places to attend on time to increase efficiency of work. The attendance system can be useful to reduce administrative complexity and cost. The system works by connecting the fingerprint sensor to the NodeMCU microcontroller, which is connected to the school's Wi-Fi network. Students would register their fingerprints in the system, which would store their details in a database. When a student arrives at school, they would place their finger on the sensor, which would scan their fingerprint and send the data to the NodeMCU. The NodeMCU would then compare the fingerprint data with the stored database and mark the student as present. At such times we need an online solution. We have used NodeMCU for this purposes. Overall, the proposed abstract smart school attendance system using NodeMCU and fingerprint sensor has the potential to transform the attendance process in schools and improve the overall efficiency of the school system.

Keywords – ESP8266, Ease, Low power consumption, Security, Scalability, etc.

I. INTRODUCTION

IoT is a combination of knowledge, web associated items, which is an integral component of the long run Internet. IoT focuses on the automation of processes to cut back human intervention. IoT in schools attendance system methods to form them more efficient and effective. It reduce the pen paper work to get attendance manually. The use of a Wifi Module is finished during this project which collects the information from different Id and sends it to the most server using wireless protocols. the info that's collected during the enter the class. The data about different environmental factors which is employed to watch the complete processes. Attendance monitoring is an indispensable part of any institute or office. Monitoring of attendance helps increasing quality outcome, be it an educational institute or be it an office. The pen-paper based manual attendance system had too many fallacies. Moreover, it had a possibility of manipulation of the original data. So, we have tried to make an automatic attendance system that would be to some extent free from some of the drawbacks of the pen-paper based attendance system. A database is created in both the cases which contain the employee/student details along with their corresponding RFID card address. Whenever a card is scanned the corresponding attendance is marked and stored in the database. Fingerprint sensor are module with TTL UART interface for direct connections to microcontroller UART or to PC through MAX232 / USB-Serial adapter.

II. METHODOLOGY

The initialization and installation of the system is done by Hardware Installation and Software Installation separately. The hardware connections can be made in a Bread board or in Vero board by connecting the junctions using Jumper cables. The primary hardware components used are ESP8266 or Wi-Fi module and fingerprint. The OLED display fingerprint sensor is interfaced with NodeMCU ESP8266 12E board. These I2C pins of OLED display the SDA SCL are connected to NodeMCU D2 D1 pins respectively. The fingerprint sensors is connected to UART pins D5 D6. The fingerprint sensors Tx and Rx wire's color may vary. In my case, The colors is yellow and blue where yellow is Tx and Blue is Rx. Its connect by finding appropriate color wires else the module won't be detected by NodeMCU. The development of a smart school attendance system using NodeMCU and fingerprint technology requires careful planning and implementation. The system should be designed to be accurate, reliable, and secure. The system should be tested thoroughly before deployment. The smart attendance system provides a convenient and efficient way of managing attendance in schools.

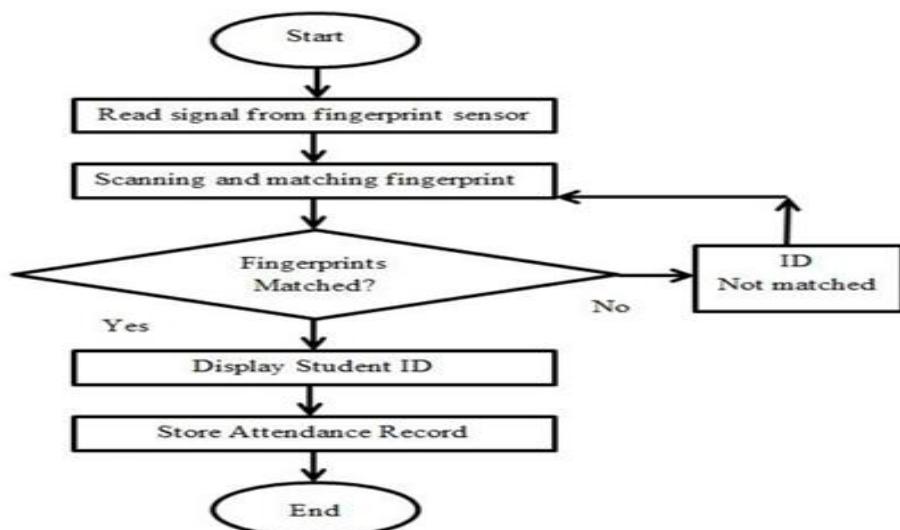


Fig : Working of Fingerprint based Attendance System

III. MODULES

3.1 NODEMCU ESP8266 WIFI MODULE

Node MCU is used which is a high speed and accurate object connector. It has an onboard optical sensor to capture the images, internal 32-bit processor that process the capture image and make it in a stream of bits and stores it in an on board memory. The memory can save up to the 200 different fingerprints. The processor communicates with its master in simple UART protocol.

Fig 3.1 : NodeMCU ESP8266 wifi module

3.2 OLED DISPLAY

The OLED (Organic Light-Emitting Diode) display is an alternative for LCD display. The OLED displays are superlight, almost paperthin, flexible and produce a brighter and crisper picture. SPI is generally faster than 12C but requires more Arduino pins. While 12C requires only two pins and can be shared with other 12C peripherals. It is a trade-off between pins and communication speed. The choice is up to you, for OLED with 12C interface, there are several types of driver such as SSD1306, SH1106 driver.



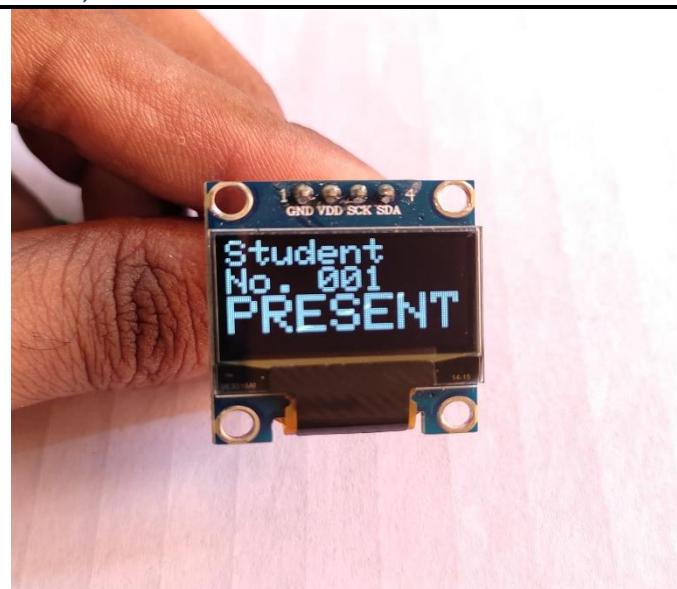


Fig 3.2: OLED Display

3.3 FINGERPRINT SENSOR

The GT521F32 optical fingerprint scanner module are JST SH connector is a high performance fingerprint scanner. Which is useful for the access controls, security, identification, and convenience. This optical sensors module is designed for easy integration into applications with serial interfaces (UART). Fingerprint sensors provide a convenient and secure way to verify someone's identity. Ultrasonic sensors use high-frequency sound waves to capture a 3D images.

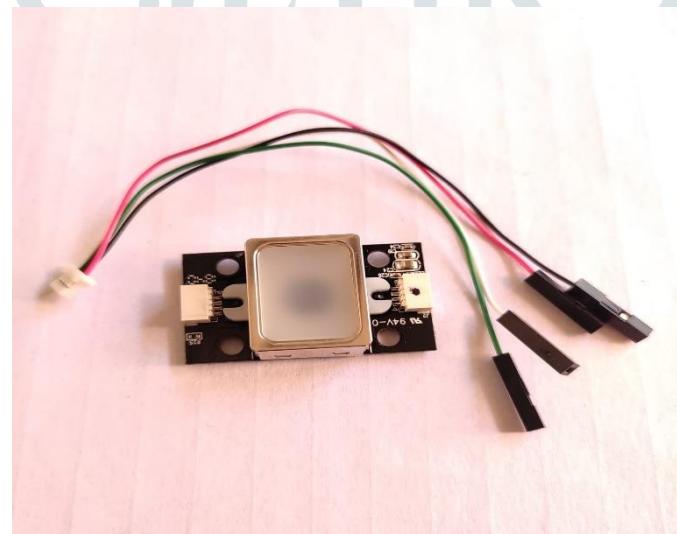


Fig 3.3: Fingerprint Sensor

3.4 TP4056 CHARGING MODULER

This TP4056 1A Li-Ion Battery Charging Board Micro USB with Current Protection is a tiny module, perfect for charging single cell 3.7V 1 Ah or higher lithium-ion cells such as 16550s that don't have their own protection circuit. The TP4056 charger IC and DW01 battery protection IC this module will offer 1A charge current then cut off when finished. When the battery voltage drops below 2.4V the protection IC will switch the load off to protect the cell from running at too low of a voltage.

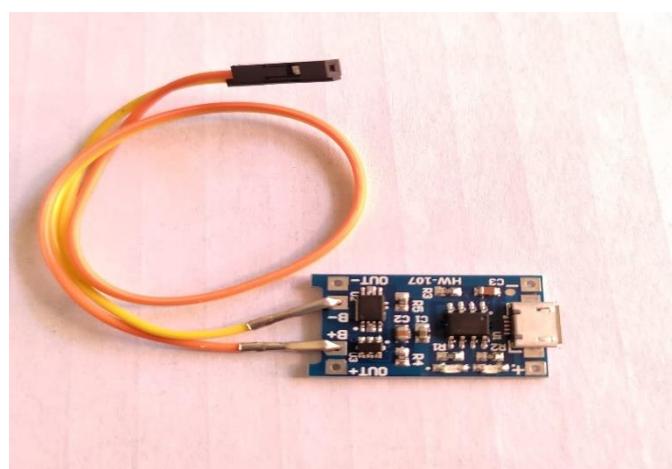


Fig 3.4: TP4056 Charging Moduler

3.5 BATTERY

The 3.7V 500mAH (Lithium Polymer) lipo rechargeable battery also known as lipo or lipoly batteries are thin and light powerful. The batteries has a capacity of 500mAH. The batteries are widely used in GPS, DVD, Ipod, Tablet PC, MP4 Player, Power Bank, Mobile Backup Power Supply, Bluetooth Speaker, IOT and other Industrial applications.



Fig -3.5: Battery

3.6 WEBSITE

At Smart School Attendance, we believe in using technology to streamline processes and improve efficiency, including the design and development of our website. We used the latest web development tools and technologies to create a user-friendly and informative website that provides a comprehensive guide to our Smart School Attendance System. Our website was built using HTML, CSS, and JavaScript to ensure that it is responsive and can be accessed from any device. Our website design incorporates a clean and modern layout, making it easy for users to navigate and find the information they need. Overall, our website was designed and developed with the user experience in mind, providing an informative and intuitive platform for users to learn about our Smart School Attendance System.



IV. LITERATURE SURVEY

[1] Attendance is a must for students in school and colleges. Without the attendance process, the lecturer or teacher cannot access the participation of a student. In the process now, The attendance is still done manually using paper. The students attendance system is done by conducting of data collection, system analysis, system design, and system implementations. This system is created using the HTML, CSS, JavaScript and Java Android programming languages. This work introduces a new paradigm of monitoring student attendance using ESP266 wifi module based on the Internet of Things (IoT).

In the Educational institutes are concerned about student irregular attendance. The truancy can affect a student's overall academic performance. ESP266 wifi module based attendance system using IoT system is one of the solutions to handle the problem. The proposed work comprises of two most popular trend in technology research; IoT and ESP266 wifi module. If we talked about the current scenarios of our education systems. we talk about attendance systems in universitie and school, lecturer did that work manually. If we talk about technology than we have found that there is lot of tools to use and reduce the burden of lectures. Using Node MCU ESP8266 wifi module is the one example of that. We if combine the Node MCU ESP8266 wifi module and IOT (Internet of Things) than we can do it automatically and there is no need to do it by lectures. Here we are planning to use cloud storage for better performance.

[2] Arduino Based Smart Security and Attendance System with Audio Acknowledgement" is developed by Yashi Mishra et al. module with ESP8266 which carry different voice codes is used in this system. If it matches then door will be opened and the attendance will store in excel sheet. Student can view the attendance detail using the OLED placed in Arduino. Here Arduino working as microcontroller to connect OLED, ESP8266 reader, wifi module and so on. Implemented an attendance system with

the combination of and WebBased system. This system uses a Node MCU ESP8266 wifi module and reader for getting students' attendance and read particular student.

V. CONCLUSION

An automatic attendance management system aims at solving the issues of manual methods of existing systems. This project of Smart attendance system based on ESP8266 wifi module smart ID card and finger print sensor for two factor authentication has been created. The concept of Smart attendance is to implement a system that marks the attendance of a particular person within a range of a classroom in limited time period. We have made the device portable for easy use even when the sessions are on, without disturbing the class. There are future scopes to make a more compact ergonomics to make it a more userfriendly product and to make an impact in building a more healthier academic environment.

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Yashraj Eknath Chaudhari
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APPENDIX E

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