

SMART ATTENDANCE USING RFID

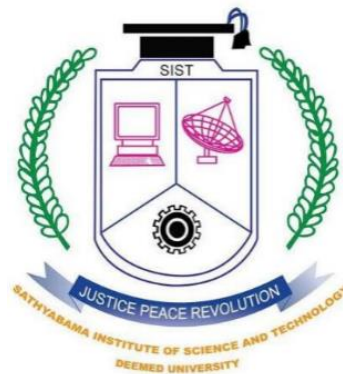
Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in Electrical and Electronics Engineering

BY

AKASH KUMAR. A (39140001)

SANJAY. K (39140048)



**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

SCHOOL OF ELECTRICAL AND ELECTRONICS

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **AKASH KUMAR.A (Reg. No. 39140001)** and **SANJAY.K (Reg. No. 39140048)** who carried out the project entitled "**SMART ATTENDANCE USING RFID**" under our supervision from November 2022 to April 2023.

Internal Guide

Dr. S. NIRMAL RAJ

Head of the Department

Dr. V. SIVACHIDAMBARANATHAN

Submitted for Viva voce Examination held on_____

Internal Examiner

External Examiner

DECLARATION

We **AKASH KUMAR.A (Reg. No. 39140001)** and **SANJAY.K (Reg. No. 39140048)** hereby declare that the Project Report entitled “**SMART ATTENDANCE USING RFID**” done by us under the guidance of **Dr. S. NIRMAL RAJ** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

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DATE:

PLACE:

SIGNATURE OF THE CANDIDATES

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ABSTRACT

Attendance systems are commonly used in schools, colleges and offices etc. Manual attendance method only used in many places. It is quite boring and it takes much time for the staffs and they need to take care of their records for long time. So we have developed a project on IOT based smart attendance system using Fingerprint sensor and using Radio Frequency Identification (RFID). By using RFID card, we can authenticate a person. First we need to Enroll all the information like student ID, class, and finger print details. When student enter to the class room it will read the student information using RFID attached with student id card then it will check the finger print of the student after the verification success it will ask the lunch type (veg/non veg). These information send to parents using SMS/email. It automatically stores the information in a IOT cloud. So the staffs can access these data's at any time. Here we are using web server to store the Students data's. If unauthorized persons touch the sensor, it will not take as a valid ID.

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LIST OF ABBREVIATIONS

GSM	-	Global System for Mobile Communication
IOT	-	Internet of Things
LCD	-	Liquid Crystal Display
RFID	-	Radio Frequency Identification
RIAMS	-	Random Interval Attendance Management System
SAS	-	Smart Attendance System
UIN	-	Unique Identification Number

CHAPTER 1

INTRODUCTION

The concept “Internet of Things” (IoT) has recently attracted growing attention from both academia and industry. IoT is a scenario where devices (even animals or people) are provided with unique identifiers and the ability to automatically transmit data over a network without requiring human-to computer interaction. IoT is a scenario where devices (even animals or people) are provided with unique identifiers and the ability to automatically transmit data over a network without requiring human-to computer interaction. RFID forms an essential block of IoT where RFID devices are wireless microchips used for tagging objects for automated identification. RFID can help to identify and to monitor items (products, people, student, etc.) wirelessly within a specified distance (a few centimeters to hundreds of meters). In this paper, we describe the proposed Smart Attendance System (SAS) using RFID technology. Our framework utilizes RFID tags which allow school/college to monitor the student attendance in and out of the class, upload the data on Google Spreadsheet, send alert to parents using SMS/email and generate a report quickly. When RFID tags pass through the read-range zone of the RFID reader, the system will record data from the RFID tags to the database system which could be a central server at the school. In Addition to schools, SAS is an automatic integrated system used to assist in taking attendance in any organization. SAS provides organization, efficiency, and convenience utilizing the trending technologies of IoT. The ultimate benefits of this system to schools and organizations is to automate the attendance system and save time. It will prevent students from bunking classes through SMS sending feature to parents if they subscribe to the service.

CHAPTER 2

LITRATURE REVIEW

2.1 SURVEY PAPERS

- A.A. Olanipekun et al., (2017) have implemented a system called RFID Based Automatic Attendance systems [3]. This attendance system software has been developed using VB.net and database (Microsoft Access). Each student has RFID tag attached with their Student ID card. There is a serial connection amid computer and RFID reader also has been maintained for connection between RFID and the computer system. The RFID reader is placed at the lecture hall door. Whenever students enter the lecture hall RFID reader read the RFID tag and it store the all information (Entry time, Name, etc.) of students into database via serial connection and maintain the system. Here admin of this system can view all documents using the software interface by retrieving information from database without any difficulties not like traditional system [3].
- Hasanein D.Rjeib et al., (2018) implemented an attendance system with the combination of RFID and Web-Based system. This system uses a RFID tag and reader for getting students' attendance and read particular student. Then this reader connects with Arduino microcontroller which passes the RFID reader response to web server by using Arduino shield, finally the attendance of students can be stored in web server by using PHP and MySQL. The admin of the system can view all students documents by login to this particular web based application and also can view the student's details using LCD displays [4]. Electronic copy available at: <https://ssrn.com/abstract=3372734>

- Srivignesh PSS et al.,(2019) Found a system that, RFID and Pose Invariant Face Verification for automatic attendance system. This system works under two-factor verifications. In the first step, students need to use RFID tag which is read by RFID reader. If the first step is succeeded then it moves to second step of verification, if not, student becomes under unrecognized category. The second step is Face verification, if the face match with particular RFID tag then it marks attendance into database. Missing the above both readings, the system identifies the fraud students. This two-factor automatic system reduces the misuse of identity theft for the purpose of getting attendance [5].
- Moth Myint Thein et al., (2020) Chaw developed a Students' Attendance Management System Based on RFID and Fingerprint Reader. This system also works as two factor verification. In this system RFID reader is connected with computer and computer has specific software to measure automatic attendance of students which is developed by Microsoft Visual studio and a SQL database also maintain in this system. At the initial, every student must register his/her RFID tag and Fingerprints and it is stored in the database. When students enter the class room they need to use RFID tag and this will be reading by RFID reader which checks the database to confirm the tag, if it is correct then next verification starts. In second step fingerprint of the student is verified. If it is matched then attendance will be stored in server. Admin can view, edit and delete the system. Also, teachers have authentication to use this system, they also can act as admin. This is very speed (since the RFID) and secure system (finger print). In case, Tag can be used by others as well but two factor mitigates the issues and attendance stored automatically proper as well as there are fraud free actions [6].
- "Arduino Based Smart RFID Security and Attendance System with Audio Acknowledgement" is developed by Yashi Mishra et al. (2017) SD card module with RFID tag which carry different voice codes is used in this system. The tag ID and code of the voice greeting stored in SD card module. While a student enters the class room door, his / her RFID tag is

being read. If the ID of the tag matched with stored data in the SD card then particular person needs to use the voice greeting, if it is matched then the door will be opened and the attendance will store in excel sheet. Student can view the attendance detail using the LCD placed in Arduino. Here Arduino working as microcontroller to connect LCD, RFID reader, SD card module and so on. This system is also working as two-factor verification process. Moreover, this system is very simple schematics than other system because of very simple components and design. Also here we get fast response with accuracy [7].

- Anil Kumar Shukla (2015) had been created a prototype system called Microcontroller Based Attendance System Using RFID and GSM. This system consists three at Mega16 microcontroller placed in between RFID reader, GSM modem and computer. Each microcontroller has its own purpose. The system starts whenever a teacher used his/her RFID tag to enter the class room and students will enter the class room by swapping their tag within five minutes. RFID reader reads RFID tag and sends the signal to first microcontroller which analyses the signal of RFID reader and opens class room door using IR signal which is influenced by a motor. The signal is temporarily stored in microcontroller, when teacher finishes his / her class he /she must swap the RFID tag again to the reader and system decides automatically that the class is over. Thus, microcontroller passes the temporary stored signal to computer database as attendance. Electronic copy available at: <https://ssrn.com/abstract=3372734> In case of absent of student, the signal passes to GSM modem and it will send the message to parents of the students who were not at the class. If any students go out before teacher use finishing RFID tag which doesn't count the status (present) of the students. This system itself added advanced and reliable security features. Thus students are not able to cheat the administration and parents [8].
- Sandhya Konatham et al. proposed a system that working with RFID and GSM. Here they have used microcontroller (LPC) as an intermediate

amid GSM module and RFID. Whenever students enter the classroom, they need to use their tag which read by RFID reader and it send to the present signal to GSM module. If the ID of the tag does not match with database it considered as unauthorized access. If it is okay then GSM module send message administration and parents. [9].

- Srinidhi MB et al., (2015) proposed a system that web based attendance using four-tier architecture by using RFID and Biometrics. In this system student's and teacher's RFID unique code will store into the database. A RFID reader and fingerprint device are placed at the door of the classroom. When students enter classroom, they need to use the RFID tag which read by reader and verifies identify by comparing with database whether the tag matches or not. Second level verification will be allowed if and only if first level is succeeded. Verification with fingerprint is the second step of the system and if the student's finger print matches with database then the attendance will be marked and stored into database, if not there is no attendance for students. The fingerprint verification only active in span of ten minutes including five minutes before the schedule and after the schedule of class starting time. If anyone late then it denies to provide attendance to particular student but students can stay at the lectures and learn. Finally, SMS will send to the student's parents about inform particular students' presence. This system is time oriented [10].
- H. K. Nguyen et al., (2014) developed a prototype for attendance management system with the placement of a greater number of RFID readers placed in room and there is a server application maintains via a laptop. The reader and laptop or PC connected with the help of wireless router or LAN connection. When a person enters the room, he / she needs to use the RFID tag which reads by RFID reader and passes the attendance to the server through wireless or LAN connection. Since many RFID readers are placed, more than one person can get the attendance simultaneously and get the higher efficiency than traditional method [11]. Also, Muhammad Benny Chaniago and Apri Junaidi suggested a system that working with RFID and Telegram Messenger

Application. In this system students are needed to meet the teachers for tapping of RFID tags. If it is matched with tag stored in the database, then it sends to the attendance to the principal in the form of excel as well as it sends a message to the specific student's parent via Telegram messenger [12].

- S. M. Anzar, (Member, IEEE), N. P. Subheesh, (Member, IEEE), Alavikunhu Panthakkan, (Member, IEEE), shanid malayil, and Hussain Al Ahmad, (Life Member, IEEE) (2021) In this paper, we introduce the 'Random Interval Attendance Management System' (RIAMS), which is an innovative solution for attendance monitoring issues, students' disengagement, and attendance faking during virtual learning. In RIAMS, we employed a face recognition module built using the Dlib open-source software library. In order to improve the efficiency of the system, we introduced two ancillary modalities – verifying students' responses to CAPTCHAs and UIN (Unique Identification Number) queries. Both the face recognition and ancillary modalities operate at random intervals of time. This distinctive feature of randomness in our design ensures that students' attention and engagement in virtual learning are enhanced. Furthermore, the RIAMS' multimodal architecture and its sub-modalities' adaptive weight system enable teachers to customize their attendance strategy for every course. The output analysis of each of the RIAMS modalities and the combined results emphasize the effectiveness and reliability of our system in the attendance management for virtual learning.

CHAPTER 3

EXISTING SYSTEM

3.1 INTRODUCTION

The Random Interval Attendance Management System (RIAMS) is based on a novel and innovative design, the first of its kind, which resolves the unavailability of a proper attendance management system for virtual learning. The experimental results show that the RIAMS device model is highly efficient and scalable. Its modest design allows teachers to precisely monitor and manage students' attendance and generate reports as per the administrative requirements. The automated system reduces wastage of time and manual labour involved in tracking and managing attendance in virtual classrooms. RIAMS is very user-friendly and robust and can be easily integrated with any existing virtual meeting platform. It offers the following innovative and efficient features.

- 1) The proposed design has a robust and efficient AI-DL based face recognition module, customized for virtual learning applications with an added fake-face identification subsystem that monitors only genuine faces in the virtual classroom.
- 2) Integration of ancillary modalities such as CAPTCHA and UIN subsystems to RIAMS further improves its efficiency. Students' responses to the queries provided by these subsystems, along with the timestamps, help teachers in assessing students' attention and engagement in virtual classrooms. Ancillary modalities also help teachers in maintaining the attention span (10-15 minutes) of students, by setting a minimum time interval between each CAPTCHA and/or UIN query.
- 3) Both the face recognition module and ancillary modalities (CAPTCHA and UIN) are designed to operate at random intervals of time. The randomness ensures that students cannot predict at which instant of time the attendance is going to be monitored. This

can effectively reduce dropping out of participants during virtual learning.

- 4) RIAMS's final decision to register the attendance is obtained by a multi-mode fusion of decisions from the face recognition, CAPTCHA, and UIN subsystems. This multi-mode approach enhances the adeptness of the system and reduces discrepancies in attendance.
- 5) RIAMS requires only a nominal bandwidth for internet usage, as the students' video cameras are supposed to be ON only for short periods at random intervals.
- 6) RIAMS has a novel, non-obvious, intelligible, and modest design that can be suitably scaled as per the academic or industrial attendance management requirements. This industrially relevant design can be implemented worldwide for any virtual meeting in post-COVID settings.

3.2 BLOCK DIAGRAM

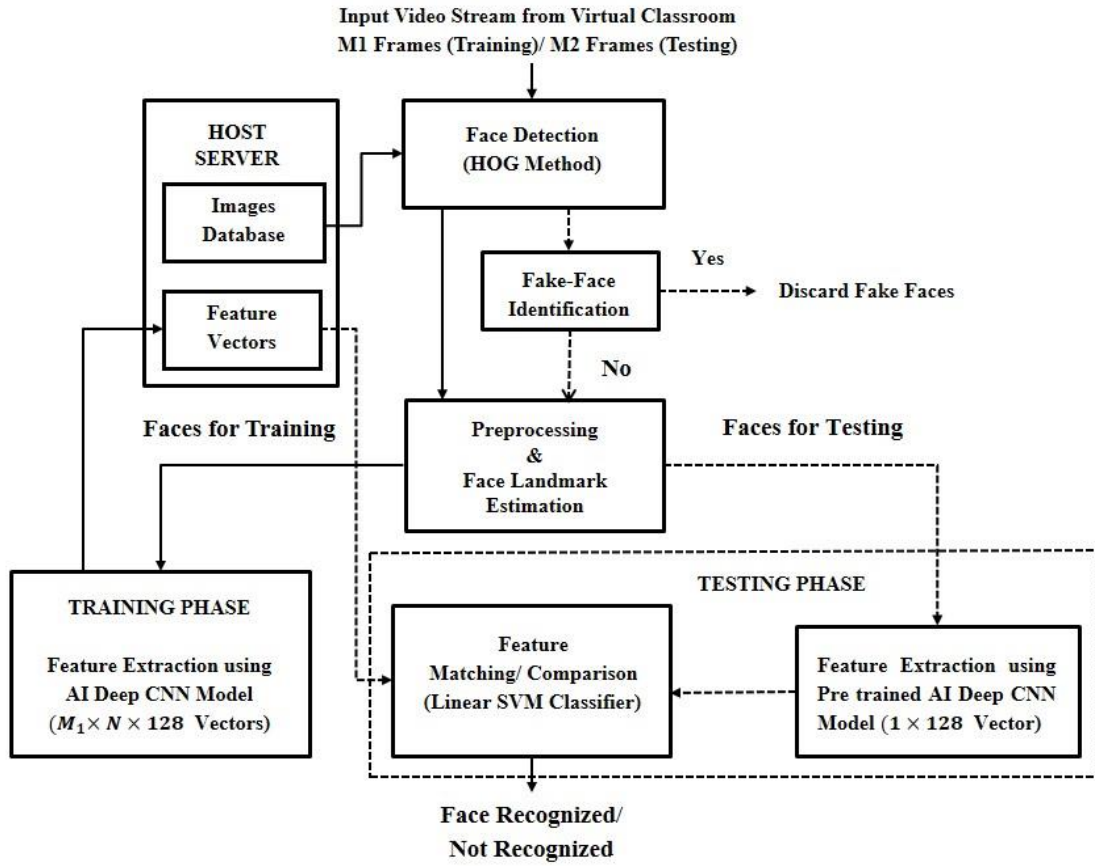


Fig. 3.1: Block diagram of RIAMS's face recognition module

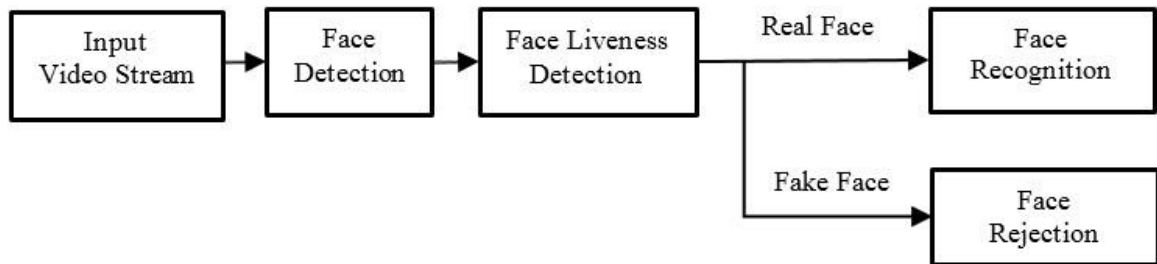


Fig. 3.2: Fake Face Identification

3.3 DISADVANTAGES

This paper attempted to bring an efficient attendance management system within the limitations of a prototype design. We developed the RIAMS as a prototype model and implemented it in a pilot study with ten students only. Extensive testing in large virtual classrooms with more students is yet to be carried out. Moreover, the overall performance of the RIAMS could not be compared with other attendance monitoring systems as its design is unique and novel. There are no similar systems for attendance monitoring in virtual classroom using the random interval technique and ancillary modalities. We used the Dlib open source software library for developing the RIAMS face recognition module as it is highly accurate and efficient. Therefore the accuracy of the RIAMS face recognition module is limited to Dlib's accuracy. In our design, we considered only static weights for face recognition and ancillary modalities. The scalability issues and potential problems that may arise while adding further modalities into the RIAMS design are not considered in this paper, as they fall outside the scope of the present work.

3.4 PROBLEM IDENTIFICATION

- ▶ The old RFID Tag reader is not enough just because it is not accurate and can be easily manipulated.
- ▶ To ensure no-malpractice is done two step verification is done (Fingerprint Recognition).
- ▶ Also to avoid food wastage in our college we have added a system in which Students are able to choose the type of food in the morning.

3.5 IEEE STANDARDS

- **IEEE 802.11(LAN)** - This standard specifies the requirements for wireless LAN (Local Area Network) products, including RFID readers and tags, that can be used for attendance tracking and other applications
- **IEEE 802.15.4(MAC)** - This standard defines the physical and MAC (Media Access Control) layer specifications for low-rate wireless personal area networks (LR-WPANs), which can be used for RFID-based attendance tracking.
- **IEEE 1599.2(LAN,WAN,WSN)** - This standard provides guidelines for the design and implementation of RFID-based attendance tracking systems. It covers various aspects of the system, such as the hardware, software, communication protocols, and security.
- **IEEE 2410(Ethernet based IOT)** - This standard specifies the requirements for RFID-based location tracking systems, which can be used for attendance tracking in large facilities, such as schools, universities, and offices.
- **IEEE 2917.1(EBAN)** - This standard provides guidelines for the deployment of RFID systems in educational institutions, including attendance tracking systems

CHAPTER 4

PROPOSED SYSTEM

4.1 INTRODUCTION

In this proposed system RFID, Finger print sensor, GSM technologies are used. When student enter to the class room it will read the student information using RFID attached with student id card then it will check the finger print of the student after the verification success it will ask the lunch type (veg/non veg).All the information send to the parents through SMS/ Email.

4.2 OBJECTIVES

The objective of the proposed system is as follows

1. To save time and work. This system contains of two step verification with an RFID tag and Fingerprint sensors.
2. To ensure No-Malpractice is done during the process. The first process consists of scanning RFID tag, the second process consists of Fingerprint recognition.
3. To let Know parent's about their Son/Daughter's Academic performances. This can be done using a GSM, Where the parent's get notified via SMS/Mail
4. To avoid food wastage, by asking the student to choose between Veg and Non-veg.

4.3 SCOPE OF THE PROJECT

1. The main scope of the project is to reduce the time taken to take Attendance during the class hours.
2. This gives the teacher more time to focus on class and teach more.
3. This also reduces the chance of malpractice for students to bunk classes during class hours.
4. This project also aims to reduce in wastage of food, by asking students to choose which type of food they need for afternoon.

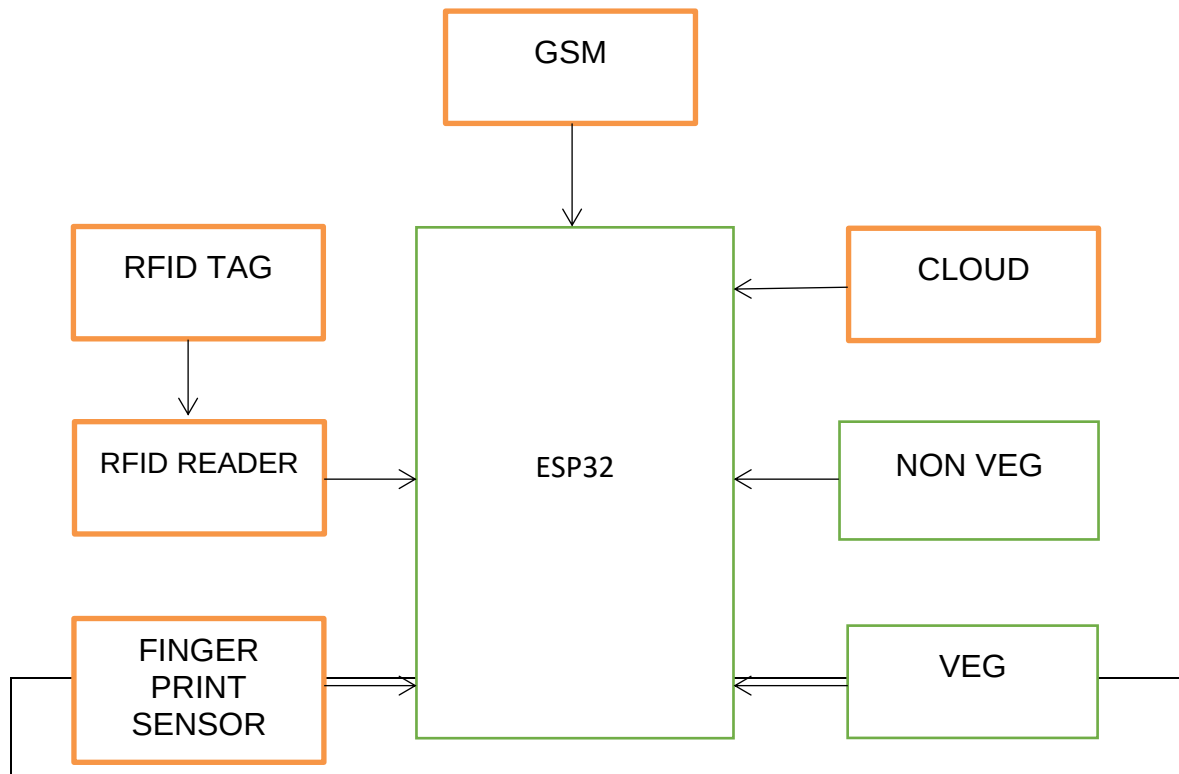
4.4 METHODOLOGY

- ▶ The ESP32 chip acts as the core of the component. This chip contains a total of 48 pins, which serves separate functions.
- ▶ The GSM is connected to the ESP32, This GSM sends Messages using IOT. The data is stored in cloud.
- ▶ The RFID tag is given to the students. The RFID reader Reads and collects data from the RFID tag.
- ▶ A secondary data analysis is done just to ensure no Malpractice is done.
- ▶ After this process student should choose whether he needs Veg or Non-Veg for the lunch. Which is provided by the college.

4.5 APPLICATIONS

The main application of the project is to avoid manual data collection and to use cloud and IOT based data collection to ensure no loss of data. And help in the process of Food Management.

4.6 BLOCK DIAGRAM



Web Server

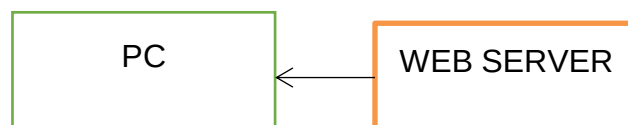


Fig. 4.1: Block Diagram of Proposed System

4.7 ADVANTAGES

Reports

Well, the thing of calculations and generating reports is certainly a frustrating job for many users. With IoT based attendance system, calculating your attendance based revenues and generating reports will be much easier and fun. The amount of time it saves will have a tremendous effect on your employee satisfaction role.

Real time tracking

Mobiles and personal computers have been a great help to the IoT based smart attendance system. The devices can keep a good track of the location of the person checking back on the quality and viability of things around. Also, it can improve safety and quality of life.

Decreased redundancy errors

Since the IoT system senses your presence based on an activity, the chance for human errors and redundant data is reduced. The time and attendance system based on the IoT technology has shown that 99% of data is accurate with minimal human intervention.

4.8 DISADVANTAGES

1. RFID systems are often more expensive than barcode systems
2. RFID technology is harder to understand
3. Can be (debatably) less reliable
4. RFID tags are usually larger than barcode labels
5. Tags are application specific. No one tag fits all
6. Possibility of unauthorized reading of passports and credit cards. More than one tag can respond at the same time

4.9 *Related Work*

Our primary criteria is to review all studies that have used IoT technology to track student attendance in order to determine which technology is the highest quality and most effective. Numerous studies have suggested various strategies and techniques for the intelligent monitoring system.

Recently, educational institutions have been attempting to use new technology that can assist them in accurately recording attendance to improve their attendance system. We mention Radio Frequency Identification (RFID) as one of these technologies. It consists of an RFID tag and an RFID reader and is becoming more and more common in the detection industry. An effective way to monitor schools is via RFID. For example, Shah S. N. et al. [23] developed a smart attendance system utilising RFID tags that would enable schools to monitor student attendance in and out of class and collect student data to make it accessible to instructors and staff at any time and from any location.

Ayu M.A. et al. proposed an attendance system in a university setting using Near-Field Communication (NFC) technology. It is a web-based attendance system that consists of a web server and NFC components, and it is designed to improve the current daily attendance registration and reduce the time spent on recording attendance. Data is sent over a short distance via NFC, which is based on RFID technology.

Microchip and RFID technologies are combined in Bluetooth Low Energy (BLE), a wireless personal area network that offers various benefits. is designed to have a far lower power usage than traditional Bluetooth. Another contemporary technology used in school attendance is BLE. For instance, BLE beacons, a smartphone, and a web service are all used in the smart attendance management system that Zori B. et al. presented. The system's architecture solves the most common problems that come up while monitoring student attendance, like frequent efforts to cheat. We chose RFID technology above the other technologies discussed in this section because of its affordable price and the many advantageous characteristics it offers, as stated in Table.

Table 4.1: Comparison proposed system with existing systems

	NFC	BLE	RFID
Range	-15 cm	-50 cm	-100 cm
Network type	Point to Point	WPAN	Point to Point
Frequency	HF	UHF/HF	LF/UHF/HF
Set-up Time	-0.1S	-9S	-0.1s
Communication	Two-Way	Two-way	One-Way
Power Consumption	Very-Low	Very-low	Varies with Frequency
Cost of Device	Very-Low	High	Low/High

A short-range wireless communication technology known as NFC (Near Field Communication) operates within a range of roughly 15 cm. It is frequently used for data transfer between devices, including smartphones and point-of-sale terminals, and contactless payments. NFC has a high frequency (HF) operation and a quick setup time of typically less than 0.1 seconds. NFC uses extremely little power and allows for two-way communication. NFC-enabled devices are typically quite inexpensive.

A wireless communication technique known as BLE (Bluetooth Low Energy) has an operating range of roughly 50 cm to 100 cm. It is frequently used to link smartphones to wearable gadgets like smartwatches and fitness trackers. BLE setup typically takes nine seconds and can work at either high frequency (HF) or ultra-high frequency (UHF). BLE utilises relatively little power and offers two-way communication. However, BLE-enabled gadgets are typically more expensive than NFC-enabled gadgets.

A wireless communication technology called RFID (Radio Frequency Identification) has a range of roughly 100 cm. It is frequently used to keep track of stock and assets, including automobiles and shipping containers. Depending on the application, RFID can operate at low frequency (LF), high frequency (HF), or ultra-high frequency (UHF). Setup occurs very quickly, usually in less than 0.1 seconds. One-way communication is supported by RFID, thus information can be read from but not written to an RFID tag. Depending on the frequency being used, RFID devices use different amounts of power. Depending on the application, RFID-enabled devices might be expensive or inexpensive.

4.10 HARDWARE KIT OF SMART ATTENDANCE USING RFID TAG

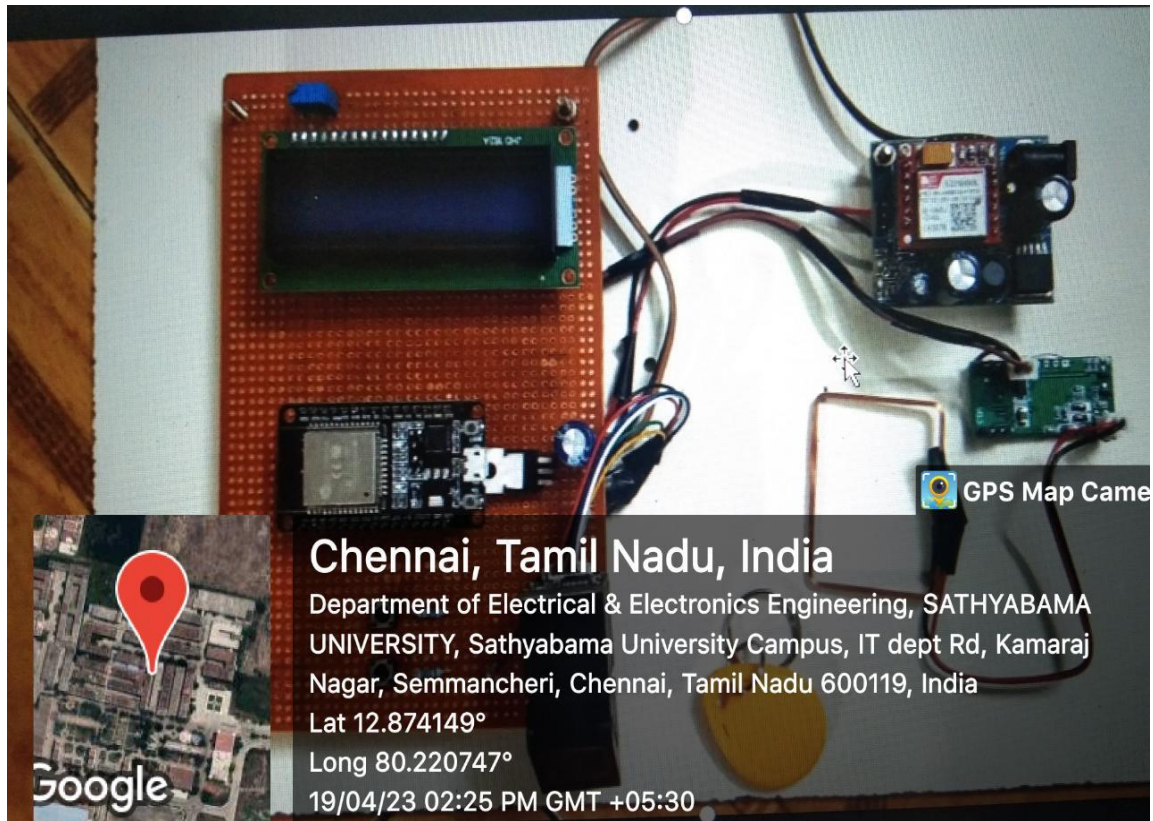


Fig.4.2: Hardware Kit

- IEEE 802.11(LAN)
- IEEE 802.15.4(MAC)
- IEEE 1599.2(LAN, WAN, WSN)
- IEEE 2410(Ethernet based IOT)
- IEEE 2917.1(EBAN)

CHAPTER 5

HARDWARE DETAILS

5.1 HARDWARE REQUIREMENT

5.1.1 ESP 32

The ESP32 chip comes with 48 pins with multiple functions. Not all pins are exposed in all ESP32 development boards, and some pins cannot be used.

There are many questions on how to use the ESP32 GPIOs. What pins should you use? What pins should you avoid using in your projects? This post aims to be a simple and easy-to-follow reference guide for the ESP32 GPIOs.

ESP32 Peripherals

The ESP32 peripherals include:

- 18 Analog-to-Digital Converter (ADC) channels
- 3 SPI interfaces
- 3 UART interfaces
- 2 I2C interfaces
- 16 PWM output channels
- 2 Digital-to-Analog Converters (DAC)
- 2 I2S interfaces
- 10 Capacitive sensing GPIOs

The ADC (analog to digital converter) and DAC (digital to analog converter) features are assigned to specific static pins. However, you can decide which pins are UART, I2C, SPI, PWM, etc – you just need to assign them in the code. This is possible due to the ESP32 chip's multiplexing feature.

Although you can define the pins properties on the software, there are pins assigned by default as shown in the following figure.



Fig. 5.1 : ESP32

The ESP32 chip contains two processing cores that can run at upto 240 MHz each, along with a variety of built-in peripherals such as Wi-Fi , Bluetooth, and Ethernet connectivity, analog to digital converters, digital to analog converters, and many more. It also has a large amount of on-board memory and supports various types of external memory, making it suitable for running complex applications. The ESP32 chip is programmed using the Arduino IDE and it also supports various programming languages such as C, C++ and Python, etc.

Overall, the ESP32 is a powerful and versatile microcontroller chip that is suitable for this type of projects which includes Wi-Fi and Bluetooth connectivity, low power consumption and wide range of built-in external peripherals.

5.1.2 Finger Print Sensor R307

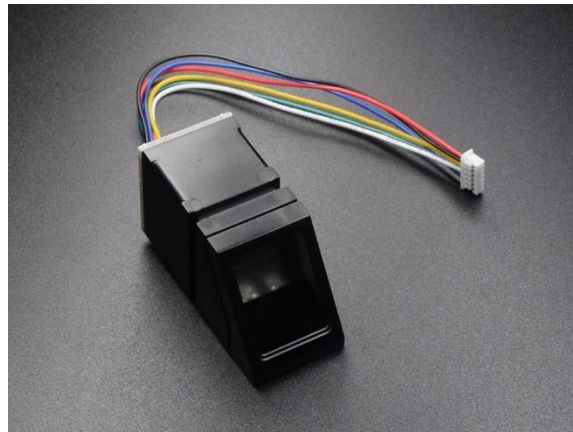


Fig.5.2 : Fingerprint sensor R307

The R307 is a fingerprint sensor module that is commonly used in various applications such as access control systems, time and attendance systems, and security devices. It is a low cost optical sensor and that is capable of capturing and storing up to 1000 fingerprint templates. The module uses a high speed DSP processor and an optical sensor to capture and process fingerprint images.

The R307 fingerprint sensor module supports several communication interfaces such as UART, TTL, and USB, making it easy to integrate into different types of systems. It has a small form factor, measuring only 54*20*22 mm, which makes it suitable for use in compact devices.

The R307 module provides a range of functions such as fingerprint enrollment, fingerprint verification, and fingerprint deletion. It also includes features like automatic finger detection and fake finger detection to prevent unauthorized access.

To use the R307 module, you will need to connect it to a microcontroller or a computer using one of the communication interfaces. The module can be programmed using the provided SDK and sample code, which makes it easy to integrate into various projects. Overall, the R307 fingerprint sensor module is a reliable and cost effective solution for implementing biometric authentication in various application.

5.1.3 LCD

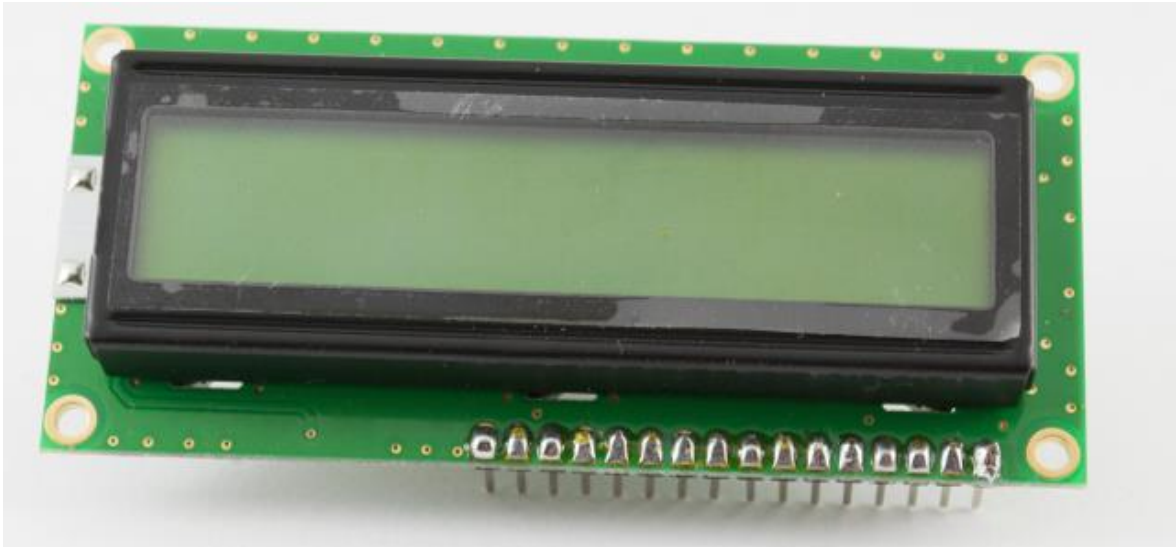


Fig.5.3: LCD display

The HD44780 supports a maximum of two lines of 16 characters each, or one line of 20 characters. It communicates with a microcontroller or other host device through a parallel interface, which typically requires at least six data lines and a few control lines.

The controller provides a set of commands that can be used to control the display, such as clearing the screen, setting the cursor position, and turning on or off the display and cursor. The controller also provides a set of character generation patterns that can be used to define custom characters for the display. The HD44780 is compatible with a wide range of LCD display modules, which can be easily interfaced with most microcontrollers or other embedded systems.

- ***Pin Description***

The most commonly used LCDs found in the market today are 1 line, 2 line or 4 line LCDs which have only 1 controller and support at most of 80 characters, whereas LCDs supporting more than 80 character make use of 2HD44780 controller. Most LCDs with 1 controller has 14 Pins and LCDs with 2 controller has 16 Pins. Pin description is shown in the table below.

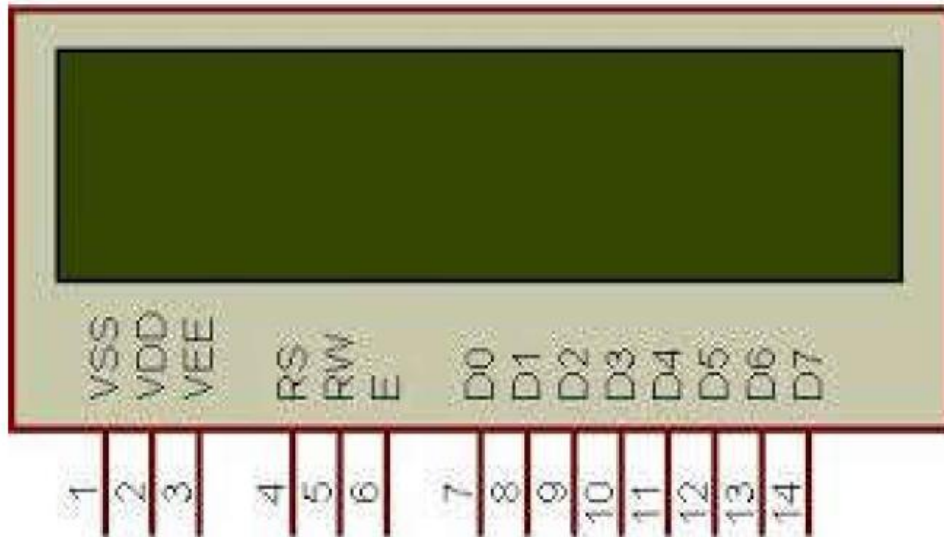


Fig.5.4: LCD display pins

LCD Pin Description

Pin No.	Name	Description
1.	Vss	Ground pin
2.	Vcc	+5v power supply
3.	Vee	Contrast setting
4.	RS(Register select)	RS = 0; Command register is selected RS = 1; Data register is selected
5.	R/W(Read/Write)	R/W = 0; for writing R/W = 1; for reading
6.	E (Enable)	When enable pin goes from high to low the LCD takes command or data

7.	D0	Data pin0
8.	D1	Data pin1
9.	D2	Data pin2
10.	D3	Data pin3
11.	D4	Data pin4
12.	D5	Data pin5
13.	D6	Data pin6
14.	D7	Data pin7
15.	LED+	Backlight +5v
16.	LED-	Backlight Ground

Table 5.1: LCD display pin description table

5.1.4 RADIO FREQUENCY IDENTIFICATION (RFID)

RFID System

An **RFID system** consists of three components: an antenna and transceiver (often combined into one reader) and a transponder (the tag). The antenna uses radio frequency waves to transmit a signal that activates the transponder. When activated, the tag transmits data back to the antenna.

What is RFID?

Radio-Frequency Identification (**RFID**) is the use of radio waves to read and capture information stored on a **tag** attached to an object. A **tag** can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked.

RFID = Radio Frequency Identification. An ADC (Automated Data Collection) technology that uses radiofrequency waves to transfer data between a reader and a movable item to identify, categorize, track. Is fast and does not require physical sight or contact between reader/scanner and the tagged item. Performs the operation using low cost components. Attempts to provide unique identification and backend integration that allows for wide range of applications.



Fig.5.5 : RFID tag

Tags can be attached to almost anything

- Items, cases or pallets of products, high value goods
- vehicles, assets, livestock or personnel

Passive Tags

- Do not require power
- Draws from Interrogator Field
- Lower storage capacities (few bits to 1 KB)
- Shorter read ranges (4 inches to 15 feet)
- Usually Write Once Read Many/Read Only tags

Active Tags

- Battery powered
- Higher storage capacities (512 KB)
- Longer read range (300 feet)
- Typically can be rewritten by RF Interrogators

RFID Reader

A radio frequency identification **reader (RFID reader)** is a device used to gather information from an **RFID** tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a **reader**.

Reader Functions

- Remotely power tags
- Establish a bidirectional data link
- Inventory tags, filter results
- Communicate with networked server(s)
- Can read 100300 tags per second

Frequency Ranges

- Low frequency, or LF, (125 – 134 kHz)
- High frequency, or HF, (13.56 MHz)
- Ultra-high frequency, or UHF, (433, and 860-960 MHz)

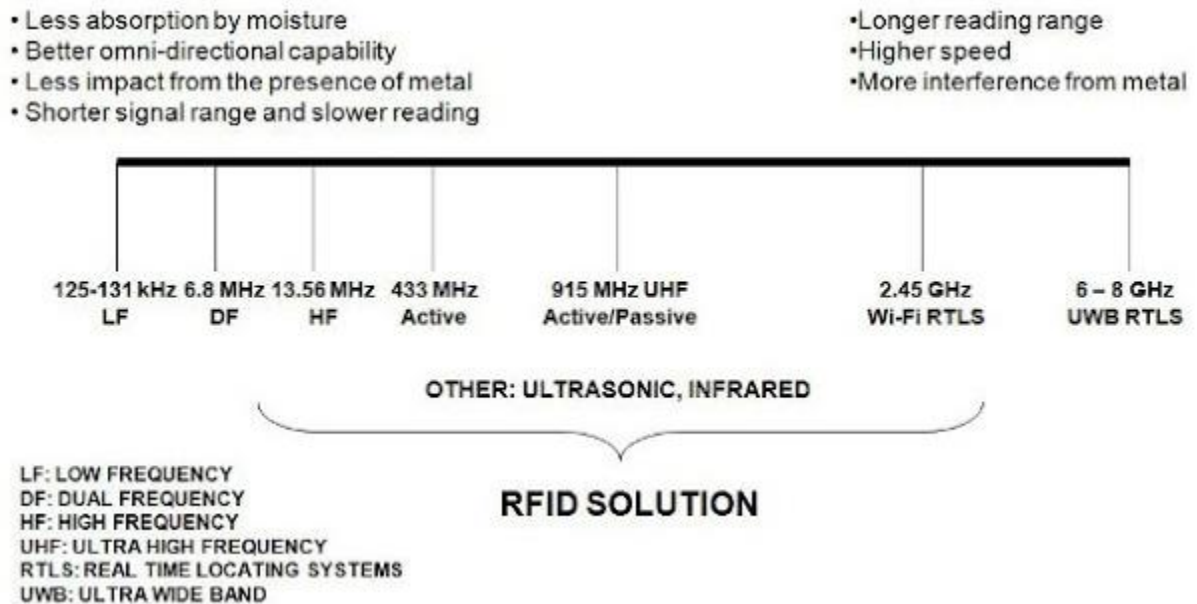


Fig. 5.6 : RFID in the Electromagnetic Spectrum

Radio waves behave differently at the various frequencies, so it is imperative to select the right frequency for your application.

For example, low-frequency tags have a long wave-length and are better able to penetrate thin metallic substances. Additionally, LF RFID systems are ideal for reading objects with high-water content, such as fruit or beverages, but the read range is limited to centi-meters or inches. Typical LF RFID applications include access control and animal tagging.

High-frequency tags work fairly well on objects made of metal and can work around goods with medium to high water content. Typically, HF RFID systems work in ranges of inches, but they can have a maximum read range of about three feet (1 meter). Typical HF RFID applications include tracking library books, patient flow tracking, and transit tickets.

UHF frequencies typically offer much better read range (inches to 50+ ft. depending on the RFID system setup) and can transfer data faster (i.e. read many more tags per second) than low- and high-frequencies. However, because UHF radio waves have a shorter wavelength, their signal is more likely to be attenuated (or weakened) and they cannot pass through metal or water. Due to their high data transfer rate, UHF RFID are well suited for many items at once, such as boxes of goods as they pass through a dock door into a warehouse or racers as they cross a finish line. Also, due to the longer read range, other common UHF RFID applications include electronic toll collection and parking access control.

RFID APPLICATIONS

Manufacturing and Processing

- Inventory and production process monitoring
- Warehouse order fulfillment

Supply Chain Management

- Inventory tracking systems
- Logistics management

Retail

- Inventory control and customer insight
- Auto checkout with reverse logistics

Security

- Access control
- Counterfeiting and Theft control/prevention

Location Tracking

- Traffic movement control and parking management
- Wildlife/Livestock monitoring and tracking

5.1.5 GSM

SIM800L GSM/GPRS module



Fig. 5.7: SIM800L GSM/GPRS module

At the heart of the module is a SIM800L GSM cellular chip from Simcom. The chip's operating voltage ranges from 3.4V to 4.4V, making it an ideal candidate for direct LiPo battery supply. This makes it a good option for embedding in projects that are short of space.

All the necessary data pins of the SIM800L GSM chip are broken out to a 0.1" pitch headers, including the pins required for communication with the microcontroller over the UART. The module supports baud rate from 1200bps to 115200bps with auto-baud detection.

An external antenna is needed for the module to be connected to the network. The module usually comes with a helical antenna that can be soldered onto the module. The board also features a U.FL connector in case you want to keep the antenna away from the board.

There's a SIM socket on the back! Any 2G Micro SIM card will work perfectly. The correct direction to insert the SIM card is usually engraved on the surface of the SIM socket.

Features

This module measures only 1 inch², but packs a surprising amount of features into its tiny frame. Some of them are listed below:

- Supports Quad-band: GSM850, EGSM900, DCS1800 and PCS1900
- Connect onto any global GSM network with any 2G SIM
- Make and receive voice calls using an external 8Ω speaker & electret microphone
- Send and receive SMS messages
- Send and receive GPRS data (TCP/IP, HTTP, etc.)
- Scan and receive FM radio broadcasts

5.2 SOFTWARE REQUIREMENT

5.2.1 Embedded C

Embedded C is a set of language extension for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements(if, switch, case), loops(while, for), functions, arrays and strings, structures and union, bit operations, macros, etc.

During infancy years of microprocessor based systems, programs were developed using assemblers and fused into the EPROMs. There used to be no mechanism to find what the program was doing. LEDs, switches, etc. were used to check for correct execution of the program .But they were too costly and were not quite reliable as well .As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers

CHAPTER 6

CONCLUSION

In conclusion, adopting a smart attendance system based on RFID tag technology has a number of benefits over conventional attendance systems. It offers a quick, precise, and effective approach to track attendance, does away with manual data entry, lowers the risk of fraud, and enables real-time attendance monitoring. However, for the system to operate well, adequate deployment and upkeep are crucial. The use of RFID-based attendance systems is projected to increase in the future due to the growing acceptance of technology across a variety of industries. While both old RFID system and the new RFID system have their advantages and Disadvantages, the new system typically offers more advanced technology, higher security, greater convenience and improved scalability and data analysis capabilities.

CHAPTER 7

SUMMARY

The project aims to develop a smart attendance system using RFID technology. The system will be designed to track the attendance of students in a classroom environment. RFID tags are used to identify each student and record their attendance. The system will also be able to generate SMS and alert the parents if students are absent. The system will be designed to be user-friendly and cost-effective. The project will involve the development of the hardware and software components of the system. The Hardware part includes a ESP32 pin, gsm, RFID reader, RFID tag, Fingerprint recognition, options to choose between Veg and Non-veg. The first process is to use the provided RFID tag which contains every information about the user. The arrival time, Date, Name of the user, Reg.no., department, Type of food are noted in a google sheet or the cloud storage. At first the user needs to scan his RFID tag then he should verify using the fingerprint recognition for secondary verification. The next step would be choosing the type of food he needs for lunch. All interactions are done using a LCD display which is simple and friendly to use.

The proposed system includes a double verification system with fingerprint recognition, which provides enhanced security compared to the existing system that only has a single verification system. Additionally, the proposed system uses RFID tags with greater accuracy and range, which can be read at a rate of up to 200 tags per second, compared to the RFID tags used in the existing system that have lesser range and accuracy.

In terms of convenience, the proposed system offers the advantage of using the RFID tags as a keychain, making them easy to carry, while the RFID cards used in the existing system are larger in size and tough to carry. Moreover, the proposed system requires minimal hardware tools as it uses Bluetooth and wi-fi, while the existing system requires additional hardware parts like antennas.

The proposed system also offers the advantage of acquiring additional data like arrival time, type of food, and departure time, which can be used for data analysis purposes. In contrast, the data collected by the existing system is much lesser. Lastly, the proposed system offers more scalability compared to the existing system, which is a large process to change.

Overall, the proposed system appears to be an upgraded version of the existing system, which offers several advantages in terms of technology, authentication, convenience, integration, data analysis, and scalability.

While both old RFID system and the new RFID system have their advantages and Disadvantages, the new system typically offers more advanced technology, higher security, greater convenience and improved scalability and data analysis capabilities.

REFERENCES

- [1] Arulogun, O.T., Olatunbosun, A., Fakolujo, O.A. and Olaniyi, O.M., IJSER, Vol. 4, No. 2, 2013, pp. 1–9.
- [2] Chiagozie, O.G. and Nwaji, O.G., Academic Research International, Vol. 2, No. 2, 2012, pp. 168–183.
- [3] Ding, K., Jiang, P., IEEE/CAA Journal of Automatica Sinica, Vol. 5, No. 1, 2017, pp. 128–138.
- [4] Irawan, J.D., Prasetio, S. and Wibowo, S.A., “IP based module for building automation system”, In: Proceedings of Second International Conference on Electrical Systems, Technology and Information 2015 (ICESTI 2015). F. Pasila, Y. Tanoto, R. Lim, M. Santoso, N. Pah (Eds), Singapore: Springer (2016). pp. 337–343.
- [5] Nainan, S., Parekh, R. and Shah, T., IJCSI, Vol. 10, 2013, p. 1.
- [6] Nguyen, H.M., Kim, S.H., Le, D.T., Heo, S., Im, J. and Kim, D., “Optimizations for RFID-based IoT applications on the Cloud”, 5th International Conference on the Internet of Things, Seoul, South Korea, 2015.
- [7] Saparkhojayev, N., and Guvercin, S., IJCSI, Vol. 9, No. 3, 2012, pp. 227–230.
- [8] Sharma, T. and Aarthy, S.L., “An automatic attendance monitoring system using RFID and IOT using Cloud”, Online International Conference on Green Engineering and Technologies (IC-GET), Coimbatore, India, 2016.
- [9] Singh, A., Meshram, S., Gujar, T. and Wankhede, P.R., “Baggage tracing and handlingsystem using RFID and IoT for airports”, International Conference on Computing, Analytics and Security Trends (CAST), Pune, India, 2016.
- [10] Singhal, Z. and Gujral, R.K. International Journal of Computer Applications, Vol. 39, No. 3, 2012, pp. 37–41.