CHAPTER 1

INTRODUCTION

In contemporary educational and professional environments, efficient and accurate attendance management is crucial for operational success and accountability. Traditional methods, such as manual roll calls or sign-in sheets, are not only time-consuming but also prone to errors and manipulation. To address these challenges, technological advancements offer innovative solutions, among which Radio Frequency Identification (RFID) stands out as a promising approach. This report introduces an RFID-based Attendance Management System developed using the ESP8266 Wi-Fi module, with data collection and management facilitated through the ThingSpeak platform. The system aims to streamline the process of recording and managing attendance by automating data capture and transmission, thus reducing manual intervention and the potential for inaccuracies. RFID technology employs electromagnetic fields to automatically identify and track tags attached to objects. In the context of attendance management, each individual is provided with an RFID card containing a unique identifier. When the card is scanned by an RFID reader, the information is transmitted to the ESP8266 microcontroller. The ESP8266, renowned for its low cost and robust Wi-Fi capabilities, processes the scanned data and communicates with ThingSpeak to log attendance records in real-time. ThingSpeak is an IoT analytics platform that enables the collection, visualization, and analysis of live data streams in the cloud. The integration of ThingSpeak with the ESP8266 enhances the system's connectivity, allowing for real-time data synchronization and remote monitoring. This connectivity is pivotal in creating a seamless and efficient attendance management system that can be accessed and managed from anywhere with an internet connection.

CHAPTER 2
PROPOSED SYSTEM

2.1 BLOCK DIAGRAM

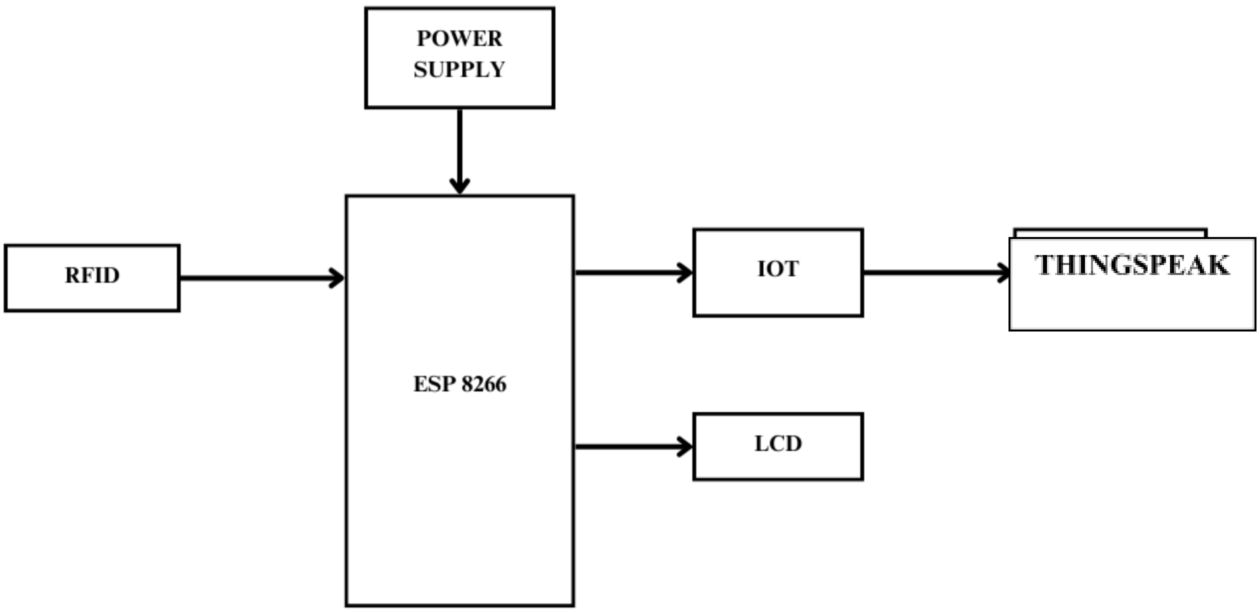


Figure 2.1 BLOCK DIAGRAM

The diagram above shows that the current process is done using RFID technology, in this program, each student has an RFID tag for attendance, the student places the RFID tag next to the RFID reader and the ID result from the RFID reader will be sent to the microcontroller and compare with the student's data stored in the memory, the memory stores the student name data, if the student ID, student name is displayed on the LCD, and if the unlisted student data is notified on the LCD, the unregistered student using the Wi-Fi module microcontroller can send the student attendance data to the cloud via the Internet, the data already installed in the cloud can be viewed in real-time by a teacher, student, and even a parent, so student attendance is monitored anywhere in real-time using the Internet of Things (IoT).

CHAPTER 3
COMPONENTS

3.1 NodeMCU ESP8266

The NodeMCU ESP8266 integrates various functionalities, including GPIO, PWM, I2C, 1-Wire, and ADC, into a single board. The NodeMCU features firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and its hardware is based on the ESP-12 module. Key features of the NodeMCU ESP8266 include 802.11 b/g/n Wi-Fi connectivity, multiple GPIO pins for interfacing with sensors and peripherals, PWM for controlling devices like LEDs and motors, and an ADC for reading analog sensors. It supports communication protocols such as I2C, SPI, and UART.

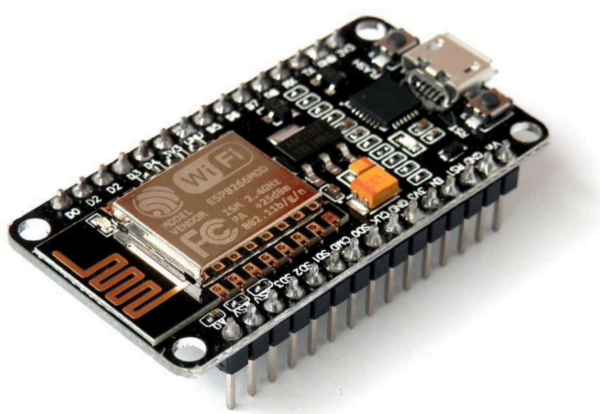


Figure 3.1 NodeMCU ESP8266

3.2 RFID READER MODULE

The RFID reader module is a crucial component for identifying and tracking tags attached to objects, operating typically at frequencies of 125 kHz or 13.56 MHz. It features a read range from a few centimeters to several meters and supports communication protocols like UART, SPI, and I2C for interfacing with microcontrollers such as the NodeMCU ESP8266. The module's ability to wirelessly read data from RFID tags makes it indispensable in security, inventory management, and various automated systems.

Figure 3.2 RFID reader module

3.3 RFID CARD

An RFID (Radio Frequency Identification) card is a contactless smart card that contains an embedded RFID chip and antenna, designed to wirelessly transmit data to an RFID reader. Operating typically at frequencies such as 125 kHz or 13.56 MHz. When an RFID card is brought near an RFID reader, the reader's electromagnetic field activates the card, allowing it to transmit its stored data.

Figure 3.3 RFID card

3.4 16x2 LCD

An electronic display module named LCD screen uses liquid crystal producing the dot and further that turned into an image. The 16*2 LCD is a very basic module commonly used in DIYs and circuits. The 16*2 translates the display of 16 characters per line in 2 such lines. There is a 5*7-pixel matrix in each character of LCD. There are two registers in 16*2 LCD, namely, command and data. To switch from one register to another register select is used. Command register RS = 0, whereas Data register RS=1.

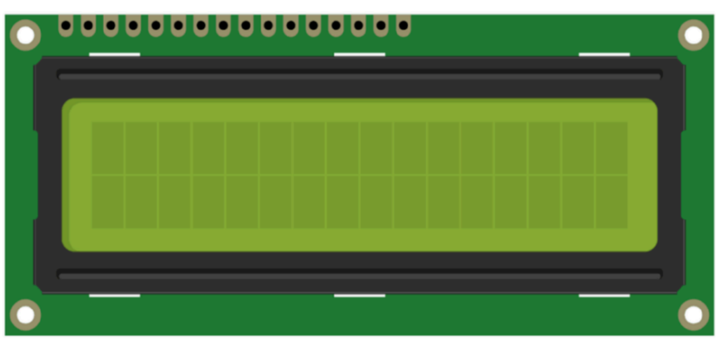


Figure 3.4 16x2 LCD

3.5 PCF8574

The PCF8574 is a popular integrated circuit commonly used as an I/O expander for microcontroller-based systems. Manufactured by Texas Instruments, this IC allows users to expand the number of digital input/output pins available to a microcontroller via the I2C serial communication protocol. With 8-bit parallel input/output ports, the PCF8574 simplifies interfacing between microcontrollers and peripheral devices such as sensors, switches, and LEDs, enabling more efficient and flexible circuit designs. Its simplicity, low cost, and ease of use make it a versatile choice for various embedded systems applications, from robotics to home automation.

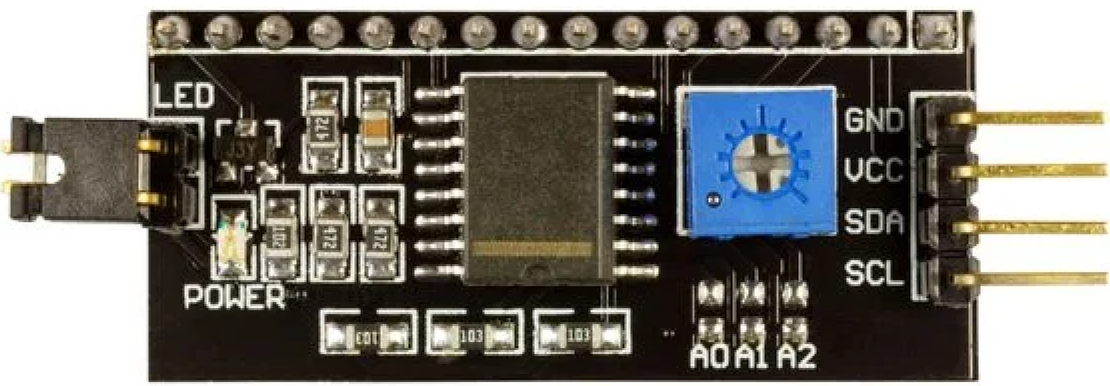


Figure 3.5 PCF8574

3.6 L7805

The L7805 is a widely used linear voltage regulator integrated circuit numproduced by various manufacturers, including STMicroelectronics. Operating as a fixed 3-terminal device, the L7805 is designed to provide a stable, regulated output voltage of 5 volts from an unregulated input voltage source. With a maximum input voltage of typically around 35 volts, the L7805 is capable of supplying up to 1 ampere of current, making it suitable for a variety of low to medium power applications.

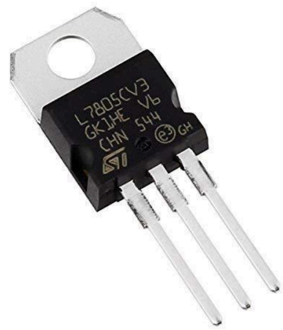


Figure 3.6 L7805

CHAPTER 4

DESIGN AND IMPLEMENTATION

The complete hardware only contains Node MCU ESP8266 SOC main controller, RFID reader module, 16*2 LCD, and PCF8574. All are powered through a 5v power supply. and ESP8266 is the main control unit RFID reader module reads the card and sends the data to ESP8266. ESP8266 send the data to the cloud and the data is display in Blynk application and that data is stored in ThingSpeak. The NodeMCU controls the LCD display through the PCF8574 I/O expander, which is connected via the I2C bus. The PCF8574 expands the limited I/O pins of the NodeMCU, allowing it to interface with the LCD's parallel data lines. The LCD displays information sent from the NodeMCU. The RFID module communicates with the NodeMCU to read RFID tags.

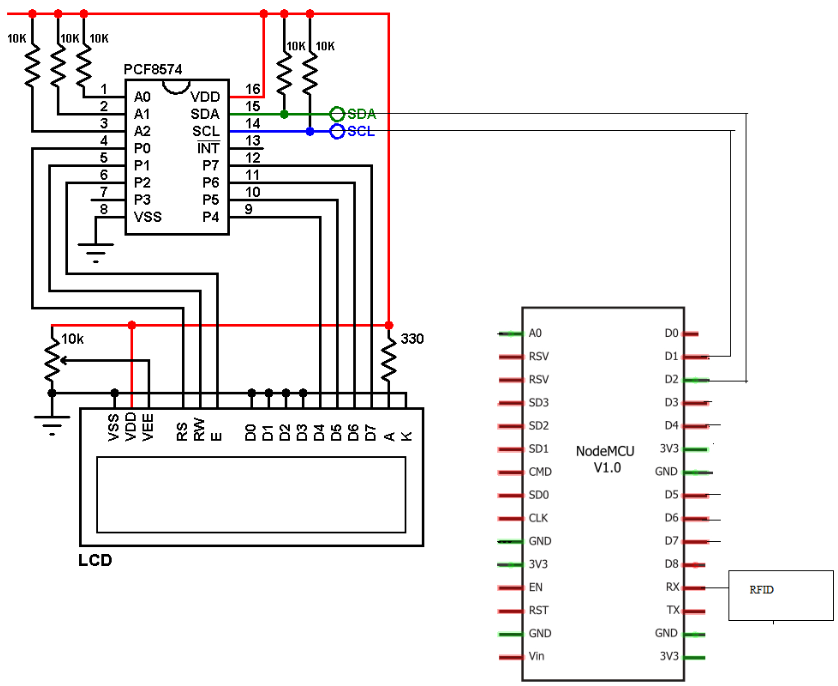


Figure 4.1 CIRCUIT DIAGRAM

CHAPTER 5

SIMULATION AND RESULT

The virtual hardware components, including the ESP8266 NodeMCU and RFID reader, were configured within the simulation environment. The firmware for the ESP8266 NodeMCU was developed to interface with the RFID reader, capture RFID tag data, and transmit it to the ThingSpeak platform. The firmware was tested within the simulation environment to ensure proper communication between the ESP8266 NodeMCU and the RFID reader. Simulated data transmission from the virtual hardware to the ThingSpeak platform to verify the system's ability to log attendance records in real-time.

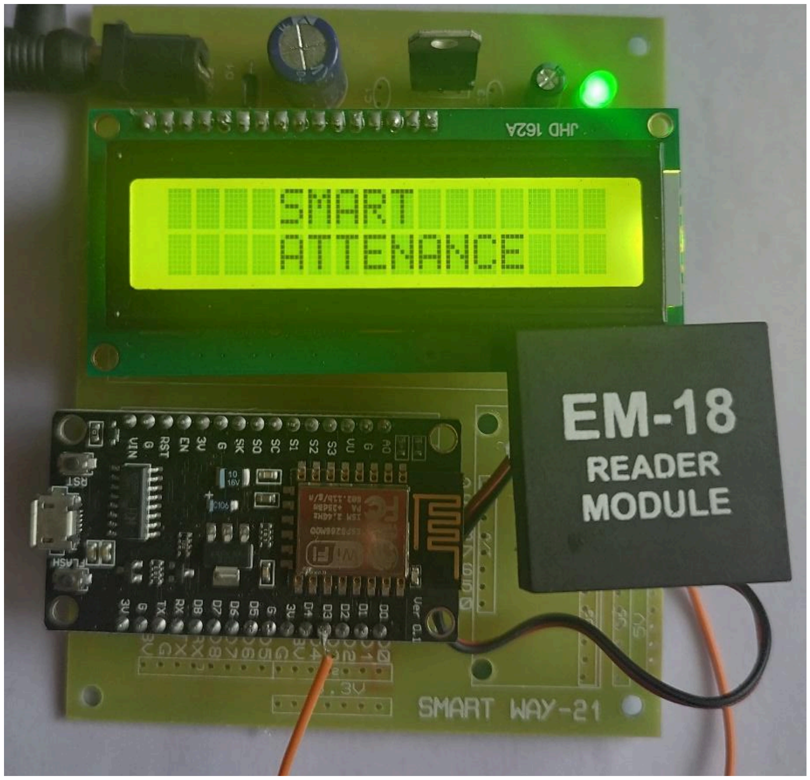


Figure 5.1 WORKING IMAGE

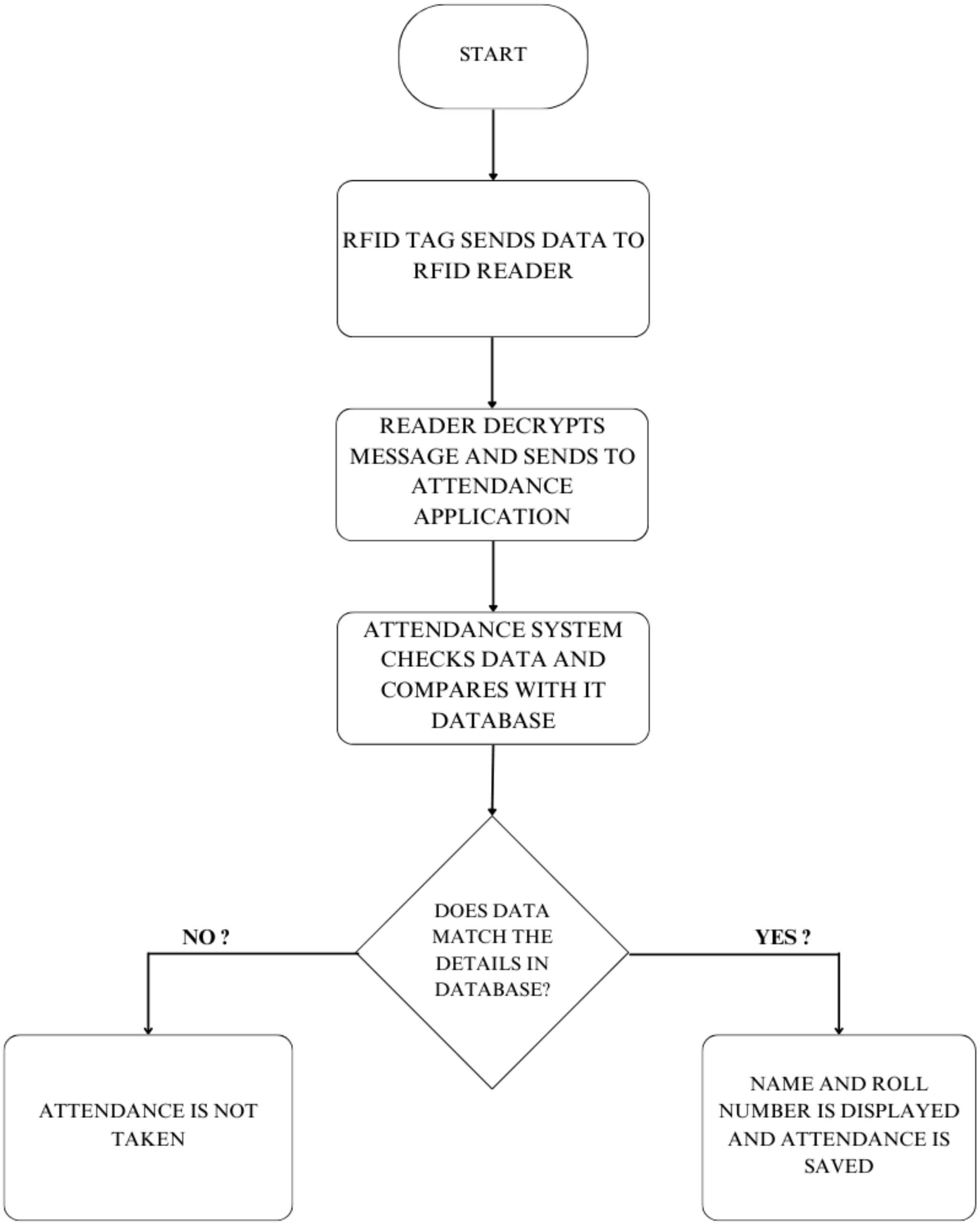
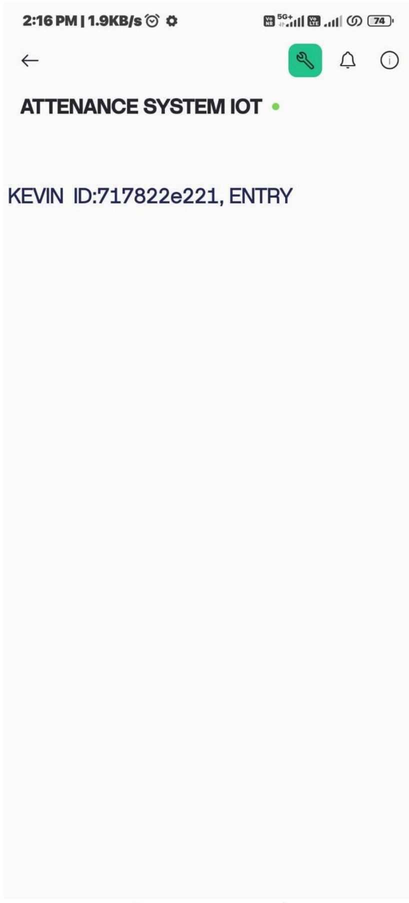
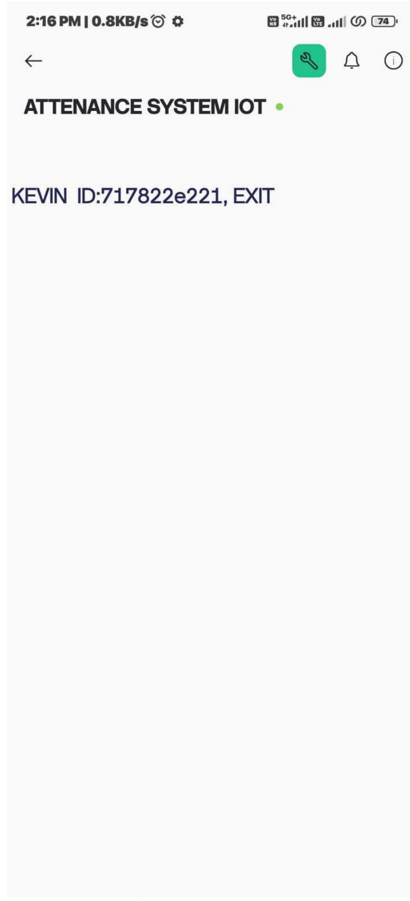


Figure 5.2 WORKING FLOW


2:16 PM | 1.9KB/s
ATTENANCE SYSTEM IOT
KEVIN ID:717822e221, ENTRY

2:16 PM | 0.8KB/s
ATTENANCE SYSTEM IOT
KEVIN ID:717822e221, EXIT

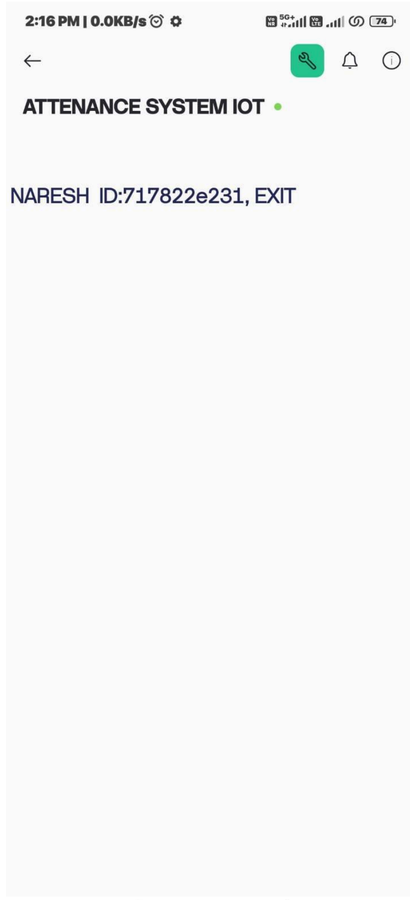


Figure 5.3 BNYNK APP DASHBOARD

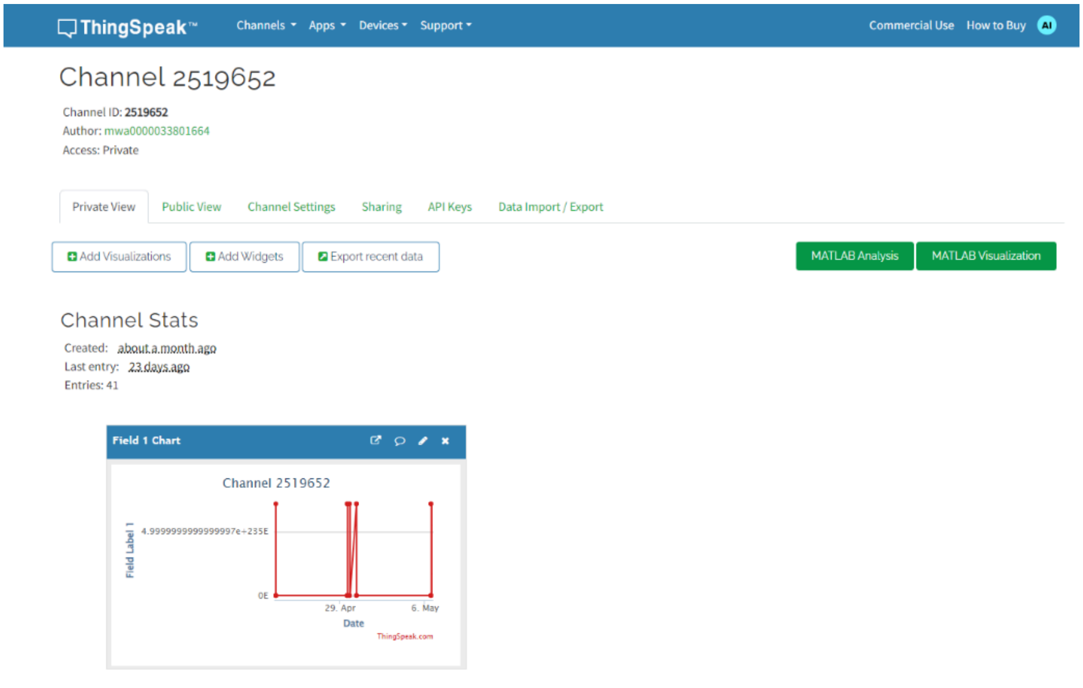


Figure 5.4 THINGSPEAK DASHBOARD

	A	B	C
1	created_at	entry_id	field1
2	2024-04-23 11:25:27 UTC	1	717822e221 - Kevin Anand Raj-ENTRY
3	2024-04-23 11:25:43 UTC	2	717822e231 - Naresh Kannan-ENTRY
4	2024-04-23 11:26:00 UTC	3	717822e236 - Prithive-EXIT
5	2024-04-23 11:26:59 UTC	4	717822e221 - Kevin Anand Raj-ENTRY
6	2024-04-23 11:27:21 UTC	5	717822e221 - Kevin Anand Raj-EXIT
7	2024-04-23 11:27:49 UTC	6	717822e248Â -Â Sriram-EXIT
8	2024-04-23 11:28:09 UTC	7	717822e236 - Prithive-ENTRY
9	2024-04-23 11:28:29 UTC	8	717822e236 - Prithive-EXIT
10	2024-04-23 11:28:48 UTC	9	717822e231 - Naresh Kannan-ENTRY
11	2024-04-23 11:47:07 UTC	10	717822e236 - Prithive-ENTRY
12	2024-04-29 09:22:58 UTC	11	717822e231 - Naresh Kannan-ENTRY
13	2024-04-29 09:23:20 UTC	12	717822e248Â -Â Sriram-ENTRY
14	2024-04-29 09:24:06 UTC	13	717822e221 - Kevin Anand Raj-EXIT
15	2024-04-29 09:31:20 UTC	14	717822e231 - Naresh Kannan-ENTRY
16	2024-04-29 09:31:38 UTC	15	717822e221 - Kevin Anand Raj-EXIT
17	2024-04-29 09:39:39 UTC	16	717822e231 - Naresh Kannan-ENTRY
18	2024-04-29 09:40:03 UTC	17	717822e248Â -Â Sriram-ENTRY

Figure 5.5 RECORDED DATA

CHAPTER 6
FUTURE SCOPE

The RFID-based Attendance Management System utilizing the ESP8266 and ThingSpeak platform demonstrates a robust and efficient solution for managing attendance. However, there are several avenues for enhancement and expansion to further improve its capabilities and applications. The following outlines potential future developments:

1. Integration with Biometric Systems

Combining RFID with biometric verification (such as fingerprint or facial recognition) can significantly enhance security and ensure that the individual scanning the RFID card is the authorized user. This dual-factor authentication can prevent proxy attendance and improve overall system integrity.

2. Mobile Application Development

Developing a mobile application can provide users and administrators with greater flexibility and ease of access. Features of the mobile app could include:

- Real-time attendance monitoring and notifications.
- Remote check-in and check-out capabilities for off-site locations.
- Access to attendance reports and analytics on the go.

3. Enhanced Data Analytics

Incorporating advanced data analytics and machine learning algorithms can offer deeper insights into attendance patterns and trends. Predictive analytics could help identify potential attendance issues before they become problematic, and anomaly detection algorithms could flag irregularities for further investigation.

4. Expanded Notification Systems

Integrating the system with various messaging platforms (such as SMS, email, or push notifications) can broaden the scope of real-time alerts and notifications. This ensures that administrators and users are promptly informed of important events, such as unauthorized access attempts or unusual attendance patterns.

5. Geofencing Capabilities

Implementing geofencing technology can restrict attendance logging to specific geographic locations. This feature can be particularly useful in large campuses or workplaces with multiple buildings, ensuring that attendance is only recorded when individuals are within designated areas.

6. Cloud Platform Interoperability

Expanding the system's compatibility with other cloud platforms beyond ThingSpeak (such as AWS IoT, Azure IoT Hub, or Google Cloud IoT) can provide additional features, better scalability, and integration with other enterprise systems.

7. Battery-Powered Portable RFID Readers

Developing portable, battery-powered RFID readers can enhance the system's flexibility, allowing it to be used in outdoor events, field trips, or locations without stable power supplies. These portable units can sync data with the central server when reconnected to the internet.

8. Customization and Scalability

Providing customization options for different organizational needs (e.g., educational institutions, corporate offices, healthcare facilities) can make the system more adaptable. Additionally, improving the system's scalability to handle a larger number of users and RFID readers without performance degradation is essential for broader adoption.

9. Integration with Other Administrative Systems

Integrating the attendance system with other administrative and human resource systems can streamline operations. For instance, syncing attendance data with payroll systems can automate salary calculations based on attendance records, thereby reducing administrative workload.

10. Energy-Efficient Hardware Improvements

Optimizing the power consumption of the ESP8266 and other components can enhance the system's efficiency, especially for battery-operated or solar-powered deployments. This can be particularly beneficial in remote or resource-constrained environments.

The future scope of the RFID-based Attendance Management System is vast, with numerous opportunities for technological enhancements and expanded functionalities. These developments can make the system more versatile, secure, and user-friendly, ultimately contributing to more efficient and effective attendance management across various sectors.

CHAPTER 7

CONCLUSION

The development and implementation of the RFID-based Attendance Management System using the ESP8266 and ThingSpeak platform represent a significant advancement in attendance tracking technology. This project successfully demonstrates the potential of leveraging RFID technology and IoT capabilities to create a reliable, efficient, and scalable attendance management solution.

This project addresses the key challenges associated with traditional attendance methods, such as manual data entry errors, time consumption, and the potential for manipulation. By automating the attendance recording process, the proposed system ensures real-time data capture and provides instant synchronization with a cloud-based platform for seamless data management and analysis. The result is a robust alternative that reduces the need for manual intervention and enhances overall efficiency.

The system effectively captures and logs attendance data using RFID tags and an RFID reader, significantly reducing the manual workload. Additionally, the ESP8266 microcontroller enables real-time data transmission to the ThingSpeak platform, ensuring that attendance records are updated instantly and can be accessed and monitored in real-time.

In conclusion, the RFID-based Attendance Management System offers a modern solution to traditional attendance challenges, providing significant improvements in accuracy, efficiency, and reliability. By embracing IoT technology and cloud-based data management, this system paves the way for more intelligent and automated administrative processes. Ultimately, it contributes to better organizational management and productivity, demonstrating the transformative potential of integrating advanced technologies into everyday operations.

APPENDIX

```
#include <LCD_I2C.h>

LCD_I2C lcd(0x3F);

#include<SoftwareSerial.h>

SoftwareSerial mySerial(D3, D4);

#include <ThingSpeak.h>

#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>

#include <EveryTimer.h>

#define PERIOD_MS 1000

EveryTimer timer;

bool active = true;

char thingSpeakAddress[] = "api.thingspeak.com";

unsigned long channelID = *******;

char* readAPIKey = "****************";

char* writeAPIKey = "****************";
```

```
unsigned int dataFieldOne = 1;

const char* ssid     = "IOT";

const char* password = "123456789";


#define BLYNK_TEMPLATE_ID "*************"

#define BLYNK_TEMPLATE_NAME "ATTENANCE SYSTEM IOT"

#define BLYNK_AUTH_TOKEN "YUtFvvpZgMUGaT-3FHoz0XexwgNQdokO"

int count = 0;

char input[12];

char reader1[] = "4D0098F0BA9F";

char reader2[] = "4D00990117C2";

char reader3[] = "4D009920887C";

char reader4[] = "4D0098A6592A";

char auth[] = BLYNK_AUTH_TOKEN;

int i;

int pureval;

unsigned int m = 0, act = 0, val, val1, val2, val3, val4, val5;

String inputString = "";

unsigned char a[200];

String predict = "";

unsigned long lastConnectionTime = 0;
```

```
long lastUpdateTime = 0;
WiFiClient client;
int gasstate, sec, act1;


String s1 = "717822e221 - Kevin Anand Raj-ENTRY ";
String s2 = "717822e231 - Naresh Kannan-ENTRY ";
String s3 = "717822e236 - Prithive-ENTRY ";
String s4 = "717822e248 - Sriram-ENTRY ";
String s11 = "717822e221 - Kevin Anand Raj-EXIT ";
String s22 = "717822e231 - Naresh Kannan-EXIT ";
String s33 = "717822e236 - Prithive-EXIT ";
String s44 = "717822e248 - Sriram-EXIT ";
int rfid;
int stdid, id1state = 0, id2state = 0, id3state = 0;
void setup()
{
  Serial.begin(9600);
  mySerial.begin(9600);
  Serial.println("SETUP");
  lcd.begin();
  lcd.backlight();
```

```
  timer.Every(PERIOD_MS, action);
  lcd.print("    SMART ");
  lcd.setCursor(5, 1);
  lcd.print("ATTENANCE");
  Blynk.begin(auth, ssid, password, "blynk.cloud", 80);
  Serial.println("BNlynk Completed");
  ThingSpeak.begin( client );
  delay(3000);
  lcd.clear();
}
void loop()
{
  rfidread();
  delay(100);
  delay(100);
  Blynk.run();
}
int write2TSData( long TSChannel, unsigned int TSField1, String field1Data)
{
  ThingSpeak.setField( TSField1, field1Data );
  int writeSuccess = ThingSpeak.writeFields( TSChannel, writeAPIKey );
```

```
  return writeSuccess;
}
void action()
{
  sec++;
}
void rfidread()
{
  if (mySerial.available())
  {
    count = 0;
    while (mySerial.available() && count < 12
    {
      input[count] = mySerial.read();
      count++;
      delay(5);
      Serial.print(input[count]);
    }
    Serial.print(input);
  }
  if (strncmp(input, reader1, 12) == 0 && id1state == 0)
```

```
{
  write2TSData(
    channelID,
    dataFieldOne, s1
  );
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("KEVIN");
  lcd.print(",717822e221");
  lcd.setCursor(0, 1);
  lcd.print("ENTRY ");
  Blynk.virtualWrite(V0, "KEVIN  ID:717822e221, ENTRY");
  input[0] = '1';
  delay(3000);
  lcd.clear();
  Blynk.virtualWrite(V0, "                    ");
  sec = 0;
  id1state = 1;
}
if (strncmp(input, reader1, 12) == 0 && id1state == 1)
{
```

```
  write2TSData(
    channelID,
    dataFieldOne, s11
  );
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("KEVIN");
  lcd.print(",717822e221");
  lcd.setCursor(0, 1);
  lcd.print("EXIT ");
  Blynk.virtualWrite(V0, "KEVIN  ID:717822e221, EXIT");
  input[0] = '1';
  delay(3000);
  lcd.clear();
  Blynk.virtualWrite(V0, "                    ");
  sec = 0;
  id1state = 0;
}
if (strncmp(input, reader2, 12) == 0 && id2state == 0)
{
  write2TSData(
```

```
    channelID,
    dataFieldOne, s2
  );
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("NARESH");
  lcd.print(",717822e231 ");
  lcd.setCursor(0, 1);
  lcd.print("ENTRY ");
  Blynk.virtualWrite(V0, "NARESH  ID:717822e231, ENTRY");
  Serial.print("Card 2 ");
  input[0] = '1';
  delay(3000);
  lcd.clear();
  Blynk.virtualWrite(V0, "                    ");
  sec = 0;
  id2state = 1;
}
if (strncmp(input, reader2, 12) == 0 && id2state == 1)
{
  write2TSData(
```

```
    channelID,
    dataFieldOne, s22
  );


  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("NARESH");
  lcd.print(",717822e231");
  lcd.setCursor(0, 1);
  lcd.print("EXIT ");
  Blynk.virtualWrite(V0, "NARESH  ID:717822e231, EXIT");
  Serial.print("Card 2 ");
  input[0] = '1';
  delay(3000);
  lcd.clear();
  Blynk.virtualWrite(V0, "                    ");
  sec = 0;
  id2state = 0;
}
if (strncmp(input, reader3, 12) == 0 && id3state == 0)
{
```

```
  write2TSData(
    channelID,
    dataFieldOne, s3
  );
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("PRITHVI");
  lcd.print(",717822e236 ");
  lcd.setCursor(0, 1);
  lcd.print("ENTRY ");
  Blynk.virtualWrite(V0, "PRITHVI  ID:717822e236, ENTRY");
  Serial.print("Card 3 ");
  input[0] = '1';
  delay(3000);
  lcd.clear();
  Blynk.virtualWrite(V0, "                    ");
  sec = 0;
  id3state = 1;
}
if (strncmp(input, reader3, 12) == 0 && id3state == 1)
{
```

```
  write2TSData(
    channelID,
    dataFieldOne, s33
  );
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("PRITHVI");
  lcd.print(",717822e236");
  lcd.setCursor(0, 1);
  lcd.print("EXIT ");
  Blynk.virtualWrite(V0, "PRITHVI  ID:717822e236, EXIT");
  Serial.print("Card 3 ");
  input[0] = '1';
  delay(3000);
  lcd.clear();
  Blynk.virtualWrite(V0, "                    ");
  sec = 0;
  id3state = 0;
}
if (strncmp(input, reader4, 12) == 0 && id3state == 0)
{
```

```
  write2TSData(
    channelID,
    dataFieldOne, s4
  );
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("SRIRAM");
  lcd.print(",717822e248 ");
  lcd.setCursor(0, 1);
  lcd.print("ENTRY ");
  Blynk.virtualWrite(V0, "SRIRAM  ID:717822e248, ENTRY");
  Serial.print("Card 3 ");
  input[0] = '1';
  delay(3000);
  lcd.clear();
  Blynk.virtualWrite(V0, "                    ");
  sec = 0;
  id3state = 1;
}
if (strncmp(input, reader4, 12) == 0 && id3state == 1)
{
```

```
    write2TSData(
      channelID,
      dataFieldOne, s44
    );
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("SRIRAM");
    lcd.print(",717822e248");
    lcd.setCursor(0, 1);
    lcd.print("EXIT ");
    Blynk.virtualWrite(V0, "SRIRAM  ID:717822e248, EXIT");
    Serial.print("Card 3 ");
    input[0] = '1';
    delay(3000);
    lcd.clear();
    Blynk.virtualWrite(V0, "                    ");
    sec = 0;
    id3state = 0;
  }
}
```

REFERENCES

1. Sneesl, R., Jusoh, Y. Y., Jabar, M. A., and Abdullah, S. (2022) 'Revising technology adoption factors for IoT-based smart campuses: A systematic review' - Sustainability Vol.14, No 8, pp.4840.
2. Singh, T., Chauhan, A., Dewan, M., and Agarwal, A. (2022) 'IoT based Digital Attendance System using RFID & ESP32' - International Journal for Modern Trends in Science and Technology Vol. 8, pp.122-126.
3. Sharma, T. and Aarthy, S.L. (2016) 'An automatic attendance monitoring system using RFID and IOT using Cloud' - Online International Conference on Green Engineering and Technologies (IC-GET), Coimbatore, India.
4. Senthilkumar, S., Bhuvaneswari, S., and Clapton, E. (2020). 'Smart monitoring system using RFID technology'. 6th International Conference on Advanced Computing and Communication Systems (ICACCS),
5. Rana, D. S. (2021) 'Smart Attendance: An Automated Attendance Management System Using Machine Learning Techniques' - Mathematical Statistician and Engineering Applications Vol 70, No.2, pp.1285-1294.
6. Mridha, K., and Yousef, N. T. (2021) 'Study and analysis of implementing a smart attendance management system based on face recognition technique using OpenCV and machine learning' - 10th IEEE International Conference on Communication Systems and Network Technologies (CSNT),
7. Naen, M. F., Adnan, M. H. M., Yazi, N. A., and Nee, C. K. (2021) 'Development of attendance monitoring system with artificial intelligence optimization in cloud' - International Journal of Artificial Intelligence Vol 8, No 2, pp.88-98.

8. Zhao, M., Zhao, G., and Qu, M. (2022) ‘College smart classroom attendance management system based on internet of things’ - Computational Intelligence and Neuroscience.
9. Zorić, B., Dudjak, M., Bajer, D., and Martinović, G. (2019) ‘Design and development of a smart attendance management system with Bluetooth low energy beacons’ - Zooming Innovation in Consumer Technologies Conference (ZINC)
10. Revathi, R., Suganya, M., & NR, G. M. (2020) ‘IoT based Cloud Integrated Smart Classroom for smart and a sustainable Campus’ - Procedia Computer Science Vol 172, 77-81.