PROJECT REPORT

ON

" Smart Attendance System with RFID & Arduino"

THIS PROJECT & RESEARCH REPORT HAS BEEN INDEPENDENTLY DEVELOPED BY ME AND IS NOT SUBMITTED TO ANY COLLEGE OR UNIVERSITY FOR ACADEMIC EVALUATION

Developed by

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SKMP PROJECT MANAGEMENT

DEPARTMENT OF IOT

POLISHLINE.BALASORE, ODISHA, INDIA

MAY-2026

“Dedicated to my beloved parents ,and teachers who have worked hard throughout my education”

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CERTIFICATE

This is to certify that the project entitled" **Smart Attendance System with RFID & Arduino***"*

Has been independently developed and completed by Suzen Kumar Mohanty for the purpose of enhancing technical knowledge, skills, and practical understanding.

This project is a self-initiated work carried out with person al interestand research. It has not been submitted to any college, university, or institution for the award of any degree or diploma.

The work presented in this project is genuine and has been completed by the developer himself.



Suzen Kumar Mohanty

(Project Developer)

Date: 27/05/2026

Place:-Balasore,Odisha,India

SELF ATTESTATION

I here by declare that I have personally worked on the project entitled " **DIY Smart Attendance System with RFID & Arduino"**

All the data, analysis, and implementation presented in this project are the result of my own efforts and genuine work .Any external sources of information, if used, have been properly acknowledged.

This project is created solely for learning , skill development ,and professional improvement, and has not been submitted to any institution for academic purposes.



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Suzen Kumar Mohanty

(Project Developer)

Date: 27/05/2026

Place:Balasore,Odisha,India

DECLARATION

I hereby declare that the project titled "**DIY Smart Attendance System with RFID & Arduino"i**s an original work carried out by me based on my own idea, research, and implementation.

This project that has not been submitted previously ,in part or in full, to any college, university, or institution for the award of any degree, diploma, or certification.

I confirm that all the information presented in this project is true to the best of my knowledge. Any references or sources used have been properly acknowledged.

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I take full responsibility for the authenticity and originality of this work.

Name: Mr. Suzen Kumar Mohanty

Branch: Computer Science And Engineering

Institution:[Srinix Collage Of Engineering ,Independent]

Date:[27/05/2026]

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to everyone who contributed, directly or indirectly, to the development of this project, "**DIY Smart Attendance System with RFID & Arduino**."

This project is the result of my personal interest, dedication, continuous learning, and exploration of electronics, automation, sensor technology, and control systems.

I am thankful to the developers of Arduino, the creators of open-source hardware and software resources, and the technical communities whose documentation, tutorials, and knowledge-sharing platforms helped me understand and implement the concepts used in this project.

I would also like to acknowledge the importance of self-learning, practical experimentation, and problem-solving throughout the development process. These experiences helped me strengthen my technical knowledge and improve my understanding of real-world automation systems.

Finally, I am grateful to everyone who supports innovation, DIY engineering, and independent technical projects. This work reflects my enthusiasm for learning, creating, and exploring new possibilities in technology.

Developed By:

Suzen Kumar Mohanty

ABOUT MYSELF



I am Mr. Suzen Kumar Mohanty , a passionate and dedicated Web Developer and SOC Analyst (Level 1) from the field of Computer Science and Engineering, with strong expertise in HTML, CSS, JavaScript, and I specialize in building scalable, responsive, and high-performance web applications that deliver seamless user experiences across all devices and screen sizes.

With a keen eye for detail, I focus on writing clean, maintainable, and well-structured code. My development approach is centered around Creating intuitive user interfaces, ensuring both functionality and aesthetic quality. I follow modern front-end development practices such as component-based architecture, responsive design principles, and performance optimization techniques to build efficient and user-friendly applications.

Beyond web development, I actively work on IoT-based solutions, where I integrate hardware and software to create smart, real-world systems. I have hands-on experience with Arduino Uno and various sensors, enabling me to develop projects such as environmental monitoring systems, smart automation solutions, and real-time data tracking applications.

One of my key strengths lies in connecting IoT devices with web technologies. I build interactive dashboards that allow real-time data visualization, giving users the ability to monitor, analyze, and control devices remotely. My work focuses on bridging the gap between the physical and digital world by transforming raw sensor data into meaningful insights.

I am deeply interested in developing innovative, data-driven solutions that combine web technologies with embedded systems. My goal is to create impactful applications that solve real-world problems while improving efficiency, automation, and user experience.

With a strong passion for continuous learning and innovation, I consistently explore new tools, frameworks, and technologies to enhance my skills and deliver high-quality, future-ready solutions.

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ABSTRACT

This project presents the design and implementation of a low-cost, DIY Smart Attendance System using RFID technology and an Arduino microcontroller. The system replaces traditional manual attendance methods, such as paper registers and roll calls, with an automated contactless identification process. Each authorized user is provided with an RFID card or key fob containing a unique identification number. When the card is tapped near the MFRC522 RFID reader, the Arduino reads the card's UID, verifies whether the user is registered, records the attendance with the current date and time, and provides immediate visual and audio feedback.

The proposed system uses an Arduino UNO R3 as the main controller, an MFRC522 13.56 MHz RFID reader for card detection, a DS3231 Real-Time Clock module for accurate timestamping, and an LCD/OLED display for user interaction. Attendance records are stored locally on a microSD card in CSV format, allowing easy export and analysis using spreadsheet software. A buzzer, green LED, and red LED provide confirmation for successful attendance, invalid cards, duplicate entries, and system errors.

The main objective of the project is to develop an accurate, efficient, and user-friendly attendance management system suitable for schools, colleges, offices, laboratories, libraries, and small organizations. The system reduces manual workload, minimizes human error, prevents duplicate attendance entries, and enables faster generation of attendance reports. It can operate in offline mode using SD-card storage or in online mode

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through Wi-Fi connectivity and cloud-based platforms such as Google Sheets, Firebase, or a custom web dashboard.

The project also considers scalability, security, and privacy. While a basic version uses RFID card UIDs for identification, an advanced version can use encrypted card authentication, administrator-controlled enrollment, secure cloud communication, and data backup mechanisms. The system can be further enhanced with mobile applications, biometric verification, SMS/email alerts, GPS-based attendance, and artificial-intelligence-based attendance analytics.

The experimental implementation demonstrates that the RFID-based attendance system can detect registered cards, record attendance automatically, prevent repeated entries within a defined time period, and store attendance data reliably. The proposed system offers an affordable, practical, and expandable solution for modern attendance management and can be customized for educational institutions, workplaces, and event-management applications.

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1 Introduction

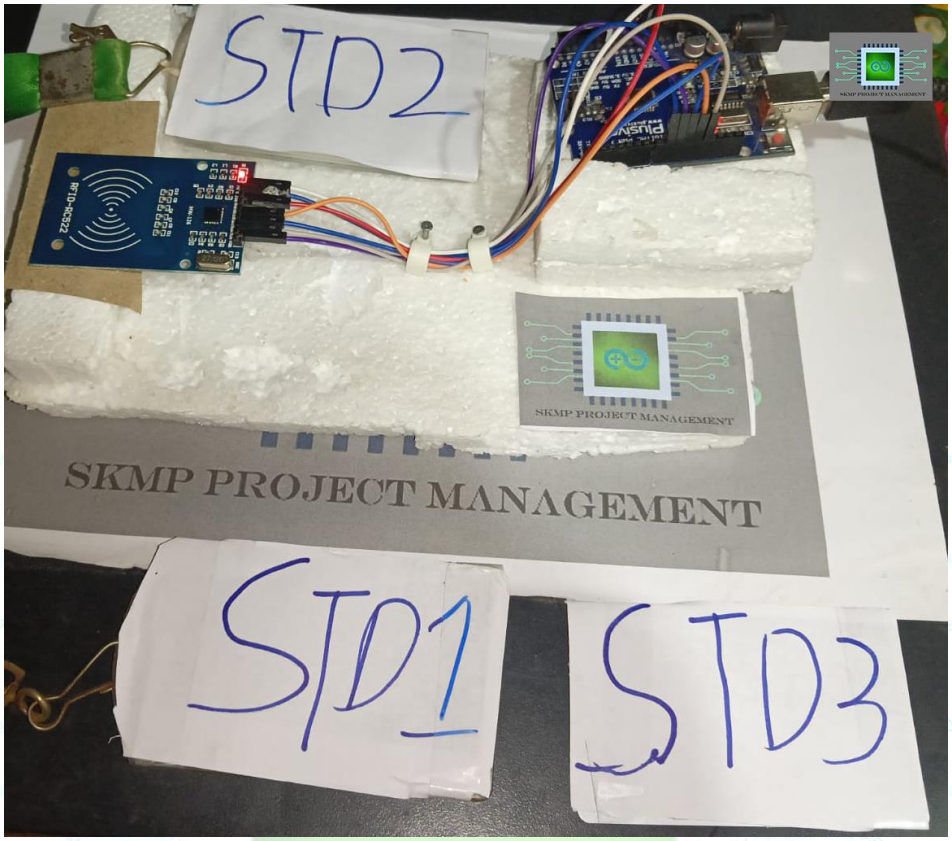

Fig:01

Attendance management is a routine but important activity in schools, colleges, offices, laboratories, libraries, hostels, and event venues. Traditional attendance methods—such as paper registers, roll calls, or manual spreadsheets—are time-consuming, prone to human error, and vulnerable to proxy attendance.

Radio Frequency Identification (RFID) provides a contactless method of identifying a person using a card, key fob, or tag. When a registered RFID card is tapped near the reader, the system reads its unique identifier, verifies whether the user is authorized, records the date and time, and stores the attendance entry. The Arduino microcontroller acts as the central controller, coordinating

the RFID reader, display, storage, feedback devices, and optional cloud connectivity.

This project is designed as a practical, educational, and scalable DIY system. It can be implemented as a basic offline attendance logger or extended into an IoT-enabled attendance platform with remote dashboards, reports, and notifications.

2 Problem Statement

Manual attendance systems face several limitations:

- Teachers, administrators, or supervisors spend valuable time calling names or maintaining registers.
- Paper-based attendance can be misplaced, damaged, or manipulated.
- Manual data entry into spreadsheets increases administrative workload.
- Proxy attendance may occur when one person marks attendance for another.
- Real-time attendance visibility is limited in conventional systems.
- Retrieving attendance reports for a particular student, employee, class, or date can be slow.

The proposed RFID-based attendance system addresses these issues by automating identification, time stamping, storage, and reporting.

3 Objectives

The main objective is to design and build a reliable smart attendance system using RFID technology and Arduino.

Specific objectives are:

1. To design an RFID-based attendance system using an Arduino board and MFRC522 RFID reader.
2. To register authorized RFID cards with unique user identities.
3. To automatically record attendance when a registered card is tapped.
4. To display real-time attendance status on an LCD or OLED display.
5. To store attendance records locally using EEPROM, SD card, or a connected computer.
6. To prevent duplicate attendance entries within a defined time window.
7. To provide audio and visual feedback using a buzzer and LEDs.
8. To generate attendance reports in CSV format for analysis.
9. To optionally upload attendance data to Google Sheets or a cloud dashboard.
10. To create a low-cost, expandable system suitable for schools, offices, and small organizations.

4 Scope of the Project

The project can be implemented at three levels:

Level	System Capability	Suitable Use Case
Basic	RFID card detection, LCD display, buzzer feedback, serial monitoring	Student project, demonstration
Intermediate	RTC timestamping, SD-card logging, CSV export, duplicate prevention	Classroom, laboratory, small office
Advanced	Wi-Fi/Internet connectivity, Google Sheets/cloud database, web dashboard, SMS/email alerts	Institutions, offices, multi-room deployment

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The core version of this report focuses on an Arduino UNO-based system with local attendance logging and optional cloud integration.

5. Applications

The system can be used in:

- Schools, colleges, and coaching institutes
- University laboratories and libraries
- Offices and small businesses
- Hostels and residential facilities
- Event registration and access control
- Manufacturing units and warehouses
- Gyms, clubs, and membership-based organizations
- Research laboratories and restricted work areas

6. Literature Review

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6.1 RFID Technology

RFID stands for Radio Frequency Identification. It is a wireless identification technology in which a reader communicates with a tag or card through radio-frequency signals. An RFID tag contains a microchip and antenna; when it enters the electromagnetic field of the reader, it transmits identification data.

RFID systems are commonly classified by operating frequency:

Frequency Range	Typical Range	Common Applications
Low Frequency (LF), 125–134 kHz	Up to 10 cm	Animal tagging, access control
High Frequency (HF), 13.56 MHz	Up to 10 cm	Attendance, payment, NFC, libraries
Ultra High Frequency (UHF), 860–960 MHz	Several metres	Warehouse tracking, vehicle identification

The MFRC522 module operates at 13.56 MHz and supports ISO/IEC 14443 Type A, MIFARE, and NTAG-compatible contactless cards. Its typical read/write distance can reach up to 50 mm, depending on antenna design, tag type, and operating conditions.

6.2 Arduino in Embedded Systems

Arduino is an open-source electronics platform based on easy-to-use hardware and software. The Arduino UNO R3 uses the ATmega328P microcontroller, operates at 16 MHz, includes 32 KB Flash memory, 2 KB SRAM, and 1 KB EEPROM. It provides 14 digital input/output pins, 6 analog input pins, and supports UART, I2C, and SPI communication.docs.

For this project, Arduino is suitable because it is inexpensive, widely available, easy to program, and supports the SPI interface required by the MFRC522 RFID module.

6.3 Existing Systems

Several RFID attendance systems use the MFRC522 reader with Arduino boards. Common implementations read the card UID, compare it with stored

authorized IDs, display the user's status, and log the event with a timestamp. Some systems store data on an SD card, while others send it to a computer, Google Sheets, or an IoT dashboard.projecthub.arduino+4

A typical RFID attendance architecture includes:

- RFID reader for card detection
- Microcontroller for decision-making
- Real-time clock for accurate timestamps
- Display for user feedback
- Storage medium for attendance records
- Buzzer/LED for immediate confirmation
- Optional cloud service for remote access

6.4 Research Gap

Many basic RFID attendance projects only print a card UID to the serial monitor. They do not address practical requirements such as duplicate-entry prevention, offline storage, report generation, data privacy, secure card authentication, or scalability.

This project improves upon a basic RFID reader demonstration by including:

- User registration and authorization
- Attendance logging with date and time
- Duplicate-entry prevention
- Local storage and CSV export
- Real-time feedback
- Optional cloud integration
- Security and privacy considerations
- Testing and validation procedure

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System Analysis

7.1 Proposed System

The proposed system uses an RFID card as a digital identity token. Each authorized user receives a unique RFID card or key fob. When the card is tapped on the reader, the Arduino reads its UID, checks whether it is registered, records attendance, and provides immediate feedback.

The system can operate in two modes:

1. **Offline Mode:** Attendance is stored on an SD card or EEPROM and later exported to a computer.
2. **Online Mode:** Attendance is sent through Wi-Fi to Google Sheets, Firebase, a local server, or another cloud platform.

7.2 System Requirements

Hardware Requirements

Component	Purpose
Arduino UNO R3	Main controller
MFRC522 RFID reader module	Reads RFID cards and key fobs
RFID cards/key fobs	User identification
16x2 LCD with I2C module or OLED display	Displays attendance status
DS3231 RTC module	Provides accurate date and time
MicroSD card module	Stores attendance logs
Buzzer	Audio confirmation

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Component	Purpose
Red and green LEDs	Visual feedback
Push buttons	Enrollment, reset, and admin functions
5 V power adapter or power bank	System power supply
Jumper wires, breadboard/PCB	Circuit connections
Enclosure	Protection and mounting

Software Requirements

Software	Purpose
Arduino IDE	Writing and uploading Arduino code
MFRC522 Arduino library	Communicating with RFID reader
LiquidCrystal_I2C or Adafruit SSD1306 library	Display control
RTClib	RTC module control
SD library	SD-card data logging
Python or spreadsheet software	Report generation and analysis
Google Sheets API / Firebase / Blynk	Optional cloud integration

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08 Feasibility Study

Technical Feasibility

The project uses commonly available components and open-source software. The MFRC522 communicates with Arduino through SPI, while the RTC and display commonly use I2C. The Arduino UNO supports both communication protocols, making the design technically feasible.

Economic Feasibility

The system is low-cost because it uses affordable components. The main recurring cost is optional internet connectivity or cloud-service usage. For a small institution, one reader unit can serve a classroom, laboratory, office entrance, or library desk.

Operational Feasibility

The system is simple to operate: a user taps a card, and attendance is marked automatically. Administrators can enroll cards, export records, and generate reports without specialized technical knowledge.

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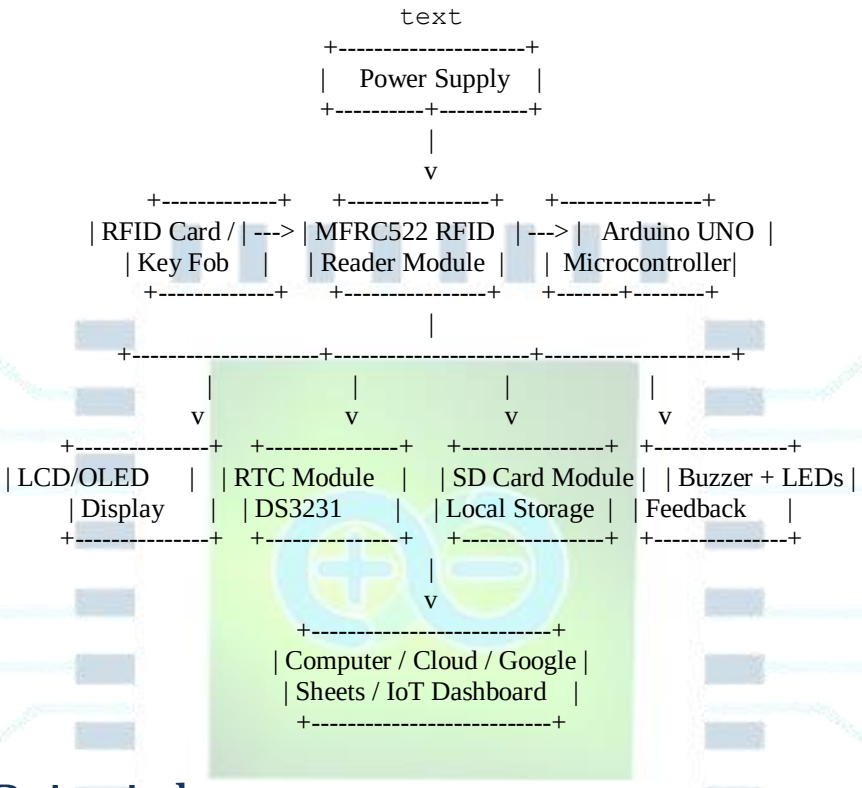
09. System Architecture

9.1 Block Diagram



9.2 Working Principle

1. The system is powered on and initializes the RFID reader, display, RTC module, SD-card module, and feedback devices.
2. The display shows a ready message such as **“Tap Your Card.”**
3. A user brings an RFID card or key fob near the MFRC522 reader.
4. The reader detects the card and sends its UID to Arduino through SPI.
5. Arduino compares the UID with the registered user database.
6. If the card is authorized, the system retrieves the current date and time from the RTC.

7. Arduino checks whether the same card has already been marked within the allowed time window.
8. If attendance is valid, the record is saved with user ID, name, date, time, and status.
9. The display shows **“Attendance Marked”** along with the user’s name or ID.
10. The green LED turns on and the buzzer gives a short beep.
11. If the card is unregistered, already marked, or read fails, the system displays an appropriate error message and gives a different audio/visual indication.
12. Attendance data can be exported as CSV or uploaded to a cloud platform.



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10. Hardware Design

● Arduino UNO Board

- The Arduino UNO is an open-source microcontroller development board based on the ATmega328P microcontroller. It is widely used in electronics, robotics, automation, and embedded system projects. It allows users to connect various electronic components, such as sensors, LEDs, motors, displays, and other devices, to develop interactive electronic applications.
- The Arduino UNO board has 14 digital input/output pins, of which 6 can be used as PWM outputs, 6 analog input pins, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.
- It can be programmed using the Arduino IDE with a simple programming language based on C and C++. The board receives instructions from the program and controls connected devices according to the given commands.

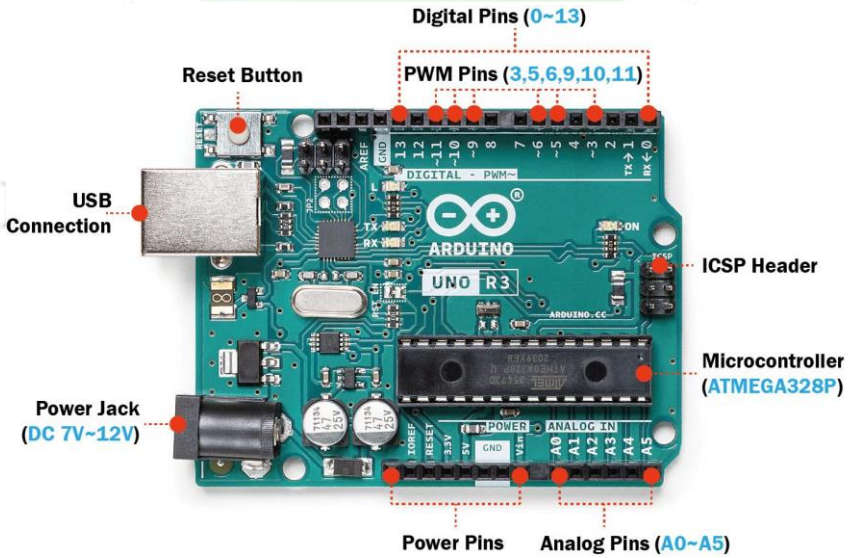

Fig -02

• *HC-SR04 Ultrasonic Sensor*

- The HC-SR04 Ultrasonic Sensor is an electronic distance-measuring sensor that uses ultrasonic sound waves to detect objects and measure the distance between the sensor and an object. It operates by transmitting high-frequency ultrasonic waves (approximately 40 kHz) and receiving the reflected waves (echo) from an object.
- The sensor consists of two main ultrasonic transducers: one acts as a transmitter (Trig), which sends ultrasonic waves, and the other acts as a receiver (Echo), which detects the reflected waves. The distance is calculated by measuring the time taken for the ultrasonic waves to travel to the object and return to the sensor.
- The HC-SR04 sensor is commonly used with microcontrollers such as Arduino UNO for distance measurement, obstacle detection, robotics, and automatic control systems.



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Fig -03

• . Resistor 220ohm

- A 220-ohm (220Ω) Resistor is a passive electronic component used to limit or control the flow of electric current in an electronic circuit. It

provides a specific resistance of 220 ohms and helps protect sensitive electronic components from excessive current that may cause damage.

- In Arduino-based projects, a 220Ω resistor is commonly used to limit current flowing through LEDs and other electronic components. It helps maintain safe operating conditions and improves the reliability of the electronic circuit.
- The resistor works according to Ohm's Law, which describes the relationship between voltage, current, and resistance.

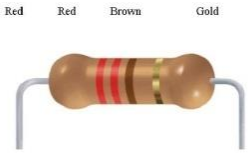

FIG-4

. Breadboard

- A Breadboard is a reusable electronic prototyping board used to build, test, and develop electronic circuits without soldering. It provides a convenient platform for connecting different electronic components using jumper wires.
- A breadboard contains several small holes arranged in rows and columns, which are internally connected through conductive metal clips. These connections allow electronic components such as resistors, LEDs, sensors, and microcontrollers to be connected easily.

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- In Arduino-based projects, a breadboard is commonly used to connect components such as the Arduino UNO, HC-SR04 ultrasonic sensor, SG90 servo motor, and resistors. It helps users assemble and modify circuits quickly during the testing and development process.

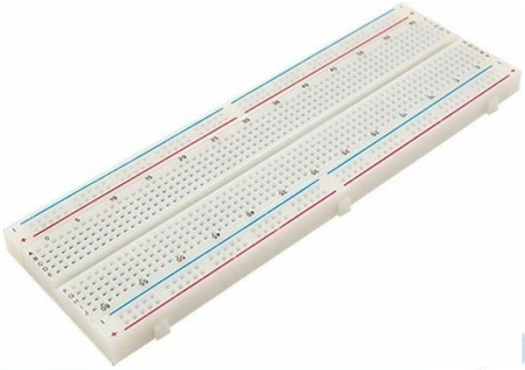

Fig-5

• Servo Motor (SG90)

- The SG90 Servo Motor is a small, lightweight, and compact rotary actuator used to control angular position with high precision. It is commonly used in robotics, automation, and Arduino-based electronic projects. The SG90 is a micro servo motor that can rotate approximately 180 degrees, allowing accurate control of its shaft position.
- The SG90 servo motor consists of a DC motor, a gear mechanism, a position feedback system, and an electronic control circuit. It operates based on Pulse Width Modulation (PWM) signals received from a microcontroller such as the Arduino UNO. By varying the width of the control pulse, the motor shaft can be positioned at a desired angle.
- The SG90 servo motor is widely used in projects requiring controlled movement, such as robotic arms, automatic doors, obstacle-avoiding robots, and digital measurement systems.

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Fig -06

• *Jumper Wires*

- Jumper Wires are electrical connecting wires used to establish temporary connections between different electronic components, sensors, and microcontroller boards. They are commonly used in electronics prototyping, Arduino projects, and embedded system development.
- Jumper wires are used to connect components such as Arduino UNO, ultrasonic sensors, servo motors, breadboards, LEDs, and other electronic modules without requiring soldering. They provide an easy and flexible method of transferring electrical power and signals between different components.
- Jumper wires are generally available in three types: Male-to-Male, Male-to-Female, and Female-to-Female. They are commonly insulated with different colours to help identify power supply, ground, and signal connections.

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Fig -07

• *LED*

- An LED (Light Emitting Diode) is a semiconductor electronic component that produces light when an electric current flows through it in the forward direction. It is a type of diode that converts electrical energy into light energy through a process known as electroluminescence.
- LEDs are widely used in electronic circuits as visual indicators to display the operating status of a system. They are available in different colours, such as red, green, blue, yellow, and white.
- In Arduino-based projects, LEDs are commonly connected to digital output pins to indicate different operating conditions. The Arduino UNO controls the LED by switching it ON or OFF according to the programmed instructions.

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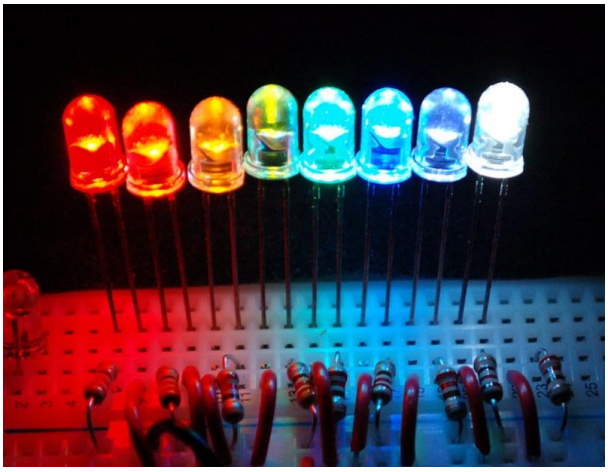

Fig-08

• *USB CABLE*

- A USB (Universal Serial Bus) Cable is an electrical communication cable used to establish a connection between electronic devices for data transmission and power supply. In Arduino-based projects, a USB cable is commonly used to connect the Arduino UNO board to a computer or laptop for programming, uploading code, and supplying electrical power.
- The USB cable allows communication between the computer and the Arduino UNO microcontroller. It transfers program instructions from the Arduino IDE to the board and also supports serial communication for monitoring sensor readings and debugging the project.
- The Arduino UNO R3 commonly uses a USB Type-B cable for connecting to a computer. One end of the cable connects to the Arduino board, while the other end connects to the computer's USB port.



Fig -09

• *Power Supply (9V Battery with connector)*

- A 9V Battery with Connector is a portable DC power source used to provide electrical energy to electronic circuits and microcontroller-based projects. It consists of a 9V battery and a battery connector that allows easy connection to the power input terminals of an electronic circuit or Arduino UNO board.
- In Arduino-based projects, the 9V battery is commonly connected to the Arduino UNO through its DC barrel jack using a 9V battery snap connector with a suitable DC plug. It supplies electrical power to the microcontroller and connected electronic components when a computer or external power adapter is not available.
- The Arduino UNO has an onboard voltage regulator that converts the input voltage into a suitable operating voltage for the board. The 9V battery provides portability and makes the project suitable for standalone operation.

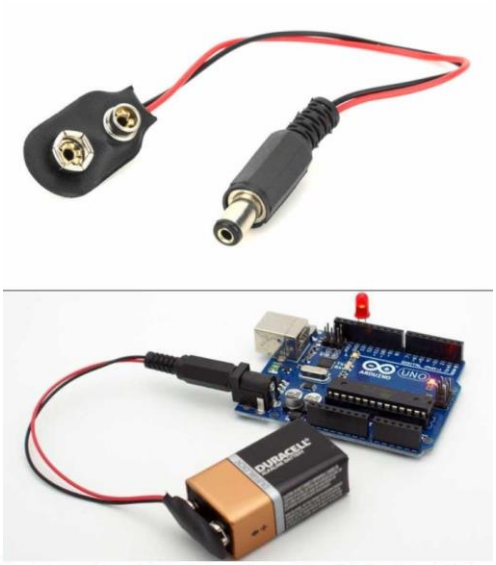

Fig -`10

• *RFID Card*

➢ An **RFID (Radio-Frequency Identification) card** is a contactless smart card that uses radio waves to transmit data between an embedded microchip and a reader device without requiring physical contact or a direct line of sight



Fig -`11

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11. Circuit Design

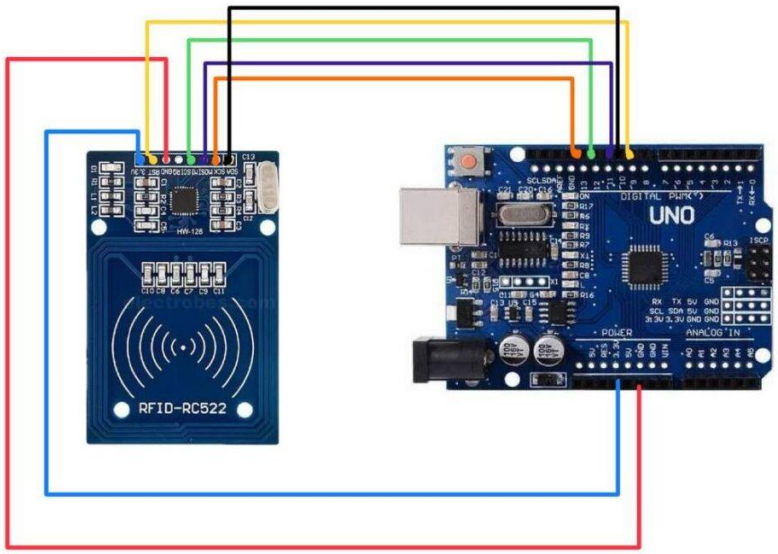

Fig -`12

11.1 MFRC522 to Arduino UNO Wiring

MFRC522 Pin	Arduino UNO Pin	Function
3.3V	3.3V	Power supply
RST	D9	Reset
GND	GND	Ground
IRQ	Not connected	Optional interrupt
MISO	D12	SPI data from reader to Arduino
MOSI	D11	SPI data from Arduino to reader
SCK	D13	SPI clock
SDA/SS	D10	SPI chip select

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This wiring follows the commonly used SPI connection arrangement for the MFRC522 module with Arduino UNO.

11.2 I2C Devices Wiring

The RTC module and I2C LCD can share the same I2C bus.

Device Pin	Arduino UNO Pin
SDA	A4
SCL	A5
VCC	5 V
GND	GND

Note: The MFRC522 and SD-card module both use SPI. They can share SPI lines, but each device requires a separate Chip Select (CS/SS) pin.

11.3 LED and Buzzer Wiring

Component	Arduino Pin
Green LED	D7
Red LED	D8
Buzzer	D6

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Use appropriate current-limiting resistors for LEDs, typically 220 ohm to 330 ohm.

12 Software Design

12.1Main Program Modules

Module	Function
`setup()`	Initializes peripherals and loads registered users
`loop()`	Continuously checks for RFID cards
`readRFID()`	Detects and reads RFID card UID
`verifyUser()`	Checks whether UID is authorized
`getDateTime()`	Reads current date and time from RTC
`checkDuplicate()`	Prevents repeated attendance within a time window
`saveAttendance()`	Writes attendance record to SD card
`updateDisplay()`	Shows status on LCD/OLED
`giveFeedback()`	Controls buzzer and LEDs
`uploadData()`	Sends data to cloud service, if enabled

12.2 Sample Arduino Code Structure

```
#include <SPI.h>
#include <MFRC522.h>

#define RESET_PIN 9
#define SELECT_PIN 10

MFRC522 rfidReader(SELECT_PIN, RESET_PIN);

int serialCounter = 1;
unsigned long startMillis;
int startHours = 12, startMinutes = 55, startSeconds = 50; // Manually set initial  time
OrderCalendars

struct UserData {
String cardUID;
```

```
String rollNumber;
String name;
String lastTimeIn;
bool isInside;
};

// Array to store registered users
UserData userList[] = {
{“46e10a2957980”, “HST-01”, “Harsh Vardhan”, “”, false},
{“6a9df0”, “HST-02”, “Viraj”, “”, false},
{“5f93979”, “HST-03”, “Vaayu”, “”, false},
};

const int userCount = sizeof(userList) / sizeof(userList[0]);

// Function to get the current time using millis()
String getCurrentTime() {
unsigned long elapsedSeconds = (millis() - startMillis) / 1000; OrderCalendars

int currentHours = startHours + (elapsedSeconds / 3600);
int currentMinutes = startMinutes + ((elapsedSeconds % 3600) / 60);
int currentSeconds = startSeconds + (elapsedSeconds % 60);

if (currentSeconds >= 60) { currentMinutes += currentSeconds / 60; currentSeconds %= 60; }
if (currentMinutes >= 60) { currentHours += currentMinutes / 60; currentMinutes %= 60; }
if (currentHours >= 24) { currentHours %= 24; } // Reset if over 24 hours

char formattedTime[9];
sprintf(formattedTime, “%02d:%02d:%02d”, currentHours, currentMinutes, currentSeconds);
return String(formattedTime);
}

// Function to find user index in the array
int findUserIndex(String cardNumber) {
for (int i = 0; i < userCount; i++) {
if (userList[i].cardUID == cardNumber) {
return i;
}
}
return -1; // Not found
}

void setup() {
Serial.begin(9600);
SPI.begin();
rfidReader.PCD_Init();

Serial.println(“Serial Number,RFID Card Number,Roll Number,Name, Time In,Time Out,Status”);
```

```
} ShopTelecom Gear

void loop() {
if (!rfidReader.PICC_IsNewCardPresent() || !rfidReader.PICC_ReadCardSerial()) {
return;
}

String cardNumber = “”;
for (byte i = 0; i < rfidReader.uid.size; i++) {
cardNumber += String(rfidReader.uid.uidByte[i], HEX);
}

String currentTime = getCurrentTime();
String timeIn = “-“, timeOut = “-“, status = “Unknown”;

int userIndex = findUserIndex(cardNumber);

if (userIndex != -1) { // Known RFID
UserData &user = userList[userIndex]; ShopTelecom Gear

if (!user.isInside) { // Student entering
user.lastTimeIn = currentTime;
user.isInside = true;
timeIn = user.lastTimeIn;
status = “STUDENT ENTERED”;
} else { // Student exiting
timeIn = user.lastTimeIn;
timeOut = currentTime;
user.isInside = false;
status = “STUDENT EXITED”;
}

Serial.print(serialCounter++);
Serial.print(“,”);
Serial.print(cardNumber);
Serial.print(“,”);
Serial.print(user.rollNumber);
Serial.print(“,”);
Serial.print(user.name);
Serial.print(“,”);
Serial.print(timeIn);
Serial.print(“,”);
Serial.print(timeOut);
Serial.print(“,”);
Serial.println(status);
} else { // Unknown RFID
Serial.print(serialCounter++);
Serial.print(“,”);
```

```
Serial.print(cardNumber);
Serial.print(“,”);
Serial.print(“Unknown”);
Serial.print(“,”);
Serial.print(“Unknown”);
Serial.print(“,”);
Serial.print(currentTime);
Serial.print(“,”);
Serial.print(“-“);
Serial.print(“,”);
Serial.println(“STUDENT ENTERED”); ShopTelecom Gear

// Optional: Add new users dynamically if needed
}

delay(1000);
rfidReader.PICC_HaltA();
rfidReader.PCD_StopCrypto1();
}
```

13 Database Design

13.1 User Registration Table

Field	Data Type	Description
User ID	Text	Unique ID assigned to the person
Name	Text	Full name of user
RFID UID	Text	Unique card identifier
Role	Text	Student, employee, visitor, admin
Department/Class	Text	Department, class, or section
Registration Date	Date	Date card was registered
Status	Text	Active or inactive

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13.2 Attendance Record Table

Field	Data Type	Description
Record ID	Integer	Unique attendance entry number
Date	Date	Attendance date
Time	Time	Attendance time
User ID	Text	Registered user ID
Name	Text	User name
RFID UID	Text	Card UID
Status	Text	Present, late, duplicate, denied
Device ID	Text	Reader/device location

13.3 Sample Attendance Data

Date	Time	User ID	Name	RFID UID	Status
2026-05-26	09:02:31	STU001	Rahul Sharma	A1 B2 C3 D4	Present
2026-05-26	09:03:10	STU002	Priya Das	B2 C3 D4 E5	Present
2026-05-26	09:05:44	STU003	Amit Kumar	C3 D4 E5 F6	Late
2026-05-26	09:07:12	STU004	Sneha Mishra	D4 E5 F6 G7	Present

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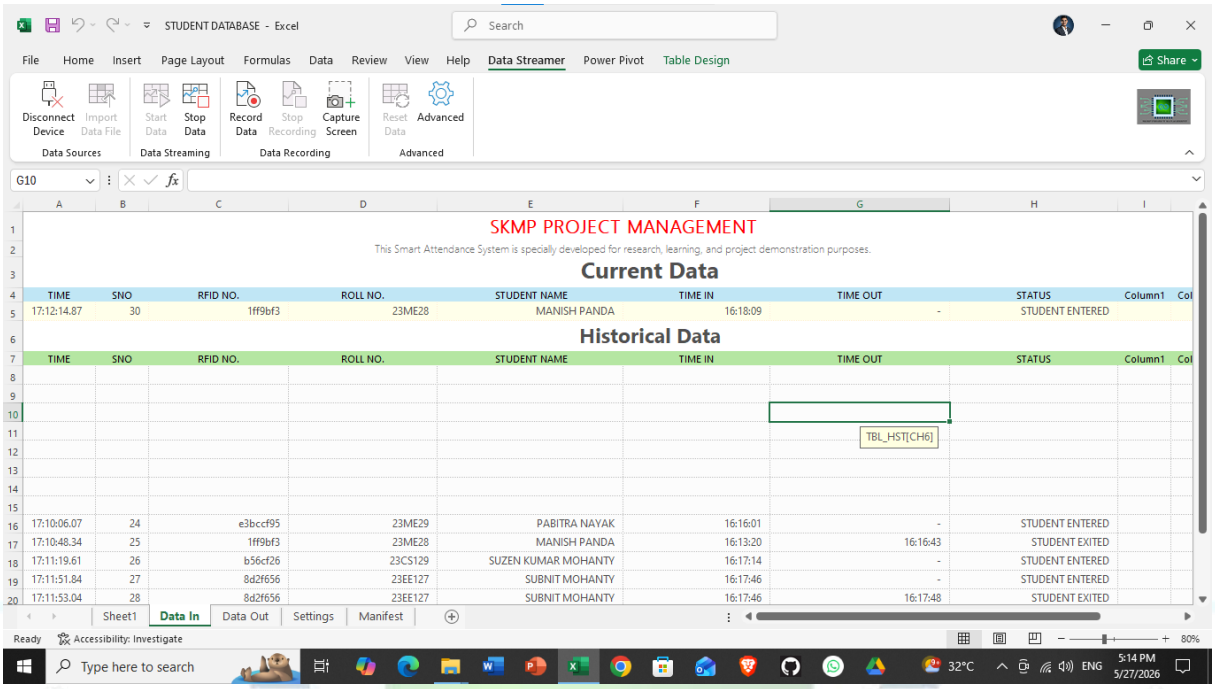

Fig-13

14. Testing and Validation

14.1 Test Cases

Test Case	Test Procedure	Expected Result
Power-on test	Supply power to system	Display shows “System Ready”
RFID detection	Tap a registered card	Card UID is read correctly
Valid attendance	Tap registered card	Attendance is saved and success message appears
Duplicate prevention	Tap same card again within time window	System shows “Already Marked”
Invalid card	Tap unregistered card	System shows “Invalid Card”
RTC accuracy	Compare RTC time with mobile/PC time	Time matches closely

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Test Case	Test Procedure	Expected Result
SD-card logging	Remove SD card and open CSV file	Attendance record is present
Buzzer test	Tap valid and invalid cards	Different beep patterns occur
LED test	Tap valid and invalid cards	Green/red LED responds correctly
Cloud upload	Connect Wi-Fi and tap card	Record appears in cloud dashboard

14.2 Performance Metrics

Metric	Target Value
Card detection time	Less than 1 second
Attendance logging time	Less than 2 seconds
Successful read rate	Above 95% in normal conditions
Duplicate-entry prevention	100% within configured time window
System uptime	Continuous operation during working hours
Data-loss rate	Minimal when SD card and RTC are functioning properly

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14.3 Expected Results

The system should successfully:

- Detect RFID cards placed near the reader.
- Identify registered users.
- Mark attendance with accurate date and time.
- Prevent duplicate attendance entries.
- Store attendance data locally.
- Provide immediate visual and audio feedback.
- Export attendance data for reporting.
- Optionally upload attendance records to a cloud platform.

15. Advantages

- **Automation:** Reduces manual attendance marking.
- **Time saving:** Attendance is recorded in seconds.
- **Accuracy:** Reduces human errors in recording names and times.
- **Contactless operation:** Users do not need to touch shared surfaces.
- **Real-time feedback:** Users immediately know whether attendance was marked.
- **Data storage:** Attendance records can be stored digitally.
- **Scalability:** Additional readers and users can be added.
- **Low cost:** Uses affordable Arduino and RFID components.
- **Report generation:** CSV data can be analyzed in spreadsheets.
- **Expandability:** Can be upgraded with Wi-Fi, GSM, fingerprint, face recognition, or cloud dashboards.

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Conclusion

The DIY Smart Attendance System with RFID and Arduino provides a practical solution for automating attendance management. By combining RFID identification, Arduino control, RTC-based timestamping, local/cloud storage, and user feedback, the system reduces manual effort and improves attendance accuracy.

The project is technically feasible, affordable, and suitable for educational demonstration as well as real-world deployment in small institutions. With the addition of Wi-Fi connectivity, secure card authentication, cloud dashboards, and analytical reporting, the basic prototype can be developed into a complete smart attendance management platform. The MFRC522 reader, Arduino UNO, RTC, and SD-card logging form a proven foundation for such systems.

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Future Scope

- The project can be expanded in several directions:
- **Wi-Fi IoT integration:** Use ESP32 or ESP8266 to upload attendance directly to Google Sheets, Firebase, Blynk, or a custom web dashboard.
- **Mobile application:** Develop an app for administrators to view attendance, register users, and download reports.
- **Biometric integration:** Add fingerprint or facial recognition for higher accuracy.
- **GPS-based attendance:** Useful for field staff or mobile workforce.
- **SMS/email alerts:** Notify parents, managers, or administrators about absences.
- **Face mask and temperature sensing:** Useful for health-screening workflows, where appropriate and legally permitted.
- **AI-based analytics:** Identify attendance trends, late arrivals, absenteeism, and unusual patterns.
- **Multi-door deployment:** Connect multiple readers to a central server.
- **Solar-powered standalone unit:** Useful for remote locations.
- **QR-code backup:** Provide a fallback attendance method when RFID cards are unavailable.

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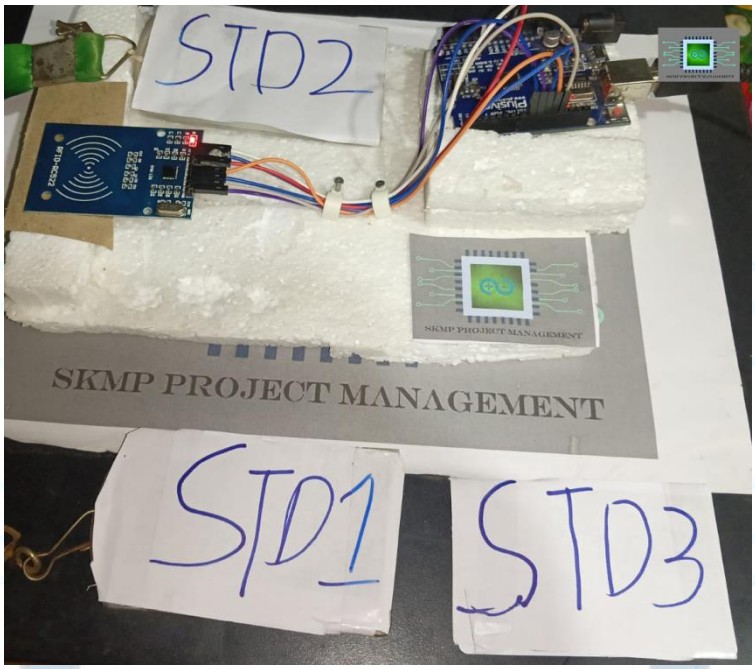
PROJECTLINK

Website lnk:-https://skmp-project-management.vercel.app/

Google Drive Link:-

https://drive.google.com/drive/folders/1fy6hnCEjNI0cSGWE10H_whyqvNc40aWE?usp=sharing

VideoLink:- https://youtu.be/x03dE8Zif-w?si=rYgkvY9t2bAHAil_



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