Project Report

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Section/Group: 24MAM-3A
Semester: 3rd
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Subject Name: Internet of Things
Subject Code:

Aim: DIY Smart Attendance System with RFID & Arduino

To design and implement a smart attendance system using RFID technology and Arduino, which can automatically identify and record the presence of students in real-time, displaying the student's name and attendance status on an LCD screen, and maintaining accurate records without manual intervention.

Objectives:

1. **Automate Attendance:**
To eliminate manual attendance taking and automate the process using RFID technology.

2. **Unique Identification:**
To uniquely identify each student using RFID cards, ensuring accurate and reliable recognition.

3. **Real-Time Display:**
To display the student's name and attendance status (Present/Absent) instantly on an I2C LCD.

Components Required:

Sno	Name of Component	Qty.
1.	Arduino UNO	1
2.	RC522 RFID Reader Module	1
3.	RFID Cards / Tags	1
4.	I2C LCD (16x2) Module	3
5.	Jumper Wires	3

Details of Components: (Times New Roman-14)

1. **Arduino UNO**

Arduino UNO is a widely used open-source microcontroller board based on the **ATmega328P** microcontroller. It has 14 digital input/output pins (6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, and ICSP header.
Arduino UNO acts as the central controller of the attendance system. It reads the UID from the RFID module, compares it with the stored list of students, and displays the name and attendance status on the LCD**.**

2. **RC522 RFID Reader Module**

   The RC522 is a high-frequency RFID module (operates at 13.56 MHz) that can read and write to MIFARE cards/tags. It communicates with Arduino using the SPI protocol. The RC522 reads the unique ID (UID) of each student's RFID card or tag. This UID is used to verify and mark attendance.

3. **RFID Cards / Tags**

   These are passive RFID cards or key fobs that contain a microchip and antenna. They are low-cost, lightweight, and do not require a battery. The chip stores a unique identification number (UID).

   Each student is assigned a card/tag. Scanning the card allows the system to identify the student automatically and mark them as Present.

4. **I2C LCD (16x2)**

   A 16x2 LCD can display 16 characters per line and has 2 lines. The I2C interface reduces the number of Arduino pins needed to just two pins (SDA & SCL) instead of multiple data pins.

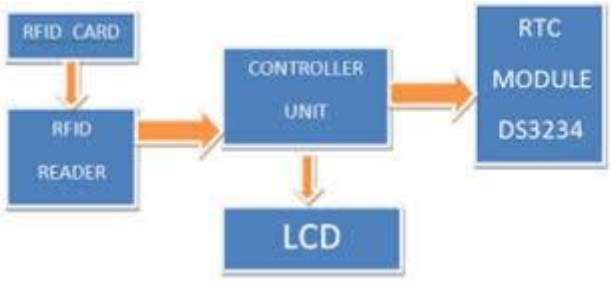
   The LCD is used to display the student's name and attendance status ("Present" or "Unknown Card") for easy visual verification.

5. **Jumper Wires**

   Jumper wires are flexible wires used to make temporary or permanent connections between components on a breadboard or directly to Arduino pins. They come in various colors and lengths.

   To establish electrical connections and data communication between all components in the system.

Block Diagram of Designed Model:



1. RFID Card / Tag

- Function: Each student is given a unique RFID card or tag containing a unique identification number (UID).
- Working: When brought near the RFID reader, the card transmits its UID via electromagnetic induction.

2. RFID Reader (RC522)

- Function: Reads the UID from the RFID card/tag.
- Working: Generates an electromagnetic field to activate the card and receives the UID, which is then sent to the Arduino via SPI communication.

3. Arduino UNO

- Function: Acts as the central controller of the system.
- Working:
  - Receives UID from the RFID reader.
  - Compares the UID with the pre-stored list of student IDs.

- Determines if the student is registered or unregistered.
- Sends the name and attendance status to the LCD and Serial Monitor.

4. I2C LCD Display (16x2)

- Function: Provides real-time display of attendance.
- Working:
  - Line 1: Displays the student's name (if UID matches).
  - Line 2: Displays Present or Unknown Card (if UID does not match).
  - Uses only 2 Arduino pins (SDA & SCL) for communication via I2C protocol.

Working of model:

Step 1: Initialization

- The Arduino UNO initializes all connected components:
- RC522 RFID reader
- I2C LCD display
- The LCD displays a welcome message such as "Scan Your Card" to indicate the system is ready.

Step 2: Scanning the RFID Card

- Each student has a unique RFID card/tag.
- When a student scans the card near the RC522 RFID reader, the module reads the card's unique identification number (UID).
- This UID is transmitted to the Arduino via SPI communication.

Step 3: UID Verification

- The Arduino compares the scanned UID with a pre-stored list of student IDs in the code.
- Two cases arise:
- **Registered UID:** If the UID matches a student's ID, the system identifies the student.
- **Unregistered UID:** If the UID is not in the list, the system marks it as unregistered card.

Step 4: Displaying Attendance

- **If UID is registered:**
- The student's name is displayed on the LCD (Line 1).
- The attendance status "Present" is displayed on the LCD (Line 2).
- The same information is printed on the Serial Monitor for debugging or logging.
- **If UID is unregistered:**
- The LCD displays "Unregistered Card" on Line 1.
- The UID of the unrecognized card is displayed on Line 2.
- Serial Monitor prints "Unregistered Card: <UID>".

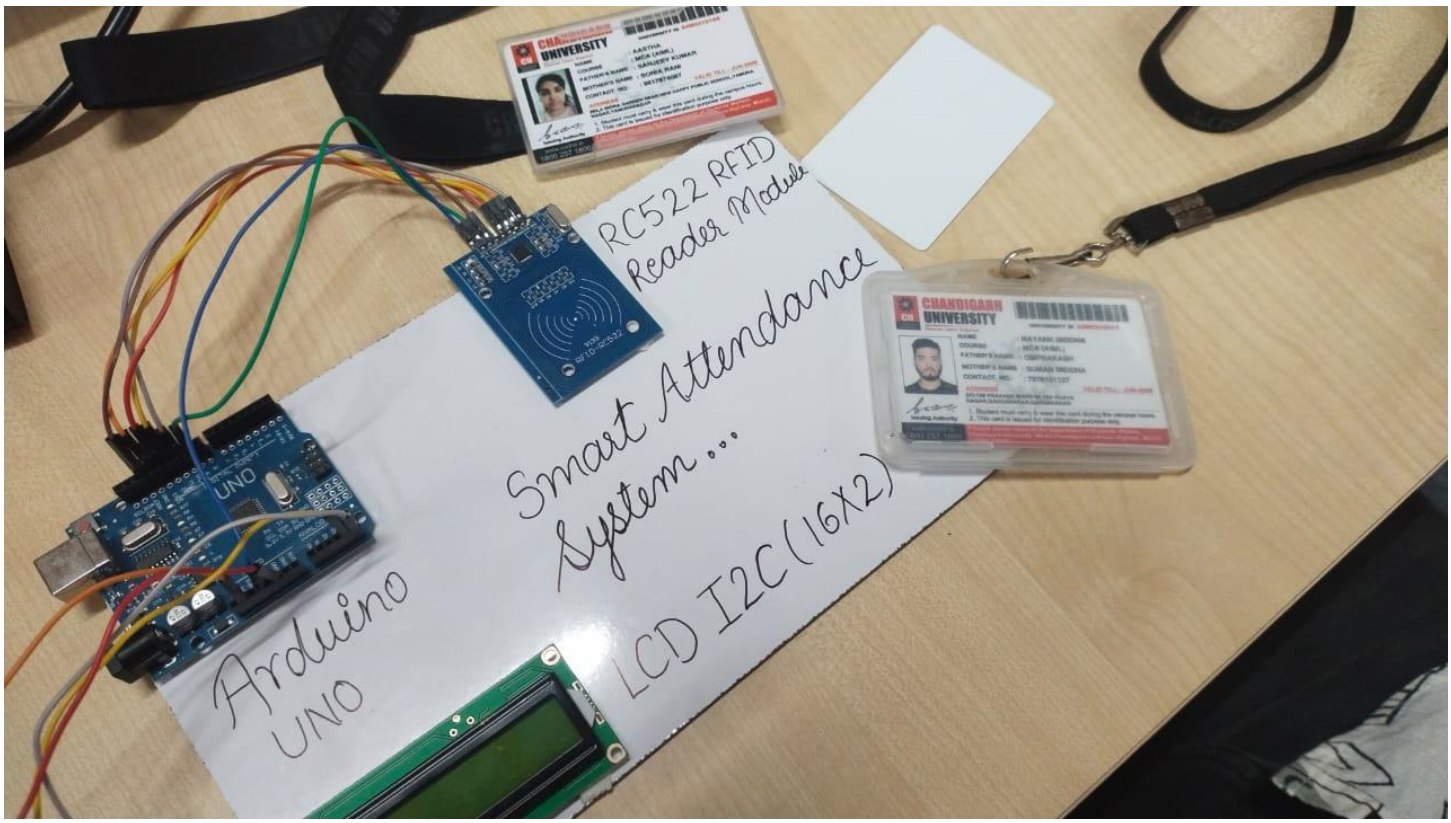
Step 5: Updating Attendance

- Once the UID is processed, the system halts the current card reading and waits for the next card.
- The LCD returns to the welcome message to indicate readiness for the next student.

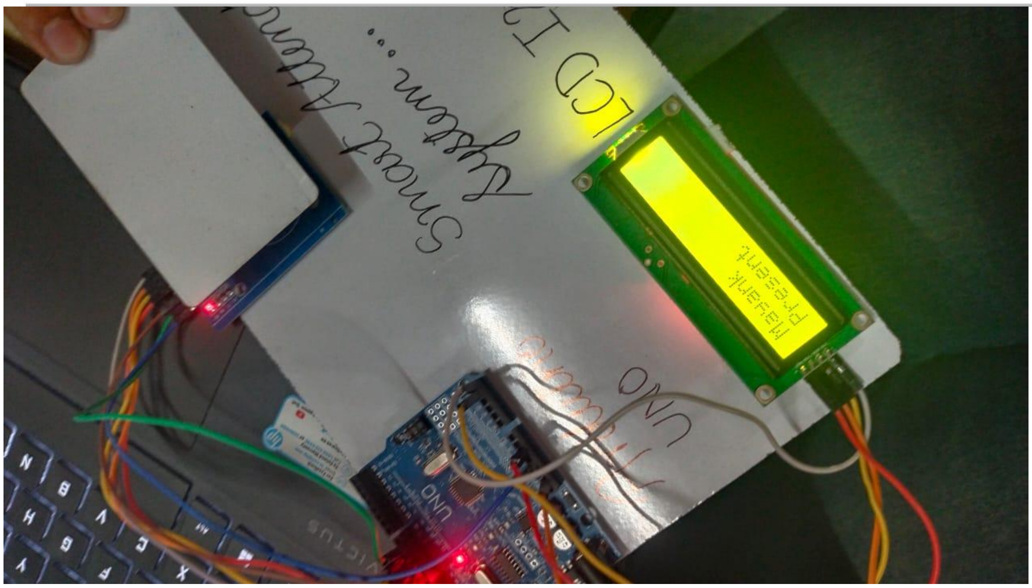
Step 6: Repeat Process

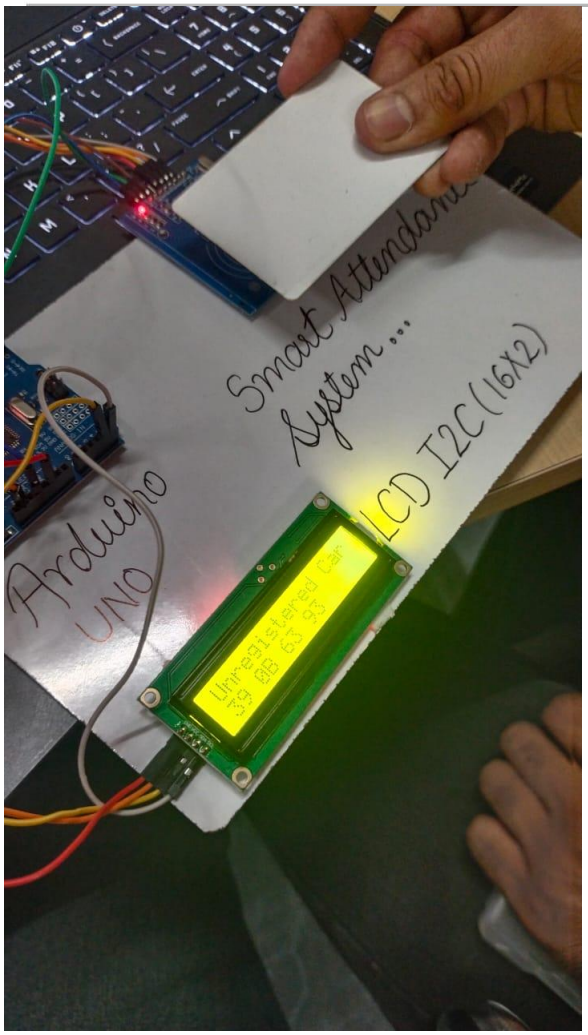
- Every time a student scans the card, the process repeats automatically.
- This eliminates the need for manual attendance, reduces errors, and provides instant verification.

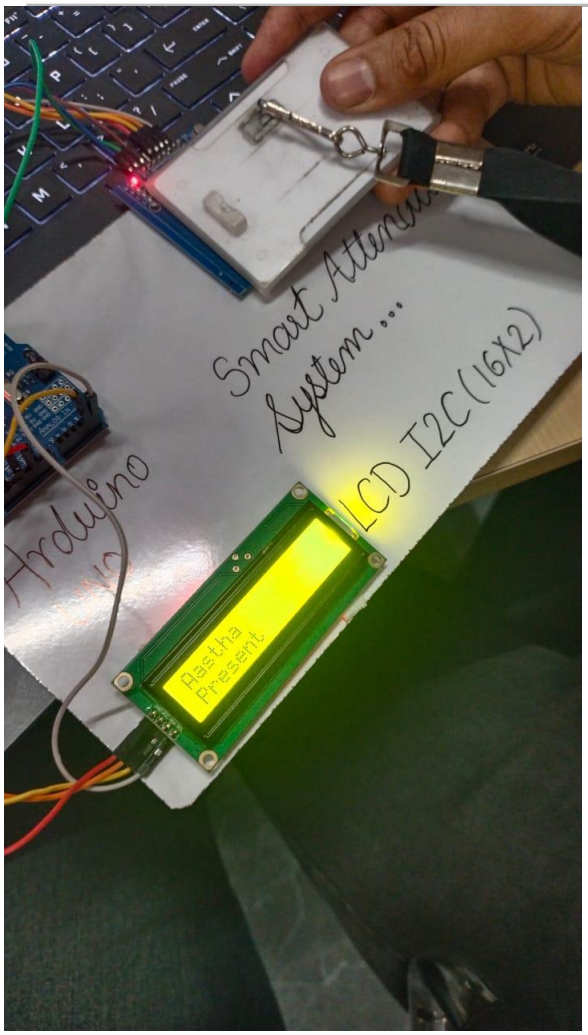
Pictures of Prototype:



Output of Deigned Model/Prototype :


Mayank
Present
UNO


Smart Attendance System...
Arduino UNO
LCD I2C (16X2)
Unregistered Car


Smart Attendance System...
LCD I2C (16X2)
Arduino
Radha
Present

Learning outcomes (What I have learnt):

1.Understanding of RFID Technology:

Learned how RFID cards and modules work, including reading unique IDs and communication protocols (SPI).

2. Arduino Programming Skills:

Gained hands-on experience in writing Arduino code for interfacing RFID modules and I2C LCD displays**.**

Learned how to store and compare data in arrays to verify student IDs.

3. I2C Communication:

Learned to use the I2C protocol for connecting LCD displays using only two pins (SDA & SCL).

Understood how to send text and format output on an LCD.

4. System Design and Integration:

Learned how to combine hardware (Arduino, RFID, LCD, and jumper wires) with software logic to create a functional project.

Understood proper wiring, power requirements, and troubleshooting of modules.