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Design and Implementation of an Attendance System Using MFRC522 RFID Cards Based on Arduino Uno and XAMPP for Jakarta International Polytechnic

Lanny Catrin Dale[1], Lidya Natalia Sartono[2], Iramdan[3]

[1]Cyber Security, Politeknik Jakarta Internasional, Jakarta Selatan, Indonesia

[2,3] Universitas Indraprasta PGRI Jakarta

Email: lanny.dale@jihs.ac.id

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ABSTRACT

The development of automatic identification system technology provides an opportunity to improve the efficiency of administrative processes, including attendance systems in educational environments. Conventional attendance systems that still use manual signatures have various weaknesses, such as the potential for data manipulation, slow recording processes, and difficulties in centralized data processing. This study aims to design and build an RFID card-based attendance system using the MFRC522 RFID module integrated with Arduino Uno as the main controller and the XAMPP server as a data processing and storage medium. This system is implemented in the Jakarta International Polytechnic environment to improve the efficiency of student and staff attendance management. The research methods include hardware design, software development, system integration, and performance testing. The MFRC522 RFID module is used to read the user's RFID card, then the identity data is processed by the Arduino Uno and sent to the server via serial communication to be stored in a database managed using XAMPP. The system is also equipped with a web-based interface to facilitate the management and monitoring of attendance data in real-time. The results of the study show that the designed system is able to carry out the user identification process quickly and accurately and record attendance data automatically into the database. Implementation of this system can reduce the potential for fraud, speed up the attendance recording process, and increase the efficiency of data management in educational institutions so that it can be a more effective alternative solution compared to conventional attendance systems.

INTRODUCTION

The development of information technology and automation systems has brought significant changes across various fields, including the management of attendance systems in educational environments. Attendance systems are an important part of academic administration for recording the presence of students and teaching staff.

Most educational institutions still use manual attendance systems with signatures on attendance lists. This method has several weaknesses such as the possibility of data manipulation, recording errors, and a recap process that requires a considerable amount of time.

One technology that can be used to improve the efficiency of attendance systems is Radio Frequency Identification (RFID). This technology enables automatic user identification via radio waves without direct contact. This study uses the MFRC522 RFID module connected to an Arduino Uno microcontroller to read users' RFID cards.

The implementation of an RFID-based attendance system offers multiple operational advantages beyond basic efficiency and accuracy. By automating identification and timestamping, the system reduces the administrative burden on staff, shortens queue times during class entry, and provides near-real-time monitoring of attendance patterns. Automated data collection enables faster generation of reports and analytics, such as per-course attendance rates, chronic absenteeism detection, and correlations between attendance and academic performance, which can inform targeted interventions and policy decisions.

From a technical standpoint, the MFRC522 module and Arduino Uno present a low-cost, robust prototype platform suitable for pilot deployments. The MFRC522 supports ISO/IEC 14443A compliant tags (commonly MIFARE), offering reliable short-range reads and low power consumption. The Arduino Uno handles tag reading and preliminary processing, then formats data (e.g., UID, timestamp, reader ID) for transmission. Communication to the server can be implemented via serial-to-USB tethering to a PC running XAMPP, or extended using Wi-Fi or Ethernet shields for direct network connectivity. On the server side, XAMPP provides Apache for hosting web interfaces and PHP scripts, and MySQL/MariaDB for structured storage of attendance logs, user profiles, and configuration tables. A web-based dashboard allows administrators and lecturers to review attendance records, export data (CSV/PDF), and manage user enrollments and access rights.

Security and data integrity are critical considerations. Measures should include secure transfer protocols (HTTPS) for web access, proper sanitization of input to prevent SQL injection, and access control with role-based authentication. Although passive RFID tags do not transmit sensitive personal data inherently, tying tag UIDs to personal records requires safeguarding to protect privacy and comply with institutional policies or local regulations. Backup strategies and database transaction logging help prevent data loss and enable audit trails.

For scalability and future improvement, the prototype can evolve into a distributed system with multiple readers synchronized to a central server, integration with student information systems (SIS), and the incorporation of fallback mechanisms (e.g., PIN entry) when tags fail. Additional features could include push notifications for unauthorized absences, integration with classroom entry turnstiles, and energy-optimized readers for 24/7 operation. Pilot testing at Politeknik Jakarta Internasional should measure reliability, read accuracy across busy environments, user acceptance, and total cost of ownership to validate readiness for full deployment.

METHOD

Research Design

The author uses an experimental approach employing the scientific method to systematically test the effect of one variable on another. The experiment for this study was conducted in the computer lab of Politeknik Jakarta Internasional, located at SCBD Area Kav 52-53 Lot 21, Senayan, Kebayoran Baru, RT.7/RW.1, Senayan, Kec. Kby. Baru, South Jakarta City, Special Capital Region of Jakarta 12190. The Research Flow Diagram outlines the steps taken to support a more systematic research process. The following diagram was used (shown below): RFID Card → RFID Reader (MFRC522) → Arduino Uno → Serial Communication → MySQL Database → Web Monitoring System

RESULT AND DISCUSSION

This section explains the results: the developed system is able to read RFID cards quickly using the MFRC522 module. Each card has a unique UID used as the user identity in the system. After the card is presented to the RFID reader, the Arduino reads the card UID and sends that data to the server via serial communication. The server running on XAMPP receives the data and stores it in the MySQL database.

1. Data in the Database

The data stored in the database includes:

- User ID
- User name
- Attendance date
- Attendance time
- Attendance status

Test results show that the system can read RFID cards in less than one second and automatically record attendance data. In addition, administrators can view attendance reports through the provided web interface.

2. Device Specifications

The hardware used to run this application is a Lenovo laptop with an Intel Core i5-120U 1.40 GHz processor with the following specifications:

No	Spesifikasi	Keterangan
1	*Processor*	Intel Core i5-11400H 2.70 GHz
	Memory RAM	DDR4 16 GB
	VGA	NVIDIA GeForce RTX 2050 4GB
	System Type	64-bit *Operating System*
	Hardisk	500 Gigabyte NVMe
	Display	IPS 15.6 inci FHD 1920 x 1080 pixel
	OS	*Windows* 11 Home single Language 64 Bit

No	Spesifikasi	Keterangan
1	*OS*	*Windows* 11 Home Single Language 64 Bit
2	*Database*	PHPMyadmin 5.2.1
3	*Xampp*	Versi 8.2.4-0
4	Program *WEB*	*HTML, Javascript, PHP,CSS, Apache*
5	*Software Editor*	*Visual Studio Code*

3. Outputs Successfully Executed

a. RFID Attendance Output in the Command Prompt

When an RFID card is scanned, the Command Prompt displays the following information in real time:

- Card UID
- User ID (if lookup performed)
- Timestamp (date and time of scan)
- Attendance status (e.g., Present, Late, Invalid)
- Confirmation of data sent to server and saved to MySQL (or error messages if transmission/storage fails)

Example console lines:

- "Card detected: UID = 04 A2 3B 1C"
- "User found: ID = 102, Name = Ahmad"
- "Timestamp: 05/04/2026 08:12:34"
- "Status: Present"
- "Data transmitted: OK — Saved to database"

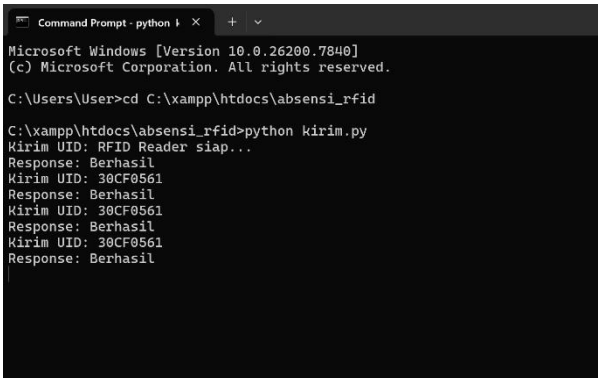


Fig 1. Output Program

b. website localhost xampp

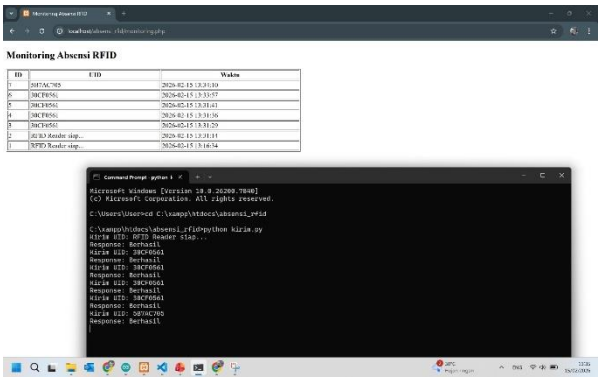


Fig 2. Monitoring RFID

This display shows the condition when a user presents a UID card to the MFRC522 module and it is automatically read and reflected on the localhost XAMPP website. This proves that login validation works as expected.

c. Output from the Arduino Uno program

When the Arduino Uno runs the attendance sketch, the serial output typically shows:
- "Card detected: UID = <uid bytes>"
- "Reading UID..."
- "UID: <formatted UID>"
- "Lookup user: ID = <id>, Name = <name>" (if lookup implemented)
- "Timestamp: <mm/dd/yyyy HH:MM:SS>"
- "Status: <Present/Late/Invalid>"
- "Sending data to server..."
- "Transmission: OK" or "Transmission error: <error message>"
- "Saved to database" or confirmation received from server (if Arduino receives acknowledgment)

These messages appear in the serial monitor/command prompt and correspond to the events when a card is scanned, processed, and sent to the server.

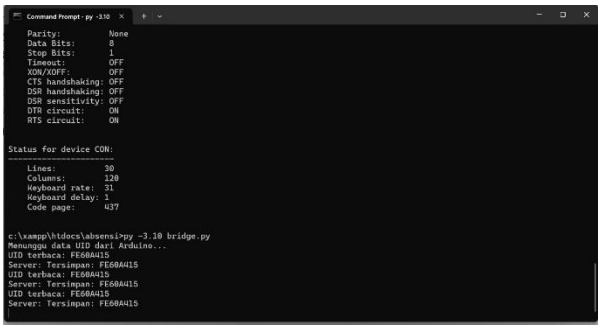


Fig 2. Monitoring output Arduino Uno

4. Coding Program was needed
a. Program Arduino Uno Ide

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

#define SS_PIN 10
#define RST_PIN 9

MFRC522 rfid(SS_PIN, RST_PIN);

void setup() {
  Serial.begin(9600);
  SPI.begin();
  rfid.PCD_Init();
  Serial.println("RFID Reader Siap...");
}

void loop() {
```

```
 if (!rfid.PICC_IsNewCardPresent()) return;
 if (!rfid.PICC_ReadCardSerial()) return;

 Serial.print("UID:");
 for (byte i = 0; i < rfid.uid.size; i++) {
  Serial.print(rfid.uid.uidByte[i], HEX);
  if (i < rfid.uid.size - 1) Serial.print(":");
 }
 Serial.println();

 rfid.PICC_HaltA();
}
```

b. Program Absensi.php

```
<?php
$koneksi = new mysqli("localhost", "root", "", "andika");

$uid = $_GET['uid'];

$query = $koneksi->query("SELECT nama FROM users WHERE uid='$uid'");
$data = $query->fetch_assoc();

if ($data) {
   echo "OK|" . $data['nama'];
} else {
   echo "NO UID";
}
?>
```

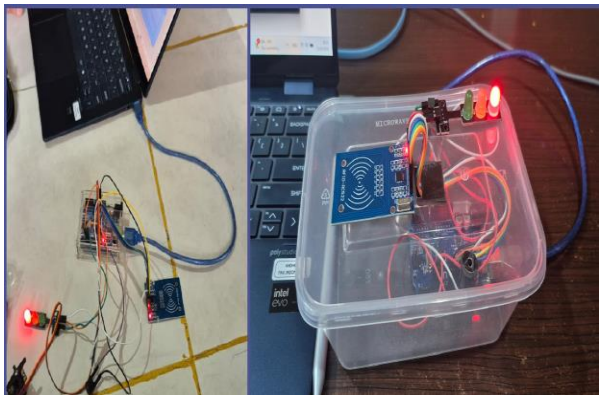
c. Program bridge.py

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

#define SS_PIN 10
#define RST_PIN 9

MFRC522 rfid(SS_PIN, RST_PIN);

void setup() {
 Serial.begin(9600);
 SPI.begin();
 rfid.PCD_Init();
 Serial.println("RFID Reader Siap...");
}

void loop() {
 if (!rfid.PICC_IsNewCardPresent()) return;
 if (!rfid.PICC_ReadCardSerial()) return;

 Serial.print("UID:");
 for (byte i = 0; i < rfid.uid.size; i++) {
  Serial.print(rfid.uid.uidByte[i], HEX);
  if (i < rfid.uid.size - 1) Serial.print(":");
 }
 Serial.println();
```

```
  rfid.PICC_HaltA();
}
```

7. Program dashboard.php

```
<?php
$conn = mysqli_connect("localhost", "root", "", "andika");
if (!$conn) die("Koneksi gagal!");

$log = mysqli_query($conn, "
   SELECT log_andika.*, users.nama
   FROM log_andika
   LEFT JOIN users ON log_andika.uid = users.uid
   ORDER BY log_andika.waktu DESC
");
?>

<!DOCTYPE html>
<html>
<head>
   <title>Dashboard andika</title>
   <style>
      body { font-family: Arial; margin: 30px; }
      h2 { margin-bottom: 20px; }
      table { border-collapse: collapse; width: 100%; }
      table, th, td { border: 1px solid #444; }
      th, td { padding: 10px; text-align: left; }
      th { background: #f0f0f0; }
   </style>
</head>
<body>

<h2>Dashboard Absensi - Politeknik Jakarta Internasional</h2>

<table>
   <tr>
      <th>Nama</th>
      <th>UID</th>
      <th>Waktu</th>
   </tr>

   <?php while ($row = mysqli_fetch_assoc($log)) { ?>
   <tr>
      <td><?= $row['nama'] ?></td>
      <td><?= $row['uid'] ?></td>
      <td><?= $row['waktu'] ?></td>
   </tr>
   <?php } ?>

</table>

</body>
</html>
```



Conclusion

Based on the results of the study, it can be concluded that:

1. The RFID-based attendance system using the MFRC522 and Arduino Uno was successfully designed and implemented.
2. Integration of the system with an XAMPP server enables automatic recording of attendance data into the database.
3. The system can improve efficiency, speed, and accuracy of attendance recording and reduce the potential for data manipulation.

Recommendations

Based on the development and testing of this application, the following recommendations are proposed:

1. Integrate a camera for face recognition.
2. Use RFID with higher frequency (HF/UHF) for improved range and performance.

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