**Arduino-Based RFID and Fingerprint Sensor Attendance System**

The Arduino-Based RFID and Fingerprint Sensor Attendance System is a sophisticated and efficient solution designed to automate attendance tracking. The system leverages RFID technology, fingerprint recognition, and data storage capabilities to streamline the process of recording attendance. With the ability to enroll up to 120 fingerprints and store data on an SD card, this system ensures secure, accurate, and tamper-proof attendance records. A 20x4 I2C LCD display provides real-time feedback and status updates to the users.

**Features**

1. **Integrated RFID and Fingerprint Verification:**
   * Combines RFID card reading and fingerprint scanning for dual authentication, enhancing security.
2. **Data Storage on SD Card:**
   * Stores all attendance data on an SD card for easy retrieval and backup, maintaining detailed logs of user IDs, times, and dates.
3. **Real-Time Clock (RTC) Module:**
   * Integrates an RTC module to provide accurate time and date for timestamping attendance logs, ensuring precise tracking of attendance history.
4. **User-Friendly LCD Display:**
   * Features a 20x4 I2C LCD display to show real-time attendance status and messages, displaying information such as welcome messages, attendance confirmations, and error notifications.
5. **Capacity for Multiple Users:**
   * Supports the enrollment of up to 120 fingerprints, making it suitable for larger groups, with each fingerprint linked to a unique RFID card for individual identification and record-keeping.

**Components**

* **Arduino Uno:** Central microcontroller that coordinates all components.
* **RFID Reader Module (RC522):** Reads RFID tags/cards and communicates with the Arduino.
* **Fingerprint Sensor Module:** Captures and verifies fingerprint data.
* **20x4 I2C LCD Display:** Provides a user-friendly interface to display attendance information.
* **Real-Time Clock (RTC) Module (DS3231):** Maintains accurate time and date for timestamping.
* **SD Card Module:** Stores attendance logs in a structured format.
* **Power Supply:** Ensures consistent power to all components.
* **Other Components:** Breadboard, jumper wires, LEDs, buzzer.

**Applications**

* **Educational Institutions:** Schools, colleges, and universities can automate student attendance.
* **Corporate Offices:** Streamlines employee attendance and time-tracking.
* **Events and Conferences:** Efficiently manage attendee check-ins and participation records.

**Connections**

* **I2C LCD Module**
  + VCC -> 5V
  + GND -> GND
  + SDA -> A4
  + SCL -> A5
* **RTC (Real-Time Clock)**
  + VCC -> 5V
  + GND -> GND
  + SDA -> SDA pin on Uno
  + SCL -> SCL pin on Uno
* **Buzzer**
  + GND -> GND
  + VCC -> D4 pin of Uno
* **LED**
  + GND -> GND
  + VCC -> D4 pin of Uno
* **Fingerprint Sensor**
  + VCC -> 5V
  + GND -> GND
  + Yellow -> RX (2)
  + Green -> TX (3)
* **RFID Sensor**
  + SDA -> 10
  + SCK -> 13
  + MOSI -> 11
  + MISO -> 12
  + GND -> GND
  + 3.3V -> 3.3V of Uno

**Steps**

1. **Install Libraries:**
   * Download the folders LiquidCrystal\_I2C and RTClib.
   * Copy these folders to your Arduino libraries folder and restart the Arduino IDE.
   * Install MFRC522 (library for RFID) and Adafruit\_Fingerprint (library for fingerprint sensor).
2. **Verify Code:**
   * Open the main\_c.ino file and verify it. Ensure there are no errors in the code; if errors occur, there may be a problem with the library.
3. **Enroll Fingerprint:**
   * Open the fingerprint\_enroll file, upload it to your Uno, and make connections as mentioned.
   * Open the serial monitor, which will show steps to enroll your fingerprint.
4. **Set RTC Time:**
   * Open the main\_c.ino file, uncomment line 54, and upload the code (this is your main project code). Once you enroll your fingerprint, upload the main\_c code.
   * Check the time on the display. If it is correct, comment out line 54 and upload the code again to save the time in your RTC.
5. **Enroll RFID Card ID:**
   * Start your project and connect it to your Arduino IDE. Open the serial monitor and place your card near the RFID sensor. The serial monitor will show the ID of the card (e.g., {0x20, 0x8D, 0xBE, 0x59}).
   * Add these IDs to your code (lines 33-36). You can add multiple unique IDs.
   * Add names for the IDs on lines 41-45.