**PROGRESS REPORT**

**THE DESIGN OF AN IOT BASED STUDENT ATTENDANCE SYSTEM USING RADIO FREQUENCY IDENTIFICATION (RFID) AND FINGERPRINT**

**1. Project Overview**

* This project focuses on the design, implementation of an IOT based student attendance system using biometric fingerprint, and Radio Frequency Identification (RFID) tailored for taking attendance smartly in an educational domain.

Some Aims and Objectives

* Comprehensive literature review of existing attendance systems
* Comprehensive literature review of existing RFID systems
* Design of the RFID attendance system to ensure easy adoption and usability
* Performance evaluation.

**2. Current Status**

* Overall progress (60% of the work has been accomplished).
* System Capabilities
  + System Currently Is able to both store RFID tag and Fingerprint of person.
  + The system follows a sequential process of RFID tag check followed by the scan of the fingerprint image.
  + The system employs a client-server architecture using websocket communication protocol, where full duplex communication is established between the microcontroller board (esp32) and clients (devices) connected to its server.
  + For a person’s attendance to be taken, they must first be enrolled, so the system has the allowance for enrollment of persons and storing of their details in memory, then taking the attendance.
  + The system incorporates validation mechanisms to ensure both Fingerprint and RFID images and tags respectively are unique, thereby eliminating possibilities of impersonation and fraud.
  + The system facilitates data export in multiple formats for attendance data as text or a csv table.
  + The system has an interface for interaction with user where user enters the necessary prompts (name of person, course code etc.) necessary to take attendance.

**3. Completed Tasks**

* Hardware Design and Connection
* Connections between Esp32-Wroom-DA module and DY50 Fingerprint Sensor
  + - 3.3V pin of dy50 sensor to 3.3V of Esp32-wroom-da module.
    - GND pin of dy50 sensor to GND pin of Esp32-wroom-da module.
    - TX pin of dy50 sensor to GPIO16 pin of Esp32-wroom-da module.
    - RX pin of dy50 sensor to GPIO17 pin of Esp32-wroom-da module.
  + Connections between Esp32-Wroom-DA module and RFID-RC522
    - 3.3V pin of RFID to 3.3V pin of Esp32-wroom-da module.
    - RST pin of RFID to GPIO27 pin of Esp32-wroom-da module.
    - GND pin of RFID to GND pin of Esp32-wroom-da module.
    - MISO pin of RFID to GPIO19 pin of Esp32-wroom-da module.
    - MOSI pin of RFID to GPIO23 pin of Esp32-wroom-da module.
    - SCK pin of RFID to GPIO18 pin of Esp32-wroom-da module.
    - SDA pin of RFID to GPIO5 pin of Esp32-wroom-da module.
* Websocket Communication Protocol.
  + The ESP32 is configured for concurrent operation in both Station and Access Point modes.
  + The Web interface of the system is stored in the flash memory of the Esp32 board through LittleFS library.
  + When devices on the same network as the Esp32 access its IP address, they receive this Web Interface which is then Rendered by the browser.
  + Once connection is complete both the Esp32 and client begin to listen for incoming messages, and take action based on the message received.
* The system's core algorithms have been implemented
  + The person is made to put in their name before any enrollment is taken
  + Without enrolling, the person’s data isn’t stored in memory and their attendance cannot be taken
  + Enrollment and Attendance follows similar sequential process of scanning the RFID tag then taking the fingerprint image.
  + Checks are made to eliminate impersonation.
  + Attendance can be downloaded in multiple formats of text and csv.

**4. Ongoing Tasks**

* Refining the user interface to a more detailed design
* Optimizing data storage and retrieval for improved performance
* Implementing error handling and system robustness
* Testing the system with a larger dataset to ensure scalability
* Implementing data encryption for enhanced security

**5. Challenges and Solutions**

* Challenge: Ensuring the uniqueness of both RFID tags and fingerprints.
  + Solution: Implemented checks in the enrollment process to verify uniqueness before storing new data.
* Challenge: Managing websocket connections for multiple clients.
  + Solution: Implemented connection management and cleanup routines.
* Challenge: Ensuring system reliability in various network conditions
  + Solution: Implementing robust error handling and data synchronization mechanisms

**6. Timeline**

* Current progress: 60% completion.
* Estimated completion date: July 30th, 2024.

**7. Budget**

* Current spending vs. allocated budget.
* Any financial concerns or additional resource needs.

**8. Next Steps**

* Implement data persistence to retain information after system restarts.
* Develop a more comprehensive reporting system for attendance data.
* Enhance security measures for data protection.
* Conduct thorough system testing and bug fixing.
* Prepare user documentation and system manual.

**9. Risks and Mitigation**

* Data loss due to power failures Mitigation: Implement regular data backups and consider adding a small UPS.
* Scalability issues with larger number of students Mitigation: Optimize data structures and consider database implementation for larger datasets.
* Privacy concerns with biometric data Mitigation: Implement strong encryption for stored data and ensure compliance with data protection regulations

**11. Conclusion**

* The IoT-based student attendance system using RFID and fingerprint biometrics has made significant progress, with 60% of the work completed. The core functionalities of enrollment and attendance tracking are operational, with a working user interface and data export options. The next phases will focus on system refinement, enhanced reporting, and rigorous testing to ensure reliability and scalability.