Project Synopsis

Real-Time Secure Dashboard with RFID-Based Portfolio and Price Alerts

Abstract

This project proposes the development of a real-time, IoT-enabled smart dashboard using the ESP32 microcontroller. The system is designed to display publicly available live data such as weather conditions, stock and cryptocurrency prices, air quality index, and time/date on an OLED or LCD screen. This general information is accessible to all users without any authentication.

In addition to public data, the system also supports a secure, personalized financial portfolio feature. Users can configure their portfolio by adding selected assets (e.g., specific stocks or cryptocurrencies) through a companion mobile app or cloud platform. The portfolio data is encrypted and stored in a remote database. Access to this personal financial information is restricted using RFID-based authentication. Only when an authorized RFID tag is scanned does the system retrieve and decrypt the personalized data for display.

Furthermore, the system includes a real-time alert mechanism for price fluctuations in the tracked assets. It uses visual cues (RGB LED) or audible signals (buzzer) to notify users of significant changes in asset values. This project combines IoT, access control, data encryption, and real-time monitoring into a single practical solution.

Objectives

To build a smart dashboard that displays real-time public data including weather, air quality index, time/date, and asset prices.

To enable personalized financial portfolio tracking by allowing users to add their assets through a mobile app or cloud platform.

To implement RFID-based access control so that only authenticated users can view personal portfolio information.

To use AES or similar encryption for secure storage and transmission of personal financial data.

To develop a real-time notification system using LEDs and buzzers for price changes in tracked assets.

To demonstrate integration of secure communication, access control, and embedded systems in an IoT environment.

Hardware Components

ESP32 Dev Board – Microcontroller with Wi-Fi and BLE capabilities

RFID Module (MFRC522) – Used for access control and authentication

OLED or LCD Display – To show public and personalized data

RGB LED – To indicate price changes visually

Buzzer – To provide audio alerts for price changes

Power Supply – Battery or USB power for the ESP32 board

Jumper Wires, Breadboard – Circuit integration and prototyping

Software and Tools

Arduino IDE – Code development and flashing ESP32

Realtime Database(like Firebase) – Stores encrypted user data and public data

Automation tool (like n8n) – Fetches and automates public data input using APIs

AESLib – Encrypts and decrypts sensitive data (e.g., user portfolio)

SHA256 Library – Hashing for RFID UID verification

FirebaseESP32.h – Handles Firebase communication with ESP32

BLEDevice.h – Optional secure data transfer via Bluetooth

Working Principle

1. On startup, the ESP32 connects to the internet via Wi-Fi and pulls real-time public data (e.g., weather, AQI, asset prices) from Firebase or n8n and displays it on the screen.

2. Public information is continuously shown by default and is accessible to all users without authentication.

3. When an RFID tag is scanned, the UID is hashed and matched with authorized user entries.

4. If the tag is valid, the ESP32 requests the encrypted portfolio data for that user from Firebase.

5. The data is decrypted locally using an AES key and displayed securely on the screen.

6. The ESP32 continuously monitors prices of tracked assets and compares them to the previous values.

7. If a significant change is detected, it triggers a visual or audible alert using an RGB LED or buzzer.

8. Without RFID authentication, the system does not access or display any personalized data.

Security Features

RFID-based authentication to restrict access to personal data

SHA-256 hashing for secure RFID UID verification

AES-128 encryption for portfolio data stored in the cloud

Secure data transfer using HTTPS or optionally BLE for key exchange

Modular handling of encryption keys (static or dynamically updated)

Expected Outcomes

A functional prototype of a secure, real-time dashboard using ESP32

Display of real-time public information from online sources

Secure display of personal asset values using RFID authentication

Real-time alert mechanism for price change notifications

Demonstration of integrated hardware, software, and cloud systems

Applications

Personal finance tracking terminals with secure access

Smart dashboards for homes, labs, or offices

Educational tools for demonstrating IoT and cybersecurity

Embedded systems projects for showcasing integration of APIs, authentication, and hardware control

Tech demonstration models for exhibitions or classrooms

Team Members:-
Om Gupta- 24BIT0316
Nishaad Paunikar- 24BIT0264
Disha Singh- 24BIT0269
Aarav Jain- 24BIT0023
Chinmay- 24BIT0453