PBL: EMBEDDED SYSTEM AUTOMATION

PROJECT : GROUP-10

WiFi Door Lock Using ESP32-CAM and Blynk App

Abstract :

With the increasing need for smart security solutions, this project introduces a WiFi-enabled smart door lock system utilizing the ESP32-CAM and the Blynk app for remote access and monitoring. The system employs facial recognition technology for authentication, ensuring that only authorized individuals can unlock the door. The ESP32-CAM captures and processes images, matching them against a stored database to grant or deny access. Additionally, the Blynk app provides users with real-time control, notifications, and activity logs, allowing them to monitor and manage the lock remotely from their smartphones.

The integration of IoT and biometric authentication enhances security while maintaining user convenience. The system eliminates the need for physical keys, reducing the risk of unauthorized access due to lost or duplicated keys. Its cost-effectiveness and ease of implementation make it a viable option for smart home security. Future enhancements may include multi-factor authentication, AI-based facial recognition improvements, and integration with other smart home devices for a comprehensive security system.

With the rise of smart home technology and the increasing need for enhanced security, traditional door locking mechanisms are being replaced by advanced digital solutions. This project focuses on the development of a WiFi-enabled smart door lock system using the ESP32-CAM and the Blynk app. The system leverages face recognition for authentication, allowing only authorized individuals to access the door. By integrating the Internet of Things (IoT) with biometric security, this project provides a contactless, secure, and convenient way to manage home or office entry.

The ESP32-CAM, a low-cost microcontroller with an integrated camera, is used to capture images of individuals at the door. The device processes these images using built-in facial recognition algorithms, comparing them with a pre-stored

database of authorized users. If a match is found, the ESP32-CAM triggers a servo motor or relay module to unlock the door. If the person is unauthorized, the system remains locked and can send a real-time alert to the user via the Blynk app.

The Blynk app plays a crucial role in remote access control. Through the app, users can monitor door activity, receive instant notifications, and manually unlock or lock the door if needed. The integration of cloud-based control ensures that the system remains accessible from anywhere, enhancing security by allowing remote intervention. Additionally, the system maintains access logs, which can help in tracking entry and exit times for better security management.

This project offers several advantages over traditional and keypad-based locking systems. Firstly, it eliminates the need for physical keys or access codes, reducing the risk of unauthorized duplication or password leaks. Secondly, it enhances security by requiring biometric verification, which is difficult to bypass. Thirdly, it provides real-time monitoring, which allows users to stay informed about any access attempts. Moreover, the system is cost-effective, as it uses readily available components like the ESP32-CAM, servo motors, and a WiFi-enabled microcontroller, making it an affordable and scalable solution.

Despite its advantages, the system also has some limitations, such as dependency on internet connectivity for remote control and potential challenges in low-light conditions for facial recognition. However, these challenges can be addressed by integrating infrared (IR) cameras for better image capture in the dark and adding alternative authentication methods such as RFID or fingerprint scanning for enhanced reliability.

In conclusion, this project successfully demonstrates a smart WiFi-based door locking system using the ESP32-CAM and Blynk app. It provides an efficient and secure alternative to traditional locking mechanisms by utilizing face recognition and IoT-based remote access. The project can be further enhanced with AI-powered facial recognition, multi-factor authentication, and integration with other smart home security systems. With its cost-effectiveness and ease of implementation, this smart door lock system has the potential to become a widely adopted security solution for homes, offices, and other restricted-access areas.