PBL: EMBEDDED SYSTEM AUTOMATION

PROJECT : GROUP-10

WiFi Door Lock Using ESP32-CAM and Blynk App

Abstract :

With the increasing demand for smart security solutions, this project presents a Wi-Fi-enabled smart door lock system integrating ESP32-CAM, the Blynk app, geofencing, and cloud storage using Firebase. The system enables remote access, real-time monitoring, and automated control, ensuring both security and convenience for the user.

This smart door lock system is designed to provide contactless authentication and remote control via a smartphone. The ESP32-CAM serves as the core component, capturing images of individuals at the door and storing them in Firebase Cloud Storage for future reference. Users can access these images and logs anytime through the Blynk app. A servo motor is used as the locking mechanism, which unlocks the door upon receiving a valid command. The system eliminates the need for physical keys, reducing security risks associated with lost, stolen, or duplicated keys. Additionally, a push button is integrated to provide a manual unlocking option.

The Blynk app allows users to control the door lock remotely, receive real-time status updates, and get notifications of access attempts and activity. Geofencing technology enables automatic unlocking when the owner's smartphone enters a predefined location and sends alerts if the owner leaves the area while the door remains unlocked. An auto-locking feature ensures that the door secures itself after a set period if left open. Cloud integration through Firebase enhances security by storing access logs, timestamps, and visitor images, allowing users to review past activity.

This smart Wi-Fi door lock system offers several advantages that enhance both security and convenience. By integrating IoT-based automation, it allows users to remotely control and monitor door access from anywhere through the Blynk app, eliminating the need for physical keys and reducing the risk of unauthorized duplication or loss. The incorporation of geofencing technology ensures seamless access by automatically unlocking the door when the owner's smartphone enters a predefined location and sending alerts if the door remains unlocked when the owner leaves. This automation minimizes human error and enhances home security. Additionally, the system’s integration with Firebase cloud storage enables real-time logging of access events and visitor images, providing a reliable and secure way to track entry history.

The use of a servo motor as the locking mechanism makes the design cost-effective and easy to implement without the need for complex mechanical components. Its remote access feature, combined with cloud-based logging, ensures that security is maintained even when the user is away. Furthermore, the system is scalable, allowing future enhancements such as multi-factor authentication, AI-powered facial recognition, and integration with other smart home devices for a more comprehensive security solution. Its affordability, ease of installation, and automation features make it a practical and efficient alternative to traditional locking mechanisms, offering an advanced level of security suitable for homes, offices, and other restricted-access areas.

By combining IoT-based automation, cloud computing, and geolocation-based control, this project enhances both security and user convenience. It eliminates the risks associated with traditional keys, provides remote monitoring, and ensures that access logs are securely stored in the cloud. Future improvements may include multi-factor authentication, AI-enhanced facial recognition, and integration with additional smart home security devices. This cost-effective and easy-to-implement solution offers a reliable smart lock system suitable for homes, offices, and other restricted-access areas.