ADHIYAMAAN COLLEGE OF ENGINEERING[AUTONOMOUS], HOSUR-635130

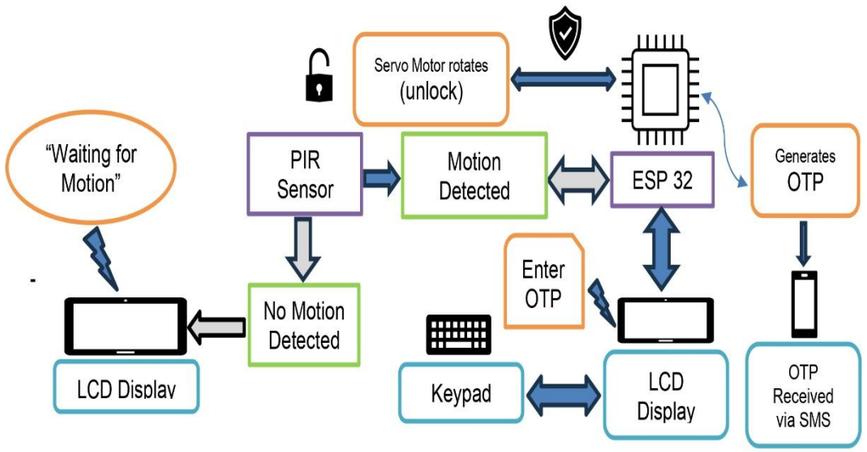
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

IoT-POWERED OTP-BASED VAULT SECURITY SYSTEM

OBJECTIVES

- To design a smart and affordable vault security system using IoT and dynamic OTP-based authentication.
- To implement motion-triggered OTP generation using a PIR sensor for efficient intrusion detection.
- To transmit OTPs via Twilio API using Wi-Fi, enabling real-time SMS alerts without GSM dependency.
- To verify user identity through a keypad interface, ensuring secure access through time-sensitive OTP entry.
- To integrate a servo-controlled locking mechanism that physically restricts access based on authentication.

BLOCK DIAGRAM



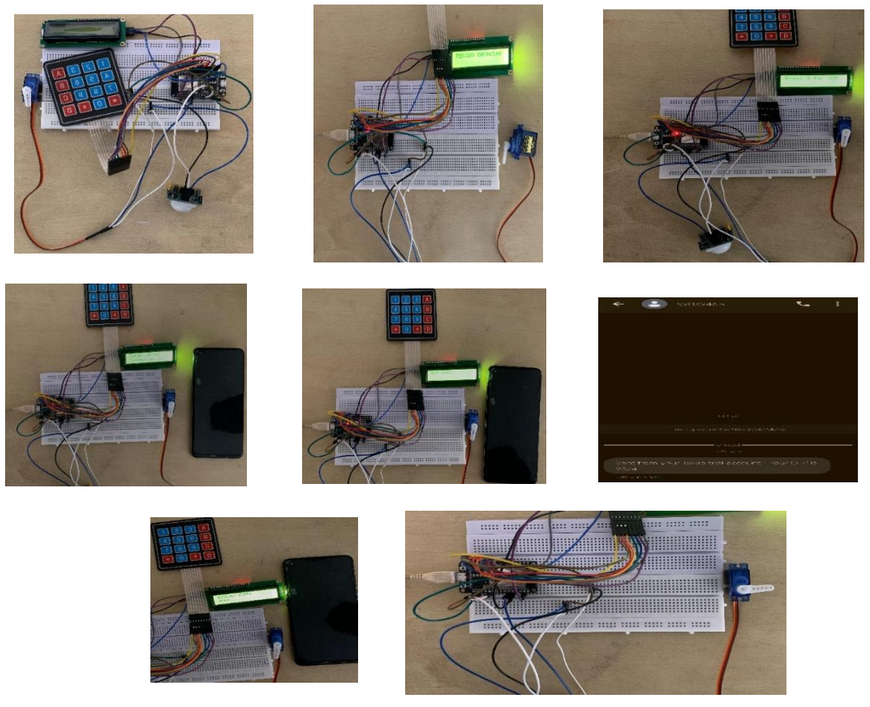
WORKING PRINCIPLE

- A PIR sensor continuously monitors the area near the vault. When motion is detected, it activates the system.
- The ESP32 microcontroller instantly generates a random 4-digit OTP upon motion detection.
- The generated OTP is sent to the registered mobile number using the Twilio SMS API over Wi-Fi.
- The user enters the received OTP using a 4x4 matrix keypad. The '#' key acts as the Enter command.
- The entered OTP is verified against the stored one on the ESP32. If it matches, access is granted.
- A servo motor unlocks the vault if authentication is successful. If incorrect, the system prompts for OTP regeneration.

EXPERIMENTAL SETUP

- PIR Motion Sensor is connected to the ESP32 (VCC to 3.3V, GND to GND, OUT to digital pin) to detect movement near the vault.
- 4x4 Keypad is interfaced with eight digital GPIO pins of the ESP32 to capture OTP input from the user, with the '#' key used for submission.
- Servo Motor is connected to a PWM-capable pin of ESP32 for controlling the vault lock mechanism, with VCC powered via 5V and GND common.
- 16x2 LCD (I2C) is linked to ESP32 through SDA (D21) and SCL (D22) pins for displaying system messages like OTP prompts and status updates.
- Wi-Fi Connection enables the ESP32 to communicate with the Twilio API, sending OTPs to the user's phone via internet-based SMS.
- Common Grounding and Stable Power Supply are ensured using a 5V USB or battery, with proper regulation to avoid voltage spikes affecting sensitive components.

EXPERIMENTAL RESULTS



CONCLUSION

The proposed system ensures secure vault access using motion detection, keypad input, and OTP delivery via Twilio. The ESP32 efficiently manages all operations, while the modular design allows for future upgrades. It offers a reliable, cost-effective, and internet-based security solution suitable for modern smart homes and offices.

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