

Group 9:

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Laser Based Security System

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Overview

The objective of this project is to demonstrate our understanding of microprocessors and microcontrollers and their applications. Our team has decided to build an affordable security system that detects unauthorized entry and transmits alerts to a web-based dashboard in real time.

Key Features

1. **Laser Tripwire System:** Uses laser diodes to continuously emit a beam of light onto a LDR sensor. Upon interruption, the system detects a change and
2. **AES 256 Encrypted Alerts:** Uses AES-256 encryption to securely transmit breach notifications
3. **IOT-Based Notification System:** Uses ESP32 to send real time alerts to the dashboard
4. **Web-based Dashboard:** Developed with Flask (backend) and React (frontend) for real-time monitoring
5. **Solar/Rechargeable lithium Battery:** The system requires a power source, so Solar powered batteries for outdoor applications or rechargeable batteries for long term use.

Working Principle

Laser Diodes are used to emit beams of light. When paired with a Light-Dependent-Resistor, they form a complete circuit. Upon any interruption in the path of light, the circuit breaks. By connecting a microcontroller to the circuit, changes in the sensor output can be detected.

Since we want a microcontroller with Wifi and Bluetooth capabilities, older uC's like 8051 can not be used. 8051 is better suited for embedded systems, and is considered 8-bit, which does not provide the processing power necessary for encryption. Thus, we decided to use an ESP-32, a 32 bit microcontroller that features Wi-Fi connectivity. It is commonly used in smart home devices.

The ESP-32 encrypts the message using AES-256 and transmits it securely. Inside the server, a flask backend uses API calls to receive the encrypted data. Then, it is decrypted and assembled into JSON format for the React-based frontend to display.

Along with the warning, an alarm is triggered. This is the complete working principle of the laser based Security System.

Components Required

Component	Cost
Laser Diode (KY-008)+ Light Dependent Resistor(LDR)	₹200
ESP32	₹500
Small Solar Cell/Battery	₹500 - ₹1000
Miscellaneous (PCB, Wires, Casing)	₹500 - ₹1000
Total	₹1,700

Expected Outcome

- a functional laser-based security system with real-time encrypted alerts.
- A secure web-based dashboard for remote monitoring.
- An affordable and scalable security solution.

Conclusion

This project aims to develop a robust and secure laser-based intrusion detection system that ensures confidentiality and efficiency using AES-256 encryption. With real-time monitoring and IoT-enabled communication, this system can be implemented in various security-sensitive environments.