

ENGR 331 Project Proposal

Proximity Security System

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Problem Statement:

The goal of this project is to design a device that detects movement in a darkened room and evaluates threat levels based on proximity. When an object or individual comes within a predefined distance of the device, the system will activate an alarm (buzzer) and display warning messages to indicate the severity of the threat. Additionally, the system will feature tamper detection to detect and respond to any attempts to move the device.

REQUIREMENTS

The system SHALL:

1. Processor and Operation

- Operate using an ARM Cortex M4 processor.
- Function autonomously without manual intervention after initial setup and power-on.
- Be capable of performing real-time sensor data acquisition, processing, and decision-making without noticeable lag.

2. Power and Battery

- Be powered by a battery/battery pack with a minimum continuous operation time of **2 hours** under typical operating conditions.
- Power-saving modes to optimize battery life without compromising the system's responsiveness.

3. Light and Tamper Detection

- Use a **light sensor (photoresistor)** to detect the lighting in the room or environment and automatically arm the system when the lights are turned off.
- Implement tamper detection using the **LIS3DSH MEMS accelerometer** to identify any attempts to move or displace the device. The system shall respond by sounding an alarm and logging into the tampering event.

4. Proximity Detection and Threat Level Assessment

- Utilize an **HRS04 ultrasonic sensor** to detect the closeness of objects or individuals in the environment. It will continuously monitor objects entering a predefined threshold distance.
- The system shall trigger an alarm/buzzer when the object detected is within the threshold and display the message "Danger" on the **LCD screen**.

5. Message Display

- Use an **LCD screen** to display the status of the system. The LCD shall display "Armed" when the system is powered on and "Danger" when the sensors detect a threat.
- The LCD shall also provide a real-time proximity reading(distance) or threat level indication when an object is detected.

6. Alarm and Response

- Activate an **alarm/buzzer (WT-1205)** whenever the system detects an object or individual that crosses the predefined proximity threshold.
- The system shall differentiate between various threat levels (e.g., low, medium, high) based on the distance to the detected object and provide distinct audio and visual indicators for each level.

7. LED Proximity Indicators

- Use **LED indicators** to display how close an object or individual is to the system. The LEDs shall be arranged to represent proximity levels
- The LEDs shall light up progressively as the detected object moves closer to the system, providing a visual indication of threat severity.

8. System Reset and Manual Override

- Include a manual override to reset or deactivate the system if needed (e.g., through a button press or external command).
- The system shall automatically reset and return to an "Armed" state after the alarm is triggered and the threat is no longer detected.

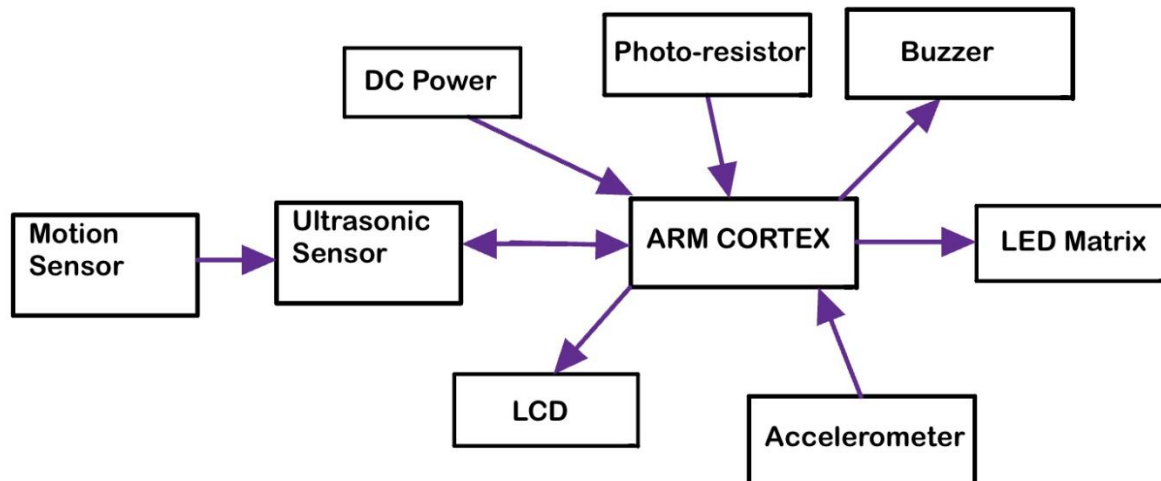
9. User Interface and Feedback

- The system shall provide clear user feedback through the **LCD screen**, **LED indicators**, and **alarm/buzzer** to ensure the user is aware of the system's status and any detected threats.
- The user shall be able to configure system settings (e.g., threshold distance, sensitivity) via a simple interface or external configuration method.

PROPOSED SENSORS AND ACTUATORS

1. **Light Sensor (Photoresistor)** – Used to detect ambient light levels for system activation.
2. **HRS04 Ultrasonic Sensor** – Utilized for proximity detection to measure object distance.
3. **LIS3DSH MEMS Accelerometer** – Onboard sensor for motion or tilt detection, integrated within the STM32 board.
4. **Speaker/Buzzer (WT-1205)**– Used with a PWM to change tone and sound level depending on threat level
5. **LCD Screen** – Displays messages such as "Armed" or "Danger" based on sensor input
6. **LED Matrix** – We will use a blank circuit card to design our own to use a PWM to turn on certain lights and different rates to display threat level.

System Block Level Diagram:



UPDATED:

Instead of ordering a LED Matrix, we are going to use individual LEDs so a PWM can be utilized.