PROBLEM STATEMENT

Utilizing the MBED RTOS, create an alarm security system that users can program, set, and use ensure their property remains safe.

This system will be used as a traditional alarm system; more specifically, the system will be triggered if there is sound nearby or if there is motion detected. Then, if the system is triggered and not disarmed by the end of the alarm countdown, the authorities will be notified. The system also functions as an audio passthrough system. This allows the owner to speak to people near the alarm system – similar to a Ring Doorbell.

This system intends to contribute to the safety application area. By providing an intuitive and accessible security interface for individuals, people will be more likely to invest in a security alarm system. This will hopefully deter people from attempting to burglarize property or from harming other people. In other words, creating a system that reduces crime in specific areas will generate an overall increase in people's safety.

INITIAL CONSTRAINTS AND SPECIFICATIONS

The system must be capable of the following functionality:

- Define an initial security code when first powered on
- Arm the system or disarm the system by pressing "A" (After security code is entered)
- Display the system status when idling (No button has been pressed in 10 seconds)
- Trigger the armed alarm system when an active sensor has been tripped
- Notify system owner which sensor has been tripped upon alarm system trigger
- At all times, show which sensors are activated
- "Alert authorities" if system is not disarmed within 10 seconds after triggered
- Must run "forever"

The system is subject to the following constraints:

- The active alarm sensors shall be a microphone sensor and ultra-sonic range sensor
- The active sensor status must be shown on individual LEDs
- The ultrasonic sensor shall not be activated by stationary distant objects
- The microphone sensor shall not be triggered by ambient sound
- When triggered, an active buzzer shall activate, and LEDs must flash
- The triggered system countdown shall be displayed on a seven-segment display
- The system shall take input from a 4x4 keypad matrix

ASKS

The purpose of this system is to provide an intuitive and cheap alarm security system which consumers can use to create a safer space. This could mean having a better protected home, business, or area in the form of surveillance.

The system will take input from a ultrasonic sensor to keep track of nearby objects, a microphone to detect loud noises, and a 4x4 matrix keypad which the user will use to control the system (arming, disarming, setting the pin, etc.).

In terms of outputs, the UI will be controlled on a 1602 LCD display, a seven-segment display will be used for the triggered system countdown, an active buzzer will serve as the auditory queue for the triggered system, and several LEDs will be used as system indicators for when sensors are active, alarms are triggered, or system input is detected.

This system must not activate from normal environmental conditions. More specifically, it should be able to ignore ambient sounds such as wind, rain, and other light sounds. Furthermore, it should be able to discern stationary objects that should not trigger the ultrasonic sensor. This means walls, furniture, and other items that do not move, should not trigger the system. The system must also have the capability of being armed and disarmed through the keypad and output to the correct indication LEDs or displays when alarms are triggered or sensors or active.

PRELIMINARY BOM

The following materials are needed for this system:

- 1602 LCD with I2C chip: Used to display the UI
- Nucleo-L4R5ZI: This microcontroller will control the system logic
- 4x4 Matrix Keypad: System input device the user will control
- Solderless Breadboard: Provides an easy way to connect the parts together
- Jumper wires: Provides connections between the pieces
- LEDs: Will be used as outputs to indicate various events such as alarms or inputs
- Microphone sensor: Used to detect nearby sound
- HC-SR04 Ultrasonic Sensor: Used to detect nearby motion
- One Digit Seven Segment Display: Used for Alarm Countdown
- Active Buzzer: Used as the alarm sound of the triggered system