*EECS3201 F Final Report**

# Home Security System

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## Abstract

Our project is a home security system. Some of the features of this project are; a mode system to change the security mode, an alarm system that goes off when the door is opened and password saving/changing for the security (passcode is 4 bits long). We should be able to create a physical representation of the idea and run some trials. *Link to our video*

## Design

### HCSRO4.v

The design of this file was inspired by @tuansydau's project, specifically the sonic.v file. You can see in our code however that we implemented the communication utilizing an ASM (Moore) design instead since this suited better with the content of the course. We have five states as follows;

- *'IDLE (Reset)'*: Resets instances and signals, and prepares for a measurement request.
- *'SEND_PULSE'*: Makes a measurement request by driving sensor input high for 10us.
- *'WAIT_ECHO'*: Wait for sensor output (echo) to respond (echo goes high).
- *'MEASURE'*: Count elapsed microseconds the sensor output has been high; datasheet specifies distance is proportional to elapsed time.
- *'WAIT_CYCLE'*: Wait for next measurement; datasheet specifies 60ms delay.

### ModeMessage.v

This module is responsible for displaying different messages on the seven segment display depending on the System State and Input. We implemented it using a Mealy machine with five states as follows:

- *'UNARM'*: Displays 'unarm' on the seven segment display.
- *'ARMS'*: Displays 'armS' on the seven segment display.
- *'ARMA'*: Displays 'armA' on the seven segment display.
- *'RESET'*: Displays 'reset' on the seven segment display.
- *'DISPLAY'*: Displays the contents of the 4 bit input on the seven segment display (responsive to changes in input).

### AlarmDrive.v

This module is used to perform a pattern on leds and play the buzzer for each Alarm State. We implemented it using a Moore machine with four states as follows:

- *'ALRMOFF' (Alarm Off)*: Buzzer and all leds are off.
- *'ALRMON' (Alarm On)*: Red leds and buzzer blink/buz every second, blue led is off.
- *'AWAYSEQ'* (Away Sequence): Red leds and buzzer are on, blue led is off.
- *'PLCCLD'* (Police Called): Blue led and buzzer turn on and off every second, red leds are off.

### SecuritySystem.v

This module is the main file and responsible for the whole system. Drives all operations by controlling the states and inputs/outputs of the above modules. We implemented it as a Mealy machine with four states as follows:

- *'UNARM'*: Displays 'unarm' message, alarm is off.
- *'ARMS'*: Displays 'armS' message. Checks periodically if distance measured is smaller than threshold, if so alarm state is set to ALRMON. If the correct passcode is not entered in less than 10 seconds, an alarm state is set to PLCCLD to symbolize police being called.
- *'ARMA'*: Displays 'armA' message. In the first 2 seconds the alarm state is set to AWASEQ, giving a time window for the user to leave the area. After 2 seconds the operation is identical to the ARMS state above.
- *'RESET'*: Displays 'reset' message. If the correct passcode is entered, allows the user to reset the passcode; the new passcode is displayed.

# Appendix A: Video Script / Procedure

1. Show board and setup of the security system. Realistically be on a wall with the sensor being placed higher up so that there is no disturbance from people going near the door.
2. Going the reset mode and changing the password, showcasing that the passcode cannot be changed without having the old passcode. Once the correct passcode is inserted and confirmed (via the confirm button) the owner is able to change the passcode. The confirm button is pressed twice to update the passcode; we showcase this and the new passcode being updated.
3. First security mode we show is the Unarm mode. This mode is designed for simple access to coming in and out without triggering anything. It will not trigger the leds, buzzer nor the police led (which signals if the police is called for a potential break-in).
4. The second security mode (first armed one) is Armed S (Armed Stay). This mode is designed for when a user is at home and not planning on going outside. It would trigger if the door is opened after setting it to this mode. When triggered, the alarm

would go off (red leds and buzzer) and if in a situation where it was not a break in (owners returning home) the passcode can be put in within a certain amount of time to stop the alarm. This time is set to 60 seconds on the actual system; for the video demonstration it is set to 10s. If the time is exceeded with no passcode, it is assumed to be a break in and the police led (signalling police notified) starts blinking with the buzzer.

5. The next mode is similar to the armed stay in the way it is triggered, however it has a different purpose. Armed A (away) is meant for times where no one is in the house. This mode would be set and a light buzzer with flat leds (not blinking) to signal everyone to leave before the system is armed. This will not trigger an alarm during the time, giving adept time for people to leave; for the demo it is 2 seconds but in reality it would be ~15-30s. After the duration it is armed similar to Armed S and can be disabled by entering the passcode; in the demo we show the alarm going off to its full extent to showcase the police led.

# Sources


- @tuansydau EECS3201 Project (2020)
    - sonic.v
- HC-SRO4 Datasheet
- Our Project Video Demo