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University of Ottawa
Faculty of Engineering

School of Electrical Engineering
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CEG4166/CSI4141/SEG4145 Real Time System Design Winter 2024

To be submitted via <https://uottawa.brightspace.com/> on March 30 at 11:59 p.m.

Lab4: The addition of a PIR motion detector and buzzer from lab3 for the alarm system

1. Objective

The aim of lab 4 is to add a PIR motion detector and buzzer from lab 3 to the alarm system.

2. Development

Lab 4 is the second module in the alarm system project. In this lab, you'll add a PIR motion detector and a buzzer from Lab 3. When a warm body, such as a person or animal, passes by, the passive infrared (PIR) sensor first intercepts one half of the PIR sensor, causing a positive differential change between the two halves. When the warm body leaves the detection zone, the opposite occurs, and the sensor generates a negative differential change. It is these pulses of change that are detected.

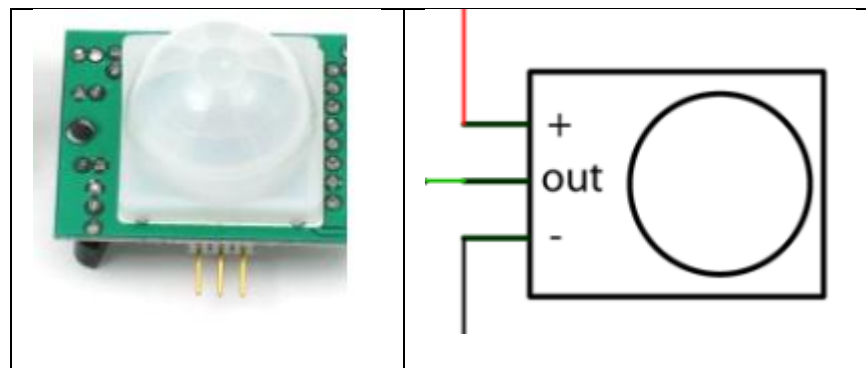


Figure 1 : PIR sensor

The buzzer is used to sound when a PIR has detected movement.

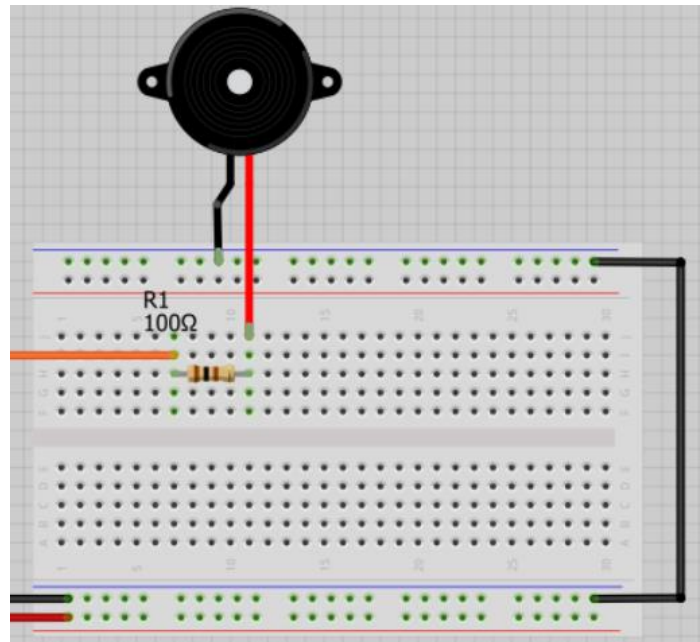
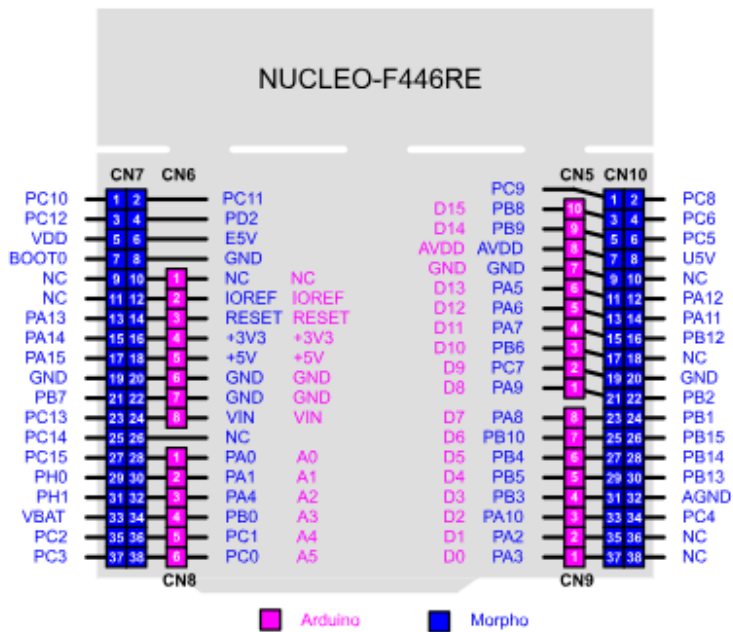
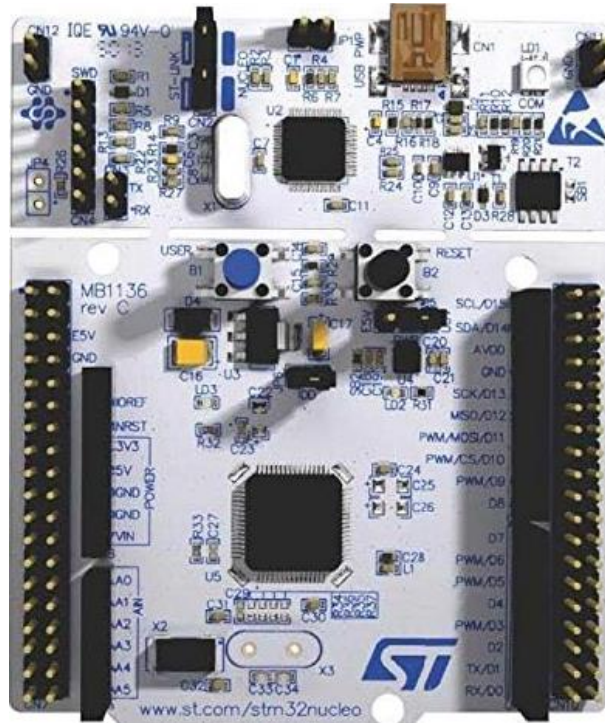


Figure 2 : Buzzer





Note that this application can be realized with a super loop, but it's mandatory to use tasks and choose their number correctly.

Considering the pins you've chosen for lab3, choose pins for the motion detector sensor (PIR) and the buzzer to sound the alarm. Lab4 completes Lab3. This means integrating the keypad and OLED into the alarm system. Once Lab4 is complete, you'll have an alarm system with all the basic functions:

- 1 Keypad for password creation, alarm arming and disarming.
- 1 OLED for alarm status display.
- 2 LEDs to indicate alarm status.
- 1 PIR for motion detection.
- 1 Buzzer to trigger alarm, etc.

A typical use case for your alarm system can be described as follows. The user arms the system. This means that the OLED displays ARMED, and the red LED is lit. The system waits 60 seconds before sounding the audible alarm to allow the user to leave the premises. After this time, the system must trigger the audible alarm if it detects movement. In this scenario, when the user returns from the premises, the system waits 60 seconds before triggering the buzzer to allow the user to disarm the system using the password. When the system is disarmed, the LED displays NOARMED and the green LED lights up. You can obtain a bonus of 3 points if you implement a countdown from 59 seconds to 0 seconds to warn the user to leave the premises or disarm.

3. Deliverables

- Brief description of the purpose and theory of the problem.
- Brief explanation of your solution algorithm.

- Design document.
- Screenshots of the application demonstration.
- Discussion.
- Conclusion.

4. Evaluation

- Points for correct operation of the application: /50.
- Points for the laboratory report: /50.