

**York University**  
**Lassonde School of Engineering**

**EECS 3215**  
**Embedded Systems**

**Motion Detection System**

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## Introduction

The persistence of security threats has made security become an intrinsic part of our everyday lives. The apparent need for security has spurred the demand for security alarms and as a result fueled the development of new alarm system technologies, one of which is the motion sensor alarm system. A motion sensor alarm system is a circuit that triggers an alarm when a movement is detected relative to its surroundings. It offers protection and security in both residential and commercial areas, an alternative solution to the often pricey alarm systems, and has the advantage of being portable and easy to install.

## Hardware Schematics

The motion sensor alarm system is a circuit that triggers an alarm when a movement is detected relative to its surroundings. Once triggered, the alarm will remain on until it is turned off by the user.

Alarm System Main Components:

- PIR Motion Sensor
- BeagleBone Black
- LED

One of the main components of this system is the PIR motion sensor which detects movements by picking up infrared waves. Specifically, the sensor detects the motion of an object by the change in surrounding ambient temperature when the object passes across the detection range. When a movement is detected, the sensor outputs a logic high value which then triggers the alarm.

The PIR motion sensor used in this system has 3 pins which are all connected to the microcontroller as shown in the schematic diagram. The first pin is for the positive DC voltage to power up the sensor. This pin is connected to the 5V terminal of the microcontroller. The second pin is the output of the PIR which is high when the sensor detects a motion and low when no movement is detected. This pin is connected to the digital GIO pin of the microcontroller. The third pin of the sensor is the ground pin which is connected to negative DC voltage.

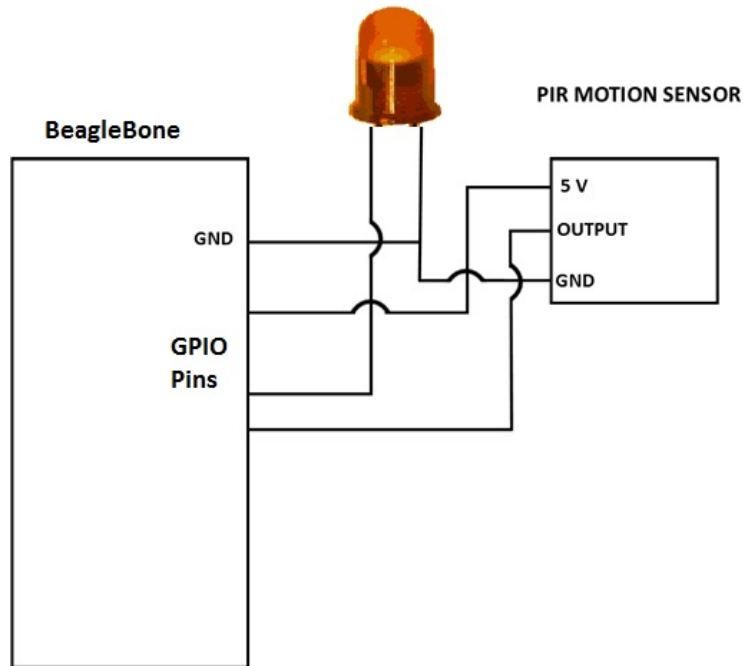


Figure 1. General hardware schematic of the Motion Alarm System.

## Software

The microcontroller is programmed such that it checks the PIR sensor every 3 seconds. For each 3 second interval, if the sensor detects temperature change then a motion is detected and the LED is turned on for a given period of time then turned back off. Otherwise, the LED remains off and the console outputs “No Motion Detected”.

```
var a = require('bonescript');
var led = "P8_13";
a.pinMode(led, 'out');
a.pinMode('P8_19', b.INPUT);
setInterval(checkPIR, 3000);

function checkPIR(){
a.digitalRead('P8_19', printStatus);
}
function printStatus(x) {
  if(x.value === 0){
    console.log("Motion Detected");
    for(var i = 1; i < 750; i++)
    {
      a.digitalWrite(led, 1);
      i++;
    }
  }
}
```

```
    }  
    a.digitalWrite(led, 0);  
  }  
  else{  
    console.log("No Motion Detected");  
    a.digitalWrite(led, 0);  
  }  
}
```

## **Conclusion**

Through this project, I was able to apply the theoretical concepts learned in class to build a simple embedded system. Specifically, I was able to design a motion detector system using the in-depth technical knowledge gained in class and in the lab regarding the use of LEDs, sensors, and microcontrollers. Overall, building the project was a great learning experience and served as an eye opening to the countless possibilities of embedded systems.