

Loomis Crowd Flow Monitoring

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Background



Why are we doing this?

Ever wonder when's the best time to come in and out of loomis without having to see too many people? Well this project is here for you!

What are we going to learn?

Crowd flow in loomis and its relation with room temperature.

Measurement parameters



- Temperature
- Time
- Pictures
- Motion

Sensors and Layout

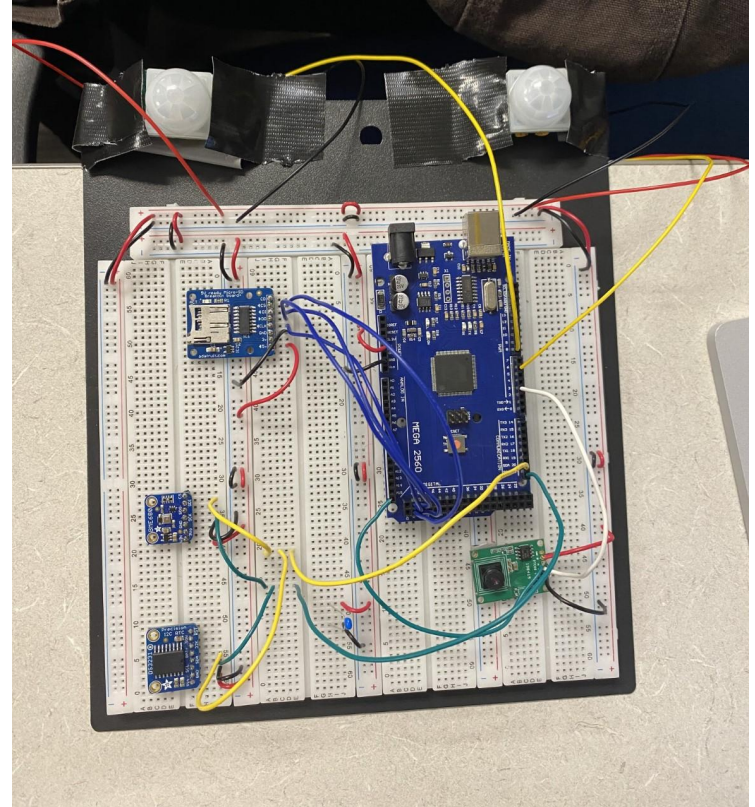
RTC - to create a timestamp for each dataset recorded, measures to 1 second

BME680 -to log the temperature, sensitivity is $0.01\text{ }^{\circ}\text{C}$

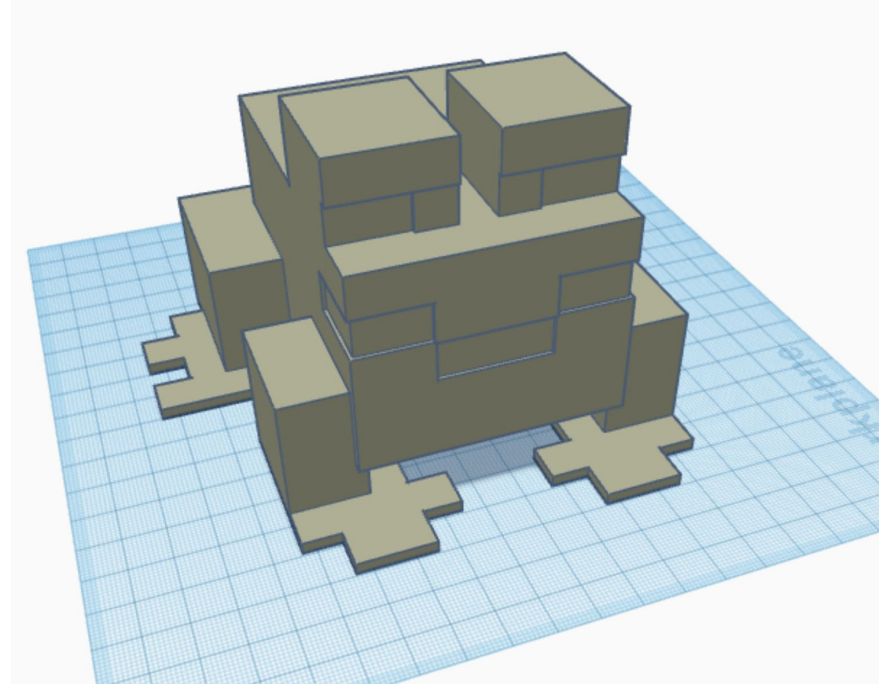
TTL Serial Camera - triggered by the motion sensors, used to record how many people are in each frame

2 PIR Motion Sensors - detects motion in an 110° range

MicroSD Breakout Board - loads pictures and data taken to be analysed



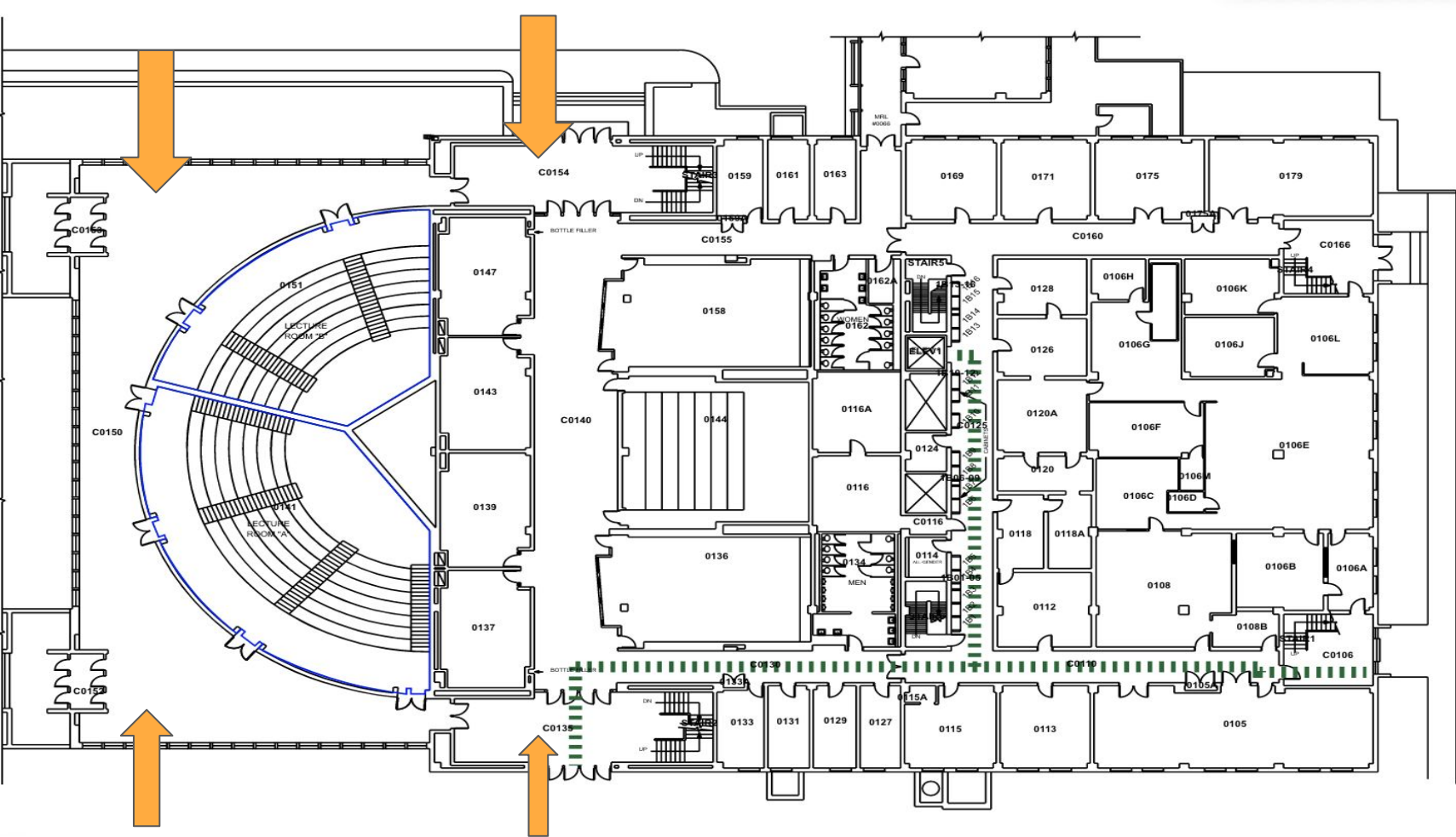
Frog - which one is our project?





Data acquisition

- Storing the data in CSV
- Quick calculations ...
 - Taking data from 10 am - 4 pm = 22,600 seconds
 - 48 KB per photo
 - 10 KB of other data taken in 6 minutes > 27.78 bytes/second
 - Assuming 48.027 KB per second > 1.0854102 gigabytes with 22,600 triggers throughout the day, which is an upper bound
- Our SD card has 64 GB storage, so it's plenty enough!



Arduino code



```
void loop() {
  valleft = digitalRead(inputPinLeft); // read input value
  if (valleft == HIGH) { // check if the input is HIGH
    digitalWrite(ledPin, HIGH); // turn LED ON
    Serial.print("LED triggered");
    delay(1000);
    if (! cam.takePicture())
      Serial.println("Failed to snap!");
    else
      Serial.println("Picture taken!");

    // Create an image with the name IMAGExx.JPG
    char filename[13];
    strcpy(filename, "IMAGE00.JPG");
    for (int i = 0; i < 100; i++) {
      filename[5] = '0' + i/10;
      filename[6] = '0' + i%10;
      // create if does not exist, do not open existing, write, sync after write
      if (! SD.exists(filename)) {
        break;
      }
    }

    // Open the file for writing
    File imgFile = SD.open(filename, FILE_WRITE);

    // Get the size of the image (frame) taken
    uint32_t jpglen = cam.frameLength();
    Serial.print("Storing ");
    Serial.print(jpglen, DEC);
    Serial.print(" byte image.");
  }
}
```

```
DateTime now = rtc.now();
float temperature = bme.readTemperature();
float pressure = bme.readPressure();
float humidity = bme.readHumidity();
// Write data to SD
myFile = SD.open("DATA.csv", FILE_WRITE);
myFile.print(now.year(), DEC);
myFile.print("-");
myFile.print(now.month(), DEC);
myFile.print("-");
myFile.print(now.day(), DEC);
myFile.print(",");
myFile.print(now.hour(), DEC);
myFile.print(":");
myFile.print(now.minute(), DEC);
myFile.print(":");
myFile.print(now.second(), DEC);
myFile.print(",");
myFile.print(temperature);
myFile.print(",");
myFile.print(humidity);
myFile.print(",");
myFile.print(pressure);
myFile.print(",");
myFile.println(datapoint, DEC);
myFile.close();
```




Data Analysis

The data points collected will be the time and temperature each time the motion sensor is triggered

Then, the number of people in each picture taken will be collected as well

This will be done in multiple locations on multiple floors around Loomis

The number of people will be analyzed against each variable, and trends will be determined



Plans for the future

Measure the crowd flow through 6 locations in Loomis

Determine if physical setup (orientation of device/specific location) needs changing

Collect data & analyze

- This is likely the largest next step



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