Lab – 8 Datasheet

CpE 4010: Sensors, Actuators, and Integration

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From procedure 3:

Motionless X-axis acceleration_____0 rad/s^2_____

Motionless, Y-axis acceleration_____0 rad/s^2_____

Motionless, Z-axis acceleration_____-0.59 rad/s^2_____

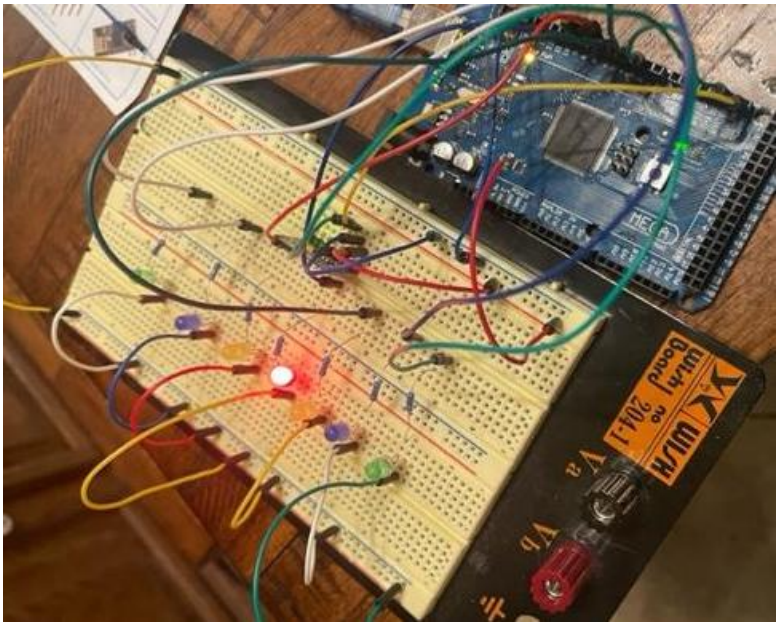
From procedure 4:

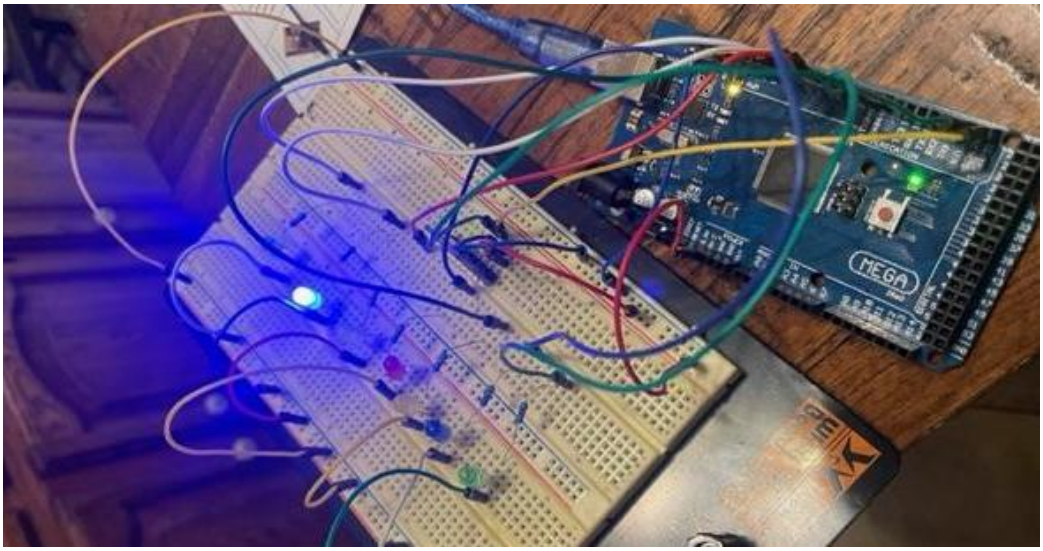
Experimentally-determined, minimum acceleration_____-12.04 rad/s^2_____

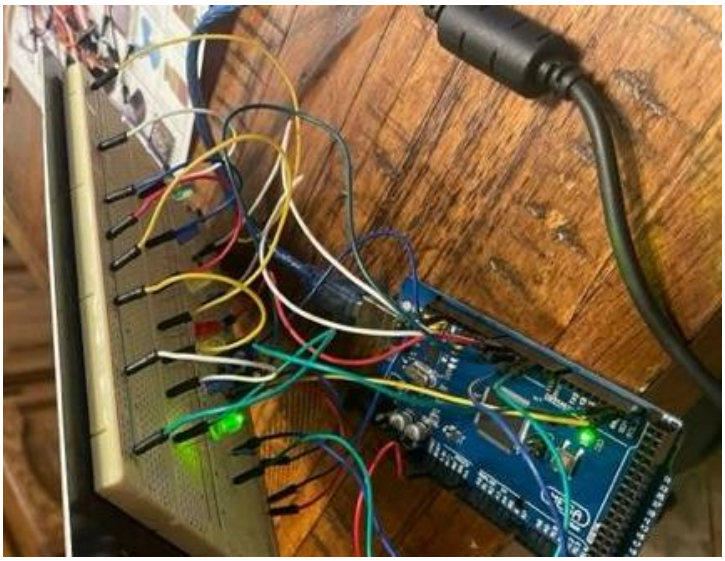
Experimentally-determined, maximum acceleration_____11.05 rad/s^2_____

From procedure 7:

Insert picture of your modified circuit with an acceleration LED illuminated here:







From procedure 8:

Insert a screenshot of your Serial Monitor window showing various acceleration message(s) here:

```
Acceleration X: 10.07 m/s^2, LED Index: 7
Acceleration X: 10.05 m/s^2, LED Index: 7
Acceleration X: 8.85 m/s^2, LED Index: 7
Acceleration X: 6.26 m/s^2, LED Index: 6
Acceleration X: 3.99 m/s^2, LED Index: 5
Acceleration X: 1.73 m/s^2, LED Index: 4
Acceleration X: 0.19 m/s^2, LED Index: 4
Acceleration X: -1.12 m/s^2, LED Index: 3
Acceleration X: -2.23 m/s^2, LED Index: 3
Acceleration X: -3.94 m/s^2, LED Index: 2
Acceleration X: -4.98 m/s^2, LED Index: 2
Acceleration X: -6.15 m/s^2, LED Index: 1
Acceleration X: -5.76 m/s^2, LED Index: 1
Acceleration X: -2.94 m/s^2, LED Index: 2
Acceleration X: 0.22 m/s^2, LED Index: 4
Acceleration X: 3.13 m/s^2, LED Index: 5
Acceleration X: 5.42 m/s^2, LED Index: 6
Acceleration X: 7.15 m/s^2, LED Index: 6
Acceleration X: 7.62 m/s^2, LED Index: 6
Acceleration X: 5.52 m/s^2, LED Index: 6
Acceleration X: 2.73 m/s^2, LED Index: 5
Acceleration X: -0.23 m/s^2, LED Index: 3
Acceleration X: -2.10 m/s^2, LED Index: 3
Acceleration X: -3.57 m/s^2, LED Index: 2
Acceleration X: -4.74 m/s^2, LED Index: 2
Acceleration X: -5.53 m/s^2, LED Index: 1
Acceleration X: -6.00 m/s^2, LED Index: 1
Acceleration X: -6.14 m/s^2, LED Index: 1
Acceleration X: -3.89 m/s^2, LED Index: 2
Acceleration X: -0.78 m/s^2, LED Index: 3
Acceleration X: 2.53 m/s^2, LED Index: 4
```

From procedure 9:

Insert a screenshot of your IDE code window showing your modified source code here:

```ino
#include <Adafruit_MPU6050.h>
#include <Adafruit_Sensor.h>
#include <Wire.h>

Adafruit_MPU6050 mpu;

const int numLeds = 7;
const int ledPins[numLeds] = {2, 3, 4, 5, 6, 7, 8}; // Adjust pin numbers as needed
const float maxAcceleration = 8.0; // Modify with your experimentally determined maximum acceleration

void setup(void) {
  Serial.begin(115200);
  while (!Serial)
    delay(10);

  Serial.println("Adafruit MPU6050 test!");

  if (!mpu.begin()) {
    Serial.println("Failed to find MPU6050 chip");
    while (1) {
      delay(10);
    }
  }
  Serial.println("MPU6050 Found!");

  mpu.setAccelerometerRange(MPU6050_RANGE_8_G);

  Serial.print("Accelerometer range set to: ");
  switch (mpu.getAccelerometerRange()) {
    case MPU6050_RANGE_2_G:
      Serial.println("+-2G");
      break;
    case MPU6050_RANGE_4_G:
      Serial.println("+-4G");
      break;
    case MPU6050_RANGE_8_G:
      Serial.println("+-8G");
      break;
    case MPU6050_RANGE_16_G:
      Serial.println("+-16G");
      break;
  }
```

```
  // Initialize LED pins
  for (int i = 0; i < numLeds; i++) {
    pinMode(ledPins[i], OUTPUT);
    digitalWrite(ledPins[i], LOW);
  }

  Serial.println("");
  delay(100);
}

void loop() {
  /* Get new sensor events with the readings */
  sensors_event_t a, g, temp;
  mpu.getEvent(&a, &g, &temp);

  // Calculate the normalized acceleration value between -1 and 1
  float normAccX = constrain(a.acceleration.x / maxAcceleration, -1, 1);

  // Map the normalized acceleration value to LED indices
  int ledIndex = int((normAccX + 1) * 0.5 * (numLeds - 1)) + 1;

  // Illuminate the corresponding LED
  for (int i = 1; i <= numLeds; i++) {
    digitalWrite(ledPins[i - 1], i == ledIndex ? HIGH : LOW);
  }

  Serial.print("Acceleration X: ");
  Serial.print(a.acceleration.x);
  Serial.print(" m/s^2, LED Index: ");
  Serial.println(ledIndex);

  delay(500);
}
```

From procedure 10b:

Insert a screenshot of your IDE code and Serial Monitor window showing different angles of rotation:

```
#include <Adafruit_MPU6050.h>
#include <Adafruit_Sensor.h>
#include <Wire.h>

Adafruit_MPU6050 mpu;

void setup(void) {
  Serial.begin(115200);
  while (!Serial)
    delay(10);

  Serial.println("Adafruit MPU6050 test!");

  if (!mpu.begin()) {
    Serial.println("Failed to find MPU6050 chip");
    while (1) {
      delay(10);
    }
  }
  Serial.println("MPU6050 Found!");

  mpu.setAccelerometerRange(MPU6050_RANGE_8_G);

  Serial.print("Accelerometer range set to: ");
  switch (mpu.getAccelerometerRange()) {
    case MPU6050_RANGE_2_G:
      Serial.println("+-2G");
      break;
    case MPU6050_RANGE_4_G:
      Serial.println("+-4G");
      break;
    case MPU6050_RANGE_8_G:
      Serial.println("+-8G");
      break;
    case MPU6050_RANGE_16_G:
      Serial.println("+-16G");
      break;
  }

  Serial.println("");
  delay(100);
}

void loop() {
```

```
void loop() {
  /* Get new sensor events with the readings */
  sensors_event_t a, g, temp;
  mpu.getEvent(&a, &g, &temp);

  // Calculate the roll angle (X-axis)
  float rollAngle = atan2(a.acceleration.y, a.acceleration.z) * 180.0 / PI; //Utilizing the formula mentioned in lecture

  Serial.print("Roll Angle: ");
  Serial.print(rollAngle);
  Serial.println(" degrees");

  delay(1000);
}
```

```
Roll Angle: -9.56 degrees
Roll Angle: -13.20 degrees
Roll Angle: 80.36 degrees
Roll Angle: 169.65 degrees
Roll Angle: -173.27 degrees
Roll Angle: 176.32 degrees
Roll Angle: 127.10 degrees
Roll Angle: -146.55 degrees
Roll Angle: -113.84 degrees
Roll Angle: -114.64 degrees
Roll Angle: -68.23 degrees
Roll Angle: -48.58 degrees
Roll Angle: -147.38 degrees
Roll Angle: -175.43 degrees
Roll Angle: 157.49 degrees
Roll Angle: 138.59 degrees
Roll Angle: 113.89 degrees
Roll Angle: 51.42 degrees
Roll Angle: -35.46 degrees
Roll Angle: -81.21 degrees
Roll Angle: 59.45 degrees
Roll Angle: 171.97 degrees
Roll Angle: -178.94 degrees
Roll Angle: -178.20 degrees
Roll Angle: 175.63 degrees
```

Conclusions:

Fixing Baud to 115200 was the biggest detail I missed at the start. Once that was handled I didn't have any more issues with the sensor and the leds.