Alexandria University
Faculty of Engineering
Computer and Systems Engineering Department

CSE343 Embedded Systems
Assigned: **Saturday 02/03/2024**
Due: **Saturday 09/03/2024**

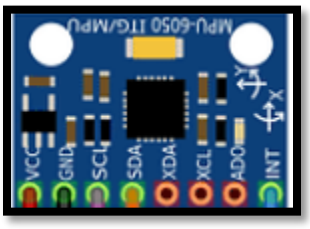
Lab Experiment 03-A

Objectives

Study on Inertia Measurment Unit (IMU).

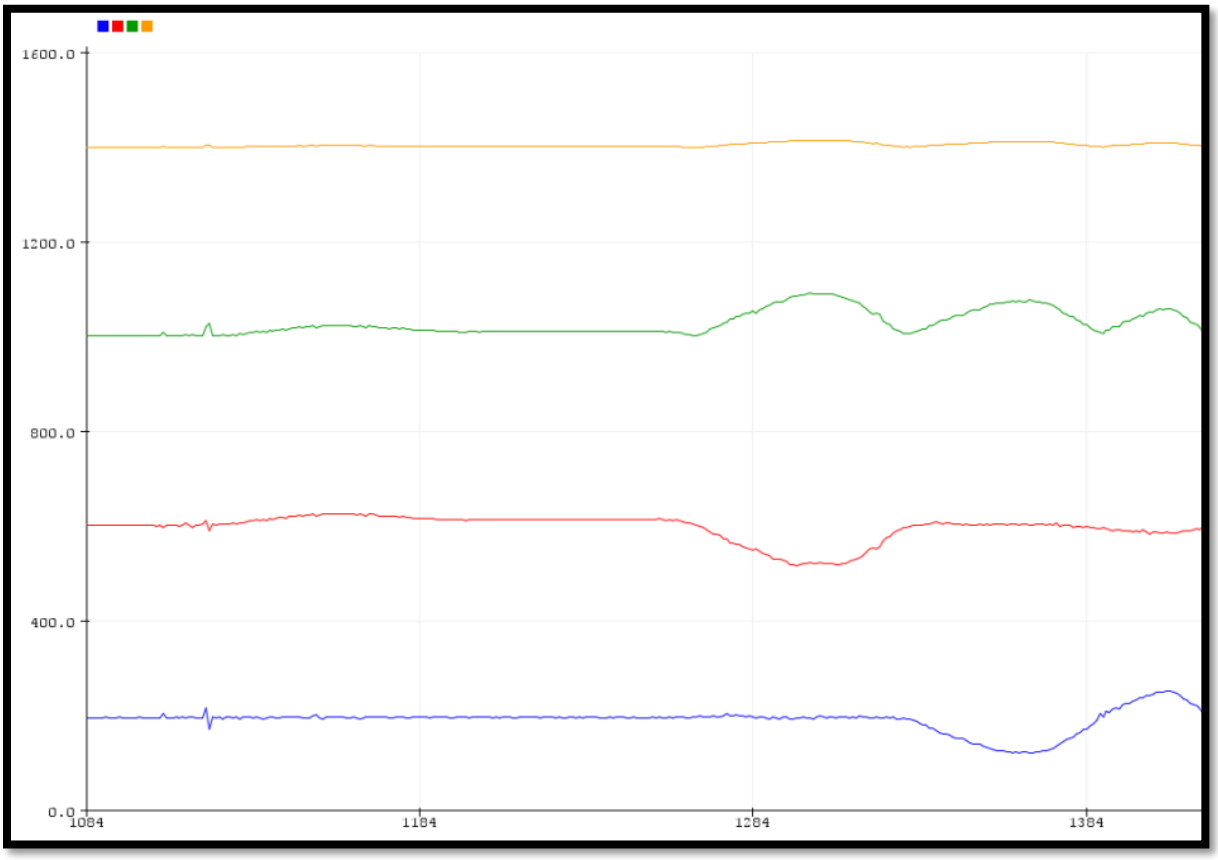
Part One: Basic Recording.

You are required to implement a software-hardware strategy to measure the acceleration angle. Initially the accelerometer is placed horizontally at rest as shown below(plan view).



As the time proceeds, rotate slowly the accelerometer horizontally and then vertically. Print the angle with x-axis, y-axis, and z-axis using serial print. You should adjust the plots for the angles to be aligned under eachother with 400 units vertically space in between and keep the plots for the angle to be from 0 to 360 degrees. In addition, plot the magnitude of the resultant acceleration after subtracting the bias g (16000 units magnitude of acceleration in z-axis) and normalize the graph to be from (0 to 360) with 400 units shift from the last angle printed. This is done in order to keep all the plots shown without overlapping and having equal areas of plotting over the plotter.

The following figure shows what is meant by the range mentioned. It is taken from previous offering submissions.



Implementation Details:

- You should import the mpu6050 and I2Cdev libraries and put them under the arduino libraries root directory.
- You will find the mpu6050 and I2C libraries in the following link: https://drive.google.com/file/d/1Tn8jaXYTmgxsiO6O5YYhFq6vUDpeBIAg/view?usp=sharing
- The basic source code you will find here. You need to adapt the code to implement the requirement. https://drive.google.com/file/d/16GZ5XCTI9nGlhSkIvCXvqwC49ja8K41d/view?usp=sharing
- The interfacing of MPU 6050 to arduino should look like this. You can ignore the Interrupt connection(INT).

- You can find MPU 6050 datasheet in the following link: https://www.alldatasheet.com/view.jsp?Searchword=Mpu6050%20datasheet&gclid=COrSnOWw9tICFdeIaAodVhwIMw

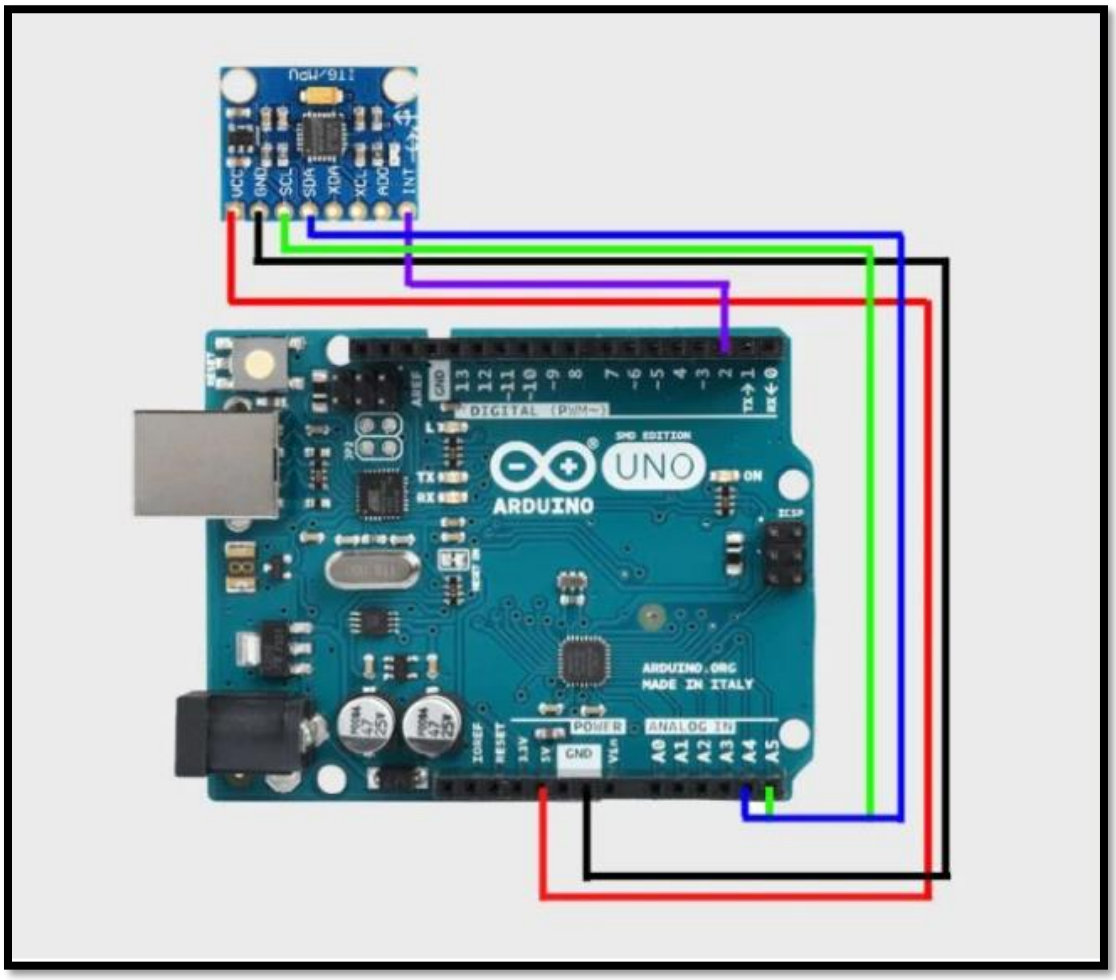


Figure from: https://robu.in/mpu6050-with-arduino/

Part Two: Data Stream Recording for Later Use

The basic problem in part one is that we can only process the data instantly, we need to adapt the strategy for later use. You are required to implement one of the following variants:

Variant One: Excel Data Streamer

- Record the last 100 readings using microsoft office excel data streamer(use Microsoft office 365 provided by our university or if you have a version of microsoft office 2016+). Use excel plotting to visualize the streamed data.
- Download and install the data streamer. You can check the foolowing link for download:
- https://www.microsoft.com/en-us/download/details.aspx?id=56976

- Disconnect the serial printer/plotter and now you can use the excel data streamer to record the readings.

Variant Two: Record the last 10 readings on Arduino Builtin EEPROM

- Modify the provided code to save the last 10 readings on the EEPROM. Process the data to get the steady state acceceleration (average of the 10 readings of the resultant acceleration). If the resultant acceleration exceeds ***1.2g,*** determine the force that caused this spike in acceleration.

Variant Three: Record the readings over the last 20 seconds on an external SD card using SD-Card Module

- Modify the hardware interfacing to use an external SD card module.
- Modify the code to save the readings over the last 20 seconds on the SD card.

Delivery Policy

- Each group must send a 20-second video for each of the two parts showing the scenario discussed.
- You should submit a report showing your schematic diagram and the challenges you faced (if any).
- You should submit the sketch source code (.ino file(s)).
- You should cite any additional resources you used.
- Further details for the submission instructions will be posted later on MS Teams.

Good Luck