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Lab 4

Q1. How many addressable registers are in the MPU-6050? (refer to the datasheet, register reference and example code)

* From the register map, and example code of MPU-6050, we could find that there were 82 total addressable registers.

Q2. What is the data format of I2C messages written to the MPU-6050?

* Just like in any I2C, data transmissions always start with a high to low transition on the data line while the clock line is high. Data is then transmitted in groups of 8 bits/1 byte. After every byte there is an acknowledge signal that determines whether more data can be sent or if the transmitter needs to wait.
* The actual data being sent is done serially and always starts with a 7-bit address with the 8th bit being R/W, then depending on where data is going to/from further bytes will either contain data, a register address, or a new 7-bit address + R/W if switching directions.

Q3. What factors affect the smoothness of your spinning cube sketch when using the raw data from the MPU-6050? Is averaging the data any help?

* For our sketch, the smoothness of the spinning cube is determined by how stable the values of gyro-rates are, even subtle fluctuations can cause from the gyroscope can cause the cube to act finicky. Because the moving average stabilizes the values of gyro-rates, it does help with the smoothness of the spinning cube by eliminating noise.

Q4. What is the performance cost of the Quaternion-based approach in part 3 over using raw data in part 2? Explain your measurement procedure.

* The quaternion-based approach involves a lot of calculations to turn the raw accelerometer/gyroscope data into actual quaternions. This having to be done on the fly for every single data point, especially since the calculations are done to floats, introduces a delay compared to using the raw data itself. This can be shown by using the graph program for each case and measuring the amount of time it takes for each graph to stabilize after moving the unit, the quaternion program has a noticeable delay.