Analysis Report for LAB-2

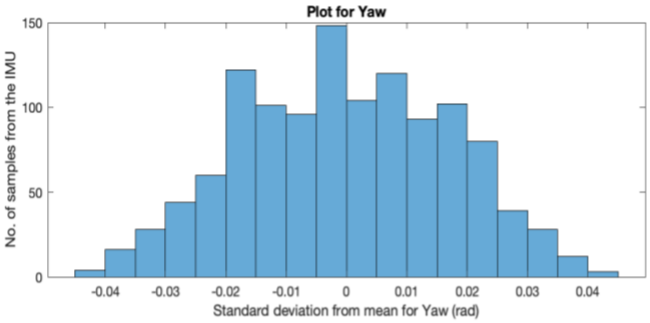
EECE5554: Robot Sensing and Navigation

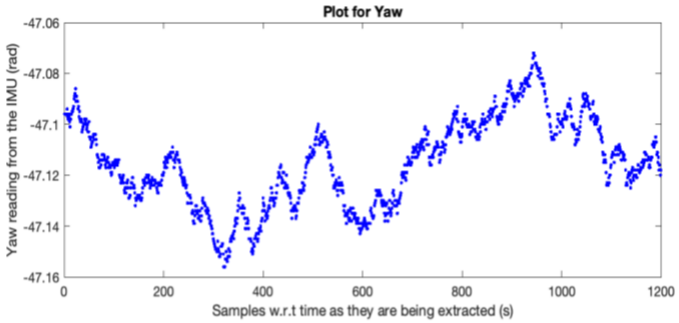
Topic Name: Navigation with IMU and Magnetometer

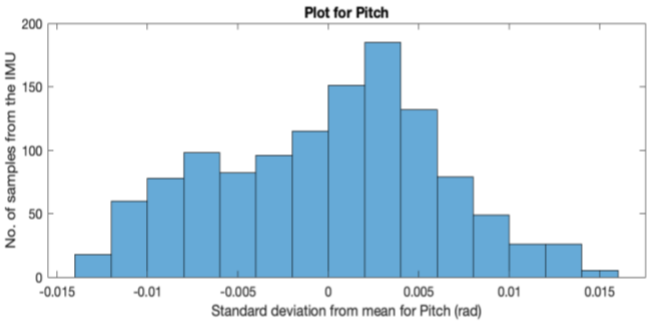
1. Analysis of Stationary IMU Data:

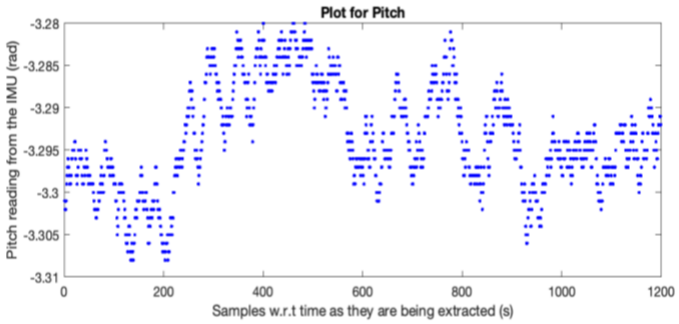
Data was collected by writing a device driver for IMU which would read in the input data using a serial emulator and use that to parse the required components. Reading for Yaw, Pitch and Roll were converted to Quaternions and were published to a predefined IMU message along with data for Angular Velocity and Linear Acceleration in all the 3 axis X Y Z.

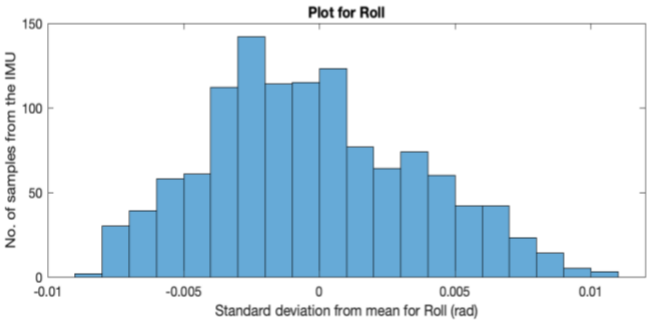
1.1. Time series plots for the Yaw, Pitch and Roll from the IMU:

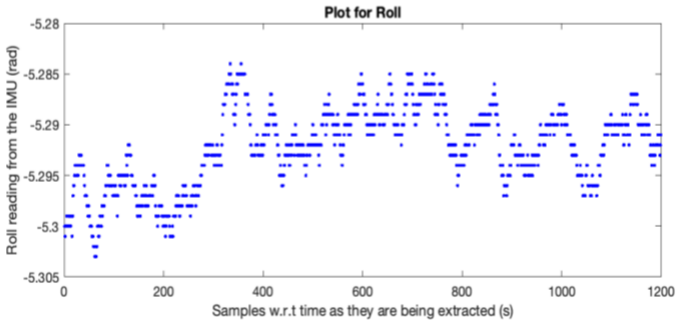








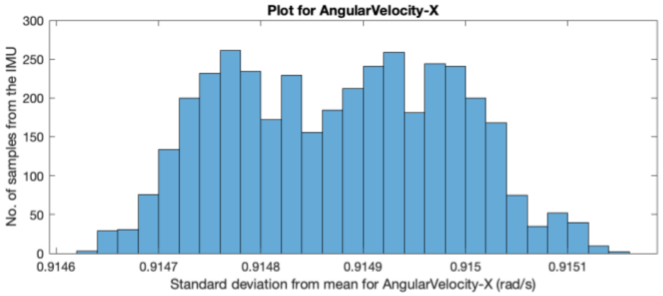


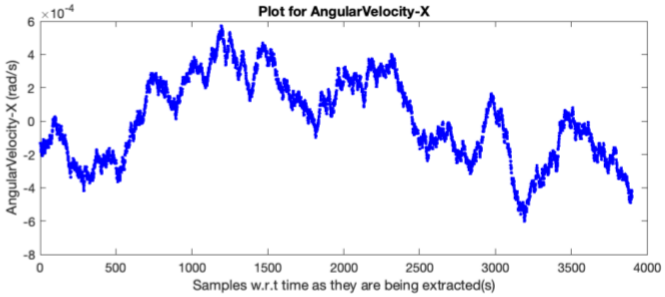


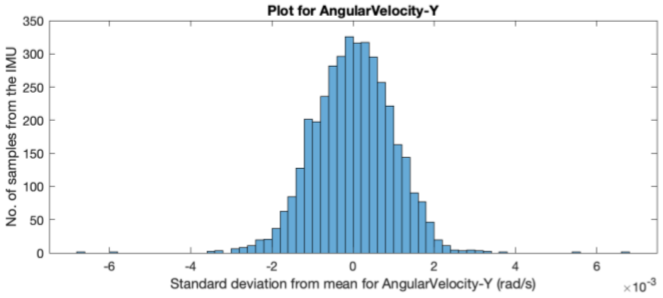
The distribution for the Yaw, Pitch and Roll is comparable to a Gaussian distribution. The output readings are pretty streamlined which shows that there is little deviation when the sensor is kept stationary at one location.

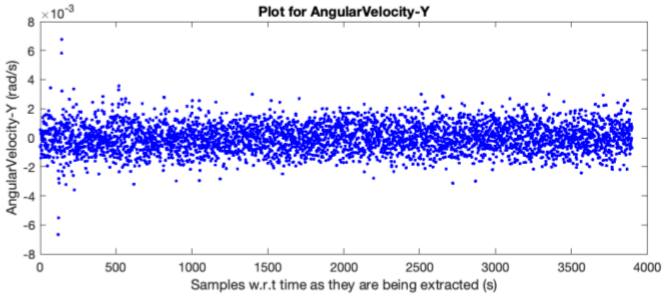
Mean Yaw: -47.11510222 radians
Mean Pitch: -3.293839144 radians
Mean Roll: -5.292108558 radians

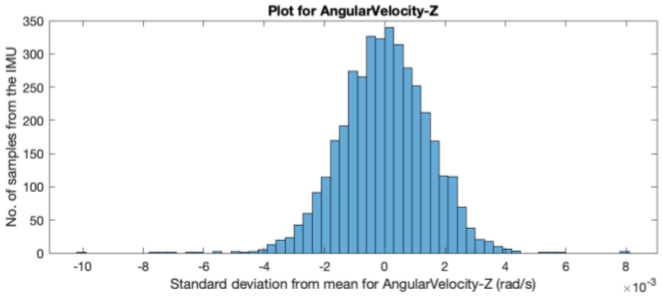
1.2. Time series plots for Angular Velocity from the IMU:

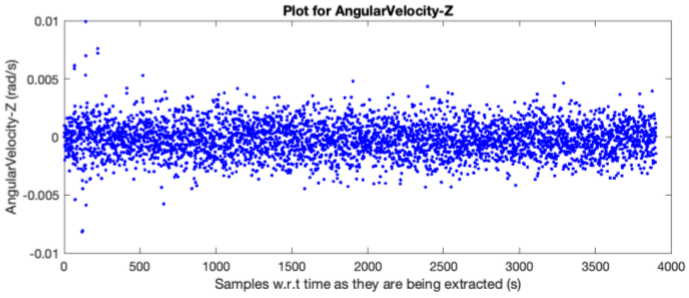








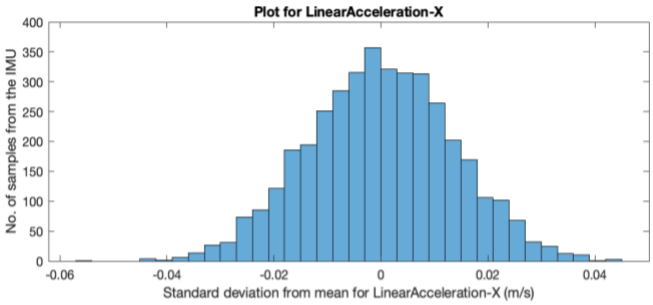


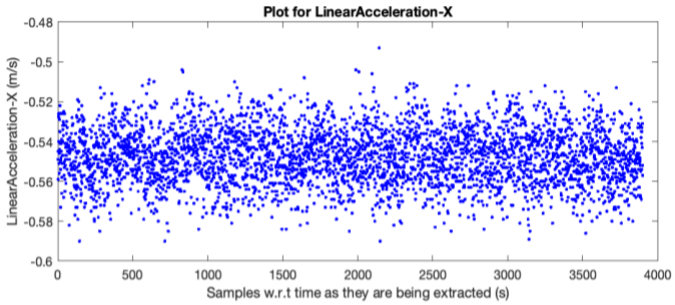


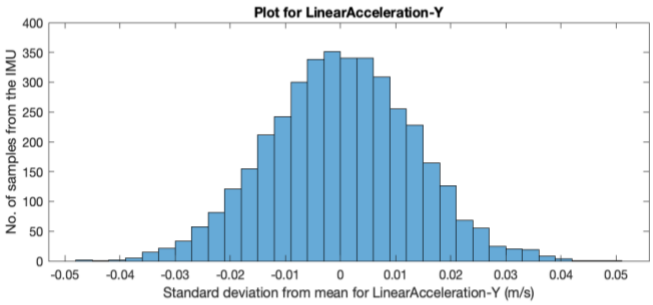
The plots for three axes of accelerators are comparable to a Gaussian distribution. The noise distribution can therefore be attributed as gaussian. It was observed that for the X orientation the noise was spread more vastly than that of Y and Z orientation which might be as a result of some improper placement or disturbance caused in X direction.

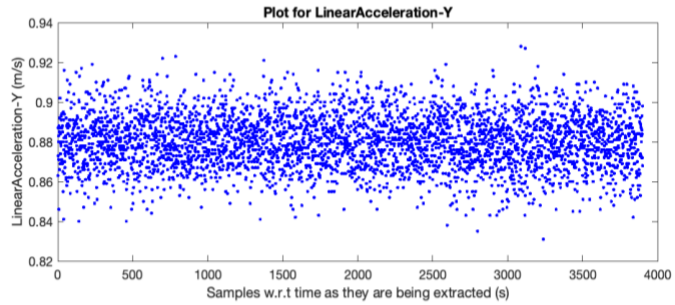
Mean Angular Velocity X: 0.000011011 radians/seconds
Mean Angular Velocity Y: -0.000165 radians/seconds
Mean Angular Velocity Z: -0.000165 radians/seconds

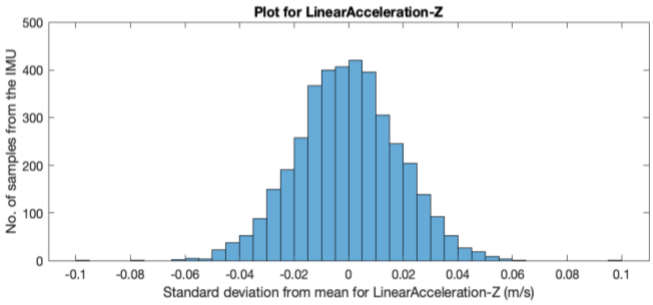
1.3. Time series plots for Linear Acceleration from the IMU:

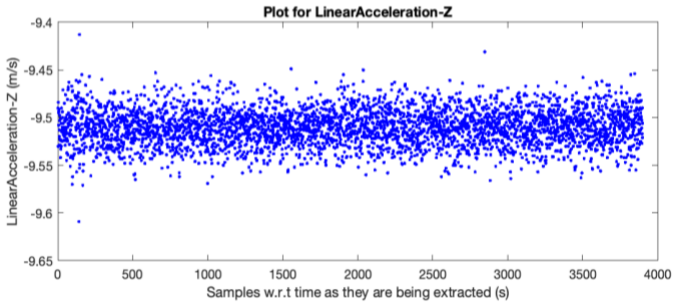








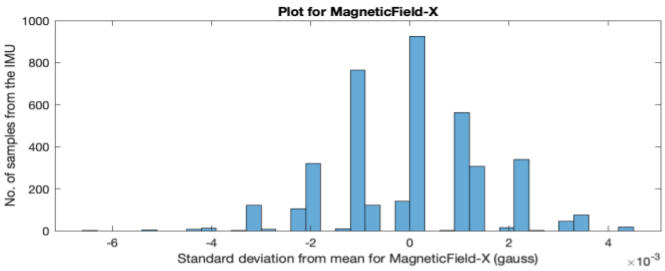


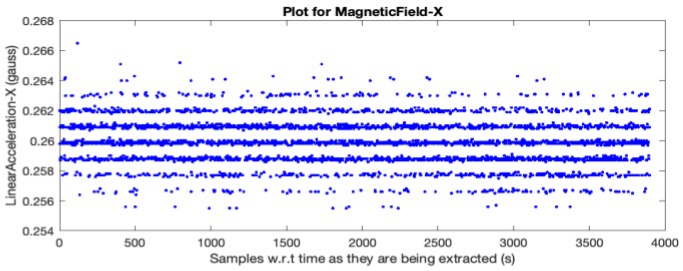


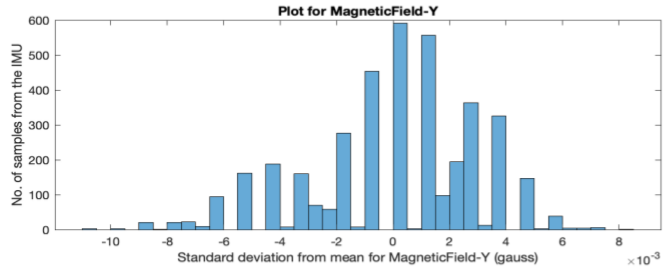
The plots for all the three axes for Linear acceleration are also comparable to the ones found for the Angular Velocity. The noise distribution here can also be therefore attributed as gaussian. It was observed that for the Z orientation the noise was spread very minutely as contrast to that of X and Y orientation which are also pretty small with little variation.

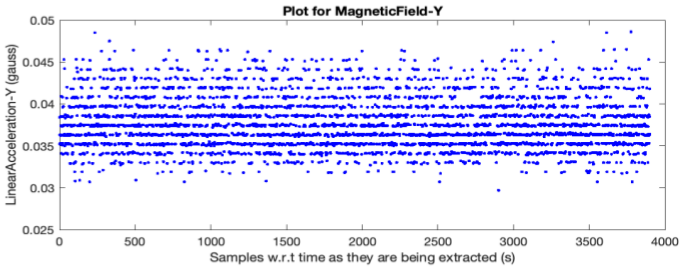
Mean Linear Acceleration X: -0.547487512 m/s
Mean Linear Acceleration Y: 0.880382867 m/s
Mean Linear Acceleration Z: -9.510073177 m/s

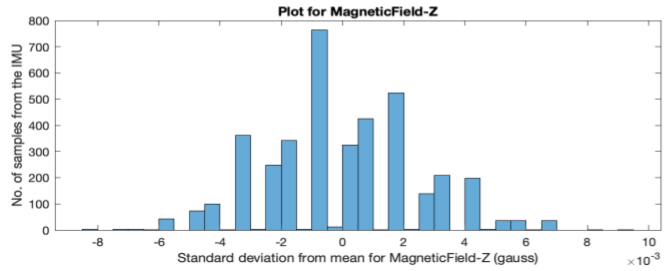
1.4. Time series Magnetic Fields from the Magnetometer:

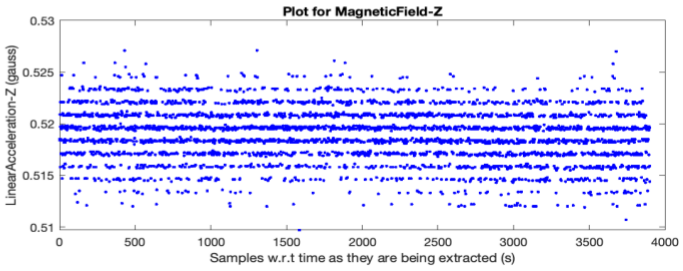












Although not a good way to interpret data for the stationary data of the magnetic field, above are the plots shown for each field. The deviation is because of presence of soft and hard iron effects that comes into account. These keep on changing continuously and hence the variation in the plots.