# Individual Lab Report – 8

Progress Review 9

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## Team F – Falcon Eye

### Team Members:

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March 1,2017

# Individual Progress

I was responsible for testing the IMU with Husky.

## IMU

During our FVE and FVE Encore, we faced issues pertaining to our IMU. We were not able to calibrate it and get accurate readings from it. So, at last, we opted to use our mobile as IMU. In last PR, I integrated the new IMU SparkFun 9DOF Razor, with Arduino and was able to read and visualize the input from IMU.

For this, Progress Review, I worked on testing IMU with the full stack of Husky. While testing I realised that it was not properly calibrated also it was having some errors due to the change in location as I calibrated inside the lab and was testing it outside on the lawn. Also the motors on the husky were also creating the distortion in the magnetometer readings of the husky. Danendra worked on this with me, as it is very risky to test outside without anyone else to handle the emergency situations, when the robot doesn't behave the way we intend it to.

So, I took it outside and recalibrated it. I followed the following steps for the calibration:

1) Connected the IMU with the arduino. This IMU can give readings directly to the serial monitor in Arduino (as shown in Fig 1), without using Arduino Board. I just had to install the Sparkfun 9dof razor and the libraries for that.

2) Then #oc starts giving only accelerometer readings as shown in Fig 5 . The I held the board with pointing down with x-axis and then slowly rotating the it about x-axis to the maximum x value.

3) Repeated the same thing with x pointing upwards, and rotating it slightly in all directions to get the minimum value for x, such that it doesn't change anymore.

4) Repeated the same to get the maximum and minimum value for y-axis and z-axis.

5) These were the calibration parameters, which I updated in the base firmware code of the arduino.

6) Gyroscope calibration was relatively simple. Pressing #on twice started giving gyroscope readings on the serial monitor (as shown in the Fig 4), and waiting for sometime gives the time to collect and average the noise on gyroscope. And the same values were updated on firmware.

7) Magnetometer calibration was a bit tricky. It compensates for all hard and soft iron errors. I made sure that we calibrate after placing on husky, so that it can factor in the distortions in real conditions, in which the IMU will be finally running.

8) I used magnetometer calibration sketch to calibrate and visualize the calibration(as shown in Fig 2). It gave the parameters that were supposed to be incorporated in the firmware file for the magnetometer calibration.

After that I flashed the new firmware on the IMU. And the I was getting good readings from IMU. Then I input some GPS locations from the lawn on husky launch node. Then I tested the complete system.

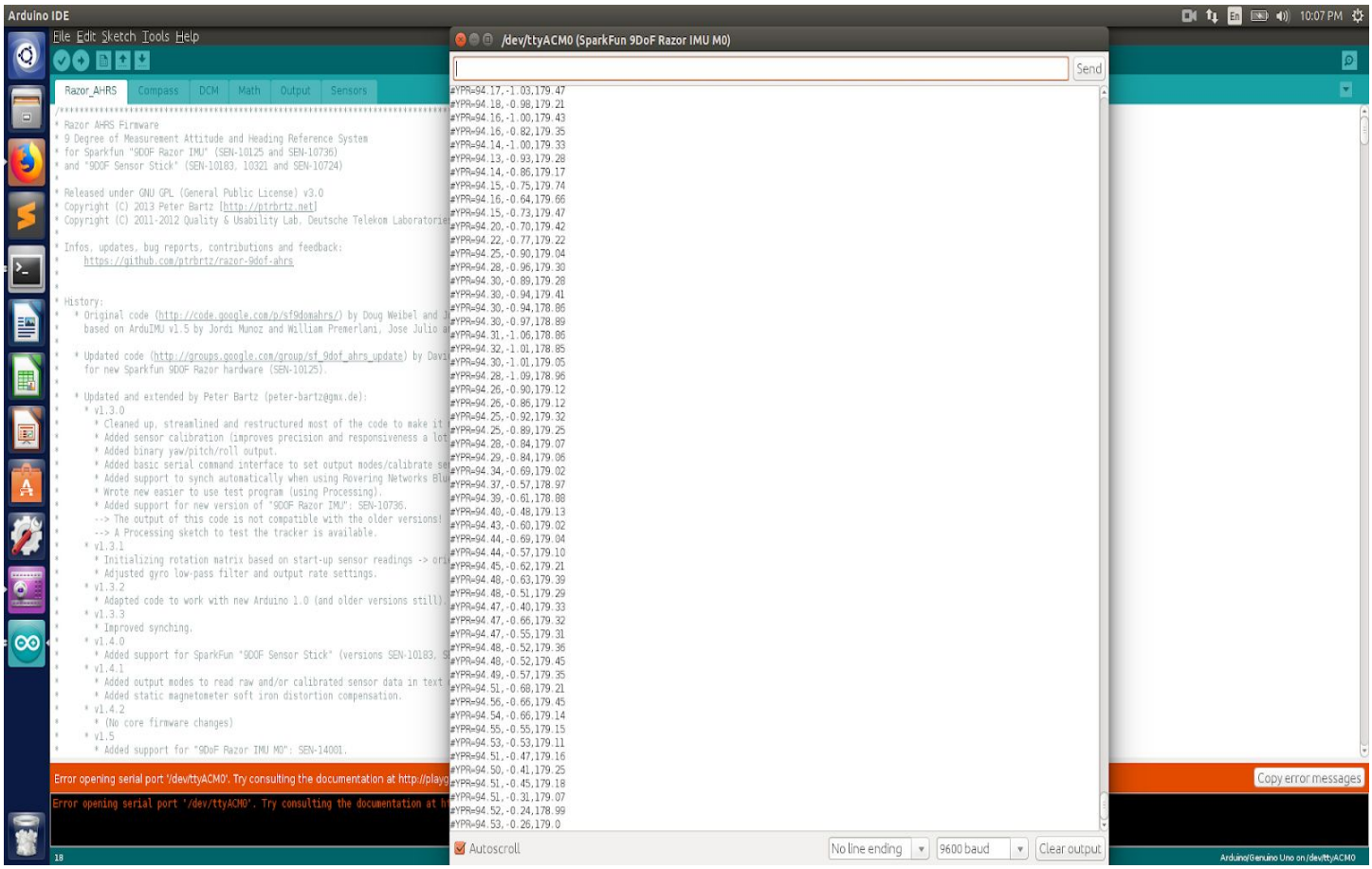


Fig 1 : YPR values read from IMU on Arduino

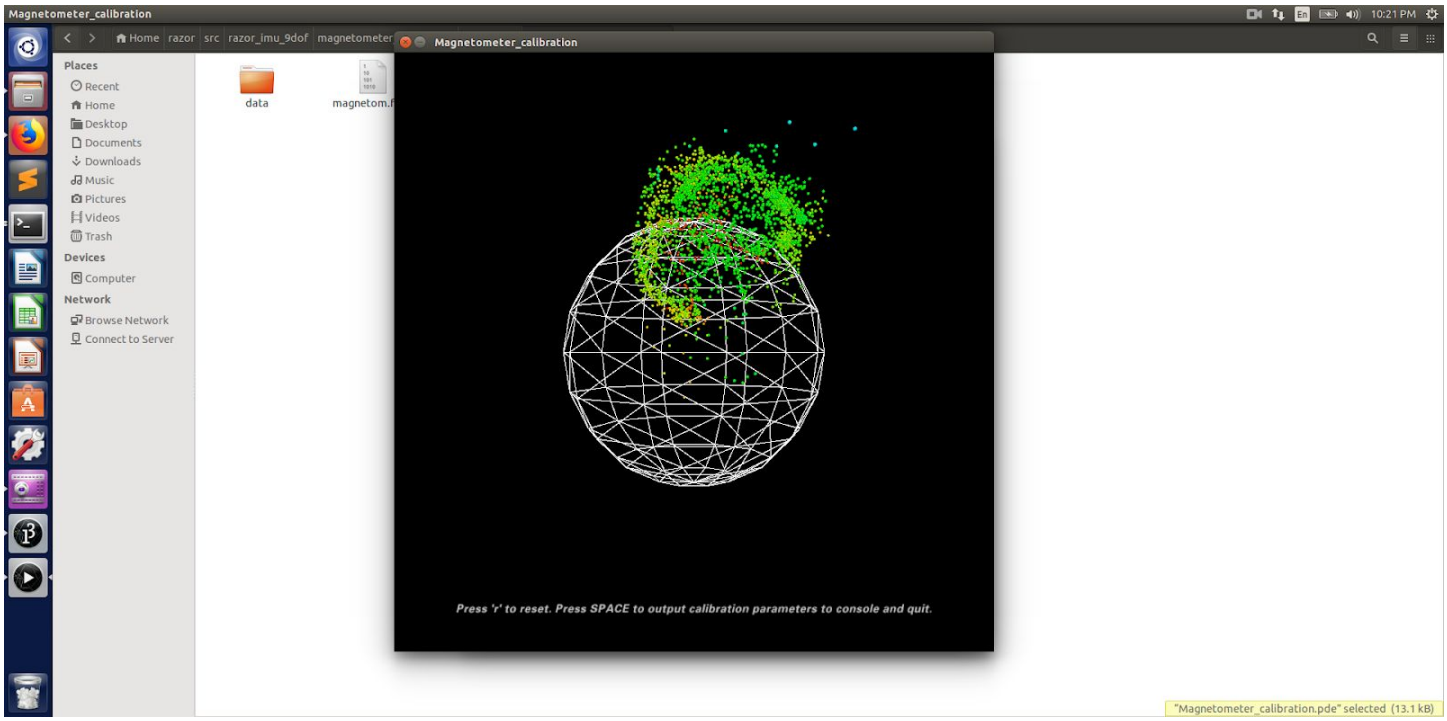

Fig 2: Magnetometer calibration of IMU

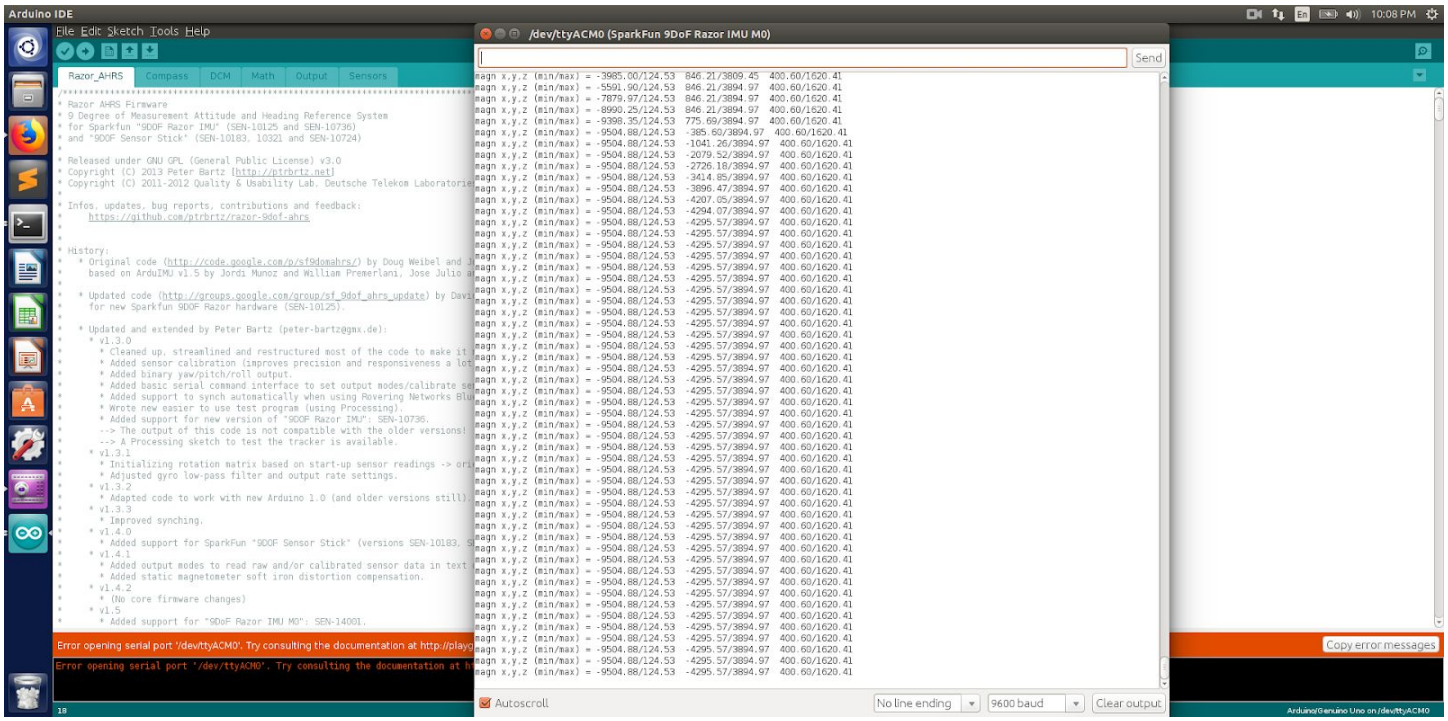


Fig 3: Magnetometer readings from IMU

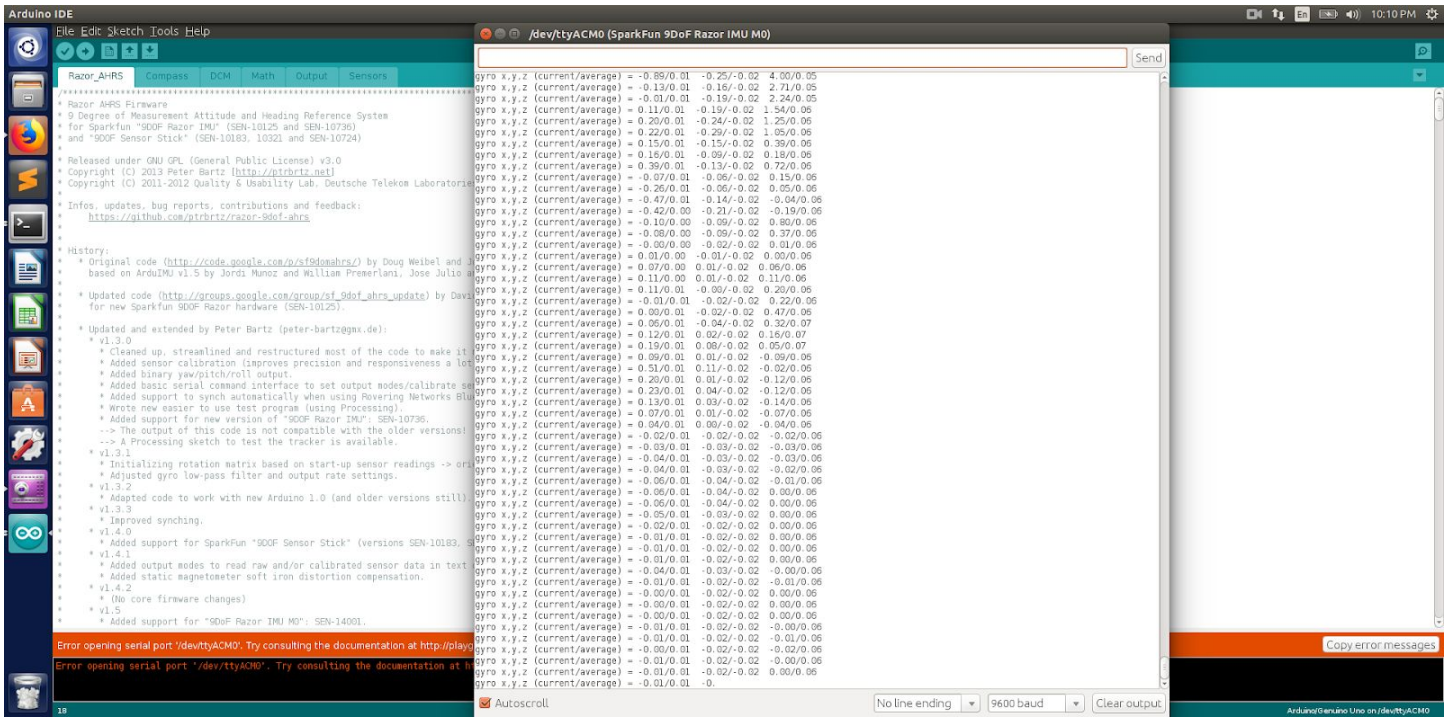


Fig 4: Gyroscope readings from IMU

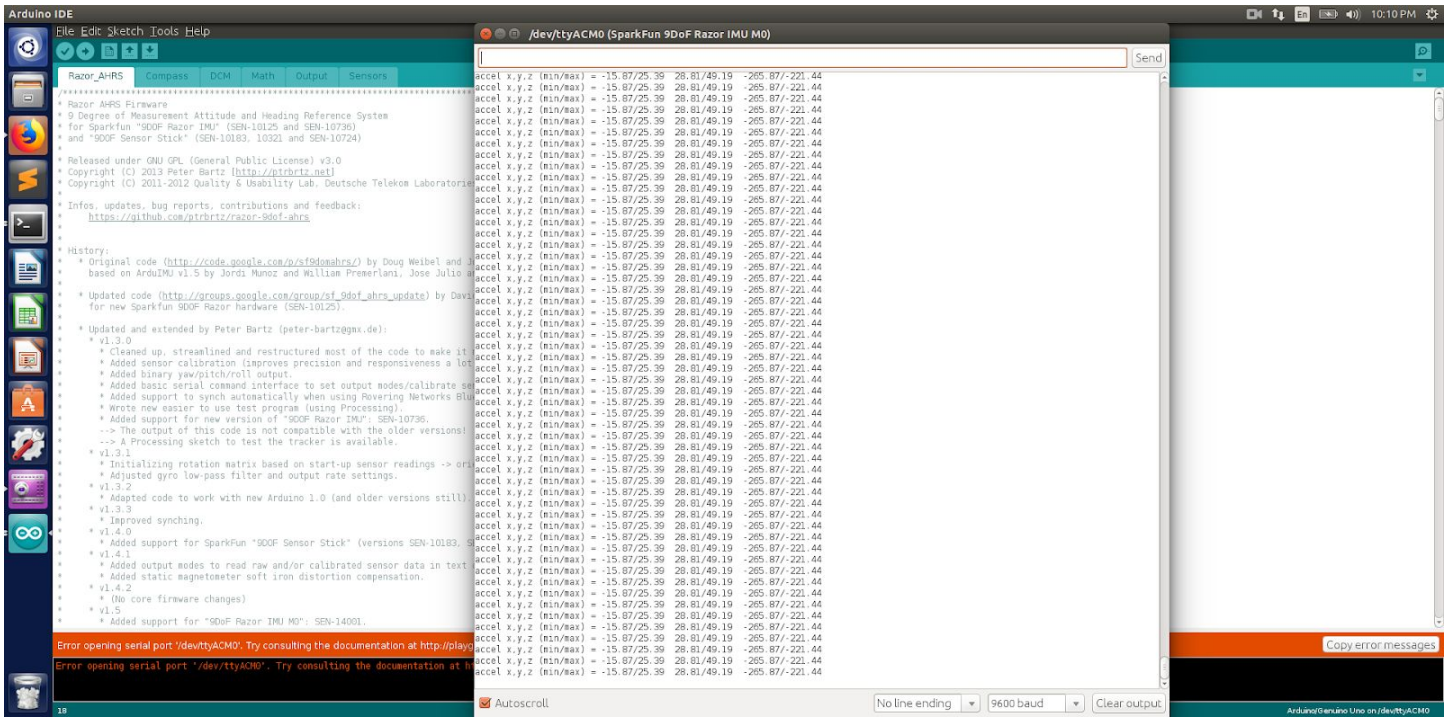

Fig 5: Accelerometer readings from IMU

## Challenges Faced

Some of the Challenges are:

1) One of the major challenge was I was using the using a compass app on my phone to verify that the north direction from the IMU was correct or not. I was tuning on the basis of that, but I realized it was not stable itself, because of which I was tuning the values and after sometime they were again drifting. Then I used the phone IMU app, we used during FVE as the base value for tuning the parameters.

2) Another problem that I was constantly facing was that, when I was interfacing the IMU with the arduino on ubuntu, it was not able to open the port itself. I had to always run the port opening command.

3) Another thing which I had to be careful of was that while calibrating the IMU, if I moved it very fast the calibration parameters was getting messed up. So, the key for that was to move it very slowly in all directions, till the time the values don't change anymore.

4) Another very unexpected challenge was that our drone got stuck on a tree. The whole team tried all possible ways for about 3-4 hours to get it down.

5) One of the major challenge in overwhelming coursework, as I'm taking Deep learning and SLAM. Assignments for both Deep learning , SLAM and robot autonomy are released almost together, so it's like 4 assignments to be worked on in two weeks and all of them have good difficulty levels.

6) Similar situation is faced by rest of the team members, which causes stretched working hours.

## Team Work

Danendra and I worked on testing Husky outside with IMU and GPS.
Pulkit and rahul developed the algorithm for obstacle avoidance for Husky. Currently they used the brute force logic, that as soon as the Husky sees an obstacle it turns in one direction to avoid it. They were successfully able to test.
Yuchi developed the the sweeping algorithm for beebop, which it will use to scan the area.

## MRSD Project Progress and Future Plans

We have completed the independent subsystems Husky and Beebop. Now, we have to implement the communication layer between them. An we have to test the system together outside, ensuring that they work properly together with each other.