

# **Individual Lab Report – 7**

Progress Review 8

By Pratibha Tripathi

## **Team F – Falcon Eye**

### **Team Members:**

Danendra Singh  
Pulkit Goyal  
Rahul Ramakrishnan  
Yuchi wang

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## Individual Progress

I was responsible for Calibrating and 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 getting the IMU readings on Husky node. I wrote a separate launch file for the IMU. And modified the main husky main code file to use the input from this new IMU instead of phone IMU inputs. I tested that the IMU data topics are properly subscribed on the husky node and IMU is working fine in indoors testing. We have to do complete testing outdoors with other sensors as well later on.

```
class cmdServer {
private:
    ros::NodeHandle n;
    ros::Subscriber gps_sub, att_sub;
    ros::Publisher cmd_vel_pub, takeoff_pub, land_pub, vis_pub;
    logger log;
    pose odom;
    std::vector<geometry_msgs::TransformStamped> frames;
    geometry_msgs::TransformStamped home_frame;
    gpsFix gps, tar;
    std::vector<gpsFix> tars;
    std::vector<gpsFix>::iterator tars_it;
    int gpsIndex = 0;
    double dist to target, heading to target, angle diff;
    double LOW_PASS_ALPHA, ANGULAR_SPEED_MAX, ANGULAR_MARGIN, ANGULAR_MOVE_MARGIN, DIST_MARGIN, MOVE_SPEED_MAX, MOVE_SPEED_MIN, MO
tf2_ros::Buffer tfBuffer;
    tf2_ros::TransformListener tfListener;
    geometry_msgs::TransformStamped transformStamped;
    bool new_target;
    void move(double x, double y, double z, double r);
    void takeOffLand(int z);
    void updatePositions();
    void lowPassFilter(geometry_msgs::Transform update, geometry_msgs::Transform & state);
    void publishMarkers();
    void initializeFrames();
    void initializeGPSLocation();
    void navigateToGPSLocation();
bool end;
public:
    cmdServer(ros::NodeHandle nh);
    void imuCallback(const sensor_msgs::Imu msg);
    //void imuCallback(const geometry_msgs::Vector3Stamped msg);
    void gpsCallback(const sensor_msgs::NavSatFix msg);
    void control();
};

cmdServer::cmdServer(ros::NodeHandle nh) : n(nh), tfListener(tfBuffer), frames(10), log(){
    gps_sub = n.subscribe("gps/fix", 1000, &cmdServer::gpsCallback, this);
    // att_sub = n.subscribe("imu_um7/rpy", 1000, &cmdServer::imuCallback, this);
    att_sub = n.subscribe("/imu", 1000, &cmdServer::imuCallback, this);
    //att_sub = n.subscribe("phone/data", 1000, &cmdServer::imuCallback, this);
    cmd_vel_pub = n.advertise<geometry_msgs::Twist>("husky_velocity_controller/cmd_vel", 1000);
    vis_pub = n.advertise<visualization_msgs::Marker>("visualization_marker", 0);
};
```

Fig1 : Changes in the Husky main code file

```

<?xml version="1.0"?>
<launch>

  <node pkg="razor_imu_9dof" type="imu_node.py" name="imu_node">
    <!--param name="port" type="string" value="$(optenv HUSKY_IMU_PORT /dev/clearpath/um7)"/-->
    <param name="port" type="string" value="/dev/ttyimu"/>
    <!--param name="name" type="string" value="usb-Silicon_Labs_CP2104_USB_to_UART_Bridge_Controller_00E59175-if00-port0"/-->
    <!--param name="port" type="string" value="/dev/serial/by-id/usb-Silicon_Labs_CP2104_USB_to_UART_Bridge_Controller_00E59175-if00-port0"/-->
    <param name="mag_updates" type="bool" value="false"/>
    <param name="frame_id" value="imu_link"/>
    <param name="tf_ned_to_enu" value="false"/>
    <remap from="imu_node" to="razor_imu_9dof"/>
  </node>

  <node pkg="nodelet" type="nodelet" name="imu_manager" args="manager"/>

  <!-- Transforms UM7 tilted data in imu link frame to ENU data in base link frame -->
  <node pkg="nodelet" type="nodelet" name="imu_data_transformer" args="load imu_transformer_nodelet imu_manager">
    <remap from="imu_node" to="razor_imu_9dof"/>
    <remap from="/imu" to="imu/data_raw"/>
    <remap from="razor_imu_9dof/mag" to="imu/mag"/>
    <param name="target_frame" value="base_link"/>
  </node>

  <!-- Filter raw gyro, accel and mag data into a usable orientation -->
  <node pkg="nodelet" type="nodelet" name="imu_filter" args="load imu_filter_madgwick/ImuFilterNodelet imu_manager">
    <roscpp param file="$(env HUSKY_MAG_CONFIG)" />
    <roscpp param>
      orientation_stddev: 0.001
      gain: 0.01
      zeta: 0.001
      publish_tf: false
    </roscpp param>
  </node>

</launch>

```

Fig2: Launch file for the IMU

```

t...
[INFO] [WallTime: 1518738299.196818] Writing calibration values to razor IMU board...
rd...
[INFO] [WallTime: 1518738300.212698] Printing set calibration values:
ACCEL_X_MIN:-250.00
ACCEL_X_MAX:250.00
ACCEL_Y_MIN:-250.00
ACCEL_Y_MAX:250.00
ACCEL_Z_MIN:-250.00
ACCEL_Z_MAX:250.00
MAGN_X_MIN:-600.00
MAGN_X_MAX:600.00
MAGN_Y_MIN:-600.00
MAGN_Y_MAX:600.00
MAGN_Z_MIN:-600.00
MAGN_Z_MAX:600.00
MAGN_USE_EXTENDED:false
magn_ellipsoid_center:[0.0000,0.0000,0.0000]
magn_ellipsoid_transform:[[0.0000000,0.0000000,0.0000000],[0.0000000,0.0000000,0.0000000],[0.0000000,0.0000000,0.0000000]]
GYRO_AVERAGE_OFFSET_X:0.00
GYRO_AVERAGE_OFFSET_Y:0.00
GYRO_AVERAGE_OFFSET_Z:0.00
[INFO] [WallTime: 1518738300.213650] Flushing first 200 IMU entries...
[INFO] [WallTime: 1518738304.221292] Publishing IMU data...

angular_velocity_covariance: [0.02, 0.0, 0.0, 0.0, 0.02, 0.0, 0.0, 0.0, 0.02]
linear_acceleration:
s1 x: -1.66625390625
   y: 0.368874140625
   z: -9.67193359375
linear_acceleration_covariance: [0.04, 0.0, 0.0, 0.0, 0.04, 0.0, 0.0, 0.0, 0.04]
---
header:
  seq: 4773
  stamp:
    secs: 1518738399
    nsecs: 695302009
  frame_id: base_imu_link
orientation:
s1 x: 0.794534243627
s1 y: 0.600365554245
s1 z: -0.0559168527988
s1 w: 0.0717624034867
orientation_covariance: [0.0025, 0.0, 0.0, 0.0, 0.0025, 0.0, 0.0, 0.0, 0.0025]
angular_velocity:
s1 x: -0.01
s1 y: 0.02
s1 z: -0.0
angular_velocity_covariance: [0.02, 0.0, 0.0, 0.0, 0.02, 0.0, 0.0, 0.0, 0.02]
linear_acceleration:
s1 x: -1.68540625
s1 y: 0.522092890625
s1 z: -9.64320507812
linear_acceleration_covariance: [0.04, 0.0, 0.0, 0.0, 0.04, 0.0, 0.0, 0.0, 0.04]
---

```

Fig3: Reading from IMU being published on /imu topic

## Challenges Faced

Some of the Challenges are:

- 1) 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.
- 2) Similar situation is faced by rest of the team members, which makes it difficult to allocate sufficient time on the project.

## Team Work

I worked on testing and reading the IMU data on Husky node on ROS. Pulkit and rahul worked on obstacle clustering and registration. Danendra worked on creating mesh network. Yuchi worked on connecting the April tags as a graph. Danendra and Pulkit worked on resolving the network issue.

## MRSD Project Progress and Future Plans

Danendra and I will work on outdoor testing of IMU. Rahul and Pulkit will work on obstacle avoidance. Yuchi will work on Bebop2 exploration algorithm