ROS Code Manual for 9DOF IMU

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1 Introduction

Inertial Measurement Units are combination of Accelerometer, Gyroscope and Magnetometer which is used to find the linear velocity, angular rate and orientations. Various sensor fusion techniques mainly (Kalman Filter, Complementary Filter) are widely used to get and stable and filtered data.

1.1 Hardware Interface

IMUs (assuming MPU9250) is connected to Raspberry Pi through I2C protocol, using SCL-SDA pins of Rasp-Pi.

2 IMU files

1. MPU9250.py

Class for MPU9250 I2C protocol.

2. fusion.py

Class provides sensor fusion allowing heading, pitch and roll to be extracted. This uses the Madgwick algorithm. The update method must be called periodically.

3. read9axis.py

It imports *fusion.py* and *MPU9250.py* class mentioned above.
Run "*python read9axis.py*", in terminal and swing the magnetometer in shape of Infinity gently for 120 seconds. It will give MAG_HARD_BIAS and MAG_SOFT_BIAS vectors, copy it and paste the vector in imu9250.py file

4. imu9250.py

It imports MPU9250 class.

This file read the raw data from IMU sensor.

First calibrate and modify MAG_HARD_BIAS and MAG_SOFT_BIAS. Eg:-

MAG_HARD_BIAS = (113.99, -40.54, -16.35)

MAG_SOFT_BIAS = (0.96, 0.98, 1.06)

Publisher:

1. rospy.Publisher('imu/data_raw', Imu, queue_size=10)

Contain the ax, ay, az from accelerometer and gx, gy, gz from gyroscope

2. rospy.Publisher('imu/mag', MagneticField, queue_size=10)

Contains the mx, my, mz from magnetometer

3 Complementary Filter

First install the imu_tools package to your src folder of catkin workspace.

See Complementary Filter ROS, for details.

This node will take the raw data from IMU (ax,ay,az,gx,gy,gz,mx,my,mz mentioned above) and fuses the accelerometer, gyroscope, magnetometer raw data to give roll, pitch, yaw.

This node is executed in launch file, there is no separate python file. Various parameters needs related to it will be mentioned in launch file.

Suscriber:

1. imu/data_raw, Imu

Message containing raw IMU data, angular velocities and linear accelerations.

2. imu/mag, MagneticField

Magnetic field vector.

Publisher:

1. imu/data, Imu

The fused Imu message, containing the orientation.