9 DOF Sensor Fusion with magnetometer

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Motivation:

In homework 5 we implemented the complementary filter in orientation tracking with the IMU. However, we only corrected the pitch and roll angles combining the gyro and accelerometer measurements, and ignored the yaw value. According to the research done by Oculus VR [1], the correction of yaw error(parallel to the gravity vector) relies on the measurement of magnetometer. Thus we propose to expand the 6 DOF sensor fusion to 9 DOF sensor fusion to utilize all the measurements of gyro, accelerometer and magnetometer.

Different from the hardware used by Oculus VR which have a separate chip for magnetometer, we have gyro, accelerometer and magnetometer all integrated on the same IMU chip. As mentioned in class, some trouble have been observed when streaming the magnetometer via I2C to Arduino. In our project: 1. we are going to fix the streaming problem. 2. we will test the output of magnetometer and do the calibration. 3. we will apply the 9 DOF sensor fusion and make some comparison with the 6 DOF sensor fusion. 4. we will add a magnet to our headset by pressing which realize forward motion in the virtual world.

Proposed timeline

Week 1:
Fix the streaming problem of magnetometer via I2C to Arduino

Week 2:
Calibrate the magnetometer and implement the 9 DOF sensor fusion

Week 3:
Build a simple application (forward motion) by detecting the change of magnetic field

Reference:

[1] LaValle, Steven M., et al. "Head tracking for the Oculus Rift." *Robotics and Automation (ICRA), 2014 IEEE International Conference on*. IEEE, 2014.

[2] InvenSense MPU-9255 Datasheet: http://43zrtwysvxb2gf29r5o0athu.wpengine.netdna-cdn.com/wp-content/uploads/2015/02/MPU-9255-Datasheet.pdf