**WEEKLY REPORT DE BENEDETTI MATTEO**

**WEEK 12: 18/11/2019 – 22/11/2019**

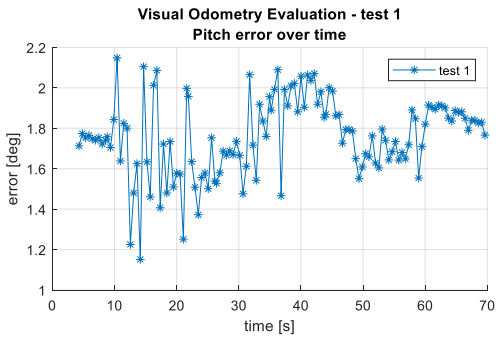
FIXING ORIENTATION ESTIMATE OF THE SPARTAN VO:

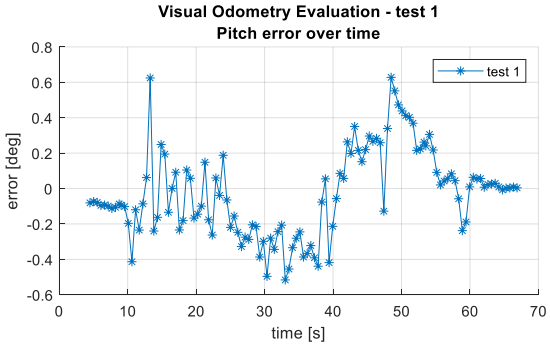
The problem where the SpartanVO was estimating a zero orientation was found in the pose manipulation through the various reference frames (camera, body, and world) of the algorithm.

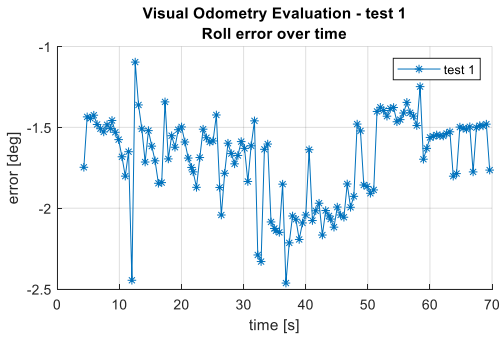
IMPROVING THE VO WITH IMU ORIENTATION ESTIMATE:

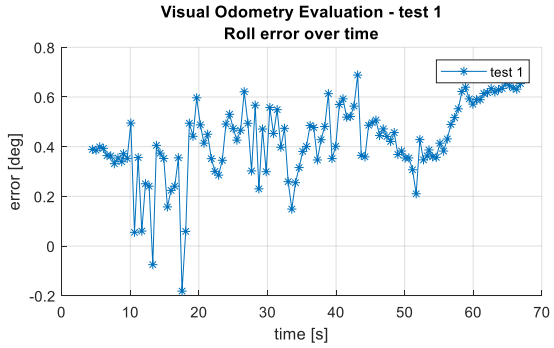
The constant error of the IMU was investigated and it was found that it was not caused by the IMU itself, but from the Vicon system being not perfectly calibrated.

After recalibrating the origin of the Vicon frame and defining a new ExoTer Object, another test was run and the following picture shows that the error is now significantly smaller (plots on the right) in both the pitch and roll components than before (plots on the left).

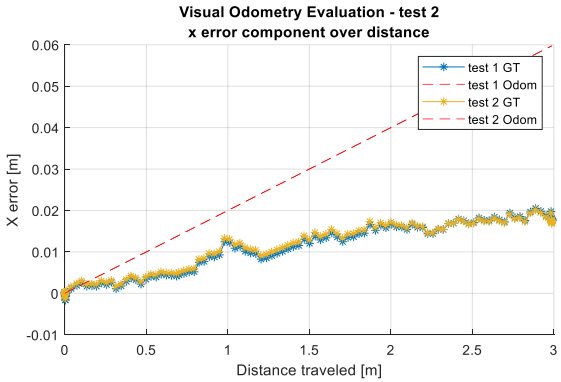


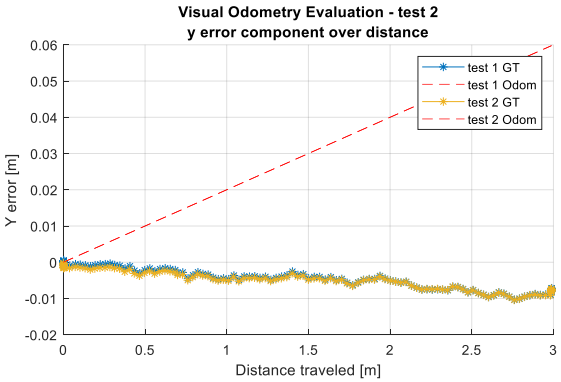



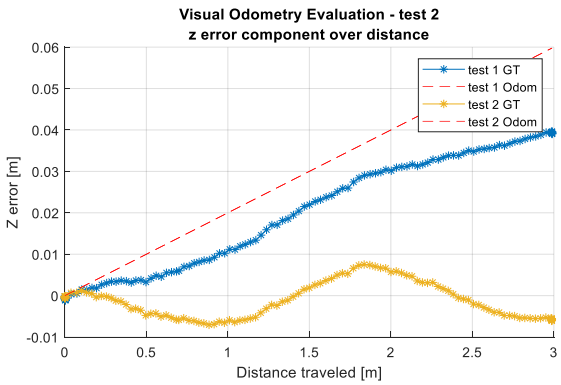



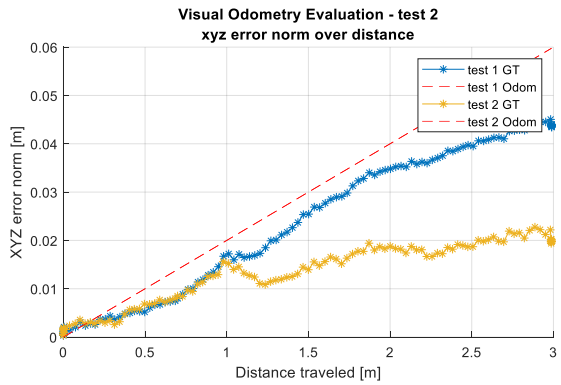



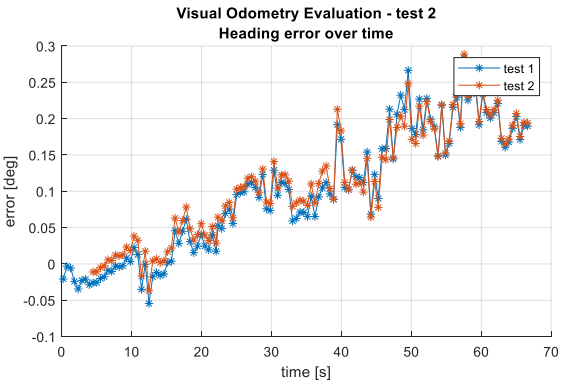

The SpartanVO with IMU is now better than pure Spartan both in orientation (there is still a small offset between the VO roll and the GT roll of about 0.4 degrees) and position, as the following plots show (in the legends: test1 is pure Spartan, test2 is Spartan with IMU)

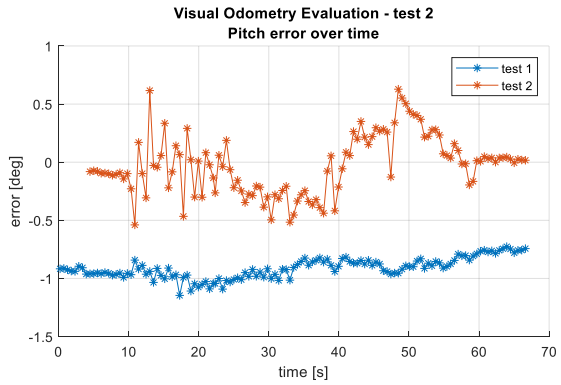

Visual Odometry Evaluation - test 2
x error component over distance
test 1 GT
test 1 Odom
test 2 GT
test 2 Odom
X error [m]
Distance traveled [m]

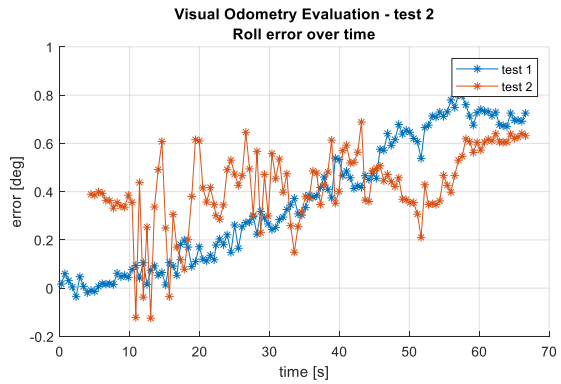

Visual Odometry Evaluation - test 2
y error component over distance
test 1 GT
test 1 Odom
test 2 GT
test 2 Odom
Y error [m]
Distance traveled [m]


Visual Odometry Evaluation - test 2
z error component over distance
test 1 GT
test 1 Odom
test 2 GT
test 2 Odom
Z error [m]
Distance traveled [m]


Visual Odometry Evaluation - test 2
xyz error norm over distance
test 1 GT
test 1 Odom
test 2 GT
test 2 Odom
XYZ error norm [m]
Distance traveled [m]


Visual Odometry Evaluation - test 2
Heading error over time
test 1
test 2
error [deg]
time [s]


Visual Odometry Evaluation - test 2
Pitch error over time
test 1
test 2
error [deg]
time [s]


Visual Odometry Evaluation - test 2
Roll error over time
test 1
test 2
error [deg]
time [s]

FUTURE OBJECTIVES:

A good accuracy, in both position and orientation, has been achieved with the SpartanVO with IMU, there is a quick last thing I want to try to further improve is the body-camera transform: I think that the pitch could be refined with a finer search of 0.1deg instead of the 1deg done so far, and also it could be interesting to see if changing also the roll and yaw and positions even better results could be achieved.

After this, the tests at different velocities will be rerun and then the effect of the velocity in combination with exposure time, VO frequency and ambient light will be studied.