Tracking and localization using inertial, visual and mapping informations

Internship at Gipsa-lab
(Univ. Grenoble Alpes, France)

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Starting date of the Internship: Winter or Spring 2020

Description:

Attitude and position estimation as well as tracking is a crucial problem that occurs in a wide range of applications. It has attracted continuous attention in the last decades in many applications such as robotics, pedestrian navigation, UAV, to name just a few. The attitude is represented sometimes by Euler angles, rotation matrix or quaternion. The position represents the linear displacement in 3D (x, y, z). In indoor applications, only proprioceptive measurements can be used and then GPS data is missing.

Traditionally a standard inertial measurement unit (IMU) comprised of 3-axis linear acceleration measurement by accelerometers installed at center of mass and 3-axis angular velocity measurement by rate gyros readily provides complete attitude motion-related measurements spanning the 3-dimensional space [5, 6]. Sometimes a 3-axis magnetometer is added to complete the attitude with heading (yaw angle). The gyroscope-free inertial measurement unit (GF-IMU) is one of the more popular IMU methods to derive linear acceleration, angular acceleration, and angular velocity [7, 8]. Compared to the traditional IMU, the GF-IMU utilizing only accelerometers includes several features such as low-cost, easy calibration, being less affected by temperature variations, and a simple mechatronic setup. Some recent works propose to use a set (6, 9, etc.) of 3-axis accelerometers, complemented sometimes by one 3-axis magnetometer. Kalman filters and observers are proposed to be used to combine these measurements. The proposed work in this internship consists in revisiting these configurations/estimation approaches and combining with recent magnetic navigation approaches [9, 10, 11, 12, 13]. Also some mapping aiding techniques need to be considered, together the fusion with visual data informations. The goal is to estimate attitude and velocity in a first step and later focus on the observability of position state.

- **Profile:** The candidat should have a solid background in control theory (observers, nonlinear dynamics), and computer skills in Matlab.
- **Location:** GIPSA-Lab, Grenoble University East Campus, Grenoble, France.
- **Dates:** Beginning: Early of 2020. Duration: 5-6 monthes.
- **How to apply:** Applications should be declared as soon as possible. The position may be closed as soon as a competent candidate has applied. Please include the CV, marks and a list of (at least) two references to one of the advisors.

References

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