INF FAKULTÄT FÜR INFORMATIK

"Analysis and Implementation of LIOSAM on AuRa bike to solve the localization problem with baselining Trimble GPS output and comparison with Google Cartographer positioning"

Master Thesis Proposal

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Research Background :

The Simultaneous Localisation and Mapping (SLAM) problem asks if it is possible for a mobile robot to be placed at an unknown location in an unknown environment and for the robot to incrementally build a consistent map of this environment while simultaneously determining its location within this map. AuRa is the project at OVGU, which aims to have a three-wheeled cargo bike, which can orient and move independently on footpaths and cycle paths, and localization and positioning of the bike is of utmost importance for the initiative to be successfully implemented. SLAM has faced major challenges in terms of the computational complexity and as well as data latency, for the usual expectation from these algorithms. The Cartographer, as well as the advent of Odometry and Mapping has really helped the autonomous driving research groups in terms of better results with 3D lidar data with much less computational effort. The research around this topic is still underway with the effectiveness of the algorithm and fast response in accordance with concepts like visual odometry which concentrates on local consistency with an incremental afterpose path estimation.

The ground truth of the entire research encircling this thesis , is the output provided with the Trimble GPS module, which is considered and has been proven to be extremely accurate in its output.The issue with the same is that the GPS module is extremely expensive to be used on all the bikes in the project. So, our main aim is to compare the Trimble output with the LIOSAM and Cartographer positions with respect to the inputs from the LiDAR,IMU and GPS modules combined. In case of a successful attempt, the cost behind the trimble gps can be circumvented.

Methodology and Thesis Details :

The Master Thesis can be subdivided into several sections:

- Data acquisition with the right infrastructure setup , as per the algorithm requirements.
- Coordinate transformations and sensor data fusion for a compatible input into the visual odometry model.
- The Implementation of the LIOSAM Algorithm on the AuRa bike to solve the localization problem
- Analysis and listing down of the required topics which the algorithms need to subscribe for their proper functioning.
- Backdrops of using Google Cartographer Algorithm on the bike and the differences in the result with the other implemented results.
- Finally, compare the position results from the Trimble which is considered to be the baseline, with the LIOSAM and Cartographer results.