# Mobile Robotics Project Proposal
## Codename: Lost Bumblebee

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## 1 Introduction

In the current *robust-perception age*, visual odometry and semantic methods have become more prevalent in SLAM research and draw upon the decades of advancements in the field of computer vision. Our project is motivated by the approach to semantic SLAM presented by Bowman et al. in [1]. The proposed algorithm combines inertial, geometric and semantic observations into a joint optimization problem for more informed data association. Erroneous data association can lead to divergence in the SLAM algorithm and Bowman et al. show that using semantic along with geometric information can effectively address this as well as loop closure. We aim to apply it on one of the KITTI data-sets and compare the results against benchmarks provided in the KITTI Vision benchmark suite.

## 2 Project Outline and Milestones

The project, and its milestones, can be separated into independent steps: (1) Extract inertial sensor information from the data-set. (2) Process geometric features from camera data using ORB. (3) Object detection and classification. (4) Integrate the sensor information into a single pose graph. (5) Solve the full pose graph optimization using GTSAM. (6) Overlay results onto video for visualization. After combining the parts, the quantitative results can be compared with the data-set benchmarks.

## 3 Viability and Contingency

While this algorithm has been proven to perform successively in environments comprised of static and dynamic objects, the viability of this project is contingent on the time needed to complete the components. If time does not permit the full integration of geometric and semantic measurements into the pose graph, we plan to switch to a pose graph created with odometry readings and LIDAR data, as proposed in [2] and use GTSAM for optimization of the new pose graph.

## 4 Expected Outcomes

Through this project, we hope to gain insight into the current state of SLAM research as well as become familiar with state-of-the-art tools, like GTSAM. We also hope to gain more experience with vision and learning fields while implementing the techniques used in [1]. Another expected outcome would be a working software which can be easily applied to other data-sets and even on physical robots.

## References

[1] Sean L. Bowman, Nikolay Atanasov, Kostas Daniilidis, and George J. Pappas. Probabilistic data association for semantic slam. *2017 IEEE International Conference on Robotics and Automation (ICRA)*, pages 1722–1729, 2017.

[2] Giorgio Grisetti, Rainer Kümmerle, Cyrill Stachniss, and Wolfram Burgard. A tutorial on graph-based slam. *IEEE Intelligent Transportation Systems Magazine*, 2:31–43, 2010.