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Abstract:

The goal of this project is to enable an autonomous robot to navigate from one specified position to a goal position in an unknown environment. The robot (car) will be dropped in an environment with general knowledge of the environment (roadways), however, there may be roadblocks or obstacles in the street that are unknown. The car will be equipped with LIDAR and cameras so that as it drives it can update the map and avoid obstacles using motion planning.

Although we are working on creating an end to end an autonomous system, the focus of the project is to implement motion planning algorithms on the GPU(GMT*). The structure that we defined for the project requires the implementation of side algorithms such as Structure from Motion (SfM), Optical Flow (OF), Iterative Closest Points (ICP) for scan matching, and Particle Filter(PF) or Extended Kalman(EKF) filter for SLAM. For these side algorithms, we might use external resources to help us with the implementation and then work on integrating them within the bigger picture of our autonomous system.

The simulator CARLA will be used to test the algorithms but they will be built in such a way to operate on a physical system, the requirement is the ability to operate in real-time. To see the benefit of utilizing a GPU on an autonomous robot. The main goal of the project is to implement an end to end autonomous system on the GPU but if we have time left we will also implement a CPU version to do performance comparisons.

Timeline:

Milestone 1 (11/18):
Simulation infrastructure and understanding GMT* paper

Milestone 2 (11/25):
GPU: motion planning (GMT*)

Milestone 3 (12/02):
Optimizations/ Perception and SLAM algorithms

Final Submission (12/8):
Presentation and performance analysis

References:

[1] https://arxiv.org/pdf/1705.02403.pdf