Project Description

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In this project, we aim to explore and compare two SLAM algorithms - EKF SLAM and Fast SLAM on different datasets through step-by-step implementation. We will(in MATLAB environment) first use the dataset given in the graph slam lab and then utilize other datasets and if time permits we also plan to include a dataset involving dynamic objects. In order to handle dynamic objects we first treat them as noise and in the later stage, we will include them in the space vector and track them along with SLAM (SLAM and moving object tracking).
We will make a comparison based on the below points (expanded as we progress):

1. We want to see how FastSLAM scales with an increasing number of landmarks (and if EKFSLAM struggles to do so).
2. We will see the effect of loop closure in EKFSLAM and examine how fewer hypothesis in FASTSLAM impacts it to converge to the true position.
3. We will also analyze the time complexity of each algorithm on a particular dataset by increasing the speed of the robot, i.e. we expect that with increasing speed, the measurements will be seen for shorter amounts of time, due to which data association time will be limited and performance might degrade for EKFSLAM, but FastSLAM might be robust.
4. We expect that EKFSLAM fails in the case of a symmetrical dataset, whereas FastSLAM with its multiple hypotheses performs well.
5. While handling dynamic objects(in the case, where dynamic objects are treated with sensor noise), we expect that FastSLAM will perform better because each particle maintains an independent estimate of the map and will be robust to the sensor reading of dynamic objects, but EKFSLAM might not perform so well because of the dependencies in the covariance matrix.

Note: We are aiming for grade A and it will be very helpful if you mention if this amount of ‘implementation’ is sufficient for this grade (assuming a well-written report).