1. Introduction & Motivation (around 600 words – 1 day)

The simultaneous localization and mapping (SLAM) problem questions the autonomy of a mobile robot in an unfamiliarised environment: would a robot be able to explore and incrementally construct the information of its surroundings, yet at the same time accurately locate its position in the complex, realistic environment. Solutions to the SLAM problem would imply that a robot has become “truly autonomous” as it no longer requires arbitral instructions or fixed input in order to understand its relation with its situated context [part I]. Over the decades, multiple solutions have been proposed in different technical and mathematical forms, and have been applied to various fields of robots, including group aerial, underwater, indoor, etc. From a theoretical perspective, SLAM has deemed as a solved problem[part 1].

However, in a realistic environment, different solutions will showcase their advantages and disadvantages. For example, algorithms such as iterative closet point (ICP) perform exceptionally well in an indoor context, but when it comes to complex, outdoor environment, they may fail to reach the expectation for accuracy[evaluation]. Moreover, substantial issue remains in implementing these solutions. Problems such as the trade-off between accuracy, speed, memory and power consumption continue to challenge the researchers and practical commercialization. Hence, there has been sustained research in practical implementation and evaluation of different SLAM solutions.

In recent year, the creation of new sensors and increase in processing power have enabled the releases of newer, more accurate and efficient SLAM systems. As SLAM systems continue to evolve and develop, needs for evaluating diverse SLAM algorithms surge exponentially. Unfortunately, despite heated discussion over SLAM, there has been little attention devoted to standardizing the evaluation of all SLAM systems. Different approaches have been used by researchers to test and experiment the SLAM algorithms, making it difficult to compare the performance of various SLAM systems. Furthermore, most of the testing and evaluation can take considerable effort and have been done in a specified, manual procedure. Researchers need a plug and play system that can easily evaluate the performance different SLAM systems and streamline the testing process.

Context of SLAMBench

Problem encounter

Ways to solve the problem

1. Background Information (60 – 100 words)
   1. Introduction to Robotics System Benchmarking (500 words – 1 day)
   2. Simultaneous Localization and Mapping (500 words – 1 day)
   3. Filtering and Sparse-bundle Adjustment for SLAM (100 words – 1 day)
      1. Markov Random Field (1000 words – 2 days)
      2. Filtering (1000 words – 2 days)
      3. Keyframe Bundle Adjustment (1000 words – 2 days)