Project 4 Report

Yizhan Ao(Email: [josephao@umd.edu](mailto:josephao@umd.edu)) Yingqiao Gou(ygou@terpmail.umd.edu)

1. Work Distribution

We have distributed the work equally throughout the project so we both learned from the course material to complete the project.

1. Introduction

The goal of this project is to determine the drone camera's 3-Dimensional position and posture in the global frame using **AprilTag** recognition from the given frames. We're also attempting to map the environment. The key of simultaneous localization and mapping (SLAM) is that we must deal with these two variables simultaneously and can only make guesses. Fortunately, we have limitations that we can apply with some precision to guide and modify our estimations.

1. Tasks

In general there are two main tasks in this project.

1. SLAM mode

2. Localization mode

From SLAM, the map generated by (GTSAM-toolbox) was given the April-Tag results by optimizing the factor graphs.

In localization mode, the use of constructed map was based on the observation measurements the drone makes.

1. Steps
   1. Initialize the camera pose
   2. Initialize Frame landmark position
   3. Camera pose estimation

We added the numbers we generated based on the first section to the initial estimate (homographies). This contained the estimated stances as well as the real-world locations of the landmarks.

* 1. GTSAM

1. Results

We adjusted the picture outputs manually to show results of the GTSAM compared to without GTSAM. The pictures from the dataset 1 worked well in our optimizer. From the figures below, we could tell the GTSAM applications were a lot better than without.

* 1. DataSquareFall2020.mat

Graphical user interface, application

Description automatically generated(Side View)

Graphical user interface

Description automatically generated(Top View)

Graphical user interface

Description automatically generated with low confidence(From down to upwards)

Graphical user interface, application

Description automatically generated(The view from above)

* 1. DataSquareFall2020.mat

Graphical user interface, chart

Description automatically generated(Top View)Chart

Description automatically generated with medium confidence(Side View)

Graphical user interface, chart

Description automatically generated(General view)