Project report

Project description:

The main idea is to make a DJI Tello scan a room , find the exit point (open door) and navigate to this point.

we have used ORB_SLAM2 (with a virtual machine) to save the map of the features and DJI TELLO Drone library.

In addition, we have used multiple of a built-in functions and algorithms that was part of our algorithm for detection the door, such as: KNN, Kmeans ….

We have build several of small algorithms that also used in our algorithm like:Finding rectangle, Finding the furthest point of any point in the rectangle, Clean the point cloud, and more others.

Methodology:

1. Dataset:

We made our own dataset by flying the drone on several rooms with opened door then we saved its map. In addition, we used some other dataset from students in our course.

2. Algorithm:

- Cleaning the data and keep the borders only
- Surround the borders with a rectangle
- Split the noisy points to groups and make centroid for each one
- Find the most far centroid from the rectangle.

In order to find a rectangle on a map we used two known algorithms which have a built-in function in python: KNN, and Kmeans.

Firstly, we had to clean the point cloud in order to have an accurate result, so we used KNN with a radius of 0.1 and 15 neighbors that give as points cloud without the lonely points, Then for the cleaned point , we have made another aggressive cleaning to make sure we keep only the boarders of the room.

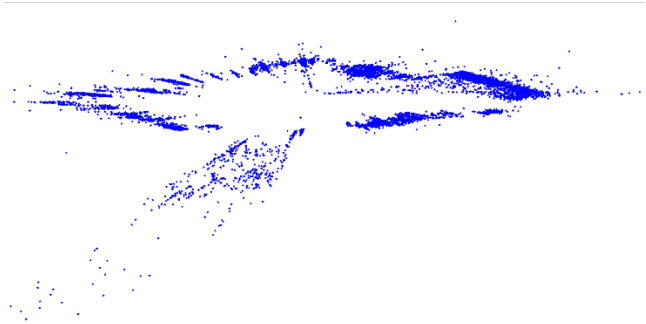
Then, we surrounded the cleaned points with a rectangle.

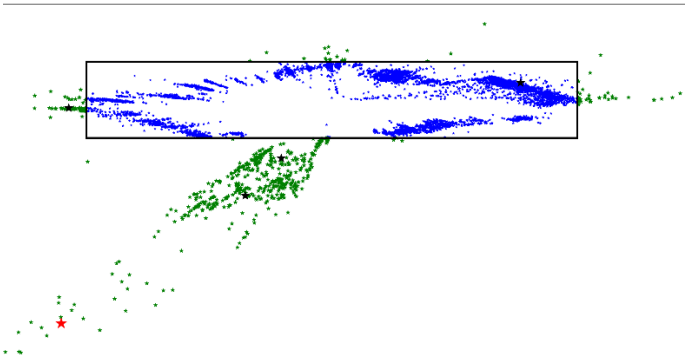
For the points that outside the rectangle (the noisy points) we used the Kmeans algorithm to find the centroids of them, in order to check which of them are the farthest of the rectangle.

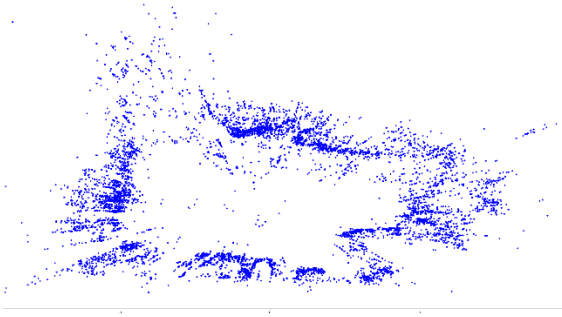
Our algorithm to find the furthest centroid:

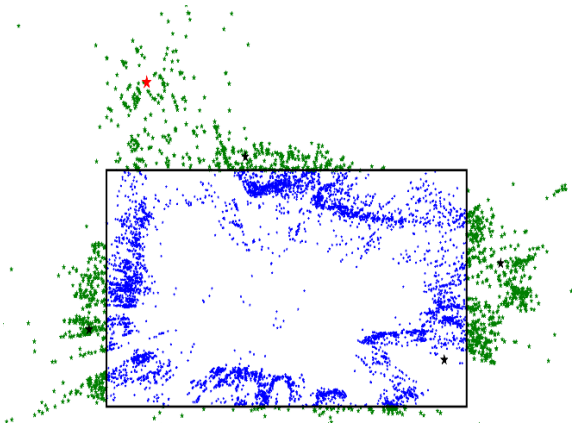
First, we checked where is the location of the points from the rectangle. There are some conditions: it could be in the bottom right, bottom left, up right, up left, or near a side of the rectangle. Second, if it’s near a side so we calculated the distance between a point and a line (for this we used a built-in function). If it’s not, we calculated the distance between two points, the point (one of the centroids) and the nearest head to it.

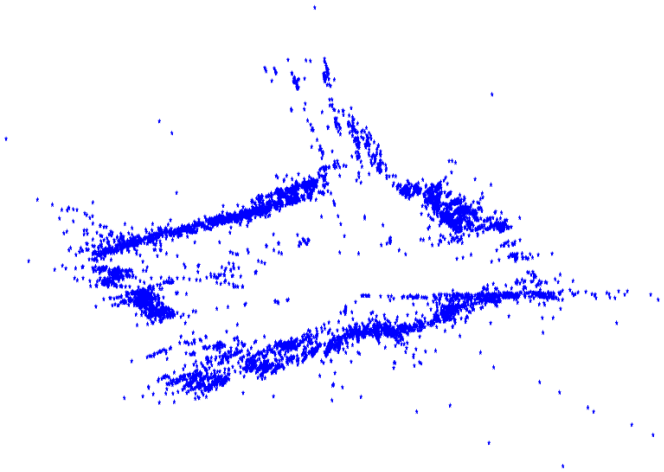
Running the algorithm on different scans from the data base:

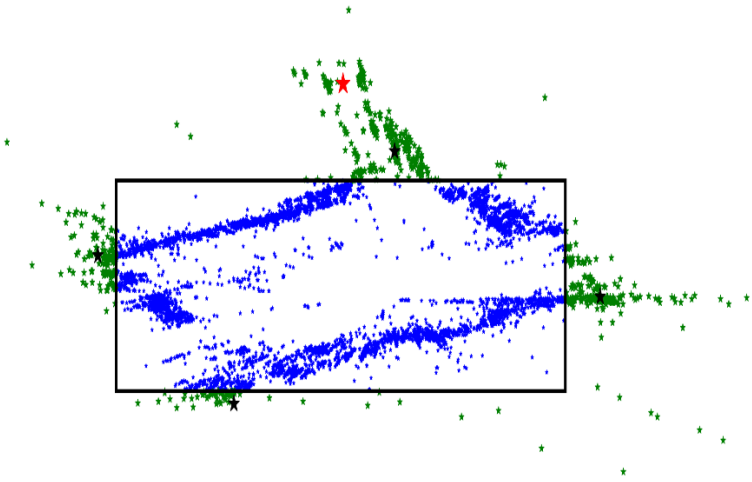


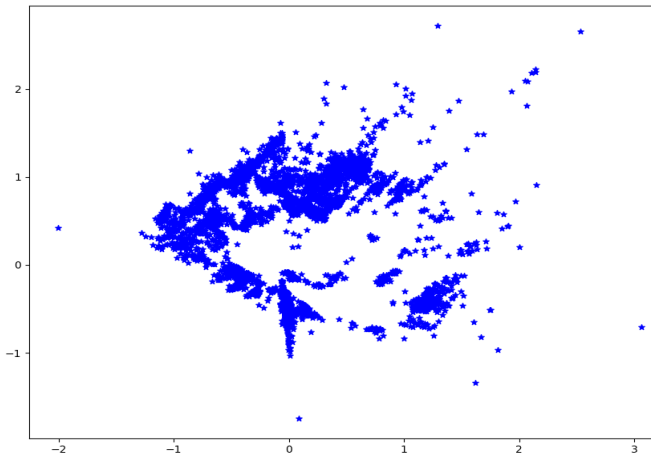








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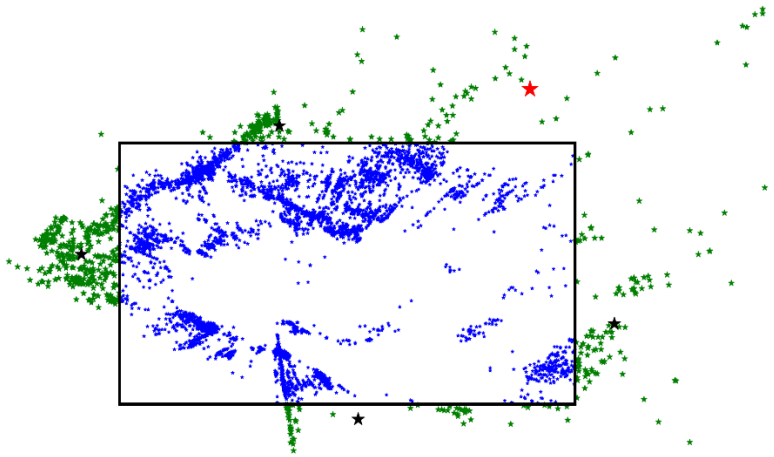

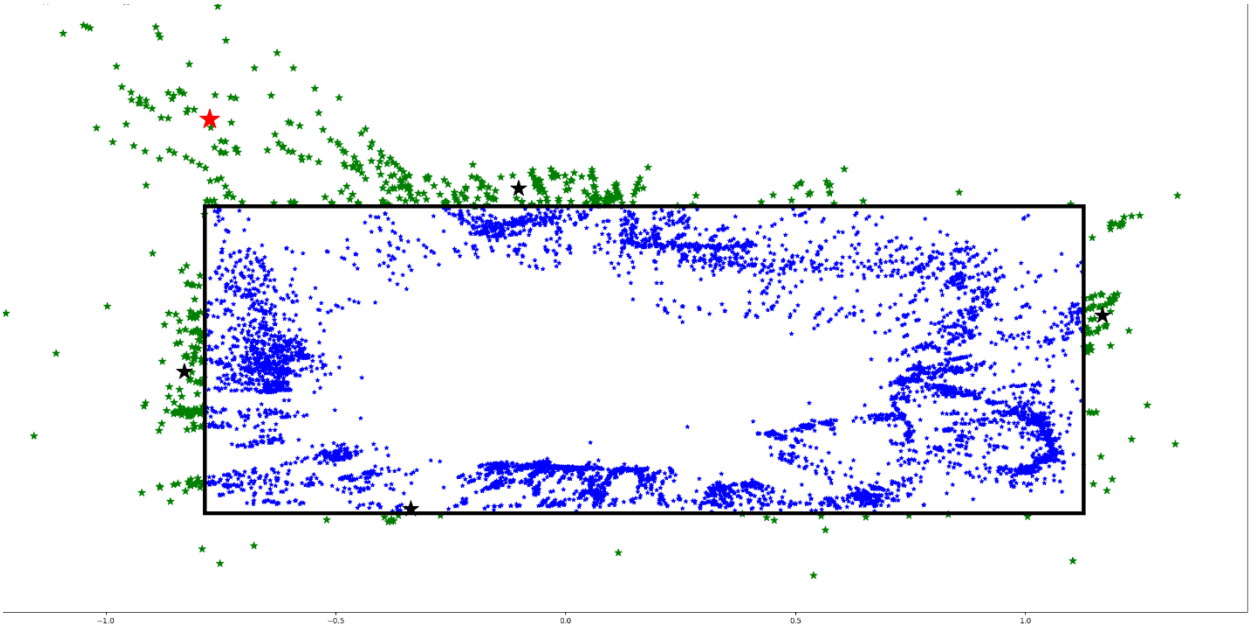
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Problems and difficulties we faced:

The must difficult thing was the setup of the ORB_SLAM on the virtual machine, we had a lot of errors when we tried to install OpenCV, and we couldn't do the building part for the ORB_SLAM. In addition, we had a problem on opening the camera to record a video and try ORB_SLAM in real time.

Furthermore, we faced some problems at the beginning of using the drone: broken battery, not recognizing any features when we run the ORB_SLAM.

Moreover, we had a very annoying problem which is we live far from each other so we couldn't attend in the lab at the first month and a half (especially that one of us works on a part job).

Why we deserve a full mark:

First reason and the most important one, we believe that our project works well.

Second is for the problems and difficulties we faced yet we did a nice job. In addition, we didn't have a good computer with ubuntu as OS our computers were very slow and old, till the last week of the semester (each one of us borrowed a computer from a friend or a family member)

We both are new and never tried real time software, and never deal with tello ever, and despite of this we learned from zero knowledge until we got out product.

Furthermore, we didn't know each other we got to know each other from the WhatsApp group of the course. Moreover, we were three students working at the project at the beginning then one of us left.

To sum up:

We have really enjoyed this course especially when we see all the things work together and get the wanted result.

This course and this experience opened our eyes on a big world that we never know, different new things that we had interested in and this make us eager more to explore and learn new things .