RTAB – FINAL PROJECT
KALAIPRIYAN R – KR53

ASSIGNMENT:

Description

RTAB-Map (Real-Time Appearance-Based Mapping) is a loop closure detection approach for SLAM. In this exercise, the students must perform RGB-D SLAM using recorded image data. You are provided with two data sequences (one collected on campus, the other collected in a cornfield from the terrasentia robot). The ZED camera was used to collect RGB and depth images. In addition, the robot was equipped with a GPS module, an inertial measurement unit, and wheel encoders. These sensors' measurements were fused by an Extended Kalman Filter (EKF), which computes an approximation of the ground-truth trajectory.

1. Run RTABMap on rosbag1 and rosbag2 (see a tutorial in the appendix section). Add the 3D maps to your report.
2. Implement a ROS node to get the coordinates (x,y,z) of the estimated trajectories by RTAB map (/rtabmap/odom) and the ground truth trajectories (/terrasentia/ekf). Store the data in .txt files. Add the 3D plots of these trajectories to your report.
3. Compute the Root mean square error between the estimated trajectories ($\mathbf{y} \in R^3$) and the ground truth trajectories ($\hat{y} \in R^3$).

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N} \|y(i) - \hat{y}(i)\|^2}{N}},$$

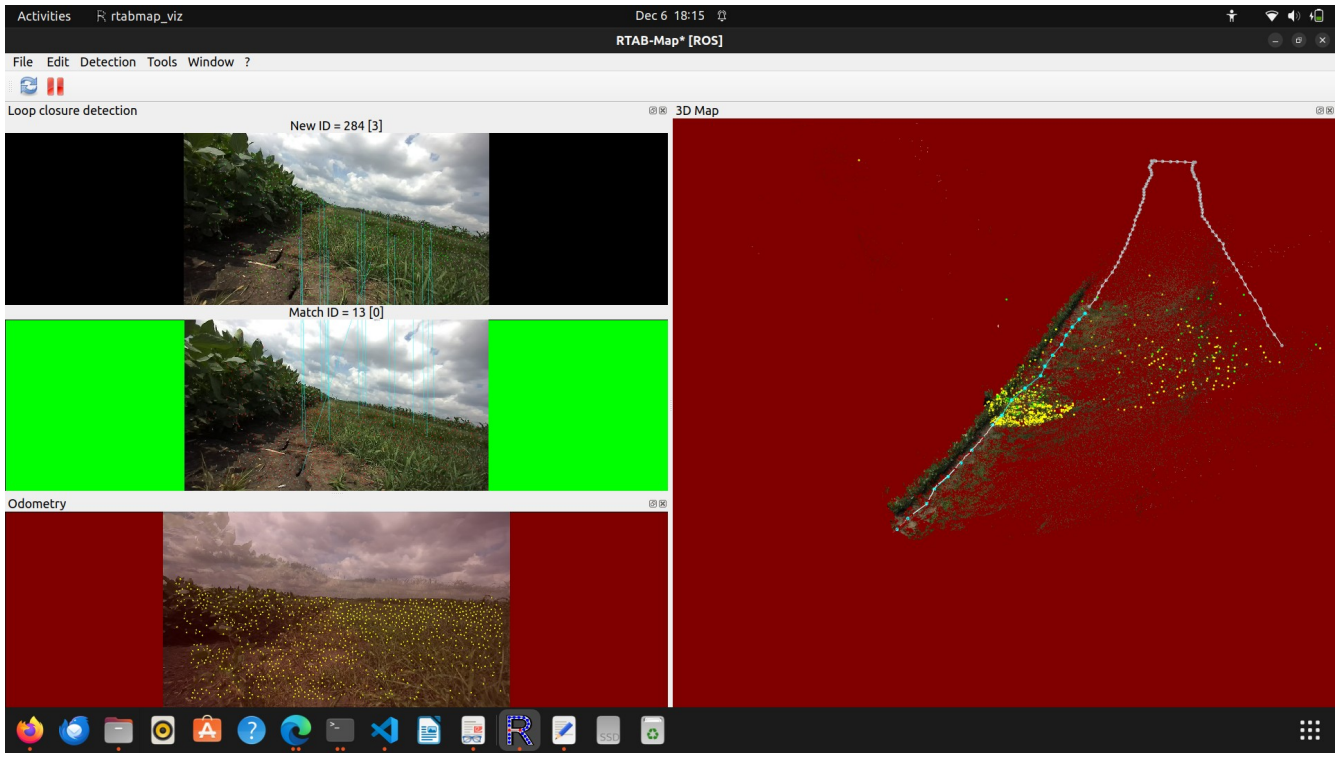
4. Discuss the results.

I

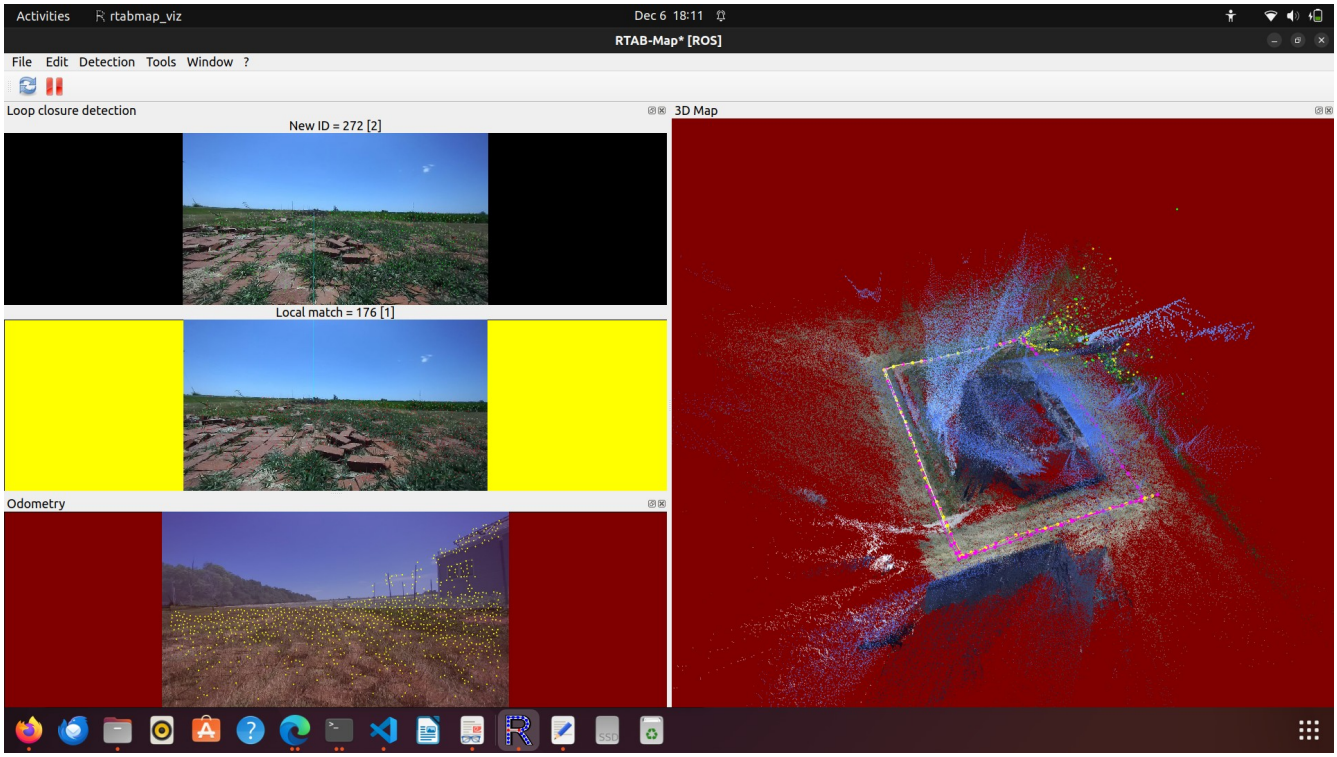
1)

RTAB SCREENSHOTS

BAG 1 :

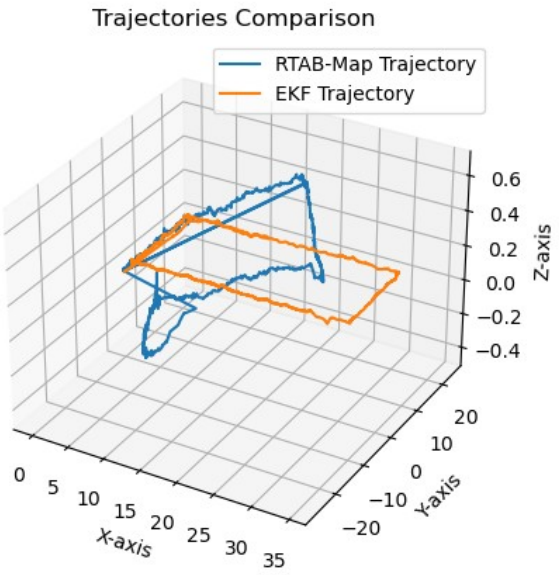


BAG 2:

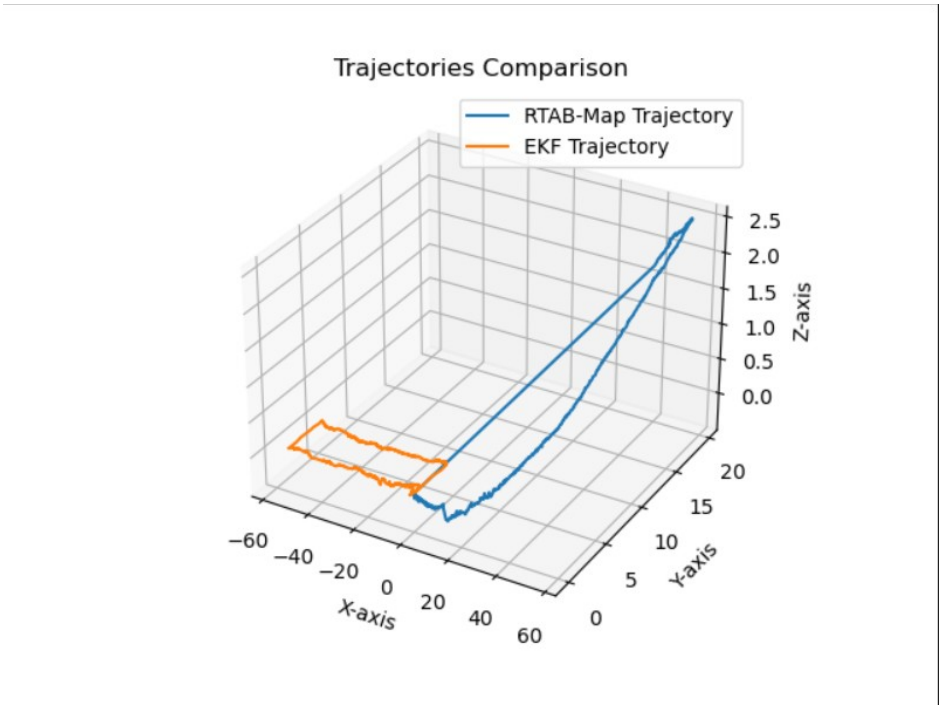


2)

BAG 1:


Trajectories Comparison
RTAB-Map Trajectory
EKF Trajectory
X-axis
Y-axis
Z-axis

BAG 2:


Trajectories Comparison
RTAB-Map Trajectory
EKF Trajectory
X-axis
Y-axis
Z-axis

3)

RMSE:

BAG 1:

RMSE: [18.54076501 15.61295726 0.4484616]

BAG 2:

RMSE: [31.33947028 8.86194619 1.13474423]

4)

DISCUSSION:

ERROR IN BAG 1 < ERROR IN BAG 2

Why ERROR?

The RMSE values of **[18.54076501 15.61295726 0.4484616] for Bag 1 and [31.33947028 8.86194619 1.13474423] for Bag2,** suggest that the trajectory estimation has significant discrepancies from the ground truth. This could be due to sensor noise, the SLAM system's inability to accurately map the environment, or errors in data association within the SLAM process. The larger errors in the horizontal plane (x and y axes) indicate potential challenges in lateral movement estimation, while the smaller error in the vertical (z-axis) suggests better altitude tracking.