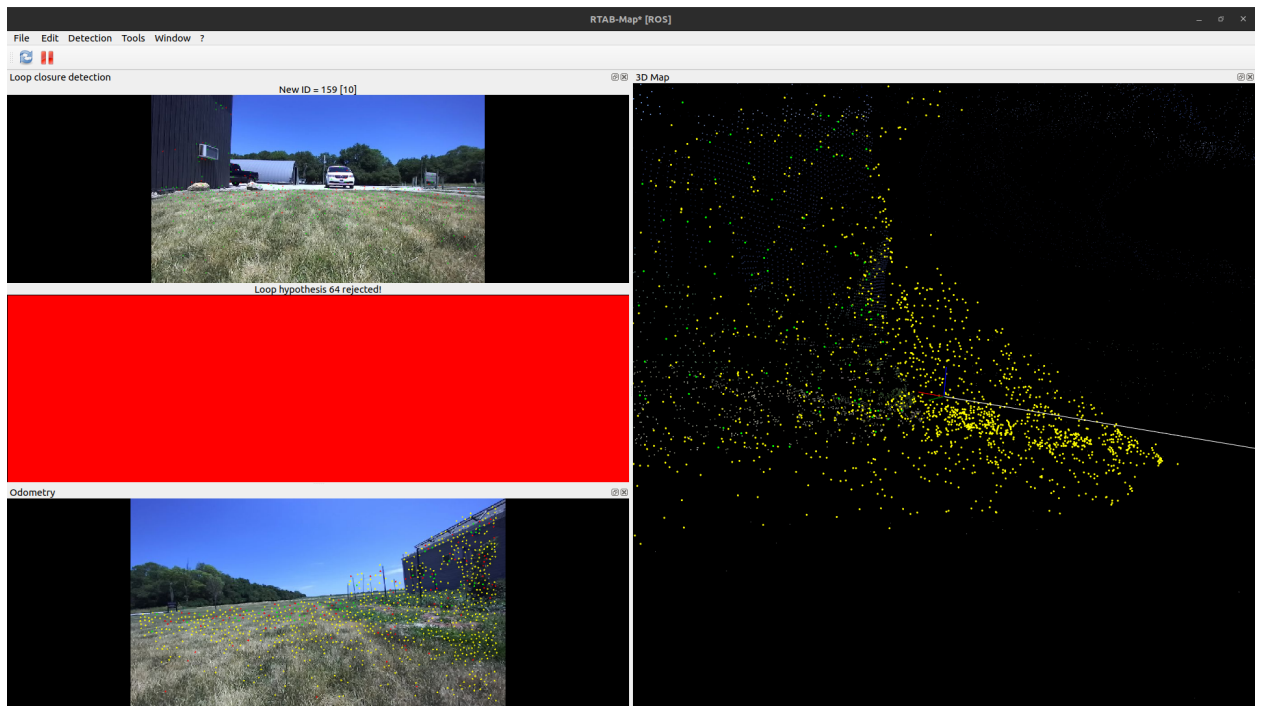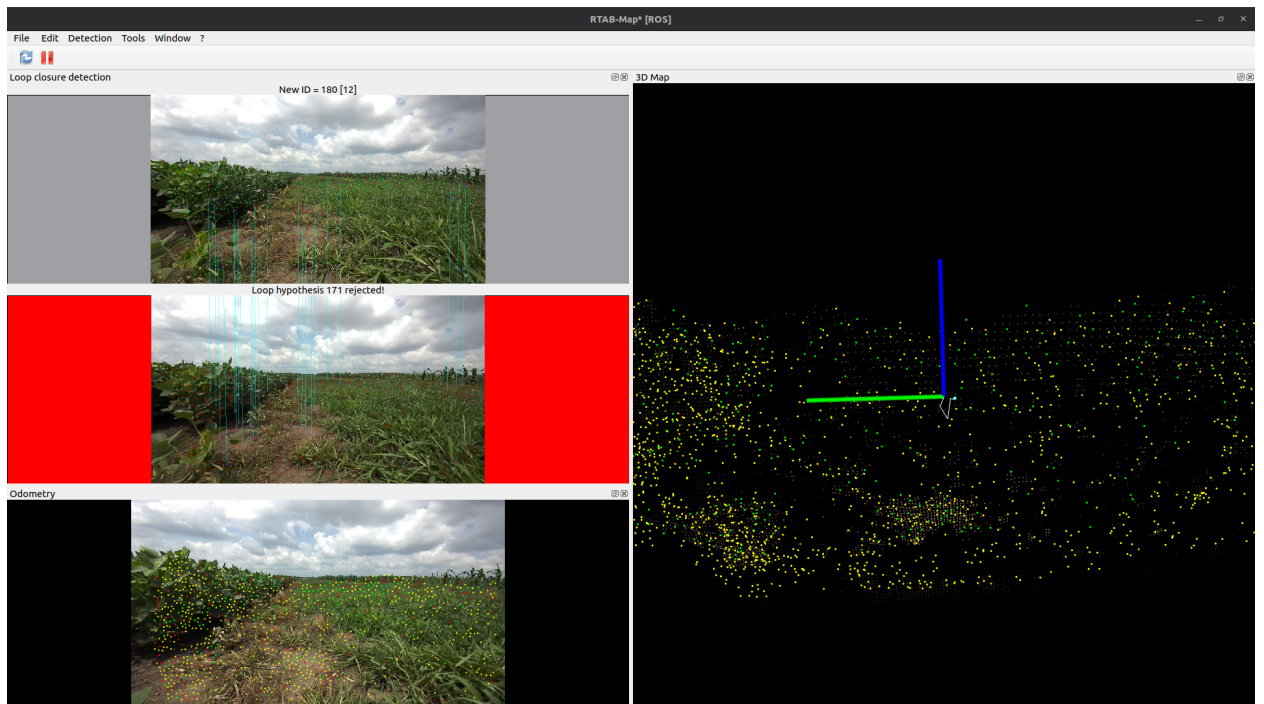Vaibhav Raheja RTAB MAP

1. Run RTABMap on rosbag1 and rosbag2 (see a tutorial in the appendix section). Add the 3D maps to your report.
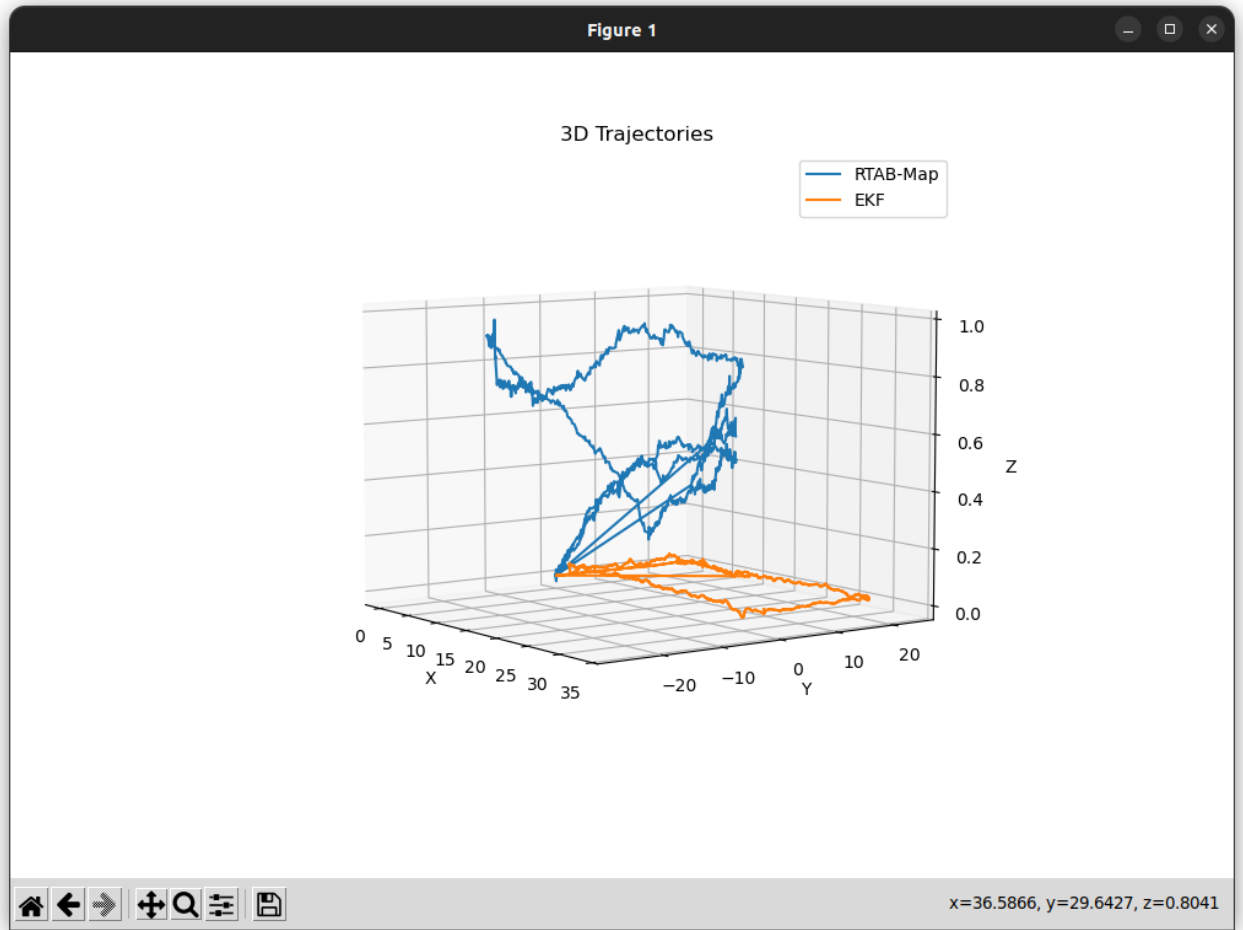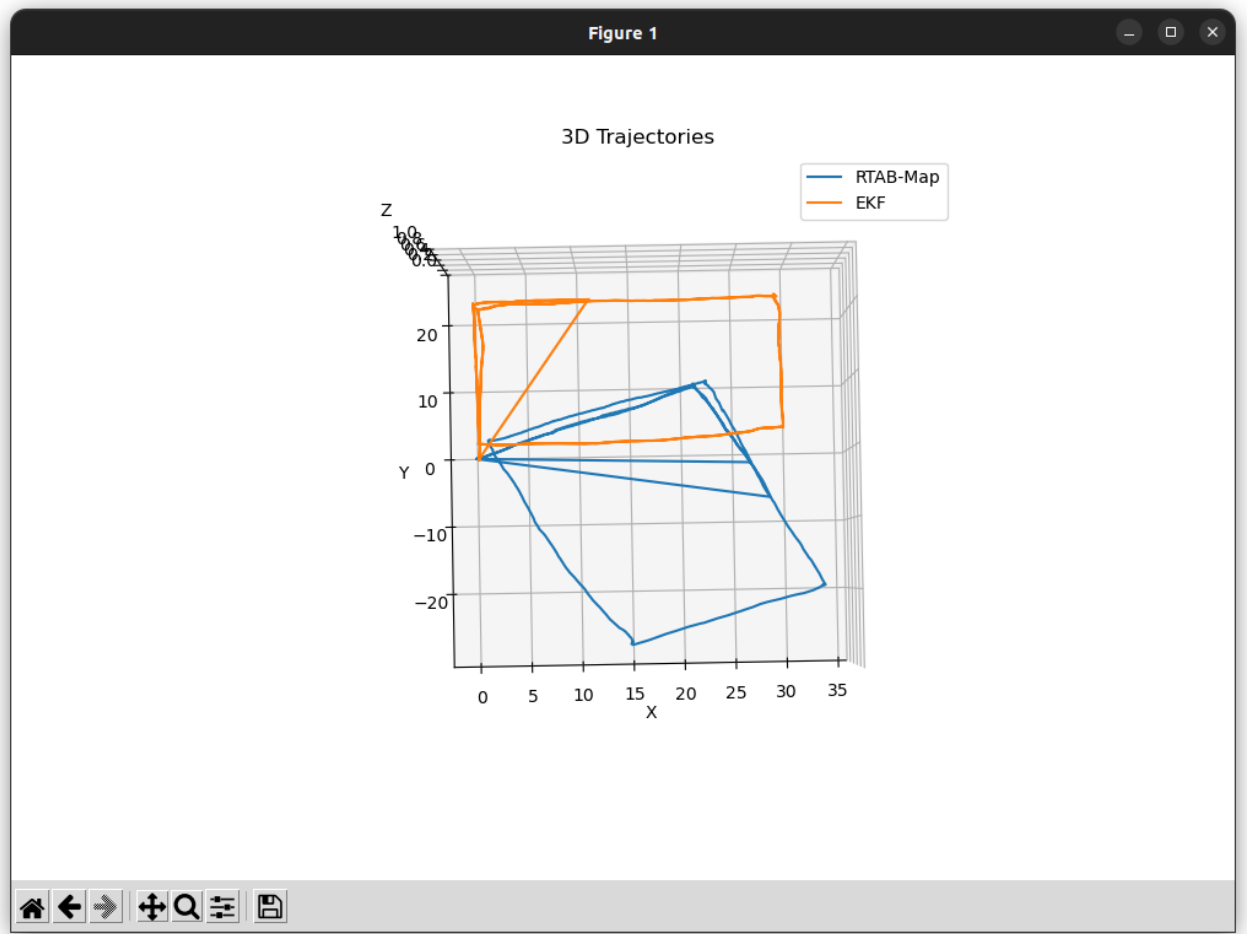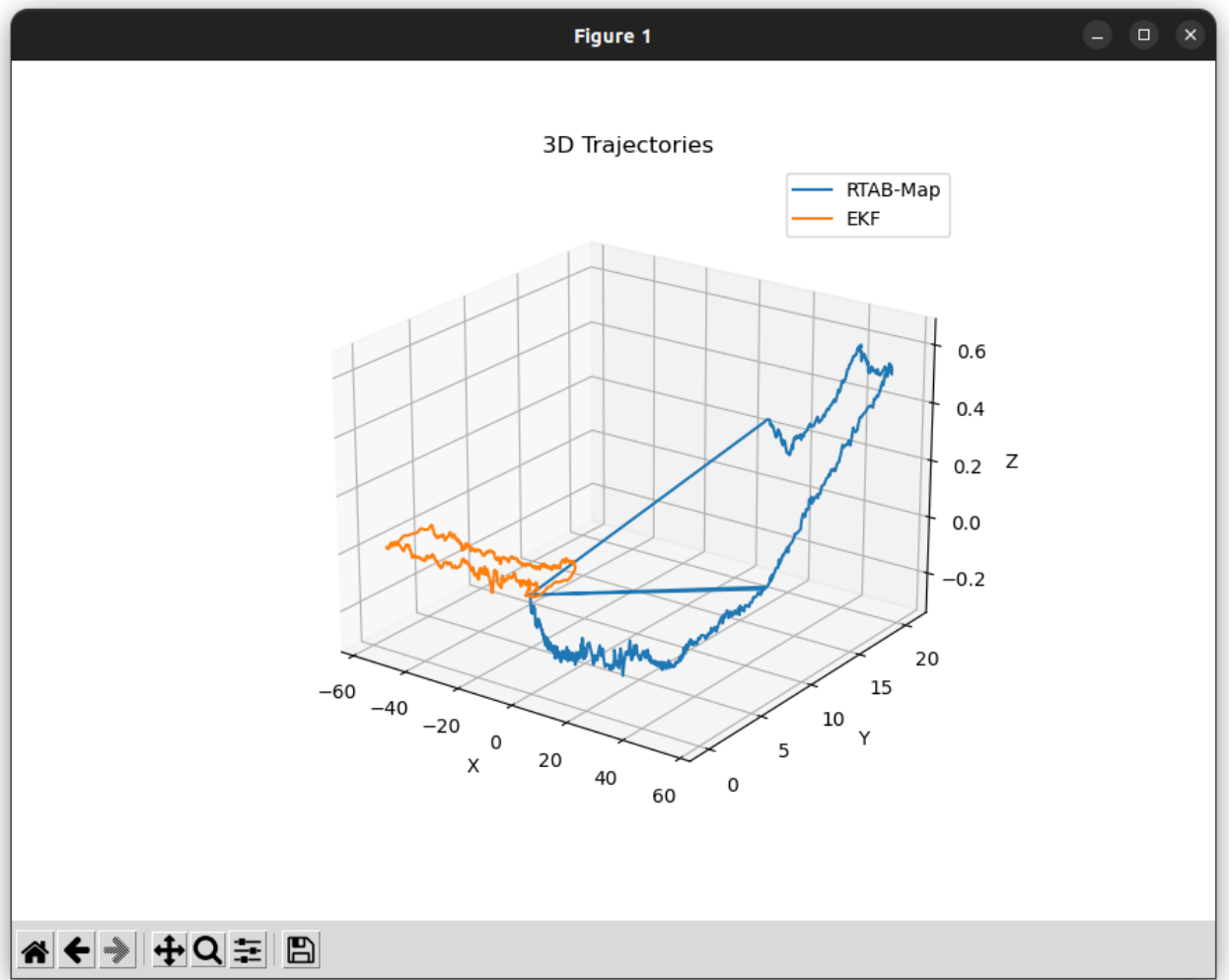   Bag1:

   Bag2:

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.
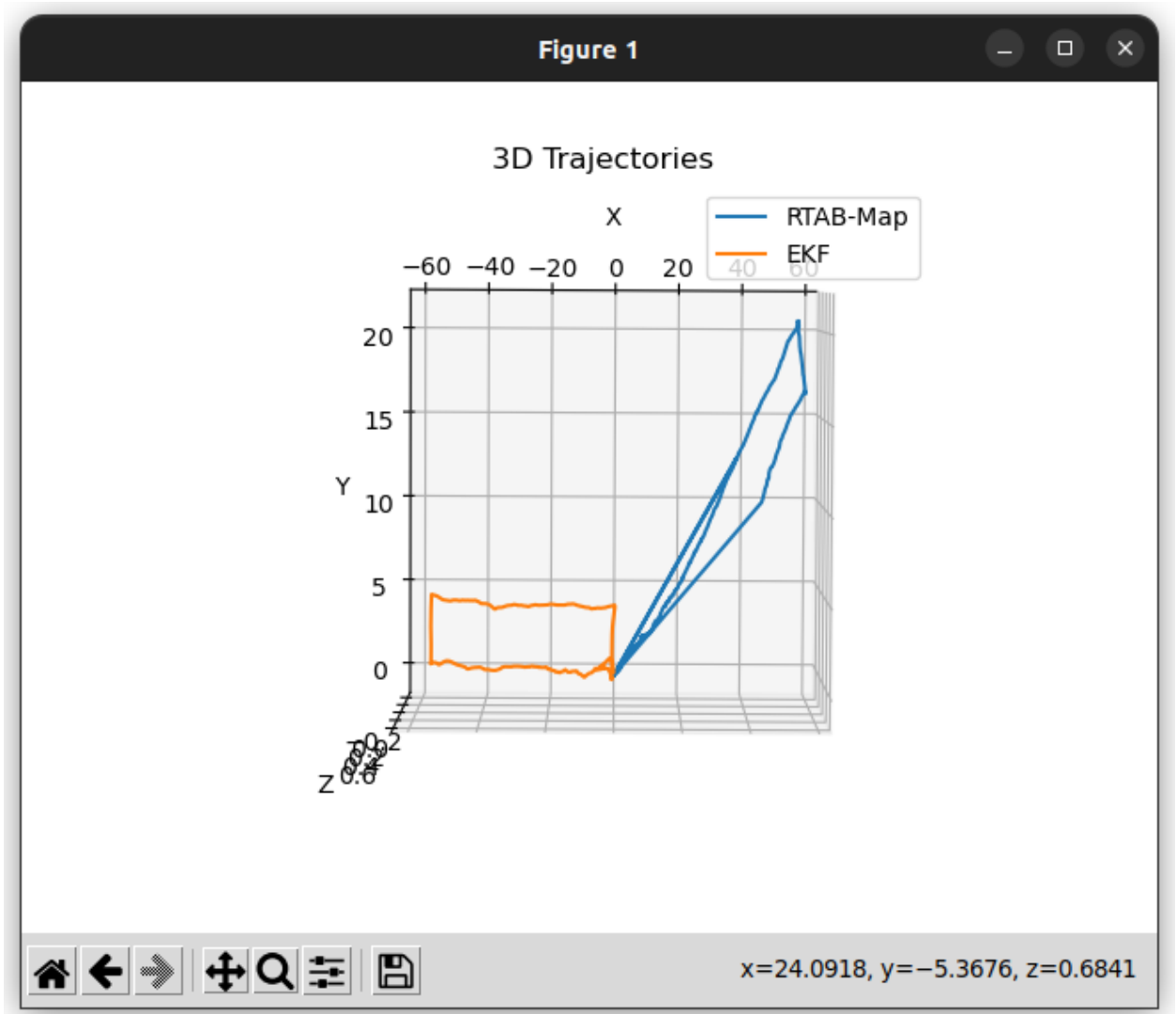
Bag1:

Vaibhav Raheja RTAB MAP

3D Trajectories

Vaibhav Raheja RTAB MAP

Bag2:

Vaibhav Raheja RTAB MAP

3. Compute the Root mean square error between the estimated trajectories (y∈) and the$R3$ ground truth trajectories (∈).$yR3$
   Bag 1:
   RMSE: 12.834908694038301 15.96204686828787 0.41239799071463223 (x, y, z)
   3D RMSE: 20.48638312422337
   Bag2:
   RMSE: 29.575752211036903 8.800371399989867 0.2675750461407151 (x, y, z)
   3D RMSE: 30.858438911126576

4. Discuss the results.

The 3D models created by RTAB generally capture the correct shape, but they are marred by discernible noise. This issue becomes more evident in the 3D representations and the Root Mean Square Error (RSME) analysis, where RTAB exhibits significant deviations from the baseline provided by the Extended Kalman Filter (EKF). Possible causes for this noise might include inaccuracies in wheel encoders or challenges presented by uneven terrain. Since much of the data was collected on surfaces like grass or dirt, these factors could have affected the accuracy of measuring the robot's position.

In a comparative analysis of RTAB and EKF, RTAB shows greater discrepancies in the horizontal (x and y) axes, while its performance in the vertical (z) axis is relatively more consistent. This observation is consistent with the nature of the terrain, which was predominantly flat without major slopes or elevations. Thus, the bulk of the RSME occurs in the x-y plane, which is the main area of movement for the terrasentia robot.

I also noted that the values obtained from RTAB tended to converge to zero more quickly than those from the EKF, impacting the completeness of the 3D models. To address this, I conducted multiple runs with RTAB and observed significant variations in the results.