Progress Review 10

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Team B / Auto Pirates

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1. Individual Progress

1. Robot Localization package test

I've been working on testing the robot localization package in ROS. The robot localization package provides nonlinear state estimation through sensor fusion of an arbitrarily number of sensors. Although the boat has been operating with the Novatel's precise INS system, I assume that robot localization package provides compatible functions with several navigation packages on ROS. Therefore it is worth to integrate it into our boat system.

At first, I downloaded the robot localization package in their git repository on the github like the following command.

git clone https://github.com/cra-ros-pkg/robot_localization.git

After making package in workspace directory, In order to compile the robot localization package, I run the catkin_build.

There are some parameters in the launch file that I should check.

```
<param name="map_frame" value="map"/>
<param name="odom_frame" value="odom"/>
<param name="base_link_frame" value="base_link"/>
<param name="world_frame" value="odom"/>
```

These parameters are description of frames. In this section, world frame and odom_frame are identical with odom. The odometry frame is considered as start point of robot. When I

```
<node pkg="rosbag" type="play" name="rosbagplay" args="$(find robot_localization)/
test/
```

consider to integrate GPS in this package, I should consider that world_frame is different value, not as odom.

This package is operated by rosbag file made by the Clearpath Husky robot and Microstrain 3DM-GX2 IMU.

```
<node name="test_ekf_localization_node_bag1_ekf" pkg="robot_localization"
type="ekf_localization_node" clear_params="true">
```

The robot localization package provides Extended Kalman Filter (EKF) and Unscented Kalman Filter (UKF). This setting is for Extend Kalman Filter.
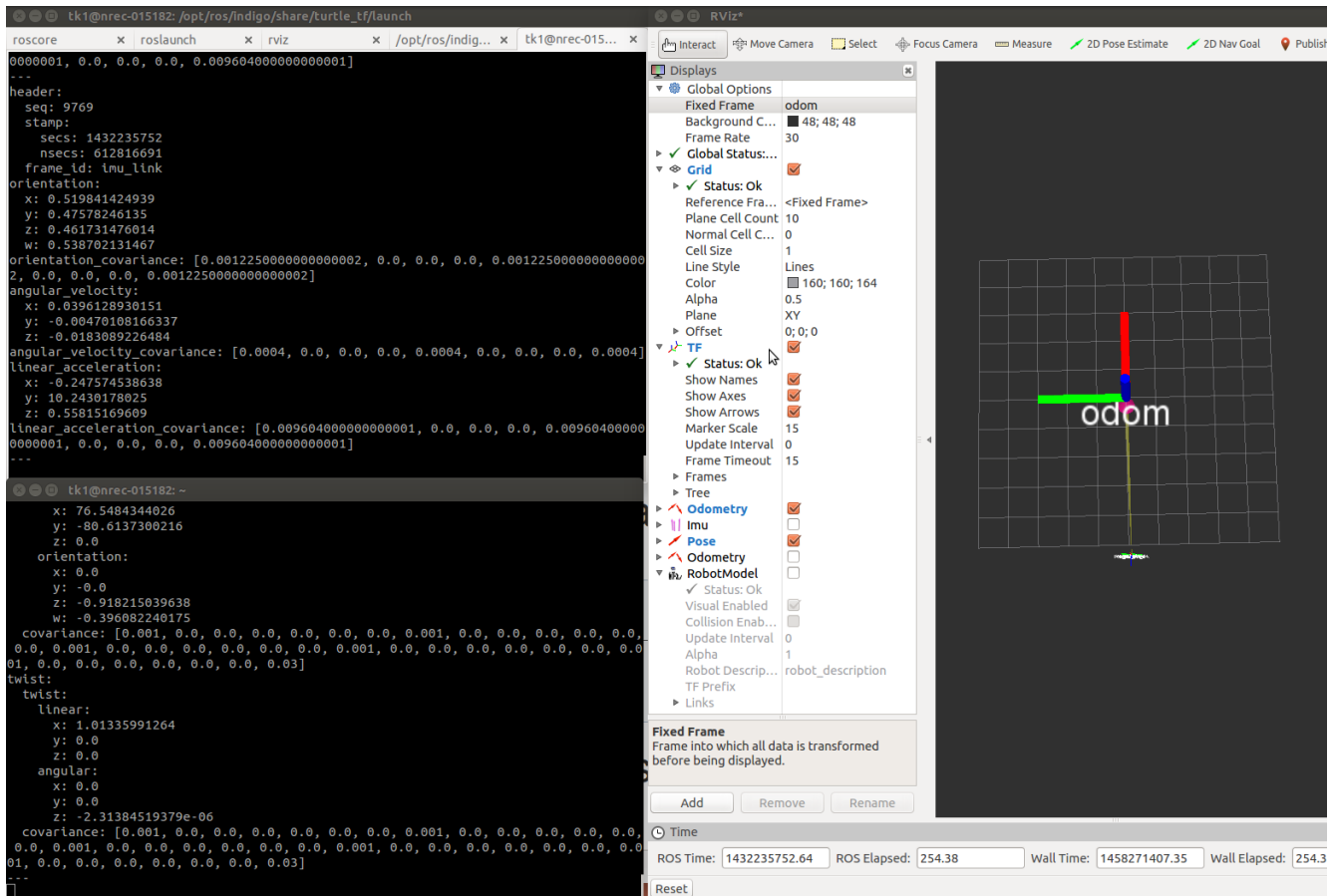

Figure 1. Robot localization package

The working robot localization is like the figure 1. Left-up window displays the IMU data and left-bottom window shows husky robot's odometry and right window shows visualization of moving odometry, base_link, and imu frame. Currently, odom frame is fixed.

There are some other bag files which could be tested in Unscented Kalman Filter (UKF). Also I tested Unscented Kalman Filter where the AR drone operated.

2. Preparing field test
Before the field test, I worked on field test plan with William and Shiyu. According to field test plan, I arranged some shell commands. I updated source code through git pull command to each laptop computer and check the issues through reviewing boat's operation via playing last bag files. Through replaying ROS bag files, I could check how the path planner made the

path at certain time. Based on the issues observed in simulation, I discussed some issues that our team would test on the field test with team members.

2. Challenges

When I installed and tested the robot localization package, I couldn't display the each frame (odom, base_link, and imu frame). The ROS tf package setting was too complicated to apply to the robot localization package. So, I asked my teammate William to help me to show each frame on RVIZ. He discovered other launch file which is in test directory and it showed the base_link and mu_link frame moving with respect to the odom frame. As a result, we can check that launch file how the setup file is made.

3. Teamwork

1) Shiyu Dong: Shiyu worked with William to create the test plan for the field test and also get the system ready for the field test. In addition to this he also created the videos of field tests depicting success and failure instance which were presented during PR.

2) Bikram Hanzra: Bikram added the joystick control for simulating the fake obstacles and integrated that to the system.

3) William Seto: William worked with Shiyu together and got the entire system ready for the field test with launch files, maps and configurations. In addition to this, he also fixed bugs related to addition of obstacles to the environment.

4) Tushar Chugh: Tushar worked on fixing the bug related to waypoint buffer by sending only 100 waypoints at a time.

4. Future Plans

1) Integrating GPS bag file into Robot localization package
The Robot localization package shows that base_link and imu frames moves with respect to the odom frame without world frame. I assume that if the GPS is integrated, we can show

world frame in the map which enables the UTM coordinate system has latitude and longitude.

2) Robot localization package test on the boat

 I plan to test robot localization package on the boat. Specifically, I will make GPS and Novatel INS data feeding into robot localization package and checked the filtered localization data by Kalman filter in the package. Finally, I could show the boat's current location on the occupancy grid map.