Progress Review 11

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Team B / Auto Pirates

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1. Individual Progress

1. NovAtel INS Interface

 I've been working on interfacing with NovAtel INS to get the INS data on the boat. At first, I connected host computer with INS via USB cable to setup the network of INS. In the host computer, I needed the NovAtel Connect program which was a windows-based GUI to access the INS.

USB   Ethernet

Figure 1. ProPak6 GNSS Receiver

 After that, I executed the NovAtel Connect program to setup up communication like the following commands so that ROS communicated with INS through Ethernet.

```
wificonfig state disabled
ethconfig etha auto auto auto auto
icomconfig icom1 tcp :3001
ipconfig etha static 192.168.1.50 255.255.255.0 192.168.1.1
saveconfig
saveethernetdata etha
```

 For reference, NovAtel Connect program provided various functions to check the status of INS shown in the Figure 2. Specifically, I could check latitude and longitude in position window and velocity of north and east in the INS window.

2. Testing novatel_span_driver ROS package

 For testing novatel_span_driver package in ROS, what I did at first was to connect ethernet cable between NovAtel INS and Linux laptop computer directly. Secondly, I executed roscore and novatel_span_driver package through roslaunch program like the following command.

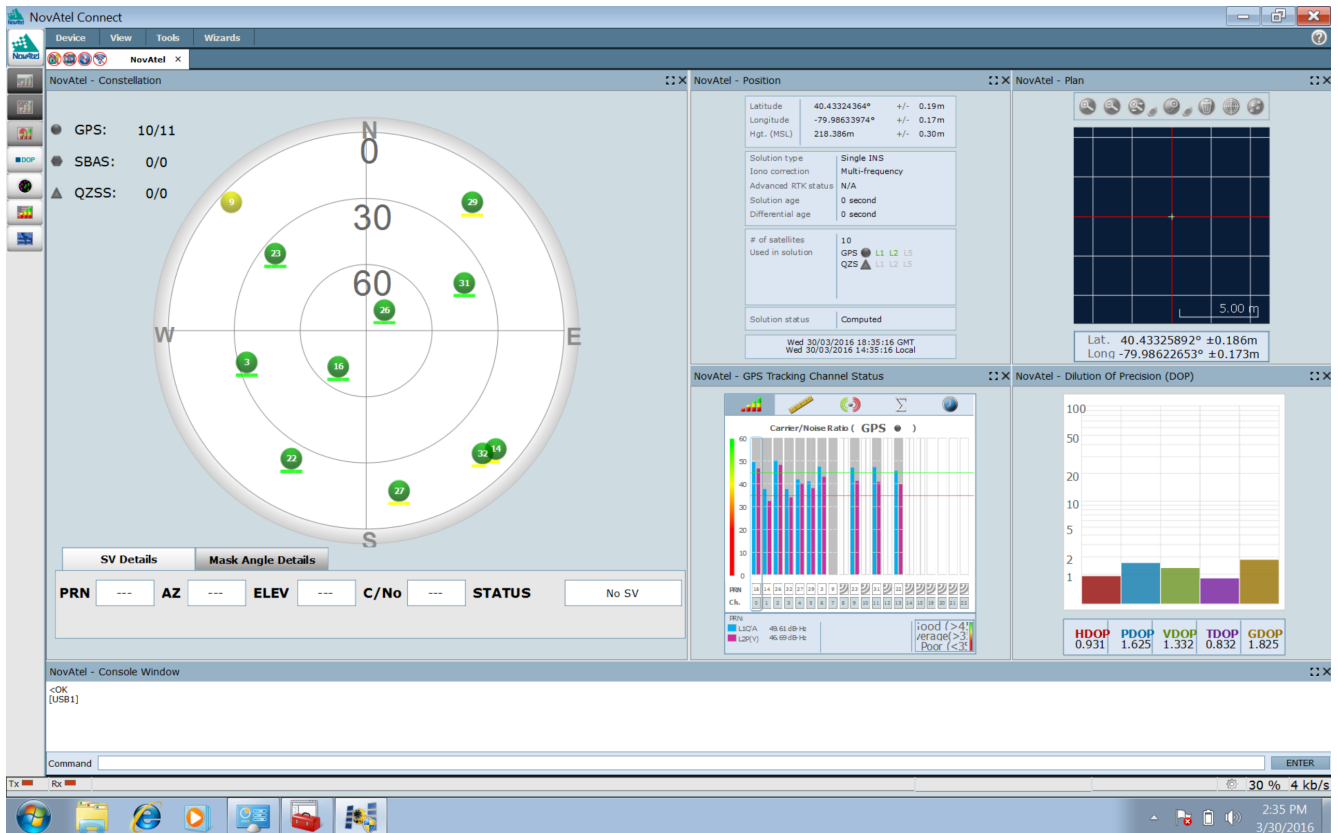   roslaunch novate_span_driver example.launch ip:=192.168.1.50 —screen

Figure 2. NovAtel Connect

When I checked topic list in ROS, there were some topics related to NovAtel INS like the following figure 3.

Figure 3. Topic list of novatel_span_driver

I could check useful topics through rostopic command. First, '/imu/data' topic showed orientation, angular velocity, and linear acceleration like the following figure 4.

```
  x: -0.0653535563625
  y: -0.39696227235
  z: -0.0692908109005
linear_acceleration_covariance: [0.001, 0.0, 0.0, 0.0, 0.001, 0.0, 0.0, 0.0, 0.001]
---
header:
  seq: 52141
  stamp:
    secs: 0
    nsecs: 0
  frame_id: base_link
orientation:
  x: 0.0285927088289
  y: 0.0057538866102
  z: -0.202427467922
  w: 0.978862845357
orientation_covariance: [1.004788503467169, 0.0, 0.0, 0.0, 1.0048338255760425, 0.0, 0.0, 0.0, 1.01040122569897]
angular_velocity:
  x: -0.00405744371038
  y: -0.00761424525945
  z: 0.00504816604533
angular_velocity_covariance: [0.001, 0.0, 0.0, 0.0, 0.001, 0.0, 0.0, 0.0, 0.001]
linear_acceleration:
  x: -0.0145171093181
  y: -0.432205303502
  z: 0.0501783216948
linear_acceleration_covariance: [0.001, 0.0, 0.0, 0.0, 0.001, 0.0, 0.0, 0.0, 0.001]
---
```

Figure 4. rostopic echo /data/imu

Secondly, '/navsat/odom' topic showed boat's odometry including pose and twist like the following figure 5.

```
  frame_id: odom
child_frame_id: base_link
pose:
  pose:
    position:
      x: 2699.37152893
      y: -1119.3088748
      z: -0.221945706755
    orientation:
      x: 0.0110668365482
      y: -0.0241700410892
      z: -0.997741472985
      w: 0.0616870110159
  covariance: [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0
.0, 0.0, 0.0, 1.0100561240304373]
twist:
  twist:
    linear:
      x: -13.1284715292
      y: -1.56006077844
      z: -0.115044799584
    angular:
      x: 0.0
      y: 0.0
      z: 0.0
  covariance: [1.0044860169778709, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0059899941030999, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1
0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.1]
---
```

Figure 5. rostopic echo /navsat/odom

Next, '/tf' topic showed the translation and rotation transforms between odom and base_link frame .

Lastly, Rviz showed the boat moving with respect to the odom frame following figure 7.

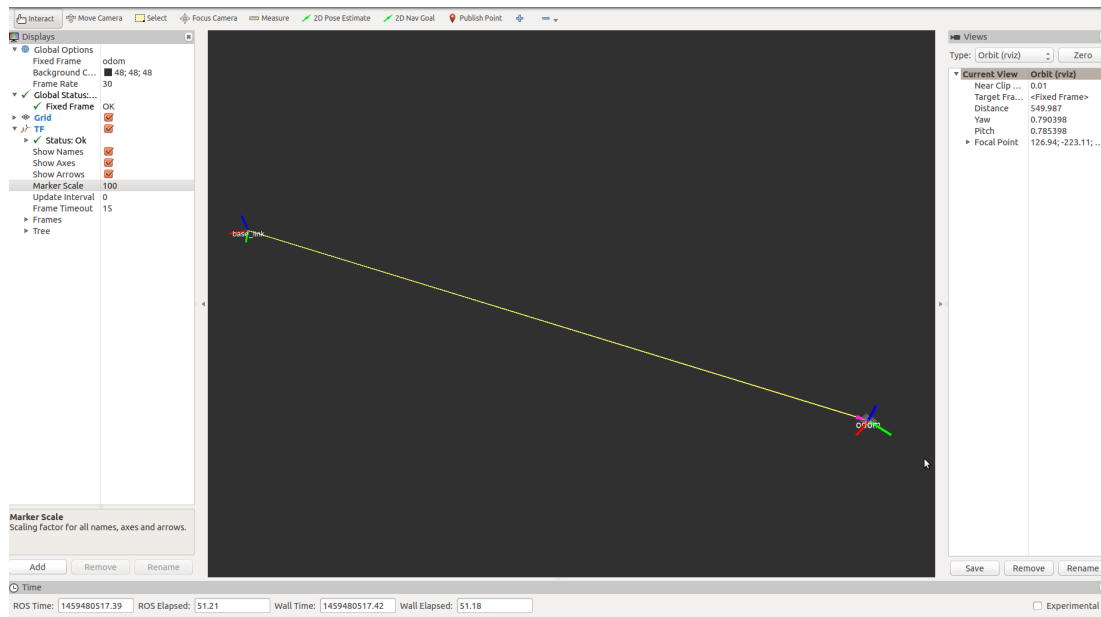

Figure 6. rostopic echo /tf

Figure 7. rostopic echo /tf

2. Challenges

In the field test, I was able to test it because this test needed to interface with INS sensor directly. I was trying to test with robot_localization package together but the test time was limited. For that reason, I couldn't test it together. But I was able to make rosbag file for NovAtel INS sensor. I thought that I should analyze that rosbag file and prepare jobs needed for next field test.

3. Teamwork

1) Shiyu: Shiyu edited maps and improved GUI for predefined locations. Shiyu responded instantaneously to change maps according to the boat's path planning performance so that the boat became more possibly to follow the road of the rules.

2) Tushar: Tushar made inflation of cost of the obstacles with Bikram and rules of the road with William

3) William: William worked on improving path planning to follow the rules of the road with Tushar and helping with integration.

4) Bikram: Bikram worked on inflation of cost of the obstacles and support the field test.

4. Future Plans

1) Integrating INS data into world frame.
 Currently, INS data was based on odometry and base_link frame without map. I think that I'll work on integration of INS data based on world frame in the occupancy grid map. Then I can show the boat moving on the occupancy grid map.

2) Waypoint GUI program
 I'll make the simple waypoint GUI program so that the operator could enter the latitude and longitude of the water taxi stop. So it would be demonstrated on SVE day.