

ROS Exercise 1

2017-2018

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1 Intro

This report explains exercise in Chapter 3: Writing ROS programs from a set of exercises for the book "A Gentle Introduction to ROS". The exercise asks the student to create a new package containing new two nodes.

- The first node is `vel_printer` which subscribes to `geometry/Twist` messages and prints them on the console.
- The second node is `vel_filter` which subscribes to the messages published by `pubvel` node and then republishes the filtered messages which only has positive angular velocity component.

2 Implementation

The program that creates `pubvel` node can be found in Listing 3.4 from the book. Meanwhile, the program of `vel_printer` node is similar to subscriber example program in Listing 3.5. The differences are only the topic that it subscribes (`geometry/Twist`) and the way it prints the messages (we print x-axis linear velocity and z-axis angular velocity).

Basically, the implementation of `vel_filter` node combines both publisher and subscriber program. First, it creates an object to subscribe the messages published by `pubvel` node which has topic `turtle1/cmd_vel` then it creates an object to publish the filtered message which has topic `geometry/Twist`. It is shown by code snippet in Listing 1.

Listing 1: Publisher and Subscriber in `vel_filter`

```
// Create a subscriber object.  
ros::Subscriber sub = nh.subscribe("turtle1/cmd_vel", 1000,  
    &twistMessageReceived);
```

```
// Create a publisher object.
ros::Publisher pub =
    nh.advertise<geometry_msgs::Twist>("geometry/Twist",1000);
```

The subscriber object has call back function `twistMessageReceived`. This call back function assigns the z-axis angular velocity and x-axis linear velocity from `turtle1/cmd_vel` messages into global variable `angular_vel` and `linear_vel` respectively. It is shown by code snippet in Listing 2.

Listing 2: Call back function in `vel_filter`

```
// angular velocity
double angular_vel = 0;
double linear_vel = 0;

// A call back function . Executed each time a new
// turtle1/cmd_vel message arrives.
void twistMessageReceived(const geometry_msgs::Twist& msg)
{
    angular_vel = msg.angular.z;
    linear_vel = msg.linear.x;
}
```

Afterwards, the code snippet in Listing 3 shows how to republish filtered messages. Because there is another work other than the callback function, `ros::spinOnce()` is used instead `ros::spin()`. Then the conditional statement (`angular_vel >= 0`) filters the messages and make the program only publishing the messages with positive angular velocity.

Listing 3: Loop in `vel_filter`

```
while(ros::ok()) {
    // Let ROS take over
    ros::spinOnce();
    // only publish when angular velocity is positive
    if (angular_vel >= 0)
    {
        // message for republish
        geometry_msgs::Twist msg;
        msg.linear.x = linear_vel;
        msg.angular.z = angular_vel;
        // Publish the message.
        pub.publish(msg);
    }
    // Wait until it's time for another iteration.
    rate.sleep();
}
```

3 Result

Figure 1 shows the visualization of publish-subscribe relationship between the three nodes.

- The `pubvel` node is represented by `/publish_velocity` node which publish messages with topic `/turtle1/cmd_vel`.
- The `vel_filter` node is represented by `/filter_twist` node which subscribes messages with topic `/turtle1/cmd_vel` and publishes messages with topic `/geometry/Twist`.
- `vel_printer` node is represented by `/subscribe_geometry_Twist` node which subscribes messages with topic `/geometry/Twist`.

Messages `/geometry/Twist` is the filtered version of messages `/turtle1/cmd_vel`.



Figure 1: Relationship between 3 nodes

Figure 2 shows the result of filtering the messages. The left terminal is `vel_printer` node and the right terminal is `pubvel` node. As we can see, the left terminal only prints the positive angular velocity. Meanwhile, the right terminal prints the original random velocity which includes both positive and negative angular velocity.

4 Conclusion

This exercise introduces several fundamental concepts in ROS, which are :

- A ROS package which is a collection of files, executables and other supporting files.
- Nodes which is a running instance of ROS program.
- Topics and messages which are basic entities in communication between ROS nodes.
- Publisher and Subscriber programs which enables communicating between nodes via messages.

```
pradiateguh@pradiateguh-NS512U: ~/ros
[INFO] [1512561574.383638102]: Linear = 0.55, angular = 0.76
[INFO] [1512561577.383652979]: Linear = 0.70, angular = 0.21
[INFO] [1512561578.383837381]: Linear = 0.47, angular = 0.96
[INFO] [1512561579.383598639]: Linear = 0.58, angular = 0.53
[INFO] [1512561579.883886664]: Linear = 0.26, angular = 0.26
[INFO] [1512561580.383855292]: Linear = 0.79, angular = 0.80
[INFO] [1512561580.883733884]: Linear = 0.19, angular = 0.78
[INFO] [1512561581.383939862]: Linear = 0.00, angular = 0.84
[INFO] [1512561581.883832954]: Linear = 0.94, angular = 0.10
[INFO] [1512561582.883578201]: Linear = 0.62, angular = 0.19
[INFO] [1512561584.383815144]: Linear = 0.40, angular = 0.86
[INFO] [1512561585.384054282]: Linear = 0.53, angular = 0.95
[INFO] [1512561586.883664410]: Linear = 0.10, angular = 0.06
[INFO] [1512561587.883861985]: Linear = 0.16, angular = 0.92
[INFO] [1512561589.383844954]: Linear = 0.27, angular = 0.57
[INFO] [1512561590.883883398]: Linear = 0.67, angular = 0.99
[INFO] [1512561591.883897413]: Linear = 0.32, angular = 0.97
[INFO] [1512561592.883957305]: Linear = 0.09, angular = 0.80
[INFO] [1512561594.883618398]: Linear = 0.58, angular = 0.60
[INFO] [1512561595.383795087]: Linear = 0.37, angular = 0.48
[INFO] [1512561595.883606342]: Linear = 0.76, angular = 0.26
[INFO] [1512561596.383898119]: Linear = 0.09, angular = 0.22
[INFO] [1512561597.384078554]: Linear = 0.40, angular = 0.42
[INFO] [1512561597.883711688]: Linear = 0.44, angular = 0.17
[INFO] [1512561598.883877394]: Linear = 0.58, angular = 0.45
[INFO] [1512561599.383690345]: Linear = 0.54, angular = 0.80
[INFO] [1512561599.883807805]: Linear = 0.71, angular = 0.81
[INFO] [1512561600.383581615]: Linear = 0.03, angular = 0.60
[INFO] [1512561601.383642642]: Linear = 0.02, angular = 0.42
[INFO] [1512561601.883536141]: Linear = 0.18, angular = 0.30
[INFO] [1512561602.383914264]: Linear = 0.72, angular = 0.52
[INFO] [1512561603.883546211]: Linear = 0.72, angular = 0.19
[INFO] [1512561604.383524834]: Linear = 0.82, angular = 0.24
[INFO] [1512561607.384079290]: Linear = 0.29, angular = 0.82
[INFO] [1512561608.383848315]: Linear = 0.71, angular = 0.52
[INFO] [1512561608.883565138]: Linear = 0.44, angular = 0.46
[INFO] [1512561609.383843497]: Linear = 0.47, angular = 0.25
[INFO] [1512561610.383585163]: Linear = 0.38, angular = 0.66
[INFO] [1512561610.883647164]: Linear = 0.28, angular = 0.77
[INFO] [1512561611.383683177]: Linear = 0.04, angular = 0.99
[INFO] [1512561611.883624442]: Linear = 0.48, angular = 0.73
[INFO] [1512561612.883863815]: Linear = 0.09, angular = 0.89
[INFO] [1512561613.383811919]: Linear = 0.84, angular = 0.79
[INFO] [1512561614.383945870]: Linear = 0.28, angular = 0.24
[INFO] [1512561614.883595442]: Linear = 0.38, angular = 0.14
[INFO] [1512561616.883817814]: Linear = 0.97, angular = 0.12
[INFO] [1512561619.383850712]: Linear = 0.02, angular = 0.40
[INFO] [1512561619.883953877]: Linear = 0.09, angular = 0.26
[INFO] [1512561620.883891077]: Linear = 0.58, angular = 0.95
[INFO] [1512561621.383872179]: Linear = 0.07, angular = 0.99
[INFO] [1512561622.383564993]: Linear = 0.62, angular = 0.39
[INFO] [1512561623.383480804]: Linear = 0.03, angular = 0.63
[INFO] [1512561625.883646509]: Linear = 0.43, angular = 0.79
[INFO] [1512561626.383612837]: Linear = 0.44, angular = 0.31
[INFO] [1512561628.383704766]: Linear = 0.38, angular = 0.33
[INFO] [1512561629.383611186]: Linear = 0.66, angular = 0.57
[INFO] [1512561630.383713361]: Linear = 0.48, angular = 0.48
[INFO] [1512561630.883868126]: Linear = 0.43, angular = 0.81
[INFO] [1512561631.383978539]: Linear = 0.56, angular = 0.65

pradiateguh@pradiateguh-NS512U: ~/ros
[INFO] [1512561602.598889841]: Linear = 0.451426, angular = -0.822243
[INFO] [1512561603.598882844]: Linear = 0.502694, angular = -0.576235
[INFO] [1512561603.598965169]: Linear = 0.720852, angular = 0.188816
[INFO] [1512561604.098975734]: Linear = 0.823774, angular = 0.236308
[INFO] [1512561604.598974458]: Linear = 0.958156, angular = -0.554846
[INFO] [1512561605.098976205]: Linear = 0.330032, angular = -0.206998
[INFO] [1512561605.598963834]: Linear = 0.807884, angular = -0.0476152
[INFO] [1512561606.098816426]: Linear = 0.582827, angular = -0.224752
[INFO] [1512561606.598935174]: Linear = 0.201433, angular = -0.912588
[INFO] [1512561607.098944671]: Linear = 0.287414, angular = 0.821478
[INFO] [1512561607.598992861]: Linear = 0.95122, angular = -0.370223
[INFO] [1512561608.098971194]: Linear = 0.708557, angular = 0.215475
[INFO] [1512561608.598983554]: Linear = 0.44274, angular = 0.457712
[INFO] [1512561609.098525861]: Linear = 0.46854, angular = 0.24539
[INFO] [1512561609.591897113]: Linear = 0.379069, angular = -0.628712
[INFO] [1512561610.098875363]: Linear = 0.383462, angular = 0.460989
[INFO] [1512561610.598847618]: Linear = 0.275523, angular = 0.772313
[INFO] [1512561611.098871667]: Linear = 0.0423769, angular = 0.992749
[INFO] [1512561611.598974020]: Linear = 0.480565, angular = 0.722201
[INFO] [1512561612.091834320]: Linear = 0.614528, angular = -0.122558
[INFO] [1512561612.598967078]: Linear = 0.0887276, angular = 0.889121
[INFO] [1512561613.098846748]: Linear = 0.835222, angular = 0.793864
[INFO] [1512561613.598946515]: Linear = 0.420753, angular = -0.325503
[INFO] [1512561614.098922000]: Linear = 0.284156, angular = 0.244371
[INFO] [1512561614.598887887]: Linear = 0.388995, angular = 0.14314
[INFO] [1512561615.098832359]: Linear = 0.532925, angular = -0.338571
[INFO] [1512561615.598856192]: Linear = 0.886459, angular = -0.517037
[INFO] [1512561616.098858678]: Linear = 0.089952, angular = 0.341603
[INFO] [1512561616.598955835]: Linear = 0.978337, angular = 0.116984
[INFO] [1512561617.091136328]: Linear = 0.951894, angular = -0.391188
[INFO] [1512561617.598977272]: Linear = 0.745136, angular = -0.329288
[INFO] [1512561618.098957717]: Linear = 0.1799, angular = -0.958682
[INFO] [1512561618.598832333]: Linear = 0.221513, angular = -0.555446
[INFO] [1512561619.098893481]: Linear = 0.0170335, angular = 0.404155
[INFO] [1512561619.598920487]: Linear = 0.0884275, angular = 0.263124
[INFO] [1512561620.098927230]: Linear = 0.140798, angular = -0.64569
[INFO] [1512561620.598948310]: Linear = 0.576122, angular = 0.95284
[INFO] [1512561621.098858171]: Linear = 0.073687, angular = 0.99375
[INFO] [1512561621.598942444]: Linear = 0.313269, angular = -0.204314
[INFO] [1512561622.098890866]: Linear = 0.610061, angular = 0.388527
[INFO] [1512561622.598938820]: Linear = 0.929413, angular = -0.69603
[INFO] [1512561623.098937409]: Linear = 0.0264782, angular = 0.631743
[INFO] [1512561623.598977551]: Linear = 0.393466, angular = -0.76714
[INFO] [1512561624.098948159]: Linear = 0.14507, angular = -0.272393
[INFO] [1512561624.598934774]: Linear = 0.674922, angular = -0.806672
[INFO] [1512561625.098836640]: Linear = 0.71321, angular = -0.159883
[INFO] [1512561625.598829237]: Linear = 0.43232, angular = 0.78622
[INFO] [1512561626.098859888]: Linear = 0.440717, angular = 0.307666
[INFO] [1512561626.598938382]: Linear = 0.115387, angular = -0.0844986
[INFO] [1512561627.098977919]: Linear = 0.35591, angular = -0.592371
[INFO] [1512561627.598971685]: Linear = 0.0893126, angular = -0.00658277
[INFO] [1512561628.098935528]: Linear = 0.380969, angular = 0.33087
[INFO] [1512561628.598829479]: Linear = 0.472729, angular = -0.0906871
[INFO] [1512561629.098965627]: Linear = 0.66231, angular = 0.571995
[INFO] [1512561629.598958023]: Linear = 0.812499, angular = -0.437259
[INFO] [1512561630.098955210]: Linear = 0.480261, angular = 0.483825
[INFO] [1512561630.598848713]: Linear = 0.433356, angular = 0.0134784
[INFO] [1512561631.098950592]: Linear = 0.557784, angular = 0.653644
[INFO] [1512561631.598954097]: Linear = 0.623109, angular = -0.405709
```

Figure 2: Result comparison between pubvel node and vel_printer node