Communication with Marvelmind devices using ROS (Robot Operating System).

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Marvelmind supplies ROS package, which is able to communicate with mobile beacon and provide location data received from it. We suppose you are using ROS Kinetic installed under Ubuntu Linux. The ROS package is available in repository by link: https://bitbucket.org/marvelmind_robotics/ros_marvelmind_package

To install the package in the ROS system, at first execute the step 1 of ROS tutorial (beginner level): http://wiki.ros.org/ROS/Tutorials

Then create the directory for the package by executing commands in the terminal:

```
$ cd ~/catkin_ws/src
$ mkdir marvelmind_nav
```

Then copy downloaded sources from the repository into the created directory.
Before running the software from the package, you should execute following command from the 'catkin_ws' directory:

```
$ source devel/setup.bash
```

After this, you can build and install Marvelmind ROS package: execute from ‘catkin_ws’ directory:

```
$ catkin_make
$ catkin_make install
```

Now we are ready to run the software, but before it we need to prepare the marvelmind system.
Use another PC with dashboard software to build map as described in the operating manual: http://marvelmind.com/pics/marvelmind_navigation_system_manual.pdf

Then connect the mobile beacon (hedgehog) by the USB cable to the USB port of your ROS machine.
Execute command in terminal to find the virtual serial port used by the hedgehog:

```
$ ls /dev/ttyACM*
```

In most cases, the hedgehog connects to "/dev/ttyACM0", this port is used by default in the Marvelmind ROS software. If no ports found by this command, try another one:

```
$ ls /dev/ttyUSB*
```
Before running Marvelmind ROS software, run the ROS server in separate terminal:

$ roscore

Then run the node 'hedge_rcv_bin' for receiving data from hedgehog as shown on following screenshot. Note the parameter of the running program is '/dev/ttyACM1', the name of virtual serial port detected by previous command. If the port is '/dev/ttyACM0', this parameter can be skipped.
You can get message like ‘unable to open serial connection’ even if the serial port is present. This may mean you have no permissions to access this port. You can get all permissions by command ‘**sudo chmod 0777 /dev/ttyACM0**’. But you will lose the permissions after next reboot. For permanent permissions you can add user to **dialout** group as described here: [https://askubuntu.com/questions/58119/changing-permissions-on-serial-port](https://askubuntu.com/questions/58119/changing-permissions-on-serial-port)

If the node successfully receives data from hedgehog, it outputs the location data to the terminal as shown on screenshot:

```
First value in square brackets is a ROS timestamp, then hedgehog timestamp in milliseconds, time (in milliseconds) between position samples, coordinates X,Y,Z in meters, and byte of flags.
```

The node 'hedge_rcv_bin' works as ROS publisher, it sends the message with location data to the topic named '/hedge_pos'. The package contains another node 'subscriber_test', which is working as ROS subscriber and receiving data from the topic. This node can be used for test purposes and as basis for user software.

Run the 'subscriber_test' node in separate terminal as shown on following screenshot:

```
```
The running **subscriber_test** node outputs to the terminal received location data from the topic `/hedge_pos` as shown on the next screenshot:

![Terminal output](image)

In addition this node works as publisher and sends data to topic "**visualization_marker**". This allows to view the position in the standard ROS software 'rviz'. Run the 'rviz' in separate terminal as shown on screenshot:

![Terminal output](image)

The GUI window, shown on the next screenshot, should appear.

To see the hedgehog, make sure the 'Fixed frame' parameter has value 'my_frame', and the marker 'visualization marker' is connected.
The next screenshot shows the dashboard window on another computer with system, used for the described above testing of ROS.