ME454
Dynamic System Programming

TA Session 2. Linux basic command practice

Class objectives

- Linux basic command practice

- ros2, rviz2 tutorials

Linux basic command practice

- Package Management commands
- File Management commands
- Searching commands
- System commands

Linux basic command practice

- Package Management commands

commands	function
sudo	Execute a command as superuser(admin)
apt	Software package management for Debian-based systems and stands for “advanced package tool”
update	refresh available updates (e.g. sudo apt update)
upgrade	upgrade all packages (e.g. sudo apt upgrade)
install	install package (e.g. sudo apt install ‘package_name’)
purge	uninstall package (e.g. sudo apt purge ‘package_name’)
autoremove	remove obsolete packages (e.g. sudo apt autoremove)
search	search the installed packages (e.g. apt search ‘name’)

Linux basic command practice

- File management commands

commands	function
cd	change directory
ls	directory listing
mkdir	create a directory
' . '	“current directory” (not a command)
' .. '	“parent directory” (not a command)
' ~ '	“home directory” (not a command)
mv	move or rename a file
cp	copy a file
rm	delete a file

Linux basic command practice

- File management commands

commands	function
cat	print (concatenated) contents of the file
echo	print the input text
nano	text editor (command line interface)
vim	text editor (command line interface)
gedit	text editor (graphical user interface, similar to Windows notepad)
pwd	print working directory

Linux basic command practice

- File management commands practice

```
pwd
```

```
cd /
pwd
```

```
cd home
pwd
```

```
cd ..
pwd
```

```
clear
```

Linux basic command practice

- File management commands practice

```
cd
pwd
cd ../../etc
pwd
```

```
cd /
pwd
cd etc
pwd
```

Linux basic command practice

- File management commands practice

```
mkdir ~/tutorial
cd tutorial
```

```
mkdir dir1
ls
```

```
mkdir dir2 dir3
```

```
ls
-----------------------------------------
~/tutorial
  ∟dir1
  ∟dir2
  ∟dir3
```

Linux basic command practice

- File management commands practice

```
mkdir dir4/dir5/dir6
```

```
mkdir -p dir4/dir5/dir6
ls
```

```
cd dir4
ls
cd dir5
ls
cd dir6
cd ../../..
```

Linux basic command practice

- File management commands practice

```
rm dir4
```

```
rm -r dir4
ls
```

```
mkdir --parents --verbose dir4/dir5/dir6
mkdir -p --verbose dir4/dir5/dir6
mkdir -p -v dir4/dir5/dir6
mkdir -pv dir4/dir5/dir6
```

Linux basic command practice

- File management commands practice

```
mkdir another folder
ls
```

```
mkdir "folder 1"
mkdir 'folder 2'
mkdir folder\ 3
mkdir "folder 4" "folder 5"
mkdir -p "folder 6"/"folder 7"
ls
```

Linux basic command practice

- File management commands practice

```
ls > output.txt
ls
```

```
cat output.txt
```

```
echo "This is a test"
```

```
echo "This is a test" > test1.txt
ls
cat test1.txt
echo "This is another test" >> test1.txt
cat test1.txt
```

Linux basic command practice

- File management commands practice

```
mv [SOURCE] [DEST or DIRECTORY]
  : rename SOURCE to DEST, or move SOURCE(s) to DIRECTORY.
mv test1.txt dir1
ls
```

```
ls dir1
```

```
mv dir1/test1.txt dir4/dir5/dir6
ls dir1
ls dir4/dir5/dir6
```

Linux basic command practice

- File management commands practice

```
cp dir4/dir5/dir6/test1.txt .
ls dir4/dir5/dir6
ls
```

```
cp test1.txt test2.txt
ls
```

```
mv test2.txt test1_backup.txt
ls
```

Linux basic command practice

- Process commands

commands	function
ps -e	Show process list
history | grep	Show history of past commands
jobs	Show processes in current terminal
bg % [job number] fg % [job number]	Convert process in back/fore ground of process
"command" &	Execute on background in terminal
Nohup "command" &	Execute on background without terminal
kill "process ID"	Terminate process

Linux basic command practice

- Process commands practice

```
ping 127.0.0.1
ping 127.0.0.1 &
jobs
fg Ctrl + c
( or kill -2 %1 )
```

```
nohup ping 127.0.0.1 &
nohup ping 0.0.0.0 > nohup1.out &
vim
Ctrl + z
Jobs
```

Linux basic command practice

- Process commands practice

```
fg
Ctrl + z
fg -
Ctrl + z
bg +
kill -2 %1
kill -9 %2
cat nohup.out
cat nohup1.out
```

Linux basic command practice

- Process commands practice

```
nohup ping 127.0.0.1 &
jobs
ps -e
kill -2 'process ID'
```

Linux basic command practice

- Searching commands

commands	function
find	search the file
find *dir* –name *file*	search the file in some *dir* name *file*
grep *pattern file*	search the *pattern* in *file*
grep -r *pattern dir*	search recursively for *pattern* in *dir*
command | grep *pattern*	search for *pattern* in the output of command

Linux basic command practice

- Searching commands practice

```
find test1.txt
```

```
find tes*
```

```
find dir4/dir5/dir6 -name test1.txt
```

Linux basic command practice

- Searching commands practice

```
grep This test*
```

```
grep -r This .
```

```
ls | grep dir1
```

```
ls -R | grep dir
```

Linux basic command practice

- File management commands practice

```
rm dir4/dir5/dir6/test1.txt test1_backup.txt
```

```
rm folder\ *
ls
```

```
rmdir folder\ *
ls
```

```
rm -r folder\ 6
ls
```

Linux basic command practice

- Environment variables management

commands	function
. or source	Read and execute commands in the current shell
export	Set an environment variable
=	Assign environment variable
env	Display, set, or remove environment variables
printenv	List names and values of all environment variables

Linux basic command practice

- Environment variables practice

```
MYVAR=testvar
echo $MYVAR
declare -p | grep MYVAR
```

```
export MYVAR
export MYENV=testenv
env
env | grep MY
```

```
mv test2.txt test1_backup.txt
ls
```

Linux basic command practice

- Environment variables practice

```
cat > test1.bash
export MYENV2=testenv2
echo "MYENV2 = $MYENV2"
ctrl+d (end of file)
```

```
. test1.bash
Or
source test1.bash
```

```
env | grep MY
printenv | grep MY
```

Linux basic command practice

- System commands

commands	function
df	show disk usage
du	show directory space usage
man	show the manual for command
shutdown	turn off PC (wsl)
ifconfig	show network information
ping	check the icmp response
wget	download files from the URL

Linux basic command practice

- .bashrc
  - Bash shell script that runs whenever it is started interactively
  - Initiate the shell session

```
cat ~/.bashrc
echo "echo Hello bash" >> ~/.bashrc
echo "source /opt/ros/humble/setup.bash" >> ~/.bashrc
  # It will set up your environment without typing every time

bash (or open new terminal)
```

Turtlesim source installation

https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Introducing-Turtlesim/Introducing-Turtlesim.html

Installing

sudo apt update

sudo apt install ros-humble-turtlesim

ros2 pkg executables turtlesim # Check that the package is installed

ros2 run turtlesim turtlesim_node # Start turtlesim

ros2 run turtlesim turtle_teleop_key # In another terminal tab

sudo apt install ~nros-humble-rqt* # Download the rqt

Task 1 - turtlesim

Turtlesim tutorial

```
kms@DESKTOP-0DGUIHG: $ ros2 pkg executables turtlesim
turtlesim draw_square
turtlesim mimic
turtlesim turtle_teleop_key
turtlesim turtlesim_node
kms@DESKTOP-0DGUIHG: $ ros2 run turtlesim turtlesim_node
QStandardPaths: wrong permissions on runtime directory /run/user/1000/, 0755 instead of 0700
[INFO] [1709614806.324101694] [turtlesim]: Starting turtlesim with node name /turtlesim
[INFO] [1709614806.329977387] [turtlesim]: Spawning turtle [turtle1] at x=[5.544445], y=[5.544445], theta=[0.000000]
```

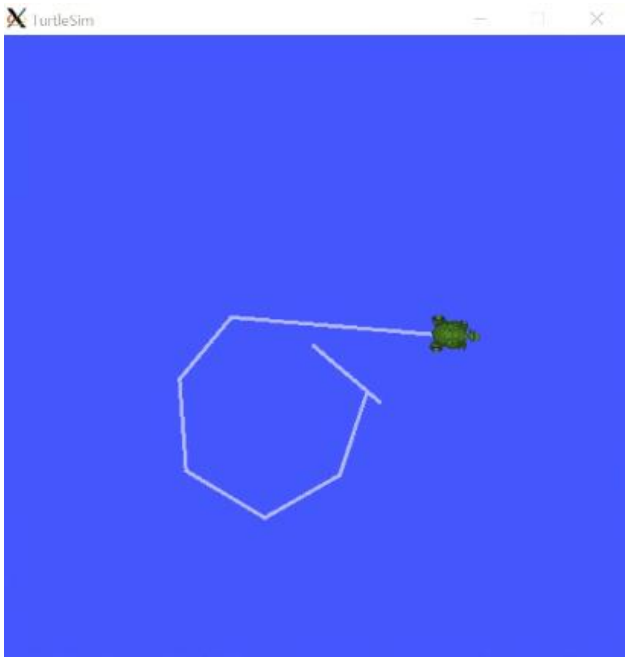
ros2 run turtlesim turtlesim_node

```
kms@DESKTOP-0DGUIHG:~$ source /opt/ros/humble/setup.bash
kms@DESKTOP-0DGUIHG:~$ ros2 run turtlesim turtle_teleop_key
Reading from keyboard
---------------------------
Use arrow keys to move the turtle.
Use G|B|V|C|D|E|R|T keys to rotate to absolute orientations. 'F' to cancel a rotation.
'Q' to quit.
```

ros2 run turtlesim turtle_teleop_key
(Use arrow keys to move the turtle)

Task 1 - turtlesim

Turtlesim tutorial




```
kms@DESKTOP-0DGUIHG: ~
Reading state information... Done
ros-humble-turtlesim is already the newest version (1.4.2-1jammy.20240217.075955).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
kms@DESKTOP-0DGUIHG:~$ source /opt/ros/humble/setup.bash
kms@DESKTOP-0DGUIHG:~$ ros2 pkg executables turtlesim
turtlesim draw_square
turtlesim mimic
turtlesim turtle_teleop_key
turtlesim turtlesim_node
kms@DESKTOP-0DGUIHG:~$ ros2 run turtlesim turtlesim_node
QStandardPaths: wrong permissions on runtime directory /run/user/1000/, 0755 instead of 0700
[INFO] [1709614806.324101694] [turtlesim]: Starting turtlesim with node name /turtlesim
[INFO] [1709614806.329977387] [turtlesim]: Spawning turtle [turtle1] at x=[5.544445], y=[5.544445],
 theta=[0.000000]

kms@DESKTOP-0DGUIHG:~$ source /opt/ros/humble/setup.bash
kms@DESKTOP-0DGUIHG:~$ ros2 run turtlesim turtle_teleop_key
Reading from keyboard
---------------------------
Use arrow keys to move the turtle.
Use G|B|V|C|D|E|R|T keys to rotate to absolute orientations. 'F' to cancel a rotation.
'Q' to quit.
```

Rviz

- ROS graphical interface that allows you to visualize a lot of information
- Using plugins for many kinds of available topics
- Gazebo is useful for dynamics simulation, and rviz is useful for checking cameras or laser scan sensors

Rviz

https://docs.ros.org/en/humble/Tutorials/Advanced/Simulators/Gazebo/Gazebo.html

Installing

sudo apt-get update && sudo apt update

sudo apt install ros-humble-ros-gz

export LIBGL_ALWAYS_SOFTWARE=1

ign gazebo -v 4 -r visualize_lidar.sdf # Launch the simulation

Rviz

https://docs.ros.org/en/humble/Tutorials/Advanced/Simulators/Gazebo/Gazebo.html

Configuring # To communicate simulation w/ ROS2

sudo apt-get install ros-humble-ros-gz-bridge # In another terminal tab

ros2 run ros_gz_bridge parameter_bridge /model/vehicle_blue/cmd_vel@geometry_msgs/msg/Twist]ignition.msgs.Twist

ros2 topic pub /model/vehicle_blue/cmd_vel geometry_msgs/Twist "linear: { x: 0.1 }"
In another terminal tab

send a command to the topic using 'ros2 topic pub'

Rviz

https://docs.ros.org/en/humble/Tutorials/Advanced/Simulators/Gazebo/Gazebo.html

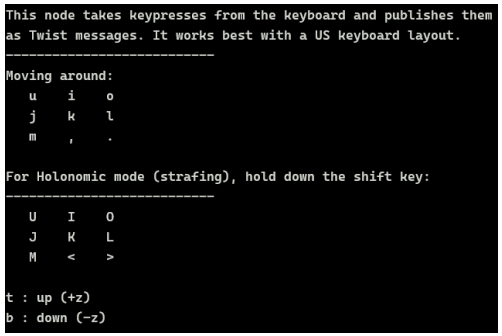
Configuring

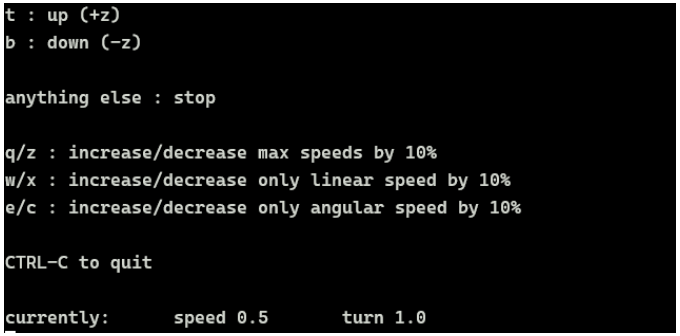
ign gazebo -v 4 -r visualize_lidar.sdf # **close all tab and restart**

sudo apt-get install ros-humble-teleop-twist-keyboard # In another terminal tab

ros2 run ros_gz_bridge parameter_bridge /model/vehicle_blue/cmd_vel@geometry_msgs/msg/Twist]ignition.msgs.Twist # In another terminal tab

ros2 run teleop_twist_keyboard teleop_twist_keyboard --ros-args -r /cmd_vel:=/model/vehicle_blue/cmd_vel # In another terminal tab





Rviz

https://docs.ros.org/en/humble/Tutorials/Advanced/Simulators/Gazebo/Gazebo.html

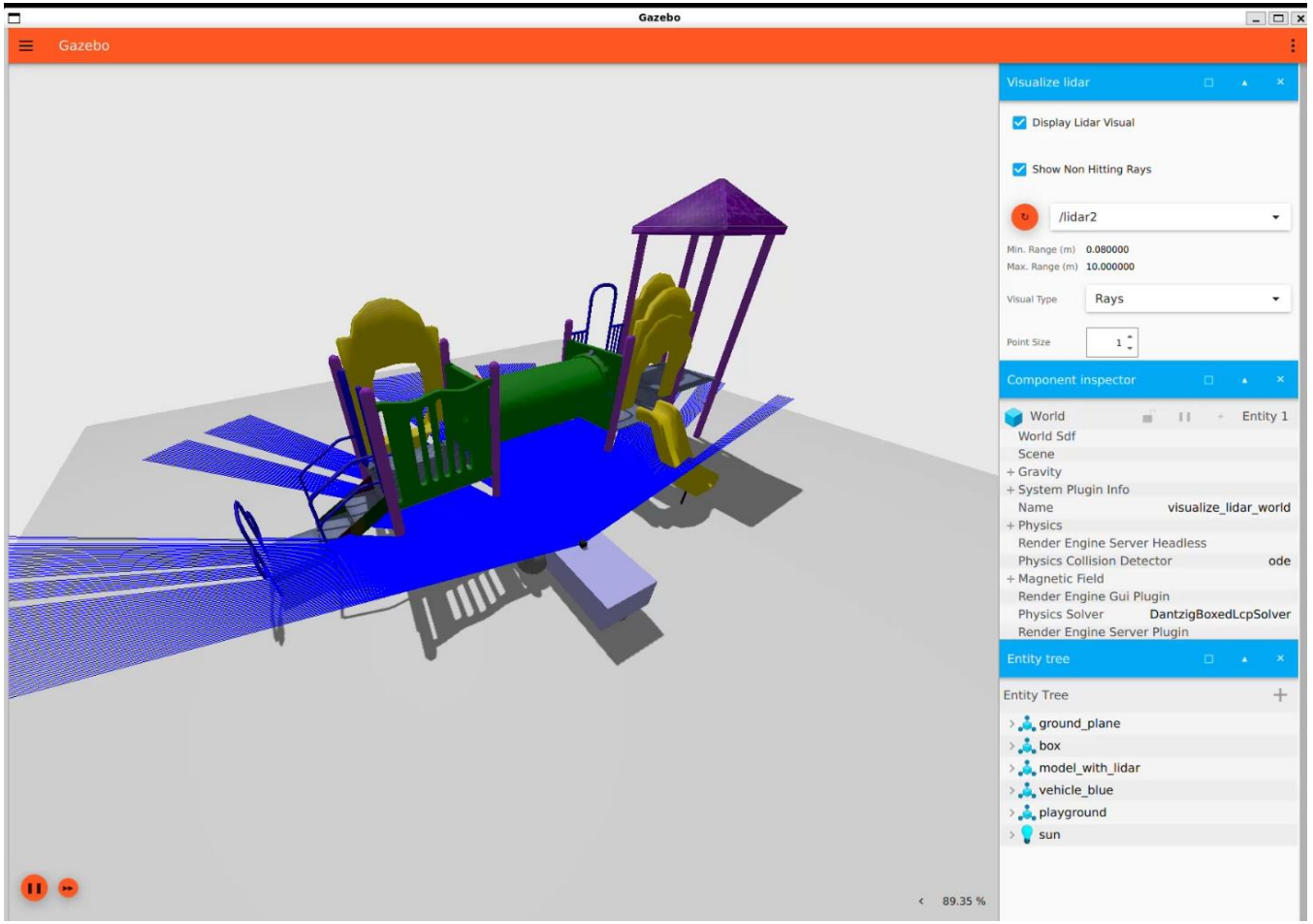
Visualizing lidar data in ROS2

```
ros2 run ros_gz_bridge parameter_bridge /lidar2@sensor_msgs/msg/LaserScan[igni
tion.msgs.LaserScan --ros-args -r /lidar2:=/laser_scan # In another terminal tab
```

```
rviz2 # In another terminal tab
```

Task 2 - Rviz

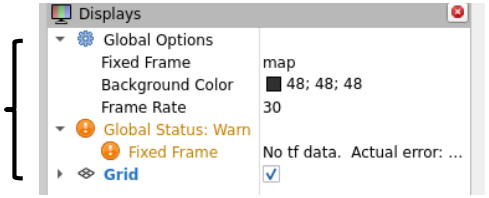
Visualize simulation data (RViz2)

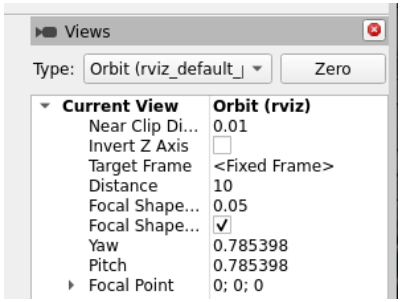


Rviz guide

Type ‘rviz2’ on the command line

Initially, there are three items in ‘Displays’ panel



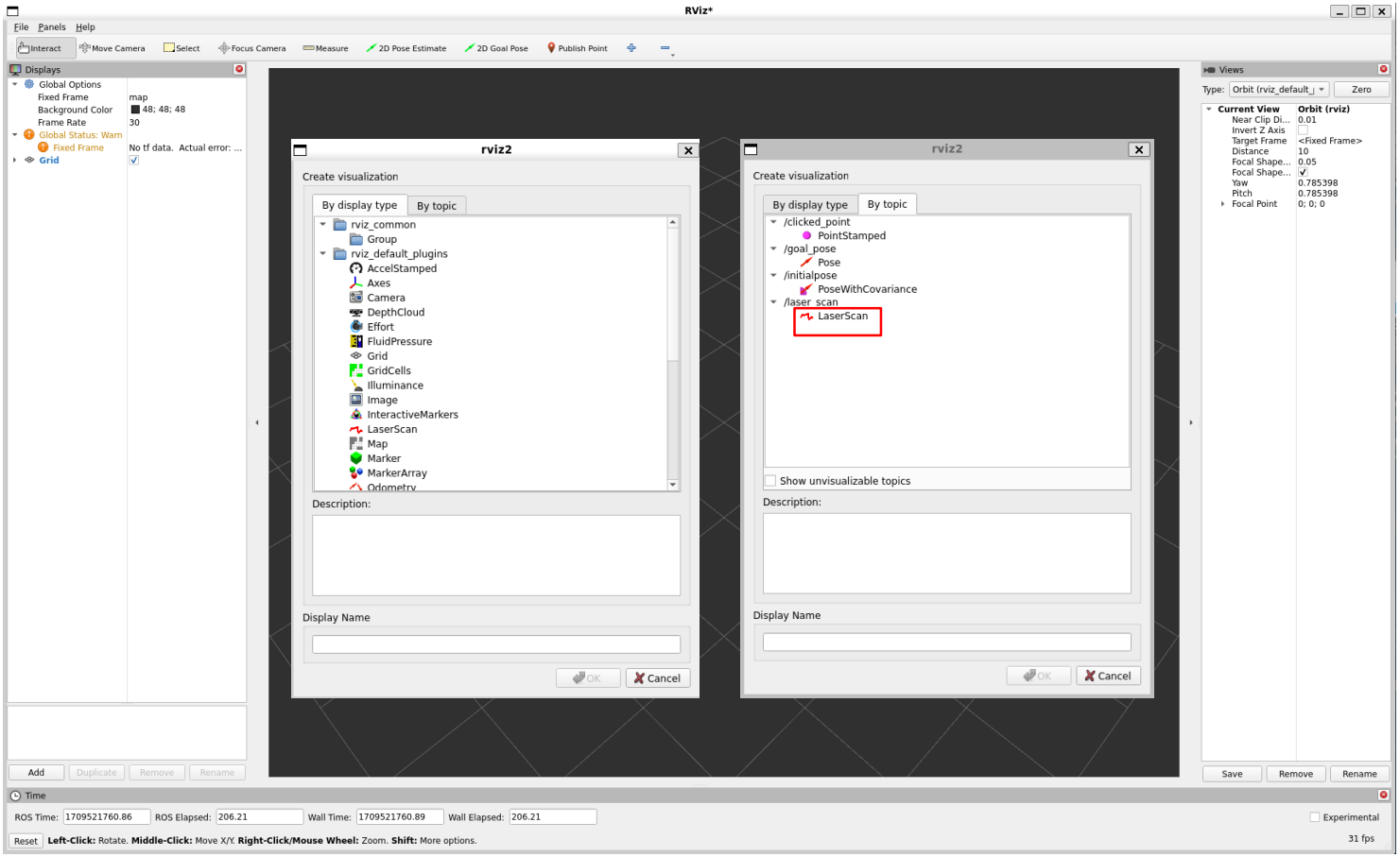


‘View’ panel

‘Time’ panel

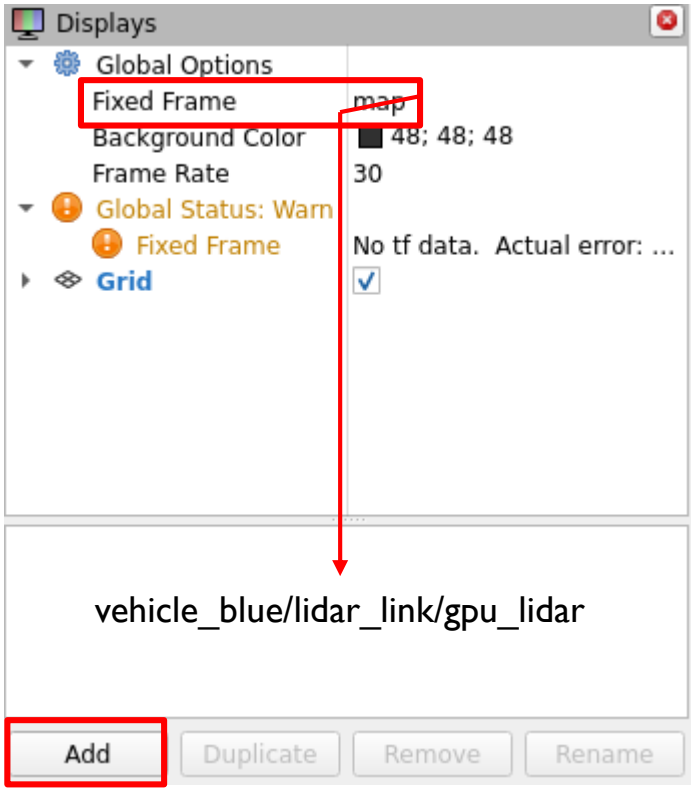
Rviz guide

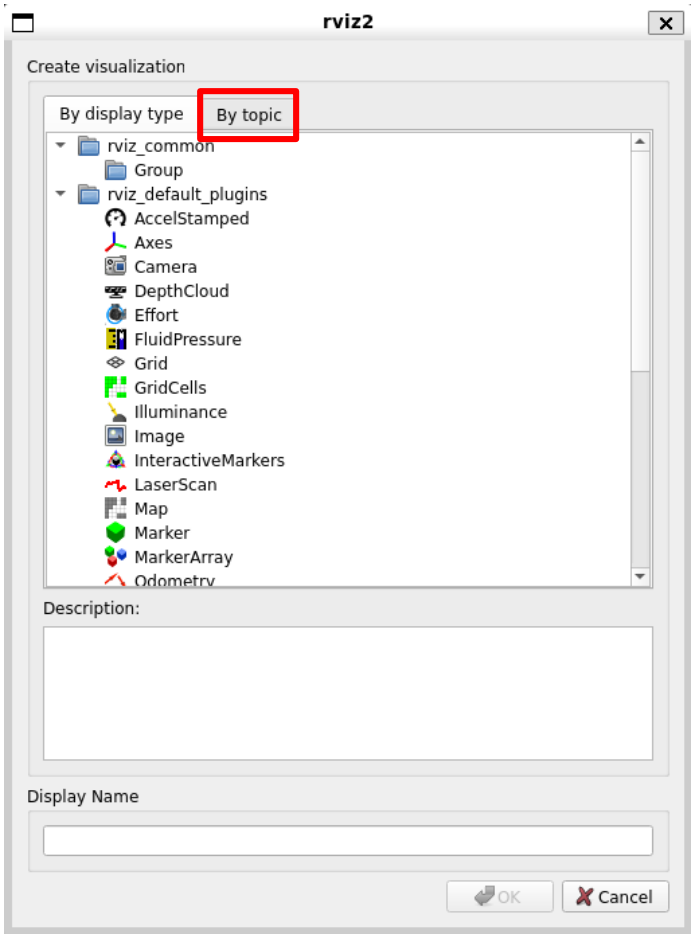
Panels can be deleted and added



Rviz guide

Display items can be added

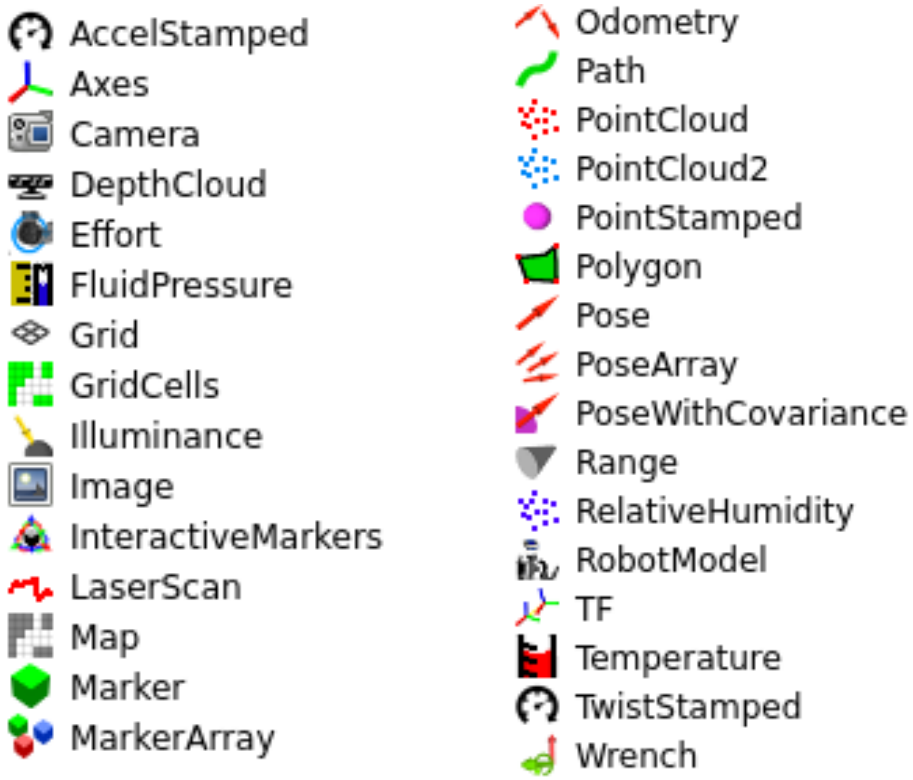




https://www.stereolabs.com/docs/ros2/rviz2

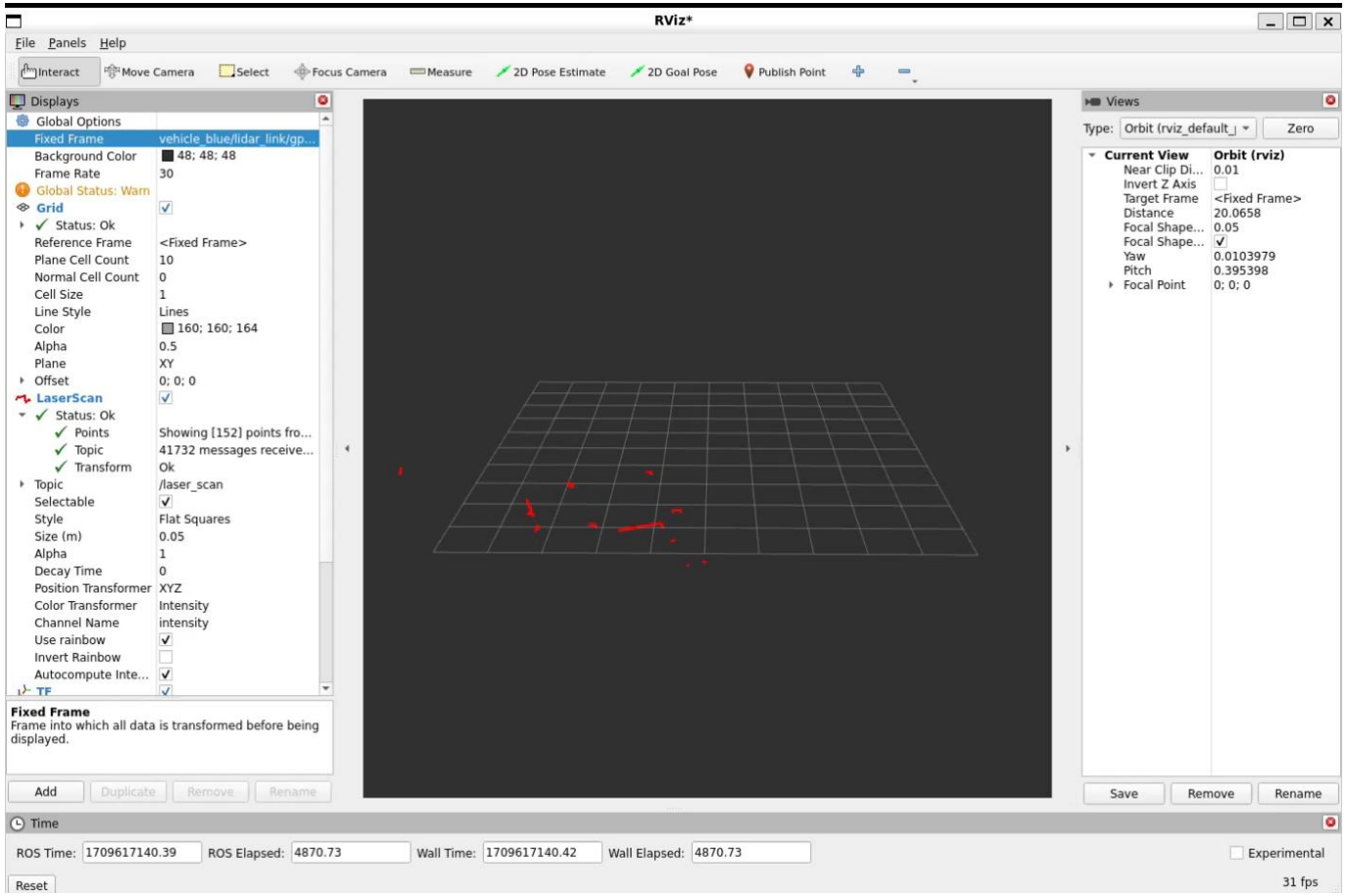
Rviz guide

Built-in display types



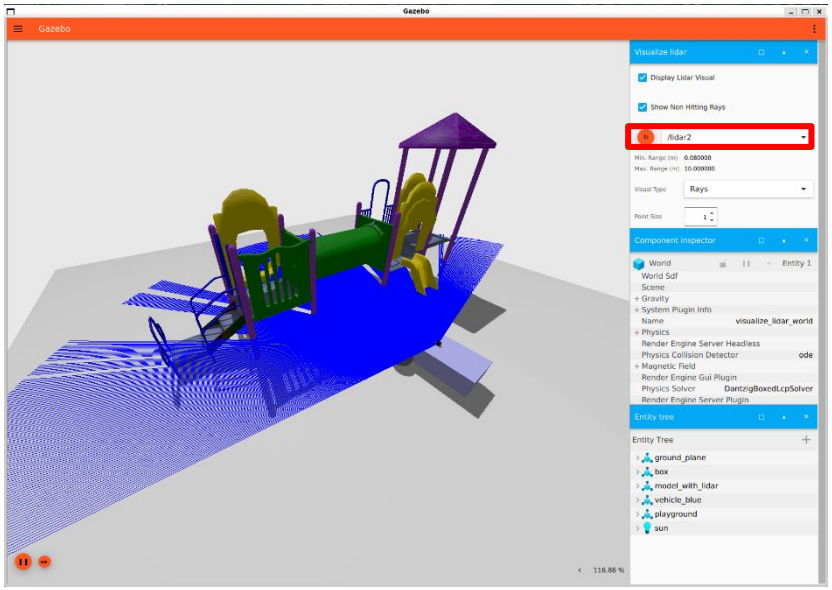
Task 2 - Rviz

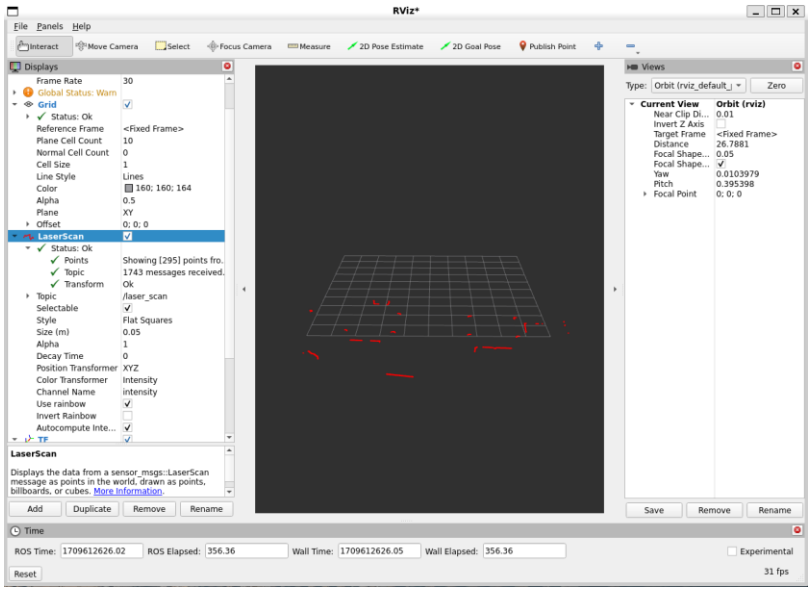
Display laser scan data on Rviz2



Tasks

- To make turtle move (31 page)
- Simulate a car moving around the environment and display the laserscan data in Rviz (37, 42 page)





Survey of extra practice room opening

Please check every available time in
https://www.when2meet.com/?24011846-48qYc

- Until the end of this practice session
- Please write "your name" as your name
- After the survey, we will open this practice room for those who need computers for homework or study
- The time will be announced later