

AMRITA VISHWA VIDHYAPEETAM

ROBOTIC OPERATING SYSTEM AND ROBOT SIMULATION LAB ASSIGNMENT- 4

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All codes are available in:

<https://github.com/Nandana19052003/Gazebo-Plugins-labsheet-4>

Introduction:

Gazebo Plugins are integral components of the Gazebo simulation environment, a widely used platform for simulating and testing robotic systems. Plugins extend the capabilities of the Gazebo by providing additional functionality and customization options. They are essential for creating dynamic and interactive simulations, enabling users to model complex robotic behaviors and interactions.

The importance of Gazebo Plugins lies in their ability to enhance the simulation experience, allowing developers and researchers to replicate real-world scenarios with precision. By integrating plugins into Gazebo, users can simulate various aspects of robot systems, including the world environment, models, sensors, system behavior, visualization, and even user interfaces.

Gazebo Plugins are designed to be modular and can be developed using different programming languages, such as C++ and Python, depending on the specific plugin type and requirements. This flexibility enables developers to extend the functionality of Gazebo according to their specific needs, making it a versatile platform for simulating and testing different robotic applications.

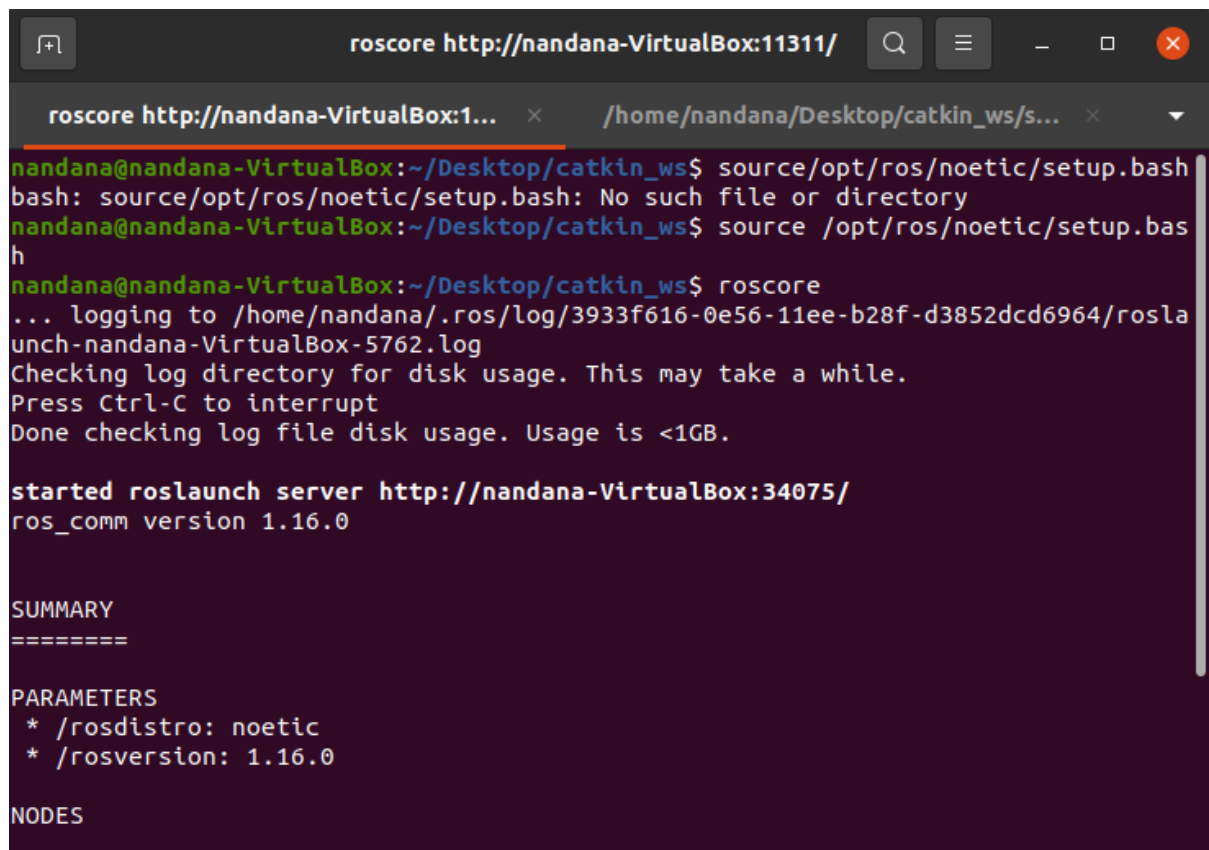
Throughout this report, we will explore the various types of Gazebo Plugins and delve into their functionalities, providing insights into how they contribute to the overall simulation experience. By understanding the capabilities of Gazebo Plugins, users can leverage these tools to create rich and realistic simulations, facilitating the development and testing of robotic systems in a virtual environment.

1. World Plugins:

Gazebo World Plugins are software modules that extend the functionality of the Gazebo simulator by allowing developers to add custom behaviors, control mechanisms, or environmental modifications to Gazebo worlds. In this report, we will provide an overview of Gazebo World Plugins, including their development, integration, and usage.

Each plugin is associated with a specific Gazebo world and can modify the world's properties, control elements within the world, or provide custom behaviors.

Gazebo World Plugins provide a powerful mechanism to customize and enhance Gazebo simulator worlds. By developing custom plugins, users can add specific behaviors, and control mechanisms, or modify the environment within Gazebo worlds, enabling realistic simulations and testing of various robotic systems. The integration and usage of Gazebo World Plugins allow for a highly customizable and dynamic simulation environment within Gazebo.

A terminal window titled 'roscore http://nandana-VirtualBox:11311/' with standard window controls. The terminal shows a user named 'nandana' at a prompt 'nandana@nandana-VirtualBox:~/Desktop/catkin_ws\$'. The user enters 'source/opt/ros/noetic/setup.bash', which results in an error: 'bash: source/opt/ros/noetic/setup.bash: No such file or directory'. The user then enters 'source /opt/ros/noetic/setup.bash', which also results in an error: 'bash: source /opt/ros/noetic/setup.bash: No such file or directory'. Finally, the user enters 'roscore', which starts the roscore service. The output shows logging to a specific directory, a disk usage check (usage is <1GB), and the start of a roslaunch server at 'http://nandana-VirtualBox:34075/'. Below this, the 'SUMMARY' section is empty, and the 'PARAMETERS' section lists '/rostdistro: noetic' and '/rosversion: 1.16.0'. The 'NODES' section is also empty.

```
roscore http://nandana-VirtualBox:11311/
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ source/opt/ros/noetic/setup.bash
bash: source/opt/ros/noetic/setup.bash: No such file or directory
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ source /opt/ros/noetic/setup.bash
bash: source /opt/ros/noetic/setup.bash: No such file or directory
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roscore
... logging to /home/nandana/.ros/log/3933f616-0e56-11ee-b28f-d3852dcd6964/roslaunch-nandana-VirtualBox-5762.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

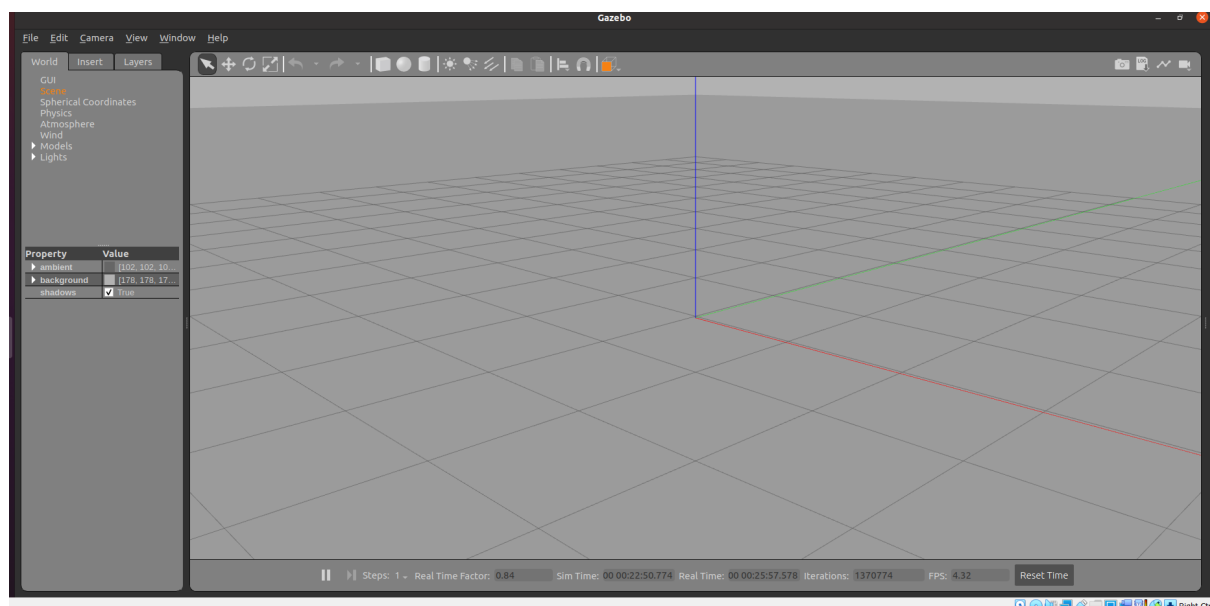
started roslaunch server http://nandana-VirtualBox:34075/
ros_comm version 1.16.0

SUMMARY
=====

PARAMETERS
* /rostdistro: noetic
* /rosversion: 1.16.0

NODES
```

```
/home/nandana/Desktop/catkin_ws/src/gazebo_plugins/worl...
roscore http://nandana-VirtualBox:1... x /home/nandana/Desktop/catkin_ws/s... x
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ cd src
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src$ cd gazebo_plugins/
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src/gazebo_plugins$ source devel/
setup.bash
bash: devel/setup.bash: No such file or directory
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src/gazebo_plugins$ cd ..
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src$ cd ..
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ source devel/setup.bash
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ ls
build  devel  src
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ cd src
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src$ ls
assignment_1  gazebo_plugins  turtlebot3_msgs
CMakeLists.txt  turtlebot3      turtlebot3_simulations
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src$ cd gazebo_plugins/
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src/gazebo_plugins$ ls
joint_control_plugin  light_move_plugin  README.md
LICENSE               model_plugin       subscriber_model_plugin
light_control_ros     model_plugin_ros   world_plugin
nandana@nandana-VirtualBox:~/Desktop/catkin_ws/src/gazebo_plugins$ roslaunch wor
ld_plugin gazebo_world_plugin.launch
... logging to /home/nandana/.ros/log/3933f616-0e56-11ee-b28f-d3852dcd6964/rosla
unch-nandana-VirtualBox-6733.log
Checking log directory for disk usage. This may take a while.
```



2. Model Plugins:

Gazebo Model Plugins are software modules that extend the functionality of the Gazebo simulator by allowing developers to add custom behaviors, control

mechanisms, or visual enhancements to Gazebo models. In this report, we will provide an overview of Gazebo Model Plugins, including their development, integration, and usage.

Gazebo Model Plugins are typically implemented as shared libraries (.so files) written in C++ and compiled using the Gazebo Plugin API. Each plugin is associated with a specific Gazebo model and can interact with the model's properties, sensors, and the Gazebo simulation environment.

Gazebo Model Plugins provide a flexible and powerful way to extend the capabilities of Gazebo simulator models. By developing custom plugins, users can add specific behaviors, control mechanisms, or visual enhancements to Gazebo models, enabling realistic simulations and testing of various robotic systems. The integration and usage of Gazebo Model Plugins allow for a highly customizable and dynamic simulation environment within Gazebo.

```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ source devel/setup.bash
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ catkin_make
Base path: /home/nandana/Desktop/catkin_ws
Source space: /home/nandana/Desktop/catkin_ws/src
Build space: /home/nandana/Desktop/catkin_ws/build
Devel space: /home/nandana/Desktop/catkin_ws/devel
Install space: /home/nandana/Desktop/catkin_ws/install
####
#### Running command: "make cmake_check_build_system" in "/home/nandana/Desktop/catkin_ws/build"
####
####
#### Running command: "make -j1 -l1" in "/home/nandana/Desktop/catkin_ws/build"
####
[ 0%] Built target _turtlebot3_msgs_generate_messages_check_deps_Sound
[ 0%] Built target std_msgs_generate_messages_cpp
[ 0%] Built target _turtlebot3_msgs_generate_messages_check_deps_SensorState
[ 0%] Built target _turtlebot3_msgs_generate_messages_check_deps_VersionInfo
[ 3%] Built target turtlebot3_msgs_generate_messages_cpp
[ 3%] Built target std_msgs_generate_messages_py
[ 8%] Built target turtlebot3_msgs_generate_messages_py
[ 8%] Built target std_msgs_generate_messages_nodejs
[ 12%] Built target turtlebot3_msgs_generate_messages_nodejs
[ 12%] Built target std_msgs_generate_messages_lisp
[ 16%] Built target turtlebot3_msgs_generate_messages_lisp
[ 16%] Built target std_msgs_generate_messages_eus
[ 21%] Built target turtlebot3_msgs_generate_messages_eus
[ 21%] Built target turtlebot3_msgs_generate_messages
[ 21%] Built target roscpp_generate_messages_eus
[ 21%] Built target sensor_msgs_generate_messages_lisp
[ 21%] Built target sensor_msgs_generate_messages_nodejs
[ 21%] Built target rosgraph_msgs_generate_messages_py
```

Launch gazebo simulator with model plugin

```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch model_plugin model.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualB
ox-18715.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:42325/

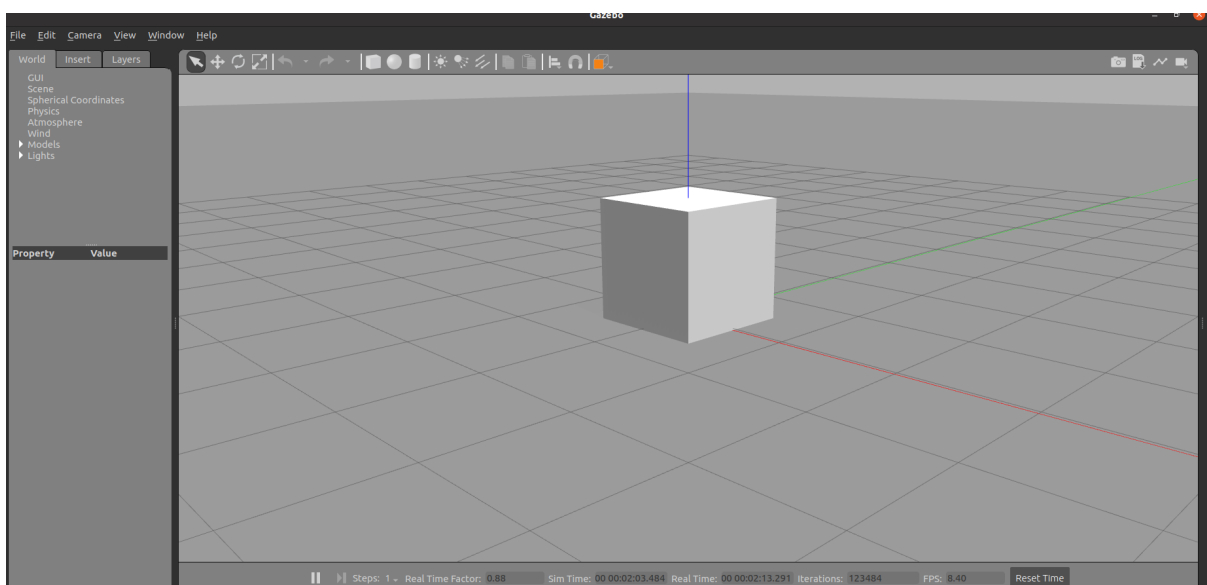
SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /rostdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
/
  gazebo (gazebo_ros/gzserver)
  gazebo_gui (gazebo_ros/gzclient)

ROS_MASTER_URI=http://localhost:11311

process[gazebo-1]: started with pid [18730]
process[gazebo_gui-2]: started with pid [18735]
```



Launch gazebo simulator with custom model plugin

3. ROS Model Plugins:

Gazebo model plugins are essential to Gazebo, a popular open-source robot simulation environment. These plugins provide a way to extend the functionality of Gazebo models by adding custom behaviors, sensors, controllers, or other components to the simulated objects. Model plugins are written in C++ or other

supported languages and can be dynamically loaded into Gazebo to interact with the simulated environment.

Gazebo model plugins are associated with specific models and are loaded when those models are instantiated in the simulation. This allows developers to add unique characteristics or behaviors to individual models without affecting the rest of the simulation. Model plugins have access to a wide range of features and functionality provided by the Gazebo API, allowing them to interact with the simulation environment, access sensor data, control joints and links, and perform other tasks.

Launch gazebo simulator with simple ros model plugin

```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch model_plugin_ros simple_rosplugin.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualBox-15037.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:41189/

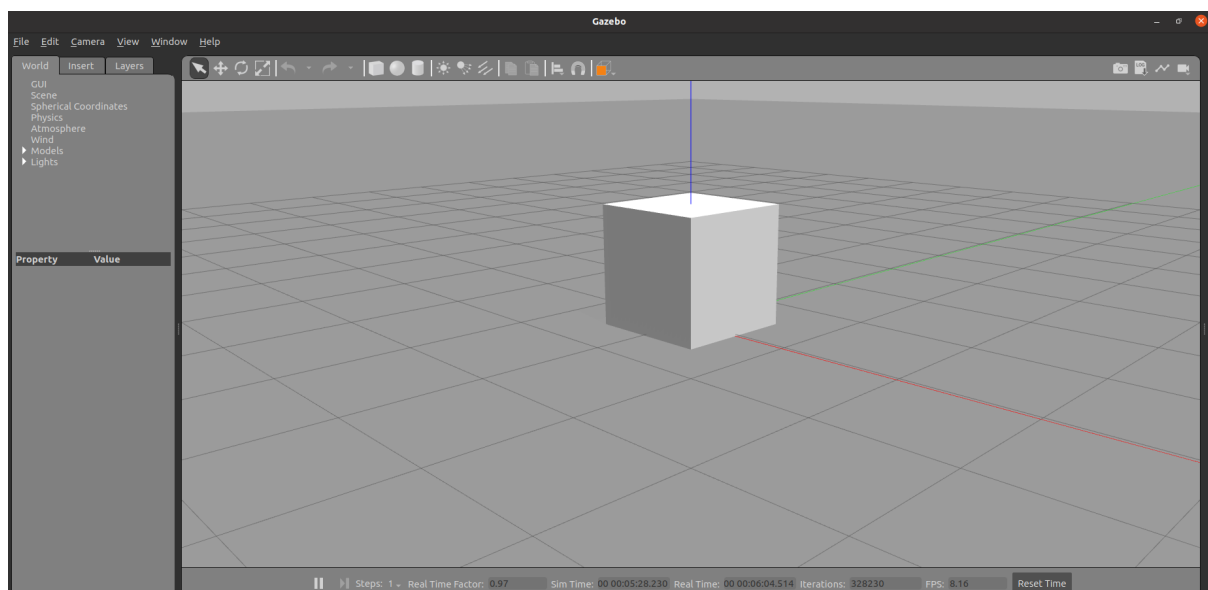
SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /rostdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
/
  gazebo (gazebo_ros/gzserver)
  gazebo_gui (gazebo_ros/gzclient)

ROS_MASTER_URI=http://localhost:11311

process[gazebo-1]: started with pid [15051]
process[gazebo_gui-2]: started with pid [15056]
[ INFO] [1687866787.188747822]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687866787.189896471]: waitForService: Service [/gazebo/set_physics_properties] has not been advertised, waiting...
[ INFO] [1687866787.340000827]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687866787.343733529]: waitForService: Service [/gazebo_gui/set_physics_properties] has not been advertised, waiting...
[ INFO] [1687866787.740007350]: waitForService: Service [/gazebo/set_physics_properties] is now available.
[ INFO] [1687866787.765243712]: ROS Model Plugin Loaded!
[ INFO] [1687866787.770880288]: Physics dynamic reconfigure ready.
Model Name=box
model_vel= 0.2
```



Launch gazebo simulator with ros model plugin

```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch model_plugin custom_model.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualBox-18858.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:41409/

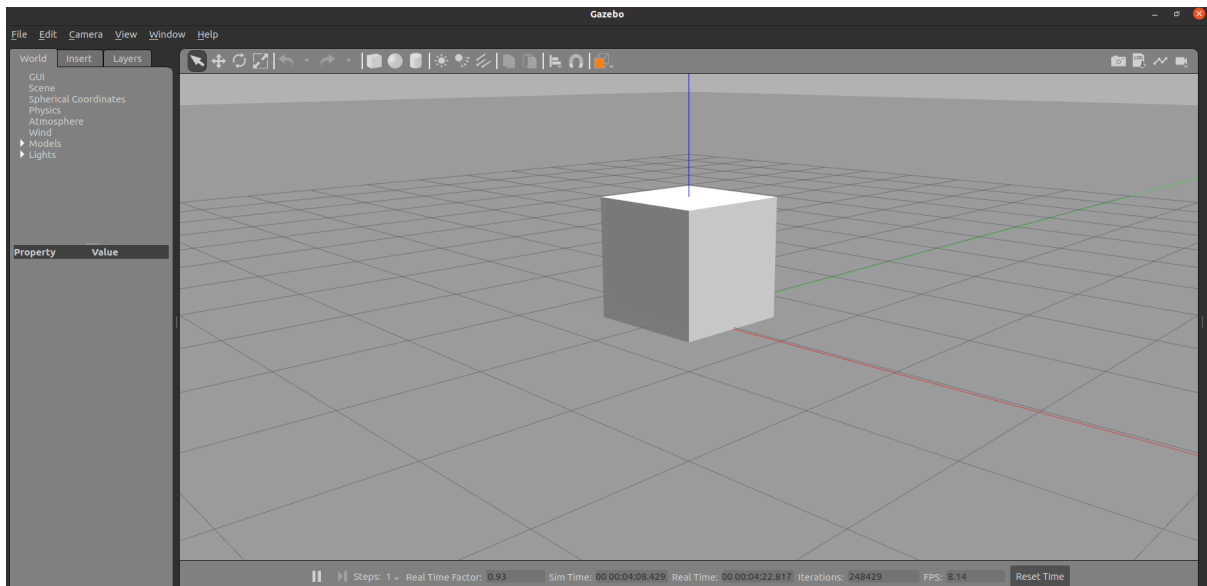
SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /rostdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
/
  gazebo (gazebo_ros/gzserver)
  gazebo_gui (gazebo_ros/gzclient)

ROS_MASTER_URI=http://localhost:11311

process[gazebo-1]: started with pid [18872]
```




```
/home/nandana/Desktop/catkin_ws/src/gazebo_plugins/model_plugin_ros/launch/rosp...
roscore http://nandana-VirtualBox:11311/ x /home/nandana/Desktop/catkin_ws/src/gazebo_pl... x

... shutting down processing monitor complete
done
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch model_plugin_ros rosplugin.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualB
ox-15608.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:38599/

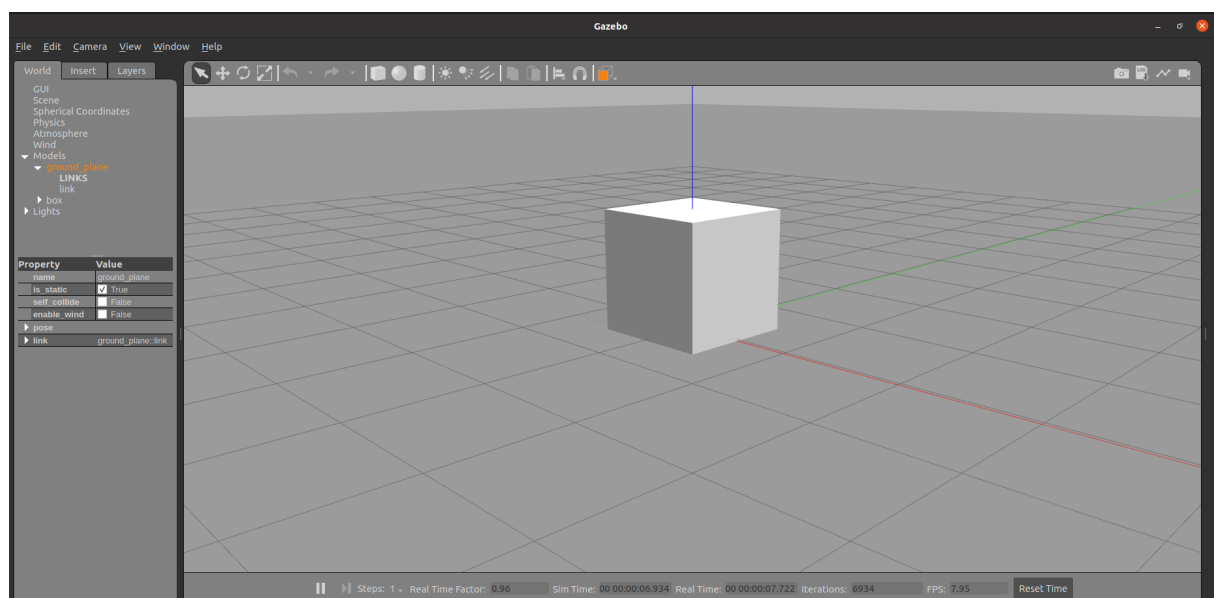
SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /rostdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

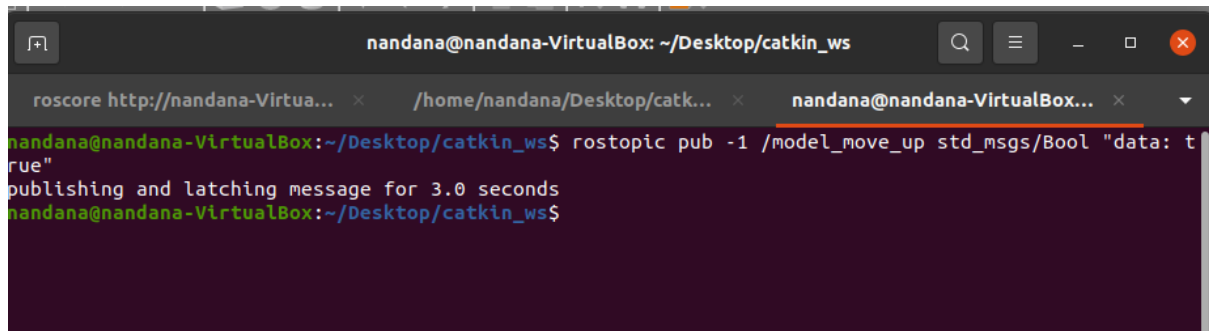
NODES
/
  gazebo (gazebo_ros/gzserver)
  gazebo_gui (gazebo_ros/gzclient)

ROS_MASTER_URI=http://localhost:11311

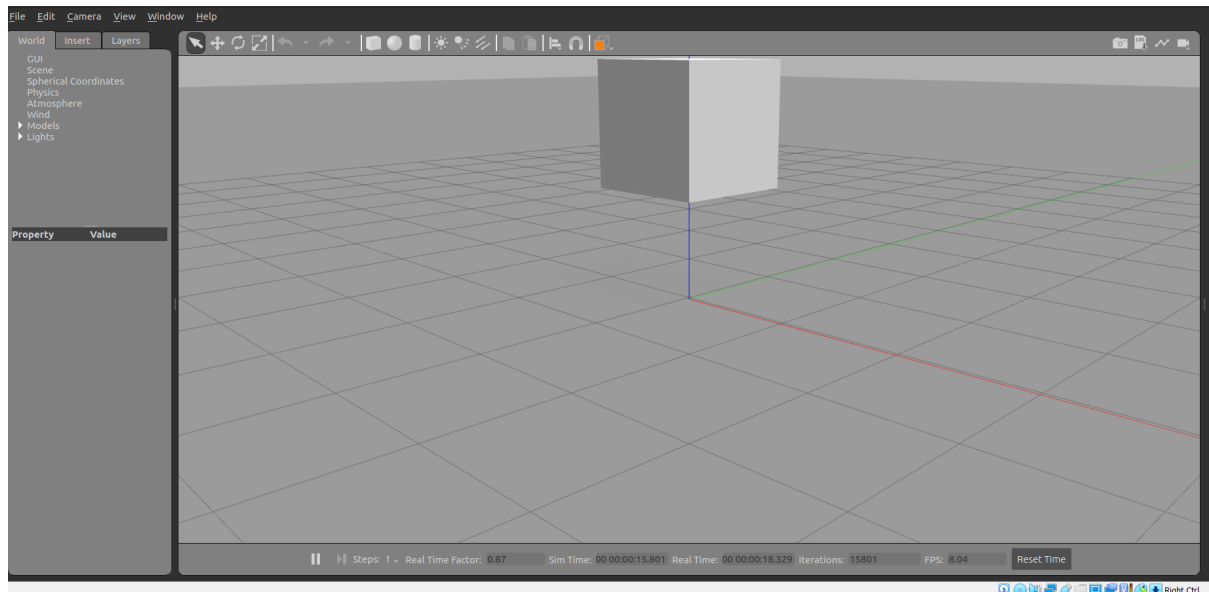
process[gazebo-1]: started with pid [15622]
process[gazebo_gui-2]: started with pid [15627]
[ INFO] [1687867530.719811576]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687867530.721188440]: waitForService: Service [/gazebo/set_physics_properties] has not been
advertised, waiting...
[ INFO] [1687867530.846337928]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687867530.848665487]: waitForService: Service [/gazebo_gui/set_physics_properties] has not
```



Publish once on /model_move_up topic

A terminal window titled 'nandana@nandana-VirtualBox: ~/Desktop/catkin_ws' with three tabs. The active tab shows the command 'rostopic pub -1 /model_move_up std_msgs/Bool "data: true"' being executed. The output indicates that the message was published and latched for 3.0 seconds. The prompt returns to the shell.

```
nandana@nandana-VirtualBox: ~/Desktop/catkin_ws$ rostopic pub -1 /model_move_up std_msgs/Bool "data: true"
publishing and latching message for 3.0 seconds
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$
```



4. Subscriber Model Plugins:

The ROS Gazebo Subscriber Model Plugins are software modules that extend the functionality of the Gazebo simulator by allowing the integration of ROS subscribers within Gazebo models. These plugins enable Gazebo models to subscribe to ROS topics and interact with the ROS ecosystem. In this report, we will provide an overview of the development and usage of ROS Gazebo Subscriber Model Plugins.

The ROS Gazebo Subscriber Model Plugins are typically implemented as ROS packages. They include custom Gazebo model plugins that integrate with Gazebo's simulation engine and subscribe to ROS topics for receiving data.

The ROS Gazebo Subscriber Model Plugins provide a powerful mechanism to integrate Gazebo models with the ROS ecosystem. By developing and utilizing these plugins, Gazebo models can subscribe to ROS topics and respond to incoming data, allowing for rich interactions and dynamic behavior within the Gazebo simulation environment. These plugins enhance the capabilities of Gazebo for simulating and testing ROS-enabled robotic systems.

```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch subscriber_model_plugin gazebo_subscriber.l
aunch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualB
ox-16905.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:43803/

SUMMARY
=====

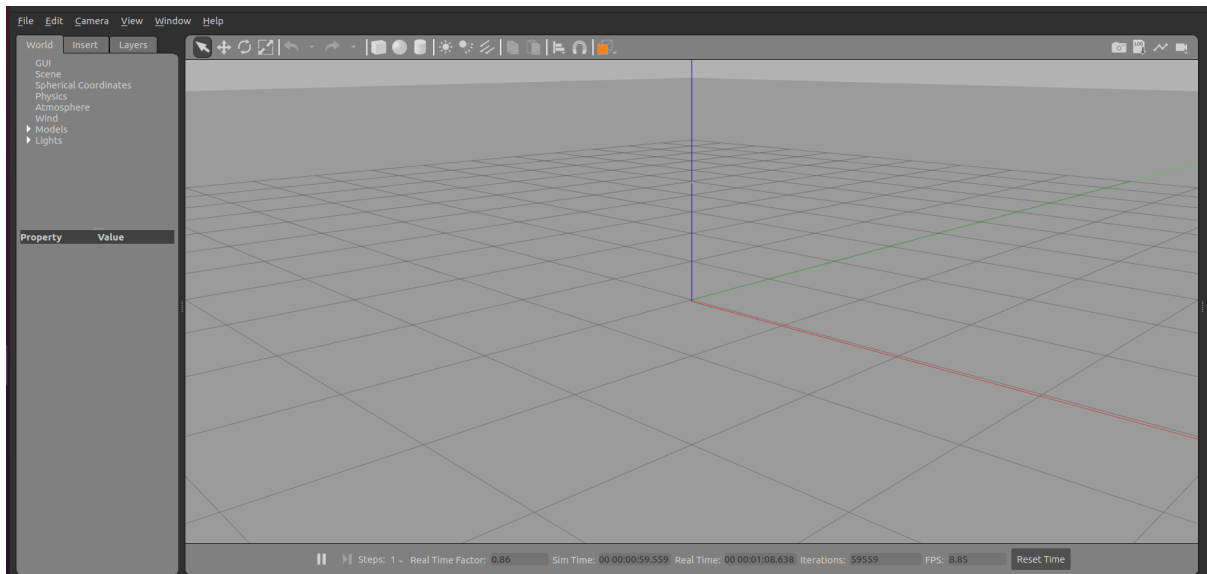
PARAMETERS
* /gazebo/enable_ros_network: True
* /rostdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
/
  gazebo (gazebo_ros/gzserver)
  gazebo_gui (gazebo_ros/gzclient)

ROS_MASTER_URI=http://localhost:11311

process[gazebo-1]: started with pid [16919]
process[gazebo_gui-2]: started with pid [16924]
[ INFO] [1687868331.890052991]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687868331.892225766]: waitForService: Service [/gazebo/set_physics_properties] has not been
advertised, waiting...
[ INFO] [1687868332.003884260]: Finished loading Gazebo ROS API Plugin.
```

```
/home/nandana/Desktop/catkin_ws/src/gazebo_plugins/subscriber_model_plugin/laun...
roscore http://nandana-VirtualBox:11311/
Model Name = box
sim_time {
  sec: 0
  nsec: 0
}
pause_time {
  sec: 0
  nsec: 0
}
real_time {
  sec: 0
  nsec: 24000727
}
paused: false
iterations: 0
sim_time {
  sec: 0
  nsec: 191000000
}
pause_time {
  sec: 0
  nsec: 0
}
real_time {
  sec: 0
  nsec: 224324812
}
paused: false
iterations: 191
sim_time {
  sec: 0
  nsec: 383000000
}
pause_time {
```



5. Joint Control plugin:

The Joint Control Plugin for Gazebo ROS is a software module designed to enable joint control of simulated robots or robotic systems in the Gazebo simulator using the Robot Operating System (ROS) framework. This plugin provides a convenient interface to control and manipulate robot joints within the Gazebo environment. This report outlines the development and implementation details of the Joint Control Plugin for Gazebo ROS, including the necessary ROS commands for its operation.

The Gazebo Joint Plugin extends the capabilities of the Gazebo simulator by enabling users to control and manipulate individual joints within a simulated environment. By implementing custom control algorithms and utilizing the Gazebo Plugin API, users can apply forces, torques, or position commands to joints, integrate sensors, and achieve closed-loop control. The plugin offers flexibility and versatility for simulating and testing robotic systems in a realistic manner within the Gazebo simulator.

```
/home/nandana/Desktop/catkin_ws/src/gazebo_plugins/join...
roscore http://nandana-VirtualBox:1...  /home/nandana/Desktop/catkin_ws/s...
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ source
build/.catkin_workspace devel/src/
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ source devel/setup.bash
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ catkin_make
Base path: /home/nandana/Desktop/catkin_ws
Source space: /home/nandana/Desktop/catkin_ws/src
Build space: /home/nandana/Desktop/catkin_ws/build
Devel space: /home/nandana/Desktop/catkin_ws/devel
Install space: /home/nandana/Desktop/catkin_ws/install
####
#### Running command: "cmake /home/nandana/Desktop/catkin_ws/src -DCATKIN_DEVEL_
PREFIX=/home/nandana/Desktop/catkin_ws/devel -DCMAKE_INSTALL_PREFIX=/home/nandan
a/Desktop/catkin_ws/install -G Unix Makefiles" in "/home/nandana/Desktop/catkin_
ws/build"
####
-- Using CATKIN_DEVEL_PREFIX: /home/nandana/Desktop/catkin_ws/devel
-- Using CMAKE_PREFIX_PATH: /home/nandana/Desktop/catkin_ws/devel;/opt/ros/noeti
C
-- This workspace overlays: /home/nandana/Desktop/catkin_ws/devel;/opt/ros/noeti
C
-- Found PythonInterp: /usr/bin/python3 (found suitable version "3.8.10", minimu
m required is "3")
-- Using PYTHON_EXECUTABLE: /usr/bin/python3
-- Using Debian Python package layout
```

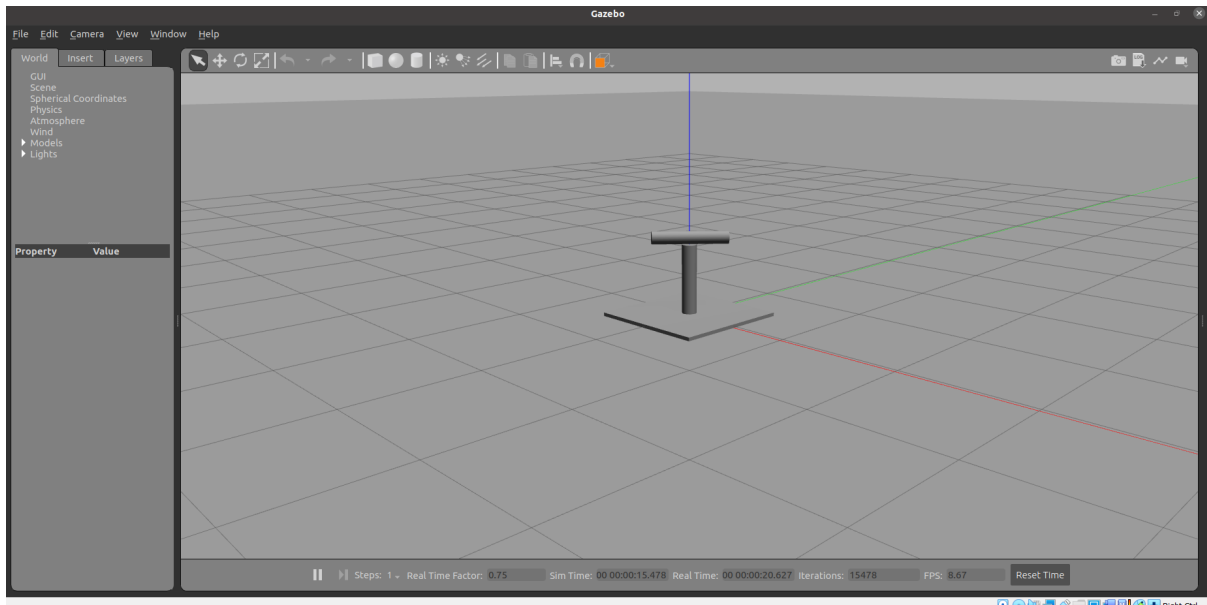
```
/home/nandana/Desktop/catkin_ws/src/gazebo_plugins/join...
roscore http://nandana-VirtualBox:1...  /home/nandana/Desktop/catkin_ws/s...
[100%] Linking CXX shared library /home/nandana/Desktop/catkin_ws/devel/lib/libw
orld_gazebo_plugin.so
[100%] Built target world_gazebo_plugin
[100%] Built target turtlebot3_description_xacro_generated_to_devel_space_
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch joint_control_plugin j
oint.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/rosla
unch-nandana-VirtualBox-6607.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:43035/

SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /roscdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
```



6. Light Control plugin:

The ROS Gazebo Light Control Plugin is a software module that enhances the functionality of a Gazebo simulation by allowing the control of light sources within the simulation environment. This report will outline the steps to create a light control plugin that subscribes to a ROS topic and modifies the light color in Gazebo based on the received data.

Plugin Workflow

The workflow of the ROS Gazebo Light Control Plugin is as follows:

- Launch the Gazebo simulation environment.
- Start the necessary ROS nodes and topics.
- Publish light control commands on the `/light_color` ROS topic.
- The Gazebo plugin subscribes to the `/light_color` topic and receives the light control commands.
- Based on the received commands, the Gazebo plugin modifies the light color in the simulation environment.

The ROS Gazebo Light Control Plugin provides a convenient way to control and modify light sources within the Gazebo simulation environment using ROS topics. By implementing the plugin and following the provided steps, users can publish light control commands and observe the changes in the Gazebo simulator. This plugin enhances the capabilities of the Gazebo for simulating and testing lighting scenarios in robotic systems.

Launch gazebo simulator with simple ros light control plugin

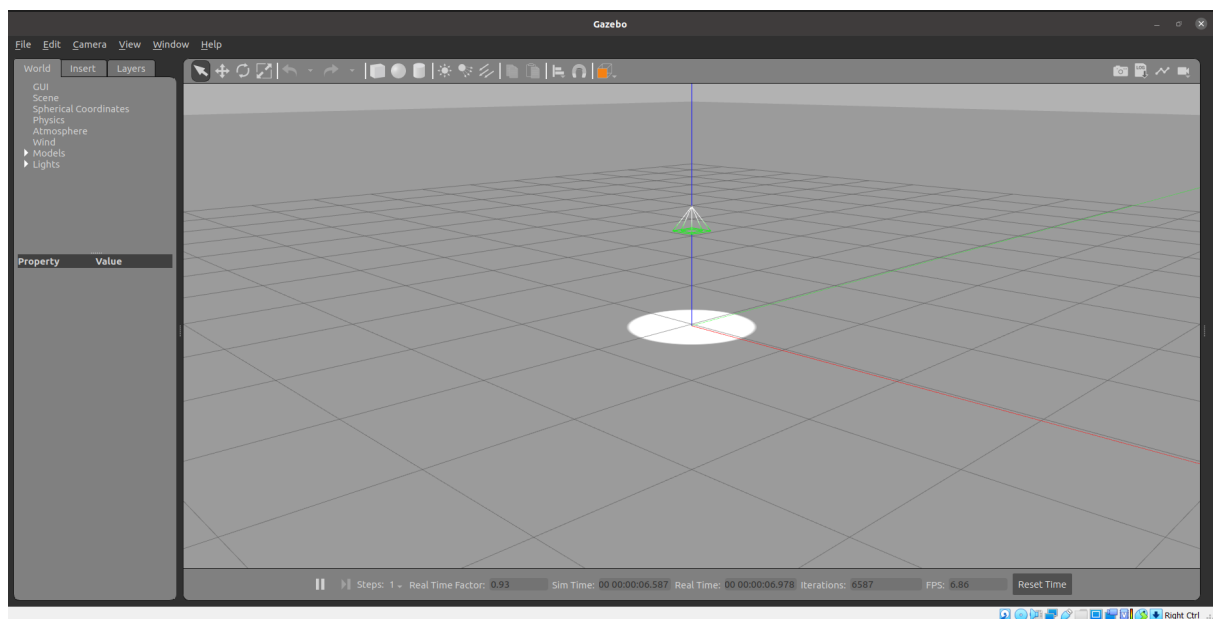
```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch light_control_ros simple_lightcontroller.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualBox-13173.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:42511/

SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /rostdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
/
  gazebo (gazebo_ros/gzserver)
```



Launch gazebo simulator with ros light control plugin

```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch light_control_ros lightcontroller.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualBox-13361.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:34695/

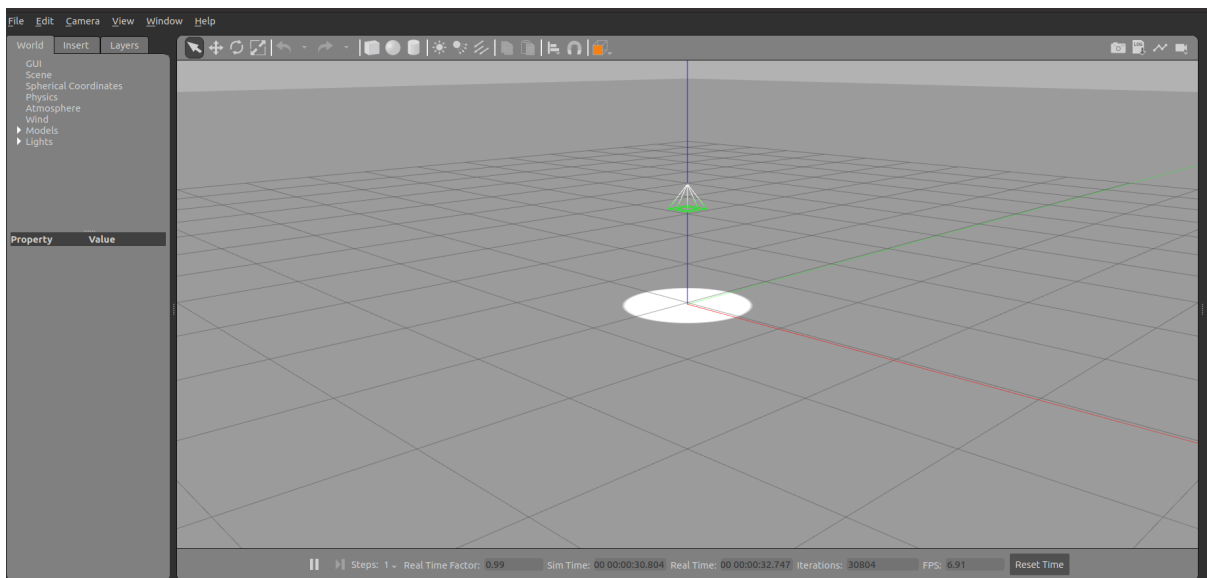
SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /roscdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
/
  gazebo (gazebo_ros/gzserver)
  gazebo_gui (gazebo_ros/gzclient)

ROS_MASTER_URI=http://localhost:11311

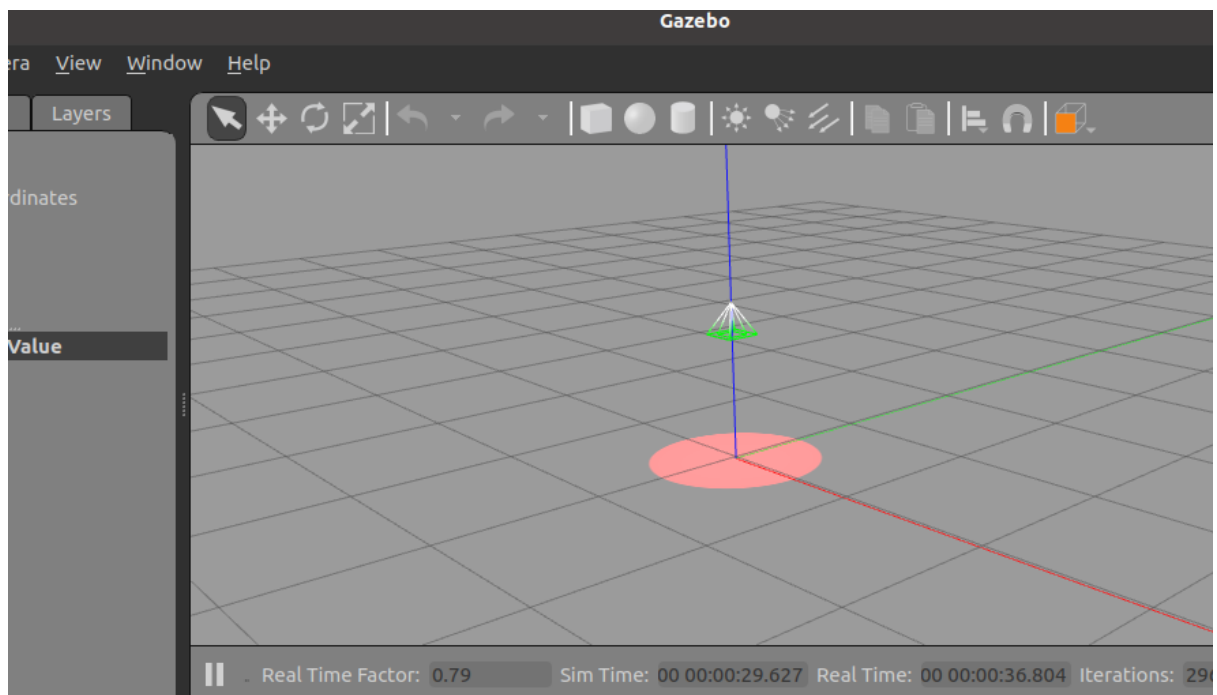
process[gazebo-1]: started with pid [13375]
process[gazebo_gui-2]: started with pid [13380]
[ INFO] [1687865412.292210737]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687865412.293366290]: waitForService: Service [/gazebo/set_physics_properties] has not been advertised, waiting...
[ INFO] [1687865412.417542398]: Finished loading Gazebo ROS API Plugin.
```



Publish once on /light_color topic:

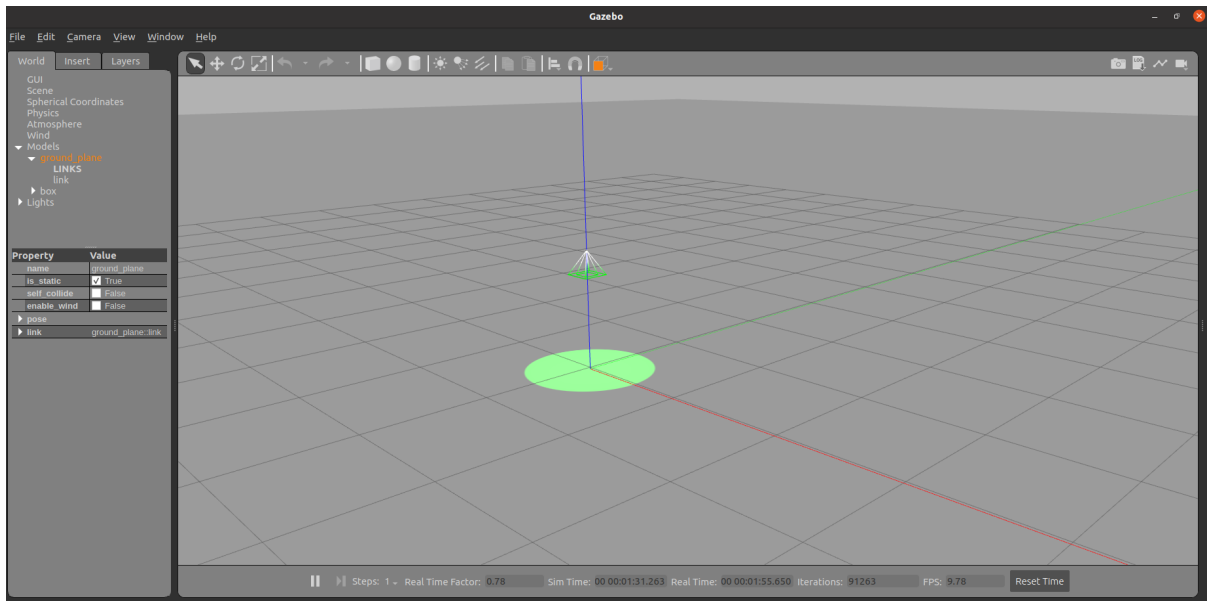
red color

```
roscore http://nandana-Virtua... x /home/nandana/Desktop/catkin... x nandana@nandana-VirtualBox... x
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ rostopic pub -1 /light_color std_msgs/String "data: '
red'"
publishing and latching message for 3.0 seconds
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$
```



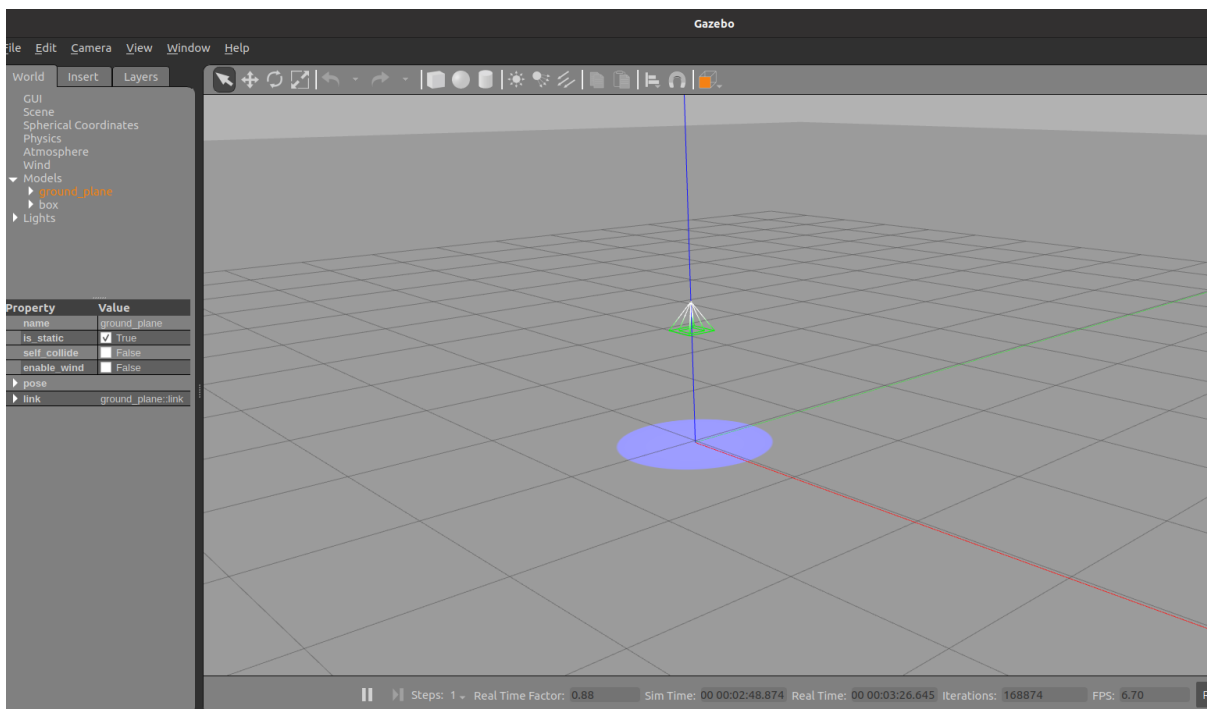
green color

```
roscore http://nandana-VirtualBo... x /home/nandana/Desktop/catkin... x nandana@nandana-VirtualBox: ~/... x
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ rostopic pub -1 /light_color std_msgs/String "data: 'green'"
publishing and latching message for 3.0 seconds
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$
```



blue color

```
nandana@nandana-VirtualBox: ~/Desktop/catkin_ws
roscore http://nandana-VirtualBo... x /home/nandana/Desktop/catkin_... x nandana@nandana-VirtualBox: ~/... x
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ rostopic pub -1 /light_color std_msgs/String "data: 'green'"
publishing and latching message for 3.0 seconds
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ rostopic pub -1 /light_color std_msgs/String "data: 'blue'"
publishing and latching message for 3.0 seconds
```



7. Light Move Plugin

The ROS Gazebo Light Move Plugin is a software module that extends the functionality of the Gazebo simulator by allowing the movement and animation of light sources within the simulated environment. In this report, we will outline the steps to create a light move plugin that controls the position and orientation of lights in the Gazebo using ROS topics.

The ROS Gazebo Light Move Plugin is implemented as a ROS package. It includes a custom Gazebo plugin that interacts with Gazebo's lighting system and subscribes to ROS topics for light movement control.

The ROS Gazebo Light Move Plugin provides a convenient way to control and animate the movement of light sources within the Gazebo simulation environment using ROS topics. By implementing the plugin and following the provided steps, users can publish light movement commands and observe the changes in the Gazebo simulator. This plugin enhances the capabilities of Gazebo for simulating and testing dynamic lighting scenarios in robotic systems.

```
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ source devel/setup.bash
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ catkin_make
Base path: /home/nandana/Desktop/catkin_ws
Source space: /home/nandana/Desktop/catkin_ws/src
Build space: /home/nandana/Desktop/catkin_ws/build
Devel space: /home/nandana/Desktop/catkin_ws/devel
Install space: /home/nandana/Desktop/catkin_ws/install
####
#### Running command: "make cmake_check_build_system" in "/home/nandana/Desktop/catkin_ws/build"
####
####
#### Running command: "make -j1 -l1" in "/home/nandana/Desktop/catkin_ws/build"
####
[ 0%] Built target _turtlebot3_msgs_generate_messages_check_deps_Sound
[ 0%] Built target std_msgs_generate_messages_cpp
[ 0%] Built target _turtlebot3_msgs_generate_messages_check_deps_SensorState
[ 0%] Built target _turtlebot3_msgs_generate_messages_check_deps_VersionInfo
[ 3%] Built target turtlebot3_msgs_generate_messages_cpp
[ 3%] Built target std_msgs_generate_messages_py
[ 8%] Built target turtlebot3_msgs_generate_messages_py
[ 8%] Built target std_msgs_generate_messages_nodejs
[12%] Built target turtlebot3_msgs_generate_messages_nodejs
[12%] Built target std_msgs_generate_messages_lisp
[16%] Built target turtlebot3_msgs_generate_messages_lisp
[16%] Built target std_msgs_generate_messages_eus
[21%] Built target turtlebot3_msgs_generate_messages_eus
[21%] Built target turtlebot3_msgs_generate_messages
[21%] Built target roscpp_generate_messages_eus
[21%] Built target sensor_msgs_generate_messages_lisp
[21%] Built target sensor_msgs_generate_messages_nodejs
[21%] Built target rosgenmsg_generate_messages_py
[21%] Built target roscpp_generate_messages_lisp
[21%] Built target geometry_msgs_generate_messages_py
```

```
roscore http://nandana-VirtualBox:11311/ x /home/nandana/Desktop/catkin_ws/src/gazebo_plugins... x
nandana@nandana-VirtualBox:~/Desktop/catkin_ws$ roslaunch light_move_plugin light.launch
... logging to /home/nandana/.ros/log/941e9e84-14da-11ee-8fe5-3f1f7c0a4879/roslaunch-nandana-VirtualBox-14779
.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://nandana-VirtualBox:36885/

SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /rostdistro: noetic
* /rosversion: 1.16.0
* /use_sim_time: True

NODES
/
  gazebo (gazebo_ros/gzserver)
  gazebo_gui (gazebo_ros/gzclient)

ROS_MASTER_URI=http://localhost:11311

process[gazebo-1]: started with pid [14793]
process[gazebo_gui-2]: started with pid [14798]
[ INFO] [1687866134.244412605]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687866134.261024965]: waitForService: Service [/gazebo/set_physics_properties] has not been adverti
sed, waiting...
[ INFO] [1687866134.453484462]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1687866134.454491275]: waitForService: Service [/gazebo_gui/set_physics_properties] has not been adv
ertised, waiting...
[ INFO] [1687866134.722441339]: waitForService: Service [/gazebo/set_physics_properties] is now available.
[ INFO] [1687866134.772328811]: Physics dynamic reconfigure ready.
complete_light_name=box::link_1::user_spot_light_1
light off
light on
light off
light on
light off
light on
light off
light on
light off
light on
```

