Understanding the e-Drone Model

In this tutorial you will learn how to use the **e-Drone model** for Task 1.

Steps to understand the drone model:

1. Find **e-Drone.ttm** in the Tutorials folder. Copy it into *V-REP_PRO_EDU_V3_5_0_Linux/models/robots/mobile* folder.

2. Run roscore by typing the following command in your terminal:

   ≫ `roscore`

3. Now launch the simulator by typing the following command in the V-REP directory and also check if the RosInterface has been loaded successfully:

   ≫ `./vrep.sh`

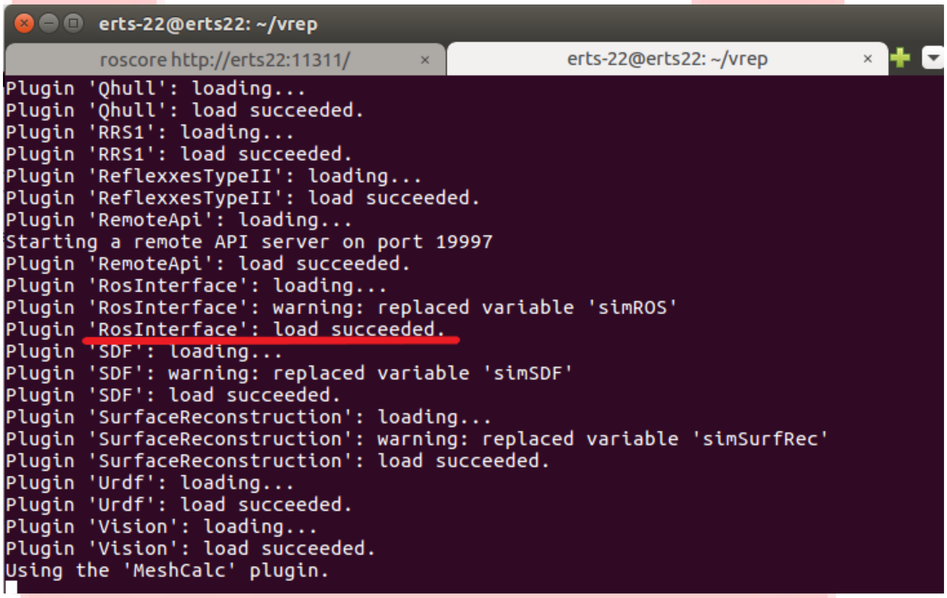
   

   Figure 1: 'RosInterface' plugin load confirmation

   If the 'RosInterface' has not been loaded then check if roscore is running before debugging further.

4. Select the "mobile" folder from the "Model Browser" tab. Find the e-Drone.ttm model, then drag and drop the same into the simulator scene.
   Alternatively, open the "File" tab in V-REP. choose "Load model..." and choose the following file from the Task 1/Task folder

   e-Drone.ttm

5. Run the simulation by clicking the play button in V-REP.

6. Make sure that in the top toolbar, Dynamics engine is set to **Bullet 2.78**, Dynamics Settings as **Accurate** (default), Simulation Timestep is **dt=50ms** (default), and the Simulation is in **Real-Time mode** as shown in Figure 2. For this competition, we instruct you to not change these parameters.

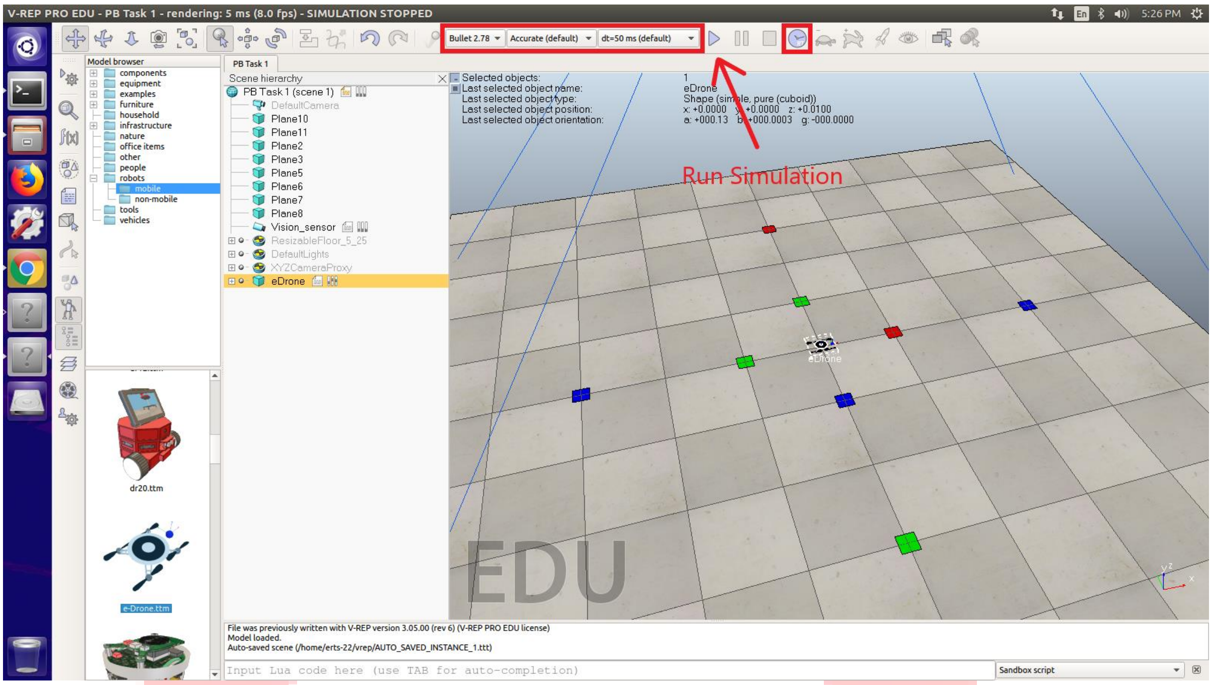


Figure 2: V-REP settings

7. Check all the topics published by V-REP. Run the following command in the terminal to check all the topics published by V-REP:

   ≫ **`rostopic list`**

   You should find the topics **"/drone_command"** and **"/drone_yaw"**.

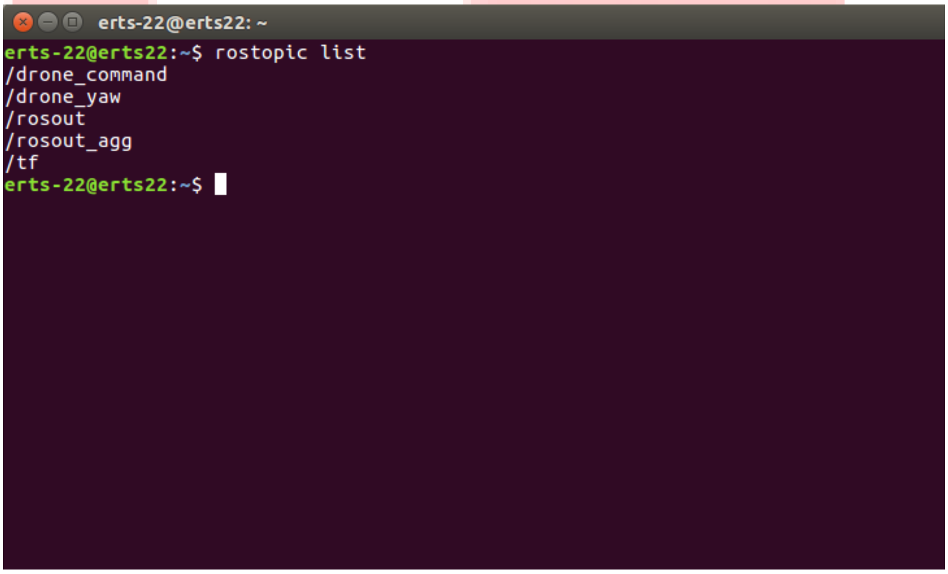


Figure 3: rostopic list output

"/drone_command" is a topic subscribed by the **e-Drone model.** It commands the drone's motion in terms of **roll, pitch, yaw and throttle.**

"/drone_yaw" is a topic published by the **e-Drone model.** It indicates the drone's orientation about the z-axis with respect to the V-REP world.

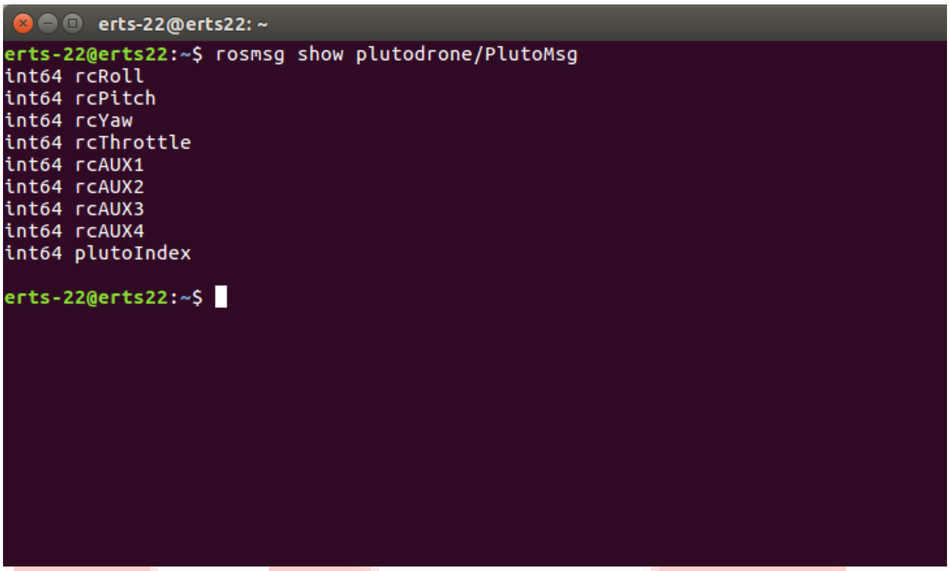
8. Check the type of messages accepted by the **"/drone_command"** topic. Run the following command in the terminal to check:

   ≫ `rostopic info /drone_command`

   Your output will display the topic type as **"plutodrone/PlutoMsg"**.

   Check the structure of the message by typing the following command in the terminal:

   ≫ `rosmsg show plutodrone/PlutoMsg`



```
erts-22@erts22: ~
erts-22@erts22:~$ rosmsg show plutodrone/PlutoMsg
int64 rcRoll
int64 rcPitch
int64 rcYaw
int64 rcThrottle
int64 rcAUX1
int64 rcAUX2
int64 rcAUX3
int64 rcAUX4
int64 plutoIndex

erts-22@erts22:~$
```

Figure 4: drone_command message structure

   The values for *rcRoll*, *rcPitch*, *rcYaw* and *rcThrottle* range from 1000 to 2000.

9. Do the same for the **"/drone_yaw"** topic to check the type of messages published by it. Run the following command in the terminal to check:

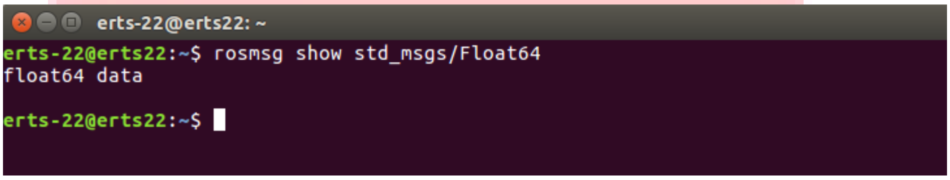
   ≫ `rostopic info /drone_yaw`

   Your output will display the topic type as **"std_msgs/Float64"**.

   Check the structure of the message by typing the following command in the terminal:

   ≫ `rosmsg show std_msgs/Float64`

   The values for '*data*' ranges from -179 to 179.



```
erts-22@erts22: ~
erts-22@erts22:~$ rosmsg show std_msgs/Float64
float64 data

erts-22@erts22:~$
```

Figure 5: drone_yaw message structure

Arming the Drone:

An armed drone means the drone is ready to take commands from a user or software to fly.

The condition to arm the drone is rcThrottle = 1000 (minimum value) and rcAUX4 ≥ 1300. To test arming the drone model, publish the following message to the topic **"/drone_command"** by typing the command:

≫ `rostopic pub /drone_command plutodrone/PlutoMsg "{rcRoll: 1500, rcPitch: 1500, rcYaw: 1500, rcThrottle: 1000, rcAUX1: 0, rcAUX2: 0, rcAUX3: 0, rcAUX4: 1500}"`

This should now arm the drone. A message should pop on the V-REP window which says **"ARMED"** and the propellers should start rotating.

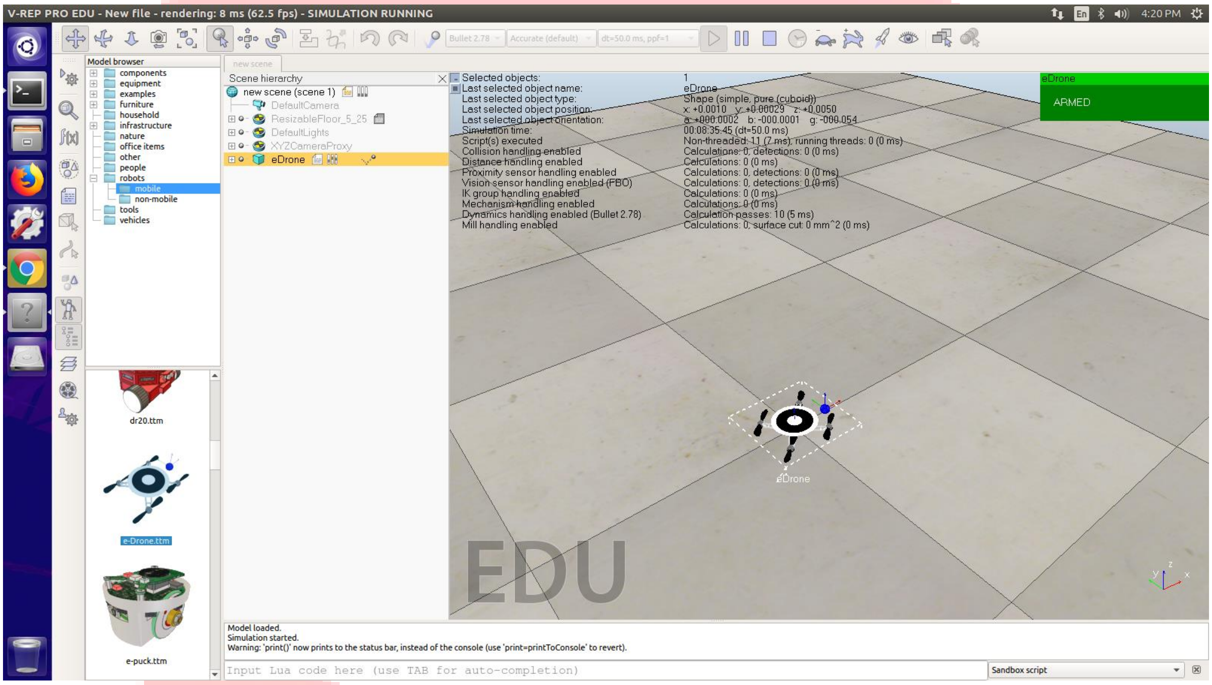


Figure 6: Arm

Flight (Take-Off):

The condition for the drone to take-off is rcThrottle ≥ 1500, after arming. To test the drone's take-off, publish the following message to increase the throttle:

≫ **rostopic pub /drone_command plutodrone/PlutoMsg "{rcRoll: 1500, rcPitch: 1500, rcYaw: 1500, rcThrottle: 1500, rcAUX1: 0, rcAUX2: 0, rcAUX3: 0, rcAUX4: 1500}"**

The drone should now steadily rise until a new command is given.

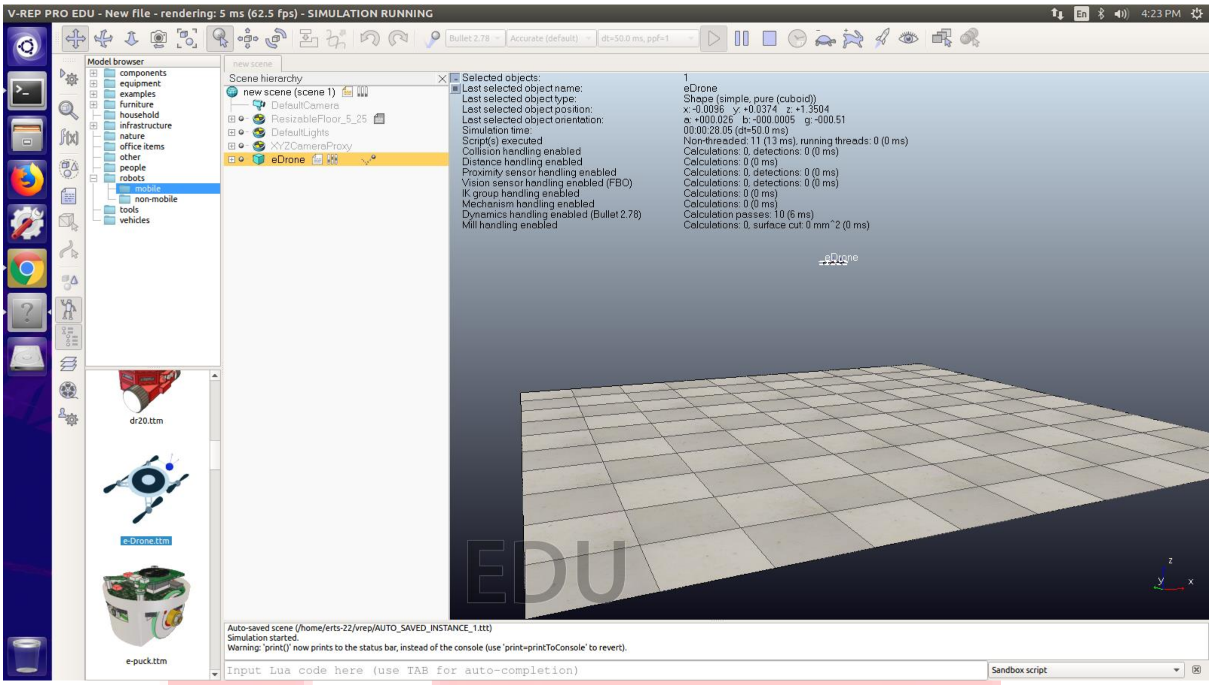


Figure 7: Flight

Disarming the Drone:

A disarmed drone means the drone is in a mode that will not take any commands from a user or software to fly.

The condition to disarm the drone is rcAUX4 ≤ 1200. To test disarming the drone model, publish the following message to the topic **"/drone_command"** by typing the command:

≫ **rostopic pub /drone_command plutodrone/PlutoMsg "{rcRoll: 1500, rcPitch: 1500, rcYaw: 1500, rcThrottle: 1000, rcAUX1: 0, rcAUX2: 0, rcAUX3: 0, rcAUX4: 1200}"**

The drone should now be disarmed. A message should pop on the V-REP window which says **"DISARMED"** and the propellers should stop rotating.

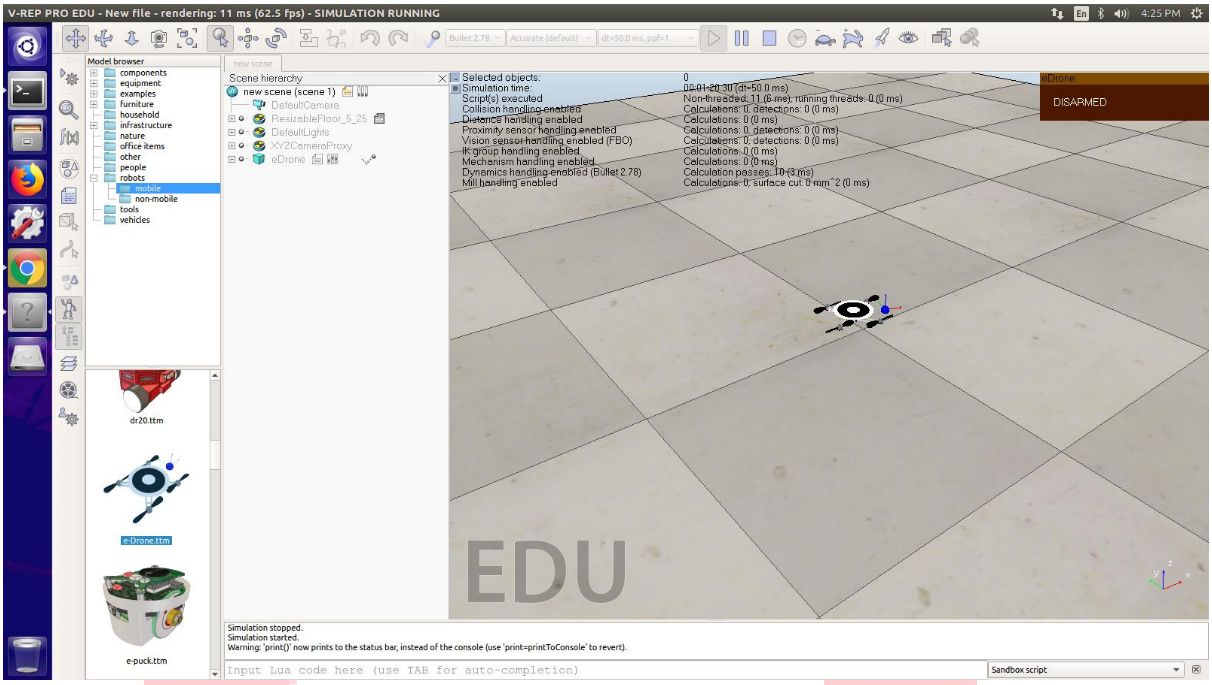


Figure 8: Disarm

Heading if the Drone:

It is important to understand the heading direction of the drone. Refer to Figure 9 to check the heading of drone.

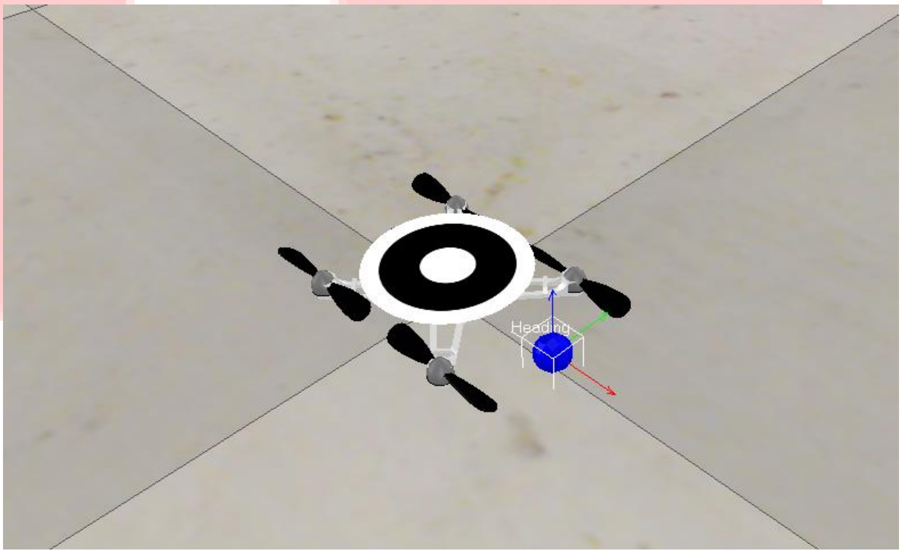


Figure 9: Heading of the Drone

- Red Arrow: Positive X-Axis (Pitch)
- Green Arrow: Positive Y-axis (Roll)
- Blue Arrow: Positive Z-axis (Throttle)