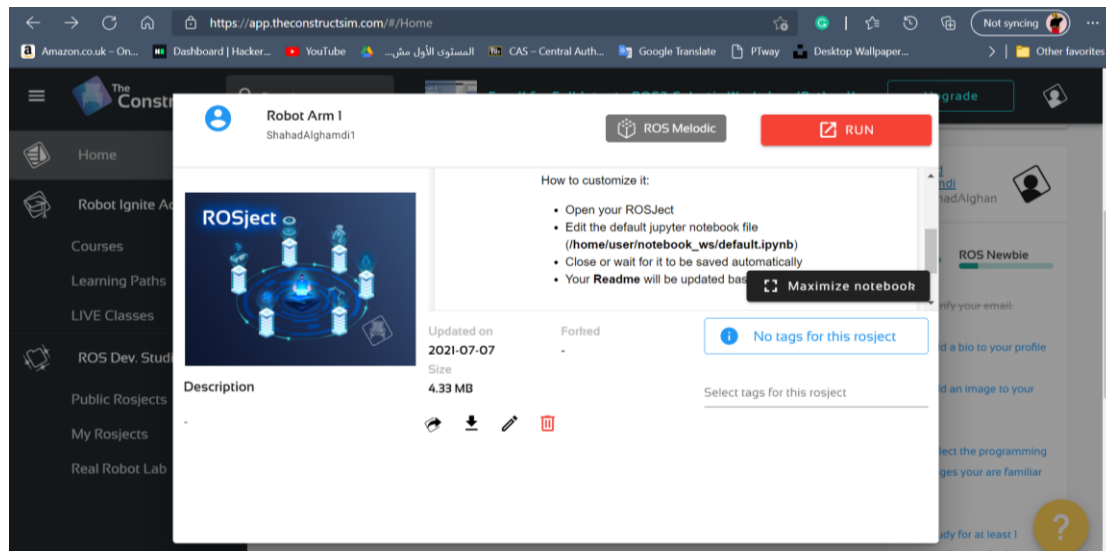


Robot operating system installation and configuration

Signing up at <https://www.theconstructsim.com/>, click on create a project and the following screen will appear. start filling the blanks by writing the project name, choose which ROS version you want to work with, and in my case, I'm working with ROS Melodic, and finally add a brief description then click create.



1. installing the package (arduino_robot_arm)

The next step is to clone the robot arm package from GitHub, so we will use the command (Sudo apt install git) to install Github on ROS to clone the project using its' path from GitHub to ROS.

```
#581 +
user:~$ cd ~/catkin_ws/src
user:~/catkin_ws/src$ sudo apt install git
Reading package lists... Done
Building dependency tree
Reading state information... Done
git is already the newest version (1:2.17.1-lubuntu0.8).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
user:~/catkin_ws/src$ git clone https://github.com/smart-methods/arduino_robot_arm
Cloning into 'arduino_robot_arm'...
remote: Enumerating objects: 173, done.
remote: Counting objects: 100% (65/65), done.
remote: Compressing objects: 100% (65/65), done.
remote: Total 173 (delta 32), reused 0 (delta 0), pack-reused 108
Receiving objects: 100% (173/173), 1.23 MiB | 12.39 MiB/s, done.
Resolving deltas: 100% (61/61), done.
user:~/catkin_ws/src$
```

2. Install all the dependencies

To run the package we need other dependencies (MoveIt, joint state publisher, gazebo ..etc), so we used the following commands to install those dependencies on ROS, and we compiled the package after the installation is completed.

```
#581 +
remote: Counting objects: 100% (65/65), done.
remote: Compressing objects: 100% (65/65), done.
remote: Total 173 (delta 32), reused 0 (delta 0), pack-reused 108
Receiving objects: 100% (173/173), 1.23 MiB | 12.39 MiB/s, done.
Resolving deltas: 100% (61/61), done.
user:~/catkin_ws/src$ cd ~/catkin_ws
user:~/catkin_ws$ rosdep install --from-paths src --ignore-src -r -y
#All required rosdeps installed successfully
user:~/catkin_ws$ sudo apt-get install ros-melodic-moveit
Reading package lists... Done
Building dependency tree
Reading state information... Done
ros-melodic-moveit is already the newest version (1.0.8-1bionic.20210601.181746).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
user:~/catkin_ws$ sudo apt-get install ros-melodic-joint-state-publisher ros-melodic-joint-state-publisher-gui
Reading package lists... Done
Building dependency tree
Reading state information... Done
ros-melodic-joint-state-publisher-gui is already the newest version (1.12.15-1bionic.20210505.032058).
ros-melodic-joint-state-publisher is already the newest version (1.12.15-1bionic.20210505.031159).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
user:~/catkin_ws$
```

```
#581 +
ros-melodic-moveit is already the newest version (1.0.8-1bionic.20210601.181746).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
user:~/catkin_ws$ sudo apt-get install ros-melodic-joint-state-publisher ros-melodic-joint-state-publisher-gui
Reading package lists... Done
Building dependency tree
Reading state information... Done
ros-melodic-joint-state-publisher-gui is already the newest version (1.12.15-1bionic.20210505.032058).
ros-melodic-joint-state-publisher is already the newest version (1.12.15-1bionic.20210505.031159).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
user:~/catkin_ws$ sudo apt-get install ros-melodic-gazebo-ros-control joint-state-publisher
Reading package lists... Done
Building dependency tree
Reading state information... Done
E: Unable to locate package joint-state-publisher
user:~/catkin_ws$ sudo apt-get install ros-melodic-ros-controllers ros-melodic-ros-control
Reading package lists... Done
Building dependency tree
Reading state information... Done
ros-melodic-ros-controllers is already the newest version (0.17.2-1bionic.20210601.162619).
ros-melodic-ros-control is already the newest version (0.18.3-1bionic.20210505.031003).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
user:~/catkin_ws$
```

3. Controlling the motors

Now we run the robot arm package using the following command (`roslaunch robot_arm_pkg check_motors.launch`) which will result in two separate windows, where RViz window will show the arm structure simulation and the other is the joint state publisher window showing 4 controls to adjust the positioning of the parts.

```
#581 +
user:~/catkin_ws$ roslaunch robot_arm_pkg check_motors.launch
... logging to /home/user/.ros/log/5d271f68-debe-11eb-9ab7-0242c0a82007/roslaunch-1_xterm-2628.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.

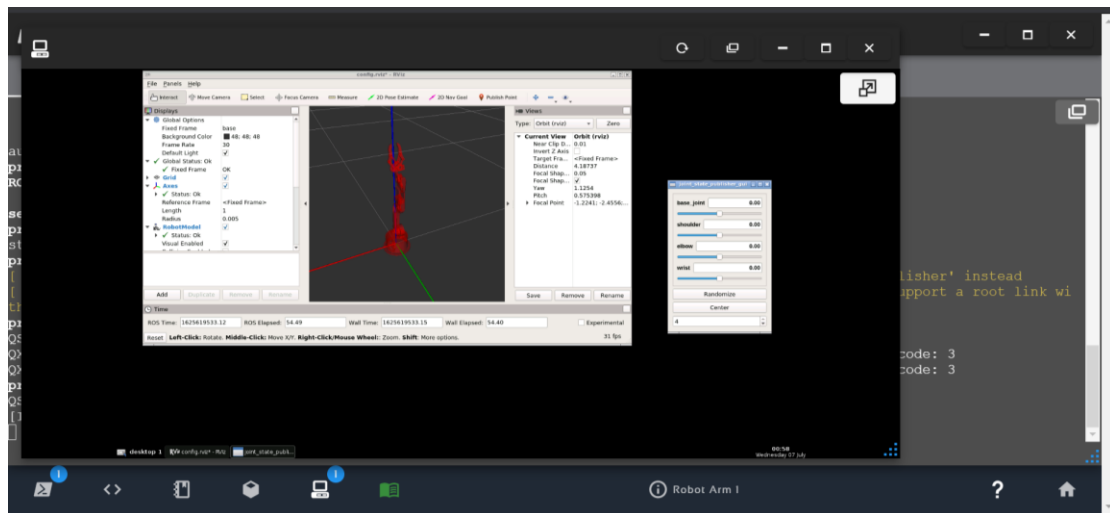
started roslaunch server http://1_xterm:36989/

SUMMARY
=====
PARAMETERS
* /robot_description: <?xml version="1....
* /roscpp: melodic
* /rosversion: 1.14.11
NODES
/
  joint_state_publisher_gui (joint_state_publisher_gui/joint_state_publisher_gui)
  robot_state_publisher (robot_state_publisher/state_publisher)
  rviz (rviz/rviz)
```

```
#581 +
robot_state_publisher (robot_state_publisher/state_publisher)
rviz (rviz/rviz)

auto-starting new master
process[master]: started with pid [2653]
ROS_MASTER_URI=http://1_xterm:11311

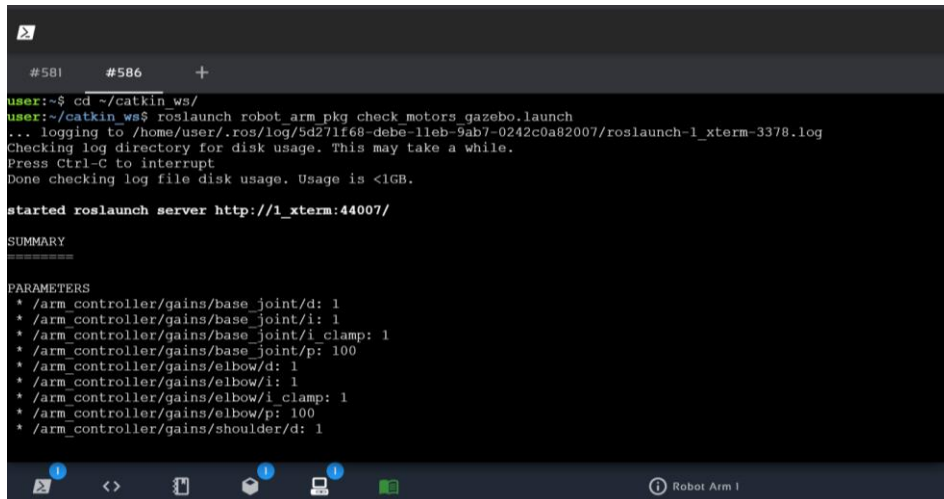
setting /run_id to 5d271f68-debe-11eb-9ab7-0242c0a82007
process[rosout-1]: started with pid [2681]
started core service [/rosout]
process[robot_state_publisher-2]: started with pid [2684]
[ WARN] [1625619477.874815822]: The 'state_publisher' executable is deprecated. Please use 'robot_state_publisher' instead
[ WARN] [1625619477.878035675]: The root link base has an inertia specified in the URDF, but KDL does not support a root link with an inertia. As a workaround, you can add an extra dummy link to your URDF.
process[rviz-3]: started with pid [2699]
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-user'
QXcbConnection: XCB error: 2 (BadValue), sequence: 565, resource id: 400, major code: 130 (Unknown), minor code: 3
QXcbConnection: XCB error: 2 (BadValue), sequence: 568, resource id: 400, major code: 130 (Unknown), minor code: 3
process[joint_state_publisher_gui-4]: started with pid [2729]
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-user'
[INFO] [1625619479.283602]: Centering
```



4. Controlling the motors in simulation

using the following commands, now we will run the arm simulation on both RViz and Gazebo and adjust the arm using the controls. \$ roslaunch robot_arm_pkg check_motors.launch \$ roslaunch robot_arm_pkg check_motors_gazebo.launch

which will result in the following windows:

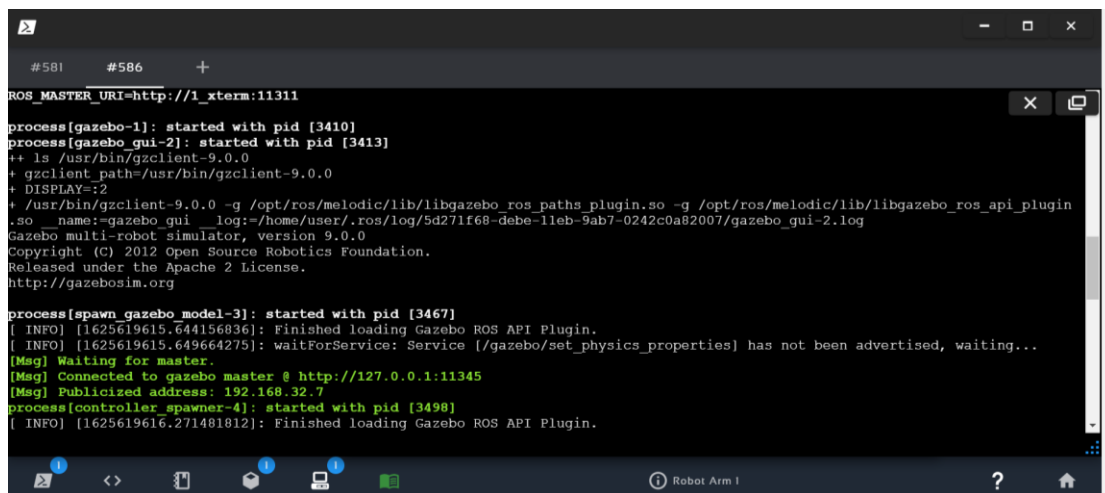


```
#581 #586 +
user:~$ cd ~/catkin_ws/
user:~/catkin_ws$ roslaunch robot_arm_pkg check_motors_gazebo.launch
... logging to /home/user/.ros/log/5d271f68-debe-11eb-9ab7-0242c0a82007/roslaunch-1_xterm-3378.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://1_xterm:44007/

SUMMARY
=====

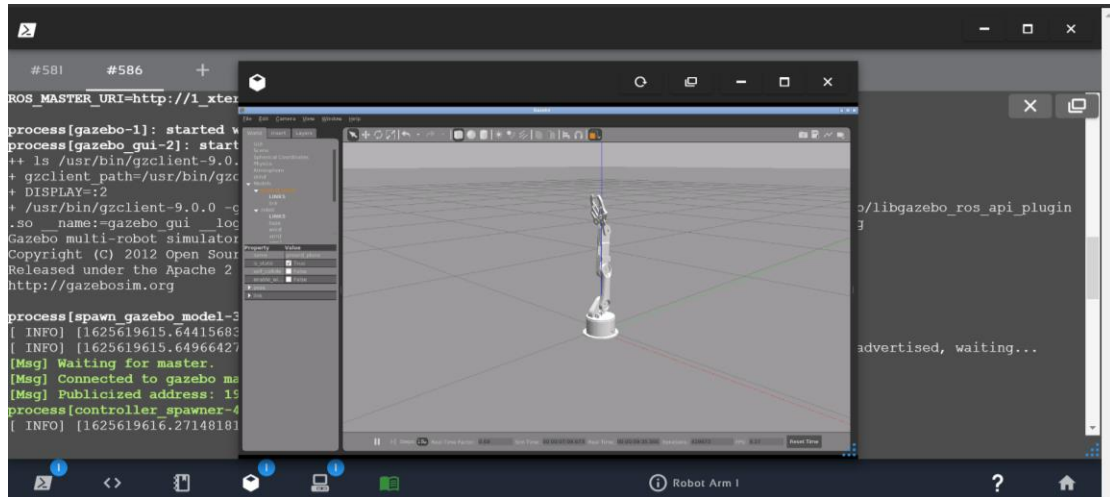
PARAMETERS
* /arm_controller/gains/base_joint/d: 1
* /arm_controller/gains/base_joint/i: 1
* /arm_controller/gains/base_joint/i_clamp: 1
* /arm_controller/gains/base_joint/p: 100
* /arm_controller/gains/elbow/d: 1
* /arm_controller/gains/elbow/i: 1
* /arm_controller/gains/elbow/i_clamp: 1
* /arm_controller/gains/elbow/p: 100
* /arm_controller/gains/shoulder/d: 1
```



```
#581 #586 +
ROS_MASTER_URI=http://1_xterm:11311

process[gazebo-1]: started with pid [3410]
process[gazebo_gui-2]: started with pid [3413]
++ ls /usr/bin/gzclient-9.0.0
+ gzclient_path=/usr/bin/gzclient-9.0.0
+ DISPLAY=:2
+ /usr/bin/gzclient-9.0.0 -g /opt/ros/melodic/lib/libgazebo_ros_paths_plugin.so -g /opt/ros/melodic/lib/libgazebo_ros_api_plugin
.so --name=gazebo_gui --log=/home/user/.ros/log/5d271f68-debe-11eb-9ab7-0242c0a82007/gazebo_gui-2.log
Gazebo multi-robot simulator, version 9.0.0
Copyright (C) 2012 Open Source Robotics Foundation.
Released under the Apache 2 license.
http://gazebo-sim.org

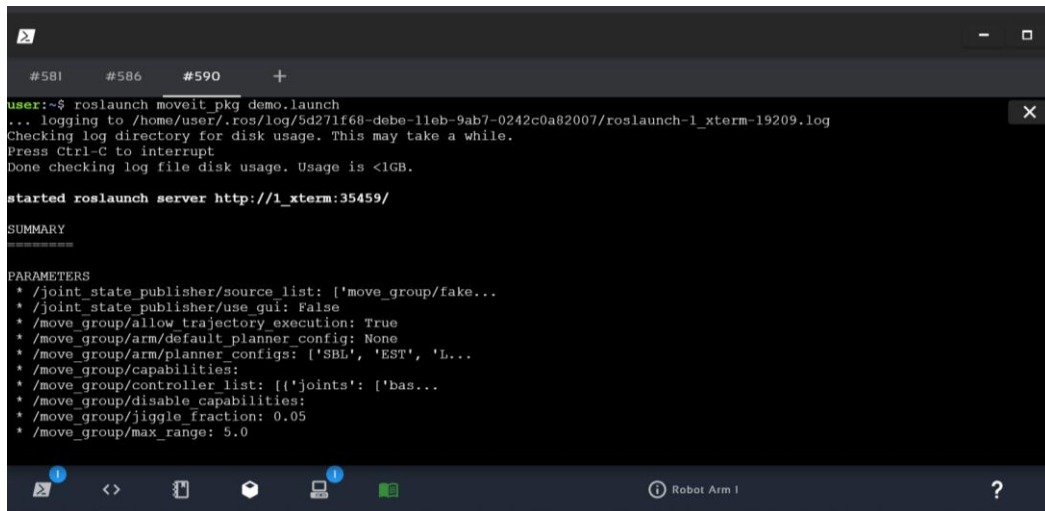
process[spawn_gazebo_model-3]: started with pid [3467]
[ INFO] [1625619615.644156836]: Finished loading Gazebo ROS API Plugin.
[ INFO] [1625619615.649664275]: waitForService: Service [/gazebo/set_physics_properties] has not been advertised, waiting...
[Msg] Waiting for master.
[Msg] Connected to gazebo master @ http://127.0.0.1:11345
[Msg] Publicized address: 192.168.32.7
process[controller_spawner-4]: started with pid [3498]
[ INFO] [1625619616.271481812]: Finished loading Gazebo ROS API Plugin.
```



5. MoveIt in RVis

To define the positioning of the arm and its' movements we use MoveIt which simulates the arm movement in different directions and scenarios (facing obstacles or not) and we can run it using the command (roslaunch moveit_pkg demo.launch)

which will result in the following windows:



```
#581 #586 #590 +
user:~$ roslaunch moveit_pkg demo.launch
... logging to /home/user/.ros/log/5d271f60-debe-11eb-9ab7-0242c0a82007/roslaunch-1_xterm-19209.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://1_xterm:35459/

SUMMARY

PARAMETERS
* /joint_state_publisher/source_list: ['move_group/fake...
* /joint_state_publisher/use_gui: False
* /move_group/allow_trajectory_execution: True
* /move_group/arm/default_planner_config: None
* /move_group/arm/planner_configs: ['SBL', 'EST', 'L...
* /move_group/capabilities:
* /move_group/controller_list: [{'joints': ['bas...
* /move_group/disable_capabilities:
* /move_group/jiggle_fraction: 0.05
* /move_group/max_range: 5.0
```

