install-arduino-robot-arm

install source code

git clone https://github.com/kira-Developer/arduino_robot_arm.git

Dependencies

run this instruction inside your workspace:

ake sure you installed all these packages:

for kinetic distro

```
$ sudo apt-get install ros-kinetic-moveit
$ sudo apt-get install ros-kinetic-joint-state-publisher ros-kinetic-joint-state-publisher-gui
$ sudo apt-get install ros-kinetic-gazebo-ros-control joint-state-publisher
$ sudo apt-get install ros-kinetic-ros-controllers ros-kinetic-ros-control
```

for melodic distro

```
$ sudo apt-get install ros-melodic-moveit
$ sudo apt-get install ros-melodic-joint-state-publisher ros-melodic-joint-state-publisher-gui
$ sudo apt-get install ros-melodic-gazebo-ros-control joint-state-publisher
$ sudo apt-get install ros-melodic-ros-controllers ros-melodic-ros-control
```

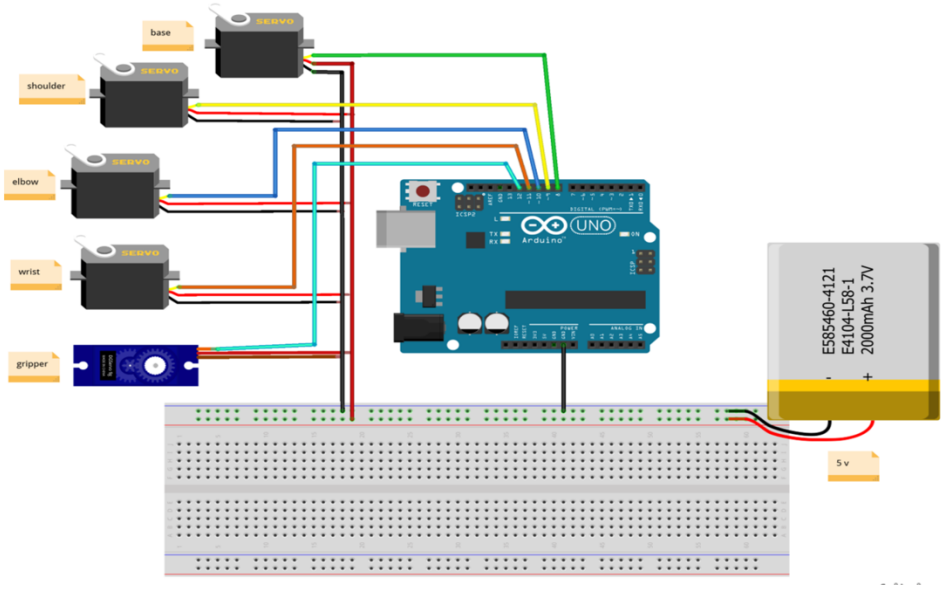
for noetic distro

```
$ sudo apt-get install ros-noetic-moveit
$ sudo apt-get install ros-noetic-joint-state-publisher ros-noetic-joint-state-publisher-gui
$ sudo apt-get install ros-noetic-gazebo-ros-control joint-state-publisher
$ sudo apt-get install ros-noetic-ros-controllers ros-noetic-ros-control
```

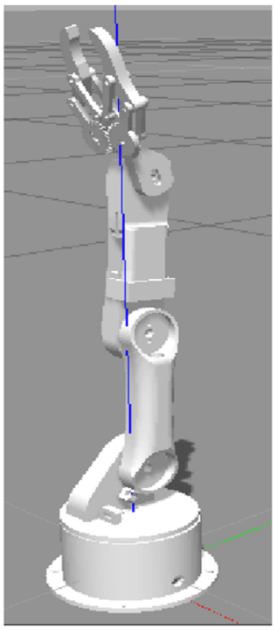
Robot Arm

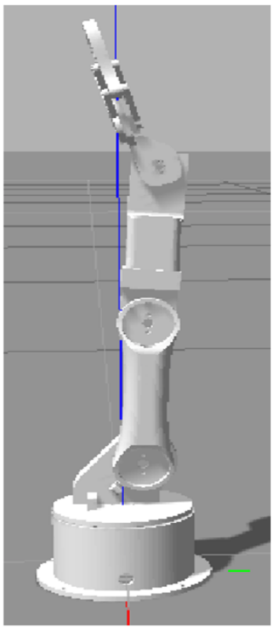
The robot arm has 5 joints only 4 joints can be fully controlled via ROS and Rviz, the last joint (gripper) has a default motion executed from the Arduino code directly.

Circuit diagram



Robot initial positions





Base: 90°

Shoulder: 90°

Elbow: 90°

Wrist: 90°

Gripper: 0° (closed)

Configuring Arduino with ROS

- Install Arduino IDE in Ubuntu https://www.arduino.cc/en/software to install run $ sudo ./install.sh after unzipping the folder
- Launch the Arduino IDE
- Install the arduino package and ros libraryhttp://wiki.ros.org/rosserial_arduino/Tutorials/Arduino%20IDE%20Setup
- Make sure to change the port permission before uploading the Arduino code `$ sudo chmod 777 /dev/ttyUSB0`

Usage

Controlling the robot arm by joint_state_publisher

```
$ roslaunch robot_arm_pkg check_motors.launch
```

You can also connect with hardware by running:

```
$ rosrun rosserial_python serial_node.py _port:=/dev/ttyUSB0
_baud:=115200
```

(Note: You may need to use ttyACM)

Simulation

Run the following instructions to use gazebo

```
$ roslaunch robot_arm_pkg check_motors.launch
$ roslaunch robot_arm_pkg check_motors_gazebo.launch
$ rosrun robot_arm_pkg joint_states_to_gazebo.py
```

(You may need to change the permission)

```
$ sudo chmod +x
~/catkin_ws/src/arduino_robot_arm/robot_arm_pkg/scripts/joint_
states_to_gazebo.py
```

Controlling the robot arm by Moveit and kinematics

```
$ roslaunch moveit_pkg demo.launch
```

You can also connect with hardware by running:

```
$ rosrun rosserial_python serial_node.py _port:=/dev/ttyUSB0
_baud:=115200
```
(Note: You may need to use ttyACM)

Simulation

Run the following instruction to use gazebo

```
$ roslaunch moveit_pkg demo_gazebo.launch
```

Pick and place by using OpenCV

Preparation

Download webcam extension for VirtualBox

https://scribles.net/using-webcam-in-virtualbox-guest-os-on-windows-host/

Testing the camera and OpenCV

Run color_thresholding.py to test the camera

Before running, find the camera index normally it is video0

```
$ ls -l /dev | grep video
```
If it is not, update line 8 in color_thresholding.py

```
8 cap=cv2.VideoCapture(0)
```
Then run

```
$ python color_thresholding.py
```

Using OpenCV with the robot arm in ROS

In Real Robot

- In a terminal run

```
$ roslaunch moveit_pkg demo.launch
```

this will run Rviz

- connect with Arduino:

1. select the Arduino port to be used on Ubuntu system
2. change the permissions (it might be ttyACM)

```
$ ls –l /dev | grep ttyUSB
$ sudo chmod –R 777 /dev/ttyUSB0
```

3. upload the code from Arduino IDE

```
$ rosrun rosserial_python serial_node.py
_port:=/dev/ttyACM0 _baud:=115200
```

- In another terminal

```
$ rosrun moveit_pkg get_pose_openCV.py
```

This will detect **blue** color and publish the x,y coordinates to /direction topic

(Note: check the camera index and update the script if needed)

- Open another terminal

```
$ rosrun moveit_pkg move_group_node
```

This will subscribe to /direction topic and execute motion by using **Moveit move group**

The pick and place actions are performed from the Arduino sketch directly.

In simulation (Gazebo)

- In a terminal run

```
$ roslaunch moveit_pkg demo_gazebo.launch
```

this will run Rviz and gazebo

- In another terminal

```
$ rosrun moveit_pkg get_pose_openCV.py
```

This will detect **blue** color and publish the x,y coordinates to /direction topic

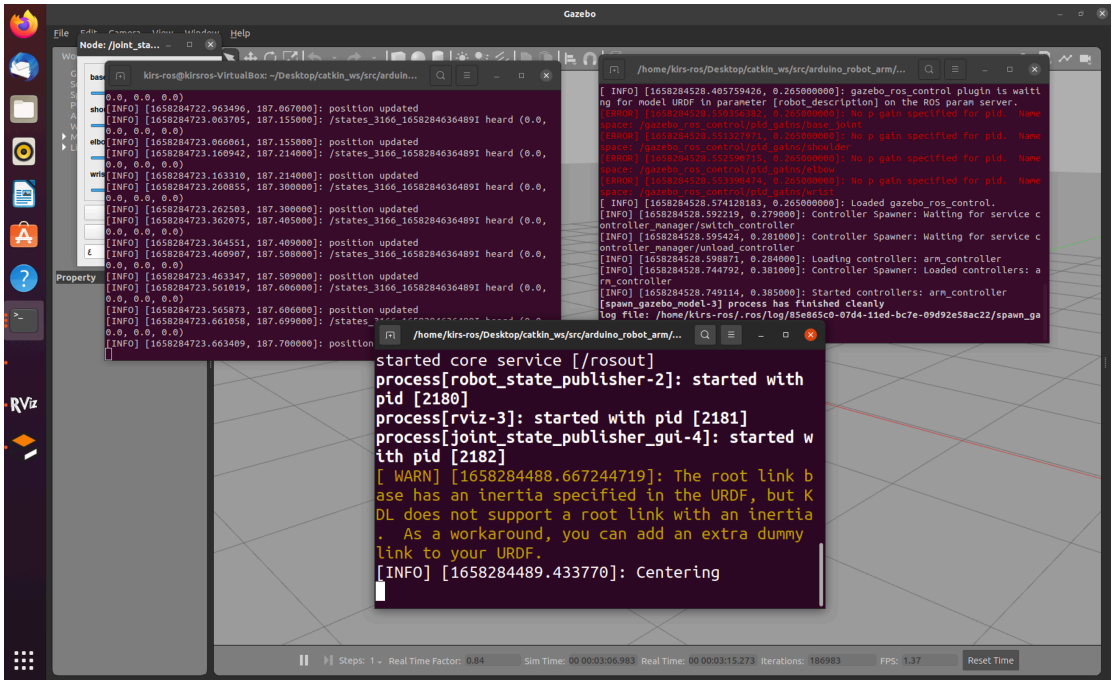
(Note: check the camera index and update the script if needed)

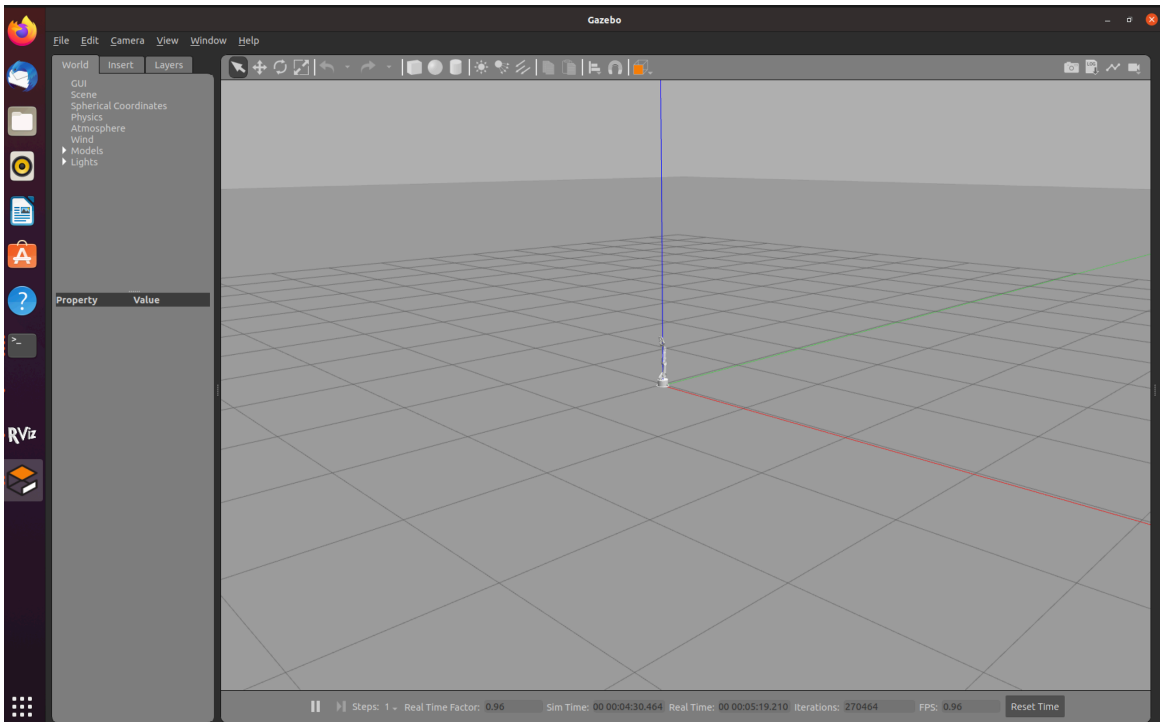
- Open another terminal

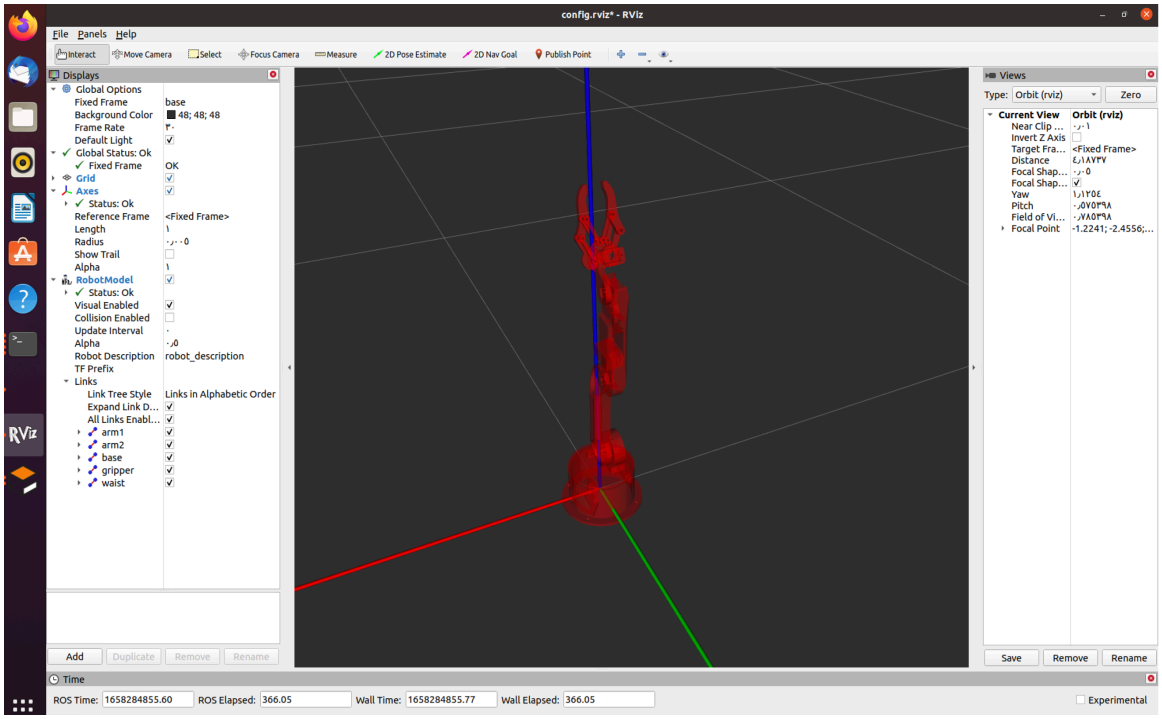
```
$ rosrun moveit_pkg move_group_node
```

This will subscribe to /direction topic and execute motion by using Moveit move group

testing




Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
Steps: 1 Real Time Factor: 0.96 Sim Time: 00 00:04:30.464 Real Time: 00 00:05:19.210 Iterations: 270464 FPS: 0.96
Reset Time


config.rviz* - RViz
File Panels Help
Interact Move Camera Select Focus Camera Measure 2D Pose Estimate 2D Nav Goal Publish Point
Displays
Global Options
Fixed Frame base
Background Color 48; 48; 48
Frame Rate
Default Light
Global Status: Ok
Fixed Frame OK
Grid
Axes
Status: Ok
Reference Frame <Fixed Frame>
Length
Radius
Show Trail
Alpha
RobotModel
Status: Ok
Visual Enabled
Collision Enabled
Update Interval
Alpha
Robot Description robot_description
TF Prefix
Links
Link Tree Style Links in Alphabetic Order
Expand Link D...
All Links Enabl...
arm1
arm2
base
gripper
waist
Add Duplicate Remove Rename
Views
Type: Orbit (rviz) Zero
Current View Orbit (rviz)
Near Clip ...
Invert Z Axis
Target Fra... <Fixed Frame>
Distance
Focal Shap...
Focal Shap...
Yaw
Pitch
Field of Vi...
Focal Point -1.2241; -2.4556;...
Save Remove Rename
Time
ROS Time: 1658284855.60 ROS Elapsed: 366.05 Wall Time: 1658284855.77 Wall Elapsed: 366.05
Experimental