

Lab03 – udev Rules and Testing

ELEC ENG 3EY4

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L04

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As a future member of the engineering profession, the student is responsible for performing the required work in an honest manner, without plagiarism and cheating. Submitting this work with my name and student number is a statement and understanding that this work is my own and adheres to the Academic Integrity Policy of McMaster University and the Code of Conduct of the Professional Engineers of Ontario. Submitted by [**Brent Menheere, menheerb, 400362843**], [**Aum Shah, shaha124, 400388075**]

Please Note; Due to an error with NoMachine, we were not able to remotely access the car, and in consequence all screenshots have been replaced with photos of the lab monitor. We were able to resolve this issue at the end of the lab with the help of our TAs by updating NoMachine on our laptop and our car and restarting them both. We apologize if the pictures we took are not the clearest.

brentandaum desktop, Ubuntu 18.04.6 LTS

NO MACHINE



Question 1:

The command we used to navigate to the rules, is `cd /etc/udev/rules.d`. We used these commands to navigate to the specific folder required to add the new files.

Question 2:

Using our Linux knowledge from Lab 1 we added the rule file for the lidar by using the command `sudo gedit rplidar.rules`. We used this to create the rplidar rule file, to put the rules in.

Question 3:

We used the command `sudo gedit vesc.rules` to create the vesc rules file, to put the rules in.

Question 4:

We used the command `sudo gedit joypad-f710.rules` to create the controller rule file, to put the rules in.

Question 5:

We used the command `sudo gedit 99-realsense-libusb.rules` to create the camera rule file, to put the rules in.

Question 6:

The control `--reload-rules` command reloads the udev rules configuration. The `udevadm trigger` command prompts udev to reapply the rules and make the system aware of any changes made to the ruleset. This makes sure that we can update the rules without interrupting current operations that are going on.

Question 7:

We need to edit the ROS launch files, "rplidar.launch" file, because we need to configure the lidar sensor's parameters, ensuring proper communication. We add that line so that the serial port knows where to look for when it needs to initialize the group of nodes specified for rplidar.

Question 8:

When executing the command `rostopic echo scan/ranges[360]`, we observed data points collected from the back of the lidar. When a laptop was put in front of the lidar at around 20 cm, the output in Figure 1 was displayed. The values shown represent the distance between the lidar and the nearest object in meters, thus the output was around 0.2.

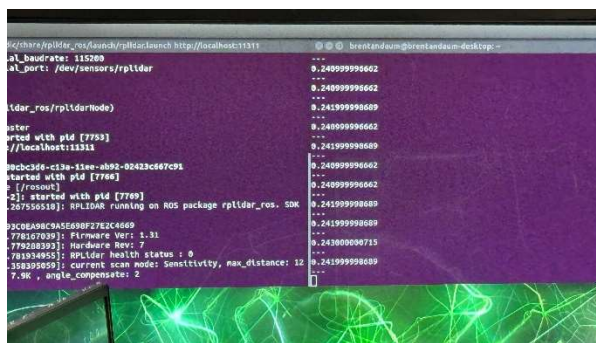


Figure 1 Output of lidar at 20 cm

We then moved the laptop back to about a 100 cm from the lidar. The output in Figure 2 shows that the reading changed to around 1.0, representing 1 meter distance between the object and the lidar.

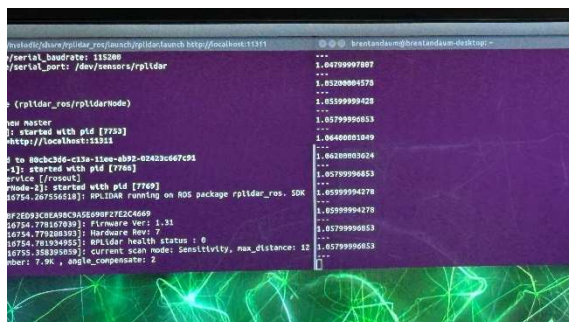


Figure 2 Output of lidar at 1 m

Question 9:

When viewing the output of the lidar system with `rviz`, we achieved the image shown in Figure 3. The point cloud represents objects seen by the lidar on a 2D plane. We observed that each of the red objects shown in the point cloud represented objects and people within the lab room. Near the top left and top right of the point cloud, straight lines can be seen, these lines show the walls of the lab room. At the centre of the grid, a collection of points can be seen which show our group along with objects close to us

Figure 3 Point cloud map of lidar

Question 10:

Shown below are the screenshots of both `image_raw` and `image_rect_raw`, respectively:

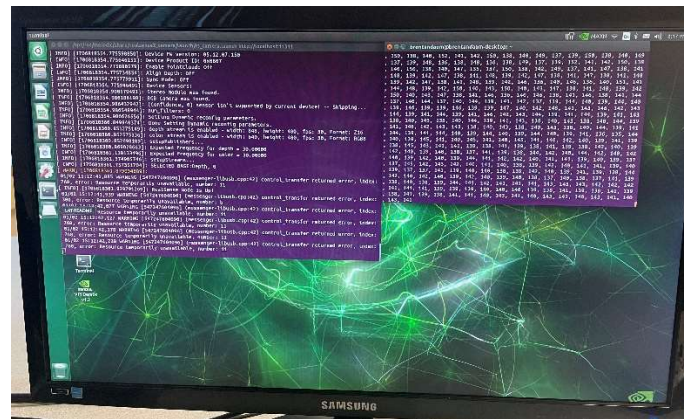


Figure 4 image_raw

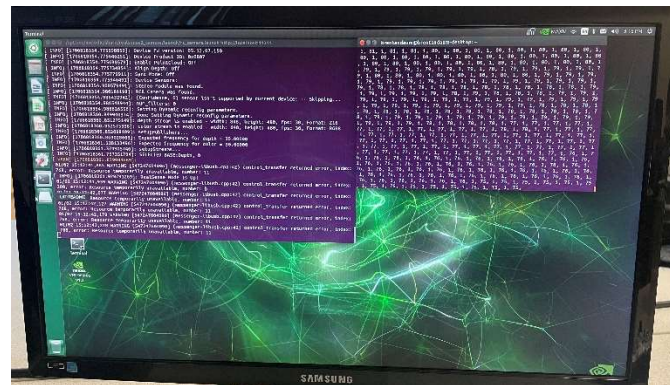


Figure 5 image_rect_raw

Question 11:

Shown in Figure 6 is a photo of our group in both a colored image and depth, simultaneously. The depth camera image reflects the colored photo image. The depth camera represents the raw image by showing the distance in different shades of darkness. The closer an object is the darker the image will surround that object, and the further it is the lighter it will show that object.

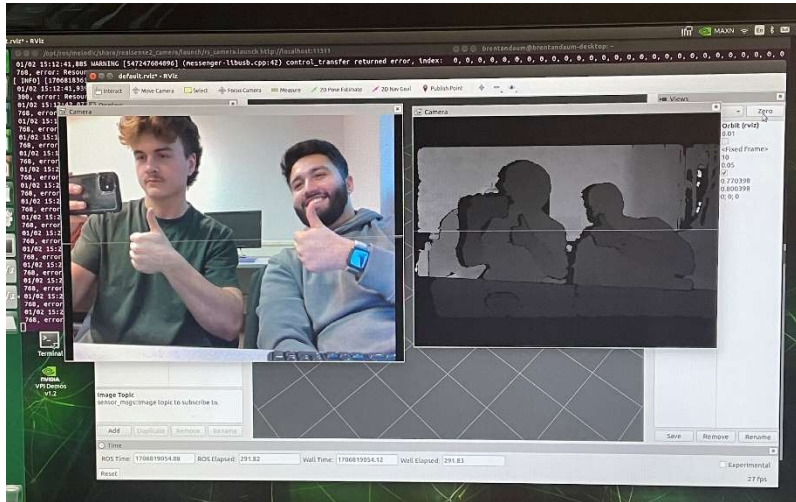


Figure 6 Camera and depth camera

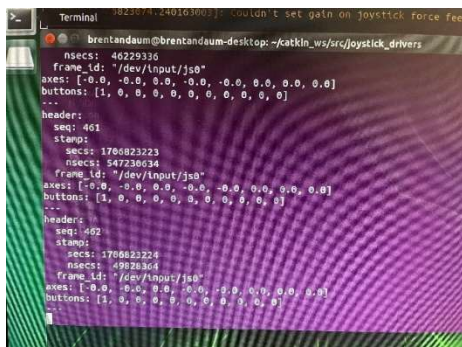
Question 12:

We added these files to help configure the controller. The command lines we added in the launch file `<node name = "joy_node" pkg="joy" type="joy_node">` to configure the joy_node. After that we used `<param name = "dev" value = "/dev/input/js0"/>` to use the joystick at /dev/input/js0. Then we used `<param name = "autorepeat_rate" value = "2" />` to set the autorepeat rate to 2 Hz for transmitting messages when there is no change in the joystick state. Finally, we added `<param name = "coalesce interval" value = "0.05" />` to adjust the coalesce interval to control the rate at which messages are published.

Question 13:

The series of figures below show the two arrays, axes and buttons, after each button is pressed.

Button A:



Button B:

```
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 707218242
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 1, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
seq: 476
stamp:
secs: 1706823230
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 1, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
seq: 477
stamp:
secs: 1706823230
nsecs: 771359957
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 1, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

Button X:

```
process[rosout-1]: started with pid [20331]
started core service [/rosout]
process[joy_node-2]: started with pid [20336]
WARN [1706823230.746404]: couldn't set gain on joystick force feedback: Bad file
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 613431958
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 0, 1, 0, 0, 0, 0, 0, 0, 0]
---
header:
seq: 498
stamp:
secs: 1706823240
nsecs: 134536937
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 0, 1, 0, 0, 0, 0, 0, 0, 0]
---
header:
seq: 499
stamp:
secs: 1706823240
nsecs: 66232600
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 0, 1, 0, 0, 0, 0, 0, 0, 0]
---
```

Button Y:

```
process[joy_node-2]: started with pid [20336]
WARN [1706823230.746404]: couldn't set gain on joystick force feedback: Bad file
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 659591531
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 0, 0, 1, 0, 0, 0, 0, 0, 0]
---
header:
seq: 511
stamp:
secs: 1706823240
nsecs: 162402554
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 0, 0, 1, 0, 0, 0, 0, 0, 0]
---
header:
seq: 512
stamp:
secs: 1706823246
nsecs: 663457464
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 0.0, -0.0, -0.0, 0.0, 0.0, 0.0]
buttons: [0, 0, 0, 1, 0, 0, 0, 0, 0, 0]
---
```

LB:


```
started core service (/dev/tty)
process[joy_node-2]: started with pid [20338]
WARN: [1706823874.240103003]: Couldn't set gain on joystick force feedback: Bad file
brentandam@brentandam-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 68601894
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 1, 0, 0]
---
header:
  seq: 854
  stamp:
    secs: 1706823342
    nsecs: 569794086
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 1, 0, 0]
  ---
  header:
    seq: 855
    stamp:
      secs: 1706823343
      nsecs: 72280778
    frame_id: "/dev/input/js0"
    axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
    buttons: [0, 0, 0, 0, 0, 0, 0, 1, 0, 0]
    ---
```

Logitech Button:

```
process[joy_node-2]: started with pid [20338]
WARN: [1706823874.240103003]: Couldn't set gain on joystick force feedback: Bad file
brentandam@brentandam-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 815794506
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 1, 0, 0]
---
header:
  seq: 886
  stamp:
    secs: 1706823356
    nsecs: 317246859
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 1, 0, 0]
  ---
  header:
    seq: 887
    stamp:
      secs: 1706823356
      nsecs: 819555076
    frame_id: "/dev/input/js0"
    axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
    buttons: [0, 0, 0, 0, 0, 0, 0, 1, 0, 0]
    ---
```

L3:

```
process[joy_node-2]: started with pid [20338]
WARN: [1706823874.240103003]: Couldn't set gain on joystick force feedback: Bad file
brentandam@brentandam-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 268343920
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 1, 0]
---
header:
  seq: 997
  stamp:
    secs: 1706823388
    nsecs: 770763788
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 1, 0]
  ---
  header:
    seq: 998
    stamp:
      secs: 1706823388
      nsecs: 272801285
    frame_id: "/dev/input/js0"
    axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
    buttons: [0, 0, 0, 0, 0, 0, 0, 0, 1, 0]
    ---
```

R3:


```
process[joy_node-2]: started with pid [20330]
WARN: [1790823074.240] [63003]: couldn't set gain on joystick force feedback: Bad file
# # # brentandaum@brentandaum-desktop: ~$ catkin_ws/src/joystick_drivers
nsecs: 800327983
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 1]
---
headers:
seq: 1023
stamp:
nsecs: 1706823395
nsecs: 804302488
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 1]
---
headers:
seq: 1024
stamp:
nsecs: 1706823396
nsecs: 364927888
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 1]
```

```
WARRN] [2740523274.240163993]: Couldn't set gain on joystick force feedback: Bad
```

```
brentandeum@brentandeum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 687677688
frame_id: "/dev/input/js0"
axes: [1.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1127
  stamp:
    secs: 1766823421
    nsecs: 198434146
  frame_id: "/dev/input/js0"
axes: [1.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1128
  stamp:
    secs: 1766823421
    nsecs: 687339415
  frame_id: "/dev/input/js0"
axes: [1.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

```
process[joy_node-2]: started with pid [20358]
[ WARN ] [1706823074.240163008]: couldn't set gain on joystick force feedback: Bad
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 970300272
frame_id: "/dev/input/js0"
axes: [-0.0, 1.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
...
header:
seq: 1153
stamp:
secs: 1706823430
nsecs: 471553808
frame_id: "/dev/input/js0"
axes: [-0.0, 1.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
...
header:
seq: 1154
stamp:
secs: 1706823430
nsecs: 974081500
frame_id: "/dev/input/js0"
axes: [-0.0, 1.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
...
```

```
started core service [/rosout]
process[joy_node-2]: started with pid [20338]
[WARN] [1706823874.240163003]: Couldn't set gain on joystick force feedback: Bad fu
brentandaum@brentandaum-desktop: ~/katkin_ws/src/joystick_drivers
nsecs: 79712626
frame_id: "/dev/input/js0"
axes: [-1.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1171
  stamp:
    secs: 1706823438
    nsecs: 838336174
  frame_id: "/dev/input/js0"
  axes: [-1.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
  header:
    seq: 1172
    stamp:
      secs: 1706823439
      nsecs: 84403565
    frame_id: "/dev/input/js0"
    axes: [-1.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
    buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
    ---
```

Left Stick Down:

```
started core service [/rosout]
process[joy_node-2]: started with pid [20338]
[WARN] [1706823874.240163003]: Couldn't set gain on joystick force feedback: Bad fu
brentandaum@brentandaum-desktop: ~/katkin_ws/src/joystick_drivers
nsecs: 695378067
frame_id: "/dev/input/js0"
axes: [-0.0, -1.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1227
  stamp:
    secs: 1706823452
    nsecs: 498678981
  frame_id: "/dev/input/js0"
  axes: [-0.0, -1.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
  header:
    seq: 1228
    stamp:
      secs: 1706823452
      nsecs: 699756114
    frame_id: "/dev/input/js0"
    axes: [-0.0, -1.0, 1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
    buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
    ---
```

Right Stick Left:

```
[WARN] [1706823874.240163003]: Couldn't set gain on joystick force feedback: Bad fu
brentandaum@brentandaum-desktop: ~/katkin_ws/src/joystick_drivers
nsecs: 281685410
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, 1.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1307
  stamp:
    secs: 1706823477
    nsecs: 784187904
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, 1.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
  header:
    seq: 1308
    stamp:
      secs: 1706823478
      nsecs: 285471812
    frame_id: "/dev/input/js0"
    axes: [-0.0, -0.0, 1.0, 1.0, -0.0, 1.0, -0.0, -0.0]
    buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
    ---
```

Right Stick Up:

```
process[rosout-1]: started with pid [20331]
started core service [/rosout]
process[joy_node-2]: started with pid [20330]
[WARN] [1706823074.240103003]: Couldn't set gain on joystick force feedback: Bad file d

brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 369432883
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, 1.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1353
  stamp:
    secs: 1706823490
    nsecs: 872073771
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, 1.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
header:
  seq: 1354
  stamp:
    secs: 1706823491
    nsecs: 373428704
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, 1.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
```

Right Stick Right:

```
process[joy_node-2]: started with pid [20330]
[WARN] [1706823074.240103003]: Couldn't set gain on joystick force feedback: Bad file d

brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 511510518
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -1.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1372
  stamp:
    secs: 1706823499
    nsecs: 14191797
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -1.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
header:
  seq: 1373
  stamp:
    secs: 1706823499
    nsecs: 515283227
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -1.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
```

Right Stick Down:

```
[WARN] [1706823074.240103003]: Couldn't set gain on joystick force feedback: Bad file d

brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 984902690
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -1.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1411
  stamp:
    secs: 1706823507
    nsecs: 487206582
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -1.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
header:
  seq: 1412
  stamp:
    secs: 1706823507
    nsecs: 988320694
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -1.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
  ---
```

LT:


```
started core process [1706823517]
process[joy_node-2]: started with pid [20338]
WARN [1706823074.240163003]: couldn't set gain on joystick force feedback: Bad fi
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 911998974
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, -1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1460
  stamp:
    secs: 1706823517
    nsecs: 414884311
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, -1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1461
  stamp:
    secs: 1706823517
    nsecs: 916347210
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, -1.0, -0.0, -0.0, 1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

RT:

```
started core process [1706823517]
process[joy_node-2]: started with pid [20338]
WARN [1706823074.240163003]: couldn't set gain on joystick force feedback: Bad fi
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 819114659
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, -1.0, -0.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1475
  stamp:
    secs: 1706823523
    nsecs: 322899741
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, -1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1476
  stamp:
    secs: 1706823523
    nsecs: 823486924
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, -1.0, -0.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

D-Pad Up:

```
started core process [1706823517]
process[joy_node-2]: started with pid [20338]
WARN [1706823074.240163003]: couldn't set gain on joystick force feedback: Bad fi
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 676459458
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, 1.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1511
  stamp:
    secs: 1706823534
    nsecs: 177491953
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, 1.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1512
  stamp:
    secs: 1706823534
    nsecs: 679261759
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, 1.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

D-Pad Right:


```
process[joy_node-2]: started with pid [20330]
[WARN] [1706823074.240163003]: Couldn't set gain on joystick force feedback: Bad file
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 876538778
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -1.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1526
  stamp:
    secs: 1706823541
    nsecs: 388073524
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -1.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1527
  stamp:
    secs: 1706823541
    nsecs: 882718675
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -1.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

D-Pad Down:

```
process[joy_node-2]: started with pid [20330]
[WARN] [1706823074.240163003]: Couldn't set gain on joystick force feedback: Bad file
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 445381642
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -1.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1539
  stamp:
    secs: 1706823547
    nsecs: 947723773
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -1.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1540
  stamp:
    secs: 1706823548
    nsecs: 449811047
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, -0.0, -1.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

D-Pad Left:

```
process[joy_node-2]: started with pid [20330]
[WARN] [1706823074.240163003]: Couldn't set gain on joystick force feedback: Bad file
brentandaum@brentandaum-desktop: ~/catkin_ws/src/joystick_drivers
nsecs: 91708987
frame_id: "/dev/input/js0"
axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, 1.0, -0.0]
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1552
  stamp:
    secs: 1706823553
    nsecs: 593428980
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, 1.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
header:
  seq: 1553
  stamp:
    secs: 1706823554
    nsecs: 96133295
  frame_id: "/dev/input/js0"
  axes: [-0.0, -0.0, 1.0, -0.0, -0.0, 1.0, 1.0, -0.0]
  buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

The following table describes the axes array behavior as different controls are manipulated. Most controls are represented as a 0 unless manipulated, however each trigger (RT and LT) is represented as a 1.0 when not pressed.

Index	Control	Behaviour
0	Left Stick (x-axis)	Left = 1.0, Right = -1.0
1	Left Stick (y-axis)	Up = 1.0, Down = -1.0
2	LT	Unpressed = 1.0, Pressed = -1.0
3	RT	Unpressed = 1.0, Pressed = -1.0
4	Right Stick (x-axis)	Left = 1.0, Right = -1.0
5	Right Stick (y-axis)	Up = 1.0, Down = -1.0
6	D-Pad (x-axis)	Left = 1.0, Right = -1.0
7	D-Pad (y-axis)	Up = 1.0, Down = -1.0

The table below describes the buttons array behavior as different buttons are pressed. Each button is represented as a 1 when pressed and 0 when unpressed.

Index	Button
0	A
1	B
2	X
3	Y
4	LB
5	RB
6	Back
7	Start
8	Logitech
9	L3 (Pressing the Left Stick in)
10	R3 (Pressing the Right Stick in)

Question 14:

In our controller we mapped both analog and digital buttons. Analog signals are used for tasks that require a smooth and continuous (e.g. 0 through 1) representation of data, such as the joysticks, L3 and R3 Triggers, and the d-pad. We use digital signal for discrete (either 0 or 1), and accurate readings such as the buttons A, B, X, Y.