인공지능 모바일 로봇 개발과정

백 진철

젊은세상

연습문제

- On/off를 반복하여 topic를 발생시키는 송신 패키지와 이를 수신하는 패키지를 작성하시오.

roslaunch

- 여러개의 노드를 실행시키기 위해 사용한다.
- rosrun을 사용하면 하나의 노드만 실행할 수있어서 반복하여 실행하여야 되는 것을 roslaunch로 한번에 수행할 수 있다.
- XML 기반의 문법을 가진다.

젊은세상

roslaunch

- 보통 *.launch라는 파일로 작성되며, catkin에서는 패키지 디렉토리에 launch디렉토리를 만들고 그밑에 작성한다.
- $ ~/catkin_ws/src/readtopic
- $ mkdir launch
- $ cd launch
- $ gedit readtopiclaunch.launch

```
<launch>
  <node name="readme" pkg="readtopic" type="listoner" />
  <node name="readyou" pkg="writetopic" type="talker" />
</launch>
```

- $ roslaunch readtopic readtopiclaunch.launch

- 같은노드 두개 실행하기

```
<launch>
        <group ns="turtlesim1">
                <node pkg="turtlesim" name="sim" type="turtlesim_node"/>
        </group>
        <group ns="turtlesim2">
                <node pkg="turtlesim" name="sim" type="turtlesim_node"/>
        </group>
</launch>
```

젊은세상

같은로봇 여러개 동시제어

- ubuntu@tegra-ubuntu:~$ rostopic list

/rosout
/rosout_agg
/turtle1/cmd_vel
/turtle1/color_sensor
/turtle1/pose
/turtlesim1/turtle1/cmd_vel
/turtlesim1/turtle1/color_sensor
/turtlesim1/turtle1/pose
/turtlesim2/turtle1/cmd_vel
/turtlesim2/turtle1/color_sensor
/turtlesim2/turtle1/pose

- rostopic pub -1 /turtlesim2/turtle1/cmd_vel geometry_msgs/Twist -- '[2.0, 0.0, 0.0]' '[0.0, 0.0, 1.8]'

publishing and latching message for 3.0 seconds

- ubuntu@tegra-ubuntu:~$ rostopic pub -1 /turtlesim1/turtle1/cmd_vel geometry_msgs/Twist -- '[2.0, 0.0, 0.0]' '[0.0, 0.0, 1.8]'

publishing and latching message for 3.0 seconds

젊은세상

연습문제

- 두개의 거북이를 거의동시에 다른방향으로 이동하는 topic를 발생시키는 송신 패키지 작성하시오.

아두이노 인스톨

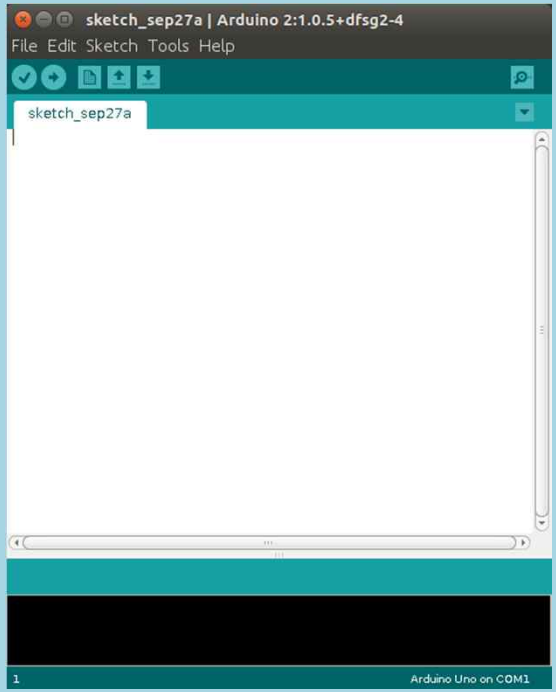
- sudo apt-get install arduino
- ls /dev

```
adnc0                i2c-5           mmcblk0p12        nvhost-msenc     ram9             tty19  tty48    usb
adnc1                i2c-6           mmcblk0p13        nvhost-nvdec     random           tty2   tty49    v4l
adnc2                iio:device0     mmcblk0p14        nvhost-nvjpg     rfkill           tty20  tty5     v4l-subdev0
adnc3                iio:device1     mmcblk0p15        nvhost-prof-gpu  rtc              tty21  tty50    vcs
adnc4                initctl         mmcblk0p16        nvhost-tsec      rtc0             tty22  tty51    vcs1
adnc5                input           mmcblk0p17        nvhost-tsecb     rtc1             tty23  tty52    vcs2
autofs               keychord        mmcblk0p18        nvhost-tsg-gpu   serial           tty24  tty53    vcs3
block                kmem            mmcblk0p2         nvhost-vi        shm              tty25  tty54    vcs4
bus                  kmsg            mmcblk0p3         nvhost-vic       snd              tty26  tty55    vcs5
char                 last_trc        mmcblk0p4         nvidiactl        stderr           tty27  tty56    vcs6
console              log             mmcblk0p5         nvmap            stdin            tty28  tty57    vcs7
constraint_cpu_freq  loop0           mmcblk0p6         port             stdout           tty29  tty58    vcsa
constraint_gpu_freq  loop1           mmcblk0p7         ppp              sw_sync          tty3   tty59    vcsa1
constraint_online_cpus  loop2        mmcblk0p8         ptmx             tegra_camera_ctrl  tty30  tty6   vcsa2
cpu_dma_latency      loop3           mmcblk0p9         pts              tegra-crypto     tty31  tty60    vcsa3
cpu_freq_max         loop4           mmcblk0rpmb       quadd            tegra_dc_0       tty32  tty61    vcsa4
cpu_freq_min         loop5           mqueue            quadd_auth       tegra_dc_ctrl    tty33  tty62    vcsa5
disk                 loop6           net               ram0             tegra-throughput  tty34  tty63   vcsa6
emc_freq_min         loop7           network_latency   ram1             timerinfo        tty35  tty7     vcsa7
fb0                  loop-control    network_throughput  ram10          trc              tty36  tty8     vga_arbiter
fd                   mapper          null              ram11            tty              tty37  tty9     video0
full                 max_cpu_power   nvhost-as-gpu     ram12            tty0             tty38  ttyACM0  watchdog
fuse                 max_gpu_power   nvhost-ctrl       ram13            tty1             tty39  ttyS0    watchdog0
gpu_freq_max         max_online_cpus  nvhost-ctrl-gpu  ram14            tty10            tty4   ttyS1    xt_qtaguid
gpu_freq_min         media0          nvhost-ctrl-isp   ram15            tty11            tty40  ttyS2    zero
hidraw0              mem             nvhost-ctrl-isp.1  ram2            tty12            tty41  ttyS3    zram0
hidraw1              min_online_cpus  nvhost-ctrl-nvdec  ram3           tty13            tty42  ttyTHS1
i2c-0                mipi-cal        nvhost-ctrl-vi    ram4             tty14            tty43  ttyTHS2
i2c-1                mmcblk0         nvhost-dbg-gpu    ram5             tty15            tty44  ttyTHS3
i2c-2                mmcblk0p1       nvhost-gpu        ram6             tty16            tty45  uhid
i2c-3                mmcblk0p10      nvhost-isp        ram7             tty17            tty46  uinput
i2c-4                mmcblk0p11      nvhost-isp.1      ram8             tty18            tty47  urandom
```

젊은세상

Arduino 실행

- Tools -> board -> arduino mega 2560 선택
- Tools -> Serial Port -> ‘/dev/ACM0 선택



젊은세상

아두이노 테스트 코드실행

```
int led = 12;
void setup() {
    pinMode(led, OUTPUT);
}
void loop() {
    digitalWrite(led,HIGH);
    delay(5000);
    digitalWrite(led, LOW);
    delay(5000);
}
```

젊은세상

ROSserial 인스톨

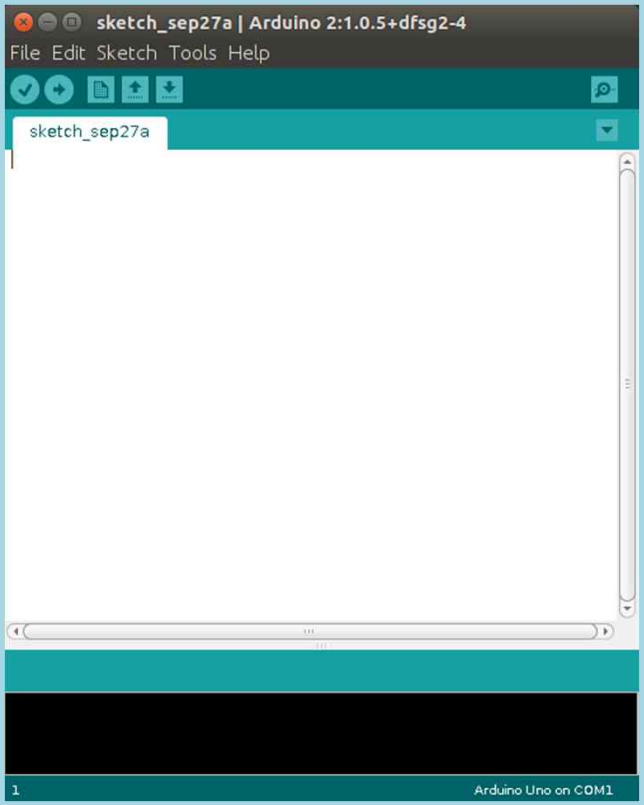
- sudo apt-get update
- sudo apt-get install ros-kinetic-rosserial-arduino ros-kinetic-rosserial
- cd ~/sketchbook/libraries
- mv ros_lib ~/ros_lib_backup
- rosrun rosserial_arduino make_libraries.py ~/sketchbook/libraries
- ls

readme.txt ros_lib

젊은세상

Arduino 실행

- File ->Examples->roslib->Blink선택
- 아이콘 창에서 '->' 선택



젊은세상

연습문제

- Turtlesim이 움직일때 마다 Led를 켜고 움직이지 않으면 Led를 끈다.

카메라 입력

- 카메라 디바이스가 있는지 확인한다.

$ ls /dev

```
gun@gun-Precision-M4600:~/catkin_ws$ ls /dev
autofs           i2c-12        memory_bandwidth    sde       tty22  tty49      ttyS16   v4l
block            i2c-2         mqueue              sde1      tty23  tty5       ttyS17   vboxdrv
bsg              i2c-3         net                 sg0       tty24  tty50      ttyS18   vboxdrvu
btrfs-control    i2c-4         network_latency     sg1       tty25  tty51      ttyS19   vboxnetctl
bus              i2c-5         network_throughput  sg2       tty26  tty52      ttyS2    vboxusb
char             i2c-6         null                sg3       tty27  tty53      ttyS20   vcs
console          i2c-7         nvidia0             sg4       tty28  tty54      ttyS21   vcs1
core             i2c-8         nvidiactl           shm       tty29  tty55      ttyS22   vcs2
cpu              i2c-9         nvidia-modeset      snapshot  tty3   tty56      ttyS23   vcs3
cpu_dma_latency  initctl       nvidia-uvm          snd       tty30  tty57      ttyS24   vcs4
cuse             input         port                stderr    tty31  tty58      ttyS25   vcs5
disk             kmsg          ppp                 stdin     tty32  tty59      ttyS26   vcs6
dri              kvm           psaux               stdout    tty33  tty6       ttyS27   vcs7
ecryptfs         lightnvm      ptmx                tty       tty34  tty60      ttyS28   vcsa
fd               log           ptp0                tty0      tty35  tty61      ttyS29   vcsa1
freefall         loop0         pts                 tty1      tty36  tty62      ttyS3    vcsa2
full             loop1         random              tty10     tty37  tty63      ttyS30   vcsa3
fuse             loop2         rfkill              tty11     tty38  tty7       ttyS31   vcsa4
fw0              loop3         rtc                 tty12     tty39  tty8       ttyS4    vcsa5
hidraw0          loop4         rtc0                tty13     tty4   tty9       ttyS5    vcsa6
hidraw1          loop5         sda                 tty14     tty40  ttyprintk  ttyS6    vcsa7
hidraw2          loop6         sda1                tty15     tty41  ttyS0      ttyS7    vfio
hpet             loop7         sda2                tty16     tty42  ttyS1      ttyS8    vga_arbiter
hugepages        loop-control  sdb                 tty17     tty43  ttyS10     ttyS9    vhci
hwrng            mapper        sdb1                tty18     tty44  ttyS11     uhid     vhost-net
i2c-0            mcelog        sdc                 tty19     tty45  ttyS12     uinput   video0
i2c-1            media0        sdc1                tty2      tty46  ttyS13     urandom  watchdog
i2c-10           mei0          sdd                 tty20     tty47  ttyS14     usb      watchdog0
i2c-11           mem           sdd1                tty21     tty48  ttyS15     userio   zero
```

젊은세상

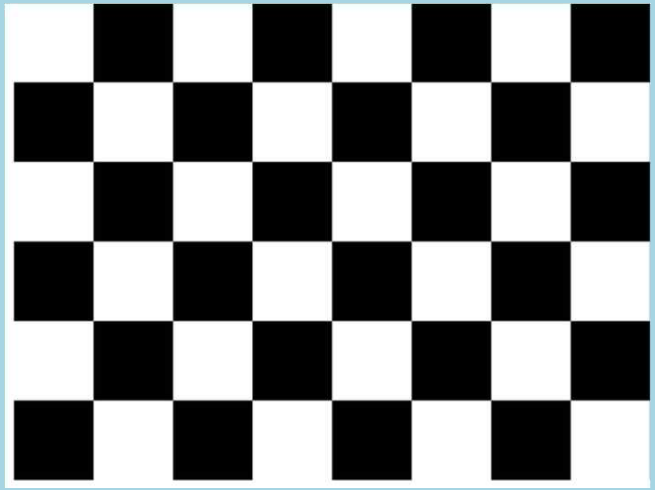
카메라 패키지 인스톨

- $ sudo apt-get install libv4l-dev
- $ cd ~/catkin_ws/src
- $ git clone https://github.com/ktossell/camera_umd.git
- $ rosrun uvc_camera uvc_camera_node
- $ rqt_image_view
- $ rqt_graph

젊은세상

Camera Config 관련 Pkg 다운

camera_calibration package



[1번 terminal] $ sudo apt-get install ros-kinetic-camera-calibration

젊은세상

1.4 Camera Config 관련 Pkg 실행

camera_calibration
package

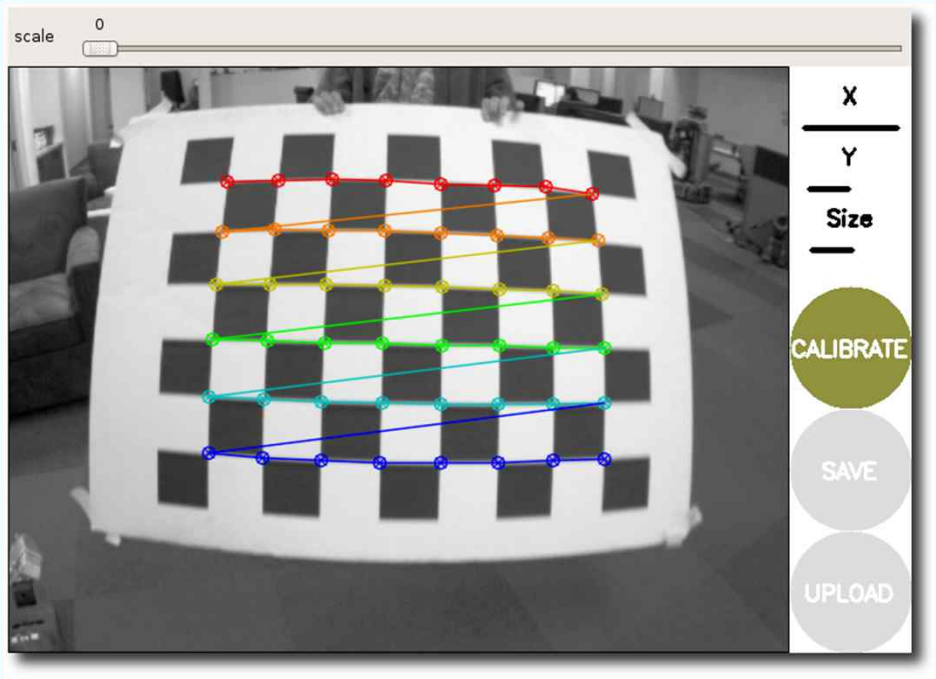
[1번 terminal] $ rosrun uvc_camera uvc_camera set_camera_info:=/camera/set_camera_info

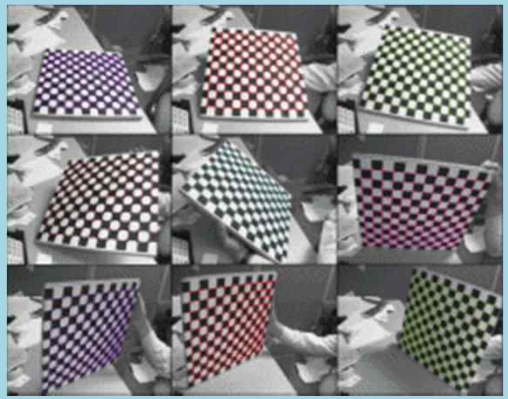
[1번 terminal] $ rosrun camera_calibration cameracalibrator.py --size 7x5 --square 0.029
image:=/image_raw camera:=/camera

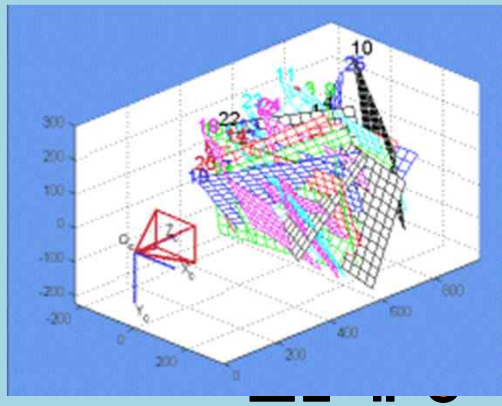
젊은세상

지금 한 것들의 의미

- 렌즈 및 CMOS 기판의 구조적 불균형으로 인한 상의 왜곡을 보정해줌







realsense 카메라

- sudo apt-get install ros-kinetic-librealsense
- sudo apt-get install ros-kinetic-realsense-camera
- roslaunch realsense_camera r200_nodelet_default.launch
- rqt_image_view

젊은세상