



캡스톤디자인(2) 진행상황

MOTUS+ER



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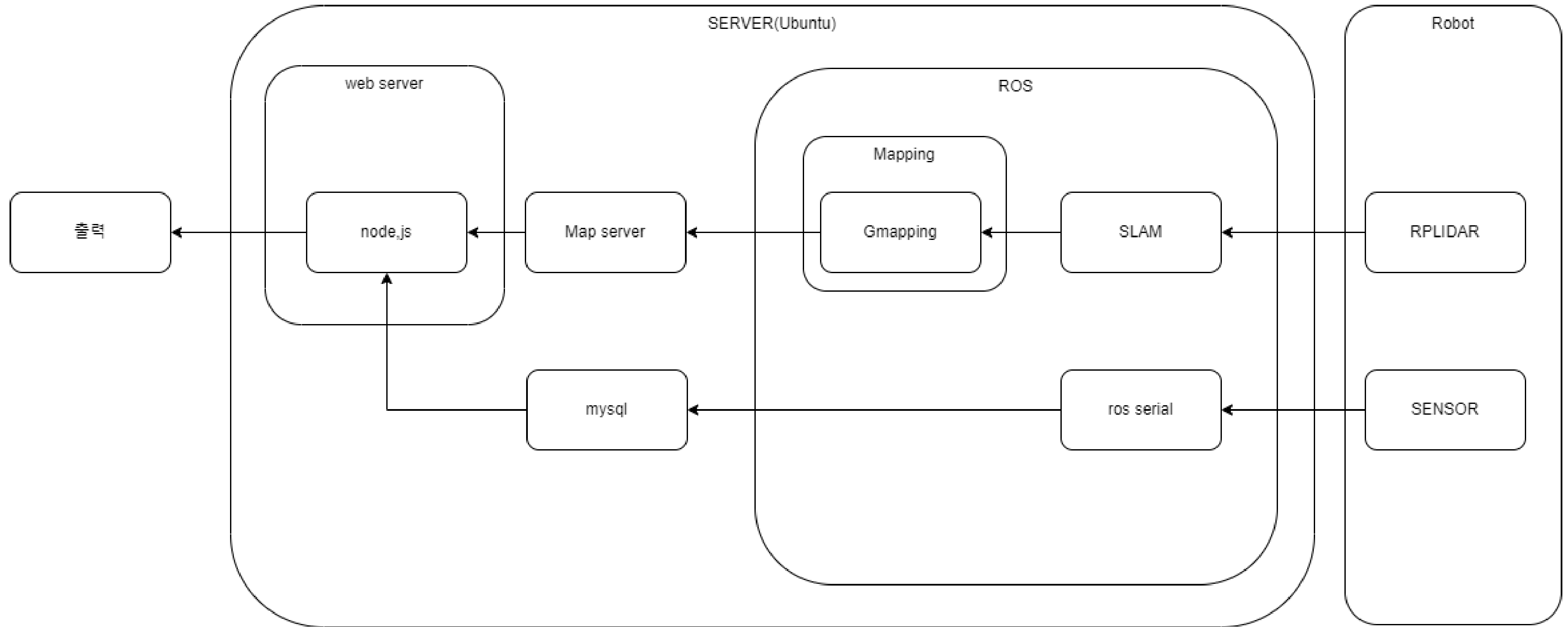
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시스템 구조도



ROS 로봇제어 : GPIO 제어

```
1: roscore http://192.168.200.174:11311/
haneul@haneul-ubuntu:~$ roscore
... logging to /home/haneul/.ros/log/1bba0dfa-f267-11ee-b2c6-030c2bd3cb30
0/roslaunch-haneul-ubuntu-47113.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://192.168.200.174:46239/
ros_comm version 1.16.0

SUMMARY
=====

PARAMETERS
* /roscpp: noetic
* /rosversion: 1.16.0

NODES
auto-starting new master
process[master]: started with pid [47121]
ROS_MASTER_URI=http://192.168.200.174:11311/

setting /run_id to 1bba0dfa-f267-11ee-b2c6-030c2bd3cb30
process[roscpp]: started with pid [47131]
started core service [/roscpp]
[]

2: haneul@haneul-ubuntu:~$
move_base_msgs
move_slow_and_clear
my_robot_control
haneul@haneul-ubuntu:~$ roslaunch my_robot_control keyboard_control_node.py

Control Your Robot!
-----
Moving around:
  u   t   o
  j   k   l
  n   ,   .

t/k: forward/backward
j/l: left/right
,n: stop

CTRL-C to quit

3: haneul@haneul-ubuntu:~$
haneul@haneul-ubuntu:~$ rostopic list
/motor_command
/rosout
/rosout_agg
haneul@haneul-ubuntu:~$
```

```
haneul@haneul-ubuntu:~$ rostopic echo /
/motor_command /rosout /rosout_agg
haneul@haneul-ubuntu:~$ rostopic echo /motor_command
data: "go"
---
data: "go"
---
data: "go"
---
data: "go"
---
data: "go"
---
data: "go"
---
data: "go"
---
data: "go"
---
data: "back"
```

```
pi@raspberrypi:~$ rosrun my_robot_control motor_control_node.py
[INFO] [1712228148.983095]: Received command: go
[INFO] [1712228150.367679]: Received command: right
[INFO] [1712228152.241264]: Received command: back
[INFO] [1712228153.191740]: Received command: left
[INFO] [1712228153.575360]: Received command: right
[INFO] [1712228153.879042]: Received command: right
[INFO] [1712228154.329703]: Received command: back
[INFO] [1712228155.259791]: Received command: right
[INFO] [1712228155.607798]: Received command: back
[INFO] [1712228156.094460]: Received command: left
[INFO] [1712228156.651752]: Received command: back
[INFO] [1712228157.343104]: Received command: right
[INFO] [1712228157.876764]: Received command: back
[INFO] [1712228162.570102]: Received command: go
[INFO] [1712228163.058290]: Received command: right
```

우분투에 ROS 패키지 생성

- 키보드 입력을 처리하는 노드를 포함하는 패키지
- 키보드 입력 노드 실행 결과

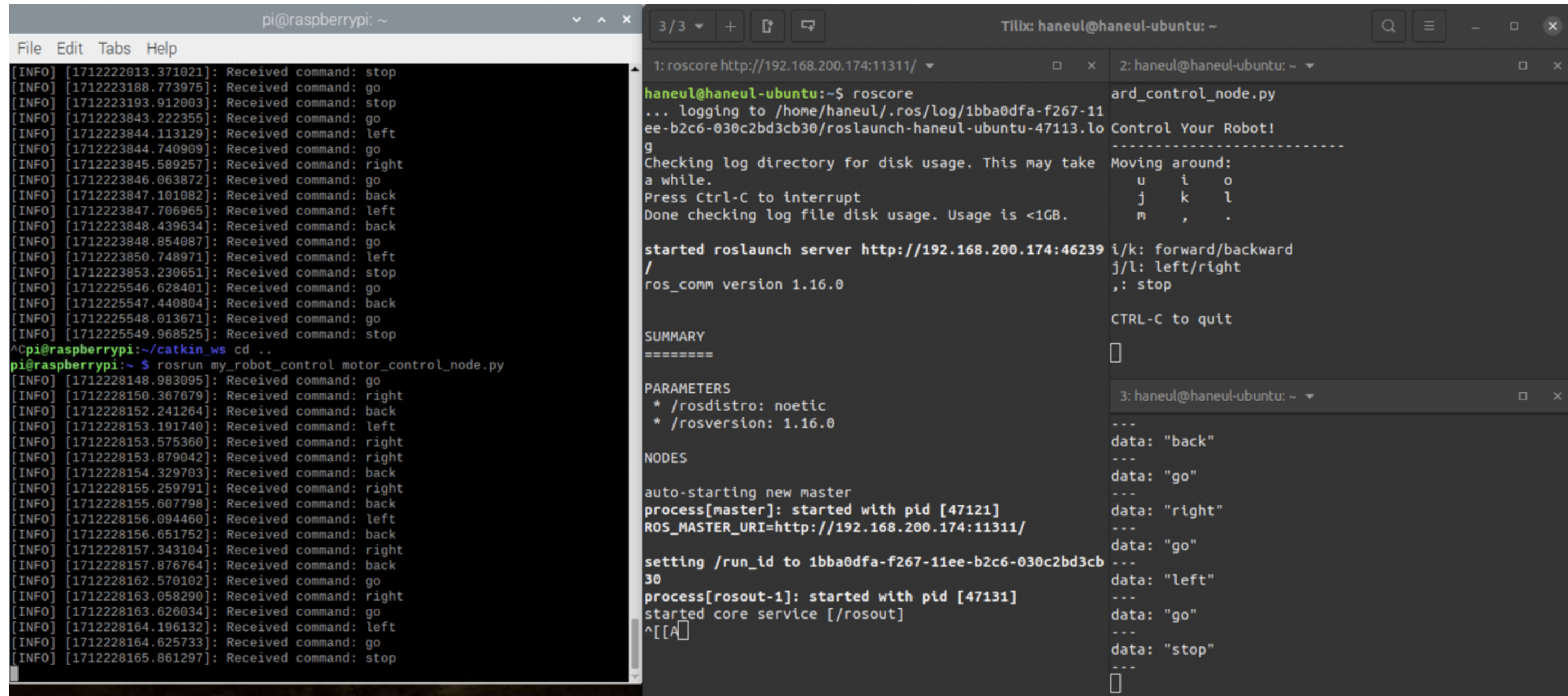
명령 전송 노드 생성

- KEYBOARD_CONTROL_NODE.PY에 키보드 입력을 받아 라즈베리파이로 명령을 전송하는 노드를 생성
- 키보드를 누를 때 DATA가 잘 발행되고 있음

라즈베리파이 설정

- 라즈베리파이에 패키지를 만들고 GPIO를 제어하는 로직을 포함한 MOTOR_CONTROL_NODE.PY 노드를 생성
- 우분투 컴퓨터로부터 키보드 입력에 해당하는 ROS 메시지를 수신하여 GPIO 핀 상태를 제어
- DATA 값을 잘 받아오고 있음

ROS 로봇제어 : GPIO 제어



The image shows three terminal windows. The left window, titled 'pi@raspberrypi: ~', displays a series of log messages from a ROS node, each starting with '[INFO]' and a timestamp, followed by 'Received command:'. The commands received include 'stop', 'go', 'right', 'left', 'back', and 'go'. The middle window, titled 'Tilix: haneul@haneul-ubuntu: ~', shows the execution of 'roscore' and 'roslaunch' commands, along with the output of 'roscomm version 1.16.0' and a summary of parameters and nodes. The right window, titled 'ard_control_node.py', displays the output of the 'ard_control_node.py' script, which includes a 'Control Your Robot!' message and a list of keyboard shortcuts for controlling the robot: 'i/k: forward/backward', 'j/l: left/right', and ',: stop'. It also shows a 'CTRL-C to quit' message and a list of data points for the robot's movement: 'back', 'go', 'right', 'go', 'left', 'go', and 'stop'.

```
pi@raspberrypi: ~  
File Edit Tabs Help  
[INFO] [1712222013.371021]: Received command: stop  
[INFO] [1712223188.773975]: Received command: go  
[INFO] [1712223193.912003]: Received command: stop  
[INFO] [1712223843.222355]: Received command: go  
[INFO] [1712223844.113129]: Received command: left  
[INFO] [1712223844.740909]: Received command: go  
[INFO] [1712223845.589257]: Received command: right  
[INFO] [1712223846.063872]: Received command: go  
[INFO] [1712223847.101082]: Received command: back  
[INFO] [1712223847.706965]: Received command: left  
[INFO] [1712223848.439634]: Received command: back  
[INFO] [1712223848.854087]: Received command: go  
[INFO] [1712223850.748971]: Received command: left  
[INFO] [1712223853.230651]: Received command: stop  
[INFO] [1712225546.628401]: Received command: go  
[INFO] [1712225547.440804]: Received command: back  
[INFO] [1712225548.013671]: Received command: go  
[INFO] [1712225549.968525]: Received command: stop  
^Cpi@raspberrypi:~/catkin_ws$ cd ..  
pi@raspberrypi:~$ roslaunch my_robot_control motor_control_node.py  
[INFO] [1712228148.983095]: Received command: go  
[INFO] [1712228150.367679]: Received command: right  
[INFO] [1712228152.241264]: Received command: back  
[INFO] [1712228153.191740]: Received command: left  
[INFO] [1712228153.575360]: Received command: right  
[INFO] [1712228153.879042]: Received command: right  
[INFO] [1712228154.329703]: Received command: back  
[INFO] [1712228155.259791]: Received command: right  
[INFO] [1712228155.607798]: Received command: back  
[INFO] [1712228156.094460]: Received command: left  
[INFO] [1712228156.651752]: Received command: back  
[INFO] [1712228157.343104]: Received command: right  
[INFO] [1712228157.876764]: Received command: back  
[INFO] [1712228162.570102]: Received command: go  
[INFO] [1712228163.058290]: Received command: right  
[INFO] [1712228163.626034]: Received command: go  
[INFO] [1712228164.196132]: Received command: left  
[INFO] [1712228164.625733]: Received command: go  
[INFO] [1712228165.861297]: Received command: stop  
^C
```

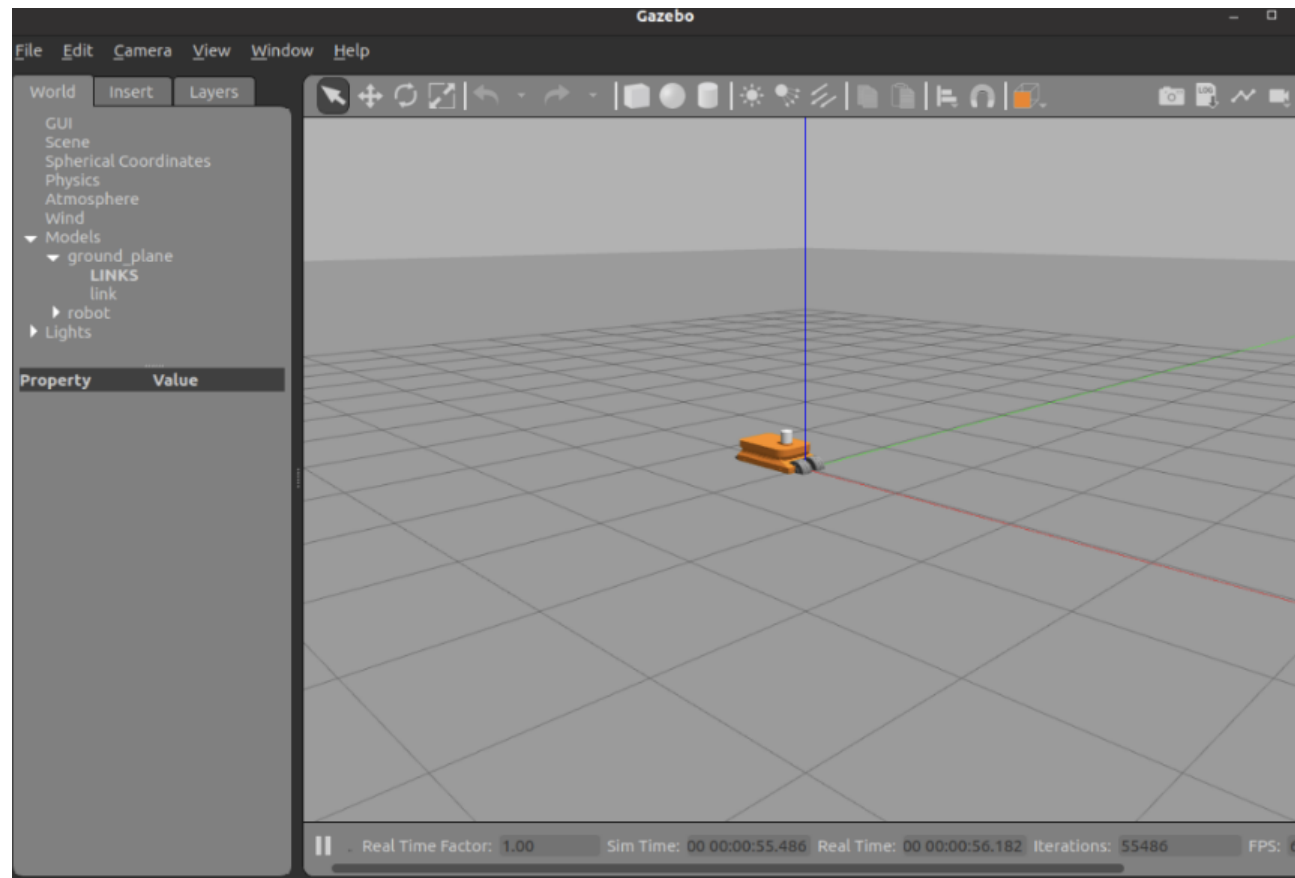
```
1: roscore http://192.168.200.174:11311/  
hanoul@haneul-ubuntu:~$ roscore  
... logging to /home/haneul/.ros/log/1bba0dfa-f267-11ee-b2c6-030c2bd3cb30/roslaunch-haneul-ubuntu-47113.lo  
g  
Checking log directory for disk usage. This may take  
a while.  
Press Ctrl-C to interrupt  
Done checking log file disk usage. Usage is <1GB.  
  
started roslaunch server http://192.168.200.174:46239/  
ros_comm version 1.16.0  
  
SUMMARY  
=====  
  
PARAMETERS  
* /rostdistro: noetic  
* /rosversion: 1.16.0  
  
NODES  
  
auto-starting new master  
process[master]: started with pid [47121]  
ROS_MASTER_URI=http://192.168.200.174:11311/  
  
setting /run_id to 1bba0dfa-f267-11ee-b2c6-030c2bd3cb30  
process[rosout-1]: started with pid [47131]  
started core service [/rosout]  
^[[A
```

```
ard_control_node.py  
Control Your Robot!  
-----  
Moving around:  
    u    i    o  
    j    k    l  
    m    ,    .  
  
i/k: forward/backward  
j/l: left/right  
,: stop  
  
CTRL-C to quit  
  
[  
  
3: haneul@haneul-ubuntu: ~  
---  
data: "back"  
---  
data: "go"  
---  
data: "right"  
---  
data: "go"  
---  
data: "left"  
---  
data: "go"  
---  
data: "stop"  
---  
[
```

실행 결과

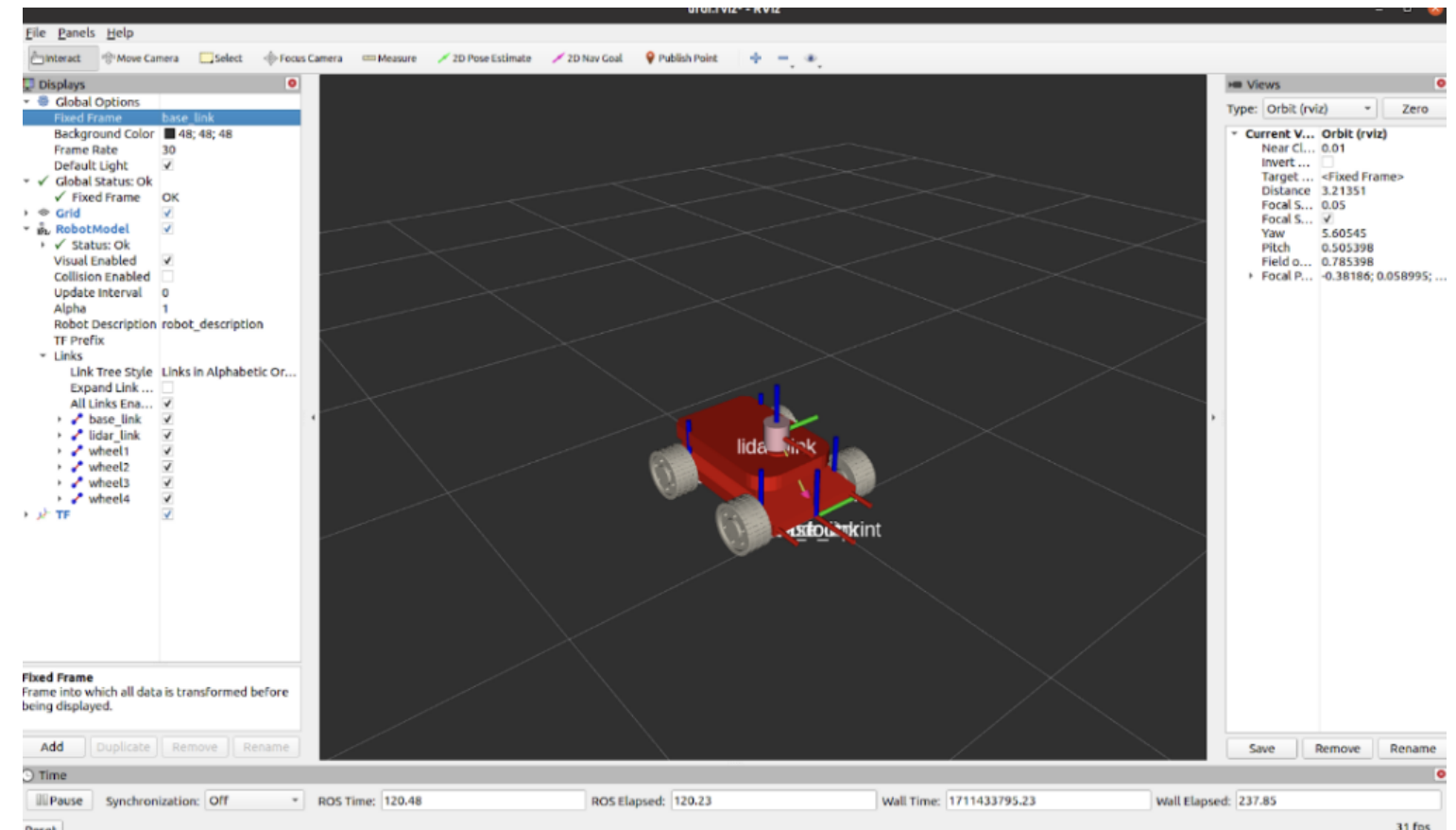
PC의 키보드 입력 값에 따라 로봇이 잘 움직임

ROS 로봇제어 : URDF



URDF 모델에 라이다 연결

URDF 모델에 라이다 연결 완료



ROBOT MODEL 오류

- 가제보 시뮬레이션시, 요소들의 문제로 인하여 ROBOT MODEL에 오류가 발생함
- 터틀봇을 기반으로 한 코드를 CAREBUDDY에 맞춰서 수정 해야 함

공기질 데이터



```
Shell
Python 3.7.3 (/usr/bin/python3)
>>> %Run pms7003b_data.py

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 39

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 39

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 39

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 39

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 39

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 39

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 40

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 40

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 40

2.5um in 0.1L of air : 13
5.0um in 0.1L of air : 40
```

PMS7003 미세먼지 센서

- 2.5MM(초미세먼지) 10MM(미세먼지)를 측정하는데 사용
- 낮은 전력소비가 특징이며 배터리 구동장치에 최적
- 데이터는 5초마다 측정



MH-Z19 CO2센서

- 현재 사용중인 제품이 400PPM이하는 측정이 안되고 있음
- 설명에서는 0~ 2000이 다 나온다고 하는데 나오지 않음
- 다양한 곳에서의 공기 측정 등 해결책 탐색

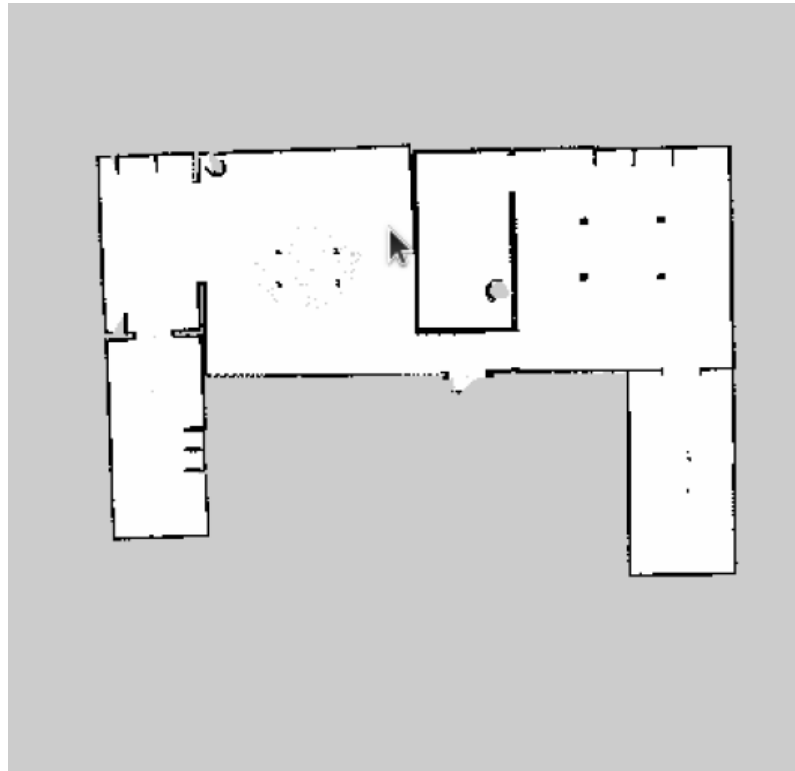
sensor_data	
PK	UniqueID
	date
	location
	temperature
	humidity
	PM2.5(µg/m³)
	CO2(ppm)

DB 테이블 구조

공간 분할

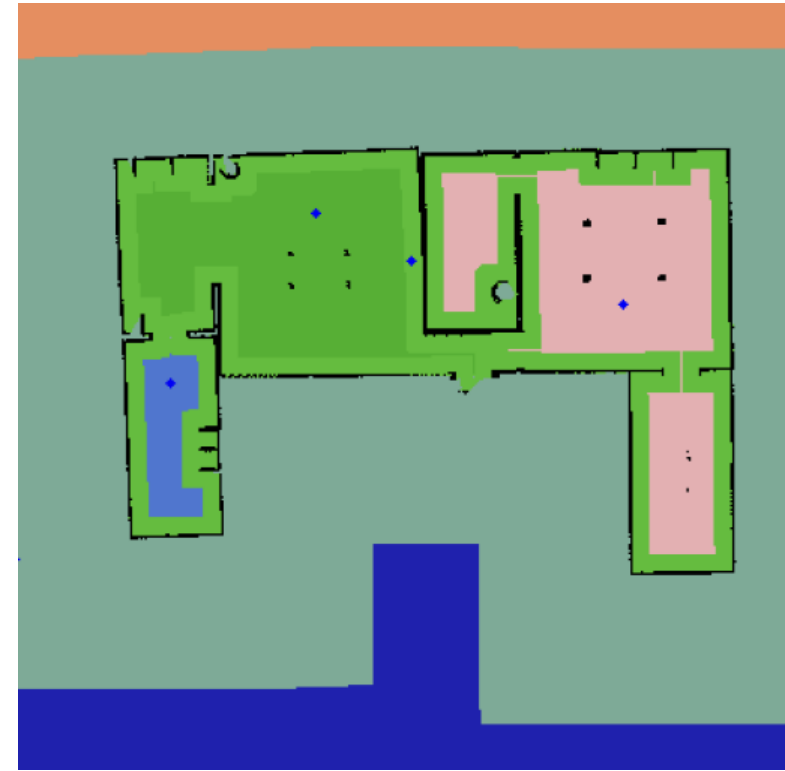
문제점

- 로봇이 네비게이션이 진행되지 않는 상황에서 원하는 공간으로 가게 하는 구현이 불가능
- 시뮬레이션을 통하여 ROS 명령어를 체크할 필요성을 느낌



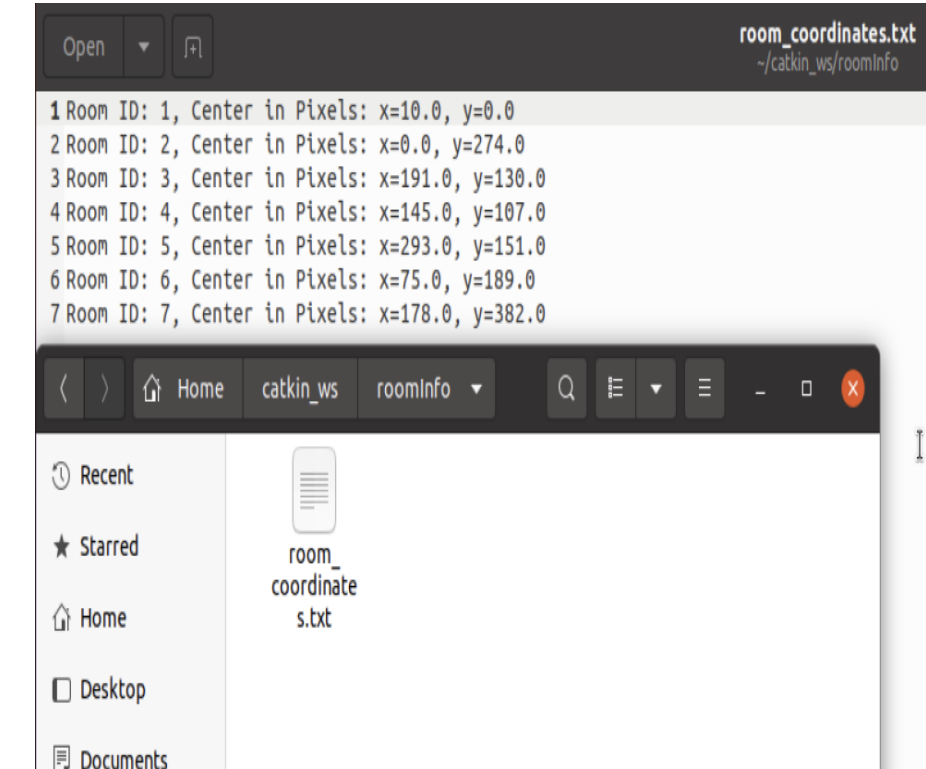
매핑

가제보와 터틀봇3을 이용한 시뮬레이션을 통해 TURTLEBOT HOUSE 공간 매핑



저장된 지도로 분할

IPA_ROOM_SEGMENTATION 이용하여 매핑한 지도 분할




ROOM 정보 출력

액션 클라이언트 서버 파일을 수정하여 SEGMENTATION한 공간의 ID와 해당 공간의 중심 좌표 출력하여 TXT파일로 저장

WEEK6 계획

CareBuddy WEEK6 계획			
공기질 데이터	센서 동작 프로그램 통합	ROS 통신 구현	-
URDF	가제보 ROBOT MODEL 수정	-	-
공간 분할	ROOM ID를 지도에 시각화	입력된 ID의 ROOM으로의 이동 구현	공간 분할 TESTCASE 1차



감사합니다

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