Turtlebot4 Practice 1

운영체제의 실제
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Turtlebot4

- The Turtlebot4 is a ROS 2-based mobile robot intended for education and research
- It is capable of mapping the robot's surroundings, navigating autonomously, running AI models on its camera and more
- A Raspberry Pi 4B runs the TurtleBot4 software

Turtlebot4 - Sensor

- RPLIDAR A1M8
  - A 360 degree Laser Range Scanner with a 12 m range
- OAK-D-Pro
  - It contains OV9282 stereo sensors as well as an IR laser dot projector and an IR illumination LED → High quality depth images

Turtlebot4 – How to use?

- Turn on:
  - Place the Turtlebot4 onto its dock
  - The green LED on the dock will turn on for a few second
  - The Turtlebot4 should power on (we can hear a “happy sound”)

- Turn off:
  - Remove the Turtlebot4 from the dock (do not leave it on the dock)
  - Press and hold the round button in the center for 5 seconds (until a “happy sound” is heard)
- Other settings have been completed by the TAs

Turtlebot4 – How to use?

- **User PC (Our laptop PC)**
  - OS: Ubuntu 24.04
  - ROS2: Jazzy
- **Check the status of Turtlebot4 using LED**

Status LED

Status LED

LED	Colour	Description
POWER	*Green*	Always ON
MOTOR	*Green*	ON when wheels are enabled, OFF when wheels are disabled
COMMS	*Green*	ON when communication with the Create® 3 is active. OFF otherwise
WIFI	*Green*	ON when a valid IP address can be found for the specified Wi-Fi interface
BATTERY	*Green, Yellow, Red*	Colour will reflect battery percentage

Battery Percentage	Colour
50-100	Green
20-50	Yellow
12-20	Red
0-12	Blinking Red

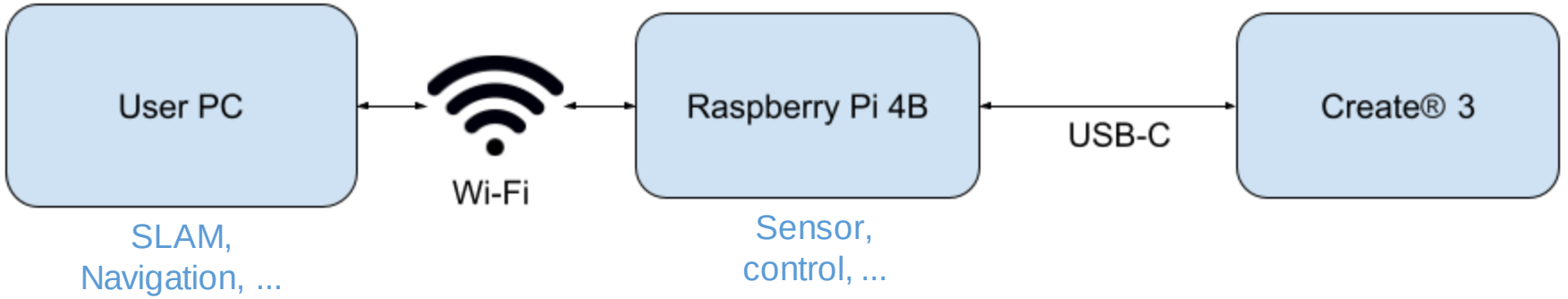
Turtlebot4 – How to use?

- **Installation**
  - Install Ubuntu 24.04 on each PC.
  - Install ROS2 Jazzy (아래 사이트를 참고해서 설치).
    - https://docs.ros.org/en/jazzy/Installation/Ubuntu-Install-Debs.html
  - Install the ROS2 Turtlebot4 package.

```
$ sudo apt update
$ sudo apt install ros-jazzy-turtlebot4-description ros-jazzy-turtlebot4-msgs ros-jazzy-turtlebot4-navigation
ros-jazzy-turtlebot4-node
$ sudo apt install ros-jazzy-turtlebot4-desktop
```

Turtlebot4 – Networking

- The User PC and the Raspberry Pi communicate via **Wi-Fi** (using the 5 GHz band for speed).
- All hardware-related processing of the robot is handled on the Raspberry Pi (including sensor topics and robot control from command velocities).
- The User PC performs computation-intensive tasks such as SLAM and navigation.



- The Raspberry Pi can be accessed via SSH (IP는 각자의 turtlebot4에 맞게 설정) **(Practice)**

```
$ ssh ubuntu@192.168.28.24
$ pw: turtlebot4
```

Turtlebot4 – Networking

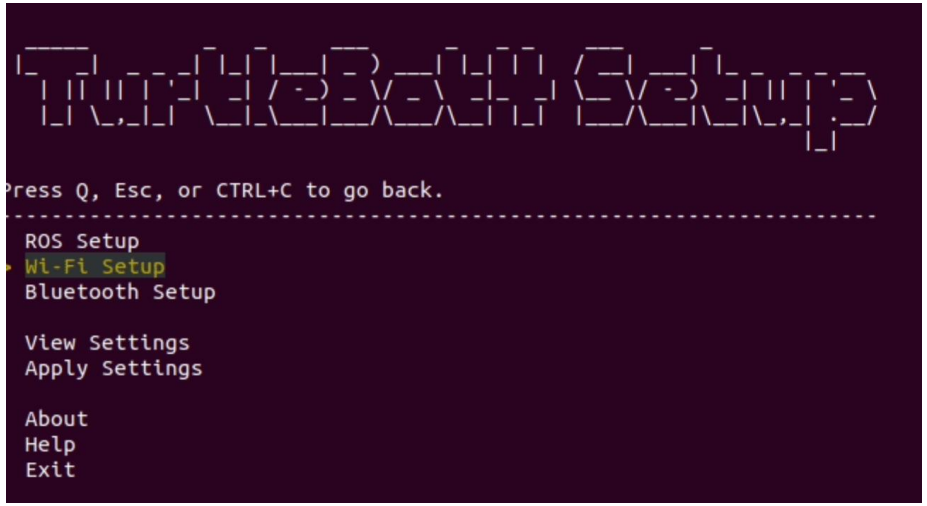
- Turtlebot4 (Raspberry Pi) <-> User PC
  - 5G로 연결하세요 (e.g., osp2_5G)

팀	터틀봇 이름	연결된 공유기 이름	Wifi 비밀번호	터틀봇 내부 IP 주소
1조	osp2-1	osp2	osp12345	192.168.0.101
2조	osp2-2	osp2	osp12345	192.168.0.102
3조	osp2-3	osp2	osp12345	192.168.0.103
4조	osp3-1	osp3	osp12345	192.168.0.101
5조	osp3-2	osp3	osp12345	192.168.0.102
6조	osp4-1	osp4	osp12345	192.168.0.101
7조	osp4-2	osp4	osp12345	192.168.0.102

Turtlebot4 – Networking

- To change the **ROS_DOMAIN_ID**, connect to the TurtleBot 4 (via SSH) and use *turtlebot4_setup*.
  - ROS setup → Bash setup → sets ROS_DOMAIN_ID → Apply Settings (Wait for a few minutes)

```
$ ssh ubuntu@192.168.28.24
$ pw: turtlebot4
$ turtlebot4-setup
```



- The ROS_DOMAIN_ID of User PC also has to be matched

```
$ echo "export ROS_DOMAIN_ID=<your_domain_id>" >> ~/.bashrc
```