MTE 544 LAB 3 – In-Lab

Initial Setup Instructions:

- Please do not dock/undock the robot by hand
- Please do not pick-up the robot by hand

Lab 3 – In Lab Map Details:

- The map for which the A* algorithm will be implemented on and the respective entry points can be seen below:

- The .pgm and .yaml files for the map with reference to each entry point (i.e. (0,0) on the map aligns where the dock is for the entry point) is provided within the Entry_#.zip files on learn
- Additionally, the cost map has already been generated and placed in a .csv file within the Entry_#.zip file. The first column of the .csv file is the y-axis coordinates with respect to the map frame, and the first row is the x-axis coordinates with respect to the map frame
- Please use the correct entry location and destination based on your timeslot in the Lab3 slots sheet
- Finally, the reference table was made below to represent the location of each entry within each entry reference frame (note these are approximate values, since the entry (0,0) location will be the entry dock)

Entry Reference Frame	Entry 1 Pose (x, y, w)	Entry 2 Pose (x, y, w)	Entry 3 Pose (x, y, w)	Entry 4 Pose (x, y, w)
1	(0,0,0)	(-1.48, -0.97, -pi/2)	(-2.71, 0, pi)	(-1.27, 1.25, pi/2)
2	(-1.48, 0.97, pi/2)	(0,0,0)	(-1.2, -1.2, -pi/2)	(-2.33, 0, pi)

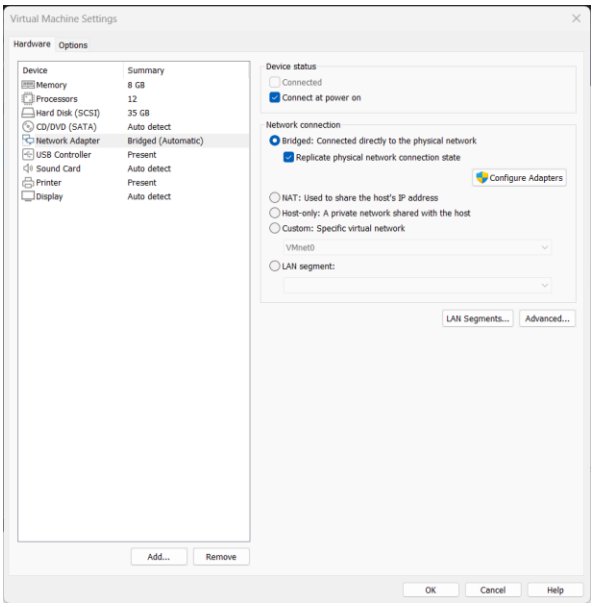
3	(-2.71, 0, pi)	(-1.2, 1.2, pi/2)	(0,0,0)	(-1.8, -1.21, -pi/2)
4	(-1.27, -1.25, -pi/2)	(-2.33, 0, pi)	(-1.8, 1.21, pi/2)	(0,0,0)

Lab 3 – In Lab Steps:

Connecting to the Robot:

1. Turn on the robot by docking the robot
2. After the robot is on, ensure that the screen on the base has what looks like an IP address. (If the lcd was turned off, the IP address is simply 100+bot_number, for example 3, is 103)

3. Switch your network to the private Turtlebot network (**SSID: turtlebot, password: tobeltrut)**
    a. If you are using a virtual machine, you will change the network on the host OS
4. Ensure that everything is up to date, and you are running the correct version of Ubuntu (<u>this should not be necessary if you did this in the previous prelabs/labs</u>)
    a. $ sudo apt update
    b. $ sudo apt install git (just in case you haven't installed git)
    c. $ sudo apt install ros-galactic-rmw-fastrtps-cpp
    d. $ sudo apt install iputils-ping
    e. $ sudo apt install net-tools
5. Setup connection environment
    a. **If you are using a virtual machine**, please ensure that your network connection in the virtual machine settings is set to bridged and replicate physical network connection state has been selected



b. Create a directory called lab3 in your home directory to clone a repository in.
c. In the lab3 directory, run clone the turtlebot4 repo with the following command:
    i. $ git clone https://git.uwaterloo.ca/robohub/turtlebot4.git

WARNING: Next step will overwrite your .bashrc. If you want to keep your original .bashrc file, copy it to another directory before proceeding.

d. From the newly cloned repo, enter the **configs folder** and copy both **.bashrc** and **.fastdds.xml** to your **Home** directory from the configs folder with the following commands:
    i. $ sudo cp ~/lab3/turtlebot4/configs/.bashrc /home/$USER/
    ii. $ sudo cp ~/lab3/turtlebot4/configs/.fastdds.xml /home/$USER/
e. Make sure robot is alive on the network by pinging it (example below is for robot 3)
    i. $ ping 192.168.23.103
f. If you saw the packets keep on, if not tell one of the TAs.
g. After the repo is cloned and the files have been copied, move into the vpn subfolder within the terminal with the command:
    i. $ cd ~/lab3/turtlebot4/vpn
h. Now within the terminal in the vpn directory run:
    i. $ ./vpn.sh 192.168.23.XYZ
    ii. Where XYZ is the number for the robot (robot 3 is 103)
    iii. It will prompt for your password first if sudo was used before in the shell
    iv. Then it prompts for another password, which is "**turtlebot**"
i. Set the ROS_DOMAIN_ID=X (the value of your robot (robot 03 is 3)) with the following command:

    $ export ROS_DOMAIN_ID=X

6. Verify the connection
    a. Once you set the ROS_DOMAIN_ID you should be connected to the robot and can verify by viewing the topics

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$ ros2 topic list
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7. Undock the robot:

   ```
   $ ros2 action send_goal /undock irobot_create_msgs/action/Undock {}
   ```

8. Take the map information given to you for the maze in lab and generate offline a cost map for it, or have the navigation toolbox and initialise a cost-map from there.
9. Run your A* motion planner.