Process:

Week 1: 08/26/24

- Did some research about ROS, TurtleBot3, and Open-Manipulator X, and tried to install the ROS 2 on old laptop.
  -https://docs.ros.org/en/humble/
  -https://docs.ros.org/en/jazzy/index.html
  -https://emanual.robotis.com/docs/en/platform/turtlebot3/overview/
  -https://emanual.robotis.com/docs/en/platform/openmanipulator_x/overview/

Week 2: 09/02/24

- Installed ROBOTC and Virtual World
  -Set up and worked in the simulation environment
  -Run almost all examples and tried to change some variables in example file to make robot do different things. Roughly learnt how the code work in ROBOTC
  -ROBOTC cannot be used because we cannot build and input self-made model and work with it even if we have the licence

Week 3: 09/09/24

- ROS2 Installation
  - First try: Install Linux Ubuntu system to my old laptop
    -Update the system to the newest version **24.04** and tried to install ROS 2 Humble
    -Cannot find the deb package for ROS 2 Humble – Cannot install
    -Installed ROS 2 Jazzy instead

Week 4: 09/16/24

- Worked in Ubuntu system and tried to install ROS 2 Humble. (Humble is the one we will use)
  -Downgrade the system version to **22.04** and finally installed ROS 2 Humble (latest version does not support Humble, strange)
- Did some research about Isaac Sim and tried to install it.
  - https://docs.omniverse.nvidia.com/isaacsim/latest/index.html#
  -Find out this simulator needs Nvidia RTX GPU
    -Only my recent laptop has RTX 3060
    -Installed WSL, Ubuntu 22.04, ROS 2 Humble in my recent laptop

Week 5: 09/23/24

- Found tutorial about Isaac Sim 2023.1.1 and tried to set it up
  -https://docs.omniverse.nvidia.com/isaacsim/latest/installation/index.html (Installation and setup)
  -
  https://docs.omniverse.nvidia.com/isaacsim/latest/introductory_tutorials/index.h

tml (tutorial of Isaac Sim)

- Find out way to link ROS 2 with Isaac Sim

  -Isaac-ROS plugin https://nvidia-isaac-ros.github.io/

  -The ROS 2 bridge which is included in Isaac Sim installation https://docs.omniverse.nvidia.com/isaacsim/latest/installation/install_ros.html#isaac-sim-app-install-ros

Week 6: 09/30/24

- Set up the ROS 2 bridge for Isaac Sim

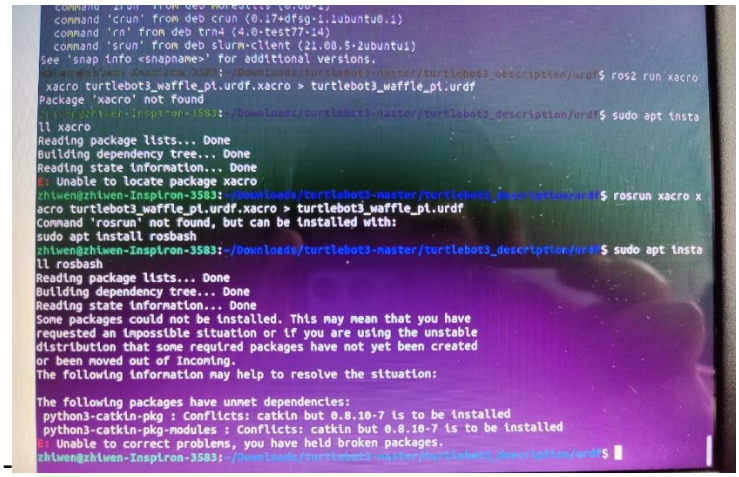
  - https://docs.omniverse.nvidia.com/isaacsim/latest/installation/install_ros.html#isaac-sim-app-install-ros (Setup for ROS 2 workspace and bridge)

- Modeled a simple robot and a manipulator in Isaac Sim and did simulate separately

  - https://docs.omniverse.nvidia.com/isaacsim/latest/advanced_tutorials/tutorial_advanced_adding_new_manipulator.html (Isaac Sim Built-in manipulator)
  - https://www.youtube.com/watch?v=0voBBEOCQuQ (simple robot creation)
  - https://www.youtube.com/watch?v=3u_cfkYq_Pg (simple move of robot)

- Found the model for turtlebot3 waffle pi and open-manipulator
  - https://github.com/ROBOTIS-GIT/turtlebot3
  - https://github.com/ROBOTIS-GIT/open_manipulator/tree/master

- Tried to put waffle pi and open-manipulator together – failed (cannot convert them from xacro file to urdf file, and package cannot locate)



- Accidently upgraded the version of Isaac Sim to 4.2.0, which caused the ROS 2 bridge cannot be loaded

  -Downgraded to 4.1.0 and finally worked, but cannot find 2023.1.1 version anymore, seems had been deleted by official.

Week 7: 10/07/24

- Convert xacro file from urdf file by using ros-humble-xacro package

  -Put the models of waffle pi and manipulator into Isaac Sim

-Combine them by using fixed joint in Isaac Sim
-Rebuilt action map for turtlebot3 waffle pi: https://www.youtube.com/watch?v=kKIdme5s9WM

- Discussed about the general direction about our project
  -have autonomous navigation towards objects also, maybe introduce different terrains and object locations. (If have time)

Week 8: 10/14/24

- Did some research about more specific application for robot and manipulator
  - https://app.cafeprozhe.com/storage/files/project/DkD2OKcV33AGXM0Uds5D3g5CIlaYU4hG7Mfrs0h4.pdf (Research and application of industrial robot manipulators in vehicle and automotive engineering, a survey)
  -https://onlinelibrary.wiley.com/doi/10.1002/rob.4620090208 (Robot manipulator control for hazardous waste-handling applications)
  -

Week 9: 10/21/24

- Find some more new papers based on key words: mobile manipulator, logistic warehouse, material handling, object recognition and retrieval
  - https://ieeexplore.ieee.org/document/10374743 (Mobile Robotic Manipulator based Autonomous Warehouse Operations)
  - https://www.mdpi.com/2075-1702/10/2/97 (Motion Planning for Mobile Manipulators—A Systematic Review)
- Find out what we will do for final task:
  - Implement a mobile manipulator by using Turtlebot3 waffle pi and OpenManipulator-X
  - Set up autonomous navigation
    - Using machine vision and machine learning
    - Training model with a predefined dataset
- Set up the grasping and placing system

Week 10: 10/28/24

- Isaac sim navigation: ROS 2 Navigation (https://docs.omniverse.nvidia.com/isaacsim/latest/ros2_tutorials/tutorial_ros2_navigation.html)
  - This is a sample navigation by using the built-in example package “carter navigation” in Isaac sim.
  - Followed the tutorial to run the example on PC with RTX 4060 Ti GPU
    - Use built-in Isaac unit *Occupancy Map* to get the map we want use in navigation
      - Need to set up the Origin is set to X: 0.0, Y: 0.0, Z: 0.0. For the lower bound, set Z: 0.1. For the Upper Bound, set Z: 0.62
    - Remember to remove the robot model before you draw the map
      - But because I use Isaac sim 4.1.0, and it seems has error in this

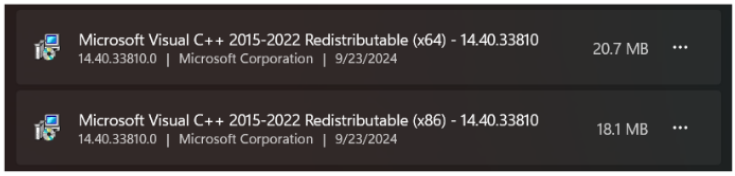
part and cannot show the map → download 4.2.0

- Because previous error about "Unable to load ROS 2 bridge in Isaac sim 4.2.0", this website gives solution: https://forums.developer.nvidia.com/t/isaac-sim-version-4-2-0-missing-many-isaac-utils-and-isaac-examples-there-were-available-in-previous-versions/307518/5

1. Install Microsoft.VisualStudio.2022.BuildTools

```
winget install Microsoft.VisualStudio.2022.BuildTools
```

```
Found Visual Studio BuildTools 2022 [Microsoft.VisualStudio.2022.BuildTools] Version 17.11.4
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://download.visualstudio.microsoft.com/download/pr/3429d84b-c702-4681-b81d-d2a4780fb8be/a1a495189dbb4d2a8849c1cb6
  ████████████████████████████  4.22 MB / 4.22 MB
Successfully verified installer hash
Starting package install...
Successfully installed
```



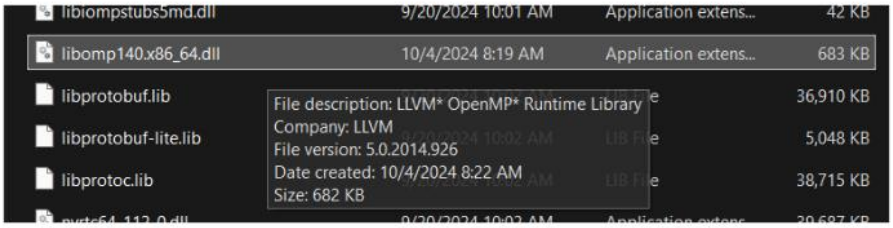
From Hammad's post I thought this was the only requirement, but I still had issues after

2. Download libomp140_x86_64

I had to manually download libomp140_x86_64 29

3. Add to libomp to Isaac 4.2.0 ml bundle

```
C:\Users\<user>\AppData\Local\ov\pkg\isaac-sim-4.2.0\exts\omni.isaac.ml_archive\pip_prebundle\torch\lib
```



- After get the map, copy the value showed in the block above the image and paste in yaml file about the map information in maps folder in *carter navigation* package
- Run command while you start the simulation in Isaac sim to launch the file for navigation.

- I kept the environment and change the carter robot to our mobile manipulator, change the setting in launch file and set the model as turtlebot3 waffle pi, but the problem is in Isaac sim, I also need to set up the action graph for our model.
- Tried to setup the action graph based on example → cannot find the topic during simulation

Week 11: 11/4/24

- Start to work on C-day poster and website
- Find some more examples about Isaac Navigation and object detection, grasping
    - https://nvidia-isaac-ros.github.io/repositories_and_packages/isaac_ros_object_detection/index.html (Object detection by using Isaac ROS)
    - https://intel.github.io/ros2_grasp_library/docs/doc/getting_start.html (Item grasping on ROS 2)
    - https://www.youtube.com/watch?v=2LDMub6-v5M (Video about Autonomous Navigation with Isaac SIM and NVIDIA Carter)
- Working on Object detection by using Isaac ROS
    - Tried the examples about all three models in Isaac ROS Object detection:
        - RT-DETR models: https://nvidia-isaac-ros.github.io/repositories_and_packages/isaac_ros_object_detection/isaac_ros_rtdetr/index.html
        - DetectNet models: https://nvidia-isaac-ros.github.io/repositories_and_packages/isaac_ros_object_detection/isaac_ros_detectnet/index.html
        - YOLOv8 models: https://nvidia-isaac-ros.github.io/repositories_and_packages/isaac_ros_object_detection/isaac_ros_yolov8/index.html
    - Planned to use RT-DETR models, and need to install docker for all the models: https://docs.docker.com/engine/install/ubuntu/#install-from-a-package (Install Docker in Ubuntu)
        - All the 2D examples works well, but cannot show the detection result while running the sample within Isaac Sim: https://nvidia-isaac-ros.github.io/concepts/object_detection/rtdetr/tutorial_isaac_sim.html
        - Two reasons may cause the problem:
            - 1, while running command line, it will have lines show "[component_container_mt-1] [INFO] [1731431313.506947072] [image_to_tensor node]: Could not negotiate"
            - 2, While running the simulation in Isaac Sim, I cannot find the topic about the action graph of model in ROS 2 topic list.
        - Haven't find the solution for these two situations

Week 12: 11/11/24

- Keep working on Object detection:
    - Try to use DetectNet models for task: the same situation, no output image in RQT
- Working on the final poster and presentation

Notes:

1. Remember to do "source /opt/ros/"version"/setup.bash" before you do anything related to ROS 2.

Reference: