

# 全方位自走車

MULTI-FUNCTIONAL AUTONOMOUS VEHICLE

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指導教授: 林柏江 教授

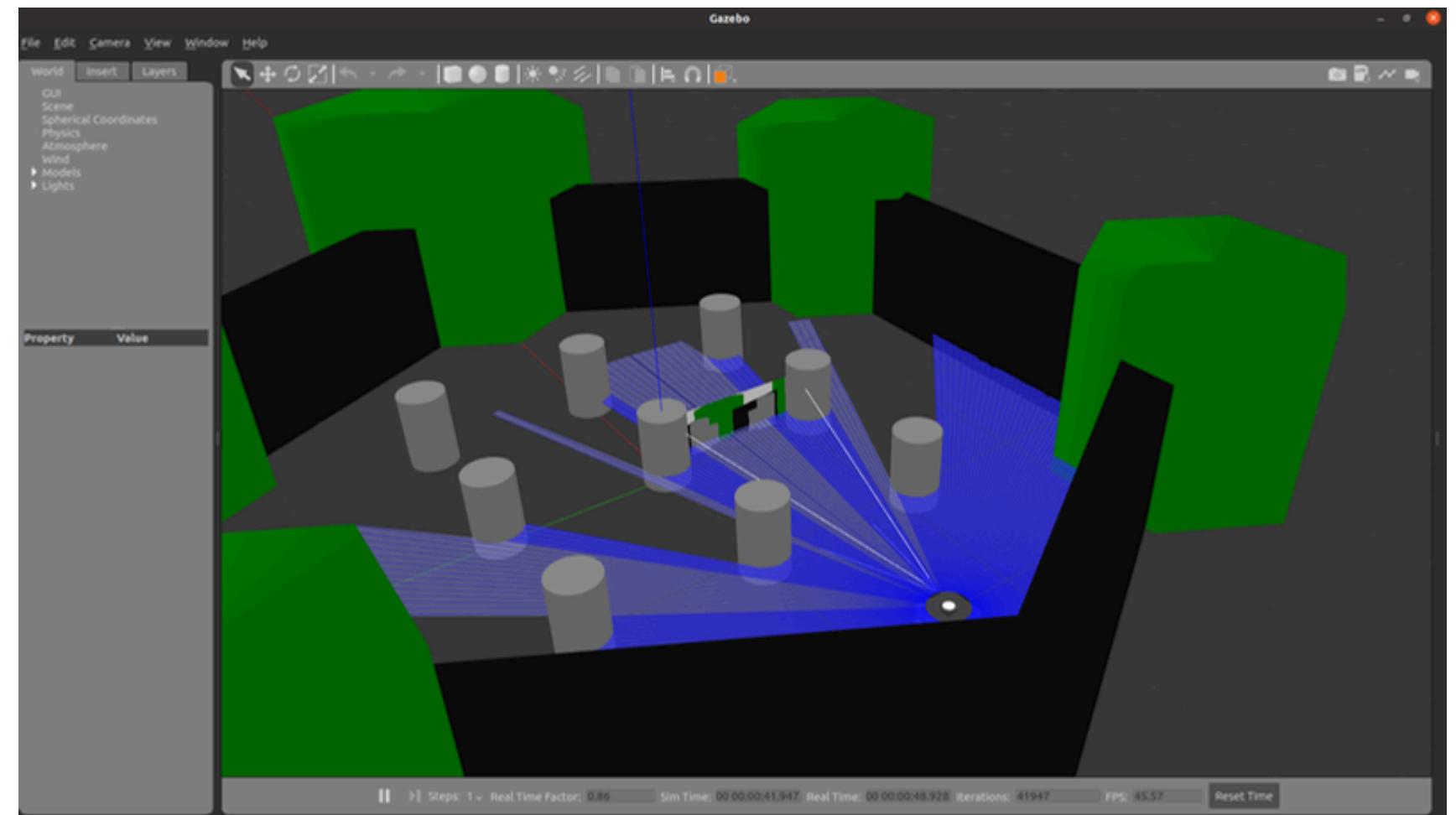
# INTRODUCTION

- 1 使用Ubuntu 22.04以及搭配 ROS2(Robot Operating System with Version2) humble的環境並參考TurtleBot4自走車競賽概念去模擬
- 2 利用TurtleBot4 實現定位及地圖建構的功能，進而完成全方位自走車的自駕功能

# METHODOLOGY

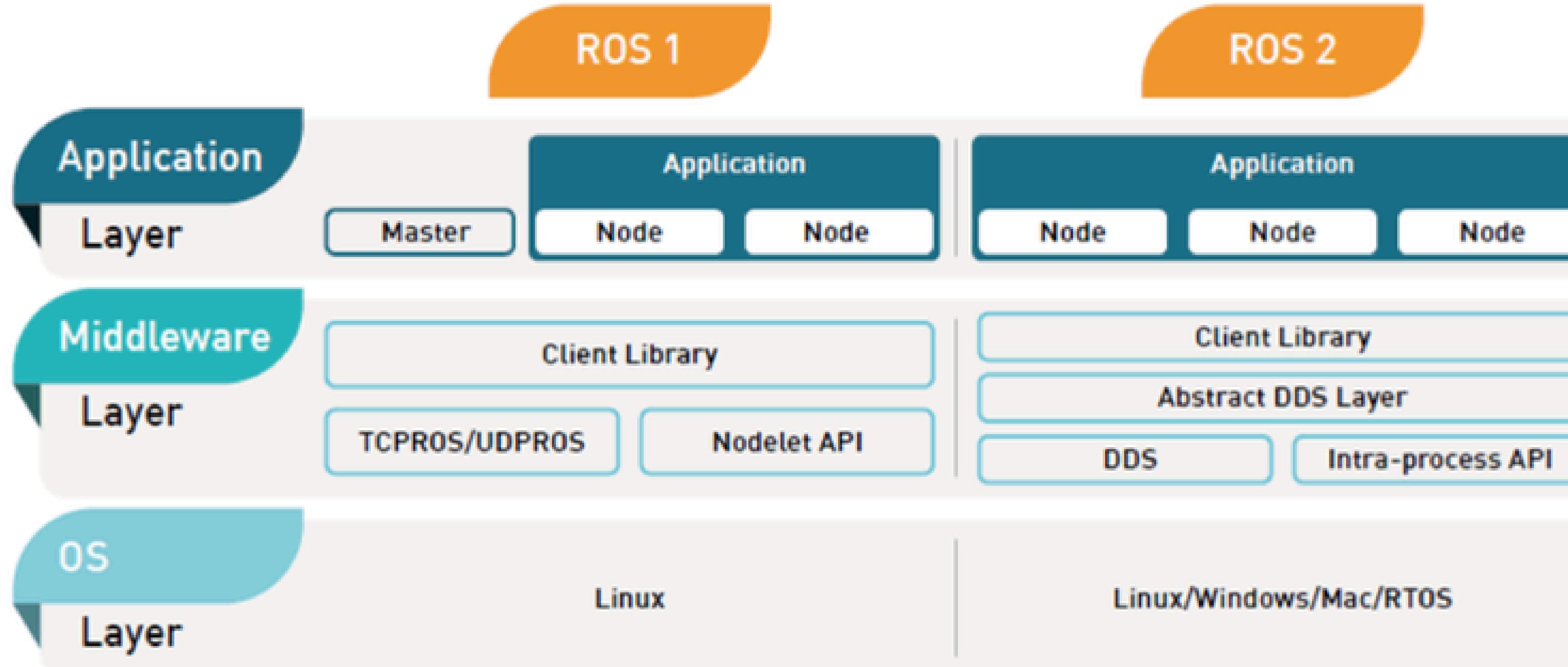
## ROS2環境設置：

1. Talker and listener 測試
2. Gazebo 環境測試
3. IP設定 (實體)
4. Robot Package 安裝

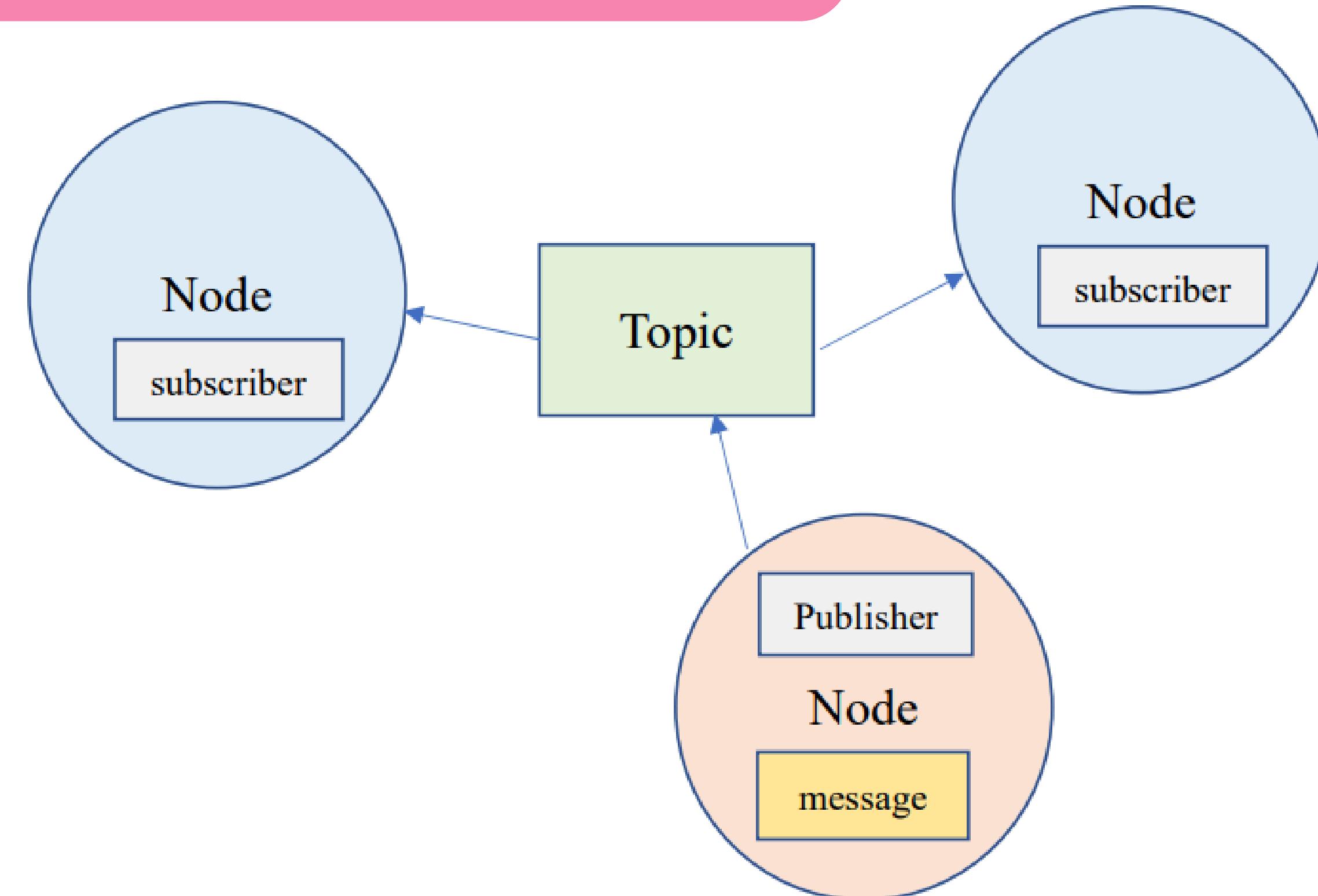


Gazebo環境

# METHODOLOGY

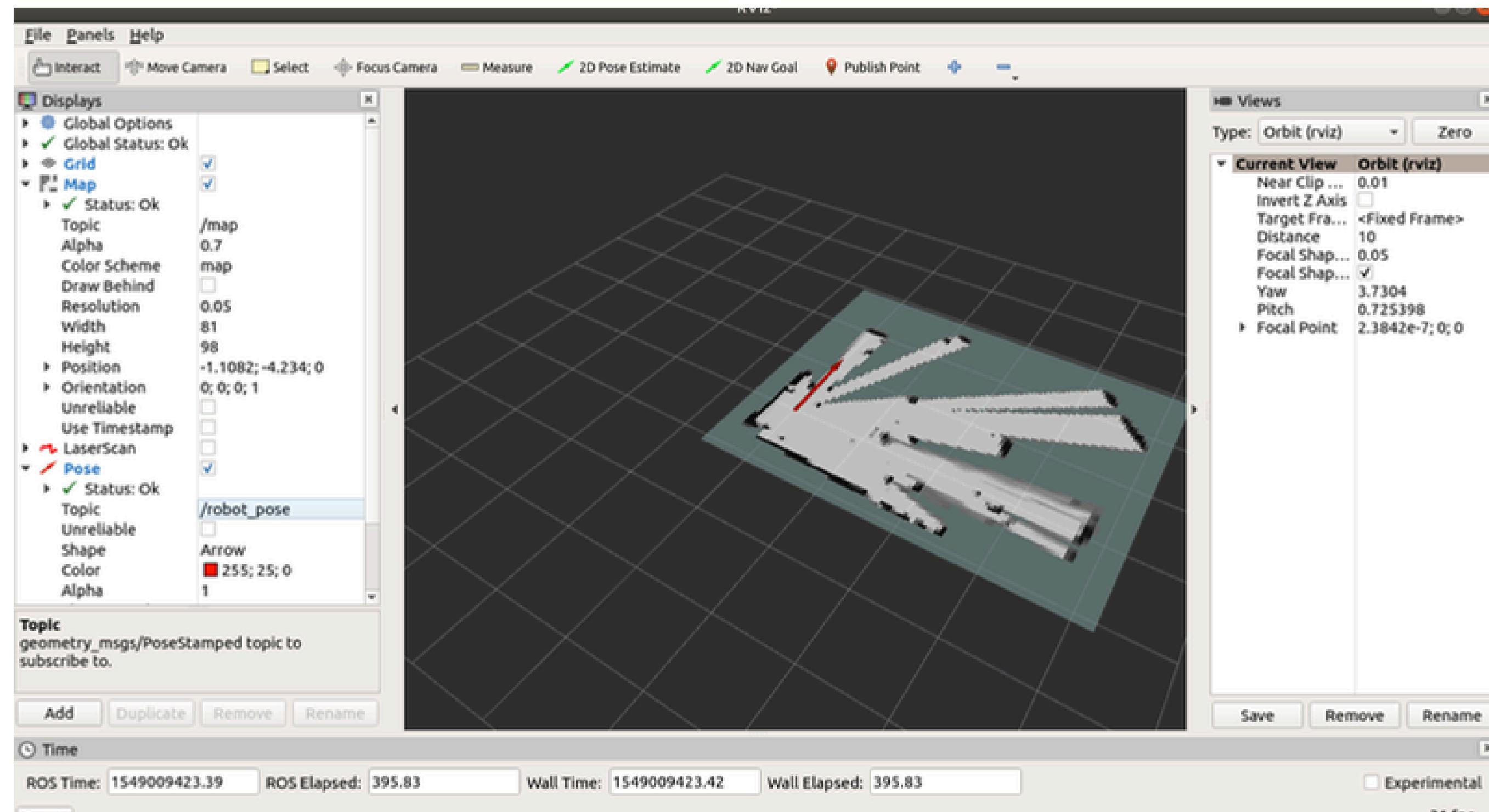


# METHODOLOGY



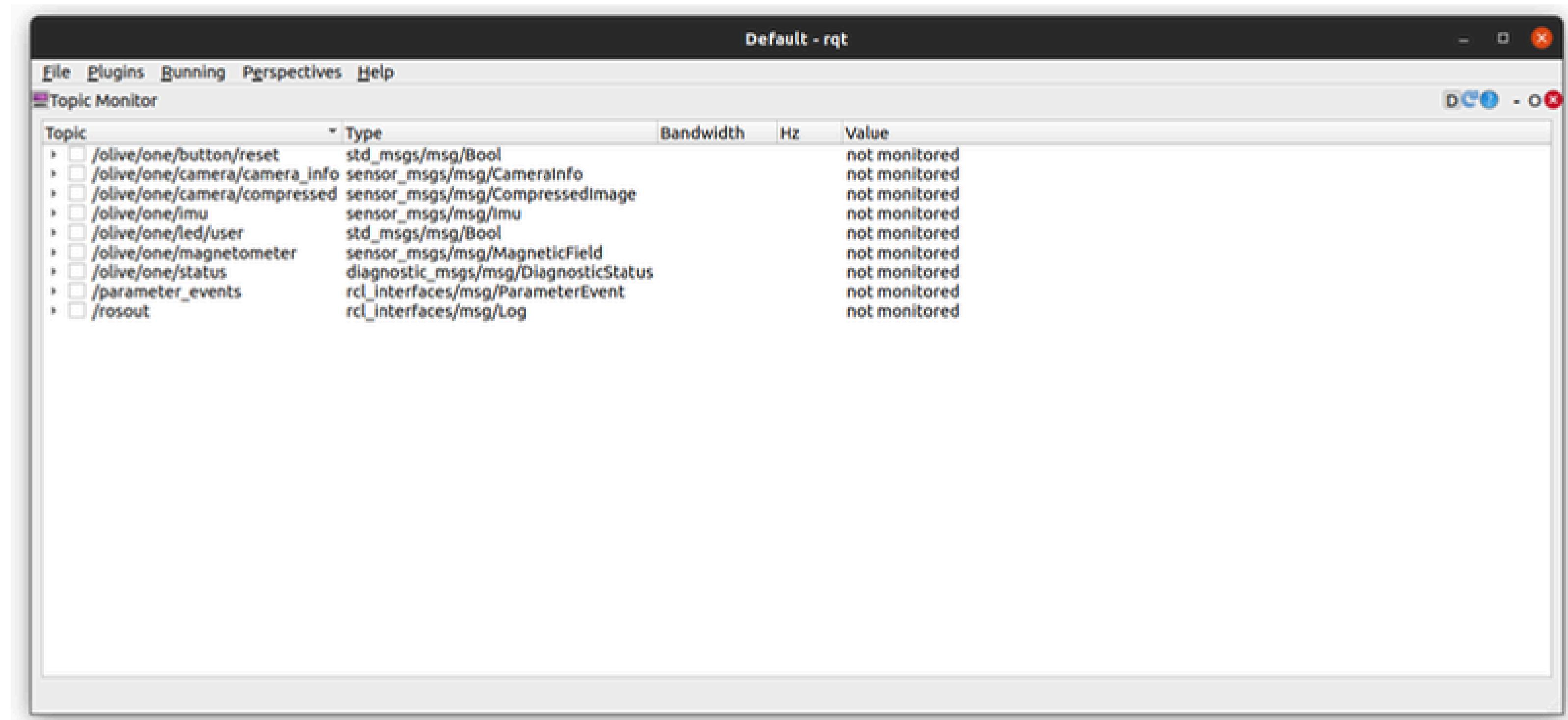
發布者與訂閱者概念圖

# METHODOLOGY



Rviz (robot visualization tool)頁面

# METHODOLOGY

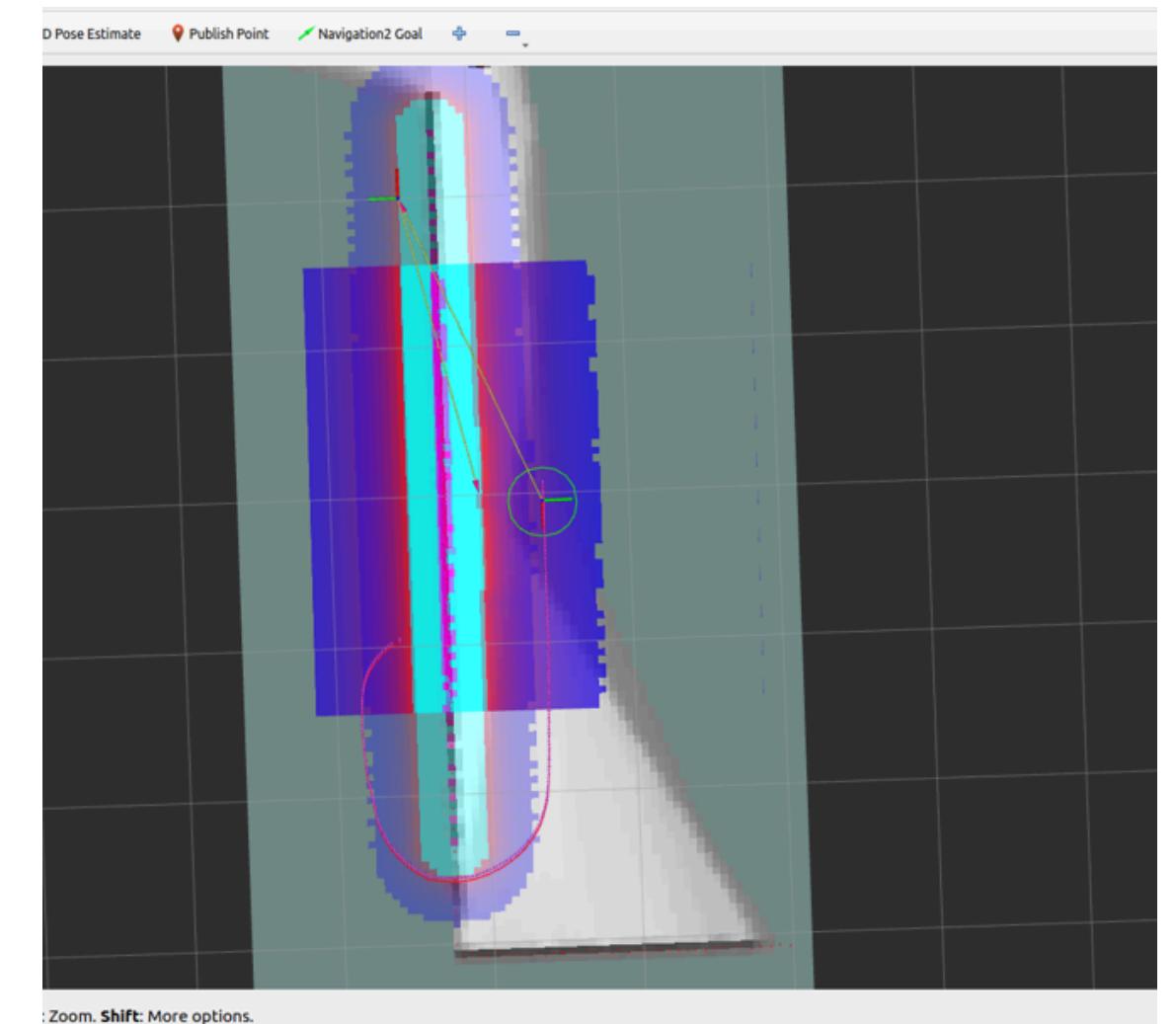


rqt 頁面

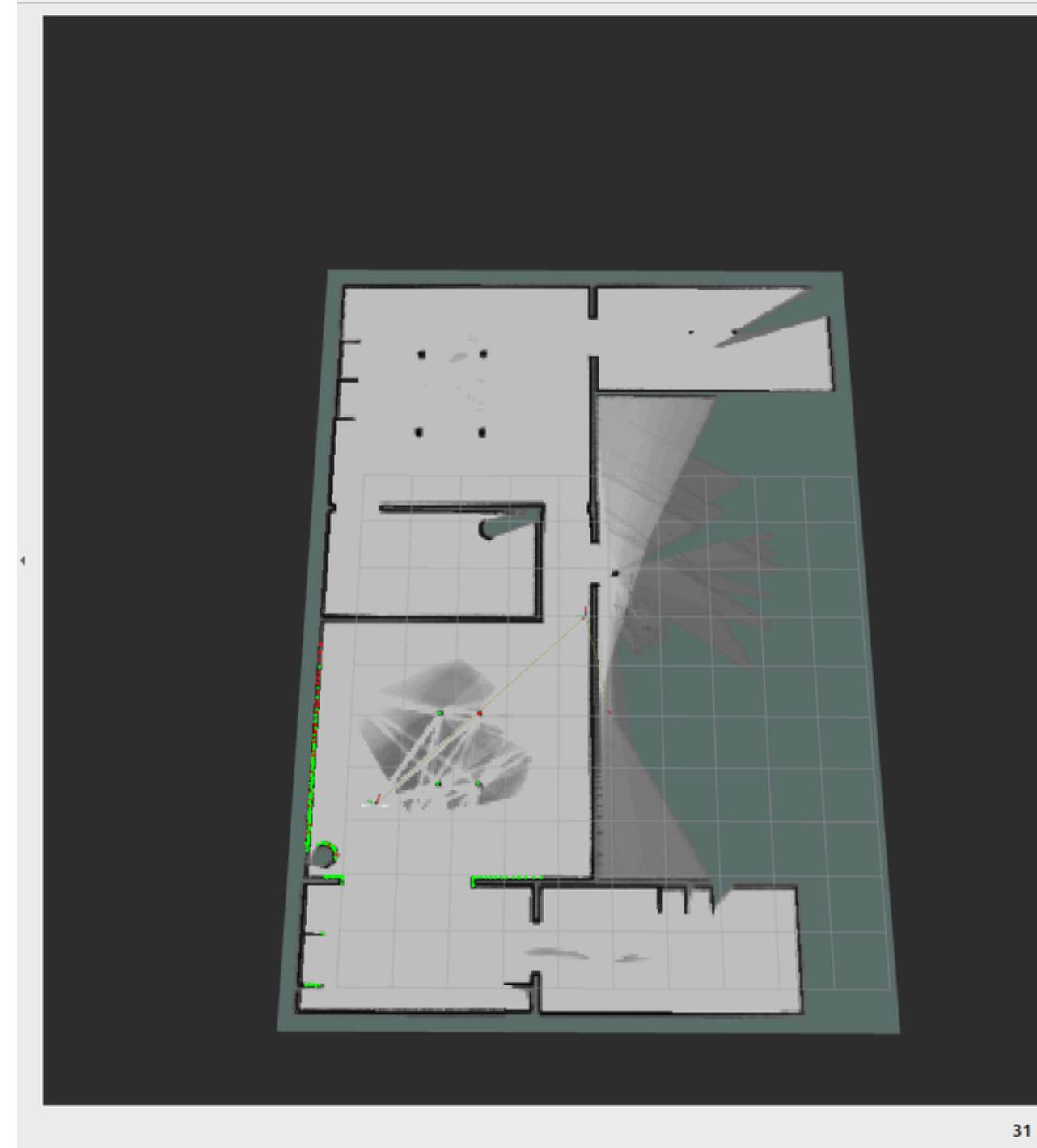
# EXPERIMENT EVALUATIONS

## SLAM 與導航模擬:

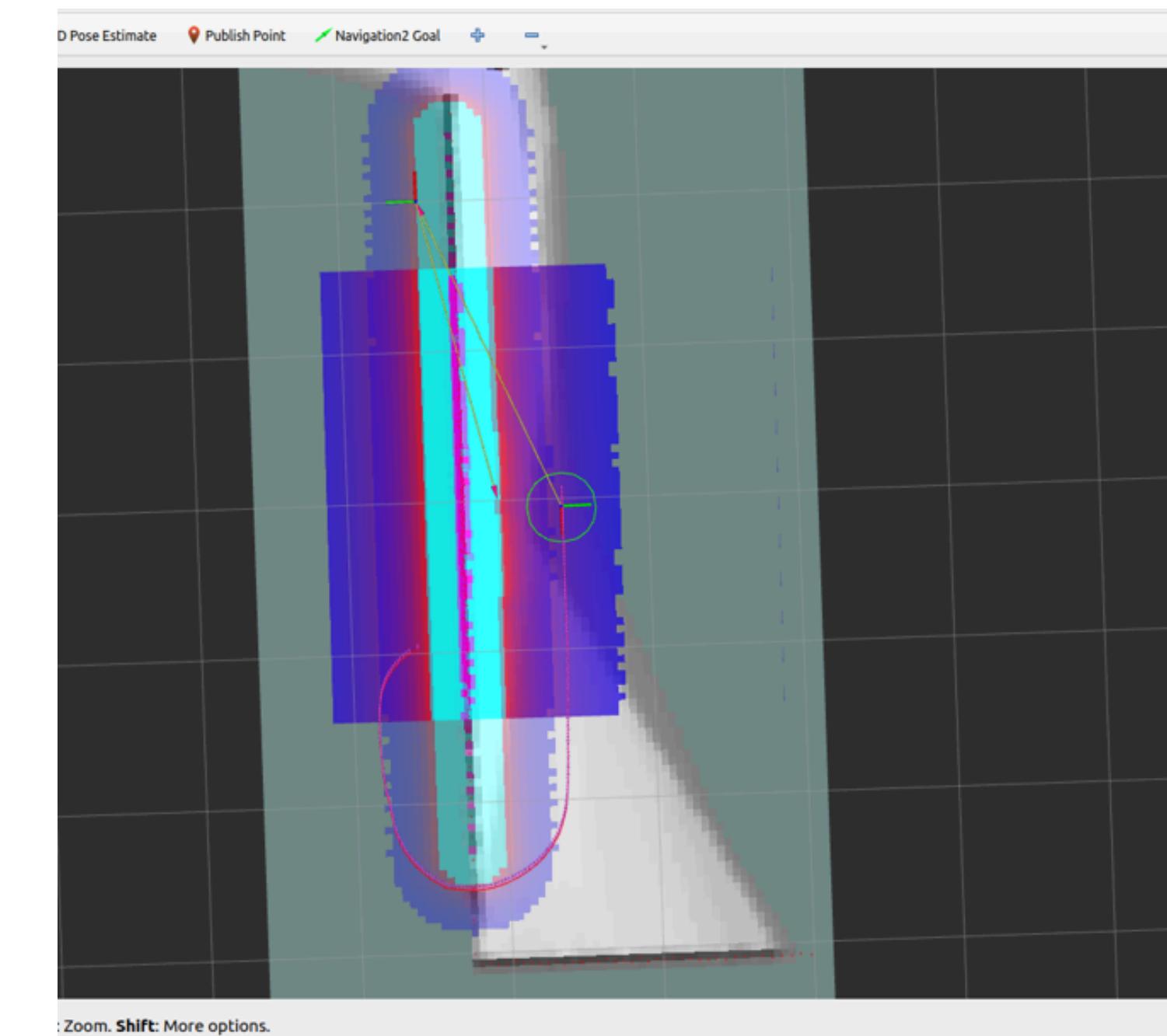
1. 將預設機器人與IP的指令寫進.bashrc 檔裡面
2. 打開 Gazebo 環境，接著執行 SLAM 的程式進行地圖建構並打開 Rviz 以及開啟內建的鏡頭
3. 運用 Teleop 指令並使用鍵盤控制方向與速度
4. 手動點選 Rviz 上方的 Navigation2 goal 來設置機器人所要到達的目的地



# EXPERIMENT EVALUATIONS



SLAM生成的地圖



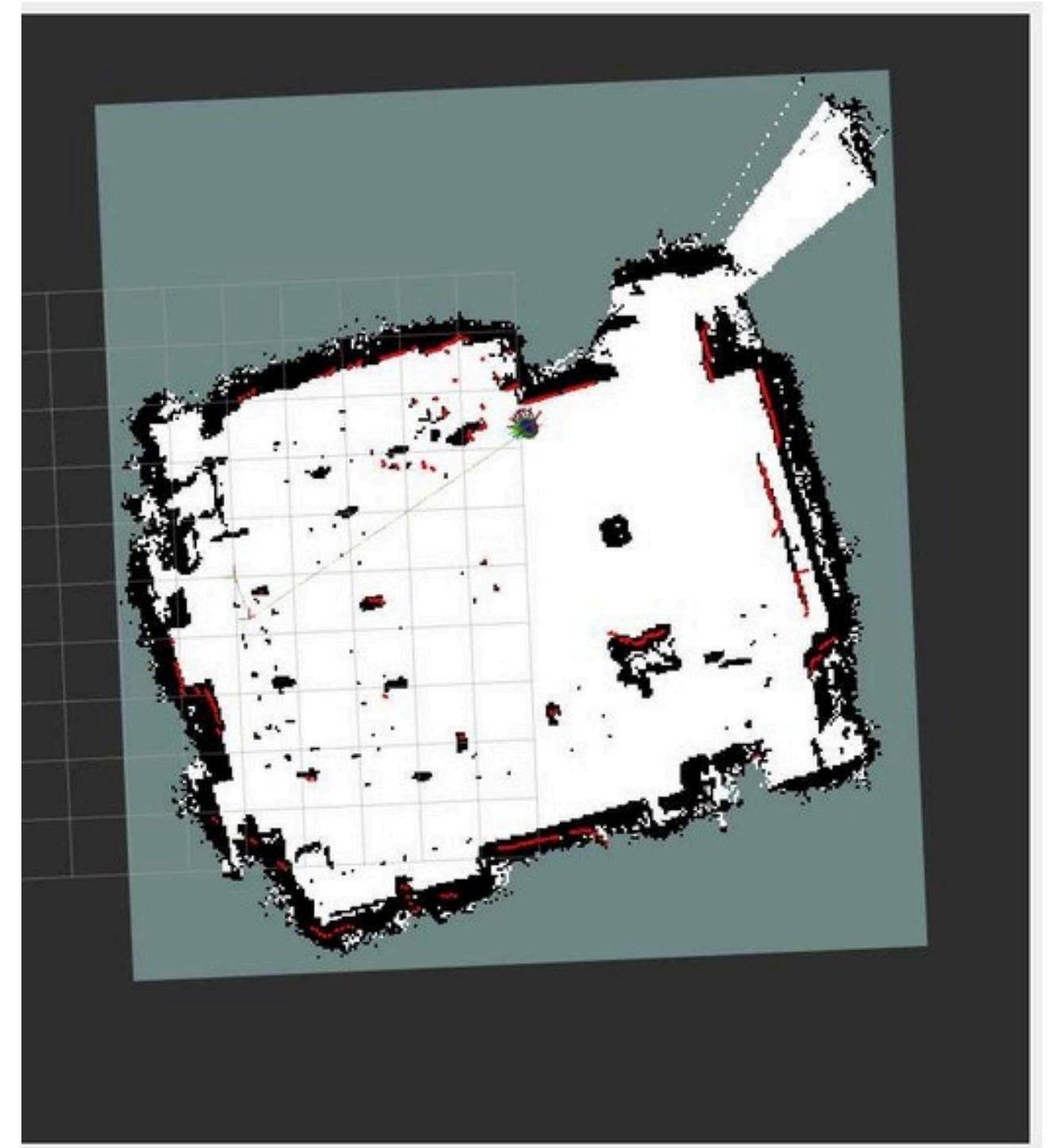
導航模擬結果圖

# EXPERIMENT EVALUATIONS

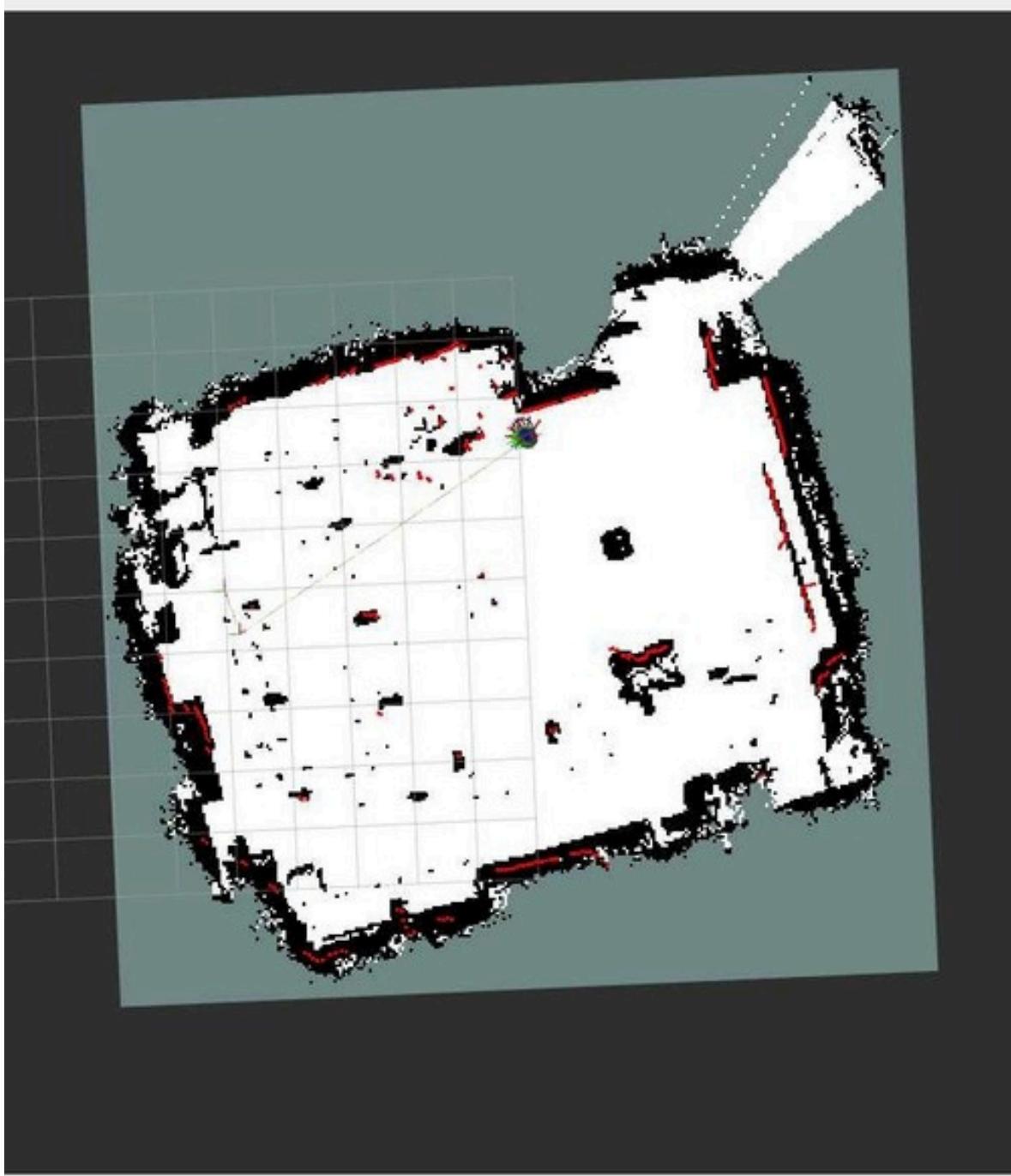
## 實際 SLAM 的過程：

1. 先執行 Keyboard 控制相關之套件
2. 手動操控 TurtleBot 運行在整個空間中，同時打開 Rviz2 描繪出相關空間中的地圖
3. 於建構好的地圖上，標註A點與B點，使 TurtleBot 能夠於描繪的地圖中，計算出路徑從A點自駕到B點

DEMO



# EXPERIMENT EVALUATIONS

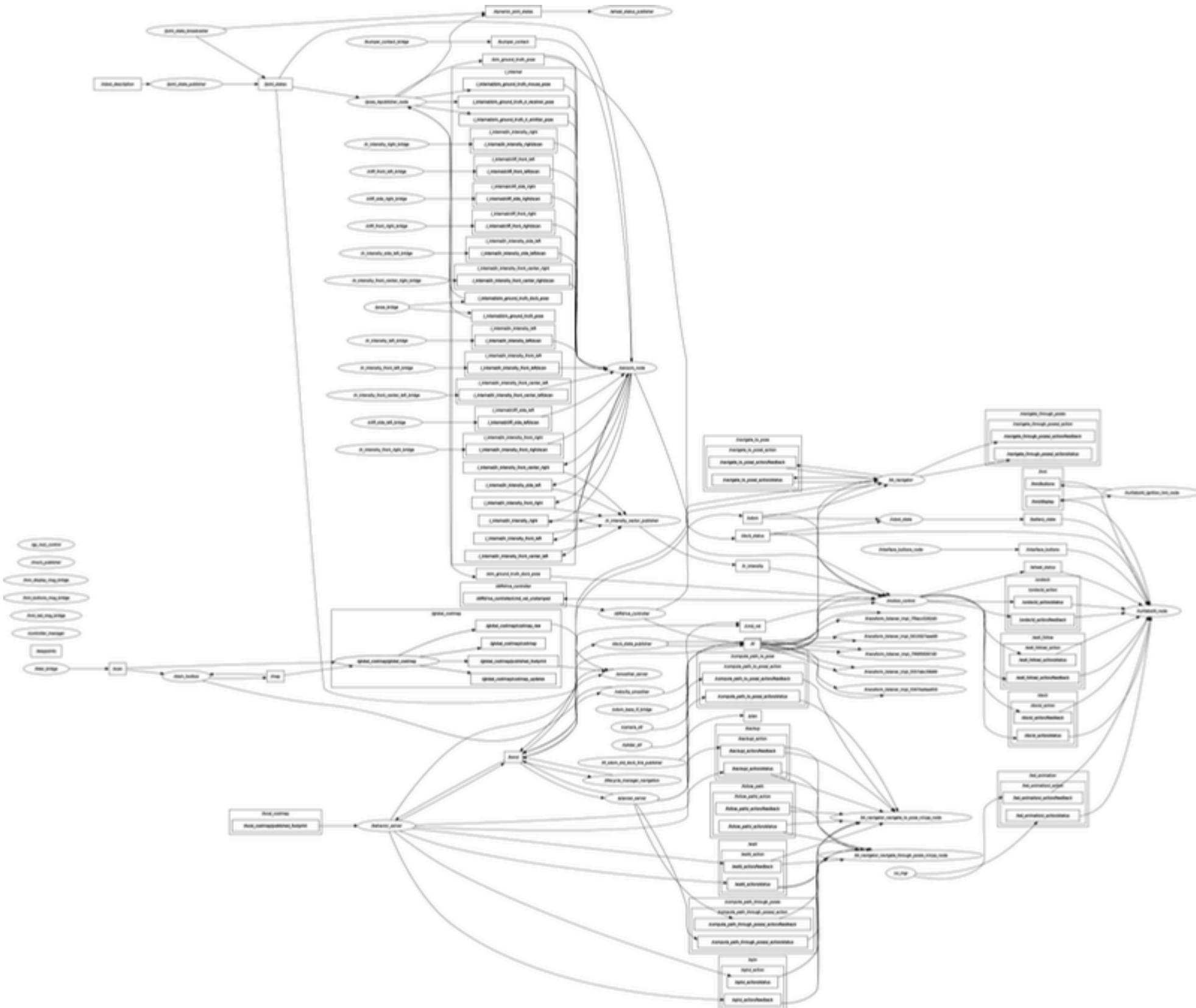


實體SLAM結果圖



70827教室

# EXPERIMENT EVALUATIONS



TurtleBot通訊節點圖  
(rqt\_graph)

# EXPERIMENT EVALUATIONS

Default - rqt

File	Plugins	Browsing	Perspectives	Help
Topic Monitor				
Topic	Type	Bandwidth	Hz	Value
✓ /internal/backup_limit	irobot_create_msq/msg/HazardDetection	unknown	unknown	
✓ /internal/bumper/event	irobot_create_msq/msg/HazardDetection	unknown	unknown	
✓ /internal/cliff/front_left/event	irobot_create_msq/msg/HazardDetection	unknown	unknown	
✓ /internal/cliff/front_left/scan	sensor_msq/msg/LaserScan	unknown	15.09	
✓ /internal/cliff/front_right/event	irobot_create_msq/msg/HazardDetection	unknown	unknown	
✓ /internal/cliff/front_right/scan	sensor_msq/msg/LaserScan	unknown	15.09	
✓ /internal/cliff/side_left/event	irobot_create_msq/msg/HazardDetection	unknown	unknown	
✓ /internal/cliff/side_left/scan	sensor_msq/msg/LaserScan	unknown	15.79	
✓ /internal/cliff/side_right/event	irobot_create_msq/msg/HazardDetection	unknown	unknown	
✓ /internal/cliff/side_right/scan	sensor_msq/msg/LaserScan	unknown	15.79	
✓ /internal/create3/buttons	std_msgs/msg/int32	unknown	unknown	
✓ /internal/fr_intensity/front_center/left	irobot_create_msq/msg/Intensity	unknown	unknown	
✓ /internal/fr_intensity/front_center/left/scan	sensor_msq/msg/LaserScan	unknown	not monitored	
✓ /internal/fr_intensity/front_center/right	irobot_create_msq/msg/Intensity	unknown	unknown	
✓ /internal/fr_intensity/front_center/right/scan	sensor_msq/msg/LaserScan	unknown	15.09	
✓ /internal/fr_intensity/front_left	irobot_create_msq/msg/Intensity	unknown	not monitored	
✓ /internal/fr_intensity/front_left/scan	sensor_msq/msg/LaserScan	unknown	not monitored	
✓ /internal/fr_intensity/front_right	irobot_create_msq/msg/Intensity	unknown	not monitored	
✓ /internal/fr_intensity/front_right/scan	sensor_msq/msg/LaserScan	unknown	not monitored	
✓ /internal/fr_intensity/left	irobot_create_msq/msg/Intensity	unknown	unknown	
✓ /internal/fr_intensity/left/scan	sensor_msq/msg/LaserScan	unknown	15.09	
✓ /internal/fr_intensity/right	irobot_create_msq/msg/Intensity	unknown	not monitored	
✓ /internal/fr_intensity/right/scan	sensor_msq/msg/LaserScan	unknown	15.09	
✓ /internal/fr_intensity_side/left	irobot_create_msq/msg/Intensity	unknown	not monitored	
✓ /internal/fr_intensity_side/left/scan	sensor_msq/msg/LaserScan	unknown	not monitored	
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✓ /internal/wheel_drop/left_wheel/event	irobot_create_msq/msg/HazardDetection	unknown	not monitored	
✓ /internal/wheel_drop/right_wheel/event	irobot_create_msq/msg/HazardDetection	unknown	not monitored	
/assisted_teleop/action/feedback	nav2_msgs/action/AssistedTeleop_FeedbackMessage	can not get message class for type "nav2_msgs/action/AssistedTeleop_FeedbackMessage"		
/assisted_teleop/action/status	action_msq/msg/GoalStatusArray	not monitored		
/audio_note_sequence/_action/feedback	irobot_create_msq/action/AudioNoteSequence_FeedbackMessage	can not get message class for type "irobot_create_msq/action/AudioNoteSequence_FeedbackMessage"		
/audio_note_sequence/_action/status	action_msq/msg/GoalStatusArray	not monitored		
/backup/_action/feedback	nav2_msgs/action/BackUp_FeedbackMessage	can not get message class for type "nav2_msgs/action/BackUp_FeedbackMessage"		
/backup/_action/status	action_msq/msg/GoalStatusArray	not monitored		
/battery_state	sensor_msq/msg/BatteryState	not monitored		
/behavior_server/transition_event	lifecycle_msq/msg/TransitionEvent	not monitored		
/behavior_tree_log	nav2_msq/msg/BehaviorTreeLog	not monitored		
/bond	bond/msq/Status	not monitored		
/bt_navigator/transition_event	lifecycle_msq/msg/TransitionEvent	not monitored		
/bumper_contact	ros_gr_interfaces/msg/Contacts	not monitored		
/clicked_point	geometry_msq/msg/PointStamped	not monitored		
/clock	rosgraph_msq/msg/Clock	not monitored		
/cmd_audio	irobot_create_msq/msg/AudioNoteVector	not monitored		
/cmd_lighting	irobot_create_msq/msg/LightingLeds	not monitored		
/cmd_yvi	geometry_msq/msg/Twist	not monitored		
/depth_and_pose	nav_msgs/msg/PointCloud2	not monitored		

rqt控制頁面

# CONCLUSION

本研究提出在在 simulation 與 real time 兩個狀況下進行自走車的定位與地圖構建。在研究中著重於 SLAM 技術的應用，透過 ROS2 humble 的環境搭配光學雷達，整合在 TurtleBot4 自走車上，實現自走車的地圖建構與導航功能。我們先在 Gazebo 模擬環境中進行測試，驗證了 SLAM 和導航系統的可行性以及穩定性。並且在模擬環境中確認後將研究成果應用於實際環境，使用 TurtleBot 4 完成了自動駕駛的實際測試，成功建構了現實環境中的地圖。

# DIVISION OF WORK

學號	姓名	貢獻比例	分工內容
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1093711	周裕庭	25%	環境建置、定位與地圖構建、成果報告書製作
1093717	陳嶸凱	25%	環境建置、定位與地圖構建、成果報告書製作
1093739	劉姿妤	25%	環境建置、定位與地圖構建、成果報告書製作

**Thank you**