

全方位自走車

MULTI-FUNCTIONAL AUTONOMOUS VEHICLE



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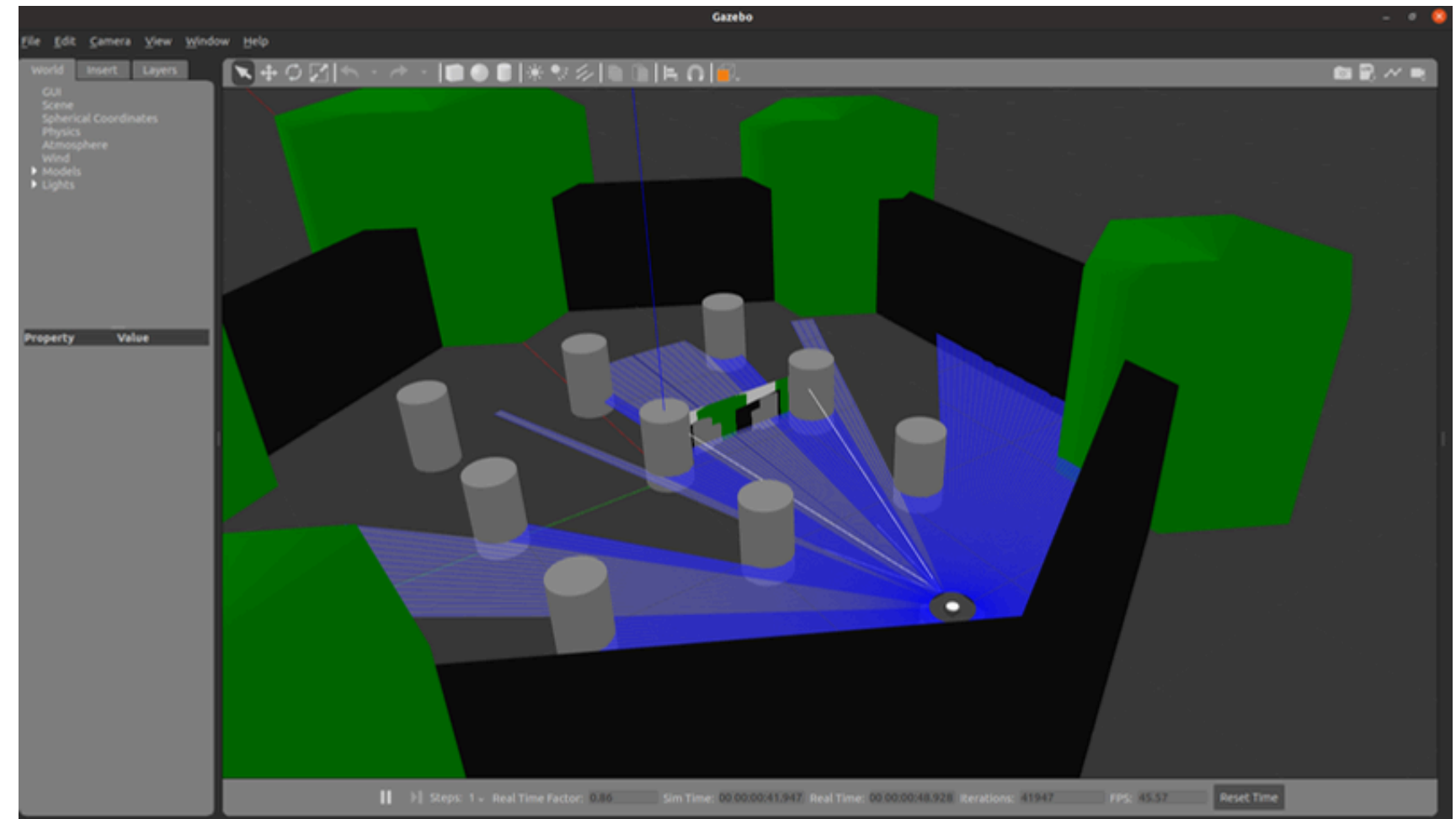
INTRODUCTION

- 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

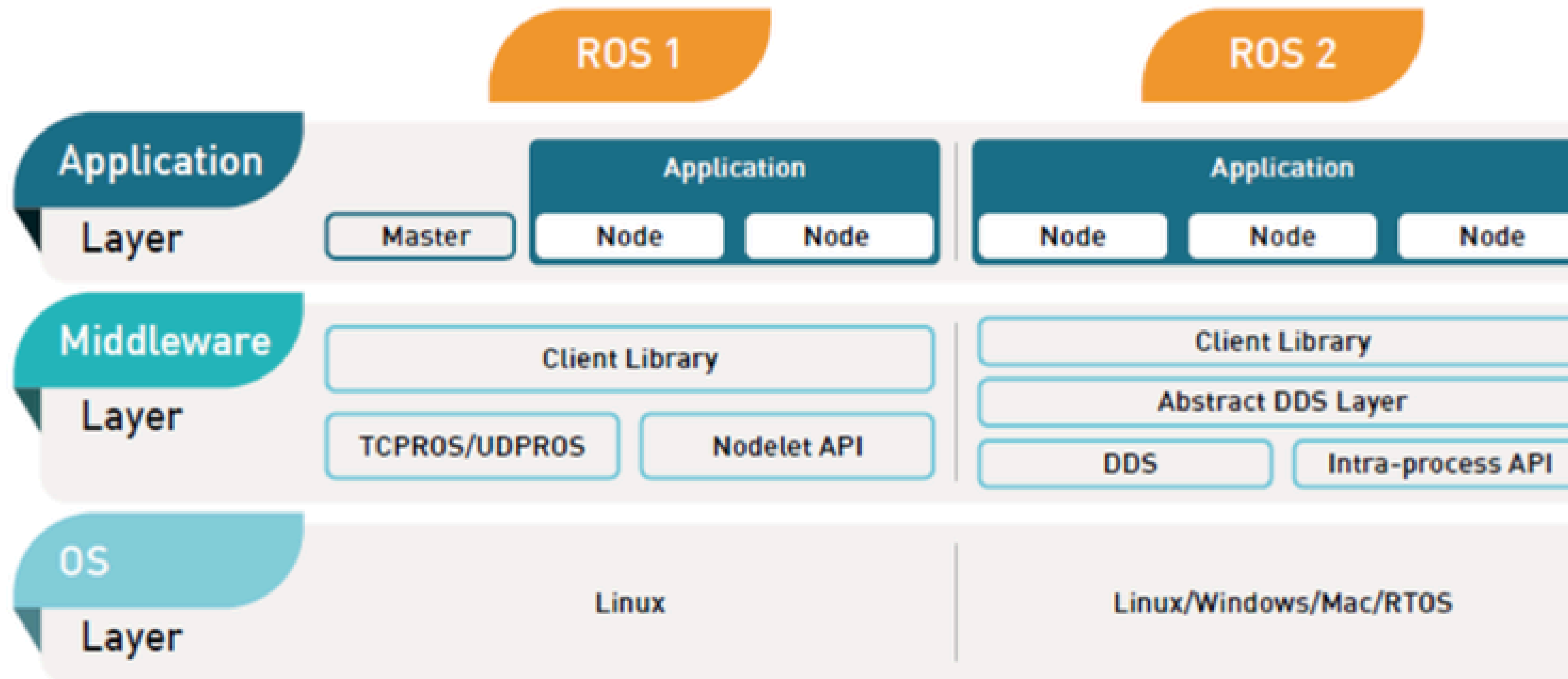
ROS2環境設置:

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

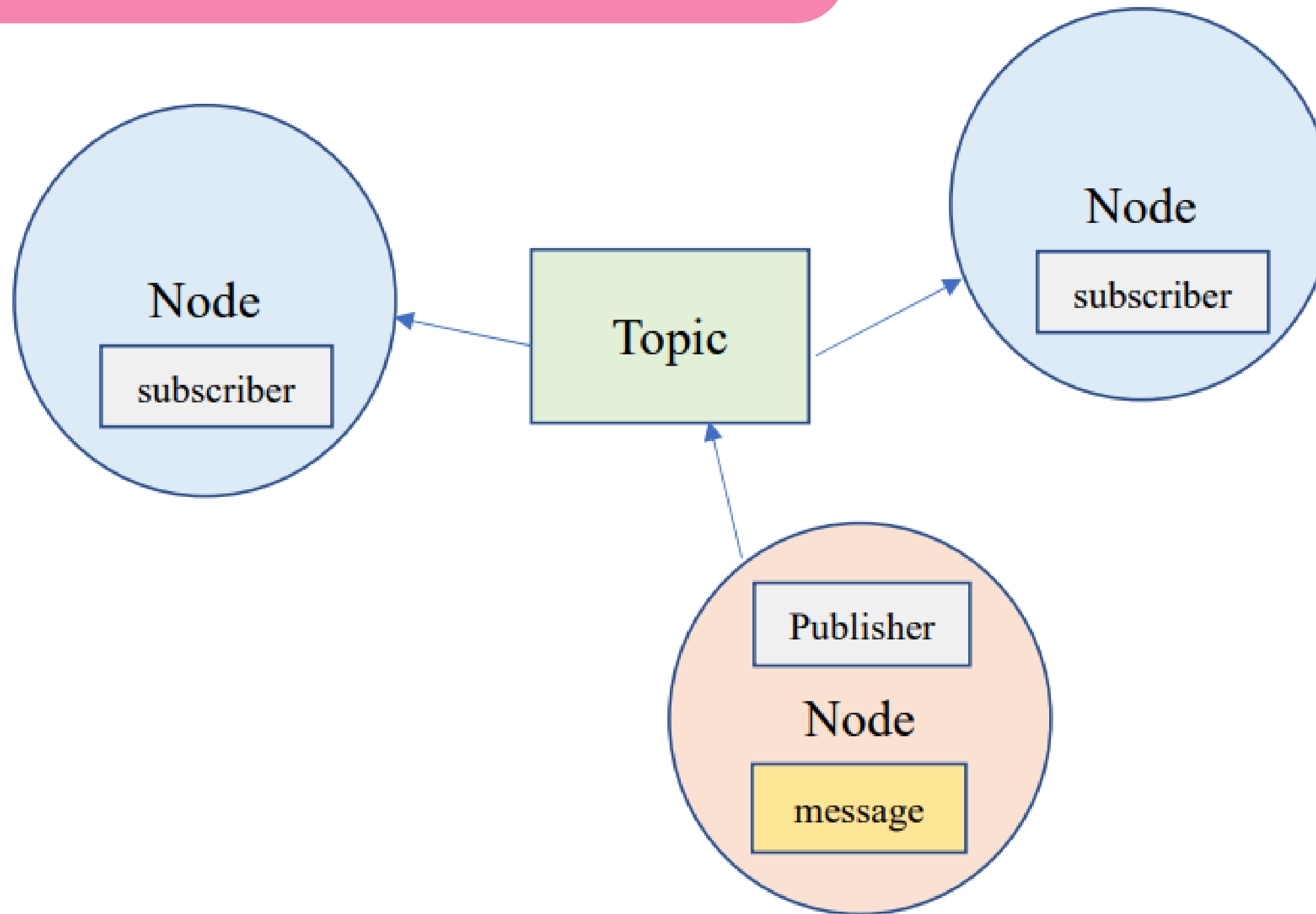


Gazebo環境

METHODOLOGY

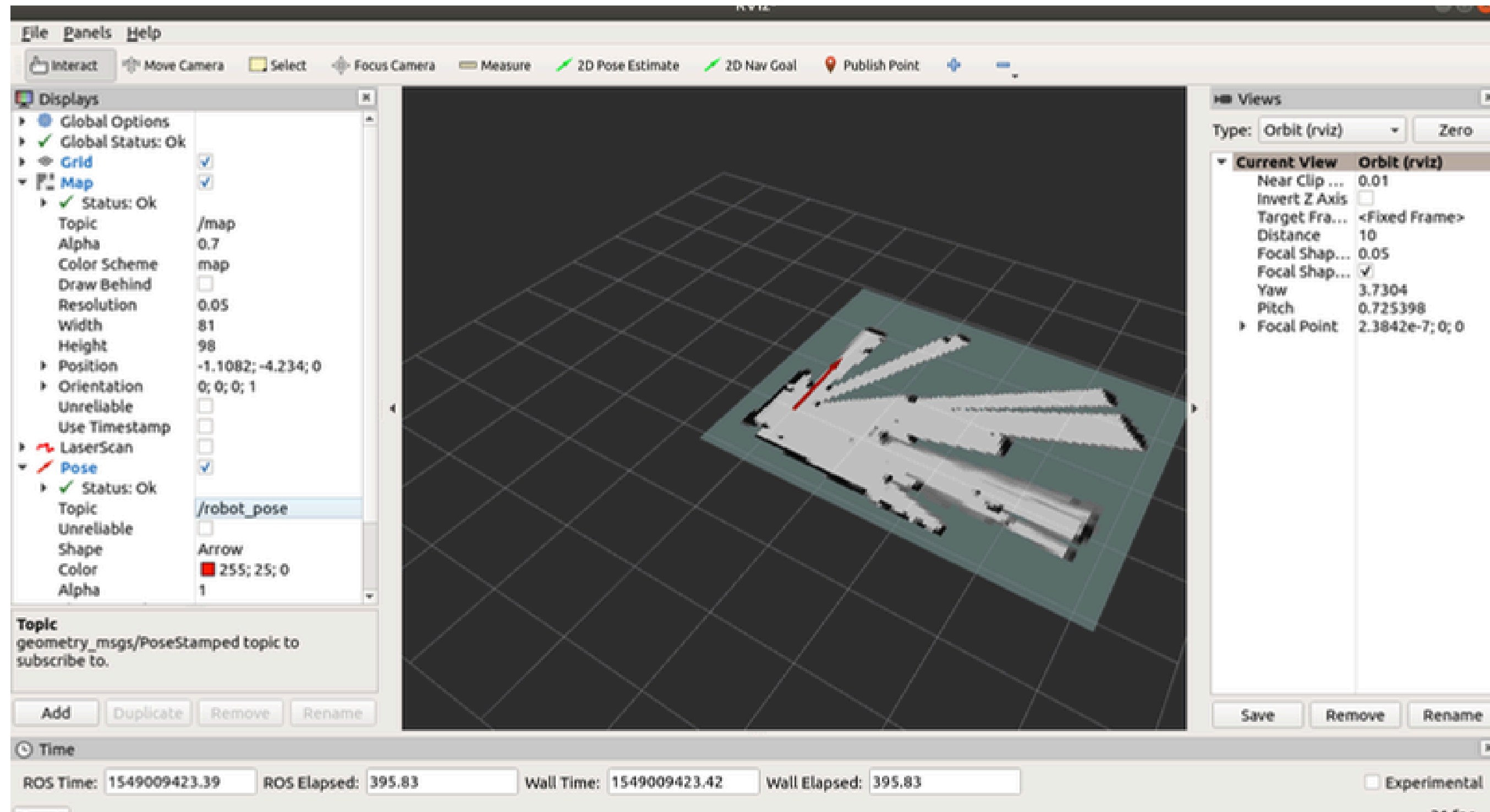


METHODOLOGY



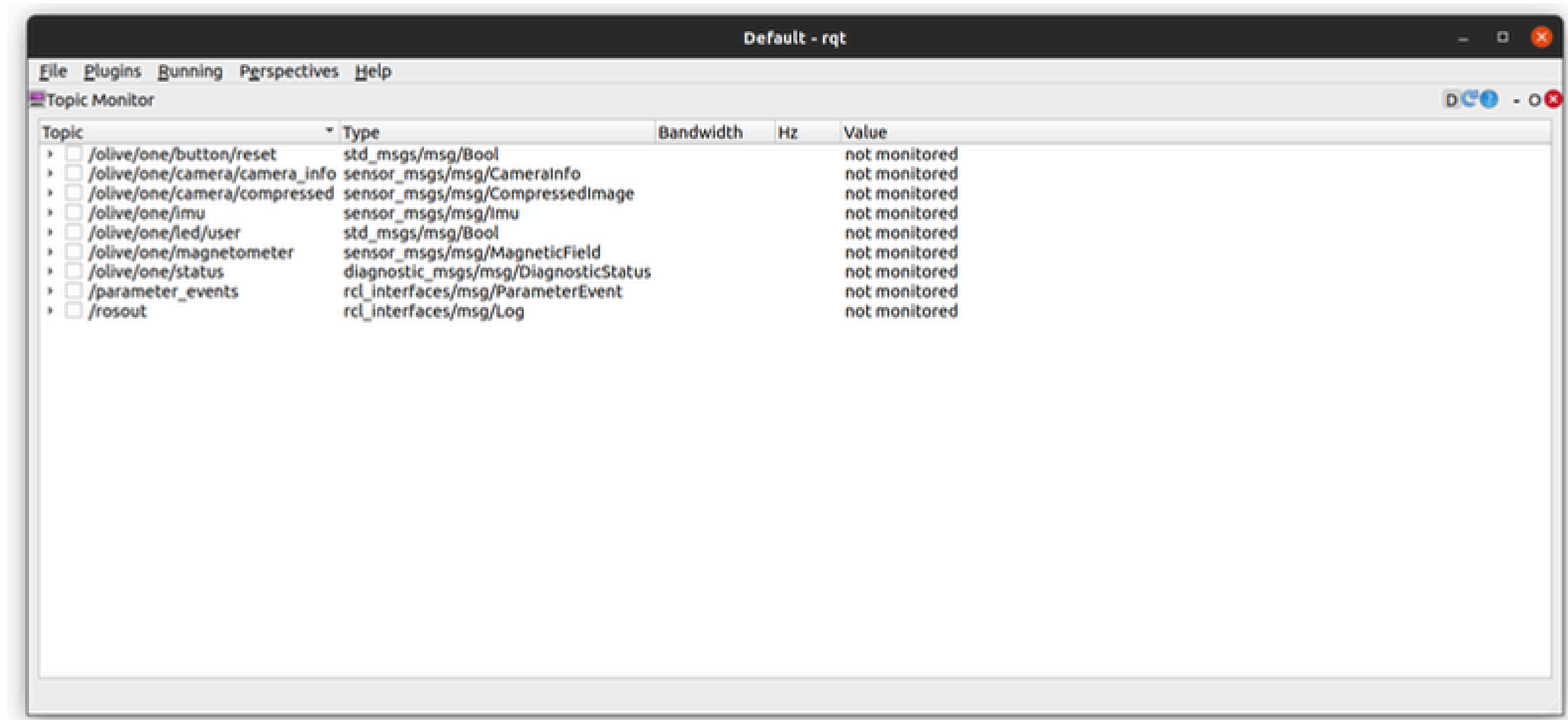
發布者與訂閱者概念圖

METHODOLOGY



Rviz (robot visualization tool) 頁面

METHODOLOGY

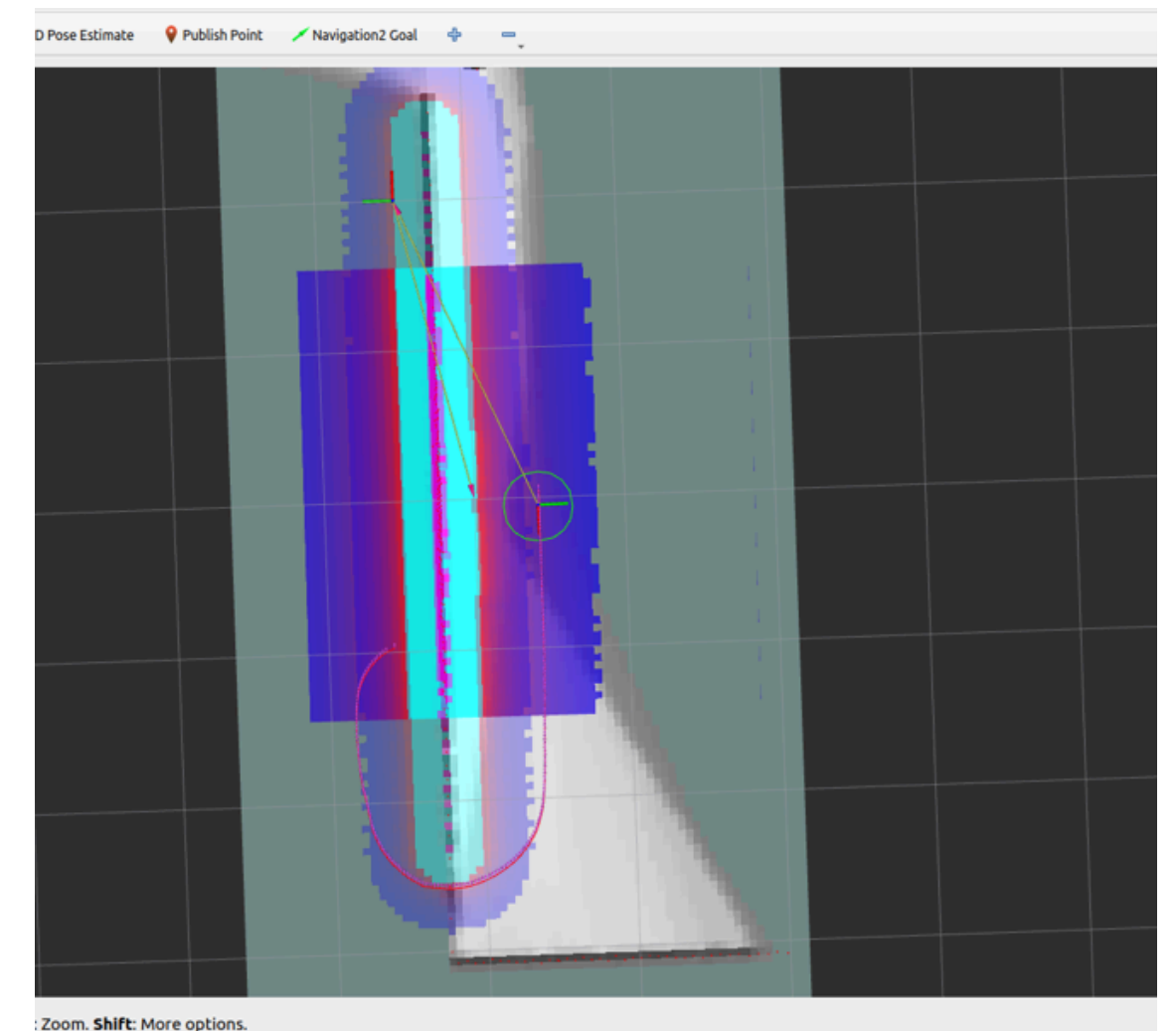


rqt 頁面

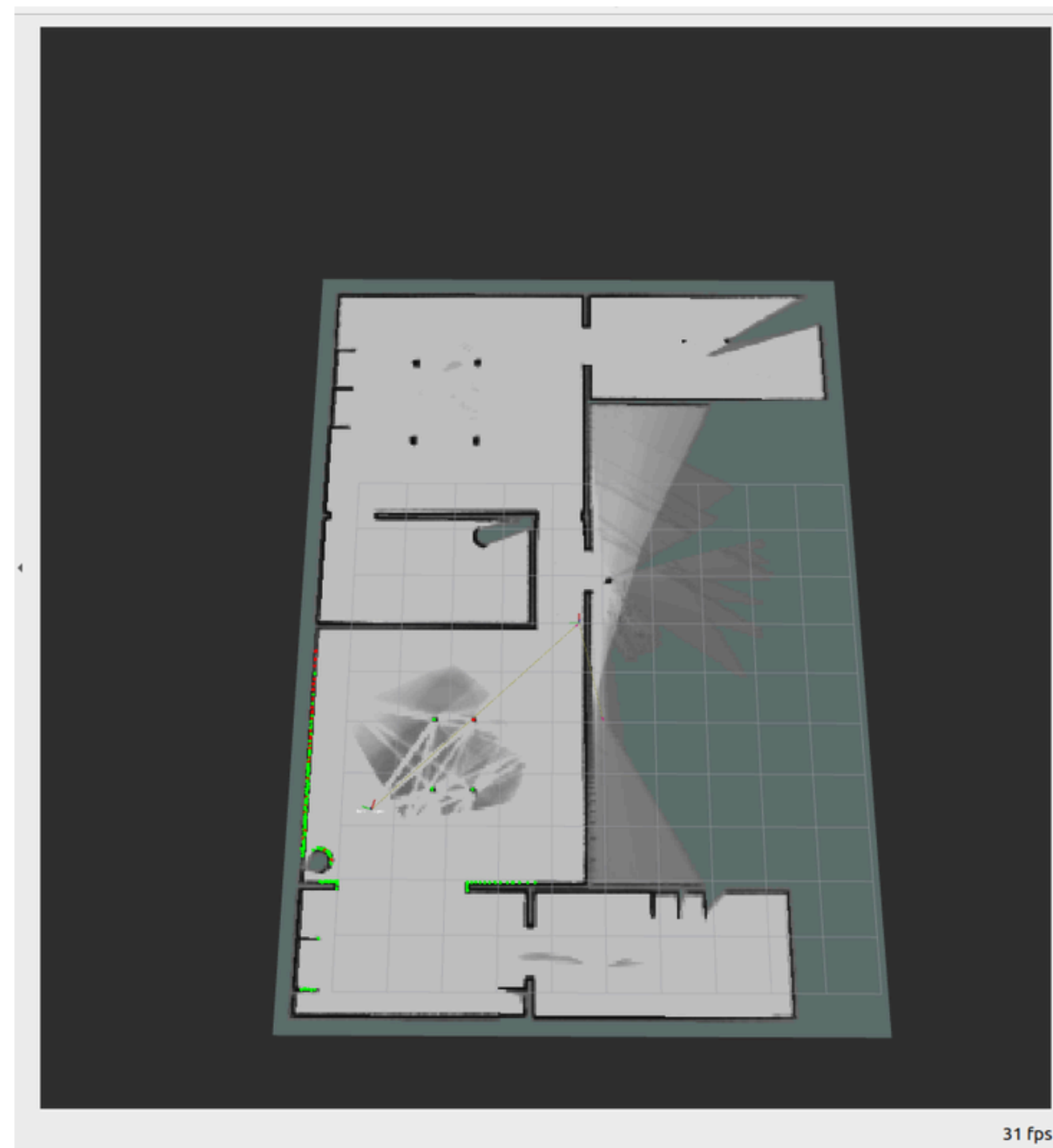
EXPERIMENT EVALUATIONS

SLAM 與導航模擬:

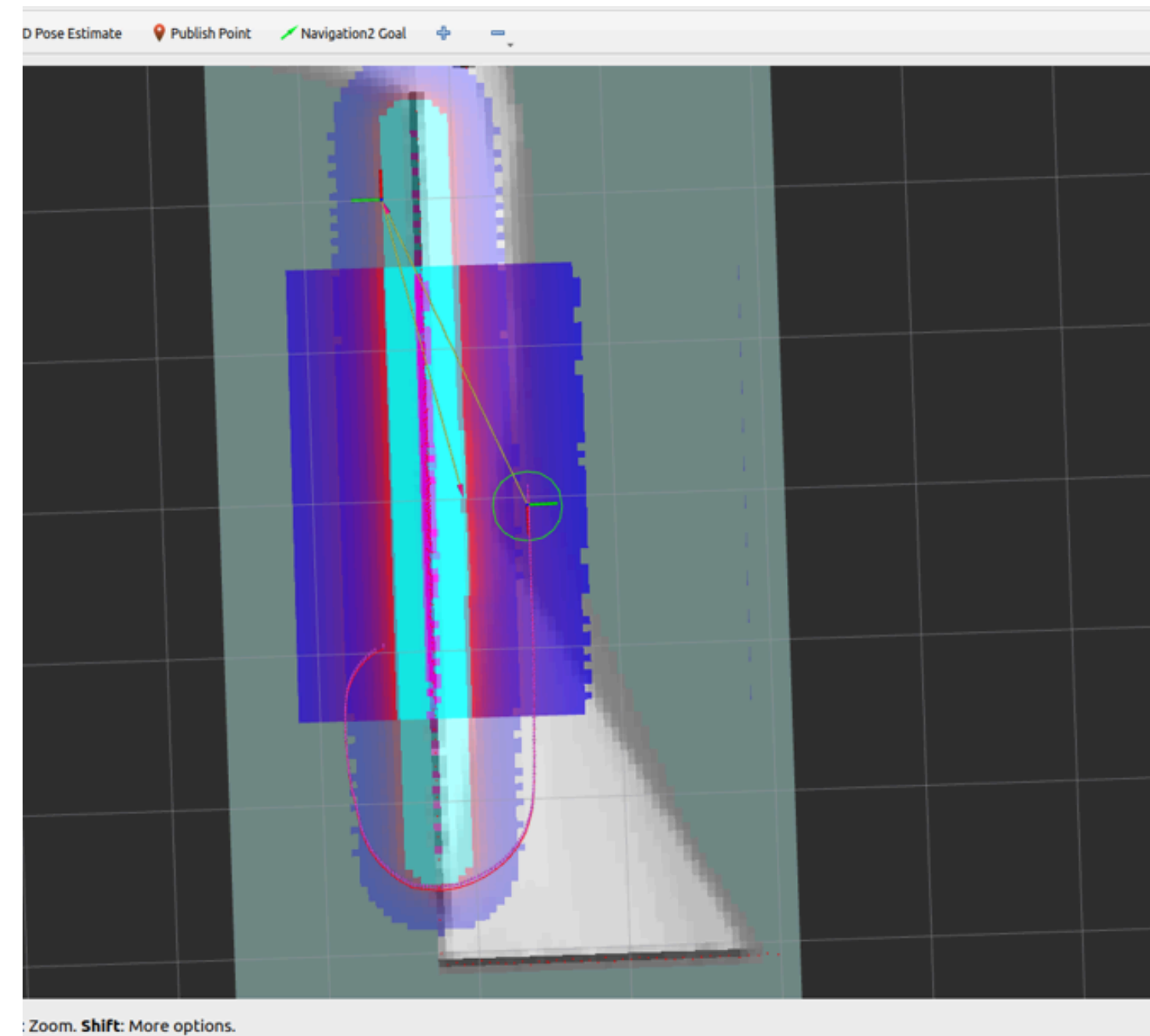
1. 將預設機器人與IP的指令寫進.bashrc 檔裡面
2. 打開 Gazebo 環境，接著執行 SLAM 的程式進行地圖建構並打開 Rviz 以及開啟內建的鏡頭
3. 運用 Teleop 指令並使用鍵盤控制方向與速度
4. 手動點選 Rviz 上方的 Navigation2 goal 來設置機器人所要到達的目的地



EXPERIMENT EVALUATIONS



SLAM生成的地圖



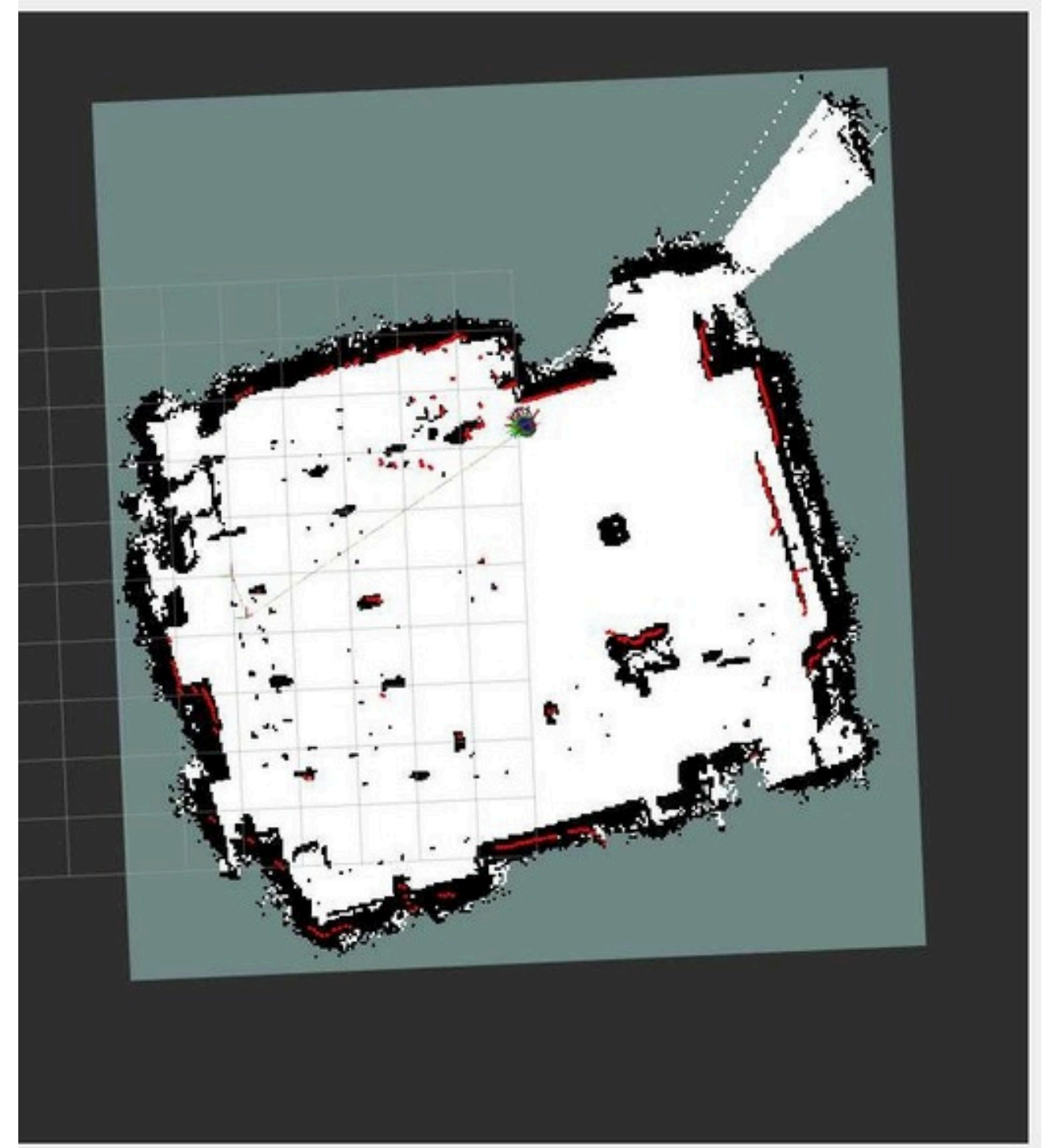
導航模擬結果圖

EXPERIMENT EVALUATIONS

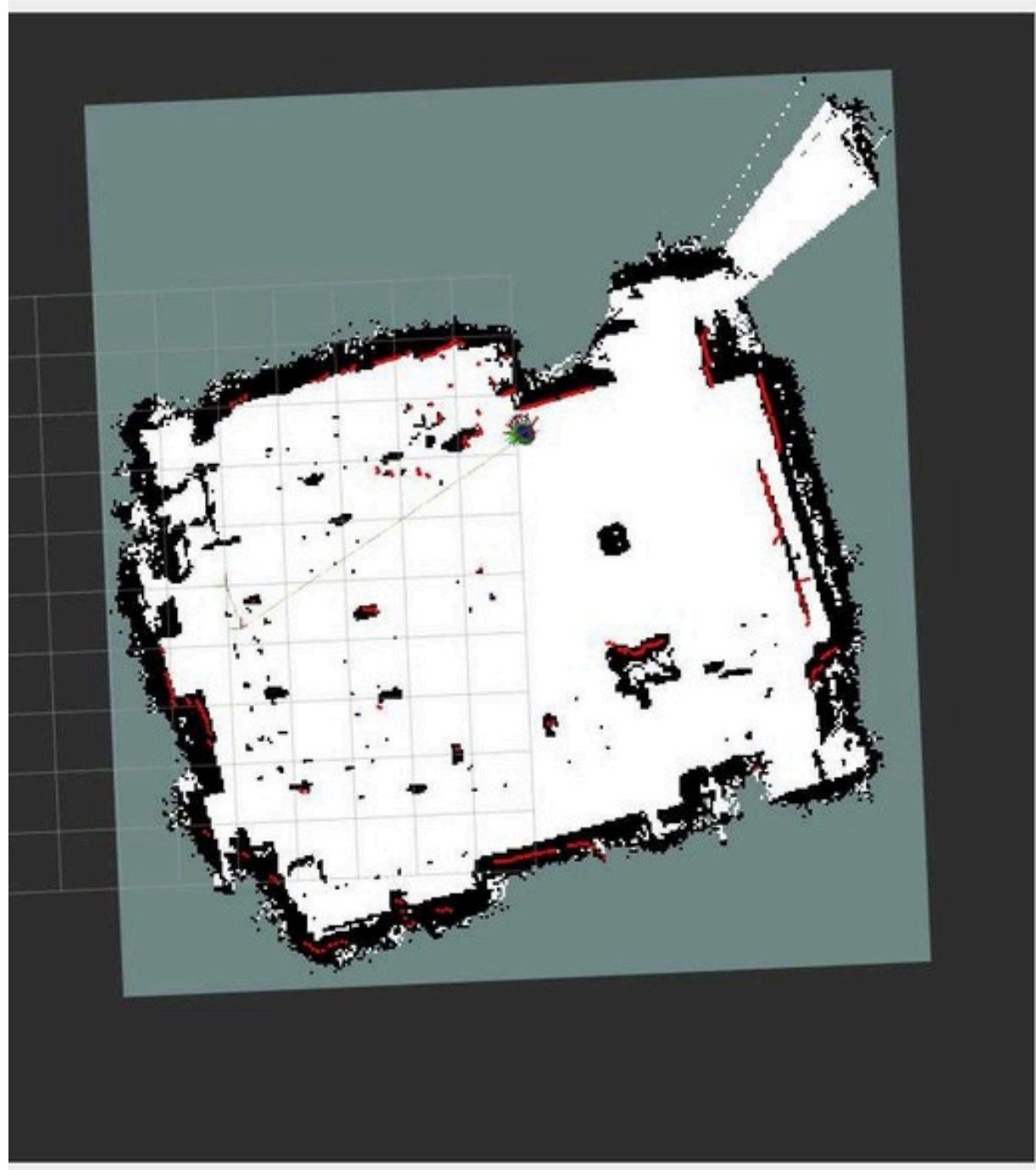
實際 SLAM 的過程:

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

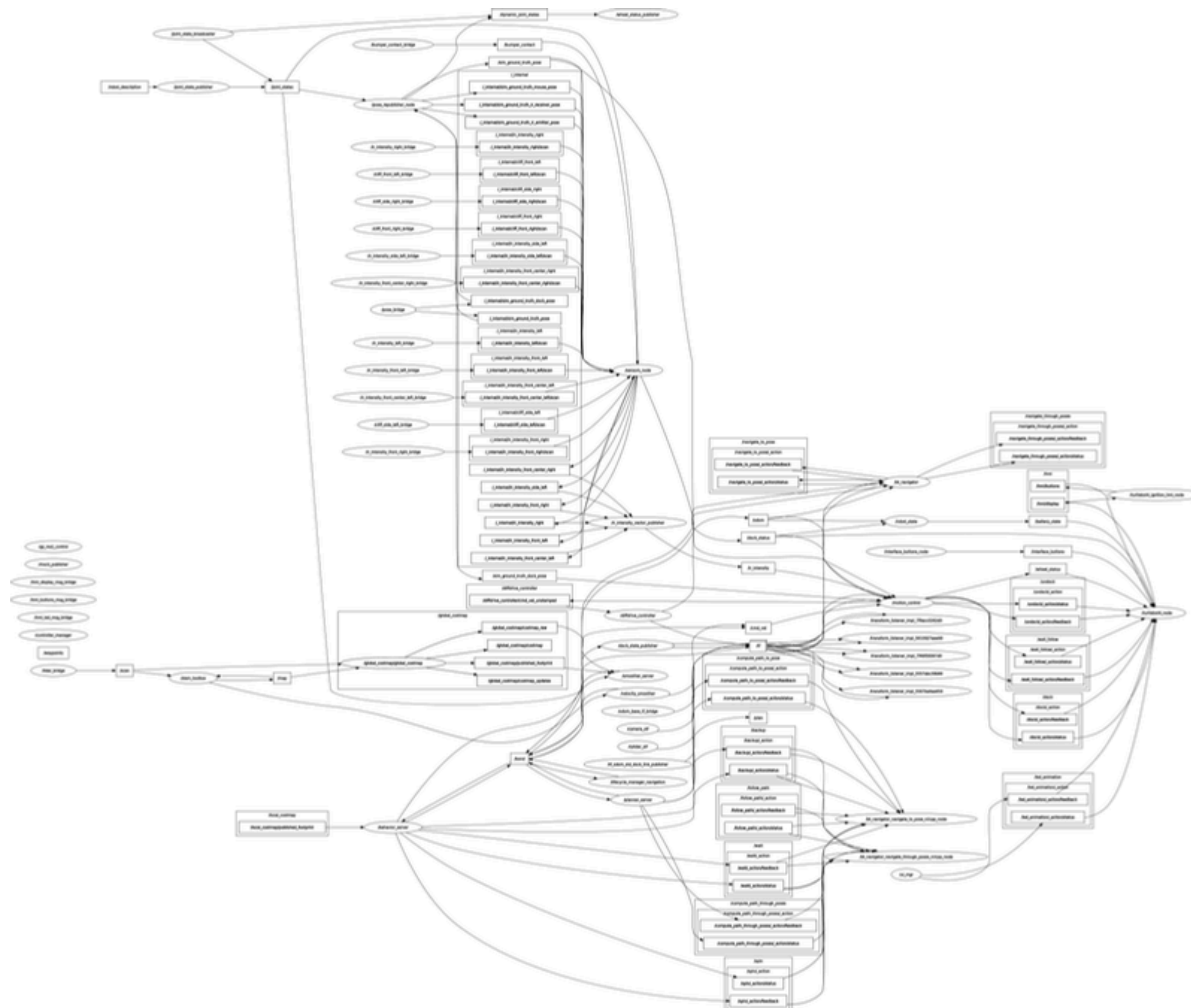


實體SLAM結果圖



70827教室

EXPERIMENT EVALUATIONS



TurtleBot通訊節點圖 (rqt_graph)

EXPERIMENT EVALUATIONS

Default - rqt				
File Plugins Running Perspectives Help				
Topic Monitor				
Topic	Type	Bandwidth	Hz	Value
<input checked="" type="checkbox"/> /internal/backup_limit	irobot_create_msgs/msg/HazardDetection	unknown	unknown	
<input checked="" type="checkbox"/> /internal/bumper/event	irobot_create_msgs/msg/HazardDetection	unknown	unknown	
<input checked="" type="checkbox"/> /internal/cliff_front_left/event	irobot_create_msgs/msg/HazardDetection	unknown	unknown	
<input checked="" type="checkbox"/> /internal/cliff_front_left/scan	sensor_msgs/msg/LaserScan	unknown	15.89	
<input checked="" type="checkbox"/> /internal/cliff_front_right/event	irobot_create_msgs/msg/HazardDetection	unknown	unknown	
<input checked="" type="checkbox"/> /internal/cliff_front_right/scan	sensor_msgs/msg/LaserScan	unknown	15.89	
<input checked="" type="checkbox"/> /internal/cliff_side_left/event	irobot_create_msgs/msg/HazardDetection	unknown	unknown	
<input checked="" type="checkbox"/> /internal/cliff_side_left/scan	sensor_msgs/msg/LaserScan	unknown	15.79	
<input checked="" type="checkbox"/> /internal/cliff_side_right/event	irobot_create_msgs/msg/HazardDetection	unknown	unknown	
<input checked="" type="checkbox"/> /internal/cliff_side_right/scan	sensor_msgs/msg/LaserScan	unknown	15.79	
<input checked="" type="checkbox"/> /internal/create3_buttons	std_msgs/msg/int32	unknown	unknown	
<input checked="" type="checkbox"/> /internal/ir_intensity_front_center_left	irobot_create_msgs/msg/irintensity	unknown	unknown	
<input checked="" type="checkbox"/> /internal/ir_intensity_front_center_left/scan	sensor_msgs/msg/LaserScan			not monitored
<input checked="" type="checkbox"/> /internal/ir_intensity_front_center_right	irobot_create_msgs/msg/irintensity	unknown	unknown	
<input checked="" type="checkbox"/> /internal/ir_intensity_front_center_right/scan	sensor_msgs/msg/LaserScan	unknown	15.86	
<input type="checkbox"/> /internal/ir_intensity_front_left	irobot_create_msgs/msg/irintensity			not monitored
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<input checked="" type="checkbox"/> /internal/ir_intensity_front_right	irobot_create_msgs/msg/irintensity	unknown	unknown	
<input type="checkbox"/> /internal/ir_intensity_front_right/scan	sensor_msgs/msg/LaserScan			not monitored
<input checked="" type="checkbox"/> /internal/ir_intensity_left	irobot_create_msgs/msg/irintensity	unknown	unknown	
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<input type="checkbox"/> /internal/sim_ground_truth_dock_pose	tf2_msgs/msg/TFMessage			not monitored
<input checked="" type="checkbox"/> /internal/sim_ground_truth_ir_emitter_pose	nav_msgs/msg/Odometry	unknown	unknown	
<input type="checkbox"/> /internal/sim_ground_truth_ir_receiver_pose	nav_msgs/msg/Odometry			not monitored
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<input type="checkbox"/> /internal/wheel_drop/left_wheel/event	irobot_create_msgs/msg/HazardDetection			not monitored
<input type="checkbox"/> /internal/wheel_drop/right_wheel/event	irobot_create_msgs/msg/HazardDetection			not monitored
<input type="checkbox"/> /assisted_teleop/action/feedback	nav2_msgs/action/AssistedTeleop_FeedbackMessage			can not get message class for type "nav2_msgs/action/AssistedTeleop_FeedbackMessage"
<input type="checkbox"/> /assisted_teleop/action/status	action_msgs/msg/GoalStatusArray			not monitored
<input type="checkbox"/> /audio_note_sequence/action/feedback	irobot_create_msgs/action/AudioNoteSequence_FeedbackMessage			can not get message class for type "irobot_create_msgs/action/AudioNoteSequence_FeedbackMessage"
<input type="checkbox"/> /audio_note_sequence/action/status	action_msgs/msg/GoalStatusArray			not monitored
<input type="checkbox"/> /backup/action/feedback	nav2_msgs/action/BackUp_FeedbackMessage			can not get message class for type "nav2_msgs/action/BackUp_FeedbackMessage"
<input type="checkbox"/> /backup/action/status	action_msgs/msg/GoalStatusArray			not monitored
<input type="checkbox"/> /battery_state	sensor_msgs/msg/BatteryState			not monitored
<input type="checkbox"/> /behavior_server/transition_event	lifecycle_msgs/msg/TransitionEvent			not monitored
<input type="checkbox"/> /behavior_tree_log	nav2_msgs/msg/BehaviorTreeLog			not monitored
<input type="checkbox"/> /bond	bond_msgs/msg/Status			not monitored
<input type="checkbox"/> /bot_navigator/transition_event	lifecycle_msgs/msg/TransitionEvent			not monitored
<input type="checkbox"/> /bumper_contact	ros_gz_interfaces/msg/Contacts			not monitored
<input type="checkbox"/> /clicked_point	geometry_msgs/msg/PointStamped			not monitored
<input type="checkbox"/> /clock	roscgraph_msgs/msg/Clock			not monitored
<input type="checkbox"/> /cmd_audio	irobot_create_msgs/msg/AudioNoteVector			not monitored
<input type="checkbox"/> /cmd_lightring	irobot_create_msgs/msg/LightRingLeds			not monitored
<input type="checkbox"/> /cmd_vel	geometry_msgs/msg/Twist			not monitored
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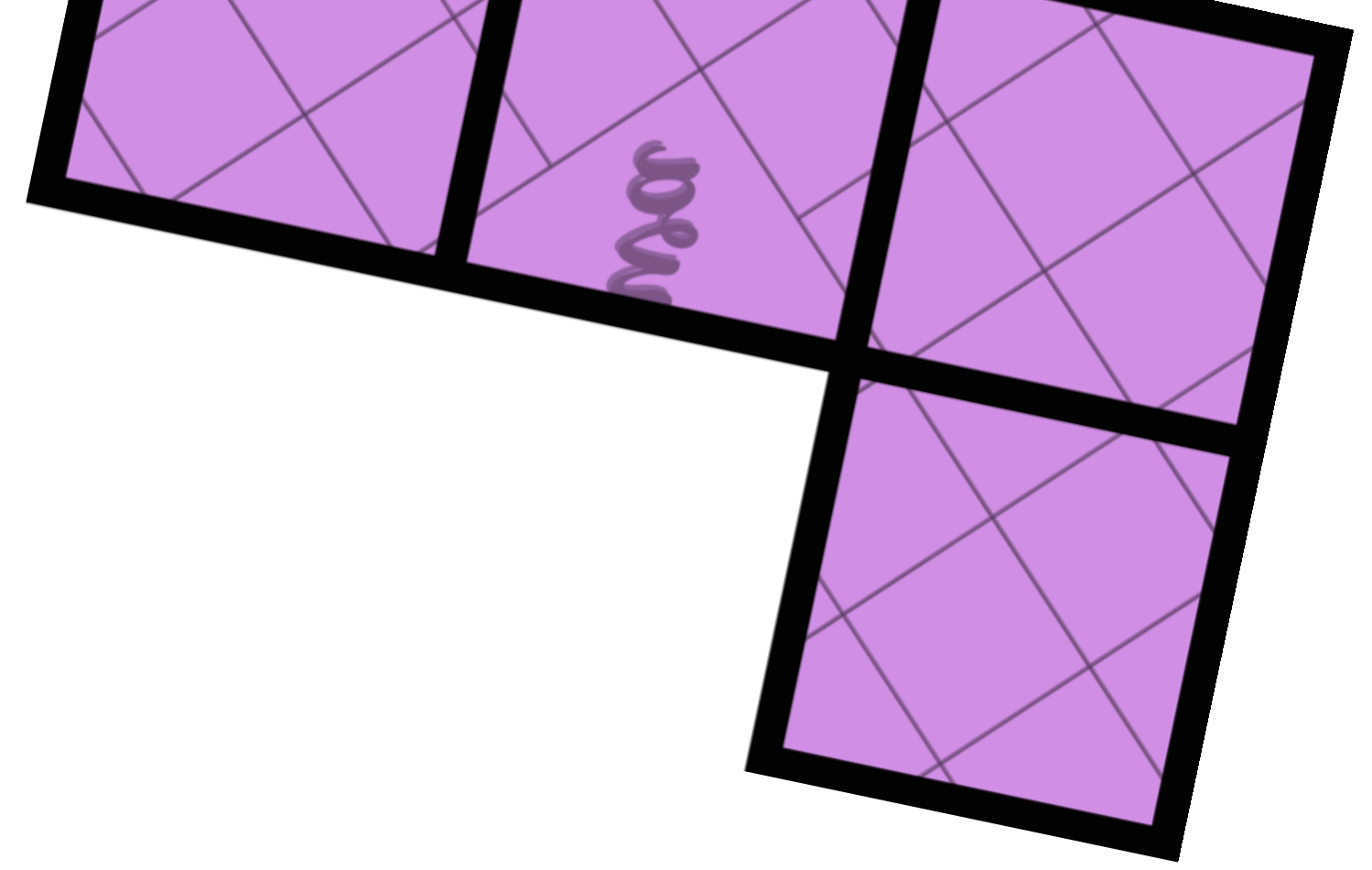
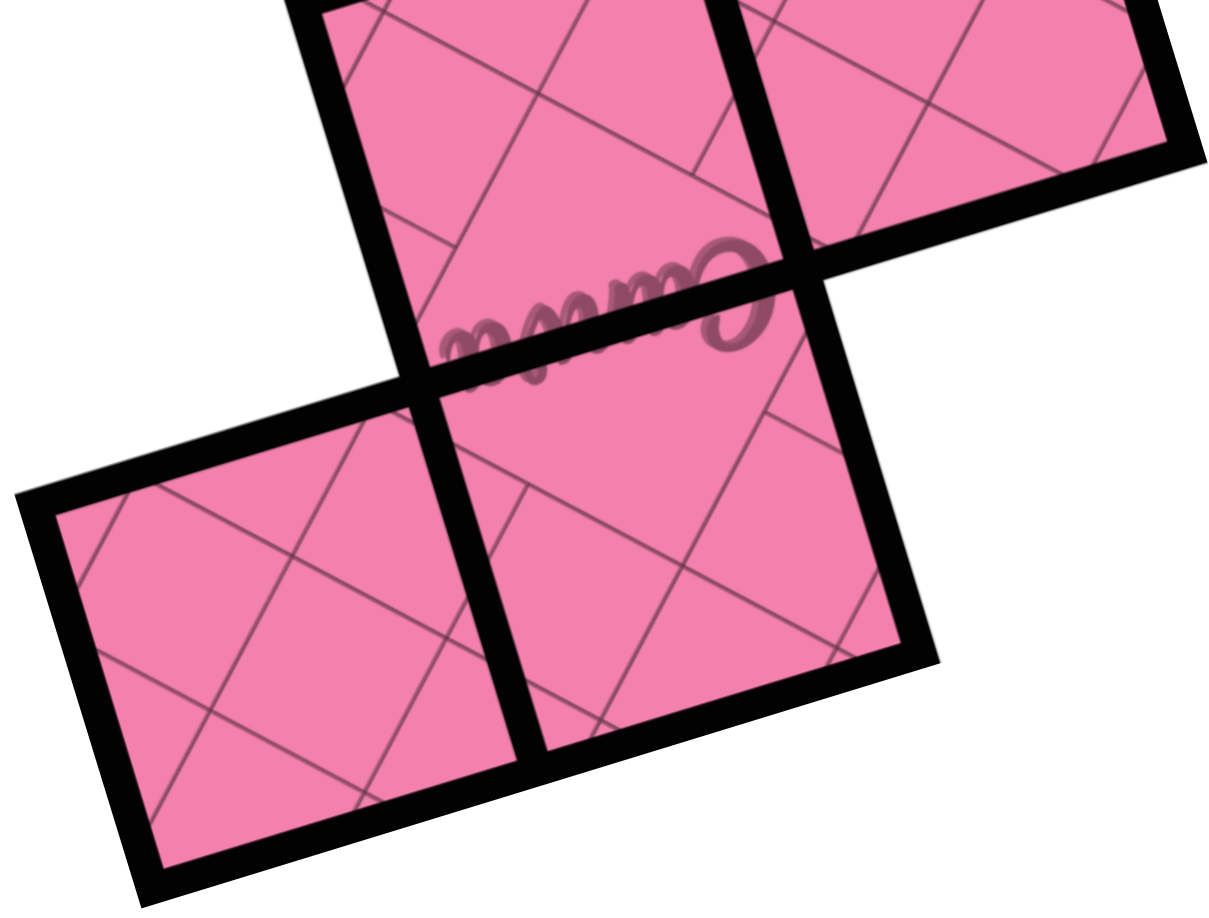
rqt控制頁面

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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1093717	陳嵒凱	25%	環境建置、定位與地圖構建、成果報告書製作
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Thank you

