POSTER ID
DCSE 21

SLAM-BASED NAVIGATION SYSTEM WITH RTAB-MAP AND A* ALGORITHM FOR MOBILE ROBOT MOTION PLANNING IN CONSTRAINED ENVIROMENT

MUHAMMAD AMIRULLAH BIN HAMZAH (2020952501)
BACHELOR OF ENGINEERING (HONS.) MECHANICAL
SCHOOL OF MECHANICAL ENGINEERING

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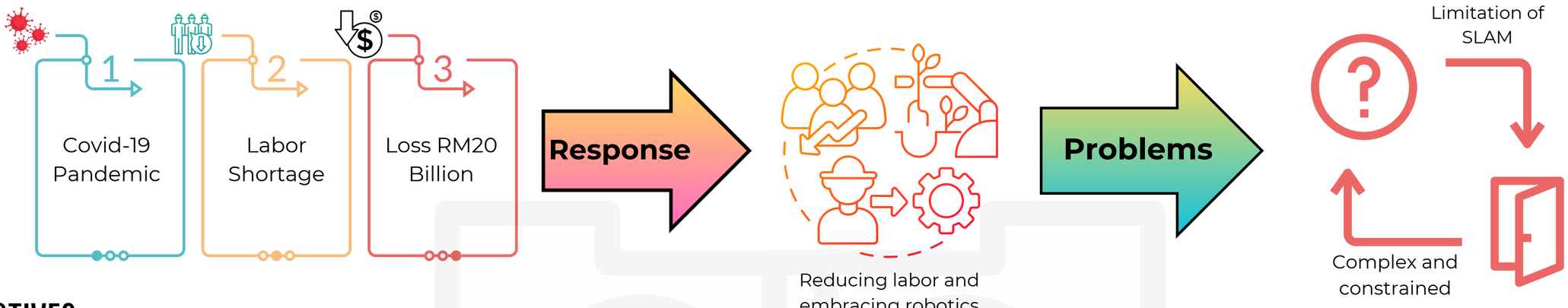
1. INTRODUCTION



OBJECTIVES

- Integrate software and hardware components
- Develop navigation algorithms
- Evaluate the performance

SCOPE OF WORK

- Simulation study of oil palm plantation at coastal area
- Husky UGV serve as hardware
- Robot Operating System (ROS) Noetic Ninjemys

2. METHODOLOGY

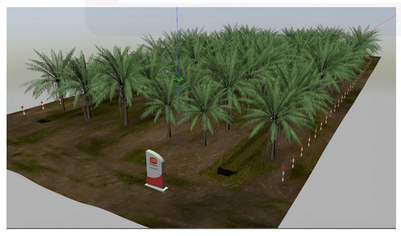
Phase 1: Feasibility Study

Phase 2: Framework Design

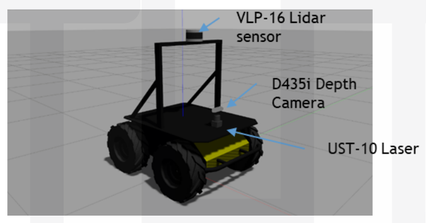
Phase 3: Simulation Analysis

TARGET AREA

Oil palm plantation at coastal area

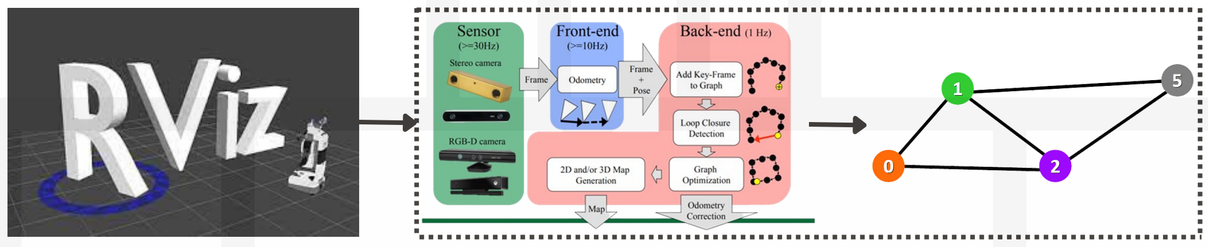


Digitalized oil palm plantation in Gazebo simulator



Husky UGV equipped with VLP-16 Lidar, depth camera and laser

ROS Noetic Ninjemys as framework



Mapping process and A* algorithms implementation

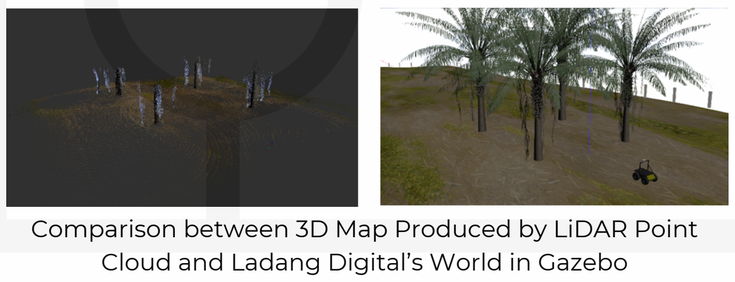
SENSORS

Velodyne VLP-16 3D LiDAR

Intel Realsense D435i Depth Camera

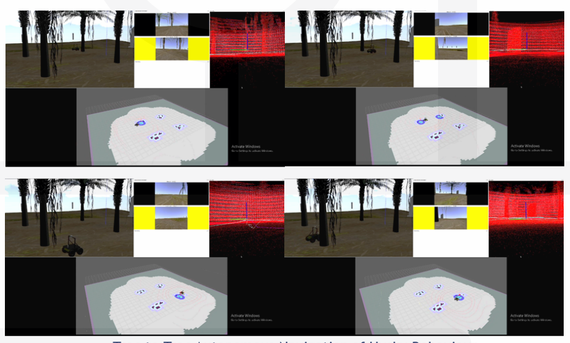
Hokuyo UST-10 Laser

3. RESULT

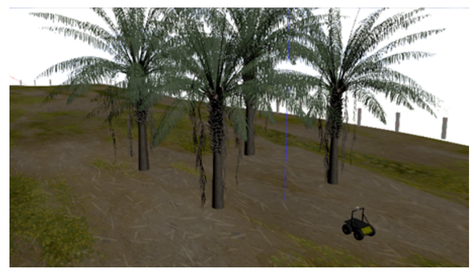


Comparison between 3D Map Produced by LiDAR Point Cloud and Ladang Digital's World in Gazebo

- Tree to tree autonomous navigation

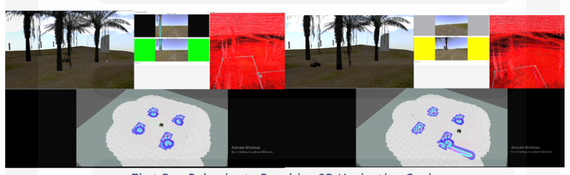


Tree to Tree Autonomous Navigation of Husky Behaviour



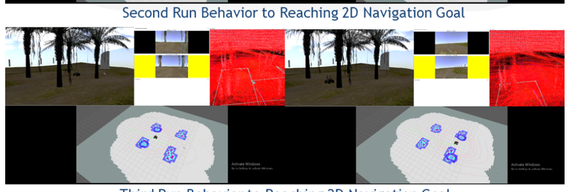
- Navigate in straight line without static obstacles
- Navigate in straight line with static obstacles
- Tree to tree autonomous navigation

- 2D Navigation without statics obstacles

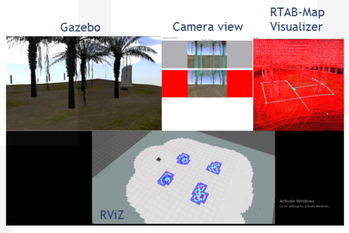


First Run Behavior to Reaching 2D Navigation Goal

Second Run Behavior to Reaching 2D Navigation Goal



Third Run Behavior to Reaching 2D Navigation Goal

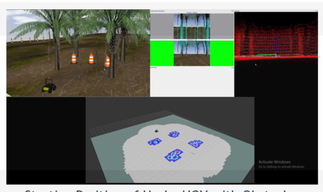


Starting Position of Husky UGV without Obstacles

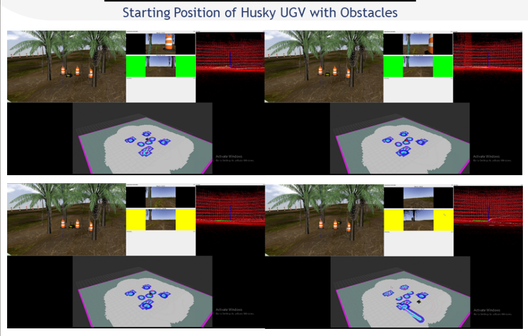
Trial no.	Time duration (s)
1	31.58
2	32.79
3	34.01

Time Taken for Husky Moving to 2D Navigation Goal Within 18.043 m in Each Iteration

- 2D Navigation with statics obstacles



Starting Position of Husky UGV with Obstacles



Series of Husky Behaviour when Facing Obstacles to Reach Navigation Goal

4. CONCLUSION

1. LiDAR sensors combined with A* pathfinding algorithms facilitate safe robotic navigation in plantation environments, specifically in settings like palm oil estates.

2. The study suggests broader applications of this technology in agricultural and industrial fields due to its effectiveness.

3. Despite challenges such as diverse weather conditions and ongoing technical refinement, there is a clear path forward to enhance autonomous systems using LiDAR and A* pathfinding.

4. The integration of the Husky Unmanned Ground Vehicle (UGV) with RTAB-Map demonstrates advanced Simultaneous Localization and Mapping (SLAM) capabilities, contributing to efficient 3D mapping and navigation tasks.

5. This progress marks a significant step toward versatile, autonomous robotic solutions applicable in various operational settings.

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