

CHARGING AND DOCKING MECHANISM FOR AMR USING APRILTAG

By

EDGARD HARYA WIRATARA

12101013

BACHELOR'S DEGREE

in

MECHANICAL ENGINEERING - MECHATRONIC CONCENTRATION

FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY



SWISS GERMAN UNIVERSITY

The Prominence Tower

Jalan Jalur Sutera Barat No 15, Alam Sutera

Tangerang, Banten 15143 - Indonesia

16,07,2025



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STATEMENT BY THE AUTHOR

Name of Student : Edgard Harya Wiratara
Student ID : 12101013
Faculty : Engineering & Information Technology
Study Program : Mechanical Engineering – Mechatronics concentration
Date of Defense : 7 July 2025
Thesis Title : CHARGING AND DOCKING MECHANISM FOR AMR USING APRILTAG

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Edgard Harya Wiratara
(Name of Student)

Approved by:
Date: 16 July 2025

Dr. Rusman Rusyadi
(Thesis Advisor)

Acknowledged by:
Date: 16 July 2025

Dr. Maulahikmah Galinium, S.Kom, M.Sc.
(Dean of Faculty of Engineering & Information Technology)

The Prominence Tower, Alam Sutera
Jalan Jalur Sutra Barat No.15, Tangerang 15143 – Indonesia
Telp : (+62) 21 2977 9596/9597 | Fax : (+62) 21 2977 9598
www.sgu.ac.id

• **ABSTRACT**

By

Edgard Harya Wiratara

Dr. Rusman Rusyadi, Advisor

SWISS GERMAN UNIVERSITY

This thesis presents the design, integration, and evaluation of an autonomous docking system for a AMR using AprilTag visual fiducial markers within the ROS2 framework. The primary objective is to enable accurate and repeatable docking to a charging station without human intervention. The system combines visual perception, SLAM-based localization, and a custom mechanical dock design to ensure reliable alignment and contact between the AMR and the charger. Methodologically, the project utilizes SLAM Toolbox for mapping, Nav2 for navigation, and a custom docking server integrated with AprilTag detection to guide the robot to the charging dock. Docking performance is evaluated both with and without a predefined staging pose, analyzing the precision and accuracy of the final pose using standard deviation and Root Mean Square Error (RMSE). The results show that the proposed docking system is capable of correcting misalignment up to 6.93° , and achieves positional accuracy with an average RMSE below 0.3 meters.

keywords: Autonomous Mobile Robot, ROS2, Simultaneous Localization and navigation, Navigation 2

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DEDICATION

I dedicate this work for the future of the automation industry in Indonesia.



• ACKNOWLEDGEMENTS

I would like to express my gratitude to all those who have supported me throughout the course of this thesis work. My heartfelt thanks go to my family and friends, with whom I spent most of my time during this journey, sharing ideas, discussing challenges, and offering mutual encouragement. I am especially thankful to my thesis advisor, Dr. Rusman Rusyadi, for his guidance, insightful feedback, and support during my research. I am also deeply grateful to my fellow comrades—Nathanael Wijaya Saputra, Richky, Nicolas Kenneth, Vassetha, and Juan Roderick—for their companionship and moral support, which made the entire process more bearable. Lastly, I would appreciate my parents for providing me with the opportunity to pursue my that enabled me to complete this thesis..



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