

**DESIGN AND SIMULATION OF A MULTI-PURPOSE AUTONOMOUS
MOBILE ROBOT FOR MATERIAL HANDLING AT PT. SAT
NUSAPERSADA TBK BATAM**

By

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12201020

BACHELOR'S DEGREE
in

MECHATRONIC
ENGINEERING AND INFORMATION TECHNOLOGY



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Revision after the Thesis Defense on 12 June 2026

STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.



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ABSTRACT

DESIGN AND SIMULATION OF MULTI-PURPOSE AUTONOMOUS MOBILE ROBOT FOR MATERIAL HANDLING AT PT. SAT NUSAPERSADA TBK

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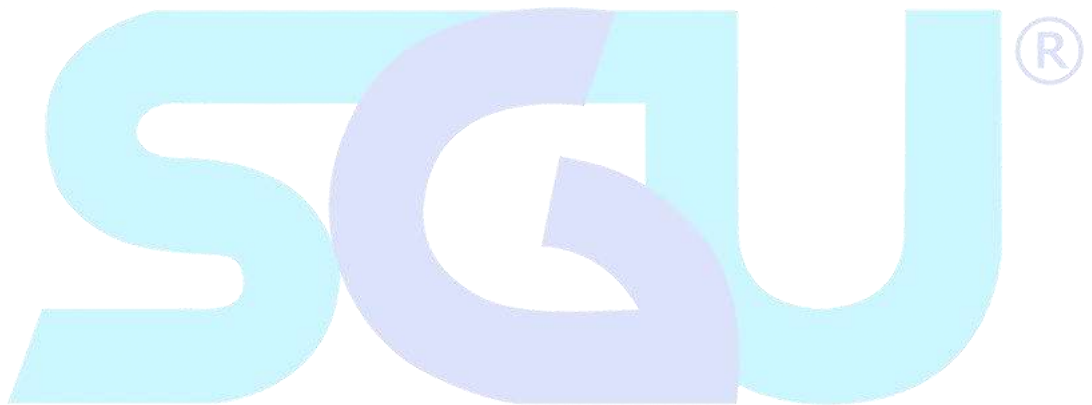
This thesis develops the design and simulation of Autonomous Mobile Robot (AMR) for material handling focusing on mechanical design, scissor lifting, and sensor fusion investigation. The mechanical design consists of a hollow steel square frame with bent sheet metal covers and differential-drive mechanism. A scaled-down scissor lifter with CNC-machined parts powered by NEMA 23 stepper motor. Mechanical design is validated with Finite Element Analysis (FEA) in SolidWorks. Sensor fusion and navigational component contribution investigation was evaluated on the company's existing hardware under a ROS Noetic using GMCL localization. FEA results confirmed that the chassis achieved a Factor of Safety (FoS) of 4.60 and stiffness of 5350.9 N/mm under 100kg load. Scissor lift testing demonstrated capability for load up to 70kg and 0.73mm positioning error, with shaft bending at 75kg load. The full fusion configuration achieved an average positional error of 3.16cm, while the encoder and LiDAR removal caused significant degradation ($p < 0.001$), IMU removal produced no significant change ($p = 0.313$). It is hoped that the results of this thesis can serve as a foundation for AMR deployment at PT Sat Nusapersada Tbk Batam.

Keywords: Autonomous Mobile Robot, Finite Element Analysis, Scissor Lifter, Sensor Fusion, ROS.



DEDICATION

I dedicate this work to my family, to the advancement of AMRs, and to the robotics industry at PT Sat Nusapersada Tbk Batam.



ACKNOWLEDGEMENTS

First, I would like to thank the almighty God that I could finish this thesis work on time despite all of the sudden changes, problems, and obstacles.

I would like to express my gratitude to the following individuals; without them I would not be able to finish this thesis work.

Dr. Rusman Rusyadi, B. Sc., M. Sc. and Mr. Leonard P Rusli, M. Sc., Ph. D. as my advisor and co-advisor for this thesis. Because of their guidance and understanding of the field and insight which guided me throughout this thesis.

The PT Sat Nusapersada Tbk Batam team, PI Department Head Mr. Eko Budianto, my supervisor Mr. Alfarizqi A M S.ST, and others. This thesis would not have been possible without their support.

My family, whose supports are beyond measure. Their supports and presence made the difficult moments more bearable.

My girlfriend, whose constant encouragement has been the source of motivation that carried through to the completion of this thesis.

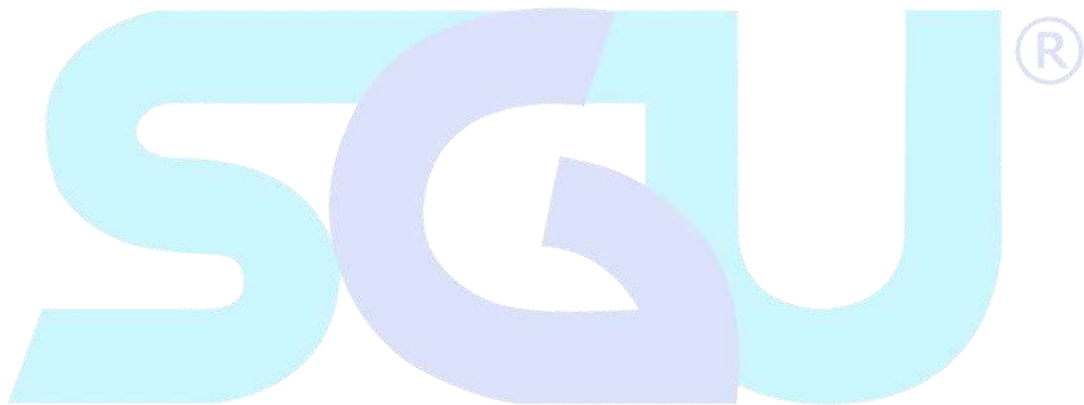
My SGU colleagues, who I fought through this journey together with. Their additional support enabled me to always find the correct path for this thesis.

TABLE OF CONTENTS

	Page
STATEMENT BY THE AUTHOR.....	2
ABSTRACT.....	3
DEDICATION.....	5
ACKNOWLEDGEMENTS	6
TABLE OF CONTENTS	7
LIST OF FIGURES.....	10
LIST OF TABLES.....	14
CHAPTER 1 – INTRODUCTION.....	16
1.1 Background.....	16
1.2 Research Problem	17
1.3 Research Objectives.....	17
1.4 Research Questions.....	17
1.5 Hypothesis.....	18
1.6 Research Scope and Limitation	18
1.7 Significance of Study	19
CHAPTER 2 – LITERATURE REVIEW.....	20
2.1 Company Overview	20
2.2 Theoretical Perspectives	21
2.2.1 Autonomous Mobile Robots (AMRs).....	21
2.2.2 AMRs vs AGVs	22
2.2.3 ROS 2.....	23
2.2.4 Micro-ROS.....	24
2.2.5 Localization.....	25
2.2.6 Simultaneous Localization and Mapping (SLAM).....	26
2.2.7 Finite Element Analysis	27
2.2.8 Scissor Lifting Mechanism	28
2.2.9 Existing AMR Designs	29
2.2.10 LiDARs	31
2.2.11 Inertial Measurement Unit	33

2.2.12 Paired-Sample T Test Method	34
2.3 Review of Previous Studies	35
2.3.1 Mechanical Improvement on Autonomous Mobile Robot	35
2.3.2 Development of Indoor Logistic AMR Based on ROS 2	36
2.3.3 Analysis of Localization Algorithms for ROS-Based Mobile Industrial Robots	37
2.4 Research Gap and Novelty	38
2.4.1 Research Gap	38
2.4.2 Novelty	38
CHAPTER 3 – RESEARCH METHODS	39
3.1 Research Framework	39
3.2 Research Design	40
3.3 Data Collection Methods	40
3.3.1 Mechanical Data	41
3.3.2 Scissor Lift Force Actuator Data	41
3.3.3 Navigation Odometry Data	41
3.4 Data Analysis Techniques	41
3.5 Required Materials and Equipment	42
CHAPTER 4 – RESULTS AND DISCUSSIONS	49
4.1 Mechanical Design	49
4.1.1 Computer Aided Design and Justification	49
4.2 Procurement Issue Context	54
4.3 Mechanical Structure Test	55
4.3.1. Scissor Lift	55
4.3.2 AMR Chassis	56
4.3.3. Lifter Top Part	60
4.4 Scissor Lift Prototype Test	60
4.4.1 Scissor Lifter Prototype Assembly Result	61
4.4.2 Scissor Lifter Prototype Test	61
4.4.3 Positioning Error Test Results	63
4.5 Positional Accuracy Test	63
4.5.1 LiDAR Merged Scan Accuracy	63
4.5.2 Full Fusion Positional Accuracy Test	65
4.5.3 Without LiDAR Positional Accuracy Test	67
4.5.4 Without Encoder Positional Accuracy Test	69
4.5.5 Without IMU Positional Accuracy Test	71

4.5.6 Statistical Analysis.....	73
CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS	74
5.1 Conclusions.....	74
5.2 Recommendations.....	75



LIST OF FIGURES

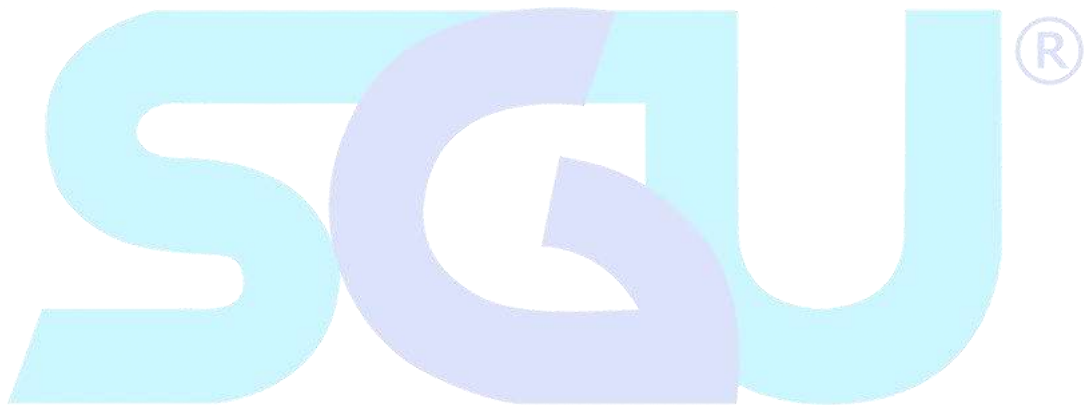
Figure	Page
1. Figure 2.1 PT Sat Nusapersada Tbk Building	20
2. Figure 2.2 ROS 2 Logo.....	23
3. Figure 2.3 Jazzy Jalisco Logo.....	23
4. Figure 2.4 Gazebo Logo	24
5. Figure 2.5 Micro-ROS Logo.....	24
6. Figure 2.6 Micro-ROS Architecture	25
7. Figure 2.7 Sample Localization with Cartesian Map	25
8. Figure 2.8 SLAM Concept.....	26
9. Figure 2.9 Finite Element Analysis	27
10. Figure 2.10 Scissor Lift with Lead Screw	29
11. Figure 2.11 MIR100	29
12. Figure 2.12 PUDU T150.....	30
13. Figure 2.13 Geek+ M200C	30
14. Figure 2.14 RPLiDAR S3	31
15. Figure 2.15 HPS-3D160-Pro.....	32
16. Figure 2.16 TiM240.....	32
17. Figure 2.17 IMU BNO055	33
18. Figure 2.18 AMR Chassis (Previous Study 1).....	36
19. Figure 3.1 Research Flowchart	39

20. Figure 3.2 Teensy 4.1	43
21. Figure 3.3 Intel NUC 13 Pro.....	43
22. Figure 3.4 ZLLG80ASM250-L V3.0	44
23. Figure 3.5 ZLAC8015D Motor Driver	45
24. Figure 3.6 BNO055 IMU	45
25. Figure 3.7 LiFePO4 Battery.....	46
26. Figure 3.8 C-CTEJ125-N Caster Wheel	47
27. Figure 3.9 NEMA 34 Stepper Motor	47
28. Figure 3.10 ZED 2 Camera.....	48
29. Figure 4.1 AMR Design View 1	49
30. Figure 4.2 AMR Design View 2	49
31. Figure 4.3 AMR Bottom View	49
32. Figure 4.4 AMR Internal View.....	49
33. Figure 4.5 AMR Main Structure Exploded View	50
34. Figure 4.6 Wheel Suspension Mechanism Exploded View.....	51
35. Figure 4.7 Scissor Lift with Structure Exploded View.....	52
36. Figure 4.8 Scaled-down Scissor Lifter Prototype Structure Exploded View	53
37. Figure 4.9 Previous AMR Hardware	54
38. Figure 4.10 Modified LiDAR Mounting Plate	54
39. Figure 4.11 Scissor Lift Min Angle Stress Analysis	55
40. Figure 4.12 Scissor Lift Max Angle Stress Analysis.....	56
41. Figure 4.13 Base Plate Displacement Analysis	56
42. Figure 4.14 Base Plate Stress Analysis.....	57
43. Figure 4.15 Base Plate with Hollow Steel Frame Displacement Analysis	57

44. Figure 4.16 Base Plate with Hollow Steel Frame Stress Analysis	58
45. Figure 4.17 Base Plate with Hollow Steel Frame Factor-of-Safety Analysis	58
46. Figure 4.18 Top Lifter Stress Analysis	60
47. Figure 4.19 Top Lifter Displacement Analysis	60
48. Figure 4.20 Scissor Lifter Prototype Minimum Lift Height	61
49. Figure 4.21 Scissor Lifter Prototype Maximum Lift Height	61
50. Figure 4.22 DM542 Stepper Driver	61
51. Figure 4.23 Weighing Machine	62
52. Figure 4.24 Load for Scissor Lifter Prototype Test	62
53. Figure 4.25 Moving Shaft Bent with 75kg Load	62
54. Figure 4.26 Mapping with Merged LiDAR Result	64
55. Figure C.1 t-Test Distribution Table	87
56. Figure C.2 Scissor Lift Simplified	88
57. Figure C.3 Scissor Lift Free Body Diagram	88
58. Figure C.4 Scissor Lift Non-Ideal Condition Front Focus Displacement	88
59. Figure C.5 Scissor Lift Non-Ideal Condition Right Focus Displacement	89
60. Figure C.6 Scaled Down Scissor Lift Stress Analysis with 120kg Load	89
61. Figure C.7 Scaled Down Scissor Lift FoS Analysis with 120kg Load	89
62. Figure C.8 Scaled Down Scissor Lift Stress Analysis with 70kg Load	90
63. Figure C.9 Scaled Down Scissor Lift FoS Analysis with 70kg Load	90
64. Figure C.10 Top Lifter Non-Ideal Condition Front Focus Displacement	90
65. Figure C.11 Top Lifter Non-Ideal Condition Right Focus Displacement	91
66. Figure C.12 Base Plate with Hollow Steel Frame Non-Ideal Right Focus Displacement	91

67. Figure C.13 Base Plate with Hollow Steel Frame Non-Ideal Front Focus

Displacement	91
68. Figure C.14 RQT Graph Full Fusion	92
69. Figure C.15 RQT Graph Without LiDAR	93
70. Figure C.16 RQT Graph Without Encoder	94
71. Figure C.17 RQT Graph Without IMU	95
72. Figure C.18 Mapping with GMapping	96
73. Figure C.19 GMCL Pose Array Arrows	96



LIST OF TABLES

Table	Page
1. Table 2.1 Comparison of AGVs and AMRs	22
2. Table 2.2 LiDARs Comparison Table	32
3. Table 2.3 Previous Studies Review	35
4. Table 4.1 Scissor Lifter Positioning Error Test Result	63
5. Table 4.2 LiDAR Merged Accuracy Test.....	64
6. Table 4.3 Full Fusion Physical Odometry Error Measurement	65
7. Table 4.4 Full Fusion EKF Odometry Error Measurement	65
8. Table 4.5 Full Fusion Angular Error Measurement.....	66
9. Table 4.6 Without LiDAR Physical Odometry Error Measurement	67
10. Table 4.7 Without LiDAR EKF Odometry Error Measurement	67
11. Table 4.8 Without LiDAR Angular Error Measurement.....	68
12. Table 4.9 Without Encoder Physical Odometry Error Measurement	69
13. Table 4.10 Without Encoder EKF Odometry Error Measurement	69
14. Table 4.11 Without Encoder Angular Error Measurement.....	70
15. Table 4.12 Without IMU Physical Odometry Error Measurement	71
16. Table 4.13 Without IMU EKF Odometry Error Measurement.....	71
17. Table 4.14 Without IMU Angular Error Measurement	72
18. Table 4.15 Paired Sample t-Test for Means.	73
19. Table 4.16 RMSE Calculation	73
20. Table A.1 Electrical BOM Table	81

21. Table A.2 Mechanical BOM Table.....	82
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