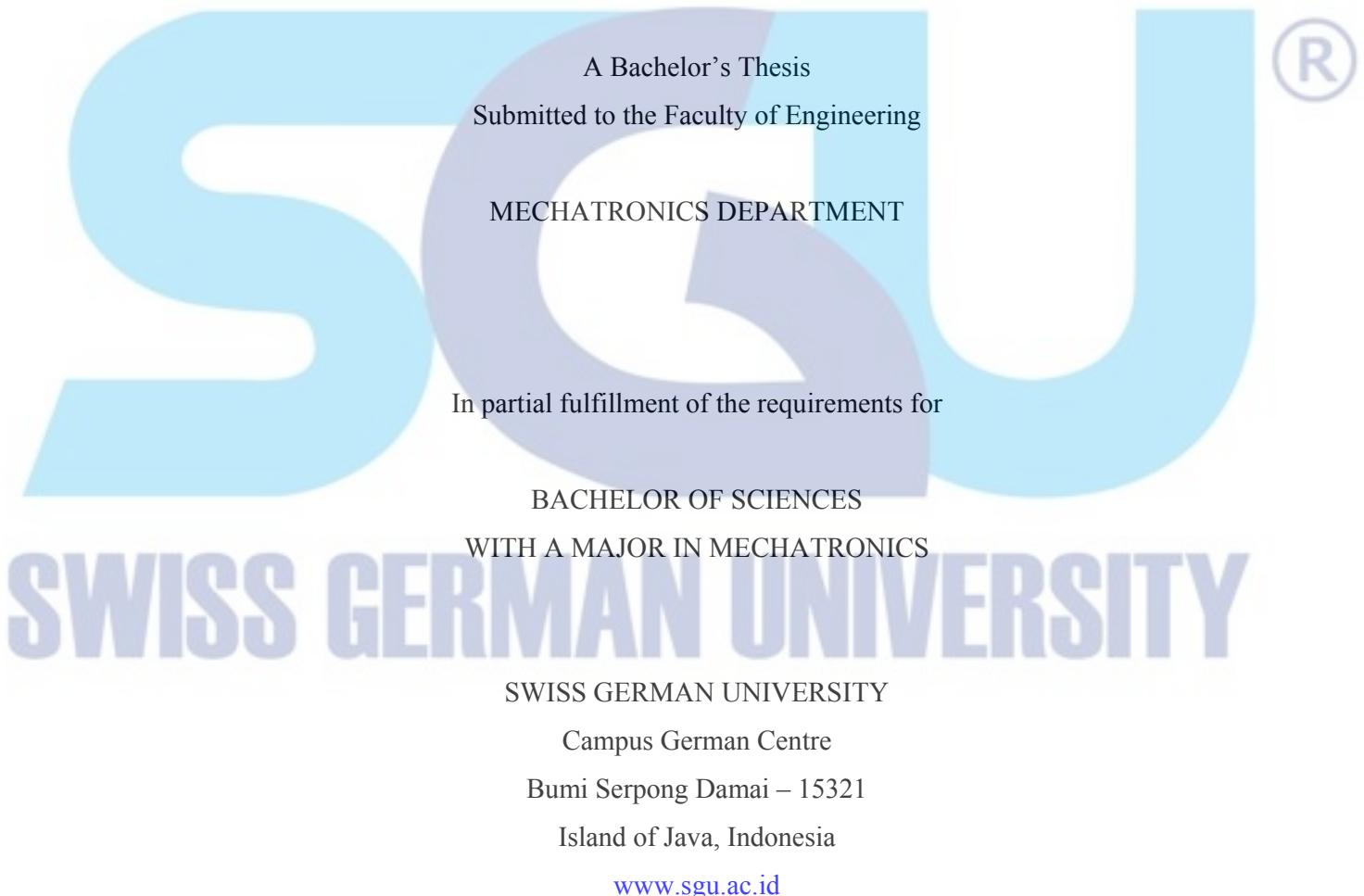


**IMPROVING MECHANICAL PLATFORM AND NAVIGATION SYSTEM
OF AN EXISTING MOBILE ROBOT**

By

Mario Gunawan

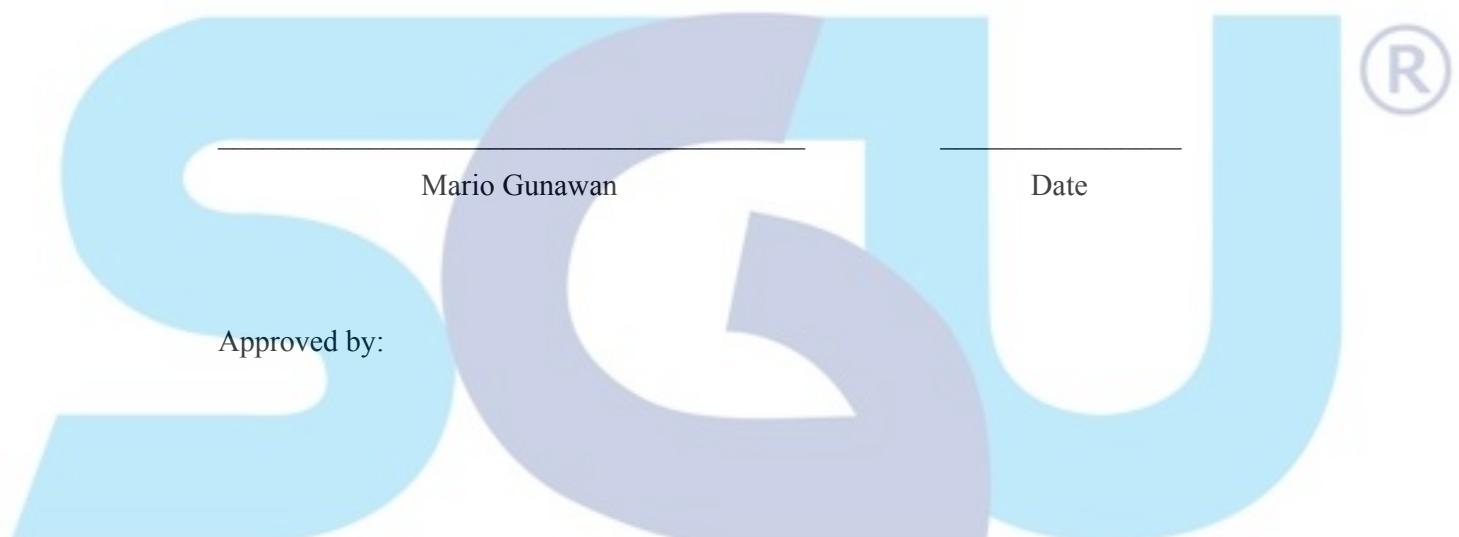


July 2008

Revision after the Thesis Defense on 13th of August 2008

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.



Edward Boris Manurung, M.E

Date

Tutuko Prajogo, PhD

Date

Chairman of the Examination Steering Committee

Date

Mario Gunawan

ABSTRACT

IMPROVING MECHANICAL PLATFORM AND NAVIGATION SYSTEM OF AN EXISTING MOBILE ROBOT

By

Mario Gunawan

SWISS GERMAN UNIVERSITY

Bumi Serpong Damai

Edward Boris Manurung, M.E

Tutuko Prajogo, PhD



This thesis project is intended to improve mechanical platform and navigation system of an existing mobile robot. The improvements are made based on the analysis of previous system. The major weaknesses in mechanical platform and driving system are solved so the robot has a better maneuver ability and working area. The response and effectiveness of the orientation system are doubled by using additional electronic compass sensor. Improvement in navigation system includes a mechanical stability system and separated transmitter-receiver laser target system. The improved navigation system was tested under indoor environment. The test results showed that the robot performed satisfactorily in navigation and position measurement system.

DEDICATION

I dedicate this thesis to God, my family, my advisors, and all of my colleagues at SGU.



ACKNOWLEDGMENTS

I would like to thank Edward Boris Manurung, M.E and Tutuko Prajogo, PhD, my thesis advisors, who gave their time and efforts to help me to complete my thesis on time.

I would like also to thank Dipl. Ing Maralo Sinaga in solving electrical problems.

The author also would like to thank Mr. Cepi Muhamad Hanafi, SST for his knowledge support and guidance during the completion of this thesis

To all my lecturers in SGU, without your help and assistance over these four years I would not have been in this current place.

Thanks also to Herry Prasetyo, Leonardo Gemuruh, Yodi Adianto, Teja Wibisana, Alzadika Djuhardi, Alexandra Lowe and the others for their supports physically and mentally.

SWISS GERMAN UNIVERSITY

At last but not least, the author would like to show his gratitude to his parents for their mental and financial supports. The helps and supports from the author's colleagues and from SGU's office boys must not be taken lightly as well.

TABLE OF CONTENTS

STATEMENT BY THE AUTHOR.....	2
ABSTRACT.....	3
DEDICATION	4
ACKNOWLEDGMENTS	5
TABLE OF CONTENTS.....	6
LIST OF FIGURES	8
LIST OF TABLES	11
CHAPTER 1 – INTRODUCTION	12
1.1 Background	12
1.2 Thesis Objectives	12
1.3 Thesis Scope	12
1.4 Thesis Limitation	12
1.5 Problem Identification	13
1.6 Thesis Structure	13
CHAPTER 2 – LITERATURE REVIEW	14
2.1 Navigation.....	14
2.2 Position Measurement.....	15
2.3 Related Work	17
CHAPTER 3 – METHODOLOGY	22
3.1 System Design Overview.....	22
3.2 Laser Target Finder System.....	23
3.3 Orientation System.....	25
3.4 Mechanical Design and Driving System.....	25
3.4.1 Mechanical Platforms	27
3.4.2 Mechanical Stability System.....	32
3.5 Electrical Design.....	35
3.5.1 Controller	35
3.5.2 DC Motor controller	38
3.5.3 Optical Encoder	39
3.5.4 Laser Target Finder Sensor.....	40
3.5.5 Ultrasonic Sensor	41
3.5.6 Hitachi® HM55B Compass Module	42
3.5.7 Power Supply	43
3.6 Software and Programming	45
3.6.1 Microcontroller assembler and downloader.....	45
3.6.2 Flowchart Design	46
3.7 Mobile Robot Position Calculation Method	52
3.7.1 Artificial Landmark Recognition	52
3.7.2 Odometry Method.....	53
3.8 Bluetooth Wireless Communication System	54
3.9 Monitoring and Controlling System	56
3.10 Mapping System	57
CHAPTER 4 – RESULT & DISCUSSION.....	58
4.1 Mechanical Aspect.....	58

4.1.1	Body of Mobile Robot	58
4.1.2	Stability System	59
4.1.3	Placement of PING))) Ultrasonic Sensor.....	59
4.1.4	Assembly of Mobile Robot.....	60
4.1.5	Landmark	61
4.2	Electrical Aspect	62
4.2.1	DC Motors	62
4.2.2	DC Motor Controller Board.....	66
4.2.3	Power Supply	67
4.2.4	7805 Regulator Board	68
4.3	Control aspect	68
4.3.1	HM55B Compass Experiment	68
4.3.2	Laser Target Finder Sensor Experiment	72
4.3.3	PING))) Ultrasonic Sensor Experiment	74
4.3.4	Mobile Robot Position Measurement	76
	CHAPTER 5 – CONCLUSION AND RECOMMENDATION	80
	GLOSSARY	81
	REFERENCES	82
	Appendix A – Wiring Diagram	83
	Appendix B – Mechanical Drawing	84
	Appendix C – Datasheet	96
	CURRICULUM VITAE	123

SWISS GERMAN UNIVERSITY