

CONTENTS

APPROVAL	ii
SELF DECLARATION AGAINST PLAGIARISM	iii
ABSTRACT	iv
ABSTRAK	v
CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
1 INTRODUCTION	1
1.1 Background	1
1.2 Research Purpose	2
1.3 Identification of Problems	2
1.4 Scope of Problems	2
1.5 Hypothesis	3
1.6 Research Methodology	3
2 REVIEW OF LITERATURE AND STUDIES	4
2.1 State of The Art	4
2.2 Differential Wheeled Robot	7
2.2.1 <i>Forward Kinematics</i>	9
2.2.2 <i>Inverse Kinematics</i>	9
2.2.3 Two Wheel Drive Mobile Robot	10
2.3 Image Sensor	10
2.3.1 <i>Camera</i>	11
2.4 <i>Digital Image Processing</i>	11
2.4.1 Binary Image	12
2.4.2 Bounding Box	12
2.5 Computer Vision	13
2.6 Navigation System	14
2.7 Fuzzy Sets Theory	15
2.7.1 Fuzzification	15

2.7.2	Triangular Membership Function	16
2.7.3	Trapezoidal Membership Function	16
2.7.4	Gaussian Membership Function	17
2.7.5	Generalized Bell Membership Function	17
2.7.6	Fuzzy Inference System	18
2.7.7	Mamdani Fuzzy Models	18
2.7.8	Sugeno Fuzzy Models	18
2.7.9	Defuzzification	19
2.7.10	Centroid of Area ^z COA	19
2.7.11	Bisector of Area ^z BOA : ^z BOA satisfies	19
2.7.12	Mean of Maximum ^z MOM	19
3	DESIGN AND MODEL SYSTEM	21
3.1	Design System	21
3.2	Object Detection	23
3.3	Hardware Design	24
3.3.1	Mobile Robot Design	24
3.3.2	Camera Design	24
3.3.3	Receiver Design	25
3.4	Design of Algorithm	25
3.4.1	Design of Fuzzy Logic Algorithm	25
3.4.2	Fuzzification of Distance	26
3.4.3	Fuzzification of Angle	26
3.4.4	Fuzzification of Velocity	27
3.4.5	Fuzzy Rule Base	27
3.4.6	Defuzzification	28
4	PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA	29
4.1	Camera Sensor Testing	29
4.2	Object Detection	30
4.2.1	Mobile Robot Detection	31
4.2.2	Obstacle Detection	31
4.2.3	Goal Detection	33
4.3	Overall Test	34
4.3.1	Data Representation	35
5	CONCLUSION AND RECOMMENDATIONS	37
5.1	Conclusions	37
5.2	Recommendations	37
	BIBLIOGRAPHY	38