

Table of Contents

CONTENTS	Page No.
Acknowledgement	i-ii
Abstract	iii-iv
Table of Contents	v-viii
List of Figures	ix-xi
List of Tables	xii
List of Abbreviations and Symbols	xiii-xiv
Chapter 1: Introduction	1-6
1.1 Motivation of Research	1
1.2 Thesis Aims	2
1.3 Thesis Structure	4
Chapter 2: Literature Review	7-30
2.1 Introduction	7
2.2 Autonomous Navigation	10
2.2.1 Sensor Based Navigation	12
2.3 Object Detection and Tracking	14
2.3.1 Static Object Detection	14
2.3.2 Detection of a Dynamic Object	16
2.3.3 Object Tracking	17
2.4 Navigation using Vision Sensor	18
2.5 Denoising Approaches and Over View of Kalman Filter	25
2.6 Gaps in Research	29
2.7 Objectives of the Proposed Research	30

CONTENTS		Page No.
Chapter 3: Approach for Tracking of Mobile Robot with Vision Sensor		31-52
3.1	Introduction	31
3.2	Methods to Detect and Track Mobile Robot	32
3.2.1	Viola Jones Algorithm	34
3.2.2	Kanade-Lucas-Tomasi Algorithm	35
3.2.3	Kalman Filter Algorithm	38
3.3	System Descriptions	39
3.4	Experimental Results	40
3.5	Conclusion	52
Chapter 4: Path Planning of Mobile Robot for Navigation using Vision Sensor		53-78
4.1	Introduction	53
4.2	System Description & Problem Statement	54
4.3	Vision-Based Navigation	55
4.3.1	Object Detection	55
4.3.1.1	Image acquisition	56
4.3.1.2	Image conversion	57
4.3.1.3	Background subtraction and erosion	57
4.3.1.4	Pixel based clustering	58
4.3.1.5	Contour detection and corner extraction	58
4.3.2	Network for Wireless Data Transfer	59
4.3.3	Path Planning using A* Algorithm	59
4.4	Mobile Manipulation-Based Path Planner	63
4.4.1	Limitations of Vision-Based A* Algorithm	63
4.4.2	Problem Definition	63
4.4.3	Object Classification on Basis of Metric Data	64
4.4.4	Generation	64

CONTENTS		Page No.
4.4.5	Priority Generation	65
4.4.6	Multi-Target Motion Cycles	66
4.4.6.1	Manipulation cycle	67
4.4.6.2	Goal cycle	67
4.5	Results and Discussion	67
4.6	Conclusion	77
Chapter 5: Approach for Path Planning and Tracking of Shape Aware Mobile Robot in Structured Environment using Vision Sensor		79-98
5.1	Introduction	79
5.2	System descriptions	82
5.3	Kinematic Model of Mobile Robot	84
5.4	Overview of Experimental Implementation	86
5.5	Experimental Results and Analysis	89
5.6	Conclusion	97
CONTENTS		Page No.
Chapter 6: Approach for Mobile Robot Navigation and Tracking using Vision Sensor in Dynamic Environment		99-123
6.1	Introduction	99
6.2	System Description	100
6.2.1	Determination the Pose of KOBUKI	103
6.2.2	Software's for KOBUKI	104
6.3	Overview of Experimental Implementation	105
6.3.1	Flow Chart for Mobile Robot Navigation	105
6.3.2	D* lite Path Planning Algorithm	107
6.4	Experimental Results and Analysis	110
6.5	Conclusion	122

CONTENTS		Page No.
Chapter 7: Conclusions and Future Work		124-130
7.1	Conclusion	124
7.2	Limitations of the proposed research	128
7.3	Future Perspective	130
References		131-150
Appendix		151-168
List of Publications		169-170
Biography of Candidate and Supervisor		171-172