



## TABLE OF CONTENTS

COVER .....	i
BACHELOR THESIS.....	ii
APPROVAL PAGE .....	iii
STATEMENT .....	iv
MOTTO AND OFFERING PAGE.....	v
PREFACE .....	vi
TABLE OF CONTENTS .....	vii
LIST OF FIGURES .....	x
LIST OF TABLES .....	xii
ABSTRACT .....	xiii
CHAPTER I INTRODUCTION .....	1
1.1 Background .....	1
1.2 Research Problem .....	2
1.3 Research Scope.....	2
1.4 Research Objective.....	3
1.5 Research Benefits .....	3
1.6 Research Methodology .....	3
CHAPTER II LITERATURE REVIEW.....	5
CHAPTER III THEORETICAL BASIS.....	9
3.1 Optical Character Recognition .....	9
3.1.1 Example of Optical Character Recognition .....	10
3.1.2 Contour Analysis .....	11
3.1.3 Machine Learning .....	12
3.2 Open Computer Vision Library .....	16
3.3 Android.....	17
3.4 ASCII Characters .....	17
3.5 Confusion Matrix .....	18
CHAPTER IV ANALYSIS AND DESIGN .....	20
4.1 System Description.....	20
4.2 System Requirement Analysis.....	21



4.2.1 Data Collections.....	21
4.2.2 System Input .....	21
4.2.3 System Output.....	21
4.2.4 Hardware and Software Specifications.....	22
4.3 Training Dataset .....	22
4.4 Interface Design Mockup .....	23
4.4.1 Main Page Design Mockup.....	23
4.4.2 Character Recognition Page Design Mockup.....	24
4.5 System Architecture .....	25
4.6 Flowchart.....	27
4.6.1 Main Flowchart.....	27
4.6.2 Feature Extraction Flowchart.....	29
4.6.3 Segmentation Flowchart .....	29
4.6.4 Rectangles Combination Flowchart.....	31
4.6.5 Sorting for Multiple Rows Result Flowchart.....	33
4.6.6 Recognition Flowchart.....	34
4.6.7 Recognition using K-Nearest Neighbor Flowchart .....	34
4.6.8 Recognition using Naïve Bayes Flowchart.....	36
4.6.9 Recognition using Support Vector Machine Flowchart .....	37
4.6.10 Training Data Creation Flowchart .....	38
4.7 Testing .....	39
<b>CHAPTER V IMPLEMENTATION.....</b>	<b>41</b>
5.1 User Interface .....	41
5.1.1 Main Page Screen .....	41
5.1.2 Character Recognition Screen .....	41
5.2 Training Data.....	42
5.3 Implementation Code .....	44
5.3.1 Camera Implementation.....	44
5.3.2 Preprocessing Implementation.....	44
5.3.3 Feature extraction Implementation .....	45
5.3.4 Segmentation Implementation .....	45
5.3.5 Training Data Implementation.....	51
5.3.6 Recognition Implementation.....	53
5.3.7 Memory Usage Implementation .....	55



5.3.8 Time Consumed Implementation.....	56
5.4 Testing Stage .....	57
5.4.1 Testing Data.....	57
5.4.2 Testing Conditions.....	57
5.4.3 Application Testing.....	57
CHAPTER VI RESULT AND DISCUSSION .....	61
6.1 Application Testing Result.....	61
6.2 Recognition Result .....	62
6.3 Memory Usage .....	65
6.4 Time Consumed .....	66
6.5 Performance Comparison .....	67
6.5.1 Recognition Result.....	67
6.5.2 Memory Usage.....	68
6.5.3 Time Consumed .....	68
6.6 Different Orientation Image Testing .....	69
6.7 Different Direction Image Testing .....	71
6.8 Different Segmentation Testing .....	72
6.9 Similar Contour Characters Testing .....	73
6.10 Different Illuminations Image Testing .....	75
CHAPTER VII CONCLUSION .....	77
7.1 Conclusions .....	77
7.2 Suggestions.....	77
BIBLIOGRAPHY .....	xiv