SUPERVISOR'S APPROVAL

EQUATION SOLVER BY USING OPTICAL CHARACTER RECOGNITION (OCR)

By

AHMAD AZZIM BIN MASHURI
2012626226

This report was prepared under the supervision of project supervisor, Miss Hajar Izzati Binti Mohd Ghazalli. It was submitted to the Faculty of Computer and Mathematical Sciences and was accepted in partial fulfilment of the requirements for the degree of Bachelor of Computer Science (Hons).

Approved by

……..……..
Miss Hajar Izzati Binti Mohd Ghazalli
Project Supervisor

JULY 30, 2015

STUDENT'S DECLARATION

I certify that this report and the project to which it refers is the product of my own work and that any idea or quotation from the work of other people, published or otherwise are fully acknowledged in accordance with the standard referring practices of the discipline.

……
AHMAD AZZIM BIN MASHURI
2012626226

JULY 30, 2015

ABSTRACT

Nowadays, calculators are widely used just like computers and mobile phones. Since the invention of abacus, the calculator has evolved from a machine that could only perform simple calculation into one that can solve complex calculation. Despite the fact that every smartphones have built in calculator, most of them can only perform simple calculation. Even though there are several applications on scientific calculator, most of them are not user friendly. Based on the observation, there are several existing systems that use Optical Character Recognition (OCR) to recognize handwritten text and solve mathematical problem. Since OCR is a powerful tools to recognize handwritten text, proposed system will use this tools to recognize human handwriting and solve basic mathematical problem as well as linear equations. For the future work, this proposed application is looking forward to solve more complex and various kind of mathematical problems. This application may assist user especially students to solve mathematical problem accurately and faster.

Keywords: Android, handwriting calculator, handwriting recognition, tesseract

TABLE OF CONTENTS

SUPERVISOR'S APPROVAL iii

STUDENT'S DECLARATION iv

ACKNOWLEDGEMENT v

ABSTRACT vi

TABLE OF CONTENTS vii

LIST OF TABLES x

LIST OF FIGURES xi

CHAPTER 1: INTRODUCTION

1.0 Introduction 1

1.1 Project Background 1

1.2 Problem Statement 2

1.3 Research Objective 3

1.4 Project Scope 3

1.5 Significance 4

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction 5

2.1 Calculator 5

2.1.1 Definition of Calculator 5
2.1.2 Chronology of Calculator 6
2.1.3 Type of Calculator 6
2.1.4 Significance 7
2.1.5 Demands 7

2.2 Image Processing 8

2.2.1 Techniques of Image Processing 8
2.2.2 Applications 9
2.2.2.1 Graphic Art 9
2.2.2.2 Medical Field 10
2.2.2.3 Forensic Studies 10
2.2.3 Types of Image Processing 11
2.2.3.1 Face Recognition 11

2.2.3.2 Signature Recognition 12
2.3 Handwriting Recognition 12
2.3.1 Methods 13
2.3.1.1 On-line Handwriting Recognition 14
2.3.1.2 Off-line Handwriting Recognition 15
2.4 Optical Character Recognition (OCR) 16
2.4.1 Overview 16
2.4.2 Advantages and Disadvantages of OCR 17
2.4.3 OCR Tools 17
2.4.3.1 Open Source Tools 18
2.4.3.2 Commercial Tools 18
2.4.4 Tesseract OCR Architecture 19
2.4.5 Comparison Technique 20
2.5 Existing System 22
2.5.1 PhotoMath 22
2.5.2 Mobile OCR 22
2.5.3 Comparison 23
2.5.4 Summary 24
CHAPTER 3: METHODOLOGY
3.0 Introduction 25
3.1 Research Methodology 25
3.2 Detail Research Methodology 26
3.2.1 Planning 27
3.2.2 Information Gathering 27
3.2.3 Design 29
3.2.3.1 Flow Chart 29
3.2.3.2 OCR engine: Tesseract 31
3.2.3.3 User Interface Design 32
3.2.4 Development 33
3.2.4.1 Retrieved Image Module 34
3.2.4.2 Recognition Module 35
3.2.4.3 Calculation Module 37
3.2.5 Testing 38
3.2.6 Result Analysis 38
3.3 Software and Hardware Requirement 39
3.3.1 Software Requirement 39
3.3.2 Hardware Requirement 40