

Text Signage Recognition (TSR) Noise Filtering Technique for Visually Impaired
People (VIP)

By

Intan Nurulhashikin Binti Mohd Yunus

16122

Dissertation submitted in partial fulfilment of
the requirements for the Bachelor of Technology (Hons)
Information & Communication Technology

May 2015

Universiti Teknologi PETRONAS

Bandar Seri Iskandar

31750 Tronoh

Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

Text Signage Recognition (TSR) Noise Filtering Technique for Visually Impaired
People (VIP)

By

Intan Nurulhashikin Binti Mohd Yunus

A project dissertation submitted to the
Information & Communication Technology Programme
Universiti Teknologi PETRONAS
In partial fulfilment of the requirements for the
BACHELOR OF TECHNOLOGY (Hons)
(INFORMATION & COMMUNICATION TECHNOLOGY)

Approved by,

(Dr. Suziah Binti Sulaiman)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

MAY 2015

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

INTAN NURULHASHIKIN BINTI MOHD YUNUS

ABSTRACT

Finding one's way across campus to a class, locating room or offices in a large medical centre, or just walking alone in the street to meet people has always been difficult or impossible for the visually impaired (VIP). Most of the time they have to be accompanied by someone or using a white cane and often have to use the well-known routes that they are familiar with. Independent navigation might be an easy task for the normal sighted people but not VIP. Implementation of OCR on mobile application is a great assistive technology that can assist the VIP during their independent navigation. Referring to the previous TSR prototype application developed in Android mobile application, we found that the usability of the prototype application has encountered problems with the presence of noise from the image captured by the VIP. Therefore, the author has proposed a new TSR technique to filter the noise present in the image captured by VIP using Gaussian filter. The project aims to deliver the proposed TSR technique to the targeted user which is low visually impaired people after considering the user's experience upon their interaction with the existing TSR prototype application.

ACKNOWLEDGEMENT

First and foremost, I would like to praise to Allah s.w.t, the Most Gracious and Most Merciful for giving the opportunity and strength in completing this final year project.

I would like to send my deepest appreciation to my supervisor, Dr. Suziah Sulaiman, senior lecturer of Computer Information Science department in UTP for her endless guidance and supervision throughout the process of this final year project. I am very thankful to be under her supervision with all the motivation she had given to me.

My grateful thanks also to my co-supervisor, Ms. Amy and Mr. Sanjay Saini for helping me in understanding the technical part. I am very thankful for the time and efforts that they had given in assisting me throughout the project.

Apart from that, I also want to extend my gratitude to staffs and students from Malaysian Association for the Blind (MAB), Ipoh for their cooperation and support throughout this project. Their feedback and helped me to acquire as much data as possible in completing this research project.

Last but not least, my heartiest thanks would go to my family and friends for giving me the moral support along the completion of my final year project. I hope, this project will be able to contribute as much as possible in providing support to the visually impaired users to read the signage images during their independent navigation.

TABLE OF CONTENTS

| | |
|---|-------------|
| ABSTRACT | iv |
| ACKNOWLEDGEMENT | v |
| LIST OF FIGURES | viii |
| LIST OF TABLES | ix |
| LIST OF ABBREVIATIONS | x |
| CHAPTER 1: INTRODUCTION | 1 |
| 1.1 Background of Study | 1 |
| 1.2 Problem Statement | 2 |
| 1.3 Objective | 2 |
| 1.4 Scope of Study | 2 |
| 1.5 Relevancy of project within scope and time frame | 3 |
| CHAPTER 2: LITERATURE REVIEW | 4 |
| 2.1 iPhone accessibility features for the Visually Impaired..... | 4 |
| 2.2 Categories of disabilities | 6 |
| 2.3 Navigation Issues for the visually impaired | 8 |
| 2.3.1 Public signage | 9 |
| 2.3.2 Misunderstood the concept of using a guide dog..... | 9 |
| 2.3.3 Skills of independent mobility are obscure and complicated for some VIPs..... | 9 |
| 2.3.4 Strategies to overcome the navigation issues | 10 |
| 2.4 Text Signage Recognition | 12 |
| 2.5 Noise in image processing | 13 |
| CHAPTER 3: METHODOLOGY | 16 |
| 3.1 Development Methodology..... | 16 |
| 3.1.1 Project Activities..... | 17 |
| 3.1.2 Proposed System Architecture..... | 18 |

| | |
|--|-----------|
| 3.1.2 Gantt Chart..... | 23 |
| 3.2 Research Methodology | 23 |
| 3.2.1 Qualitative Research..... | 23 |
| 3.3 Development tools | 24 |
| 3.3.1 Software..... | 24 |
| CHAPTER 4: RESULTS AND DISCUSSION | 26 |
| 4.1 Preliminary Testing and Interview..... | 26 |
| 4.1.1 Objective..... | 26 |
| 4.1.2 Method..... | 26 |
| 4.1.3 Study Result | 26 |
| 4.1.3.1 Pre –Testing | 27 |
| 4.1.3.2 Testing Results..... | 31 |
| 4.1.3.3 Post – Testing..... | 36 |
| 4.2 Prototype Design..... | 37 |
| 4.3 Experiment | 38 |
| 4.4 System Testing..... | 39 |
| 4.5 Usability Testing with low visually impaired (VIP) users | 41 |
| CHAPTER 5: CONCLUSION | 47 |
| 5.1 Relevancy to objectives | 47 |
| 5.2 Suggested future work for expansion and continuation | 48 |
| REFERENCES | 49 |
| APPENDICES..... | 53 |

LIST OF FIGURES

| | |
|---|----|
| Figure 1: iPhone assistive touch features..... | 6 |
| Figure 2: Levels of visual impairment..... | 9 |
| Figure 3: Tactile ground surface indicator..... | 12 |
| Figure 4: The existing TSR model..... | 15 |
| Figure 5: Agile Methodology..... | 18 |
| Figure 6: Proposed system architecture..... | 21 |
| Figure 9: Sample Original Coloured Signage..... | 21 |
| Figure 10: Gaussian filtered image..... | 22 |
| Figure 11: Adjust the intensity of the image..... | 23 |
| Figure 12: Grayscale Image..... | 23 |
| Figure 13: Thresholding applied..... | 24 |
| Figure 14: Edge of characters detected..... | 24 |
| Figure 15: The pre-processed Image..... | 25 |
| Figure 7: Screenshot of existing TSR prototype..... | 33 |
| Figure 16: Screenshot of prototype..... | 40 |

LIST OF TABLES

| | |
|--|----|
| Table 1: Requirement Planning..... | 18 |
| Table 2: User Behaviour Observation..... | 30 |
| Table 3: Respondent 1..... | 33 |
| Table 4: Respondent 2..... | 33 |
| Table 5: Respondent 3..... | 34 |
| Table 6: Respondent 4..... | 35 |
| Table 7: Summary of Preliminary Testing Results | 37 |
| Table 8: The author's evaluation on TSR noise filtering prototype | 40 |
| Table 9: Summary of System Testing Results | 42 |
| Table 10: Low VIP user's evaluation on TSR noise filtering prototype | 43 |
| Table 11: Summary of Usability Testing Results | 45 |

LIST OF ABBREVIATIONS

| | |
|-----|--------------------------|
| TSR | Text Signage Recognition |
| VIP | Visually Impaired People |