PLATE NUMBER RECOGNITION SYSTEM (PNRS)

NUR FARAH ANIS BINTI ABD AZIZ

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

© Universiti Teknikal Malaysia Melaka

BORANG PENGESAHAN STATUS TESIS*

JUDUL: PLATE NUMBER RECOGNITION SYSTEM (PNRS)

SESI PENGAJIAN: 2010

Saya NUR FARAH ANIS BINTI ABD. AZIZ

(HURUF BESAR)

mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ** Sila tandakan (/)

_____	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
_____	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
✓	TIDAK TERHAD	

(TANDATANGAN PENULIS)

Alamat tetap : Block 4E-T03-U05,
Putra Court 4, Presint 9,
Jalan P9G, Putrajaya,
62250, W.P.Putrajaya .

Tarikh : 25/06/2010

(TANDATANGAN PENYELIA)

Dr Burairah Bin Hussin

Tarikh : 26/06/2010

CATATAN: * Tesis dimaksudkan sebagai Laporan Akhir Projek Sarjana Muda (PSM)
** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa.

© Universiti Teknikal Malaysia Melaka

DECLARATION

I hereby declare that this project report entitled

PLATE NUMBER RECOGNITION SYSTEM (PNRS)

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date: 25/6/2010

(NUR FARAH ANIS BINTI ABD AZIZ)

SUPERVISOR : _____ Date: 25/6/2010

(DR. BURAIRAH BIN HUSSIN)

© Universiti Teknikal Malaysia Melaka

PLATE NUMBER RECOGNITION SYSTEM
(PNRS)

NUR FARAH ANIS BINTI ABD AZIZ

This report is submitted in partial fulfillment of the requirements for the
Bachelor of Computer Science (Artificial Intelligent).

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2010

© Universiti Teknikal Malaysia Melaka

DEDICATION

To my parents, for their support and motivation throughout my PSM... ... ...

To my supervisor, Dr Burairah Hussin, for making it all worthwhile....

I also want to thanks to my all my friends that always are by my side as I working on this project... ....

© Universiti Teknikal Malaysia Melaka

ACKNOWLEDGEMENT

Firstly and foremost, thanks to Allah for given me a chance and strength to me for finishes this PSM until the end.

I would like to express my sincere appreciation and gratitude to my respectable supervisor, Dr Burairah Bin Hussin for his expert advice and help with the selection of topics, recommendation for solutions and reviews of the materials.

Special thanks to Dr Abdul Samad Hassan Basari as my evaluator and all my fellow friend Siti Musliza and Mohd Nurul Iman and also to all my classmates whom helps me a lot to complete my PSM.

Last but not least, I would like to thank my parent, Mr Abd Aziz and Madam Raimah who have been support and motivate throughout my project.

© Universiti Teknikal Malaysia Melaka

ABSTRACT

This project name is Plate Number Recognition System (PNRS). The software that used in developing this system is MATLAB R2009a. The main objective of this project is to teach the computer to recognize the character in an image. There are several image processing techniques being used in developing this system. This system development consist of Image Pre-Processing Phase, Feature Abstraction Phase, Character Recognition Phase and Data Collection Phase. This system also can be implemented at security post guard. These system digitalize manual system to identify car bypassing premises by kept record of each vehicle. This system can decrease human mistake by replace the read the plate number automatically and kept the output in computer file directiory.

© Universiti Teknikal Malaysia Melaka

ABSTRAK

Projek ini bertajuk Sistem Kenalpasti Plat Kereta. Perisian yang digunakan dalam pembangunan sistem ini adalah MATLAB R2009a. Tujuan utama dari projek ini adalah untuk mengajar komputer untuk mengenali abjad/nombor di dalam gambar. Ada beberapa teknik pemprosesan imej yang digunakan dalam mengembangkan sistem ini. Pembangunan sistem ini terdiri daripada Tahap Pra-Pemprosesan Gambar, Tahap Ciri-ciri Abstraksi, Tahap Kenalpasti abjad dan nombor dan Tahap Pengumpulan Data. Sistem ini juga boleh diterapkan di poskeselamatan. sistem ini mendigitalkan sistem manual untuk mengenalpasti kereta yang lalu lalang masuk dan keluar ke sesuatu premis. Sistem ini boleh mengurangkan kesalahan manusia dengan membaca nombor plat secara automatik dan menyimpan hasil jawapan ke dalam direktori komputer.

© Universiti Teknikal Malaysia Melaka

TABLE OF CONTENTS

CHAPTER 1	**INTROCUCTION**	**1**
	1.0 Project Background	**1**
	1.1 Problem Statement	**3**
	1.2 Objectives	**4**
	1.3 Scopes	**4**
	1.4 Project Significance	**5**
	1.5 Expected Output	**6**
	1.6 Conclusion	**6**
CHAPTER II	**LITERATURE REVIEW AND PROJECT METHODOLOGY**	**7**
	2.1 Introduction	**7**
	2.2 Facts and Findings	**8**
	2.2.1 Malaysian Vehicle Plates Study	8
	2.2.2 Malaysian Plate Number according the regional codes:	10
	2.2.3 Example of Plate Number around the World	11
	2.2.4 Case Studies Review	15
	2.3 Project Methodology	**23**
	I. Initial Phase	23
	II. Requirement Phase	24
	III. Design Phase	25
	IV. Coding Phase	24
	V. Testing Phase	25
	VI. Implementation Phase	25

© Universiti Teknikal Malaysia Melaka

2.4 Project Requirements **25**
2.4.1 Software requirement 26
2.4.2 Hardware Requirement 26
2.4.3 Project Schedule and Milestones 26
2.5 Conclusion **27**

CHAPTER III ANALYSIS **27**
3.1 Introduction **28**
3.2 Problem Analysis **29**
3.3 Requirement Analysis **32**
3.3.1 Functional Requirement 32
3.4 Software Requirements **39**
3.5 Hardware Requirements **39**
3.6 Conclusion **39**

CHAPTER 1V DESIGN **41**
4.1 Introduction **41**
4.2 System Architecture **42**
4.3 High Level Design **43**
4.3.1 User Interface Design 43
4.3.2 Input Design 45
4.2.3 Output Design 46
4.3 Software Design **46**
(i) Button 46
(ii) Axes 52
(iii) Text Box 53
(iv) corrcheck.m [function] 53
(v) read_char.m [function] 53

© Universiti Teknikal Malaysia Melaka

4.4 Conclusion **54**

CHAPTER V IMPLEMENTATION **55**

5.1 Introduction **55**

5.2 Software and Hardware Development Environment Setup. **56**

5.3 Future System Implementation **59**

5.4 Version Control Procedure **60**

5.4 Implementation Status **61**

5.5 Conclusion **63**

CHAPTER VI TESTING **64**

6.1 Introduction **64**

6.2 Test Plan **64**

6.2.1 Test Organization 65

6.2.2 Test Environment 65

6.2.3 Test Schedule 66

6.3 Test Strategy **67**

6.3.1 White box testing 67

6.3.2 Black box Testing 68

6.3.3 Classes of test 68

6.4 Test Implementation **69**

6.4.1 Test Description 69

6.4.2 Test Data 70

6.5 Test Result and analysis. **70**

6.6 Conclusion **73**

CHAPTER VII **74**

© Universiti Teknikal Malaysia Melaka

CONCLUSION **74**

7.1 Observation on Strengths and Weaknesses **74**

7.1.1 System Strengths 74

7.1.2 System Weaknesses 75

7.2 Prepositions for Improvement. **75**

7.3 Contributions **75**

7.4 Conclusion **76**

REFERENCES **77**

ATTACHMENT **79**

© Universiti Teknikal Malaysia Melaka

LIST OF TABLES

TABLE	TITLE	PAGE
2.0	Malaysian Plate Number according regional code	10
3.0	Image Binarization	32
3.1	Conversion to Negative Image	33
3.2	Removing Small Object	34
3.3	The function resize the original image became	35
	smaller, not trim part of the image.	36
3.4	Software Requirement	32
3.5	Hardware Requirement	39
5.0	Hardware Development Environment	56
5.1	Implementation status of Plate Number	61
	Recognition System	
6.0	Test Environment for Software specification	63
6.1	Test Environment for Hardware specification	64
6.2	Test Schedule	65
6.3	Test Result and analysis	70

© Universiti Teknikal Malaysia Melaka

LIST OF FIGURES

FIGURES	TITLE	PAGE
2.0	Malaysian Vehicle Plates	8
2.1	European Union plate number example	11
2.2	British License plate number example	12
2.3	United States of America plate number example	13
2.4	Steps of automatic number plate recognition software model	15
2.5	Steps in System Design	16
2.6	Prepocessing Stage	18
3.0	UTeM Post Guard	28
3.1	Flow Chart of Current System	29
3.2	Major Step in Plate Number Recognition System	31
3.3	Erosion works on pixels	35
3.4	Correlation Formula	37
4.0	System Architecture	41
4.1	Interface Design	42
5.0	Basic Flow of PNRS	56
5.1	Future System Implementation	57
5.2	Sample source code with version control	59

© Universiti Teknikal Malaysia Melaka

LIST OF ATTACHMENTS

ATTACHMENT	TITLE	PAGE
A	Gannt Chart	77
B	Correlation Table	85
C	Input Design	87
D	Implementation Interface	89
E	User Manual	91

© Universiti Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

1.0 Project Background

The project to be developed is "Plate Number Recognition System". This system use to redeem the task of manually typing the plate number of the bypassing vehicle into the computer system. It is believed that there are currently more than half a billion cars on the roads worldwide. All those vehicles have their vehicle identification number as their primary identifier. The vehicle identification number is actually a license number which states a legal license to participate in the public traffic. All vehicles worldwide should have its license number - written on a license plate which mounted onto its and no vehicle without properly mounted, well visible and well readable license plate should run on the roads.

To process, sort or analyze data everyone thinks about using computers. If the data is already in the computer most of these tasks are rather easy to be carried out. It is needless to say that the license number is the most important identification data a computer system should treat when dealing with vehicles.

© Universiti Teknikal Malaysia Melaka

Suppose a company's security manager would like to have a system that precisely tells at every moment where the cars of the company are in the premises or out on roads. By registering every single drive-out from and drive-in to the premises, the system could always tell which car is out and which is in.

The key issue of this task is that the registration of the movement of the vehicles should be done half automatic by the system which in reading/record the plate number. As a human, we tend to make mistake and this system would help to reduce the mistake by automatically read the plate number.

Plate Number Recognition System identification system solves this problem and it recognizes the license plate numbers from images. This system uses the images, which are taken from a camera, and manually crop the plate number region. After that, Pre-process techniques will be implemented to get the better image of the plate number and the system recognizes them, they are stored as text. In this way, these tasks become half automatic and less manpower is required for them. Moreover, the probability of human mistakes disappears with this system.

This Plate Number Recognition System may also be applied for these following places:

- To check/keep record vehicle in and out of the premises.
- To assist visitor management system in recognizing guest vehicles.
- Use in border crossings. To keep every records of vehicle in and out from the country.
- Use in parking management system to check the available car park available.
- "Drive-Through Customer Recognition", to automatically recognize customers based on their license plate and offer them their last session.

© Universiti Teknikal Malaysia Melaka

1.1 Problem Statement

Analyze the identified problems is a collection of information about all the existing and non-exist automation around Malaysia. During the information stage, the main problem statements for current system are listed as follows:

In current security system, security guards still use manual system to keep the record of bypassing vehicle in and out from the premises. Security guards tend to make mistake when identify the plate number.

The current system is not completely systematic. The records of the plate number will be kept in Log Book. As we all know, this manual file management system are not easy to maintain. The Log might book may be stolen or misplace.

Furthermore, the person who in charge to keep every records of vehicle in and out might be tired and not do their job and just let the vehicle to pass trough in or out from the premises. By using PNRS all problem stated above can be solve easily by digitalize the system itself.

© Universiti Teknikal Malaysia Melaka

1.2 Objectives

The main objectives of the proposed project are listed as following:

(i) To explore plate recognition techniques worldwide.

(ii) To use appropriate technique for Malaysian plate number recognition.

(iii) To digitalize the manual recognition process for further usage.

1.3 Scopes

The scope of this project will be the current manual security system in UTeM post guard. The project has five different implementation steps:

(i) Image Pre-processing

In image pre-processing, the function of this step is obtaining the required information from the digital image by using image-processing methods.

(ii) Feature abstraction

The image of plate number will undergo object labeling and each character will be label.

(iii)Character Recognition

The character recognition part is when the image that already undergoes pre-process and feature abstraction will undergo recognition process. The plate number that already been segment will be recognized using our letter and numbers library.

(iv)Data Collection

The result which is the plate number will be kept into a local folder as a text file.

© Universiti Teknikal Malaysia Melaka

(v) **Graphical User Interface**

A simple and efficient graphical user interface is develop in order to facilitate the plate number recognition system. The current design of the GUI is more to show about the detail flow of the system. The GUI can be reconstructing to facilitate the user.

There are several assumptions being made in this system:

- The plate number must be Malaysian Standard Plate number.
- The plate number only has one line.
- The plate number character (font) must be a Malaysian standard plate number.
- The image taken must be in-front of the plate number with distance 10m from the vehicle.
- We assume that the plate number located at the same position in the image.

1.4 Project Significance

Plate Number Recognition System definitely brings benefits to user in many sectors like in security department where they can check/keep record of vehicle in and out of the premises. In service management sector, where this system can assist them to recognize their customer by identified the plate number. This system also can be useful for government sector especially for border crossing, this system will save every plate number that cross the border. PNRS benefits for parking management, where they can calculate how many parking available according to their database.

Basically, the significance of the proposed project is to build an computerize system that replace the manual system by designing an interface and developed the function for recognizing the plate number automatically without using human capabilities of reading. This system also wants to replace the file management system (Log Book) to computerize file system. These changes will make the system more efficient than manual system.

© Universiti Teknikal Malaysia Melaka

1.5 Expected Output

To develop a system that can recognize the car plate number automatically which comprise of following function:

(i) To load image that contain plate number.
(ii) To enable the crop function that use to crop the plate number automatically.
(iii) To change the image to black and white image.
(iv) To change the black and white picture to negative picture. Where white pixel change to black pixels and otherwise.
(v) To recognize the plate number by recognize one by one of the character and will display the result in the text box.
(vi) To save result in computer file directory.

1.6 Conclusion

Plate Number Recognition System will use Image processing techniques and also mathematics formula which is correlation function. These systems have 4 basic phases which are image pre-processing, feature abstractions, recognition and data collection. All this phases will contribute to the success of this system.

Once the scopes and objectives are identified, this will bring to the next activity which is the literature review and project methodology that will be discussed in detail in the next chapter.

© Universiti Teknikal Malaysia Melaka

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

This chapter tells about the manner the software engineering process is carried out from preliminary study and literature review until the project planning stage. Basically this chapter includes facts and findings, project methodology, project requirements, project schedule/milestone and conclusion of this chapter. The objective of this chapter is to gather all the information needed and to ensure that nothing is overlooked and that every system problems and objectives is identified.

This chapter also is most crucial part in system development because in this chapter will give us opportunity to discover more about subject that relevant to the project and see how the others have approached the proposed area. The research is about recognition of a character in a plate number and image processing techniques and pattern recognition techniques are completed and done through searching, studying and analyzing relevant source from reference books,

© Universiti Teknikal Malaysia Melaka

journals and web pages. Furthermore, supervision from supervisor with fully guidance and advice are helping to complete the research.

2.2 Facts and Findings

Malaysian vehicle license plates are license plates displayed on all motorized road vehicles in Malaysia, as required by law. The issuing of license numbers is regulated and administered by the Malaysian Road Transport Department, but the Department is not largely in charge of the production of license plates. Instead, vehicle dealers and specialized businesses produce the vast majority of license plates in the country. The computerize approach when recorded data about vehicle in and out from the premises is important. Plate Number Recognition System helped to decrease the probability of human mistakes while reading the plate number and recorded it in database/log book.

2.2.1 Malaysian Vehicle Plates Study

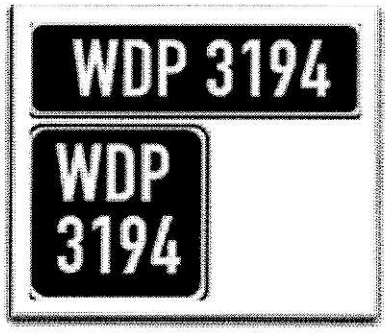

Figure 2.0: Malaysian Vehicle Plates

This is the standard layout configurations of plates for Malaysian private vehicles. The most common form of Malaysian Plate Number is derived from early iteration of plate design in United Kingdom. Malaysian Plate Number must contain minimum one character upper case alphabet and maximum three character followed by number that will start from number 1 until 9999. Example: ABC 1234.

© Universiti Teknikal Malaysia Melaka

The format is used in all classes of vehicles with engines unless stated later:

- Private vehicles (cars, motorcycles, vans, trucks and other vehicles of similar design).
- Commercial and industrial vehicles (vans, trucks – light or heavy, buses, road-legal-vehicles for construction and excavation and other vehicles of similar design)
- Service vehicles (police cars, ambulances, fire engine, public transport and other of similar design).

The Malaysian plate number on cars are normally used Arial Bold as typeface of letterings, but other readable fonts are also used occasionally. While the rear number plates of motorcycles are required to be displayed in standard fashion, there are fewer restriction on number plates displayed at the front, allowing them to be placed on the front mudguard or fairing of the vehicles, with or without a black license plate.

© Universiti Teknikal Malaysia Melaka