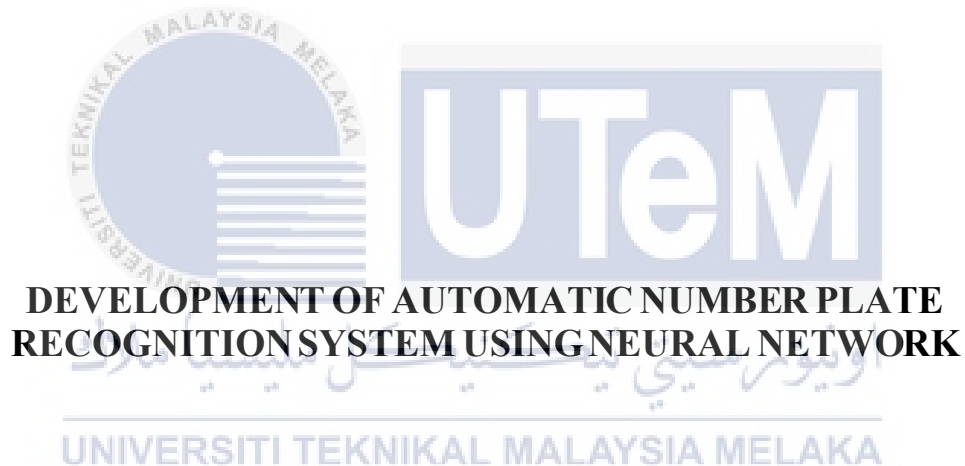




**Faculty of Electrical and Electronic Engineering Technology**



**DEVELOPMENT OF AUTOMATIC NUMBER PLATE  
RECOGNITION SYSTEM USING NEURAL NETWORK**

**NUR ZAHIRAH BINTI ALIAS**

**Bachelor of Computer Engineering Technology (Computer Systems) with Honours**

**2022**

**DEVELOPMENT OF AUTOMATIC NUMBER PLATE RECOGNITION SYSTEM  
USING NEURAL NETWORK**

**NUR ZAHIRAH BINTI ALIAS**

**A project report submitted  
in partial fulfillment of the requirements for the degree of  
Bachelor of Computer Engineering Technology (Computer Systems) with Honours**



**Faculty of Electrical and Electronic Engineering Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2022**

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Sesi Pengajian : Semeser 1 Sesi 2022/2023

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I declare that this project report entitled “Development of Automatic Number Plate Recognition System using Neural Network” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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## APPROVAL

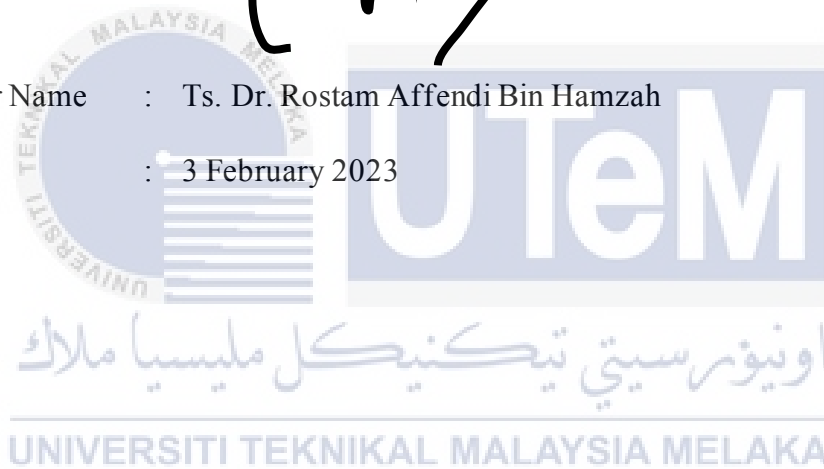
I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

Signature :



Supervisor Name : Ts. Dr. Rostam Affendi Bin Hamzah

Date : 3 February 2023



## DEDICATION

*To my beloved mother, Zainah Binti Muda, and father, Alias Bin Wahab,  
and  
To my dearest family and friends.*



## ABSTRACT

Automatic Number Plate Recognition (ANPR) system will read the image of a vehicles as input image then extracting the number plate as text. The main purpose of this system is to design and develop an efficient and systematic automatic vehicle identification system, which will use vehicle registration number plate as the parameter. The system will read the vehicle registration number plates as input and then it will automatically recognize the number plate's character as an output. This system is widely implemented in various sectors in the world, for example, in car parking management, traffic management, tolling and also Intelligent Transport System (ITS). Other than that, The Automatic Number Plate Recognition system is also being implemented as a security measure at the entrance of highly restricted areas, such as military zones or the top government offices. The developed Automatic Number Plate Recognition system identifies the incoming vehicle and then captures the vehicle's image. Image segmentation will be used to extract the vehicle number plate region from the captured image meanwhile for the character recognition, Optical Character Recognition (OCR) technique will be utilized. Next, the resulting data from the previous step will be compared with the entries in a database to determine the precise information. This system will be developed and simulated in the Matlab software and real-world images at the test subject. Based on the experiment, the developed system is able to identify and recognize the vehicle registration number plate successfully.

## ***ABSTRAK***

Sistem Pengecaman Nombor Plat Automatik (ANPR) adalah sistem yang akan membaca input image kenderaan dan mengeluarkan nombor plat kenderaan sebagai output. Objektif utama sistem ini adalah untuk mereka bentuk dan membangunkan sistem pengecaman kenderaan automatik yang cekap dan sistematik, yang akan menggunakan nombor plat pendaftaran kenderaan sebagai parameter. Sistem akan membaca nombor plat pendaftaran kenderaan sebagai input dan kemudian secara automatik akan mengecam nombor plat sebagai output. Sistem ini banyak dilaksanakan dalam pelbagai sektor di dunia contohnya dalam pengurusan tempat letak kereta, pengurusan trafik, tol dan juga Intelligent Transport System (ITS). Selain itu, Sistem Pengecaman Plat Nombor Automatik juga sedang dilaksanakan sebagai langkah keselamatan di pintu masuk kawasan larangan tinggi, seperti zon tentera atau pejabat tertinggi kerajaan. Sistem Pengecaman Plat Nombor Automatik yang dibangunkan mengenal pasti kenderaan masuk dan kemudian menangkap imej kenderaan. Pembahagian imej akan digunakan untuk mengekstrak kawasan nombor plat kenderaan daripada imej yang ditangkap manakala untuk pengecaman aksara, teknik Pengecaman Aksara Optik (OCR) akan digunakan. Seterusnya, data yang terhasil daripada langkah sebelumnya akan dibandingkan dengan entri dalam pangkalan data untuk menentukan maklumat yang tepat. Sistem ini akan dibangunkan dan disimulasikan dalam perisian Matlab dan imej dunia sebenar pada subjek ujian. Berdasarkan ujikaji, sistem yang dibangunkan dapat mengenal pasti dan mengecam nombor plat nombor pendaftaran kenderaan dengan jayanya.



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## LIST OF ABBREVIATIONS

<i>AI</i>	-	Artificial Intelligent
<i>ALPR</i>	-	Automatic License Plate Recognition
<i>ANN</i>	-	Artificial Neural Network
<i>ANPR</i>	-	Automatic Number Plate Recognition
<i>B/W</i>	-	Black/White
<i>BRTA</i>	-	Bangladesh Road Transport Authority
<i>CCA</i>	-	Canonical Correlation Analysis
<i>CCN</i>	-	Convolutional Neural Network
<i>CS</i>	-	Character Segmentation
<i>DIP</i>	-	Digital Image Processing
<i>GUI</i>	-	Graphical User Interface
<i>HD</i>	-	High Definition
<i>ID</i>	-	Identification
<i>ITS</i>	-	Intelligent Traffic System
<i>LSTM</i>	-	Long Short-Term Memory
<i>NPL</i>	-	Number Plate Localization
<i>NPR</i>	-	Number Plate Recognition
<i>OCR</i>	-	Optical Character Recognition
<i>PSDB</i>	-	Police Scientific Development Branch
<i>RFID</i>	-	Radio-Frequency Identification
<i>RGB</i>	-	Red Green Blue
<i>ROI</i>	-	Region of Interest
<i>SD</i>	-	Standard Definition
<i>SoC</i>	-	System on Chip
<i>SUN</i>	-	Scene Understanding
<i>SVM</i>	-	Support Vector Machine
<i>VNP</i>	-	Vehicle Number Plate
<i>YOLO</i>	-	You Only Look Once



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Number plates have been used as a means of identification throughout the countries in the world. However, the upsurge of the number of automotive vehicles nowadays provides a huge challenge in the identification of the number plate. Considering this current situation, the manual tracking of the traffic on the roads will eventually become a lost cause since it is a total waste of the manpower and also time. Not only that, operating manually will also demonstrate massive difficulties and tons of errors. The existing system for reading the vehicle registration number plate uses machine learning algorithms. This system, however, will not be working efficiently in real time because of the complexity in the system for processing in the real time background. This essentially caused an immediate need to design an automatic number plate recognition system which can provide assistance in vehicle identification and recognition.

### 1.2 Problem Statement

Automatic Number Plate Recognition system (ANPR) is developed mainly to provide assistance to humans in automatically detecting and reading the vehicle registration number plates without any human intervention. Previously, a person was required to manually detect and record the vehicle registration number plate. This system is flawed as it is not only inefficient since humans are more prone to make mistakes, but also increases the

need for human labour. To overcome this problem, this system is being developed to completely replace human intervention in detecting the vehicle registration number plate and also recognize the number plate and identify it.

### **1.3 Project Objective**

The primary goal of this project is to propose an ANPR system that can perform all of its functions efficiently. Specifically, the objectives are as below:

- a) To design a system which is capable of extracting the number plate of the vehicle from the input image.
- b) To develop a system that is capable of locating and reading the vehicle registration number plate.
- c) To verify the performance of the proposed system by using several types of fonts and numbers.

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### **1.4 Scope of Project**

The purpose of this project is to develop and design an Automatic Number Plate Recognition system by using artificial neural networks. This system, which functions to identify vehicle registration number plates, will be implemented in the MATLAB software by using the Image Processing Toolbox and Computer Vision Toolbox. As a result, the scope for this project are as follows:

- a) To develop a system that are capable of identifying vehicle registration number plates.

- b) Data can be extracted from the input image by using Image Processing Toolbox.
- c) The image of the vehicle registration number plate can be identified by using the neural network algorithm.
- d) The final output will be produced in the text form.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Automatic Number Plate Recognition system is a system that essentially allows the computer systems to read the vehicle registration's number from the digital images automatically by using Optical Character Recognition (OCR). The invention of the ANPR system started in 1976 in the United Kingdom at the Police Scientific Development Branch (PSDB) or now known as Home Office Scientific Development Branch and the early systems were developed for use in 1979.

Number plate identification or recognition is a type of Intelligent Traffic System (ITS) Technology which will not only identify and count vehicles, but also distinguish each vehicle as unique. Number plate identification technology is very useful in some applications like electronic toll collection and also the red-light violation enforcement, as the system can record the vehicle registration number plate alphanumeric, so that the vehicle owner can be charged the appropriate toll or fine.

Another number plate identification technology is in commercial vehicle operations or in secure-access control. When a vehicle is entering an area, the number plate identification technology will check the vehicle registration number plate and compare it to the established database to determine whether the vehicle can be allowed to enter the area or not. Another use of the number plate identification system is that it can be used in traffic control management. The system will identify any vehicles that commit traffic violations,

such as driving in the emergency lanes, driving under influence, parking illegally and also exceeding speed restrictions.

The number plate identification is a novel digital image processing-based technique for the automatic vehicle and traffic monitoring. In this project, there are two main components in the implementation of the number plate identification system, which are the digital image processing and also the neural network.

This system will employ advanced and novel digital image processing techniques such as pattern recognition to recognize the vehicle registration characters and also artificial neural network to extract the data.

## 2.2 MATLAB

Programming, visualization, and calculation are all integrated into the user-friendly environment of MATLAB, which may be used to solve mathematical problems in standard notation. It was created by MathWorks in 1984 and has expanded over the years with the participation of various users. Additionally, it may be used to create user interfaces for a variety of programs written in a variety of languages and to communicate with other programs written in a variety of other languages.

### Features of MATLAB software

- High-level programming language that can be used for numerical calculation, visualization, and the development of application.

- Has interactive settings that encourage iterative exploration, design, and also problem solving.
- Provide a large number of mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, numerical integration, and solving ordinary differential equations.
- Has development tools which can be used to enhance code quality and maintainability and maximize performance.
- Tools for developing programs which have a customized graphical user interface.[1]

This ANPR system, which functions is to identify vehicle registration number plate, will be implemented in the MATLAB software by using Image Processing Toolbox and also the Computer Vision Toolbox.

### 2.3 Digital Image Processing

The digital image processing is the technique of using a digital computer to process digital image through an algorithm. Image Processing Toolbox is a comprehensive collection of standard algorithms, functions, and also applications that are useful for image processing, image analysis, image visualization and also algorithm development. By using the Image Processing Toolbox, the user can perform several tasks, for example, image analysis, image enhancement, noise reduction and also geometric modifications. [1]

#### **Key Features of Digital Image Processing**

- Can be used for image analysis, including image segmentation, image morphology, and image measurement.

- Can be used for image enhancement, image filtering and also deblurring.

### **2.3.1 Digital Image Reading**

The `imread` function will be used to read images from any supported graphics file, in any of supported bit depth.

### **2.3.2 Image Binarization**

The process of converting a grayscale image to a black-and-white image is known as image binarization. In this process the information, which resides in the image, will be reduced from 256 shades of grey to 2: black and white, and essentially produce the final output as a binary image. This technique is commonly referred to as image thresholding, despite the fact that the result of the thresholding technique is images with more than two levels of grey. It is a type of segmentation that will essentially break down an image into individual objects. Image binarization technique will usually be performed when an object needs to be extracted from an image.[1]

### **2.3.3 Morphological Operation**

Morphological operations contain a comprehensive set of image processing techniques that are able to manipulate images depending on their shapes. The morphological techniques utilize structural elements to create an output image that has the same size as the input image. In the morphological process, the value of each pixel in the output image will be determined by comparing the corresponding pixel in the input image with its neighbours.