

UTeM SECURITY MONITORING SYSTEM (UTeM SEMS)

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**Bachelor of Electrical Engineering
(Control, Instrumentation and Automation)
June 2012**

“ I hereby declare that I have read through this report entitle “UTeM Security Monitoring System (UTeM SEMS)” and found that it has comply the fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)”

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**A report submitted in partial fulfillment of the requirements for the degree of
Bachelor Electrical Engineering (Control, Instrumentation and Automation)**

**Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

2012

I declare that this report entitle “UTeM Security Monitoring System (UTeM SEMS)” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Zainolizam Bin Musa

Date :

To my beloved mother and father

ACKNOWLEDGEMENT

Firstly, I would like to convey my grateful to my supervisor, Mr. Ir. Norazhar Bin Abu Bakar who has given guidance and direction to complete this project.

Second, I also wish to send my gratitude to my colleagues especially my course mate that's always gave help, support opinion and share knowledge to teach me to complete this report.

In addition, I also wish to convey my sincere appreciation to my partner in my group who has spent much time together to help and teach me some solution and coding for image processing by using MATLAB software and on finishing this report. Their views and tips are useful indeed.

Finally, I would like to express my fully gratitude to my parents, because they given the support and their patience to me.

ABSTRACT

This final year project represent, UTeM Security Monitoring System (UTeM SEMS) which is an image-processing technology used to identify the license plates for each vehicle. Traffic congestion is a habitual issue within the entrance of UTeM due to the vehicle validation process for security purpose. Currently the process is done manually by visual checking and this is causing congestion problem especially during peak hour. Therefore a method of plate recognition with integrated database system for monitoring and display system is developed. Vehicle plate number will be captured through the camera and recognized before some relevant information is being displayed. If the vehicle is registered within database, a welcome greeting is displayed otherwise an instruction is displayed requesting the vehicle to park at designated area to register with the security guard. With this system, the security guards do not have to stop and check each vehicle to identify the plate number, either it was registered or not before entering the main campus area. This will enhance UTeM's security system, smooth the traffic at the entrance and time management. To develop this system, the MATLAB software is used for image processing (plate recognition) and developing the graphical user interface (GUI) to display the information of driver details, while a digital camera is used to capture image of vehicle and the captured image will be stored in a computer. The method to be used for implementing plate recognition is neural network. The experiment has been done on 100 images of vehicle to analyze the accuracy of the system to recognize the plate number.

ABSTRAK

Projek tahun akhir ini adalah, Sistem Pemantauan Keselamatan UTeM (UTeM SEMS) yang menggunakan satu teknologi pemprosesan imej untuk mengenal pasti nombor plat pendaftaran setiap kenderaan. Kesesakan lalu lintas adalah satu isu yang lazimnya berlaku di pintu masuk UTeM yang disebabkan oleh proses pengesahan setiap kenderaan untuk tujuan keselamatan. Pada masa kini proses pengesahan dilakukan secara manual iaitu melalui pemeriksaan visual dan inilah punca masalah kesesakan berlaku terutamanya pada waktu puncak. Oleh itu, satu kaedah pengiktirafan plat dengan gabungan sistem pangkalan data untuk sistem pemantauan dan sistem paparan dibina. Nombor plat kenderaan akan ditangkap melalui kamera dan diiktiraf sebelum beberapa maklumat yang relevan dipaparkan. Jika kenderaan telah berdaftar dalam pangkalan data, ucapan selamat datang dipaparkan dan jika sebaliknya, satu arahan dipaparkan meminta pemandu kenderaan untuk parkir di kawasan yang ditetapkan bagi mendaftar dengan pengawal keselamatan. Adanya sistem ini, pengawal keselamatan tidak perlu untuk memberhentikan dan memeriksa setiap kenderaan bagi mengenal pasti nombor plat sama ada ia telah didaftarkan atau tidak sebelum memasuki kawasan kampus induk. Ini akan meningkatkan sistem keselamatan UTeM, melancarkan lalu lintas di pintu masuk dan melancarkan pengurusan masa. Untuk membangunkan sistem ini, perisian MATLAB digunakan untuk pemprosesan imej (pengiktirafan plat) dan membangunkan *graphical user interface (GUI)* untuk memaparkan maklumat pemandu, manakala kamera digital digunakan untuk menangkap imej kenderaan, imej yang dirakam akan disimpan ke dalam komputer. Kaedah yang digunakan untuk melaksanakan pengiktirafan plat ialah *neural network*. Eksperimen telah dilakukan ke atas 100 imej kenderaan untuk menganalisis ketepatan sistem bagi mengiktiraf nombor plat.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Lately, the news often appears either in newspapers or on television about road accidents, traffic congestion, crime prevention operations and accidents, and others that involving various vehicles. It also occurs in the UTEM campus at the main entrance. However, what happens is not like the news in the newspapers or on television about the car accident, but traffic congestion caused by vehicles had to stop in this area for security checks. Congestion problems that too often occur especially during peak hours in the morning because of all employees and all students will be rushed to their class or to their offices.

Once the inspection was going, of course it will probably take a long time that will cause more congestion and cause delays to students or employees to enter the class or the office. So that, to solve this congestion must use this system called UTeM Security Monitoring System (UTeM SEMS). It is an image processing technology used to identify vehicles by their registration plates. License plate recognition involves recording photographic images on license plates, where it is processed by a series of algorithms that can provide alpha-numeric conversion is recorded on the license plate image into the text field [9].

This technology can be used for many types of applications such as control of security, control access to parking, controlling access to areas of privacy, finding stolen cars, traffic

control and speed control. In addition, there are many type of method for plate recognition, but for this project, neural network is used by referred from another previous project for successful recognition of the plate number of vehicles [7].

Once the plate has been correctly identified, information on the vehicles can be obtained and then the identified plate number will be transferred to MATLAB GUI to check the information for identifying whether the owners of cars registered with UTeM or not.

1.2 Problem Statement

In view of the plate recognition has many applications, among them are able to control the busy traffic and control access to certain areas [9]. Therefore, this project was developed to apply plate recognition in UTeM. Since today, often seen in the morning, traffic congestion will occur at the main entrance to the main campus of UTeM. This problem occurs because of the security officer had to stopped each cars or another vehicle such as bus, lorry and motorcycle to check whether the vehicles was registered with UTeM or not before they entering the main campus area. Among the causes of each car need to stop for inspection, firstly there is some vehicle does not have a sticker of UTeM, second is the existing sticker was expired, thirdly is the writing on the sticker was blur that can give any doubt whose the real owner of the vehicle and at the same time can make sure no suspect of crime will entered the main campus of UTeM. Moreover, the main cause of traffic jams is just one lane was opened for vehicle to across the gate. To solve this problem, the system will be installed at the main entrance of the main campus UTeM. After that the lane can be opened for two lane but need to separate the two lane for the first lane is just for the vehicle that pass after checked the plate number and the second lane is just for vehicle that not pass which are do not have sticker, expired period for sticker and also blurry sticker.

1.3 Objective

The objectives of this project are:

1. To design Smart Malaysian Plate Recognition System for UTeM traffic control.
2. To develop plate recognition algorithms for plate recognition system.
3. To analyze the accuracy of the system to recognize the plate number of each vehicle that might entering UTeM's gate entrance.

1.4 Scope

The scope of this project is developed an algorithm to identify the characters of plate number by using the MATLAB software, while the hardware is using personal computer to running all software, and a digital camera is used to capturing video image to identify the plate number of vehicles. This project is focus on how to identify the plate number image to transfer on MATLAB using neural network method for recognition.

CHAPTER 2

LITERATURE REVIEW

2.1 Type of License Plate Number

Generally, there are many types of vehicles such as motorcycle, car, taxi, lorry, tractor and so on. A license plate number or also called number plate is a small metal or plastic plate attached to a motor vehicle for official identification purposes. On each vehicle, it must be appeared in pairs, with the one attached at the front and another one attached at the rear. The license plate has an alphanumeric number on it, which is specific for the vehicle. For each vehicle, it must follow the specification that has been approved by Department of Road Transport (JPJ).

In Malaysia, for normal vehicle such as personal car it has plate number with black color for the background and the font color is white, while for taxi is the background color of plate number is white and the font color is black [9]. Vehicles license plates are in the form of vertical or horizontal with normal fonts that has been standardized by JPJ which comprise of perhaps 90% of the all vehicles as shows in Figure 2.1. There are also taxi plate number and special fonts as shows in Figure 2.2.

According to the project of by Jasiha Nor Binti Jamaludin [2], and by Wisam Al Faqheri and Syamsiah Mashohor [3], they were focus on their project with horizontal license

plate form while the project by Othman Khalifa, Sheroz Khan, Rafiqul Islam and Ahmad Suleiman [7], and by Siti Norul Huda Sheikh Abdullah, Marzuki Khalid and Rubiyah Yusof [5], they were use both of license plate form. All of them were also focus on car license plate only. So that, in this project will also focus on car license plate and horizontal car license plate form.

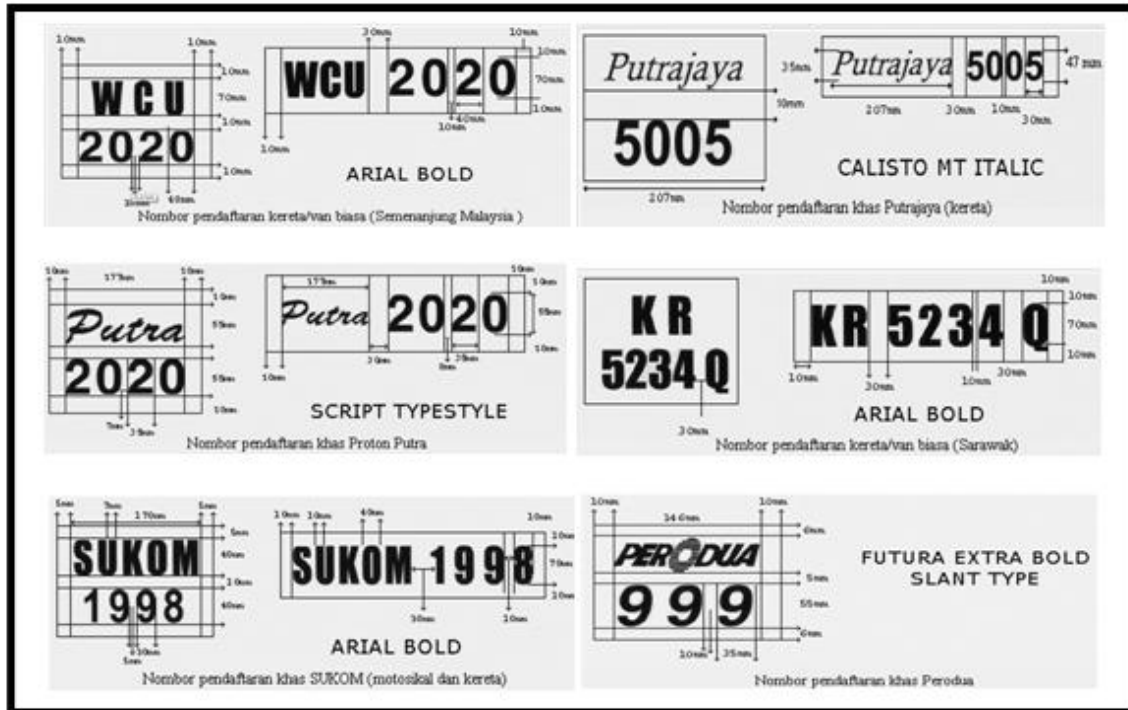


Figure 2.1: Standard size for plate number set by JPJ

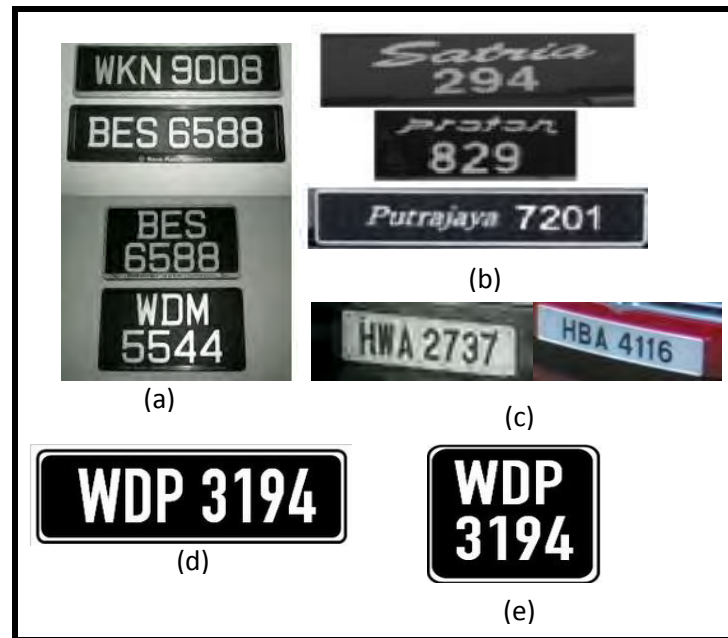


Figure 2.2: (a) Samples of common Malaysia license plates. (b) Samples of special Malaysia license plates. (c) Samples of taxi license plates. (d) horizontal license plate form (e) vertical license plate form.

2.2 Plate Recognition

According to Lee J. Nelson [10], plate identification/recognition is one form of ITS technology that not only recognizes and counts vehicles, but distinguishes each as unique. For some applications, such as red-light violation enforcement and electronic toll collection, plate identification/recognition records the license plates alphanumeric so the vehicle owner can be assessed the appropriate toll. Another application can be used with plate recognition are [12]:

- a. Traffic management systems
- b. Marketing tool
- c. Stolen cars
- d. the car plate number is registered in the entry or exits to the country at Border Control
- e. To measure average vehicle speed over longer distances for section control

- f. To automatically recognize customers based on their license plate and offer them the items they ordered the last time they used the service by Drive Through Customer Recognition which can improving service to the customer
- g. To assist visitor in recognizing guest vehicles
- h. Airport parking

Plate identification/recognition is a new tool for automatic vehicle and traffic monitoring by using digital image processing.

2.3 Image Processing

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subfield of digital signal processing, digital image processing has many advantages over analog image processing, it enables a wider range of algorithms used for data input, and also can prevent problems such as increased noise and signal distortion during processing [10]. For digital image processing, enhancing the image was the most interesting part. Enhancement program will make the information more clearly and several techniques have been used to achieve the target.

2.3.1 Pre-processing

The original image/input image is generally in a large pixel. Therefore, that input image need to crop/resize. According to Mohd Firdaus Zakaria et. al. [4], they done this step on their project in order to minimize the processing time, the original image/input image has been cropped just only fifty percent of the lower part of the input image will be processed. This is because the upper part does not contain a plate number area.

There are various problems with various image of license plate such as license plate can be dirty, the car can be of a bright color, poor lighting and so on. Hence, the captured image need to pre-processes based on some approaches. Pre-processing is very important step for the good performance of character segmentation. According to the project by Norfaeza binti Mat Noor [6], and by Othman Khalifa, Sheroz Khan, Rafiqul Islam and Ahmad Suleiman [7], they stated that input image is initially processed to improve its quality and prepare it to next stages of the system. First step, they were used NTSC standard method to convert RGB images to gray-level images:

$$\text{Gray} = 0.299 * \text{Red} + 0.587 * \text{Green} + 0.114 * \text{Blue} \quad (1.1)$$

Second step, to remove the noise, while preserving the sharpness of the image they applied median filter (5 x 5) to the gray-level image. The median filter is a non-linear filter, which replaces each pixel with a value that obtained by computing the median of values of pixels (in the case) in a 5 X 5 neighborhood of the original pixel.

2.3.2 Edge Detection

The edge in an image is the reasonably gradual or sudden change from dark to light or from light to dark of pixel intensity. To calculate the gradient image of the edges, the most common ways to extract the edges is by filtering the image with a suitable mask. Sobel was developed a filter known as the Sobel operator which is composed of two 3 x 3 masks as shown in Figure 2.3 [2].

Malaysian license plate consists of a line of white characters on a black background. "Edges" are called to be saying that the license plate region is characterized by successive transition from black and white and vice versa. The strongest edge values may occur, if the transition from white pixels to black pixels or from black pixels to white pixels can be found. For Malaysian license plate, this is ideal case because it is drawn on black background, and thus they produced high intensity edge values which can be used to find possible plate regions. Sobel operators were used to find the edge image in their project [2] [7].