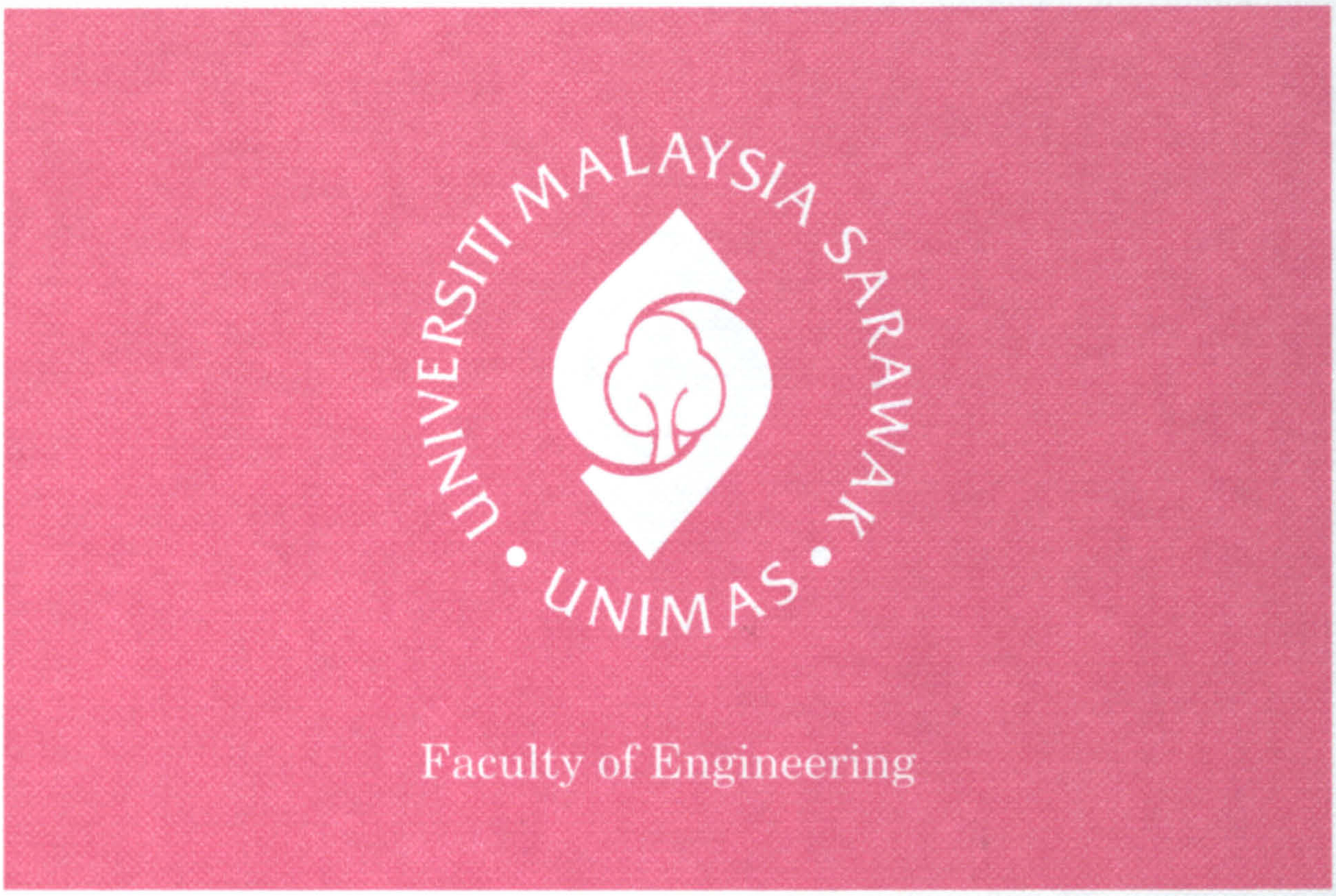

PAVEMENT CRACK IDENTIFICATION

Mohammad Hidayat Bin Isa

Bachelor of Engineering with Honours
(Electronics and Computer Engineering)
2010

BORANG PENGESAHAN STATUS TESIS

Judul: Pavement Crack Identification

SESI PENGAJIAN: 2009/2010

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Title : Pavement Crack Identification

Writer : Mohammad Hidayat Bin Isa

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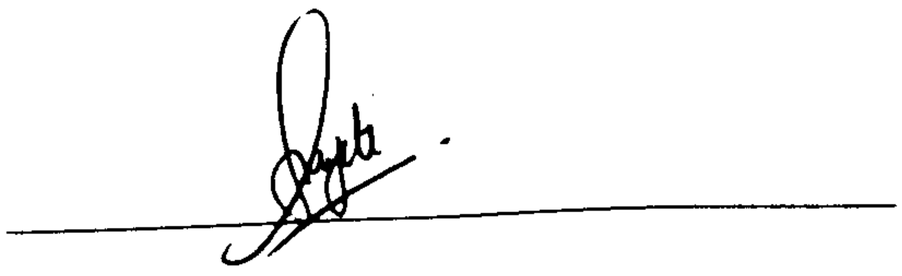

30 JUNE 2010

Madam Kuryati Kipli

SUPERVISOR

DATE

Pavement Crack Identification

By

Mohammad Hidayat Bin Isa

This project is submitted to the

Faculty of Engineering, Universiti Malaysia Sarawak

in partial fulfilment of the requirements for the degree for

Bachelor of Engineering with Honours

(Electronics and Computer Engineering)

2010

DEDICATION

Dedicated to my beloved parents who inspired me a lot..

ACKNOWLEDGEMENT

First of all, I would like to convey my very special thanks and gratitude to my supervisor, Madam Kuryati Binti Kipli who has guided me throughout this final year project. Her valuable advices and her willingness to spare her precious time in guiding and assisting me have motivated me to work hard all way through this research.

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ABSTRAK

Projek ini menunjukkan pengecaman retakan jalan raya berturap. Pengecaman retakan jalan raya berturap ini direkabentuk daripada kombinasi imej pemprosesan dan rangkaian saraf. Projek ini adalah untuk membantu penilaian kejuruteraan jalan berturap. Penilaian jalan berturap di Malaysia masih menggunakan kaedah tradisional, kaedah ini mempunyai kekurangan seperti proses yang perlahan, memerlukan tenaga kerja profesional, dan kaedah ini adalah subjektif yang boleh menyebabkan penilaian yang tidak jitu. Tambahan pula, kaedah lama ini boleh membahayakan peninjau dengan keadaan lalu lintas yang sesak. Sistem ini menggunakan pemprosessan imej untuk mendapatkan maklumat dan menjadikan input untuk rangkaian saraf buatan. Beberapa kombinasi pemprosessan imej digunakan untuk mendapatkan maklumat yang terbaik pada imej data, seperti imej berskala kelabu, pengesanan pinggir, dan operasi morfologi. Seterusnya, rangkaian saraf buatan direka dengan melatih imej data sebagai input data mengikut sasaran data. Projek ini juga memfokuskan pembinaan perisian, pengantaraan pengguna bergrafik (GUI) adalah cara alternatif untuk pengguna berkomunikasi dengan sistem yang mesra pengguna, selesa dan interaktif. Sebagai kesimpulan, kombinasi pemprosessan imej, rangkaian saraf dan GUI boleh membezakan dan mengenalpasti retakan jalan raya berturap. Tambahan pula, ia memberi kaedah alternatif untuk pengecaman retakan jalan raya berturap.

ABSTRACT

This project presents the pavement crack identification. It is designed to identify pavement crack that involves the combination of image processing and neural network. This project is used to help the engineering evaluation on the road pavement Malaysia, road pavement evaluation is still using the traditional method. This method has it shortcoming such as slow process, an experience labor needed and the method of pavement crack evaluation is subjective that can result inaccurate evaluation. Furthermore, the old method can endangered the surveyor with the high volume of traffic. This system used image processing to extract information from the image as an input for the Artificial Neural Network (ANN). There several combination of image processing is used to find the best way of extracting the data image, such as grayscale image, edge detection, and morphology operation. Next, the artificial neural network created by training the data image as the data input with correspond to the target data. This project also focus on the software development, Graphical User Interface (GUI) is an alternative way for user to interact with the system that user friendly, comfort and interactive for the users. In conclusion, the combination of image processing, neural network and GUI is capable to distinguish and identify a pavement crack. Furthermore, it gives an alternative method to identify pavement crack.

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LIST OF ABBREVIATION

ANN	-	Artificial Neural Network
GUI	-	Graphical User Interface
LMS	-	Least Mean Square
TFs	-	Transfer Functions
BP	-	Backpropagation
MATLAB	-	MATrix LABoratory
UNIMAS	-	Universiti Malaysia Sarawak
RGB	-	Red, Green and Blue
JKR	-	Jabatan Kerja Raya
MSE	-	Mean Square Error

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CHAPTER 1

INTRODUCTION

The aim this project is to analyze image processing method, to find a new alternative way to recognize or identify pavement cracks. In Malaysia, the evaluation of pavement crack is still using the traditional and time consuming methods. Thus a new alternative have to be develop in order to reduce this weakness.

The evaluation of pavement condition is an important part in pavement management. Accurate evaluations will ensure the management able to make precise decision, thus yielding a better service condition. Pavement can be evaluated through the difference types of distress experienced, such as cracking, disintegration and surfaces deformation. Pavement engineers take times to determine the information in evaluating the pavement and the pavement crack. The result from the evaluation will be documented and used to determine present pavement condition, chart past performance history, and predict future pavement performance [1].

1.1 Aims and Objective

Currently, computer and image processing technology has gone through major enhancement. Thus, an alternative ways of identifying pavement crack can be achieved.

The objectives of this project are;

I. To investigate data collection technique for evaluating pavement cracks and identified pavement crack.

II. To find the best image processing techniques for detecting pavement cracks by using MATLAB toolbox.

III. To develop image processing program with Artificial Neural Network (ANN) that able to identify pavement cracks by using MATLAB software.

1.2 Scope of Project

The scope of this project is to develop a program that can identify pavement crack by using image processing method with ANN and develop Graphical User Interface (GUI) for the program to be run. This project includes of capture a pavement image using digital image camera and subsequently processing them by using computer software to quantify pavement distress. The ANN will be use for training recognition and GUI will simplified the recognition procedure into a simple program. The software used for the pavement analysis is MATrix LABoratory (MATLAB) R2008b with image processing and neural network toolbox and tool for image acquisition is using digital camera only. Further explanation on the image processing, ANN and GUI is elaborates in Chapter 3: Methodology. The scope can be summarized as below:

I. Utilize image digital processing to analyze the types of road pavement cracks.

II. Developed a suitable image processing to view the pavement crack(s)

III. Training sample image using neural network to learn recognize desire crack.

IV. Experiment a design proper procedure data collection, image processing, training neural network and develop a GUI.

1.3 Limitation

In this project, the application using image processing technique limited to flexible pavement (asphalt concrete surfaces) distresses analysis, which is cracking. The inflexible pavement road cracking pavement analysis was not performed.

For image pavement acquisition, the pavement surface must be dry and the image must be captured during the day under ambient light. This is because images taken under direct sunlight are the best.

1.4 Statement of Problem

Engineering evaluation on the road pavement is important as the traffic user is increasing, with this evaluation the road maintenance system can be improve. Manual visual inspection, it time consuming and costly. Thus, new ways of recognition of crack have to develop, in order to reduce cost.

The traditional method for road evaluation in order to monitor pavement surface condition is the visual observation. This method only assigned to the trained engineers as they drive along the road doing inspection. Nevertheless this method has it shortcoming such as:

I. Slow, need experience labor and there are expensive.

II. The method is subjective, which create a result that is inconsistent and inaccurate in determining pavement condition.

III. Not flexible and did not provide an absolute measurement of the surface.

IV. Can be dangerous or risky to the surveyor due the high speed and high volume traffic.

There is study to minimize the problem in using the traditional method for crack recognition. Furthermore, there a number of responses for those automated, indeed the automated is a better way of recognition of cracks but costly. Therefore a new method for recognition has to develop, which is better than traditional method but less cost than the automated.

1.5 Benefit of Project

The benefits on the project application are listed as below:

Expected outcome:

- A suitable image processing methods for crack detection.
- Successful neural network training and classification.
- Working program for image recognition of the pavement cracks.
- Graphical User Interface (GUI) pavement crack identification.

Contribution to the field:

- Pavement evaluation will be simplified than the normal ways of survey.
- More accurate road pavement road cracks identification.
- Increased access, reliability and satisfaction for end-users.

CHAPTER 2

LITERATURE REVIEW

This chapter gives a brief explanation on bituminous road structure and crack pavement. Besides, this chapter includes explanation about the digital image processing and artificial neural network.

2.1 Bituminous Road Structure in Malaysia

The bituminous road in Malaysia first constructed some time stared before the Second World War. Originally, pavement road were only constructed by using stone pitching, on sand or laterite sub-based covered with a layer of tar or bitumen stabilized aggregates, as time goes by the road pavement has evolved. During the world war two, the pavement road has been constructed with crushed stone road bases and sand sub-based with dense bituminous surfacing and this construction method are still being practiced until today [1].