PALM OIL CLASSIFICATION USING RGB AND FUZZY

KHAIRUN NOR AIMI BT GHAZALLI

This thesis is submitted as partial fulfillment of the requirements for the award of the Bachelor of Electrical Engineering (Hons.) (Electronics)

Faculty of Electrical & Electronics Engineering
Universiti Malaysia Pahang

NOVEMBER 2010

Signature : _____

Author : KHAIRUN NOR AIMI BT GHAZALLI

Date : 26 NOVEMBER 2010

ACKNOWLEDGEMENT

Alhamdulillah, His Willingness has made it possible for me to complete the final year project (Projek Sarjana Muda) in time.

I would like to take this opportunity to express gratitude to my dedicated supervisor, Mrs Rohana binti Abdul Karim for her guide that help this project at every stage and getting things done by sharing his valuable ideas and knowledge. Also very huge regard and very thankful because of credibility and commitment in give tremendous amount of advice while ongoing project Palm Oil Classification Using RGB and Fuzzy.

I would also like to thank to Dr Kamarul Hawari bin Ghazali for give me an idea and their data and also to all lecturers whom had helped directly or indirectly thus making this project a reality.

Not forgotten to my colleagues for their openhandedly and compassionately guided, assisted, and supported me to make this project successful. My deepest thanks to my dearest family which always support and pray on me throughout this project. Their blessing gave me the high-spirit and strength to face any problem that had occurred and to overcome them appropriately.

The great cooperation, kindheartedness and readiness to share worth experiences that have been shown by them will be always appreciated and treasured by me, thank you.

ABSTRACT

This research is about to classification palm oil by using RGB and Fuzzy. As we know the current practice in the oil palm is to grade the oil palm bunches manually using human graders for separate which one for producing oil or others effectiveness. This method is subjective and subject to disputes. In this case, we developed systems by using image processing technique RGB as a preprocessing and fuzzy logic as classifier. The RGB color technique is utilized as the extracted features for the oil palm fruit rind. Further, the extracted feature is classified using fuzzy logic system to determine the ripeness level of the oil palm fruit. The system has been design to act like human eye and brain by process the fruit images and made a decision based on selected category. The result shows that it was successful discriminate the fruit bunches with accuracy False Rejection Rate (FRR) about 10% and False Acceptance Rate 0% for ripe categories, 20% and 0% False Rejection Rate (FRR) and 0% for False Acceptance Rate (FAR) for under ripe and unripe categories.

ABSTRAK

Tujuan kajian ini adalah untuk mendapatkan klasifikasi buah kelapa sawit dengan menggunakan teknik RGB dan Fuzzy. Seperti yang kita ketahui pada hari ini, kaedah penggredan buah kelapa sawit adalah secara manual iaitu melalui kepakaran manusia untuk menentukan samada buah kelapa sawit itu masak,separuh masak ataupun masih muda lagi. Secara praktikalnya kaedah ini adalah sangat subjektif dan pelbagai pandangan dapat dibuat melalui mereka yang mahir. Oleh yang demikian satu kajian di laksanakan bagi meningkatkan mutu dan tahap penggredan buah kelapa sawit ini. Dengan menggunakan teknik "Image processing (RGB)" sebagai pra pemprosesan dan logik fuzzy sebagai pengklasifikasinya Teknik warna RGB digunakan untuk menentukan ciri-ciri dihasilkan untuk kulit buah kelapa sawit dan cirri yang dihasilkan dikelaskan menggunakan sistem logik fuzzy untuk menentukan tahap kematangan buah kelapa sawit. Sistem ini telah dibuat untuk bertindak seperti otak dan mata manusia dengan memproses gambar buah kelapa sawit dan membuat keputusan berdasarkan kategori yang dipilih. Oleh yang demikin, keputusannya menunjukkan bahawa system ini berjaya membezakan tandan buah kelapa sawit itu samada masak,separuh masak ataupun masih muda dengan peratusan ketepatannya berdasarkan nisbah bilangan data yang betul tapi tidak diterima oleh sistem sebanyak 10% dan data yang salah tapi sistem terima 0% bagi kategori masak, sebanyak 20% dan 0% data yang betul tapi sistem tidak terima dan 0% bagi data yang salah tetapi sistem terima untuk kategori separuh masak dan tidak masak buah kelapa sawit.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

LIST OF FIGURE

LIST OF FIGURE

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Overview Of Palm Oil

Malaysia is currently one of the world's largest producer and exporter of palm oil. Oil Palm cultivation began in 1917 but growth was initially very slow. Palm oil sector was only during the last 50 years that plantation development was accelerated through large-scale investment in the cultivation of the oil palm as one of the approved crops for diversifying the country's agricultural development.[1]. Oil palm were introduced to Java by the Dutch in 1848 and Malaysia by the British colony of Malaya in 1910 by Scotsman William Sime and English banker Henry Darby[3]. Oil palm can be categorized into two species there are Arecacea or Palma family which are using for agriculture for producing palm oil.Elaeis guineensis is oil palm from the west African countries and widely use as a cooking oil.

Oil palm industry is a vast and vital industry in Malaysia that our own country had been the largest production of palm oil export. The total oil palm planted area in the country increased by 4.5% to 4.69 million hectares in 2009. Among the regions, Sarawak registered the largest increase in planted area with a growth of 12.8%, followed by Peninsular Malaysia 3.3% and Sabah 2.1%. Sabah is still the largest oil palm planted State, accounting for 1.36 million hectares or 29% of the total planted area in the

country. Exports of palm oil gained 2.9 % to 15.87 million tonnes in 2009 as against 15.41 million tonnes in 2008[4].

Nowadays, image processing is widely used in automation and manufacturing production[2][7][8][9]. The advancement in computer technology allows researches to implement it in agriculture industry. Over the last 50 years, research and development activities and technological advances have helped for improved oil palm sector. Grading of oil palm fruit bunches are developed using image processing technique. Image processing using RGB and fuzzy logic has been used as a tool to analyze oil palm fruits bunch. RGB technique is like analyze the colour of the fruit and obtain its quality based on the density of the RGB model.

Currently, grading the oil palm are using by human grader, where the grader will follow the standard inspection given by authorities based on oil palm maturity if ripe, unripe and under ripe. But human inspection are very subjective as depends on different human graders classify differently and may expert grader may fail to articulate the grading criteria properly. Besides that, for grading oil palm generally dependent upon colour of rind. The colour and lighting when taking a picture for grading will effect the classifying the maturity of oil palm bunch.

So, by developing the system that able to recognize the colour and can make decision like human thinking, it can make grading system would be easier in agriculture industry. The human eyes perceive colours differently and this very often lead to dispute between graders and sellers. Therefore, a standard colour or features of oil palm for grading will determine and it easier to make classifying of maturity oil palm bunch.

Figure 1.1 : Oil Palm tree

Figure 1.2 : Oil Palm bunch

1.2 Problem Statement

Agriculture industry are widely industry in Malaysia. One of the them is oil palm industry. As we know, Malaysia is one of the largest export oil palm in the world. As an export commodity, the production of good quality oil palm is vital because most of the importer countries are a quality conscious customer. Thus, an effort towards the best quality production of the oil palm should be discovered. Besides, it will complement Malaysia ambition in expanding the agriculture products to support growth in the economy. The implementation of the fuzzy logic in grading oil palm bunch can make the work grading more faster and not take a long time. So we need the good systematic system grading of oil palm for maintain and increase the producing of oil palm.

1.3 Objectives

The objective of this project are:

i. To determine maturity of oil palm fruit bunch
ii. To analyze the best structure of fuzzy logic for grading oil palm
iii. To developed algorithm for maturity grading

1.4 Scope Of Project

The focuses of this project are :

i. Classification of maturity oil palm
   - Ripe
   - Unripe
   - Under ripe

ii. Using parameter based on reddish and full bunch.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Colour provides valuable information in estimating the maturity and examining the freshness of fruits and vegetables. Colour also is one of the most significant criteria related to fruit identification and fruit quality and is a good indicator for ripeness. In agricultural applications, especially for fruits, we can estimate fruit quality from their colour. Nowadays, this technology are widely used in agriculture application and many researcher has done their research about this image processing technique. Quality features such as the color, size and defects of apples were measured through different equipment. The same set of apples was graded by both a human expert and a FL system designed for this purpose[7]. Monitor watermelon ripeness based on image processing technique and fuzzy logic as classifier. The RGB color technique is utilized as the extracted features for the watermelon's rind[8]. Oil palm Fruit Bunch Grading System Using Red, Green, Blue Digital Number was developed to distinguish between three different categories of oil palm fruit bunches. The maturity of colour ripeness index was based on different colour intensity.[9]

2.2 Manual Grading Of Oil Palm

Normally, in the agricultural industry grading method performed manually by human expertise. Therefore, the oil palm industry of Malaysia Palm Oil Board (MPOB) has issued a manual grading of oil palm fruits to promote quality awareness, especially among farm operators and small farmers. This manual are describe about the including sampling, and grading methods

Grading manual are available as a practical guide for grading of oil palm fruits and the main objectives are:

i. To improve the oil palm fruits which are marketed to the factory
ii. To improve the quality of crude palm oil production.
iii. To improve the efficiency of the extraction rate of palm kernel oil at the factory.
iv. To determine the supplier and manufacturer returns commensurate

Bunches Classification:

i. Ripe bunches had red and orange colour and outer mesocarp is orange . This bunch had at least ten (10) relay sockets fresh fruit and more than fifty percent (50%) are still attached to the bunches during the inspection at the factory. Fruit bunches and a detached fruit should be sent to the factory within 24 hours after harvest.

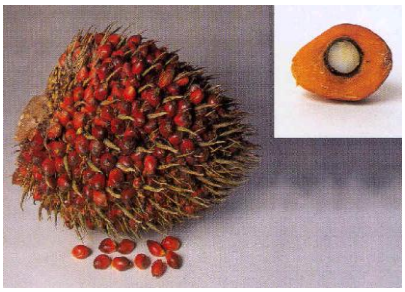

Figure 2.1: Ripe Bunch

ii. Under ripe bunches has reddish orange or reddish purple colour and the outer layer of the fruit mesocarp slightly orange color. This bunch has less than ten (10) detached sockets fresh fruit during inspection at the factory. Fruit bunches and the detached fruit should be sent to the factory within 24 hours after harvest.

Figure 2.2 : Under ripe bunch

iii. Unripe bunches had black or dark purple and their mesocarp are yellowish at outer layer. This bunch does not had fresh fruit relay socket during inspection at the factory. Fruit relay socket (if any) in the young fruit bunches are not caused by the normal ripening process.

Figure 2.3 : Unripe Bunch

iv. Overripe bunches had a dark red colour and more than fifty percent (50%) had detached fruit, but at least ten percent (10%) of fresh fruit is still attached to the bunch during the inspection at the factory. Overripe bunches and the detached fruit should be sent to the factory within 24 hours after harvest.

Figure 2.4 : Over ripe bunch

v. Empty bunch are more than ninety percent (90%) of fruit are detached from the bunch during the inspection at the factory.

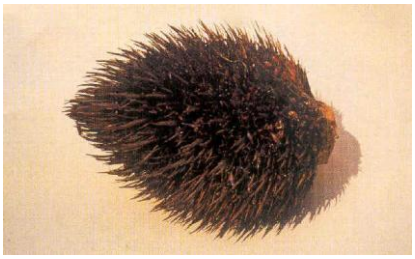

Figure 2.5 : Empty Bunch

vi. Detached fruit is reddish orange fruit that fell from the ripe bunches. It should be sent to the factory within 24 hours after the bunches are harvested.

Figure 2.6 : Detached Fruit

2.3 RGB Colour Model

The RGB colour model is composed of the primary colours Red, Green and Blue, and RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors.

Figure 2.7 : Additive primary colour

RGB values encoded in 24 bits per pixel (bpp) are specified using three 8-bit unsigned integers (0 through 255) representing the intensities of red, green, and blue. This representation is the current mainstream standard representation for the socalled