PALM OIL AUTOMATED GRADING SYSTEM, AGS (DATA ACQUISITION UNIT)

ISMAIL BIN MOHAMMAD

This Report is submitted in Partial Fulfillment of Requirements for the Bachelor of Electronic Engineering (Telecommunication Electronics)

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

June 2014

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : PALM OIL AUTOMATED GRADING SYSTEM, AGS (DATA ACQUISITION UNIT)

Sesi Pengajian : 13/14

Saya ISMAIL BIN MOHAMMAD
(HURUF BESAR)
mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.

Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.

Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.

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**	

Disahkan oleh:

(TANDATANGAN PENULIS) (COP DAN TANDATANGAN PENYELIA)

Tarikh: Tarikh:

FKEKK.PSM.0.4

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN PENERIMAAN LAPORAN PSM II

Nama Pelajar	ISMAIL BIN MOHAMMAD													
No Matrik	B	0	2	1	0	1	0	3	2	5	**Kursus**	4	B	E	N	T
Tajuk Projek	PALM OIL AUTOMATED GRADING SYSTEM, AGS (DATA ACQUISITION UNIT).													

Saya mengesahkan penerimaan perkara-perkara berikut daripada pelajar seperti yang tercatat di atas:

- ☐ 2 Laporan PSM II Berjilid
- ☐ 1 Cakera Padat Laporan Akhir
- ☐ Hasil Projek (sekiranya berkenaan)

……
(Tandatangan JKPSM)

Nama & Cop : …… **Tarikh** : ……...

Nota: Bahagian maklumat pelajar mesti ditaip kemas.

"I hereby declare that this report is my own work except for any summary and citation which each and every of them had been stated its source."

Signature : _____

Writer's name : ISMAIL BIN MOHAMMAD

Date : _____

"I hereby declare that have read this paper and in my opinion this thesis is sufficient in terms of scope and quality for the conferment of Bachelor of Electronic Engineering (Telecommunication Electronics)."

Signature : _____

Supervisor's name : FAUZI BIN MOHD JOHAR

Date : _____

"I hereby declare that have read this paper and in my opinion this thesis is sufficient in terms of scope and quality for the conferment of Bachelor of Electronic Engineering (Telecommunication Electronics)."

Signature : _____

Supervisor's name : MOHAMMAD BIN ISHAK

Date : _____

"For both of my beloved parents, Mohammad Bin Ishak and Rosnaini Binti Ali"

ACKNOWLEDGMENT

I take this opportunity to express my highest gratitude to the one and only Almighty Allah S.W.T for the blessing and the strength to finish my final year project (FYP). I am very grateful and thankful to have such supportive supervisor Mr. Fauzi Bin Mohd Johar and Mr. Mohammad Bin Ishak that has never stop giving ideas and motivation to make this project a success. I could not have accomplish the things that I had now if it isn't from my beloved family who support me not only for the FYP but since I entered the world, they are everything to me and I am very grateful to have such a loving and supportive family. Special thanks to the Sime Darby Plantation especially to the QA & OE department for sharing the knowledge and resources during the project. My project partner Nur-Iman Binti Mohammed Rosdi for the non-stop input and help to make the AGS project a success. Not to forget my friends that helped me with my project either directly or indirectly in this project with all their heartiness for their efforts, times and energy in helping me getting through. Words of gratitude might not do justice for the help that I have receive but I am sincerely thankful.

ABSTRACT

The palm oil is the most consume oil seed crop with the growing demands over it. Sime Darby Plantation had emerged the biggest producer in the world. With huge amount of palm oil production, the company a striving to achieve for better efficiency. One of the aspect that is worthwhile to be exploit is the FFB quality assessment. In order to improve the quality assessment method which is done manually, an automated system of grading the FFB is needed. The automated grading system of FFB (AGS) main purpose is to automate the picture capturing of the FFB that will be process the picture to give out the ripeness status. The novelty of the system is the determination of the ripeness of the FFB. Currently the FFB are been graded by the numbers of empty sockets, the new method is to grade the FFB by the colour of the sliced mesocarp. This method are more accurate rather than determining by the empty sockets. The methodology of the project can be divided into 3 parts, the input part, process part and the output part. Input part will deal with FFB feeding to the camera booth, the processing part will deal with the image capturing and the output part will involve the file sharing of the pictures to the data processing part.

ABSTRAK

Minyak kelapa sawit merupakan minyak yang paling banyak digunakan dengan peningkatan permintaan yang semakin menigakat. Sime Darby Plantation adalah satu syarikat pengeluar minyak kelapa sawit terbesar di duina. Dengan pengeluaran minyak mentah yang banyak, syarikat Sime Darby Plantation mahu mencapai kadar efisiensi yang lebih baik. Salah satu aspek yang boleh dieksploitasi adalah penggredan buah kelapa sawit. Untuk menaik-taraf cara pengendalian penggredan buah kelapa sawit, satu system yang automatik diperlukan. Tujuan utama sistem penggredan buah kelapa sawit automatik (AGS) adalah untuk mengambil gambar buah kelapa sawit yang ingin diproses untuk mendapatkan keputusan kadar masak buah. Pembaharuan yang di bawa oleh system AGS adalah kaedah penentuan kadar masak buah kelapa sawit.iaiatu dengan meneliti warna buah mesokap yang telah dipotong. Kaedah ini lebih tepat daripada kaedah penentuan soket kosong. Metodologi projek ini boleh dibahagi kepada 3 bahagian iaitu, bahagian input, bahagian proses dan bahagian output. Bahagian input merangkumi pengendalian buah kepada booth kamera, bahagian proses merangkumi kawalan kamera manakala bahagian output merangkumi bahagian pengkongsian gambar dengan bahagian pemprosesan gambar.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

NO **TITLE** **PAGE**

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Palm oil is the most consumed oil and fats and it is also the most efficient compared to other type of oil seed crop in the world. It is efficient as it produces 10 times more oil per hectare than other leading oilseed crops. Malaysia and Indonesia plays an important role in producing about 85% of the world's supply of palm oil, the other producer of palm oil includes Thailand, Nigeria, Papua New Guinea, Ecuador and Columbia. Palm oil is naturally reddish in color as it has high level of beta-carotene content which is precursor of vitamin A that is vital for a healthy skin, good eye health and good immune. It is not to be mistaken with the palm kernel oil of the same fruit, the mesocarp of the fruitlet produces the palm oil while the inner part of the fruitlet called kernel produces the kernel oil as shown in Figure 2.1.

Sime Darby Plantation is the world's largest palm oil producers, producing about 2.47million tons of crude palm oil (CPO) annually. The company currently have a total land bank around 349,000 hectares is Malaysia alone and another 489,423 hectares outside the country. With great amount of palm oil that is being harvest daily, the company have develop various way to process the palm oil efficiently whether it is tangible or intangible. In Sime Darby Plantation, the palm business can be divided into two major parts; the upstream and the downstream. The upstream covers right

from the planting the palm oil till the production of the CPO, the downstream in the other hand covers the processing of the CPO into finished product. In the production of the crude palm oil, there are two main parts; the mill and the estate. The estate grows the palm oil, care for it and harvest it while the mill will take the fresh fruit bunch (FFB), palm oil that has been harvested and process it into crude palm oil. Basically they run on two different set of management to delegate the operation.

The estate will supply the FFB to the mill with a set of standard which the harvester have to abide during the harvesting process. The best FFB to be process have the following criteria; ripe, clean, short stalk and fresh, conditions that are different from this will affect the oil extraction ratio (OER) and the content of saturated fatty acid. The FFB will be graded at the mill first before sending it to the mill and will be graded again as soon as it arrive at the mill. The grading at the mill are done by a quality assessor which is from the quality assurance department. The grading process is done visually at the hopper [3] by the quality assessor, 50 FFBs will be randomly assessed. FFBs that are not from the company or outside crop purchased (OCP) will be assess completely. The collected data can be used for various application such as monitoring or aiding in planning process. With the grading process done manually, it has its own pro and cons. One of the cons of having a manual grading system with the FFB condition determined by a human is that human can be persuaded or influenced. This has been one of the argument between the estate and the mill. With an automated grading system, such problems can be reduced if not eliminated.

The automated grading system (AGS) runs on a two major part, the data acquisition part and the data processing part. The data acquisition part covers the development of the automation of the grading process which includes the picture capturing and sharing the picture with the data processing unit. The data processing part covers the processing of the obtained picture with the use of Matlab software. This thesis only covers the data acquisition part. The data acquisition part comprises the microcomputer unit, webcam unit, conveyor unit and the sensor unit, all of which works together to perform a working automated grading system.

The AGS (data acquisition unit) working basic flow are; FFB will be fed to the system via the conveyor with a reasonable gap between them, the conveyor stops as soon it detects the FFB is under the camera booth, sensor will notify the microcomputer that the FFB is ready to have the picture taken, picture taking process commence and saved in a specific folder to be accessed by the data processing unit, the system will continue with the next FFB samples.

1.2 Problem Statement

With the great world demand for the palm oil, Sime Darby Plantation has emerged as the world biggest palm oil producers. With such great production of palm oil, there surely be a lot of improvement can be done to further increase the quality of the process within the palm oil business. One of the significant improvements is grading the FFB at the mill. Fresh fruit bunch (FFB) is the term that is currently being use for fresh palm oil bunch that has been harvested from the estate. When the FFB enters the mill for processing, it needs to be graded first. The grading process is currently done manually. This method requires intensive man power and often done with minimal attention to the FFB, thus, sometimes the results are not reliable and at times may cause dispute between the mill and the estate. The most important element in the process is the determination of the FFB's condition. Human can be manipulated and persuaded which is not ideal for a quality assessor. In the other cases where the quality assessor is truthful on the result, there will be an issue of doubt in the outcome. This has been the argument over the years between the mill and the estate.

With AGS, unbiased grading result can be generated with minimal man power. The AGS data acquisition part works well with the AGS data processing unit being separated as it would not overburden any one of the unit.

1.3 Objective

(a) To develop a system that captures the FFB using a high definition (HD) webcam when the system is fed with FFB.
(b) To be able to share the captured image with the AGS data processing unit.

The main objective of this project is to develop a system that is capable of capturing good quality of FFB images utilizing a HD webcam before it is sent for processing. The system will be able to operate automatically from the moment the FFB is placed on the conveyor till it is out from the system. The system will then send all the images in a batch or consignment to another process center for image processing that will then grade the FFB

1.4 Scope of work

Ultimately the purpose of this project is to deliver statistical data of the FFB ripeness index. With the given time, funding and workforce that will be dedicated to this project, there are certain part of the system that will not be covered in this project;

1.4.1 The conveyor

The conveyor for the system are not be up to scale, it has been scaled downed to a level where a palm oil fruitlet will represent as a FFB. The conveyor is made out of PVC pipes and acrylic plastic which is robust enough and easy to be manipulate. The motor that work the conveyor is a small DC motor with a gearbox.

1.4.2 The camera booth specification

The camera booth are made up-to-scale that are able to fit in a full scale FFB through it. It works hand-in-hand with the system. It was equipped with adjustable lighting to ensure a clear picture.

1.4.3 Data sharing system

The file sharing system will work using either over internet or directly using the local area network (LAN) cable which will able to access it through the shared folder.

1.4.4 Computation power

A microcontroller is needed to control the HD digital camera and the automation. A powerful microcomputer are used in the system equipped with 2 universal serial bus (USB), 1 High-Definition Multimedia Interface (HDMI) port and 1 Local Area Network (LAN) port and have multiple general-purpose-input-output ports. The microcontroller have sufficient computational to run the webcam and control the system. Basically the microcomputer is a super small computer that can be easily program with common programming language and uses minimal amount of power.

1.4.5 The FFB

When the FFB is loaded to the system, a small area of the top part of the FFB has already been sliced to expose the mesocarp. The sliced mesocarp have to be process immediately as the exposed mesocarp would oxidize and have a different color properties. The cutting part of the FFB will not be

covered by this project as well as the alignment of the FFB as it will be done manually.

1.4.6 The Software

Any microcontroller will need a decent software to run on, in this case the microcontroller are using Debian operating software and runs the coding using the IDLE 3. The language of the coding are in Python which is kind of similar to the C language.

1.5 Methodology

To come up with the design of the automation for the AGS system two approaches have been taken which are brainstorming and implementing it directly on the work table and by researching in the net to get ideas to make it better. The development of the automation system at the beginning and the finished product do have changes throughout the process. The construction of the AGS are planned to be in stages; the essential development and add-ons development. These two stages do effects both hardware and software.

1.6 Thesis Outline

The remainder of this thesis is organized as follows:

Chapter 2, *Literature Review*, the concept of the AGS system control is studied as well as all the components that will be involve in the project.

Chapter 3, *Research Methodology*, the proper procedure in designing and manufacturing of the system is discussed.

Chapter 4, *Result and Discussion,* the results of the development are presented. The gathered information are discussed to see what went wrong and what could be done better in future.

Chapter 5, *Conclusions and Recommendations,* conclusions from the results and recommendations of the project for future development.

1.7 Summaries of Chapters

Introduction was incorporated to briefly explain the overall of the project which include, objective of project, problem statement of project, scope of work and the methodology of the project.

Literature review discuss the detail concept of the component that is in AGS as well as the working concept of the whole project. This comprise of conveyor, sensors, microcomputer, amplifiers, HD webcam, lighting equipment and the camera booth.

In methodology, the method on how the AGS system was constructed from the beginning to the end. Every step and adjustments are stated here which includes sensors, microcontrollers, conveyors, camera booth and the assisting lighting.

Results and discussions will talk about the reasons of why things are done that way accompanied by the results.

In conclusion and recommendation, a short summary that concludes the whole project and some recommendation of the future application and improvement that can be applied to utilize the project.