

**Universiti Teknologi MARA**

**Automated Fruit Grading of Fresh Fruit Bunches  
(FFB) and Determination Stalk Size Based on  
Color**

**Nurul Hanis Ibrahim**

Thesis submitted in fulfillment of the requirements for  
**Bachelor of Science (Hons) Computer Science**  
**Faculty of Information Technology And**  
**Quantitative Science**

November 2008

## ACKNOWLEDGEMENTS

Alhamdulillah, praise Allah for His Almighty and Graciousness. With His blessings, I was able to complete my final year project report within the time duration given.

My greatest appreciation goes to my project supervisor, Assoc Prof. Dr. Nursuriati Binti Jamil, who has given me many good ideas that has helped me in this research project. Without her endless advice and support, I would not have completed this work. For the domain expert Mr. Hasrizal Bin Omar, this appreciation belongs to you for the cooperation in giving knowledge and advice through development of this system.

Next, my appreciation goes to my CSC 699 (Final Year Project) lecturer, Assoc Prof. Syed Ahmad bin Syed Aljunid as the coordinator of final year project who has been tolerant and patient in guiding me in completing this project paper. I also want to thank to my entire friend for all their help, support, interest and valuable hints. I am truly grateful for the many hands and hearts that have made this task possible.

Last but not least, I would like to give my special thanks to my beloved family for their supports and I gave me full attention and loved. Without all of these people through their commitment and dedication, this project proposal would not be accomplished.

Thank you very much.

## **ABSTRACT**

This research is focus on the determination of palm oil stalk's size to determine long stalk bunch category. Images from samples of oil palm Fresh Fruit Bunches (FFBs) were acquired using a camera in the actual estate environment. Image processing and analysis of the samples were carried out. Region growing method is used to determine stalk region based on color. Measurements of the stalk color were carried out by the RGB analysis. The grading process was carried out by using computerized system to replace manual system grading in the palm oil industry. The grading is based on long stalk bunch category to determine the penalty of fruits. The result shows that this automated fruit grading system can identify the long stalk bunch category with the performance of more than 70 %. This research reveals that this project can be implemented in palm oil industry with some improvement in the future for production of accurate result and less time consumed in grading process.

# TABLE OF CONTENTS

<b>ACKNOWLEDGEMENT</b>	iii
<b>ABSTRACT</b>	iv
<b>LIST OF TABLES</b>	vii
<b>LIST OF FIGURES</b>	viii

## CHAPTER 1: INTRODUCTION

1.0 Introduction	1
1.1 Problem Statement	3
1.2 Objectives	4
1.3 Scope of Study	4
1.4 Contribution of Study	5
1.5 Summary	5

## CHAPTER 2: LITERATURE REVIEW

2.0 Introduction	6
2.1 Palm Oil	6
2.2 Manual Grading of Palm oil Fruit	8
2.3 Automated Fruit Grading	12
2.4 Image Processing	15
2.4.1 Image Segmentation	16
2.5 Color Analysis	24
2.5.1 RGB Color Model	25
2.5.2 HSL Color Model	26
2.6 Summary	27

## CHAPTER 3: PROJECT METHODOLOGY

3.0 Introduction	29
3.1 Project Methodology	29
3.2 Research Activities	31
3.3 Detailed Discussion on the Application	37
3.4 Hardware and Software Requirement	45
3.4.1 Hardware Requirement	45
3.4.2 Software Requirement	46
3.5 Summary	47

## CHAPTER 4: PROJECT TESTING AND ANALYSIS

4.0 Introduction	48
4.1 Testing	48
4.2 Result	49
4.2.1 Overall Testing Result	53
4.3 Automated Fruit Grading Compared to Manual system	54
4.4 Summary	54

## CHAPTER 5: CONCLUSIONS AND FUTURE DIRECTION

5.0 Introduction	56
5.1 Conclusion	56
5.2 Constraints	57
5.3 Recommendation	58
5.4 Summary	58

REFERENCES	59
------------	----

APPENDICES	63
------------	----