



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF FRUIT SEPARATION DEVICE
USING COLOR SORTING FOR FOOD INDUSTRIES**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

by

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DECLARATION

I hereby, declared this report entitled “Development of Fruit Separation Devices Using Color Sorting for Fruit Industries” was the results from my own research throughout the entire process to complete this project except as cited in references.


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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of UTeM as a part to fulfill the requirements for the degree of Bachelor of Computer Engineering Technology (Computer System) with Honors. The supervisory member is as follows:

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ABSTRAK

Terdapat banyak penggunaan dan pengeluaran pelbagai produk dalam kehidupan seharian kita. Oleh itu, terdapat banyak industri berskala besar dan berskala kecil yang terlibat dalam proses pembuatan produk tersebut. Pengasingan produk adalah salah satu proses utama yang terlibat dalam industri perkilangan. Pada masa ini, masih terdapat industri yang masih memerlukan tenaga kerja manual untuk menjalankan proses pengasingan produk. Dengan projek ini, proses pengasingan produk dan pengiraan akan dilakukan secara automatik sepenuhnya. Ini akan meningkatkan pengeluaran produk kerana keperluan pekerja secara manual akan berkurangan dan ini akan mengurangkan kesilapan yang timbul daripada keletihan dan kecuaiian pekerja. Oleh kerana proses pengasingan produk adalah secara automatik sepenuhnya, kelajuan proses akan meningkat justeru menyumbang kepada pengeluaran dan keuntungan kepada industri. Penggunaan komponen dan saiz projek ini tidak terlalu mahal di mana ia juga sesuai dan mampu milik untuk industri kecil. Laporan ini memberi maklumat ringkas mengenai pengasingan produk berdasarkan warna dengan menggunakan beberapa komponen utama seperti sensor warna TCS3200, Arduino UNO dan motor servo. Projek ini juga akan mengira dan memaparkan data untuk memudahkan proses penyimpanan dan merekodkan data.

ABSTRACT

There is wide usage and production of a variety of product in our daily life. Therefore, there was many large scales and small-scale industries involve in the process of manufacturing the product. Sorting is one of the main processes involve in manufacturing industries. Nowadays, certain industries still required manual labor to conduct the sorting process. With this project, the sorting and calculating process will be done automated. This will increase the production of the product as the requirement of manual labor will be decreased and this will remove mistakes arising from fatigue and negligence of human worker. As the sorting process is in fully automated, the process will be increased in speed which will contribute to production and profit to an industry. Component and size use of this project is not very expensive where it also suitable for small scale industry. This report gives brief information about the object sorting process based on the color of an object by using a TCS3200 color sensor, Arduino Mega and servo motors. This project also will count and display the data to taken throughout the entire process.

DEDICATION

Special thank you to my family member especially my parent for your unconditional support regarding my studies. Thank you for trusting me and giving me chance to proving my success in study and improving my journey of education here in UTeM.

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TABLE OF CONTENTS

	PAGE
DECLARATION	i
APPROVAL	ii
ABSTRAK	iii
ABSTRACT	iv
DEDICATION	v
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	xi
LIST OF FIGURES	xii
LIST OF ABBREVIATIONS	xv
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1

1.2	Project Background	1
1.3	Problem Statement	2
1.4	Objective	2
1.5	Project Scope	3
1.6	Thesis Outline	3
1.7	Project Significant	4
CHAPTER 2 LITERATURE REVIEW		5
2.1	Introduction	5
2.2	Existing System	5
2.3	Proposed System	5
2.4	Related Work	6
2.5	Load Cell Sensors to take weighing sample	8
2.6	Sensing Device to Detect Colour	9
2.7	Microcontroller	10
2.8	Implementation of motor to the system	10
2.9	LCD to display data to the user	11
2.10	Comparison	12
CHAPTER 3 METHODOLOGY		15
3.1	Introduction	15

3.2	Flowchart	15
3.3	Block Diagram	18
3.4	Hardware Use	19
3.4.1	Arduino Mega	19
3.4.2	Colour Sensor TCS 3200	20
3.4.3	Load Cell Sensor	21
3.4.4	TowerPro SG90 micro servo	22
3.4.5	Liquid Crystal Display 16x2 (LCD)	23
3.4.6	Piezo Buzzer	24
3.4.7	Load Cell Amplifier	25
3.5	Software Use	26
3.5.1	Fritzing	26
3.5.2	Arduino Software	27
3.5.3	Proteus Software	28
3.5.4	Google Sketch up software	29
CHAPTER 4 RESULT AND DISCUSSION		30
4.1	Introduction	30
4.2	Coding simulation	30
4.3	Project prototype	33
4.4	System analysis	36

4.4.1	Colour detecting system	36
1.4.2	Weight detecting system	37
4.5	Result	40
4.5.1	First floor (colour detecting system)	40
4.5.2	Second floor (size detecting system)	41
4.5.3	Third floor (weighing system)	42
CHAPTER 5 CONCLUSION AND RECOMMENDATION		44
5.1	Introduction	44
5.2	Conclusion	44
5.3	Problem faced	44
5.4	Recommendation	45
REFERENCES		46
APPENDIX		47
A.	Coding Arduino	47
B.	Gant chart	57

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2. 1	Tables for comparison	12
Table 3. 1	Table for LCD Pin Connection	23
Table 4. 1	Analysis of colour sensor	36
Table 4. 2	Analysis for calibration of 5kg load cell	38
Table 4. 3	Servo rotation based on load cell value	39

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2. 1	Colour Sorting Using Robotic Arms	6
Figure 2. 2	Thresholding Process	7
Figure 2. 3	Morphological Process	7
Figure 2. 4	Finish Model for Author [4]	8
Figure 2. 5	Servo Motor Rotation	11
Figure 2. 6	Implementation of LCD Display	12
Figure 3. 1	Flowchart of Project Development Process	16
Figure 3. 2	Flowchart of Colour Sorting System	17
Figure 3. 3	Block Diagram of Project System	18
Figure 3. 4	Arduino Mega	20
Figure 3. 5	TCS 3200 Colour Sensor	21
Figure 3. 6	Load Cell Sensor	22
Figure 3. 7	TowerPro SG90 micro servo	23
Figure 3. 8	Liquid Crystal Display (LCD)	24
Figure 3. 9	Piezo Buzzer	25
Figure 3. 10	Load Cell Amplifier	26
Figure 3. 11	Layout of Fritzing Software	27

Figure 3. 12 Layout of Arduino Software	28
Figure 3. 13 Proteus Software Layout	29
Figure 3. 14 Google Sketch up Layout	29
Figure 4. 1 Codes to map red colour	30
Figure 4. 2 Codes to control motor from colour output	31
Figure 4. 3 Codes for calibration factor	31
Figure 4. 4 Codes to start the scale	31
Figure 4. 5 Codes for load cell calibration	32
Figure 4. 6 Codes for LCD output	32
Figure 4. 7 Rear view of project prototype	33
Figure 4. 8 Front view of project prototype	34
Figure 4. 9 Storage compartment	35
Figure 4. 10 Second floor	35
Figure 4. 11 First floor	35
Figure 4. 12 Third floor	35
Figure 4. 13 Sorting gear top view	35
Figure 4. 14 Sorting gear rear view	35
Figure 4. 15 Red object detected	37
Figure 4. 16 Green object detected	37
Figure 4. 17 Calibration formula	38

Figure 4. 18 Initial placements	40
Figure 4. 19 Servo 1 after placement	40
Figure 4. 20 Servo 1 initial places	40
Figure 4. 21 Servo 1 after places	40
Figure 4. 22 Initial position servo	41
Figure 4. 23 Servo rotate 0 degree	41
Figure 4. 24 Servo rotate 180	41
Figure 4. 25 LCD display for RH	42
Figure 4. 26 LCD display for RL	42
Figure 4. 27 LCD display for GH	43
Figure 4. 28 LCD display for GL	43
Figure 4. 29 Buzzer places on first floor	43

LIST OF ABBREVIATIONS

LCD	Liquid Crystal Display
GH	Green high
GL	Green low
RH	Red high
RL	Red low
DC	Direct current
PWM	Pulse width modulation
Vss	positive
Vdd	Ground
VE	Contrast
IC	Integrated circuit

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter is a summary of fruit separation system using colour sorting for food industries. This chapter will be discussed about project background, objectives of the project and project scopes that will be discussed further.

1.2 Project Background

Colour sensor systems are widely used in automated application where it is used to detect an object based on their colour and monitor quality mainly in manufacturing line. They are widely used especially in assembly lines to detect, identify and classify product based on their features which is colour. Some of their usage is to check the quality of products, to facilitate sorting and packaging to access product equality in storage. Low cost and simple colour sensor are most preferred where it will minimize the manufacturing cost. In line with the objective which include small-scale industries as a user.

These projects are developed to increase the productivity mainly in production line where the sorting process takes place. In this project, Arduino microcontroller act as a main component where it is used to control activity which include input and output. Liquid crystal displays (LCD) are used to display the data taken throughout the sorting process. So, it will ease the user record and collect the

data. In easy words, this project will sort object to their specific compartment in full automation without human resources needed.

1.3 Problem Statement

The market in fruit and vegetables is becoming highly discerning, requiring its suppliers to distribute the goods in accordance with very strict quality standards. Nowadays, we are living in the modern era where all process and program are functionate in full automation no matter what kind of industries there are. With the manual process, the chance of error created during the process is high. In fruit industries, all the process must be done precisely without a single error. If an error in quality checking occurs especially in the food manufacturing industries it will affect the consumer. The smooth production of a product will be decreased as the consumer conscious that the quality of a product produced by certain industries is not exemplary.

Besides, the attitude of a person during work will contribute to error in the production process. In small scale industries, there were still using a manual system due to a high cost machine that have been developed just for a high-scale industry. Therefore, small-scale industries continue to use the existing process due to their financial constraint. Size of the machine which is very big also causes them to stick with existing process. The size of the machine which is very big also causes them to stick with existing processes.

1.4 Objective

The main objective of this research in concentrated on aspect as listed below:

- i. To classify each fruit to classes based on their features (colour and size).

- ii. To develop a low cost and a medium size machine which suitable for small-scale and high-scale industries.
- iii. To display all data taken from the sorting process throughout the entire system.

1.5 Project Scope

Fruit separation system using colour sorting for food industries developed to overcome the grading process performed by the worker manually. To make sure objectives of this project archive, scopes for this project was decided as list below:

- i. Using an Arduino microcontroller board as grading system.
- ii. Using liquid crystal display (LCD) as a display.
- iii. Using TCS3200 colour sensors to determine product feature to sort.
- iv. Using load cell sensor to identify the size and packaging process.

1.6 Thesis Outline

In this thesis, there are five chapters in total where it included introduction, literature review, methodology, result and discussion and conclusion. In each chapter, it will discuss each component that associated with the project. As an overview, the structure of this report is organized as follows:

- i. Chapter 1 - Describes a general project introduction, problems statements, goals and scope of the project.
- ii. Chapter 2 - Provides literature review details that include an introduction to some basic concepts and a survey of existing fruit sorting systems work.

- iii. Chapter 3 - Shows the project method, where the primary part of this project is the sorting system. This chapter explains the method used for this project and the software and circuit design process.
- iv. Chapter 4 - Display result from this project that analyzes and discusses the outcome.
- v. Chapter 5 - Assessment of goals will be explained in conjunction with research efforts and future work on this project as well.

1.7 Project Significant

This project not only very useful to the industries, it also benefits the consumer where they will gain a good product. Generally, food is very important to human and any living thing which is used as a supplier for the energy. So, by proposing this project, it could help and improved the manufacturing process especially in production line. Therefore, the quality of product will be guaranteed, and it will benefit both industries and consumer.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will focus in detail about research work and theories that related to this project. It occupied based on journal, books and websites where in this chapter will be compare the project amongst project that related. A lot of information will be occupied from this chapter especially on colour sorting method used.

2.2 Existing System

In the existing system, most product are sort manually that required a manual labor. This will create a tendency for error in human work that will come into account and will cause the workflow going wrong. If the product not sorted properly in industries, there is a high chance of huge chaos and the final product being defective. Same goes in packaging area that mainly dominated by manual worker. If the process not done correctly, it will cause a loss for industries.

2.3 Proposed System

This project proposed a fully automated system where it will overcome all the flaws from the existing system. In the proposed system, color sensor will be used to sort the product based on their color where it is done fully automated without human interrogation. Next, the load sensor will be used to detect the value, size and weight of product that will help in packaging process.

2.4 Related Work

There are many papers about color sorting system design to improve the workflow for sorting product mainly on food industries. Author in [1] present automatic multi-color sorting and counting machine using Arduino Nano microcontroller and TCS3200 color sensor. From the project, author focus more on color sorting and counting for product where it does not have a function that can valued the product based on their quality. Author also present a program with a robotic arm as shown in figure below:

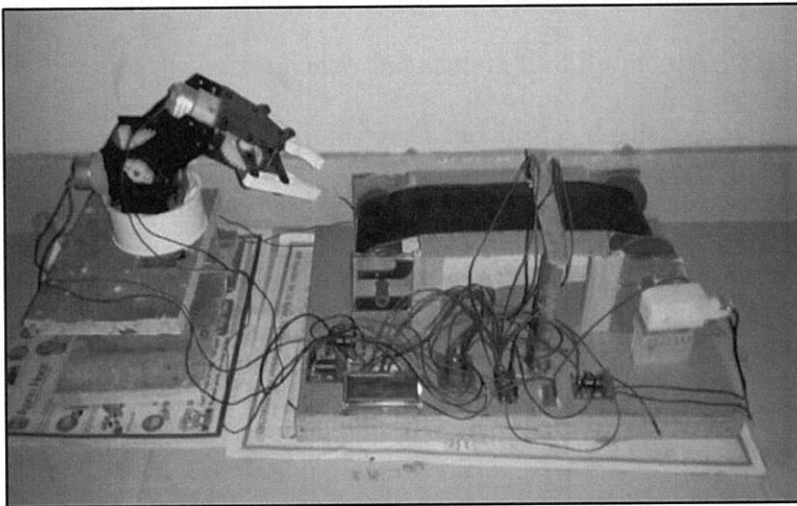


Figure 2. 1 Colour Sorting Using Robotic Arms

Author in [2] proposed an object sorting system based on color sensing using Mat lab. The author used Mat lab software because the code is easily readable, and it has more feature compare to visual basic program. In [3] the author felt that the used of conveyor and speed range in the system are expensive. Therefore, the author proposed a system that offers the advantage of a simple open loop control system, low cost and simplicity of a stepper motor with comparable stopping accuracy. The entire system consists of two part, which is the actuation feeding part and the control part.

In the next paper by author [4], the author proposed a system where the system sort the object based on color and weighed the object mainly in vegetable industries. The system also measures the humidity if the surrounding that is important in vegetable industries. Author in [5] present a project that sort the object using robotic arm. The robotic arm gripper will select the object, depending on its size. Therefore, no manual labor needed in the task. The cost of robotic arms is expensive. Therefore, it does not suitable for small industries.

In [6], author proposed a fruit sorting based on machine vision technique. The author proposed a system to identify the product defect-using camera. MATLAB software used to measure the performance and sample feed by the user. The project does not include sorting process where it just read and display the data feed by the user to examine the quality of the product. Same with author in [7] that used the same technique to identify the ripeness of fruit using MATLAB software. Figure below show the image thresholding and morphological process for an apple by using Mat lab. It is done by author in [6] and show that this is the process to undergo using Mat lab

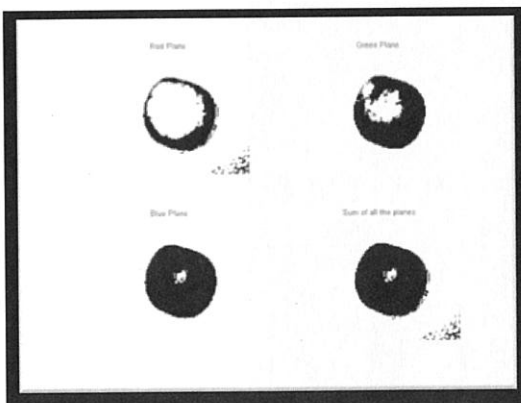


Figure 2. 2 Thresholding Process

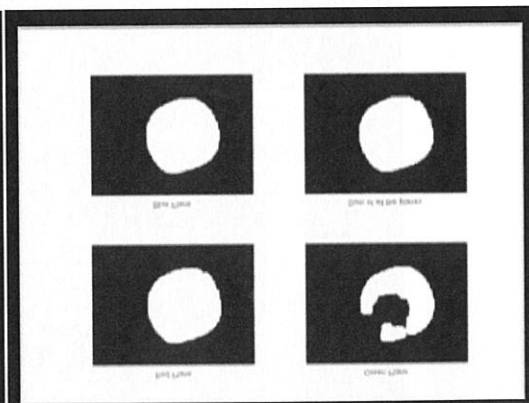


Figure 2. 3 Morphological Process

as sensing device.