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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF CONVEYOR SYSTEM INTEGRATED WITH VISION- BASED INSPECTION

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automotive & Robotics) with Honours.

اونيورسيٲى ٲيكنيكل مليسيا ملاك
UNIVERSITI TEKNIKA by MALAYSIA MELAKA

NUR INSYIRAH HANANI BINTI MOHD. LOK PI

B071610424

950926-07-5006

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

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 MOHD. LOK PI

Alamat Tetap: 20, Psn Kota Permai 3,
 Tmn Kota Permai, 14000 Bukit Mertajam,
 Pulau Pinang.

.....

 TS. AHMAD IDIL BIN ABDUL
 RAHMAN

Cop Rasmi Penyelia

AHMAD IDIL BIN ABDUL RAHMAN
 Pensyarah Kanan
 Jabatan Teknologi Kejuruteraan Elektrik
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Author : NUR INSYIRAH HANANI BINTI
MOHD. LOK PI
Date: 20 DECEMBER 2019



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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:



Signature:

Supervisor: Ts. Ahmad Idil Bin Abdul Rahman

Signature:

Co-supervisor: Ts. Johar Akbar Bin Mohamat Gani

ABSTRAK

Projek ini memfokuskan kepada reka bentuk dan pembangunan sistem pengantar diintegrasikan dengan ciri-ciri penglihatan mesin. Sistem ini juga digunakan untuk menjalankan pemeriksaan terhadap kualiti dan ciri-ciri buah-buahan itu. Sistem pengantar ini juga akan digunakan sepanjang proses pemeriksaan, dimana buah-buahan itu akan diasingkan mengikut warna dan juga saiznya. Prosedur ini dilakukan untuk memastikan tiada sebarang ralat yang berlaku sepanjang proses klasifikasi ini dijalankan. Bagi sistem berasaskan ciri-ciri penglihatan mesin pula, ia digunakan khas untuk memeriksa ketepatan dimensi buah-buahan tersebut. Data yang diterima daripada program pemprosesan imej akan dianalisis mengikut kepada warna dan saiz kemudiannya buah-buahan itu akan diasingkan setempat. Kepentingan projek ini adalah untuk mengenal pasti warna dan saiz buah-buahan itu dengan betul supaya proses klasifikasi dapat berjalan dengan lancar. Tambahan pula, projek ini dapat menambahbaik daya pengeluaran untuk proses pengasingan buah di samping dapat mengurangkan kos dan masa yang diambil untuk mengasingkan buah-buahan. Selain itu, projek ini juga dijangka dapat meningkatkan ketepatan dan produktiviti dalam proses pemeriksaan dan pengasingan berdasarkan kualiti buah-buahan.

ABSTRACT

This project focus on the design and development of a conveyor system integrated with vision-based inspection. This system will be utilized to demonstrate the inspection of fruits features. The conveyor system will be used throughout the inspection process and after that the fruits will be sorted based on its colors and sizes. This method is carried out to make sure no error or false of fruit sorting happened during the process. For the vision-based system, it is mainly used to check the fruits dimensional accuracy. The collected data from the image processing program will be analyzed based on size and color then product will be exiled. The importance of designing this system is its ability to identify the colors and sizes of fruits correctly. In addition, this project can increase the productivity of fruit sorting process as well as substantially reduce the cost and time taken to sort the fruits. This is also to improve the accuracy of the fruit's inspection.

DEDICATION

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

To my beloved parents Mr. Mohd. Lok Pi Bin Hussain and Mrs. Rizal Hazini Binti Abdul Hamid, I thank them both appreciatively for all their moral supports through my thick and thin during the process of completing this Final Year Project. They helped me a lot in terms of financial and moral support which encourages me to perform whole-heartedly towards the project accomplishment.

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LIST OF SYMBOLS

v	-	Voltage
cm	-	Centimetre
m	-	Meter
M	-	Mega
P	-	Pixel
L	-	Distance



LIST OF ABBREVIATIONS

UN	United Nations
LED	Light Emitting Diode
RGB	Red Blue Green
PC	Personal Computer
PLC	Programmable Logic Controller
CVS	Computer Vision System
CPU	Central Processing Unit
I/O	Input and Output
CDC	Color Digital Camera
PCB	Printed Circuit Board
LCD	Liquid Crystal Display
GMM	Gaussian Mixture Model
SVM	Support Vector Machine
DC	Direct Current
IR	InfraRed
CMOS	Complementary Metal-Oxide-Semiconductor
API	Application Program Interface
IDE	Integrated Drive Electronics
HD	High Definition
USB	Universal Serial Bus
BMP	Bitmap

JPG	Joint Photographic Group
I2C	Inter-C
IC	Integrated Circuits
RPM	Revolution Per Minute
GUI	Graphical User Interface
LED	Light Emitting Diode



CHAPTER 1

INTRODUCTION

1.0 Introduction

This first chapter will describe in details about the project background, problem statement, objectives and scope concerning this project.

1.1 Background

The rate of birth and death of human population are now having a divergence results from the rapid growth of the world's population over a century [1]. In this day and age, the world population has been quadrupled. Estimated in 2050, the number may reach 9.7 billion people living on earth. The developing countries are growing along with rising incomes, thus driving up the global food demand [2]. United Nations (UN) states that in Malaysia presently, the current population in 2019 is 32.45 million which equivalent to 0.42% of the total world population. The massive growth of human population will lead to high demand of food supply

This scenario alarming the stakeholders that something has to be done to solve this problem especially in the fruit industry in order to produce end products that are in good condition and have quality to be sorted accordingly. Sorting numerous quantities of fruits will affect its quality because of the factors contribute during the production

process, which are time taken to sort the fruits due to manual sorting in production and lack of technology applied.

Sorting plays an important role in any type of industry such as the fruit industry to improve the efficiency of the process. The main task is to sort and classify the fruits according to its colors and sizes, thus defining the sorting classes for the many varieties of fruits. This system will use a vision-based system that is connected to a conveyor that makes the sorting system more efficient and less time consuming. Figure 1.1 shows an apples' sorting machine using a conveyor.

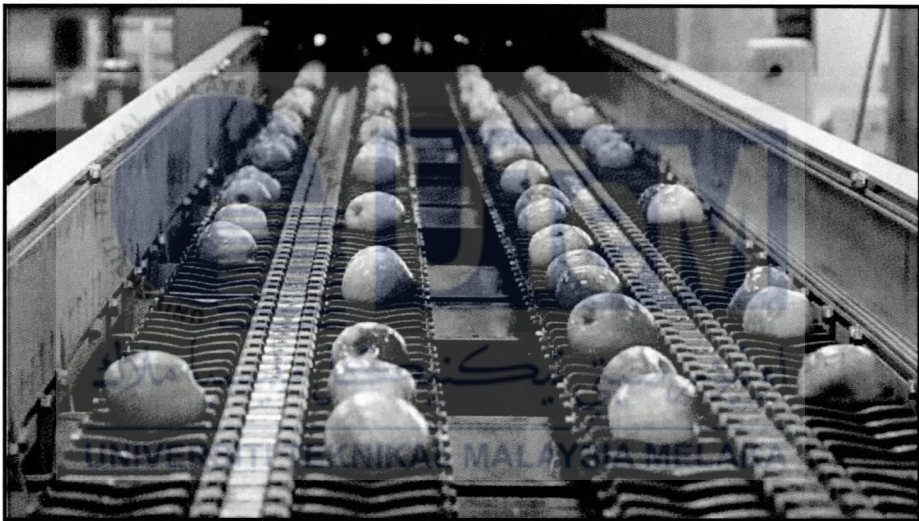


Figure 1.1: Apples' sorting machine [3]

Sorting process in the fruit industry nowadays are mostly done by using the weight sensor to categorize the fruits. The chances to get rotten fruit in packaging is potentially high. A human operator cannot spot the bad fruits in a blink of an eye especially involving larger scale of fruit quantity. The additional of the conveyor system increase the industry productivity by saving time to transfer the fruits from one place to another.

Thus, this project will draw in the development of a conveyor system with vision-based integration where it is suitable to be used in any fruit industry. However, this project will carry out using one type of fruits varying with its colors and sizes.

1.2 Problem Statement

An innovative technology has widely been created, designed and constructed in order to fulfil the demand of having a superior grade of fruits. The fruit industry needs to assure the condition of the fruits from the beginning until it is ready to be shipped or distributed to the fruit suppliers are remain in good quality throughout the process. Several rotten fruits could bring losses to the company. This is something that needs to be avoided to prevent waste.

Human tends to do mistakes in sorting things manually especially when it comes in large amount. This also may be due to fatigue caused by long working hours and not consistent in choosing good quality fruits. Maintaining the product quality and to have zero percentage of mistakes done during the sorting process are highly demanded by the producer.

In addition, using manual sorting will lead to higher cost in terms of labors' wage. The sorting operation by hands are time consuming and the workers are not accurate in choosing the correct grades and sizes of fruits. This will affect the end products quality which could lead to mixed up and scattered fruit grades non-accordingly. Every company aims to market and deliver their products estimated around thousands of fruit packages or boxes. Manual sorting method is not reliable for larger companies who deliver huge amount of fruits to be sorted.