



**DEVELOPMENT OF RESISTOR SORTING MACHINE
PROTOTYPE USING IMAGE PROCESSING**



AHMAD HARIZ BIN AHAMAD KAMEL

**BACHELOR OF ELECTRICAL ENGINEERING
TECHNOLOGY (INDUSTRIAL AUTOMATION & ROBOTICS)
WITH HONOURS**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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

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2020

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USING IMAGE PROCESSING

Sesi Pengajian: 2020

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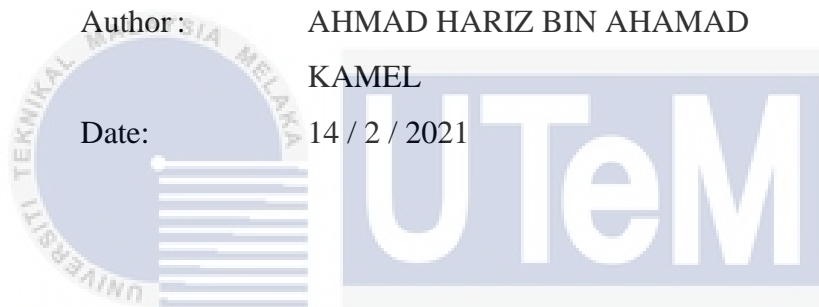
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APPROVAL

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:

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ABSTRAK

Perintang adalah komponen yang paling banyak digunakan dalam litar elektronik semasa sesi makmal. Walau bagaimanapun, komponen elektrik ini biasanya tidak disusun dengan sistematik dimana perintang ini bercampur dengan pelbagai nilai yang berbeza. Ini telah menimbulkan masalah kepada pembantu makmal kerana komponen ini perlu disusun dengan betul sebelum bermula sesi makmal yang seterusnya. Proses ini memakan masa untuk pembantu makmal kerana setiap perintang perlu diperiksa dan diasingkan mengikut nilainya. Selain itu, lebih banyak tenaga kerja yang diperlukan untuk menyusun perintang dalam masa yang singkat. Oleh itu, dengan penghasilan mesin penyusun perintang, semua pengguna makmal dapat menjimatkan masa dan mengurangkan tenaga untuk menyimpan perintang secara sistematik. Untuk memenuhi keperluan projek ini, kaedah pemrosesan gambar digunakan untuk mengesan kod warna pada perintang. Kamera Pixy2 digunakan sebagai pengesan yang melakukan tugas mengesan nilai perintang berdasarkan kod warna. Manakala Arduino Uno berfungsi sebagai otak bagi system ini dengan menjalankan proses system kawalan. Servo 1, Servo 2, LED dan LCD akan dikendalikan oleh Arduino Uno untuk melakukan tugas pengasigan. Hasil menunjukkan bahawa system ini menggunakan masa yang lebih singkat berbanding melakukannya secara manual dengan menggunakan *multimeter*. Berdasarkan data yang terkumpul, mesin ini terbukti cekap dan berkesan kerana memerlukan masa yang singkat untuk melakukan proses pengasingan perintang mengikut nilai rintangannya.

ABSTRACT

Resistors are the most used components in electronic circuit during laboratory session. However, this electrical component usually left unorganized and the resistor mixed with other resistor that has different value. Thus, this has caused problems for the lab assistant as the resistor need to be store properly before another group of students when into the laboratory. It is a time-consuming process for the lab assistant as the resistor need to be check and store according to its value. Moreover, the use of more manpower needed to sort the resistor in a short time. Therefore, with the development of resistor sorting machine, all the laboratory users can save their time and reduce energy consumption to store the resistor systematically. In order to fulfil the requirement of this project, image processing method was used to detects the colour code of the resistor. Pixy2 camera used as the sensor which performs the task of detecting resistor values based on colour code. For the brain of the system, Aduino Uno was used to process the control condition. Servo 1, Servo 2, LED and LCD will be controlled by Arduino Uno to perform segregation task. The result shows that it takes less time for the system to sort the resistor compared doing it manually with multimeter. From the data gathered, this machine proves to be efficient as it takes less time to sort the resistor compared to manually sort by human.

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LIST OF SYMBOLS

Ω	-	Ohm
Hz	-	Frequency



LIST OF ABBREVIATIONS

IDE	Integrated Development Environment
3D	3 Dimension
DC	Direct Current
IR	Infrared
LCD	Liquid Crystal Display
ANN	Artificial Neural Network
CCL	Six Connected Component Labelling
MLP	Multi-Layer Perceptron
ML-CPN	Multi-Level Counter Propagation Network
PLC	Programmable Logic Controller
USB	Universal Serial Bus
OS	Operating System
UART	Universal Asynchronous Receiver/Transmitter
ICSP	In Circuit Serial Programming
PWM	Pulse Width Modulation

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter introduces the subject matter and problems being studied, objective and the scope of the project. The problem statement is about the problems that encountered in everyday life while the objective is the target or purpose which enabled the project to be developed. However, there will be limitation in developing this project which will be discussed in this chapter.

1.1 Project Background

Sorting is a process of arranging, grouping, or separating objects between objects systematically. The sorting process usually perform based on the characteristics of the objects such as colours, shapes, and sizes that desired and undesired. Ordering and categorizing are two common types of sorting process. Ordering is arranging items in a sequence ordered by some criterion, while categorizing is grouping items with similar properties.

There are many types of sorting machine that have been invented in this world such as food sorting machine, waste sorting machine, and coin sorting machine. Every machine used different method to detect the characteristic of the object that need to be sort. In this new era, colour sensor systems are increasingly being used in automated applications to detect automation error and monitor quality at the speed of production

line. This sorting method is widely use in food industry where they use to the method to detect the colour of the food to determine the quality of the food.

Another type of sorting machine capable of receiving a mixture of different sizes of material and segregating the different sizes into separate group. Whereas the machine is particularly designed to sort headed pins such as screws, bolts, nails, rivets and the like. This type of machine did not need particular sensor to detect the characteristic of an object. Smart waste management system is another example of the system that use sorting process. This system machine is developed to sort out metal, paper, plastics and glass by developing electromechanical system using microcontroller. There are more than 3 sensors used to sort out the waste.

The term object is used in this project is an electrical component that called resistor. A resistor is a passive two-terminal component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. The main categorisation refers to the fact whether a resistor has fixed resistance or a variable resistance. In this project, fixed resistors with two-terminal devices and no polarity are the object that will be used.

The main purpose of this project is to develop a resistor sorting machine prototype using image processing to reduce time consume, the use of manpower and human error. This machine prototype will sort the resistor according to the range of the resistance. Three types of resistors that can be sort for this prototype is 2.4k Ohm, 6.2k Ohm and 10k Ohm. The value of resistor will be measured by using image processor. The image processor will capture the resistor colour code and the system will calculate the range of the resistance based on the colour detected on the resistor.

1.2 Problem Statement

After a lab session, students usually return the resistor and put the resistor back in the container without sorting it according to its resistance value. This will cause problem for the lab assistant as the resistor need to be sort before another group of students when into the laboratory. It is a time-consuming process for the lab assistant as the resistor need to be check and sort according to its value. The use of more manpower needed to sort the resistor in a short time. Moreover, the small size of the resistor can lead to human error.

1.3 Objective

1. To develop an automatic resistor sorting machine prototype using Arduino.
2. To design an image processing system for sorting mechanism.
3. To analyze the effectiveness of the proposed method for sorting purpose.

1.4 Scope

This prototype machine use image processing method for sorting mechanism. Instead of using multimeter to measure the value of the resistor, this system mainly used Pixy2 camera to determine the resistor colour code. Moreover, Arduino Uno works as the brain of this system to perform control task. PixyMon and Arduino IDE are the list of software that will be used in the developing phase of the system. This prototype machine design to sort only 4 band resistor and limited to 3 different range of resistance which is 2.4K Ohm, 6.4k Ohm and 10k Ohm.

1.5 Project Significance

The purpose of this project is to improve the efficiency of sorting resistor by reducing manpower and time consumed to complete the task. By reducing manpower, this also helps to reduce the risk of human error as humans have limited energy. This machine prototype will automatically sort the resistor into different boxes based on its respective value. Furthermore, measuring the resistor value by using image processing methods is the innovation of this project. Lastly, the target of this project is to help the lab assistance, lecturer, and student to sort the resistor especially after the lab session.

