

SMART COLOR SORTING ROBOT

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This report is submitted in partial fulfillment of the requirements for the award of the Bachelor of Electronic Engineering(Electronic Telecommunication) With Honours

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN  
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## ABSTRACT

Smart Color Sorting Robot is based on a placing system with some capability to place the object according to their color. The object will be defined by determining color of the ball while the system will figure out which location the object should be located. With the PIC as a controller for the system, a manually feed object which is a coloring ball will be determined by the robot to take and eject them to their exact location or station. In this project a line follower will brought the ball that will be sense by LDR sensor to right station. A main part in this project is an LDR sensor which is used to detect light. Capability of this system to detect the type of this object and it will be chosen based on their color. There are four stations in the Color Sorter system that we made. Each station had their own range of color except for the first station which is the load and unloading station. The ball will be inserting manually by the user. Then the LDR sensor will detect what color is the object, after the detection been done, the decision will be made and the line follower will take the object to the station that been recognized for it.

## **ABSTRAK**

‘Smart Color Sorting Robot’ adalah sistem yang membolehkan sesebuah robot berkemampuan untuk menempatkan objek berdasarkan warna yang telah ditentukan. Objek tersebut akan dikenalpasti melalui warnanya. Sementara itu, sistem ini akan mengenalpasti tempat di mana objek itu akan ditempatkan. PIC digunakan sebagai sistem kawalan, objek berwarna akan di masukkan secara manual ke dalam robot dan sistem tersebut akan menempatkan di mana objek berwarna tersebut patut ditempatkan mengikut kawasan yang ditetapkan. Projek ini menggunakan system garisan untuk membawa bola berwarna ke stesen yang ditetapkan melalui cara dimana pengesan yang telah di letakkan di robot akan mengesan garisan. Bahagian terpenting dalam projek ini adalah pengesan cahaya. Kebolehan system ini adalah mengenalpasti objek berdasarkan warna objek. Terdapat empat stesen di dalam system pengasingan warna ini. Setiap stesen terdapat jenis warna yang telah ditetapkan bagi robot menempatkan objek kecuali di stesen mula dan stesen akhir. Objek yang digunakan akan dimasukkan secara manual oleh pengguna. Kemudian, pengesan cahaya akan mengenalpasti warna objek dan keputusan akan dibuat apabila robot sampai ke stesen yang ditetapkan dan stesen seterusnya.



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## CHAPTER I

### INTRODUCTION

This chapter will briefly discuss on the project overview. The objective, scope, and thesis outline will be presented in this chapter.

#### 1.1 Project Background

Smart Color Sorting Robot is based on the placing system with some capability to decide the object according to their color. The object will be defined by determining color of the ball while the system will figure which location the object should be located. With the PIC as a controller for the system, a manually feed object which is a coloring ball will be determined by the robot to take and eject them to their exact location or station.

In this project a line follower will brought the ball that will be sense by LDR sensor to right station. A main part in this project is an LDR sensor. Commonly this type of sensor used to detect light. Other applications are for color sensor, line detector, and switching element. Capability of this system to detect the type of this object and it will be chosen based on their color.

There are four stations in the Color Sorter system that we made. Each station had their own range of color except for the first station which is the load and unloading station.

The ball will be inserting manually by the user. Then the LDR sensor will detect what color is the object, after the detection been done, the decision will be made and the line follower will take the object to the station that been recognized for it.

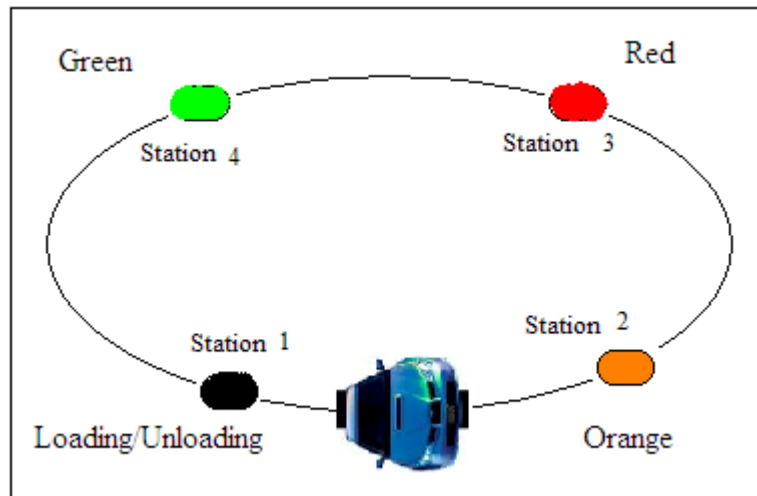
In this system, there are 4 station;

Station 1 = Load and Unloading station (10 sec delay)

Station 2 = White

Station 3 = Blue

Station 3 = Red



**Figure 1.1 Overview of the Project Sequence**

## 1.2 OBJECTIVES

This project is developed with the purposed to optimizing the productivity, minimizing the cost of the project and make no human mistakes. The main thing of this

project is to study how to communicate the programming language with the color sensor. After that, the line follower system will make its own decision to the station that been programmed. The objective can be summarized as below:

- i. To sort the object according to their color.
- ii. To sort the object to the station accordingly.
- iii. To make the system run continuously with less rest.
- iv. To make an interface between the programming of line follower and the sensors.

### **1.3 SCOPE OF PROJECT**

This project is subjected to several scope and limitations that are narrowed down to the study. There are a few scopes and guidelines listed to ensure the project is conducted within its intended boundary. This is to ensure the project is heading in the right direction to achieve its intended objectives. The objectives are:

- i. Research study on the Programmable Intelligence Computer, PIC16F876A microcontroller and the control system of the circuit.
- ii. To acquire the each sensor that use in this project.
- iii. To design circuitry for the overall system
- iv. To develop the program that can integrate and control the overall system.
- v. To construct the model and test either the robot is function or not.

### **1.4 PROBLEM STATEMENT**

The problems which often occurred in the industrial that can be solve by this project are:

- i. By using this project the company can optimize the productivity.

- ii. Each company, have their own cost; this project can be minimizing the cost of the company by minimizing the workers.
- iii. Usually, the worker maybe doing some mistakes while doing their job, by developing this project, the company can decrease the human mistakes.

## **1.5 SIGNIFICATION OF THE PROJECT**

- i. Manage to gain more idea and information about the sensor and valve.
- ii. Manage to work on the PIC programming
- iii. Manage to apply knowledge about the robotic.
- iv. Manage to build up the robot.

## **1.6 REPORT STRUCTURE**

Chapter one briefly introduces he overall of the project title Smart Color Sorting Robot. The introduction consists of overview, objective, problem statement, scope of work, methodology and structure report.

Meanwhile chapter two discuss about the background of study related to security system. Literature review will produce overall structure of the Smart Color Sorting Robot which shows the relationship between project research and theoretical concept.

Chapter three will explain about the project methodology. Project methodology give details about the method used to solve the problem to complete the project. The method used such as collecting data method, process and analysis data method, modelling and etc.

Chapter four consists of result and discussion of the project, finding and analysis throughout the research and project development.

Lastly, chapter five is the project conclusion. This chapter rounds up the attained achievement of the whole project and reserves suggestions for possible future researches.

## **CHAPTER II**

### **LITERATURE REVIEW**

This chapter is to discuss some fundamental ideas of line follower and color sensor. The features of this project are also including. All components using for this project will be explain as well.

#### **2.1 Application Review**

In this project, there is two application will be combine. This application is:

1. Line Follower.
2. Color Sensor.

Thus, the research on this application was revealed and a few references found in order to complete this project.

##### **2.1.1 Line Follower**

According to Priyank Patil [1], line follower is a mobile robot that can follow a path. It can follow path whether the path is straight, corner or at whatever direction. A

line follower will sense a line and maneuvering the line follower to stay right on the line by using infra red sensor as its 'nose'.

If the line follower tries to move out of track, the infrared sensor will give a signal to the brain of the robot to stay on line. This situation is made based on the simple closed loop feedback.

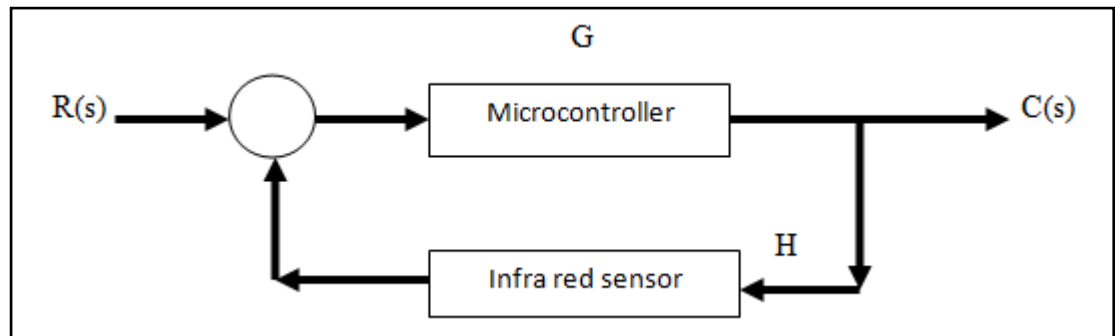


Figure 2.1.1(a): Simple Closed Loop System [1]

$R(s)$  represented as a power supply from 5V and  $C(s)$  represented as a direction of the line follower. A suitable program is needed in order to make this line follower able to track a line and it's supposed to think like a 'human'. The overview of this line follower is shown as Figure 2.1.1(b).

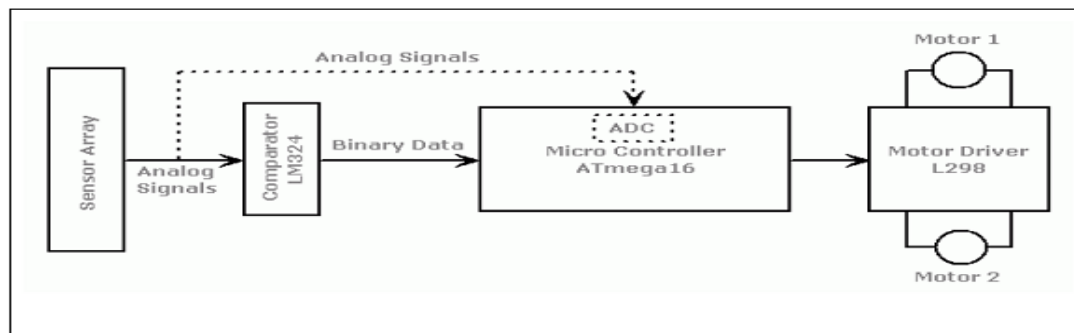


Figure 2.1.1(b): Block Diagram of Line Follower [1]

## 2.1.2 Color Sensor

According to Society of Robot's Article [2], photoresistor cannot see the color of an object. It only can read the value gain from reflection of the object. The value gain from a various object is difference. Therefore, some research has been made and the result seems to be that photoresistor can be use as color detection element. There are two methods in order to differentiate object's color.

1. Similarity Matching Method
2. Thresholding Method

### 2.1.2.1 Similarity Matching vs. Thresholding

In reality the sensor must be calibrate before the sensors before work. This means the sensor must sense the object, record the readings, and then make a chart using this data. That way when the robot is doing its thing and senses the same object, it can compare the similarity of the new reading vs. the calibrating reading.

For example, suppose the robot needs to follow a white line on a grey floor. The robot would use a microcontroller to sense the analog value from the sensor. During the calibration phase the robot measured an analog value of 95 for the grey floor, 112 for the white line, and then stored these values in memory. Now your robot is on the line, and a sensor reads 108.

Using the shareholding method, add both calibrated numbers and divide by two to find the average middle number. For example,  $(95+112)/2 = \text{threshold}$ . Anything above that threshold would be the white line, and anything under would be the grey floor. Similarity matching was used to threshold, if there is three or four colors. This process is to determine how similar each color of the object is to the calibrated value.