POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

A4 PAPER COLOR SORTER

NAME	REGISTRATION NO
SYAMEER NUR AFIF BIN SAHRUL	08DEP20F1054

JABATAN KEJURUTERAAN ELEKTRIK

SESI 1 2022/2023

COLORED A4 PAPER SORTER

NAME	REGISTRATION NO
SYAMEER NUR AFIF BIN SAHRUL	08DEP20F1054

This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

JABATAN KEJURUTERAAN ELEKTRIK

SESI 1 2022/2023

CONFIRMATION OF THE PROJECT

The project report "Colored A4 Paper Sorter" has been submitted, evaluated, and confirmed to ensure that it meets all standards and requirements of the Project Writing as stipulated.

Checked by:

Supervisor's name : NIK RABIATUL MUJAHADAH BINTI ABD RAHMAN

Supervisor's signature :

Date :

Verified by:

Project Coordinator name :

Signature of Coordinator :

Date :

"I acknowledge this work is my own work except the sections I have already clarified to our source"

1. Signature :

Name : **SYAMEER NUR AFIF BIN SAHRUL**

Registration Number : **08DEP20F1054**

Date :

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : Color A4 Paper Sorter

SESSION: SESI 1 2022/2023

1. I, **1. Syameer Nur Afif bin Sahrul, 08DEP20F1054,**

is a final year student of **Diploma in Electrical Engineering,**

Department of Electrical, Politeknik Sultan Salahuddin Abdul Aziz Shah, which is located at **Persiaran Usahawan, 40150 Shah Alam, Selangor**. (Hereinafter referred to as 'the Polytechnic').

2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.

3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **Diploma in Electrical Engineering** to me.

Made and in truth that is recognized by;

a) **Syameer Nur Afif bin Sahrul** (....……)
(021115-16-0091) **Syameer**

In front of me, **Nik Rabiahtul Mujahadah binti Abd Rahman** (820404-11-5378) (....……)
Nik Rabiahtul
As a project supervisor, on the date:

ACKNOWLEDGEMENTS

I have taken a lot of time and efforts in this Color A4 Paper Sorter Project. However, it would not have been possible and achievable without the kind support and assistance of many individuals and organizations. I would like to express my wholehearted gratitude to each and every one of you. I intend to give a great gratefulness to Puan Nik Rabiahtul Mujahadah for ther consistent guidance and supervision, as well as for providing relevant information regarding the Color A4 Paper Sorter Project and also for their help in completing this project.

I would like to convey my gratitude towards my parents and member of organization for their advice and encouragement in helping me accomplish the desired goals. I would like to express my special gratitude and thanks to industry persons for giving me such attention and time.

My gratefulness also extends to my entire team in devising the challenges, as well as to those who have volunteered to assist me with their skills.

ABSTRACT

Paper waste is a serious problem in many industries and offices. Because of printing errors, junk mail, billing and packaging, paper may contribute as much as 70% of a total waste of the company. With a lot of attention focused on plastic disposal, the impact of paper waste is often overlooked. However, improper disposal and recycling of paper waste can affect the economy and the environment as badly as other waste products. Perhaps this is because paper waste sorting machines are only available in recycling work areas because of the cost itself, the solution may seem somewhat unattainable. The project proposes a simple and effective sorting machine for workers, especially office workers, to sort A4 paper waste into different colors.

ABSTRAK

Sisa kertas adalah masalah serius dalam banyak industri dan pejabat. Kerana ralat pencetakan, mel sampah, pengebilan dan pembungkusan, kertas mungkin menyumbang sehingga 70% daripada jumlah sisa syarikat. Dengan banyak perhatian tertumpu kepada pelupusan plastik, kesan sisa kertas sering diabaikan. Walau bagaimanapun, pelupusan dan kitar semula kertas buangan yang tidak betul boleh menjejaskan ekonomi dan alam sekitar seteruk produk buangan yang lain. Mungkin ini kerana mesin pengasing sisa kertas hanya terdapat di kawasan kerja kitar semula kerana kosnya sendiri, penyelesaiannya mungkin kelihatan agak tidak dapat dicapai. Projek ini mencadangkan mesin pengisih yang mudah dan berkesan untuk pekerja, terutamanya pekerja pejabat, untuk mengasingkan sisa kertas A4 kepada warna yang berbeza.

TABLE OF CONTENTS

CONFIRMATION OF THE PROJECT i
DECLARATION OF ORIGINALITY AND OWNERSHIP iii
ACKNOWLEDGEMENTS 4
ABSTRACT 5
ABSTRAK 6
TABLE OF CONTENTS 7
LIST OF TABLES 9
LIST OF FIGURES 10
LIST OF SYMBOLS xi
LIST OF ABBREVIATIONS xii

CHAPTER 1
1 INTRODUCTION 1
1.1 Introduction 1
1.2 Background Research 2
1.3 Problem Statement 2
1.4 Research Objectives 3
1.5 Scope of Research 3
1.6 Project Significance 3
1.7 Chapter Summary 4
CHAPTER 2 5
2 LITERATURE REVIEW 5
2.1 Introduction 5
2.2 Colored A4 Paper Sorter (Literature Review Topic 1) 5
2.2.1 Color Sorter Appliances in Market (Subtopic Literature Review Topic 1) 6
2.3 Control System (Literature Review Topic 2) 8
2.3.1 TCS3200 Color Sensor 8
2.3.2 Arduino 9
2.4 Chapter Summary 9
CHAPTER 3 10
3 RESEARCH METHODOLOGY 10
3.1 Introduction 10
3.2 Project Design and Overview. 10
3.2.1 Block Diagram of the Project 10
3.2.2 Flowchart of the Project 1 11
3.2.3 Project Description 12
3.3 Project Hardware 13
3.3.1 Schematic Circuit and PCB Layout 13
3.3.2 Description of Main Component 14

3.3.2.1 Component 1 14
3.3.2.2 Component 2 14
3.3.2.3 Component 3 14
3.3.3 Circuit Operation 14
3.4 Project Software 15
3.4.1 Flowchart of the System 17
3.4.2 Description of Flowchart 17
3.5 Prototype Development 18
3.5.1 Mechanical Design/Product Layout 18
3.6 Sustainability Element in The Design Concept 19
3.7 Chapter Summary 20
CHAPTER 4 **21**
4 RESULTS AND DISCUSSION **21**
4.1 Introduction 21
4.2 Results and Analysis 21
4.3 Discussion 24
4.4 Chapter Summary 24
CHAPTER 5
CONCLUSION AND RECOMMENDATIONS 25
5.1 Introduction 25
5.2 Conclusion 25
5.3 Suggestion for Future Work 26
5.4 Chapter Summary 27
6 PROJECT MANAGEMENT AND COSTING **28**
6.1 Introduction 28
6.2 Gant Chart and Activities of the Project 29
6.3 Milestone 30
6.4 Cost and Budgeting 31
6.5 Chapter Summary 32
REFERENCES **33**
7 APPENDICES **34**
APPENDIX A- DATA SHEET 34
APPENDIX B- PROGRAMMING 35

LIST OF TABLES

TABLE	TITLE	PAGE
Table 1.1:	Color Sorter Appliances in Market	6
Table 3.1:	Sequence of Color Detector	14
Table 3.2:	Project Software	16
Table 4.1:	List of Components and Materials	24

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 1.1:	Waste composition in Malaysia throughout 1975-2011	2
Figure 2.2:	TCS3200 Color Sensor	9
Figure 2.2:	Arduino Uno	10
Figure 3.1:	Block diagram of Color A4 Paper Sorter	13
Figure 3.2:	Hardware flowchart of operation of the system	12
Figure 3.3:	Software flowchart of operation of the system	13
Figure 3.4.1:	Circuit Diagram	13
Figure 3.4.2:	PCB Layout	14
Figure 3.5:	Flowchart of the System	17
Figure 3.6:	View of the project	18
Figure 4.1:	Gantt Chart of the Project	22
Figure 4.2:	Milestone	24

x

CHAPTER 1

1 INTRODUCTION

1.1 Introduction

Machines are more effective than humans in carrying out extremely repetitive tasks. Employee fatigue on assembly lines can affect performance and make it challenging to maintain product quality. An employee who often performs inspection tasks may eventually lose track of the colour of the product. Numerous corporate processes could be automated, which would increase the effectiveness of the production system. Technology called automation makes it possible to automate a process or piece of help. Automation, also referred to as automatic control, is the process of using a variety of control systems to operate machinery, factory processes, boilers, and heat-treating ovens, to turn on telephone networks, to steer and stabilise ships, aircraft, and other applications and vehicles, all without the need for any human involvement. Some processes have been completely automated.

Color sorting frequently involves the need for colour detection and recognition. Agricultural machinery like rice sorters, bean sorters, and peanut sorters, for instance, primarily use colored sorters. Other industrial uses for colour sorters include the separation of coloured nuts and bolts, plastic granules, and quartz sand, among others. By lowering human effort, it saves time, effort, and money. The system may successfully perform handling station task, namely pick, and place mechanism with help of sensor.

1.2 Background Research

Color sensor sensors are widely used in automated applications to quickly detect automation issues and monitor quality on a production line. In assembly lines, they are utilised to distinguish and group goods according to colour. Their use serves a variety of purposes, such as assessing product quality, simplifying packaging and sorting, determining product equality in storage, and keeping track of waste materials.

The Colored A4 Paper Sorter is a device made for our communities, which includes people of all ages. Conveyor belt, small robotic manipulator powered by a servo motor, and TCS3200 colour sensor make up the majority of this machine's components. These components' input and output were interfaced using Arduino. This machine is used for sorting RGB colors. This color and recycled paper sorting machine separates different coloured objects and classifies them into respective containers.

1.3 Problem Statement

According to Municipal Solid Waste (MSW) Management in Malaysia-Changes for Sustainability, average paper waste composition received by Malaysia landfills is increasing every year. Every 5 years, average paper waste is increased due to the changes in consumption habits.

Waste composition	1975	1980	1985	1990	1995	2000	2003	2011
Organic	63.7	54.4	48.3	48.4	45.7	43.2	46.4	58
Paper	7.0	8.0	23.6	8.9	9.0	23.7	14.4	7

Figure 1.1 Waste composition in Malaysia throughout 1975-2011

This systematic research study will investigate how users perceive a paper sorter that automatically sorts items based on colour. Every pattern in the mixed papers' attributes is ignored. In fact, it can be challenging to find them even when you group sheets of the same colour. As not all materials with varied colours are acceptable for all production processes, the material itself will restrict the techniques that can be employed. For example, the paper is taken to a recycling plant to being

separated before the separated paper then is washed with soapy water to remove inks, plastic film, staples, and glue.

Waste Recycled was calculated for each waste type category, then aggregated. Where it was reported that waste was transported to another Waste and Resource Recovery Portal (WARRP) reporting facility for further processing, this waste was removed from the dataset to avoid double-counting. However, dataset for facilities which did not report in WARRP for the 2015-2016 period due to the inability to confirm the fate of the paper waste. This thesis is proposed to helps our country in recycling for paper waste generation.

1.4 Research Objectives

The following are the objectives to be applied in the system that being develop:

(i) To design a sorting machine that can sort papers automatically by its colour.

(ii) To develop the system that can display the weight of papers.

1.5 Scope of Research

This project main focus is A4 colour paper.

1.6 Project Significance

With the development of contemporary technologies like the Arduino Uno and TCS3200 colour sensor, the A4 paper colour sorter focuses on assisting in the reduction of paper waste by sorting A4 paper according to its colour. The TCS3200 colour sensor recognizes the colour of the paper and divides it into several platforms, sometimes known as "containers." The objective is to develop machinery that will solve, or at the very least, decrease, Malaysia's problem with mixed paper waste. The following are the aspects that will be emphasized in the project developed.

- Easy to use
- Work perfectly
- Unique

1.7 Chapter Summary

This chapter contains all of the procedures that needed to complete my project, including the background research, problem statement, study objectives, and scope. This thesis begins when I am looking for a suitable project to complete my assignment.

CHAPTER 2

2 LITERATURE REVIEW

2.1 Introduction

The color sorter machine has received greater attention as interest in automated products to detect the color of things has grown. Many of the tasks in these sectors might be automated, which could increase the efficiency of production system. The size of production equipment and lines can be reduced. Product quality is improving while labour and material costs are decreasing. There are fewer rejects, which means less downtime in production equipment and lower manufacturing costs. Taking everything into account, the project is nearing completion, and industries will earn significant benefits.

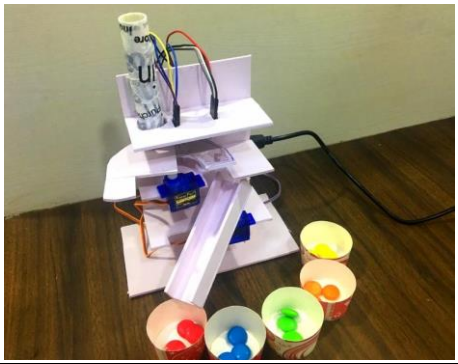
2.2.0 Colored A4 Paper Sorter (Literature Review Topic 1)

A specialised device called a coloured A4 paper sorter reduces manual handling and potential damage. The conveyor belt can also be used to idealise excellent choices. The stages in the Color Sorting Machine (Allen Machinery, Inc., Newberg, Oregon, April 5, 1996) for categorising items include detecting a multiple-color image of a piece of the object and creating colour signals indicative of multiple colours in response to sensing the multiple-color image. The method used in this study involves converting the colour signals into hue and saturation signals, and then classifying the item in response to each signal. The colour A4 paper will be scanned and then dropped onto the conveyor belt being moved by the servo motor to separate it into the different containers. The different container will be filled up with different colour of A4 paper.

2.2.1 Color Sorter Appliances in Market (Subtopic Literature Review Topic 1)

My research in this project also leads me to other inventor and researcher that make the project with another purpose which is to reduce mixed A4 recycled paper issue in the appliance. The idea comes after my research began with a colour sorting project and an A4 paper waste issue.

Table 2.1: Color Sorter Appliances in Market

	The ZX3 color sorting is suitable for sorting coffee, beans, seeds, nuts, and plastics. It detects colors and shapes defects and sorts of throughputs of up to 2.2 tons per hour per chute.
	MS Series Infrared Rice Color Sorting machine is the technology product that can sort different color and types of rice such as parboiled rice, sago rice, Indian rice, yellow rice, white rice, and black rice.
	These machines have color sensor to sense the color of any objects and after detecting the color servo motor grab the thing and put it into respective box.

	This machine is named as recycling sorting systems. The data transmitted by the sensors in the sorting equipment are simply the raw material processed by the system's "brain". Intelligent algorithms are used in this advanced software to enable exact separation between parts in the material flow.
	Recycling bins are sorted using singlestream recycling procedures. Trucks take these containers and deliver them to Materials Recovery Facilities (MRFs). To separate all of the different materials, these facilities utilise a combination of equipment and human sorting.
	The main function of this automatic waste sorting machine is to sort wastes of all sizes and shapes is conceivable, however the efficiency is higher with cylindrical or cubic items with size constraints.

2.3 Control System (Literature Review Topic 2)

The theory of control systems has been crucial to the development of this technology. Maintaining the process variable at the designated time is the most crucial responsibility. The need for automation has grown along with the daily modernization of human civilisation. Control over networks of interconnected devices is necessary for automation. A colour sorter machine is no different in this sense. It is all due to the system's numerous noteworthy benefits for our community. A colour A4 paper sorter is the initial design, which is constructed within the 14-week projected timetable and medium budget. I consider it a success that this project would successfully sort the A4 papers by colour. With regard to all of these areas of project control systems, I hope they will be responsive to project strategies based on predictions, estimates, and perfect measurements.

2.2.2 TCS3200 Color Sensor

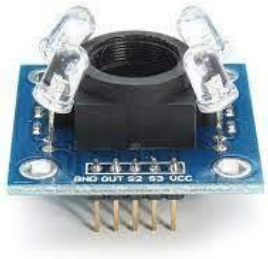


Figure 2.1: TCS3200 Color Sensor

The TCS230 Color Sensor is a programmable color sensing module that includes a GY-31 light-to-frequency converter and a tunable 8x8 silicon photodiode array in a single monolithic CMOS integrated circuit. The output is a square wave with a frequency precisely proportional to light intensity which 50 percent duty cycle (irradiance). Two control input ports can adjust the full-scale output frequency to one of three preset levels. Digital inputs and outputs enable direct communication with a microcontroller or other logic hardware**.**

2.2.3 Arduino Uno

Figure 2.2: Arduino Uno

Arduino Uno is microcontroller board based on the ATmega328P. There are 14 digital input or output pins (six of which can be used as PWM outputs), six analogue inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button on the board. It comes with everything you will need to get started with the microcontroller; simply plug it into a computer with a USB cable or power it with an AC-to-DC adapter or battery.

2.3 Chapter Summary

This section focusing on the invented design product that can reduce and eliminate mixed recycled paper waste. From several researcher that have invented the similar project, I can obtain some of their ideas and implement to my own ideas to create this project.

CHAPTER 3

3 RESEARCH METHODOLOGY

3.1 Introduction

In order to accomplish this Color A4 Paper Sorter Project as a finished good with safety features, an extremely thorough plan is being implemented. Due to a methodical approach, the colour A4 paper sorter projects are finished on time. This involves acquiring data on sample colour frequency, making the mechanical component, testing the circuit design, and so forth.

3.2 Project Design and Overview.

As mentioned in the previous chapter, the designed controller is using a closed loop system with Arduino Uno as the main controller. The design of the controller circuit using Arduino Uno realizes using Proteus Software and then convert to PCB circuit.

3.2.1 Block Diagram of the Project

The figure below, Figure 3.1 shows the block diagram of color A4 paper sorter machine project.

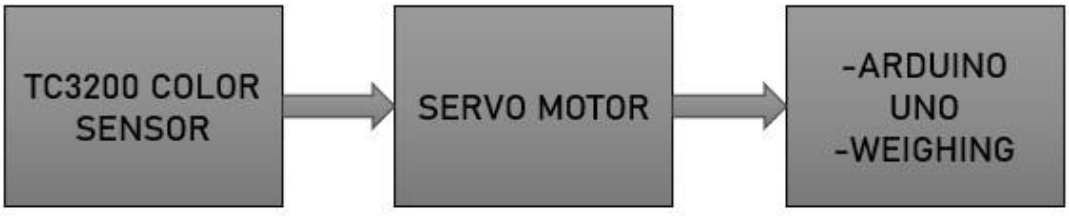


Figure 3.1: Block diagram of Color A4 Paper Sorter

3.2.2 Flowchart of the Project 1

Figure 3.2 shows the circuit diagram of the whole system. It demonstrates how the background information was discovered prior to the start of the thesis. The color connections and specific parts were then learned in order to complete this profession. Following that, payment is provided once the material has been confirmed to be used. The parts are put together with care. If an error occurs, it will be resolved as soon as possible.

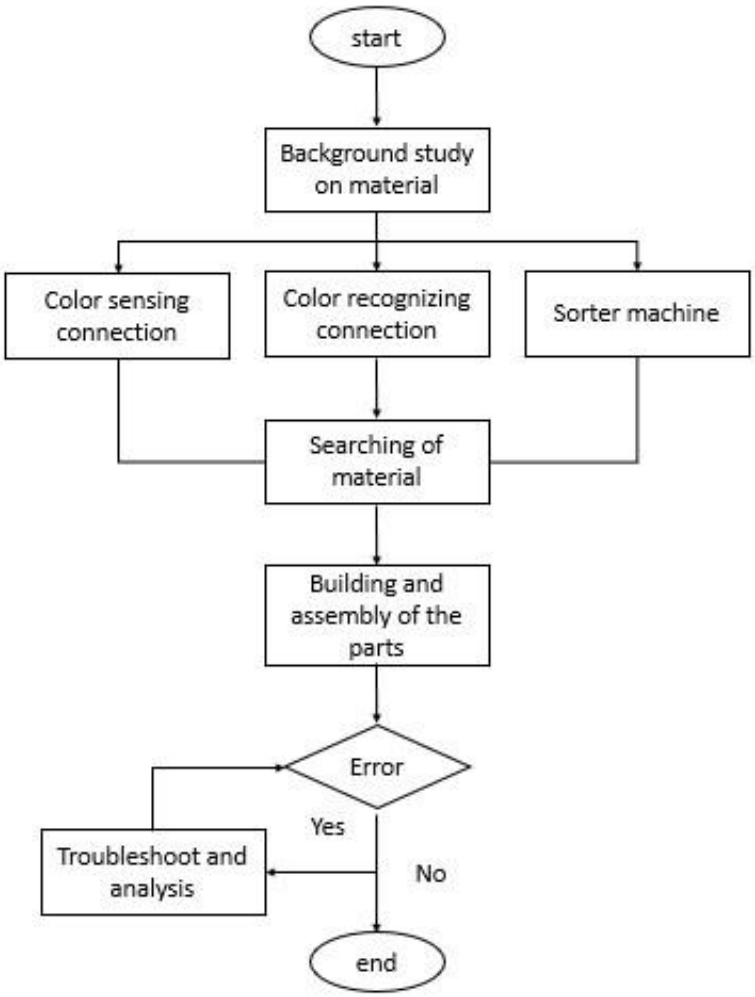


Figure 3.2: Hardware flowchart of operation of the system

Figure 3.3 is showing all this circuit diagram of the system. It displays how earlier to the start of the thesis; background C language program knowledge is

acquired. Before the confirmation, the microcontroller and components are examined.

The Arduino IDE software is then used to write the coding application. The software is then tested and executed. Whether there is an error, it will be fixed immediately.

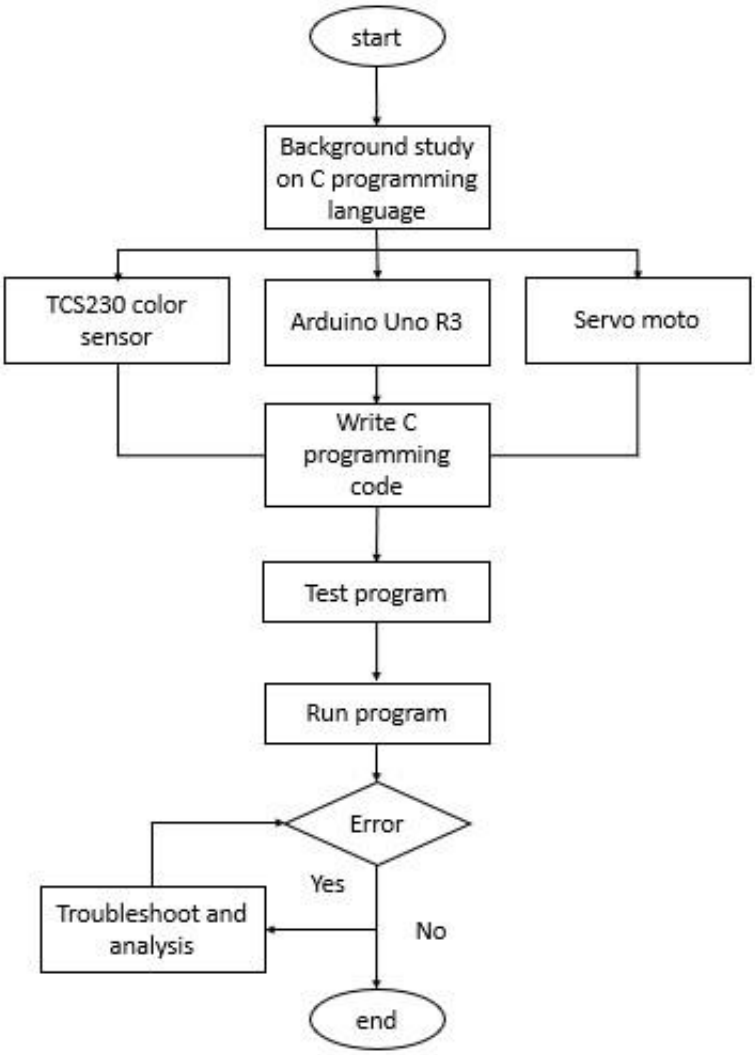


Figure 3.3: Software flowchart of operation of the system

3.2.3 Project Description

The Colored A4 Paper Sorter is a highly useful device. It is used to create friendly devices for the system, which puts forward a mechanism to detect color and sort papers through image processing. Once identified, a mechanism is used to sort the papers into particular platforms or containers.

3.3 Project Hardware

As was explained in the previous chapter, the controller uses an Arduino Uno. The A4 paper object will then be detected by the model of TCS3200 Color Sensor, and the reading data may be viewed in the Arduino IDE monitor display. The object will then be pushed or propelled by a servo motor after being read by the sensor, and it will be guided to the specified container based on the colour of each object.

Table 3.1: Sequence of Color Detector

Color	Platform 1	Platform 2	Platform 3
Red	√		
Blue		√	
Green			√

3.3.1 Schematic Circuit and PCB Layout

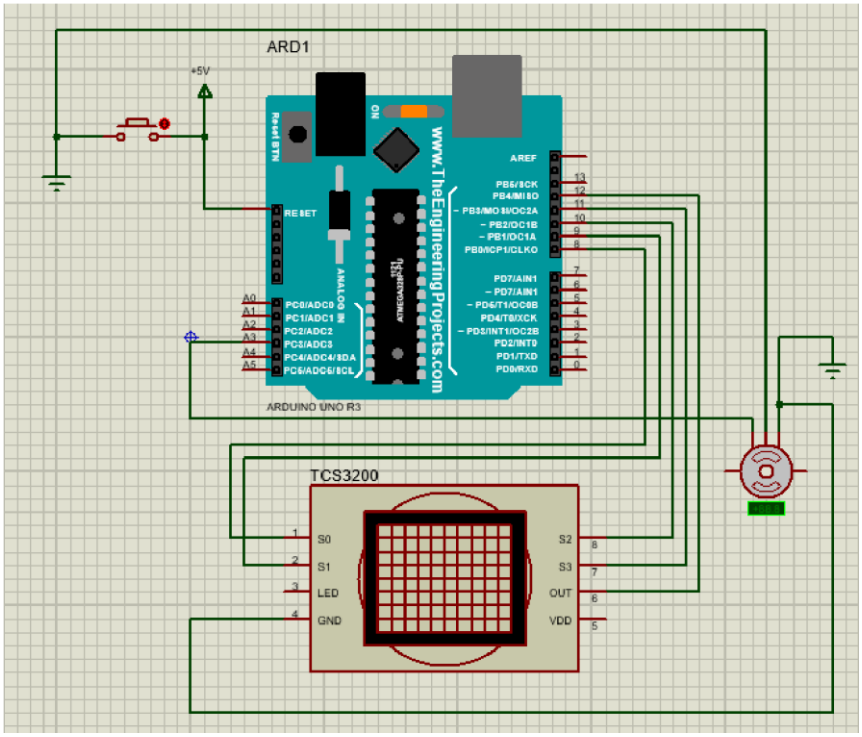


Figure 3.4.1: Circuit Diagram

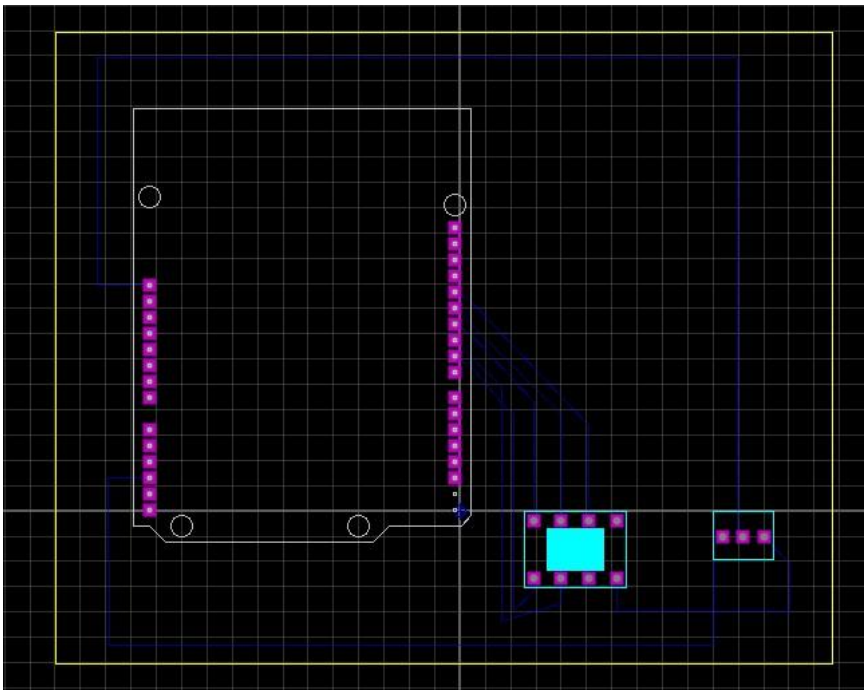


Figure 3.4.2: PCB Layout

3.3.2 Description of Main Component

The main component that used in this project will be elaborated in this section. Also, how all of the components would and should works are explained to determine the desired goals.

3.3.2.1 Component 1

TCS230 Color Sensor will detects the color of A4 paper and generates the output data to transfer to Arduino Uno R3.

3.3.2.2 Component 2

Arduino UNO R3 will process the data according to the code uploaded in the program software (ARDUINO IDE) after received the input and output data from TCS230 color sensor. Then, this Arduino command the servo motor to move and sort color A4 paper on basis of their color.

3.3.2.3 Component 3

The servo motor will move the conveyor belt and sort color A4 paper on basis of their color. The A4 paper will divide into the different containers that filled A4 with same color.

3.3.3 Circuit Operation

The TCS230 colour sensor, which is depicted in Figure 3.3 above, includes three sensors: one for RED light intensity, one for GREEN light intensity, and one for BLUE light intensity. Each of the four sensor arrays is chosen separately depending on the circumstance. The Arduino UNO that you place next to the colour sensor will determine how to follow those instructions. The command will be carried out by Arduino thanks to the supplied data. A conveyor belt driven by a servo motor will sort the A4 paper into a different container after it has been scanned.

3.4 Project Software

This project can be done by using several software programmes. The software is used to do drawings, simulations, and testing. The first software that I used to draw a circuit diagram and do a PCB layout was Proteus 8.6 Professional software. This software is quite simple and easy to understand and use. The other software is the Arduino IDE. This software is used to create a code programme that will be installed on the Arduino controller to do a command.

Table 3.2: Project Software

Proteus 8.6 Professional 	Proteus 8.6 is a proprietary software tool set used mostly for electronic design automation. Electronic design experts and technicians mostly utilise the programme to develop schematics and electronic prints for the production of printed circuit boards.
Arduino IDE 	The Arduino IDE supports the programming languages C and C++ by employing unique code organisation conventions. The Wiring project's software library, which supports many common input and output operations, is included with the Arduino IDE.

3.4.1 Flowchart of the System

The following shows how the flowchart of the system will be described.

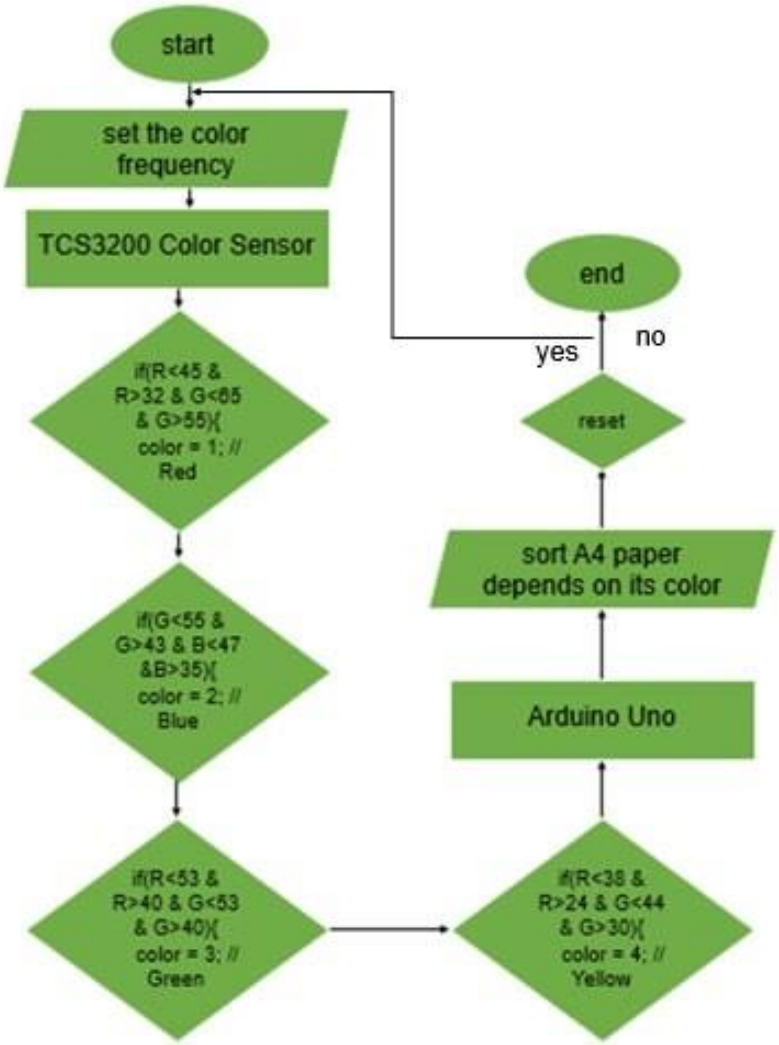


Figure 3.5: Flowchart of the System

3.4.2 Description of Flowchart

A flowchart is used to describe various processes, such as a manufacturing process, an administrative or service process, or a project plan. As shown in Figure 3.4, I created the flowchart to elaborate on how the processes will begin and end. As stated in the figure, my system will start with the colour frequency set to a certain

value to define the color of A4 paper. This input data is read by the TCS300 color sensor. The commands given as shown in diamond shape, or known as the decision process, are to decide the next step in a process. After that, the Arduino will read the data given and decide the data output, which is the colour of A4 paper.

3.5 Prototype Development

The project aims to create solutions that will enhance the recycling experience for both employees and consumers. The purpose of this project is to use the approach of automatic separation of colour A4 paper, especially paper waste. This is done based on sensor technology. Instead of sorting paper waste manually by workers, A4 paper will be separated by this machine into different boxes. A coloured A4 paper sorter will be included with buttons, while the system will be controlled by an Arduino.

3.5.1 Mechanical Design/Product Layout

Figure 3.5 shows the design of the product that was used in this project. The first column is whereas the mixed A4 papers will be inserted. Once the paper is inside, the TCS3200 color sensor will detect the color frequency and then the paper will be sorted into the particular boxes by following the commands given to the Arduino Uno.

This also happens with the help of a conveyor driven by a servo motor.

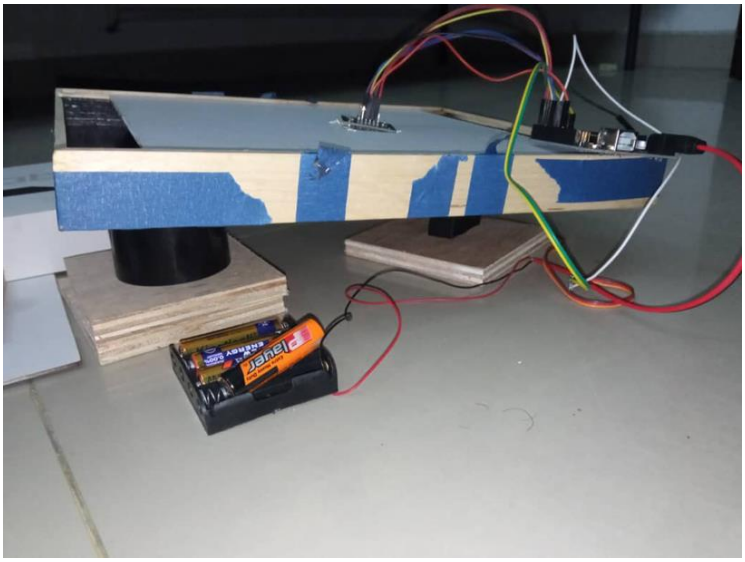


Figure 3.6: View of the Project

3.6 Sustainability Element in The Design Concept

The design criteria of the colored A4 paper project are elaborated in this section. The following are the criteria that will be focused on this project:

i. environmental design criteria

This system has capability to differentiate papers using various types of sensor technology and efficiently separate them into heterogeneous fractions by color, making the color A4 paper sorter environmentally friendly at first. This disposal paper can be used in place of raw material to make new paper products, which can then be recycled once more.

ii. social design criteria use of sustainable design tool

The colored A4 paper sorter project can minimize the use of non-renewable energy by using as much disposal paper or paper waste as possible to be sort. This helps create environmental benefits such as protecting ecosystems and reducing waste streams.

iii. economic design criteria

This initiative identifies benefits and costs that are difficult to quantify. This machine may have the potential to be one of the most cost-effective products available. By using this colored A4 paper compiler, the system may ensure the effort of shoppers to pay for services and features in exchange for the benefits they obtain.

iv. contribution to the society

Initially, the colored A4 paper sorter helps people to dispose of their paper with ease. This machine showing the ability to sorting the A4 into different

platform based on its colour. This will only take a small amount of your time to compile each paper and can make a huge difference in the amount of recycled paper in our society.

3.7 Chapter Summary

This chapter discusses excellent planning skills, such as the completion timeline of the project and the resources process. This is to ensure that projects are completed on time and on budget while adhering to specifications and quality standards, as well as maintaining a safe working environment and estimating the time required to meet set deadlines, which is typically accomplished through the use of sophisticated scheduling and cost estimation software.

CHAPTER 4

4 RESULTS AND DISCUSSION

4.1 Introduction

The prior literature review will be updated in this section. The parts, programmes, and equipment that were covered and explained in the previous chapter. To assist the study outcomes and analysis in this topic, college students are given voluntary public questionnaires. The responses of 22 survey participants from different parts of the course are included in this section.

4.2 Results and Analysis

From the chart below, the majority of respondents prefer to do "sorting events" automatically at 95.5%, followed by manually at 4.5%.

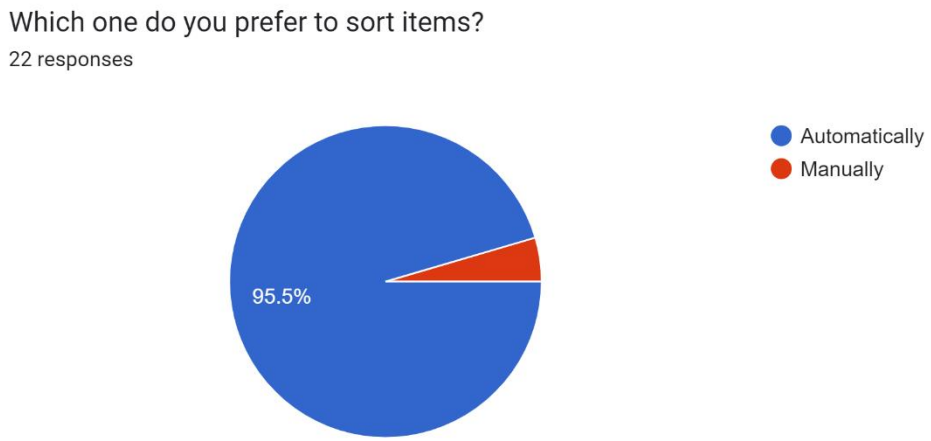


Figure 4.1

The chart below indicates that some of the respondents were involved in sorting the items before. This means that almost all respondents have had it before. While the rest still have not.

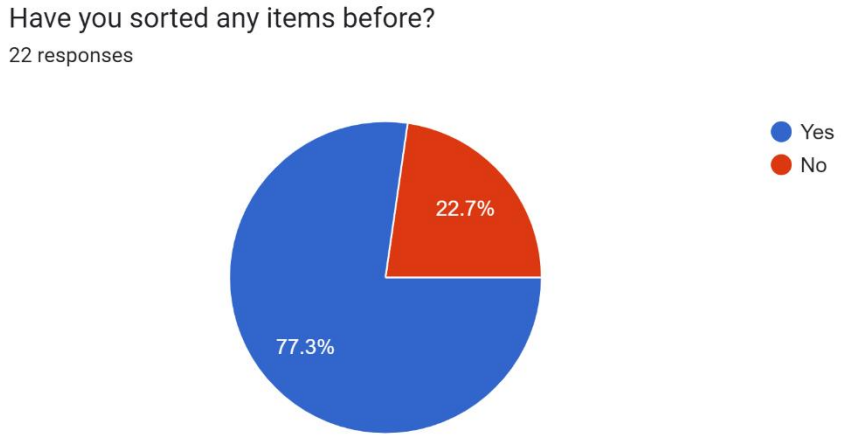


Figure 4.2

Majority of the respondents reported that, they witnessed there are no many recycling bins in public area such as street entrances, outdoor break areas, sport picnic tables and benches, stadium and arena, theme park, and employee parking lot.

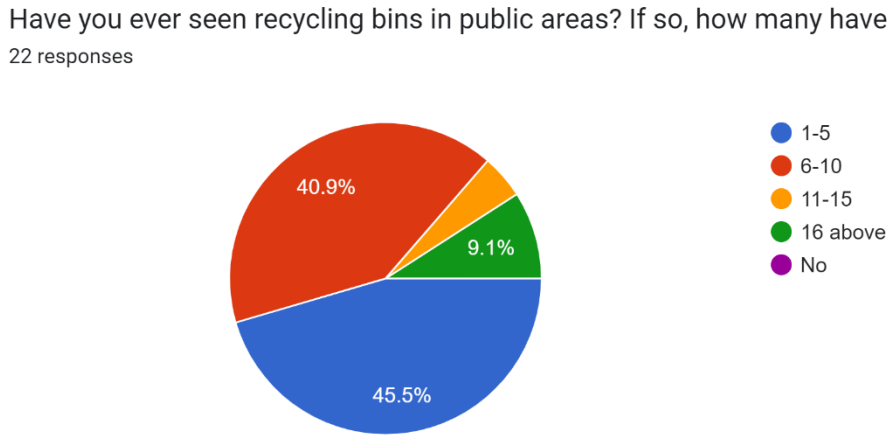


Figure 4.3

The respondents also state that they will use recycle bins if they see them in a public area. This can be their responsibility to keep the environment cleaner.

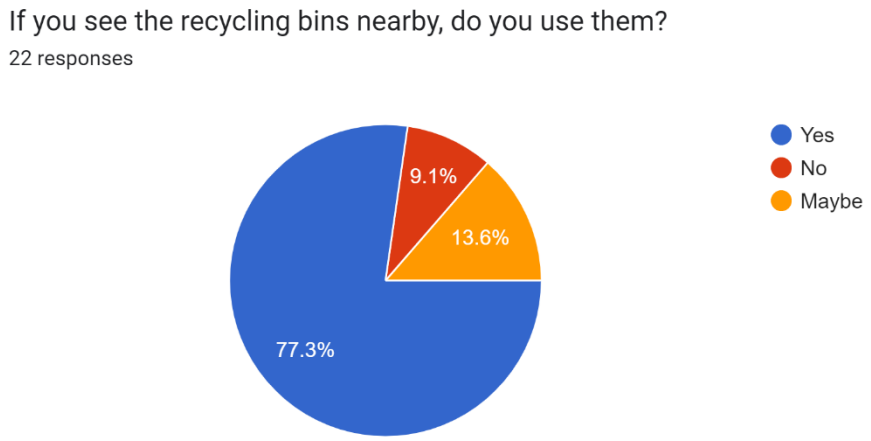


Figure 4.4

4.3 Discussion

From the pie chart that is attached above. We can conclude that many respondents prefer to sort items automatically than manually. At the same time, we can clearly see that most recycling bins in Malaysia are being ignored. This is also because recycle concepts are being ignored by majority of us. Half of respondents usually have sorted their recycled items manually because lack of recycling separation products. This situation become concerning as half of the respondents did not know and cannot handles the issue correctly. Implementation of this device seems to give a clear view that it can separate the A4 papers only according its colour, which is basic colour.

4.4 Chapter Summary

To sum up this chapter, majority of respondents really depends on automatically machine to sort some products. At the same time, we can clearly see that most recycling bins in Malaysia are being ignored. This is also because recycle concepts are being ignored by majority of us. Half of respondents usually have sorted their recycled items manually because lack of recycling separation products. This situation become concerning as half of the respondents did not know and cannot handles the issue correctly. Implementation of this device seems to give a clear view that it can separate the A4 papers only according its colour, which is basic colour. Regardless of considering the response, the product assists in sorting material mentioned without depending on human reasoning and evaluation.

CHAPTER 5

5 CONCLUSION AND RECOMMENDATIONS

5.2 Introduction

The case study discusses on how my project should be end and what is the recommendations from the people thoughts about this project. Feedback is gained from the same survey where they must write any thoughts or opinions. This section also includes past review that related to the project. Suggestion from future work is fully obtained from panel and lecturers that visit my project on the day of competition.

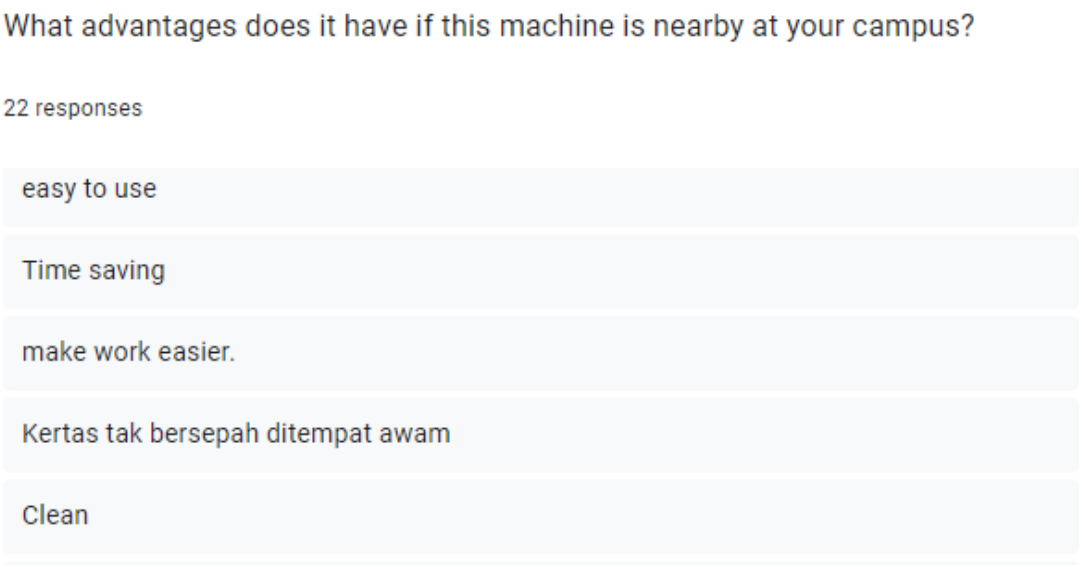


Figure 5.1

Here are some of the questions that respondents mostly agreed that this project can bring several benefits including the clean environment, time-saving, and make a work easier.

5.2 Conclusion

The biggest environmental challenge facing the automated isolation machine is the implementation of separation strategy. Waste processing and recycling have been the world-wide key technologies during the past decades. In promoting the performance and efficiency of automated A4 paper in the developed countries therefore, the main concern of municipalities is the sound management of recyclables.

5.3 Suggestion for Future Work

The suggestions are recommended by the panels and the lecturers. They hope this project will come with more colour choices for sorting the paper. Also, this type of sorting device is will be more accurate in terms of differentiate the A4 paper.

5.4 Chapter Summary

Things we can conclude here that this majority of people demand this project to be eye opener for recycle industry to also focus on recycling bins in Malaysia. If not recycling bins, the least they can do is create or produce this type of product to be launched. I believe that if recycle industry give the opportunity to market this machine, it will not only help in reducing paper waste issue but also encourage people to take a serious action towards this issue.

CHAPTER 6

PROJECT MANAGEMENT AND COSTING

6.1 Introduction

In this chapter, the project management timetable is provided. The progress of the project from Semester 4, Project 1, which involves presenting ideas and choosing the suitable component, conducting research, and developing an initial budget. A Gantt chart has been inserted for reference and to ensure that everything is on schedule. The discussion of milestones, overall cost, and costs is also addressed. The project is operational, as confirmed by the supervisor and coordinator. This chapter will include final goods.

6.2 Gant Chart and Activities of the Project

NAME	Syameer Nur Afif Bin Sahrul
MATRIX NO	08DEP20F1054
TITLE PROJECT	A4 Paper Colour Sensor

Task(Plan)

Task(Actual)

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

GANTT CHART

PROJECT TITLE : A4 PAPER COLOR SORTER

Course	NO	Task Name	Implementation	Duration (Days)	Cost (RM)	Date	Week 1 (22.08.2022- 29.08.2022)	Week 2 (30.08.2022 - 20.3.2022)	Week 3 (21.03.2022 - 27.03.2022)	Week 4 (28.03.2022 - 3.04.2022)	Week 5 (04.04.2022 - 10.04.2022)	Week 6 (11.04.2022 - 17.04.2022)	Week 7 (18.04.2022 - 24.04.2022)	Week 8 (25.04.2022 - 01.05.2022)	Week 9 (02.05.2022 - 08.05.2022)	Week 10 (09.05.2022 - 15.05.2022)	Week 11 (16.05.2022 - 22.05.2022)	Week 12 (23.05.2022 - 29.05.2022)	Week 13 (30.05.2022 - 05.06.2022)	Week 14 (06.06.2022 - 12.06.2022)
DEE40082 PROJECT 1	1	PROJECT BRIEFING	Plan	1																
			Actual	1																
	2	MEETING WITH SUPERVISOR	Plan	14																
			Actual	1																
	3	PROJECT DESIGN	Plan	14																
			Actual	21																
	4	PROJECT CODING	Plan	75																
			Actual	77																
	5	COMPONENT SOLDERING	Plan	14																
			Actual	10																
	6	SOFTWARE COMPLETION	Plan	80																
			Actual	65																
	7	HARDWARE COMPLETION	Plan	65																
			Actual	63																
	8	PROJECT TESTING	Plan	14																
			Actual	12																
	9	PROJECT PRESENTATION	Plan	2																
			Actual	2																
	10	LOGBOOK WRITING	Plan	14																
			Actual	14																
	11	ISOLMS UPDATE	Plan	14																
			Actual	11																
	12	GOOGLE FORM	Plan	7																
			Actual	10																
	13	FINAL REPORT	Plan	21																
			Actual	24																
	14	ELECTRICAL ENGINEERING I COMPETITION	Plan	1																
			Actual	1																

Figure 6.1: Gantt Chart of the Project

6.3 Milestone

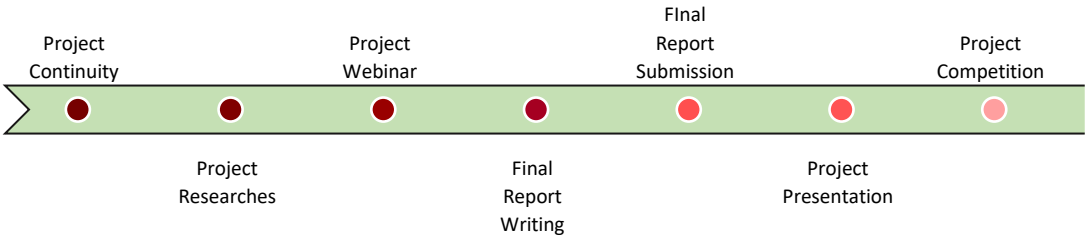


Figure 6.2: Milestone of the Project

6.4 Cost and Budgeting

Financial resources for this project are self-financed with some of basic components and material are sourced at the project laboratory. Based on the cost projection it is estimated at RM241.93 by the student alone. The development cost is still feasible with the duration of 6 months with only RM40.32 per month. It is feasible and achievable based on the investigation conducted.

Table 4.1: List of Components and Materials

Components, Materials and Other Costing	Quantity	Price
Arduino UNO set	1	RM 35.50
Servo Motor	1	RM 14.00
TCS3200 Color Sensor	1	RM 19.02
Switch	1	RM 2.50
A4 Paper	20	RM 6.00
A5 9mm Fibreboard	8	RM 16.00
A5 2.5mm board	5	RM 8.01
Others	-	RM 10.00

Postage	-	RM35
Internet	-	RM 80
TOTAL	-	**RM 231.30**

6.5 Chapter Summary

This section contains all of my work schedules that include real-time planning as described in the Gantt Chart of the project, milestone of project activities, and a cost budging schedule that filled with a list of components before the project is completed. A variety of more efficient plans are neatly arranged to bring efficiency services to complete the project. The completion update time-to-time is shown together with final product look, on top of that link to Official Video Introduction is patched.

REFERENCES

Paper Waste: Why Does It Matter? - BaleForce Recycling Equipment, (15 July 2021)

Avi P. Cohn (1997). Color Sorting Method

Saddam (02 March 2017). Arduino Weight Measurement using Load Cell and HX711 Module

NSW Environment Protection Authority (June 2019). NSW Waste Avoidance and Resource Recovery Strategy Progress Report

Allen Machinery, Inc., Newberg, Oreg, (05 April 1996). The Color Sorting Machine

Ch.Shravani, G. Indira, V. Appalaraju, (April 2019). The Arduino Based Color Sorting Machine using TCS3200 Color Sensor

Neha Desai, Hrutik Jadhav, Amisha Jadhav, Gayatri Kolte, Sneha Durugkar, (2019). Color Sorting Mchine using Arduino

ElectroPeak (21 May 2019) Weigh Scalling

North Hill Bottle Depot (12 July 2021). Benefits of Recycling

Alex Silbajoris (25 April 2017). Go-to Resource for All Things Science

I. Varshitha (2020). Arduino Weighing Machine Using Loadcelland Hx711 Module

Bickman, Josh (1996). Automated Color-Sorting uses optical technology

H. Escid, et al. (September 2011) “0.35 mm CMOS optical sensor for an integrated transimpedance circuit”, the International Journal on Smart Sensing and Intelligent Systems

Norfazlinda Binti Daud (May 2007). ”Application of colors sensor in an automated system”,Technical University Malaysia

Young Bum Kim and et all (2013). Dynamically optimal trajectories for earthmoving excavators‖, Automation in Construction 35

A.S.Hall, P.R.Mcaree (August 2005) Robust bucket position tracking for a large hydraulic excavator‖, Mechanism and machine theory, The university of Queensland, Brisbane 402, Australia

5 APPENDICES

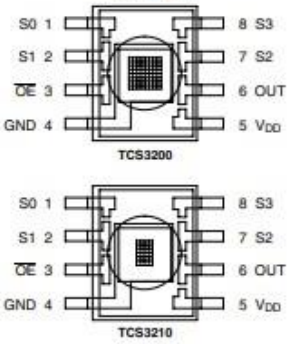
APPENDIX A- DATA SHEET

TAOS TEXAS ADVANCED OPTOELECTRONIC SOLUTIONS

TCS3200, TCS3210
PROGRAMMABLE
COLOR LIGHT-TO-FREQUENCY CONVERTER
TAOS099 – JULY 2009

- **High-Resolution Conversion of Light Intensity to Frequency**
- **Programmable Color and Full-Scale Output Frequency**
- **Communicates Directly With a Microcontroller**
- **Single-Supply Operation (2.7 V to 5.5 V)**
- **Power Down Feature**
- **Nonlinearity Error Typically 0.2% at 50 kHz**
- **Stable 200 ppm/°C Temperature Coefficient**
- **Low-Profile Lead (Pb) Free and RoHS Compliant Surface-Mount Package**

PACKAGE D
8-LEAD SOIC
(TOP VIEW)



Description

The TCS3200 and TCS3210 programmable color light-to-frequency converters that combine configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit. The output is a square wave (50% duty cycle) with frequency directly proportional to light intensity (irradiance).

The full-scale output frequency can be scaled by one of three preset values via two control input pins. Digital inputs and digital output allow direct interface to a microcontroller or other logic circuitry. Output enable ($\overline{OE}$) places the output in the high-impedance state for multiple-unit sharing of a microcontroller input line.

In the TCS3200, the light-to-frequency converter reads an 8 x 8 array of photodiodes. Sixteen photodiodes have blue filters, 16 photodiodes have green filters, 16 photodiodes have red filters, and 16 photodiodes are clear with no filters.

In the TCS3210, the light-to-frequency converter reads a 4 x 6 array of photodiodes. Six photodiodes have blue filters, 6 photodiodes have green filters, 6 photodiodes have red filters, and 6 photodiodes are clear with no filters.

The four types (colors) of photodiodes are interdigitated to minimize the effect of non-uniformity of incident irradiance. All photodiodes of the same color are connected in parallel. Pins S2 and S3 are used to select which group of photodiodes (red, green, blue, clear) are active. Photodiodes are 110 µm x 110 µm in size and are on 134-µm centers.

Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
GND	4		Power supply ground. All voltages are referenced to GND.
$\overline{OE}$	3	I	Enable for f_o (active low).
OUT	6	O	Output frequency (f_o).
S0, S1	1, 2	I	Output frequency scaling selection inputs.
S2, S3	7, 8	I	Photodiode type selection inputs.
V_{DD}	5		Supply voltage

Table 1. Selectable Options

S0	S1	OUTPUT FREQUENCY SCALING (f_o)
L	L	Power down
L	H	2%
H	L	20%
H	H	100%

S2	S3	PHOTODIODE TYPE
L	L	Red
L	H	Blue
H	L	Clear (no filter)
H	H	Green

Available Options

DEVICE	T_A	PACKAGE – LEADS	PACKAGE DESIGNATOR	ORDERING NUMBER
TCS3200	–40°C to 85°C	SOIC–8	D	TCS3200D
TCS3210	–40°C to 85°C	SOIC–8	D	TCS3210D

APPENDIX B- PROGRAMMING

```
#include <Wire.h>  // Comes with Arduino IDE


#include <Servo.h>


// TCS230 or TCS3200 pins wiring to Arduino
#define S0 2
#define S1 3
#define S2 5
#define S3 6
#define sensorOut 4

int red = 0;
int green= 0;
int blue = 0;
int Check=0;

Servo myservo1;
Servo myservo2;
```

```
int redcnt=0, yelcnt=0, bluecnt=0;
float PRed=0;
float PBlue=0;
float PGreen=0;
float PTotal=0;
int initialize=0;
int RUN=1;
int NG=0,NR=0,NY=0;
int DG=0,DR=0,DY=0;
int MG=0,MR=0,MY=0;
int ModeOperation=0;
int gcount,rcount,bcount=0;
float Diff=0;
int taosOutPin = 4;//pinC
int LED = 11;//pinD
float Mix=0;
int TIMER=0;
int SPD=100;
int Rcheck=0;
int Gcheck=0;
int Bcheck=0;
int pos=0;
int POSITION=0;//RED

void setup() {


pinMode(S0, OUTPUT);
  pinMode(S1, OUTPUT);
  pinMode(S2, OUTPUT);
```

```
  pinMode(S3, OUTPUT);

  // Setting the sensorOut as an input
  pinMode(sensorOut, INPUT);

  // Setting frequency scaling to 20%
  digitalWrite(S0,HIGH);
  digitalWrite(S1,LOW);


  Serial.begin(9600);
//DDRD = B11111110;  // sets Arduino pins 1 to 7 as outputs, pin 0 as input



 myservo1.attach(8);
    myservo2.attach(9);

//Serial.begin(9600);
//Serial.print("\n\n\nready\n\n\n");
//delay(100);

/*
pinMode(PumpR,OUTPUT);
pinMode(BUZZ,OUTPUT);
pinMode(PumpG,OUTPUT);
pinMode(PumpB,OUTPUT);
pinMode(trigPinL,OUTPUT);
pinMode(echoPinL,INPUT);
*/
for (pos = 0; pos <= 180; pos += 1) { // goes from 0 degrees to 180 degrees
    // in steps of 1 degree
    myservo1.write(pos);              // tell servo to go to position in variable 'pos'
    delay(15);                       // waits 15ms for the servo to reach the position
  }
  for (pos = 180; pos >= 90; pos -= 1) { // goes from 180 degrees to 0 degrees
    myservo1.write(pos);              // tell servo to go to position in variable 'pos'
    delay(15);                       // waits 15ms for the servo to reach the position
  }
pos=90;

}


void loop() {



 ReadColor();
  Serial.print(red);
  Serial.print("\t");
  //Serial.print(" G = ");

  Serial.print(green);
 // Serial.print(" B = ");
  Serial.print("\t");

  Serial.print(blue);

 // Serial.print(" W = ");
```

```
  Serial.println();


  if (red>=50 && red<=150 && green >180 && green<250 && blue >=100 && blue<=150){
    Serial.print("RED DETECTED");
    if (POSITION!=0){
      while (pos!=45){
        if (pos<45){
          pos++;
           myservol.write(pos);
           delay(10);
        }
         if (pos>45){
          pos--;
           myservol.write(pos);
        }
      }

       POSITION=0;
    }
    delay(2000);
  }

    if (red>100 && red<200 && green >50 && green<70 && blue >=30 && blue<=50){
        Serial.print("BLUE DETECTED");
        if (POSITION!=1){
       while (pos!=-45){
        if (pos<-45){
            myservol.write(pos);
            delay(10);
         }

       }
        POSITION=1;
    }
    delay(2000);
  }

    if (red>200 && red<250 && green >50 && green<100 && blue >=50 && blue<=100){
             Serial.print("GREEN DETECTED");
             if (POSITION!=2){
       while (pos!=0){

         if (pos>0){
          pos--;
           myservol.write(pos);
           delay(10);
         }
       }
        POSITION=2;
    }
    delay(2000);
  }
  //*********************************

if (RUN==1){// RUN MODE
  /*
```

```
void ReadColor(){
   // Setting RED (R) filtered photodiodes to be read
  digitalWrite(S2,LOW);
  digitalWrite(S3,LOW);

  // Reading the output frequency
  red = pulseIn(sensorOut, LOW);

   // Printing the RED (R) value

  delay(1);

  // Setting GREEN (G) filtered photodiodes to be read
  digitalWrite(S2,HIGH);
  digitalWrite(S3,HIGH);

  // Reading the output frequency
  green = pulseIn(sensorOut, LOW);

  // Printing the GREEN (G) value

  delay(1);

  // Setting BLUE (B) filtered photodiodes to be read
  digitalWrite(S2,LOW);
  digitalWrite(S3,HIGH);



  delay(100);
}
```