MONEY COLLECTOR ROBOT

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A proposal project submitted in fulfillment of the requirement for the award of the diploma of Electrical Engineering (Computer), Department of Electrical Engineering Polytechnic Seberang Perai (PSP).

JUN 2017

PROJECT REPORT COMFORMATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged.

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2017

Dedicated to,

Thanks to Allah,

For give me a good health and strength while making this report.

My beloved father and mother,

Mohamad Badri Bin Morshidi & Siti Norlizauyah Binti Mahli

Who has always been my epitome of love and always pray for my strength to finish up this report.

My beloved relatives,

My siblings,

Thank you for your support and pray.

The person who has been very understanding and helpful,

Mrs. Roslina Binti Saad,

For the support and guidance. Hope that I always be remembered.

My unforgettable friends,

My housemate, my coursemate and all DTK students intake June 2015,

Our struggle not yet ends.

Finally, friends that always together during this third years study,

Hopefully achieved what we aspired.

Dedicated to,

Thanks to Allah,

For give me a good health and strength while making this report.

My beloved father and mother,

Basri Bin Badrol, & Norhayati Binti Ahmad

Who has always been my epitome of love and always pray for my strength to finish up this report.

My beloved relatives,

My siblings,

Thank you for your support and pray.

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Mrs. Roslina Binti Saad,

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CONTENT

CHAPTER	TITLE	PAGES
Title Page		
Acknowledgment		i
Abstract		ii
Content		iii
CHAPTER 1:	INTRODUCTION	
1.0	Introduction	1
1.1	Problem Statement	2
1.2	Objective	2
1.3	Scope Project	3
1.4	Definition of Term	3
	Definition Arduino Uno	3
	Definition (PCB) Layout	4
	Definition Cable and Wire	4
1.5	Summary	4

CHAPTER 2: LITERATURE REVIEW

2.0	Introduction	5
2.1	The study of existing product	6
2.2	Materials	10
2.2	Summary	13

CHAPTER 3: METHODOLOGY

3.0	Introduction	14
3.1	Block Diagram	15
3.2	Flow Chart	16
3.3	Gantt Chart	17
3.4	Cost Table	17
3.5	Schematic Diagram	18
3,6	Simulate Circuit	18
3.7	Process Circuit	19
3.8	Etching	19
3.9	Risk of Etching	20
3.10	Safety	20
3.11	Etching Process	20
3.12	Drilling Process	22

3.13	Circuit Testing	24
3.14	Troubleshooting	25
3.15	Research and Analysis	25
3.16	Project Reformation	25
3.17	Session Discussion	26
CHAPTER 4:	PROJECT ANALYSIS AND DISCOVERY	
4.1	INTRODUCTION	27
4.2	Analysis	28
4.2.1	Analysis Phase	28
4.2.2	Analysis of Technique	28
4.2.3	Analysis of Data	28
4.2.4	Observation Technique	28
4.3	CODING	30
4.4	Project Estimated Cost	33

CHAPTER 5: FINDING AND DISCUSSION OF THE PROJECT

5.1 Introduction 34

5.1.1 Test Project 34

5.1.2 Testing with Digital Multimeter 34

5.2 PROBLEM FINDING 35

5.3 DISCUSSION 35

CHAPTER 6: CONCLUSION AND SUGGESTION

6.1 Conclusion 36

6.2 SUGGESTION 36

REFFERENCE 38

APPENDIX A : COODING 39

APPENDIX B : FULL CONNECTION CIRCUIT WITH ATMEGA328P-PU 42

APPENDIX C : PROTOTYPE 43

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Assalamualaikum W.B.T

Firstly, we want to say Alhamdulillah, a sincere Praise to Allah The Almighty since with His Power and Authorization, we have completed our project 2 which is Money Collector robot and proposal for project 2.

A million of thank you to our supervisor, Pn. Roslina Binti Saad for support and guidance during the project 2 and proposal four our Final Year Project. All of the guide and knowledge that she teaches us are invaluable for us specially to do the real project.

Next, the Everest of thank to our family for their support, patience, bless and understanding. Finally, yet importantly, thank to our friends for their help and idea and best effort. I am appreciated it and thank you for what they have done to me.

ABSTRACT

This project is to design an intelligence of line following mobile robot for charity application in the mosque during jumaat prayers. Mobile robots have been widely used of application in the industry as well as our daily life. An automatic mobile robot is capable of movement in a given environment. The purpose of this project is to make sure the mobile robot follows along the black line. It is focus only in the Pusat Islam on the Friday prayer. The Microcontroller Arduino Uno (ATmega328P) programming that is attached directly to the controller circuit motor driver (L293D) controls this mobile robot. The robot detects the Black line by using two IR sensors consists of transmitter and receiver that are put under the mobile robot, which is right side and left side. The program in the Arduino Uno microcontroller board controls this sensor. This robot is driven by two DC motors which are controlled by the program in the Arduino Uno (ATmega328P) microcontroller board. This DC motor is used to move the robot in forward direction. It goes forward along the black line and stops IR sensor detect white line at the end of junction. After a few second that is the timer is controlled by the programming, the robot will go forward again. The mobile robot will move slowly along the Black line that is in front of the 'saf to get easy to people to put the money in the box given.

ABSTRAK

Projek ini adalah untuk mebina sebuah robot yang dinamakan "*MONEY COLLECTOR ROBOT*" iaitu robot mudah alih untuk melakukan kerja amal di masjid semasa solat jumaat. Robot mudah alih telah digunakan secara meluas dalam aplikasi industri serta kehidupan harian kami. Robot mudah alih automatik mampu bergerak dalam persekitaran yang diberikan. Tujuan projek ini adalah untuk memastikan robot mudah alih mengikut garis hitam. Ia hanya tertumpu di Pusat Islam pada solat Jumaat. Pengaturcaraan Mikrokontroler Arduino Uno (ATmega328P) yang dipasang terus kepada "Motor driver (L293D)" mengawal robot mudah alih ini. Robot mengesan garisan hitam dengan menggunakan dua sensor IR terdiri daripada pemancar dan penerima yang diletakkan di bawah robot bergerak, yang merupakan sisi kanan dan kiri. Program di papan mikrokontroler Arduino Uno mengawal sensor ini. Robot ini didorong oleh dua motor DC yang dikendalikan oleh program di papan mikrokontroler Arduino Uno (ATmega328P). Motor DC ini digunakan untuk memindahkan robot ke arah hadapan. Ia bergerak ke hadapan di sepanjang garis hitam. Selepas beberapa saat itu pemasa dikawal oleh pengaturcaraan, robot akan terus kehadapan. Robot bergerak akan bergerak perlahan-lahan di sepanjang garis hitam yang berada di depan 'saf untuk memudahkan orang meletakkan wang di dalam kotak yang disediakan.

CHAPTER 1

INTRODUCTION

1.0 Introduction

Robotic technology becomes popular lately because it can be used in several ways to assist people for doing many tasks. This kind of robot has a programmer that imitates the actions by humans. The mobile robot has to be able to do something physically where the robot get information from its surroundings.

We have given a task to design a mobile robot for our project 1 in semester 4, a mobile robot can be defined the robot that can move smoothly, precisely using multiples degrees of motion and it can do something like human being so that the human does not need to do anymore. Briefly, the robots now facilitate the human's work. The line follower is a self-operating robot that detects and follows a line that is drawn on the floor. The basic operation of the line following is a capture line position with optical sensors. There are two line or path styles, white line on the black surface or black line on the white surface.

In this project, our money collector robot has to move and follow a line. With the using of Infrared sensor or line sensor, the mobile robot has to be able to detect the white line, black line. Microcontroller Arduino Uno (Atmega328P) is used as a controller and the motor control was performed with motor driver (L329D) that is used to run the DC motor. The mechanical parts of the robot are the DC motor with the rear wheel drive and castor wheel.

In this project, we have doing some researches for all of its components in order to get the best component to build the mobile robot. By developing the sensor, hardware and software Arduino IDE and C as its program language, the project enables me to get deeper

understanding of what is required in design of a mobile robot. So, we decided to design a mobile robot that can help Islam community inside pusat Islam to collect donation from jumaat prayers in much safety and attractive ways.

1.1 Problems Statement

Each thing that we do must have a reason, same as this project as the problem arise it lead the new idea to make this learn ware.

Nowadays, there are a lot of reported cases of stolen donation box inside mosques. This problem has been faced by Islam community a long time ago. Since then, Islam community lost a huge amount of money that are supposed use for development of Islam community but the money stolen by people for their own purpose. The main caused this problem occur is because the donation box is lack of security system, so we improve the safety of donation box to reduce the risk of getting stolen.

Charity is a good way to assist in helping poor people. The Muslims are encouraged to donate as one of the way to help this poor people. Before this, the side of mosque only supplies the tin, the prayer will pass through by hand to other prayer, and it may cause an interruption among them. In order to minimize the problem, this mobile robot is able to moves forward automatically and follows the white path and the prayer no need any more to passing the tin back, just put the money into the mobile robot.

1.2 Objective

The main objective of this project is to make a Money Collector Robot that can carry out a task.

The objective of this product are,

i. To design and develop a Money Collector Robot (MCR) that are moveable by using microcontroller that called Arduino Uno (ATmegaP 328P) version R3.

ii. To create a safety donation box inside Pusat Islam of the Polytechnic Seberang Perai.

1.3 Scope and Limitation

Scope project are important element in this project. It can make sure the project can be finished on the time. Because to make a good project there must have a scope.

i. The MCR is only used in Pusat Islam of the Polytechnic Seberang Perai
ii. The MCR is only collect donation money during jumaat prayer
iii. The MCR only moves forward and backward in one line with autonomous system control.
iv. The capacity for donation box is only 20cm x 20cm x 20cm = Width x Length x Height
v. Power supply only can last for half an hour
vi. Only collect money from 1st row of jumaat prayers due to limitation of autonomous system line follower.

1.4 Definition of Term

There are several definitions that are explain more deeply about the equipment that are used in this project.

1. Definition Arduino Uno

We use Arduino Uno is a microcontroller board based on the Atmega328P.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. [2] It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start. This type Arduino is cheap and easy to programmable to this project.

II. Definition Keypad module for Arduino

This keypad has 12 buttons, arranged in a telephone-line 3x4 grid. It's made of plastic with sturdy plastic buttons. The keys are connected to a matrix so you only need 7 microcontroller pins (3-columns and 4-rows) to scan through the pad.

III. Definition (PCB) Layout

We use a printed circuit board [PCB] because it can mechanically support and electrically connects electronics components using conductive tracks, pads and other features etched from copper sheets laminated onto a non- conductive substrate [1].

IV. Definition Cable and Wire

Cable and wire is commonly should be used in project to transmit electricity to the project to power up. [1]

1.5 SUMMARY

For chapter 1, it is explained about an overview that gives a main idea about this project. Problem statement give a problem that occur and the solution come with the project that has been suggested. Objective section will elaborately detail about project objective that need to be achieve. Project scope which in scope part have focus about the concept of mobile robot

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Literature review was an activity for researcher to research about project or paper work that has been done by someone else. The advantages and disadvantages must be taken as a guideline in order to make the project successful. From the previous research, we can use it for our guidance to create another project that is not exactly the same, but could be much better than the original one. Paper work or journal that related with special robotic should be take, as it can help in the future if problem occur, it also helps in collecting theory background because journal or paper work is new from the theory that we get in book.

In today's world, everything should be very smooth and easy by helps of robots in doing human's task, unfortunately some of us still doing it in old ways. In such a scenario, a donation box inside mosque still using the tin, the prayer will pass through by hand to other prayer, and it may cause an interruption among them. A robotic collector money does all the work by itself and requires no supervision. By investing in one of these machines, you can save yourself a lot of time and effort. Other than that, this robotic collector money is much secure and safety than using tin as a donation box.

2.1 THE STUDY OF EXISTING PRODUCT

A money collector robot is an autonomous electronic device that is intelligently programed to collect money for donations or charity. Some of the available products can collect money in public place such as, on street in the city and charity places. Some of the available products are discussed below.

A. DON-8R

DON 8-R is a cute, coin-fueled robot developed by Tim Pryde who is a student of University of Dundee. DON 8r is designed to raise money for charity. It strolls around in one of the campuses collection change.DON 8r robot stays perfectly still until a coin is inserted through an opening on its back. It keeps on blinking its head with different colors, and running around and round once a coin is detected.

Features

- Programmed to run on coins
- Capable of emitting different set of colors through its head
- Run on even grounds

Advantages

- Installed with multiple sensors which make this robot is flexible to move freely without depend on autonomous systems.
- A longer battery life that power up till at the end of the day at single charge

Disadvantages

- This robot is very costly and unaffordable
- The capacity is slightly small to collect money from donators around the town

B. Dona (Robot street fundraiser collects save children)

DONA is a humanoid robot developed by Min Su Kim of Hong IK University in collaboration with Yonsei University. DONA is designed to solicit donation from passers-by by being polite and performing different kinds of gestures. The latest DONA robot is much bigger than the older version and has a specific dimension of 78 X 45 X 55 centimeters. DONA has 22 servo motors allowing it to perform 20 preprogrammed animations. This robot is equipped with distance measuring sensors and is capable of interacting with humans. DONA can move around on even grounds

Features:

- Flexibility with 22 servo motors
- 20 preprogrammed gestures
- 3 distance measuring sensors allow effective interaction to humans
- Moves on even grounds using wheel-driven platform

Advantages

- An attractive mini robot that can attract peoples to donate and encourage kids to do the same
- Open-source electronics prototyping platform that allows other people to design same type of robot to do charity

Disadvantages

- Stand-alone robot, this robot doesn't have its own donation box which make it handy to collect donations
- Not Anti-thief safety robot due to external donation box

C. Charibot (Design and Field Trials of a Fundraising Robot)

iCharibot's main role was to raise money for charitable purposes and this goal guided our design decisions. A first prototype of the robot was tested with students from our university. The lessons learnt from these preliminary tests were incorporated in iCharibot. iCharibot's overall appearance is human-like in size with a cylindrical body. It was built using the PeopleBot platform. We ensured iCharibot did not mislead users by appearing to be more intelligent or capable than it really was

Features

- Interactive module, this module ran on the secondary Android tablet and featured a cancer-fighting game which had been approved by Imperial Cancer Research
- Voice module: iCharibot synthesized audio sentences using the Festival [4] text-to-speech engine
- Human-detection module: iCharibot was initially programmed to detect passers-by using PeopleBot's sonars

Advantages

- A big capacity of donation box
- Comes with multiple sensors which make it almost can do everything similar to human abilities

Disadvantages

- Costly
- Complicated program

A comparison of robots that we researched with general specifications like operating time, charging time, scheduling, floor type, battery indicators and navigation features is summarized in Table below.

FEATURES	DON-8R	DONA	CHARIBOT
OPERATING TIME(HRS)	6	4	3
CHARGING TIME(HRS)	10	8	11
SCHEDULING	YES	YES	YES
BATTERY INDICATORS	YES	YES	YES
FULL-bin INDICATOR	YES	YES	YES
REMOTE CONTROL	YES	YES	YES

From this table, we know that the DON-8R has more operating hours compare to others which means its battery is better than others of the smart cleaner and due to its small in size which is less usage of power. Despite that, it takes 10 hours of charging the DON-R8 compare to CHARIBOT but the DONA only takes 8 hours to charge and it only operate 4 hours. We can conclude that all this money collector robot above carry out the similar function but it has different battery lifetime of each of the cleaner. DON-R8 is the only robot has battery efficiency and less power consumption because it only takes 10 hours to charge and it can operate for 6 hours. Based on this specification that had inside DON-R8 we can take it as a reference to improvise our project.

This section describes the related projects are generally particularly in terms of throughput. The robot that we create is autonomous which can move automatically without being controlled by owner and need to follow along the line. The purpose that creating this robot is to help the methods collect donation money is more efficient. The size of the robot that we create is more likely size of a pet animals like dog which is suitable size for everyone's. This robot can be charged anytime because it has a rechargeable battery built-in it. There is buzzer built-in the robot which can reminds the owner whenever the job is done, the dump box is full and low battery.

The control process of the Robotic Collector Money is control by a few categories:

- Arduino UNO
- IR line follower sensor
- L293D Motor Driver

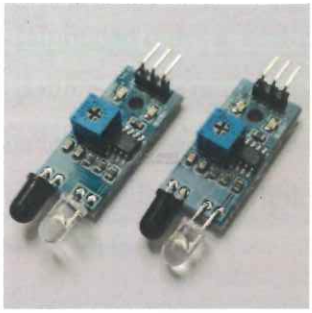
2.2 Materials

There are some materials that are used in our project such as:

I. IR sensor

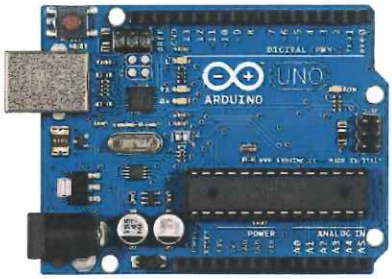
IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an

object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.



II. ARDUINO UNO

We use Arduino Uno is a microcontroller board based on the ATmega328P.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. [2] It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start. This type Arduino is cheap and easy to programmable to this project.



III. (PCB) LAYOUT

In this project we use **printed circuit board (PCB)** because mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper heats laminated onto a non-conductive substrate. [1]PCBs can be *single sided* (one copper layer), *double sided* (two copper layers) or *multi-layer* (outer and inner layers).[2] Multi-layer PCBs allow for much higher component density.[3] Conductors on different layers are connected with plated-through holes called vias. [4] Advanced PCBs may contain components - capacitors, resistors.

IV. PERSPEX

In this project, we use sheet for chassis. Because Perspex is light weight, easy to rivet or joint, it also does rust or corrode. Perspex is a transparent thermoplastic often used in sheet form as a lightweight or shatter-resistant alternative to glass. The same material can be utilized as a casting resin, in inks and coatings, and has many other uses.

2.3 Summary

The components and material was choosing with precisely and correctly to make a good product. [1] The Arduino Uno was used in this project because it easily programmable then another Arduino. [2] The gsm module 900A was used because it is cheap but quality.it can store up to 5 mobile numbers than others. [3] Then the ip camera was used because this type ip camera is small and compact body of the product is made out of aluminium is light and strong. [4]

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter is discussed about the methodology that has been used to complete this project. It was planned properly by getting the correct information from various sources from references book, journal, articles, internet and others. It also includes interview session with our supervisor to get the information, advices and guidelines to complete this proposal report. All of the data and useful information were determined to analyze to get the best result. Generally, there are several levels to reach the complete product analysis which is

1) Design analysis to the available product.
2) Design concept based on the sketching and analysis drawing.
3) Produce the product concept.
4) Produce the real concept.

FIGURE 3.1: BLOCK DIAGRAM FOR MONEY COLLECTOR ROBOT

(LINE FOLLOWING ROBOT)

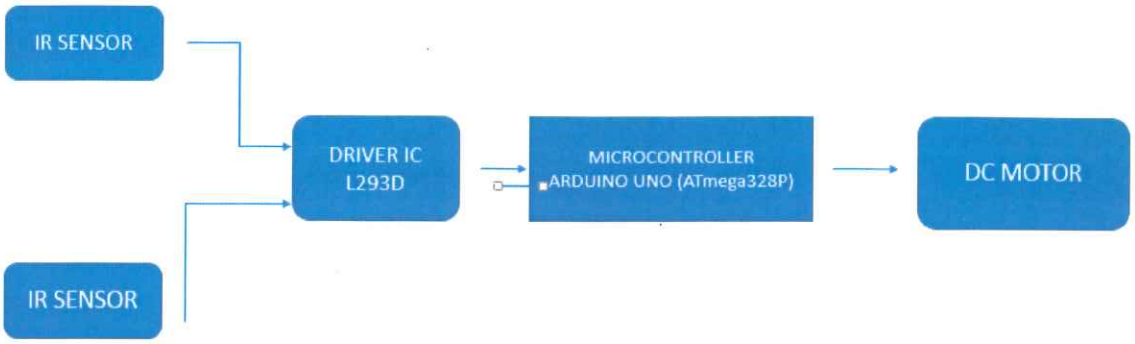
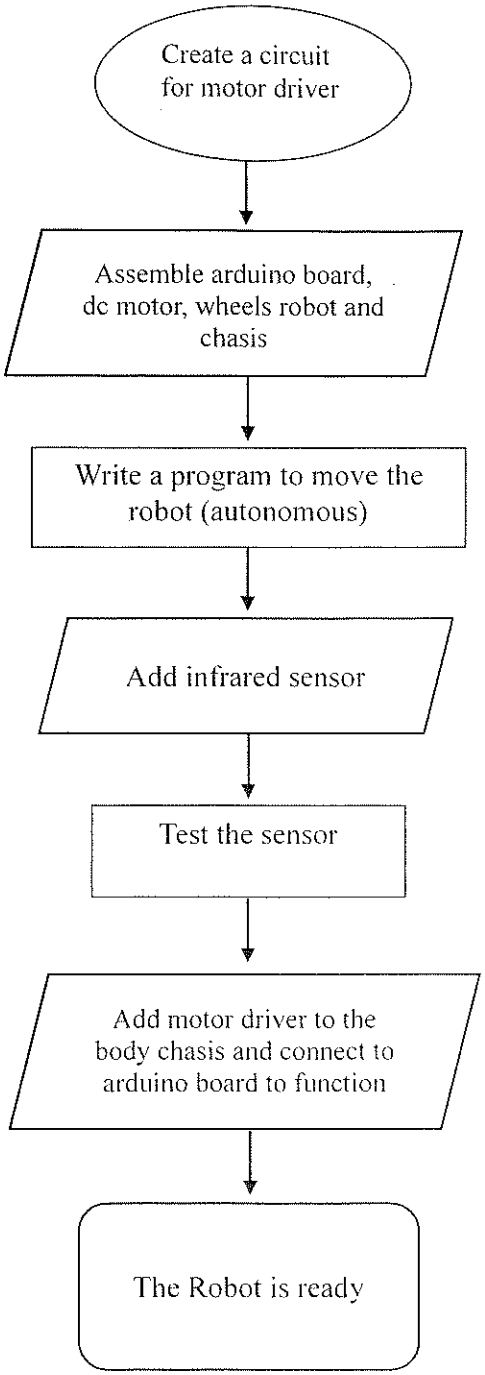
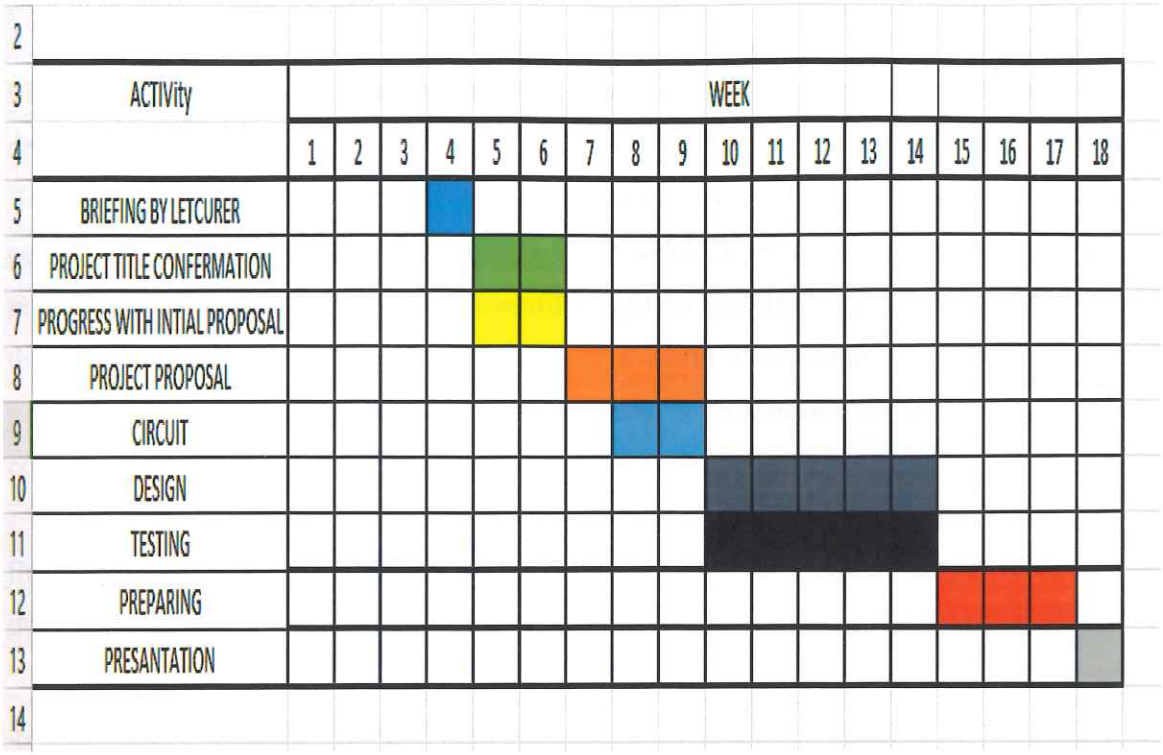


FIGURE 3.2: PROJECT FLOW CHART



3.3 Gantt Chart



3.4 PROJECT COST TABLE

NO	COMPONENT	QUANTITY	AMOUNT
1.	L293D IC	1	Rm7.00
2	Power Button	1	RM9.54
3	PCB Stand	4	RM4.00
4	Terminal Blocks	4	Rm4.00
5	Wire Jumper 1 meter	1	RM0.70
6	Bread Board	1	RM2.00
7	IR line follower sensor	2	RM5.00
8	DC Geared Motor	2	RM27.56
11	Rubber Wheel	4	RM31.80
12	Perspex	1	RM15.00
13	Power Supply (Battery 9V.)	3	RM 50.00

3.5 Draw Schematic Diagram of circuit using PROTEUS.

PROTEUS V8.4 allows professional engineers to run interactive simulation of real designs ,and to reap the reward of this approach to circuit simulation .And then, a range of simulator models for popular micro-controller and a set of animated models for related peripheral devices such as CT-ARDUINO UNO and LCD displays, resistor and more.IT is possible to simulate complete micro-controller system and thus to develop the software for them without access to a physical prototype.IN a world where time to market is becoming more important his is a real advantage .Structurally, 6 Professional separated into two main components, which is ISIS 7.

Professional and ARES 7 Professional. ISIS 7 Professional mainly involved on circuit designing and simulation. In our project, we use Proteus to design a schematic diagram.

3.6 Simulate the Circuit Using Proteus

After completing the circuit assembly and configuration, now it's time to verify whether the source code compiled is virtually accurate or not. Proteus offer a whole lot variety virtual devices.IN fact, simulation using oscilloscope and function generator can be done using Proteus. Even virtual hyper terminal is provided to demonstrate how your code perform in real world without really doing the hardware section yet.

Toolbar of Proteus simulation.

3.7 Process of Circuit Design.

Design the circuit diagram.

After decide what kind of project that we want to build. We need to make a research about the circuit, electronic component that we need to used, hardware and so on. These things actually can help us to make a better in designing circuit. For example, we need to know the size, foot of component, polarity of the component, the component method compilation and etc. to make a circuit diagram.

In the first step in Circuit Designing process is make a circuit diagram that can be used in the next process. Among steps in the circuit diagram are:

i. Before the circuit is produced the things that we need to be emphasized are the position of symbols and components used in the schematic circuit. Once we know the entire production circuit, the circuit can be drawn using software, namely Proteus ISIS Professional.

ii. Then make sure that the connection of the components is correct.

3.8 Etching

Etching is a "subtractive" method used for the production of printed circuit boards. Acid is used to remove unwanted copper from a prefabricated laminate. This is done by applying a temporary mask that protects part of the laminate from the acid and leaves the desired copper layer untouched. Etching is where the excess copper is removed to leave the individual tracks or traces as they as they are sometimes called. Buckets, bubble tanks, and spray machines lots of different ways to etching, but most firms currently use high pressure conveyorized spray equipment. Many different slow controlled speeds etch used for surface preparation to the faster etches used for etching the tracks. Some are best used in horizontal spray process equipment while others are best used in tanks.

3.9 Risk of Etching

i. There is a risk of injuries due to the chemicals involved.

ii. The quality of the result depends on several factors which you won't be able to master completely by using good machinery.

iii. There is the problem of waste disposal. Toxic chemicals require a proper disposal service.

3.10 Safety

Since the work involve dangerous chemical and power tools, we will need to take the necessary safety precautions:

i. Wear safety equipment during the whole process-gloves, protection glass and an apron.

ii. Work near an emergency eyewash station a first aid box and a phone.

iii. Familiarize yourself with the proper use of all equipment and tools in the lab-if you are unsure of anything, ask a supervisor of the project.

3.11 Etching Process

Etching is the process of using acid to remove coppers that not need on the PCB (PRINTED CIRCUIT BOARD). This acid is Acid Ferric Chloride III. is used to remove that coppers

(PCB) Developer and is Acid Ferric Chloride