

MAGNETIC SWEEPER ROBOT

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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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ACKNOWLEDGEMENT

First and foremost I would like to take this opportunity to express my gratitude to everyone who supported me throughout the course of this project. I would like to say a gratitude to our supportive supervisor, Pn.Aslina binti Arbain for her aspiring guidance, invaluable constructive criticism and friendly advice during the project work. A sincerely grateful to her for sharing his truthful and illuminating views on a number of issues related to the project.

Other than that, I would like to express gratitude towards my parents, and my colleague for kind encouragement, co-operation and their willingness to help me out which help better in completion of this project. Of course, not to forget our Almighty Creator as well.

It would not have been possible without the kind support and help of many individuals and organizations. I would like to extend our sincere thanks to all of them.

ABSTRACT

The main objective of the product is to help engineers in housekeeping after finishing their specific task or work. In this case, we are assisting Electrical Engineers, since we are Electrical Engineers ourselves. Our robot, are designed to specifically sweep or attract anything magnetic/metallic such as shards, minute screws and residue created from circuitry works. This robot can come in handy and not to mention be able to save some manpower in terms of after cleaning. In addition, by producing this product we can reduce time used in an effective way. To further support my statement, for example the time used for cleaning, can now be used to do another circuitry works or finalizing the circuitry. Subliminally, this can also increase productivity and quality as well as safety of using the lab/workspace after.

ABSTRAK

Objektif utama robot kami ini adalah untuk membantu para jurutera dalam segi pengemasan dan kebersihan selepas selesai melakukan sesuatu tugas atau kerja di bilik bengkel. Robot kami direka khas untuk 'sweep' atau menarik apa-apa objek yang bersaiz kecil seperti serpihan, skru dan sisa-sisa yang dihasilkan dari kerja litar. Kami percaya bahawa robot kami berupaya untuk menjimatkan masa dan tenaga manusia dari segi pengemasan. Di samping itu, dengan adanya robot ini, kerja lain yang lebih produktif boleh dilakukan tanpa membuang masa. Apa yang dimaksudkan oleh kami ialah, masa yang digunakan untuk melakukan pengemasan, boleh dilakukan kerja lain seperti penglitaran atau pemasangan komponen. Pada masa yang sama, akan menyebabkan peningkatan produktiviti, kualiti dan keselamatan dalam menggunakan bilik bengkel.

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CHAPTER 1

INTRODUCTION

In a studying institute, ones that cater engineering students, a laboratory is a must have facility. A laboratory is where students will be able to conduct their experiment as well as projects. However, errors are due to occur when an experiment is conducted, ones specifically when a tiny object like screws, nuts, bolts and etc. It will then causes time wastage as well as energy in searching for them.

Hopefully, the tips and suggestions offered will provide us with the tools necessary to create a useful robot while saving time and energy. At the very same time, cleans the laboratory. Not only are that, safety of the students also ensured.

1.0 Research Background

Before starting this project, we have made the observation and study of all aspects available when engineers are doing their lab work including ourselves. There are various aspects that need to be addressed so that the products have a high capacity as well as cost savings. Among the things that are concern is the selection of materials, strength of the magnet bar (Rare Earth Magnet), the efficiency of the roller and documentation to analyze the existing design, along with advantages and disadvantages of each tools and combination of magnetic bar and roller. Below we have mentioned some of the study and research that we can do.

1.1 Problem description

Nowadays, we tend to laze off when it comes to housekeeping. This is due to the fact that we've become tired or exhausted from doing the lab work. So here we have done an investigation to identify the problems and how to solve it not only in polytechnic's lab, but also later on at the working place.

1.2 System objectives

The main objective of this project is to make a magnetic cleaner that can carry out cleaning and attracting task. The following aspects were considered in the choice of a design solution:

- a) Installation costs.
- b) Time savings.
- c) Human intervention.
- d) Reliability.
- e) Power consumption.
- f) Maintenance.
- g) Expandability.

A critical consideration is the installation costs, since costs generally determine the feasibility and viability of a project. The installation must be simple enough for a user. The time savings was also an important aspect, since there is a demand to minimize time loss and to maximize the productivity of experiment/project conducted. The system must operate with optimized consistency. The power consumption must also be monitored. For maintenance, the replacement parts must be readily available and easy to install in the case of failure. Finally, the possibility for implementing the system at a larger scale (e.g. in houses, factory) should be investigated.

1.3 System Scope

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. Limited to only attracting small or minute pieces of magnetic objects.
- ii. The robot can't come in contact with liquid element.

1.4 System Limitation

The proposed system causes a lot of vague situations. For example without the battery supply, these systems will not be functioning due to fully dependent to the battery supply. Besides, the limitation of this system is, it can only be reach by the distance detection coded on the ultrasonic sensor.

1.5 Proposed solution

In order to solve the problem that are facing now, I proposed a magnetic robot system called as 'Magnetic Sweeper Robot'. 'Magnetic Sweeper Robot' is a simple and easy to use robot cleaning system. Instead of using traditional or manual way to search for small or minute objects. For the system functionalities, I will make sure that the user will be at ease when using this system with the provided user-friendly interface. I will use HC-SR-04 ultrasonic sensor on the robot that act as its "Eyes".

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

A literature review is a body of text that aims to review the critical points of current knowledge and or methodological approaches on a particular topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work.

Most often associated with academic-oriented literature, such as thesis, a literature review usually precedes a research proposal and results section. Its ultimate goal is to bring the reader up to date with current literature on a topic and forms the basis for another goal, such as future research that may be needed in the area. A well-structured literature review is characterized by a logical flow of ideas; current and relevant references with consistent, appropriate referencing style; proper use of terminology and an unbiased and comprehensive view of the previous research on the topic.

The report that we want to be produce needs few factor that should be taken into consideration until that project is implemented. To get a quality result, we need to study about the type of material, design, components that we used, framework installation, installation method and maintenance, level of product safety, structural strength, as well as project size and so on to obtain the result that we need. This is to ensure that no problems would arise during presentation of the project.

Hence, systematic and detailed planning must be arranged to produce a complete and satisfactory project. First step was design (sketching) to get the circuit that we want to produce. Due to this, the work design and study that we made is a continuing process and it involves problem solving activity which is known as literature study.

2.1 SG90 Servo Motor

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.



Figure 2.3: SG90 servo

Specifications

- a) Weight: 9g
- b) Dimension: 22.2 x 11.8 x 31 mm approx.
- c) Stall torque: 1.8 kgf·cm
- d) Operating speed: 0.1 s/60 degree
- e) Operating voltage: 4.8 V (~5V)
- f) Dead band width: 10 μ s
- g) Temperature range: 0 °C – 55 °C

2.2 Ultrasonic Sensor HC-SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work: (1) Using IO trigger for at least 10us high level signal, (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. (3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time \times velocity of sound (340M/S)

Wire connection direct as following :

- 5V supply
- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground

Electric Parameter

Table 2.5: Electric Parameter of HC-SR-04 Ultrasonic Sensor

Working Voltage	DC 5V
Working Current	15mA
Working Frequency	40Hz
Max Range	4m
Min Range	2m
Measuring Angle	15 degree
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	Input TTL lever signal and range in proportion
Dimension	45*20*15m



Figure 2.5: HC- SR-04 Ultrasonic sensor

TIMING DIAGRAM

The Timing diagram is shown below. You only need to supply a short 10uS pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion. You can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula: $\mu\text{S} / 58 = \text{centimeters}$ or $\mu\text{S} / 148 = \text{inch}$; or: the range = high level time * velocity (340M/S) / 2; we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.

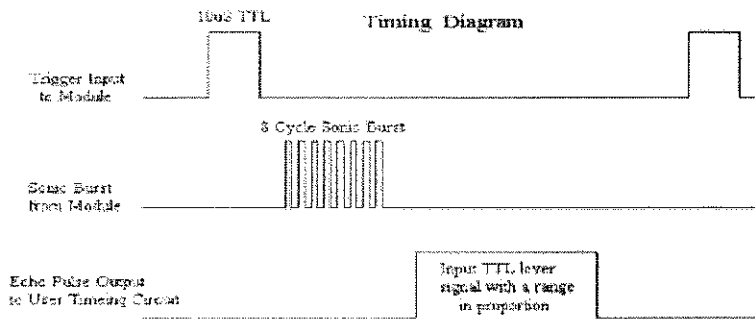


Figure 2.6 : Timing Diagram

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter discussed the methodology that has been used to complete this project. It was planned properly by getting the correct information from various sources from references such as books, journals, articles, World Wide Web and others. It also include 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 analyzed to get the best result. Generally there are several level to reach the complete product analysis which is

- a) Design analysis to the available product.
- b) Design concept based on the sketching and analysis drawing.
- c) Produce the product concept.
- d) Produce the real concept.

3.1 Block Diagram

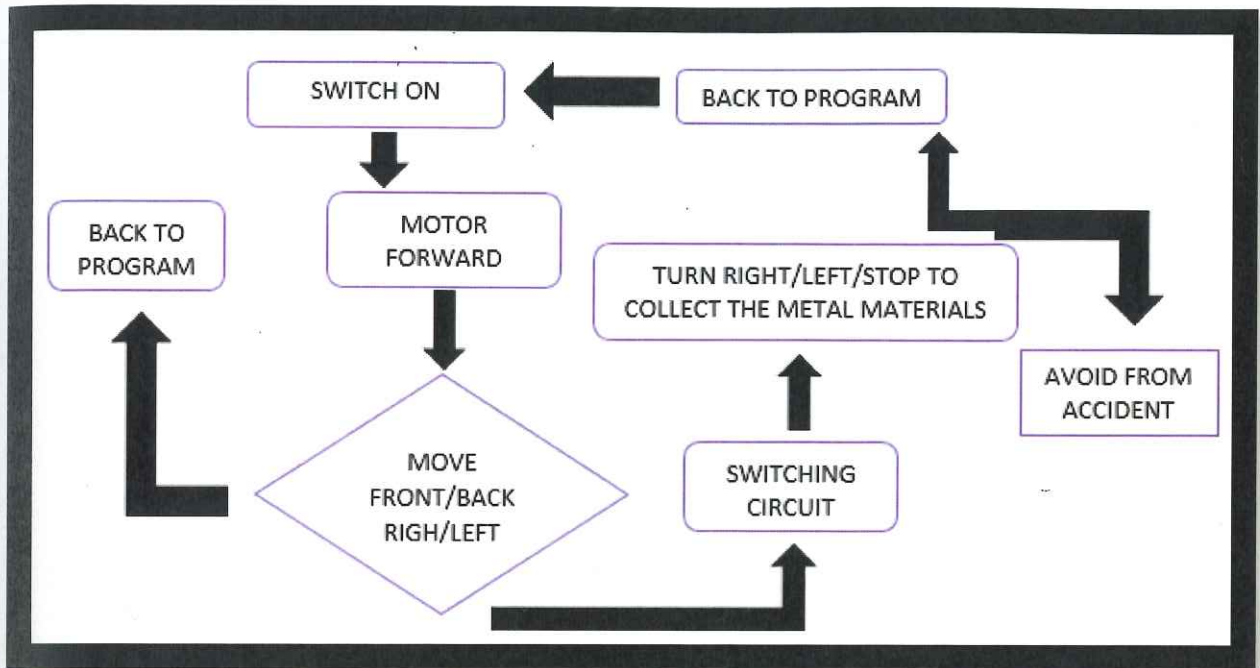


FIGURE 3.1 : Block Diagram For Magnetic Sweeper Robot

3.2 Flow Chart

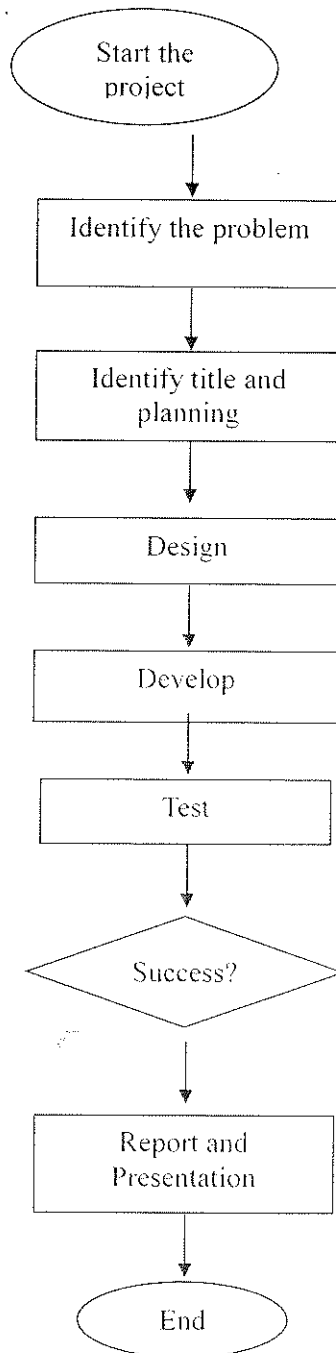


Figure 3.2: Project Flow Chart

3.3 Gantt Chart

Table 3.1: Gantt Chart of Project

ACTIVITY	WEEK														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BRIEFING LECTURER	■	■													
PROJECT TITLE CONFIRMATION			■	■											
PROGRESS WITH INITIAL PROPOSAL				■											
PROJECT PROPOSAL					■	■									
CIRCUIT						■	■	■							
DESIGN									■	■					
TESTING										■	■	■			
PREPARING													■	■	
PRESENTATION															■

■	PLANNING
	ACTUAL WORK

3.4 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 display 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 this is a real advantage. Structurally, 6 Professional separated into two main components, which 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.

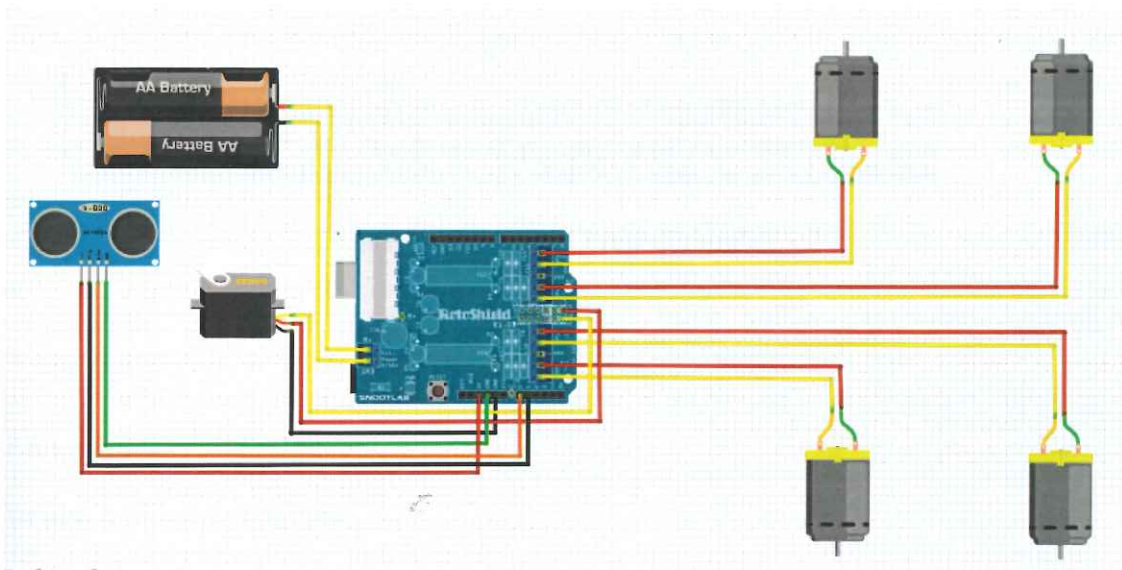


Figure 3.4: Schematic Diagram for Magnetic Sweeper Robot

3.5 Simulate the Circuit Using Proteus

After completing the circuit assembly and configuration, now its 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. We're just clicked on the play button to run the circuit and error can be detected after doing this part.



Figure 3.4:Toolbar of Proteus simulation.

3.6 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 so on 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 ISIS 7 Professional and ARES 7 Professional.
- ii. Then, make sure that the connection of the components is correct.

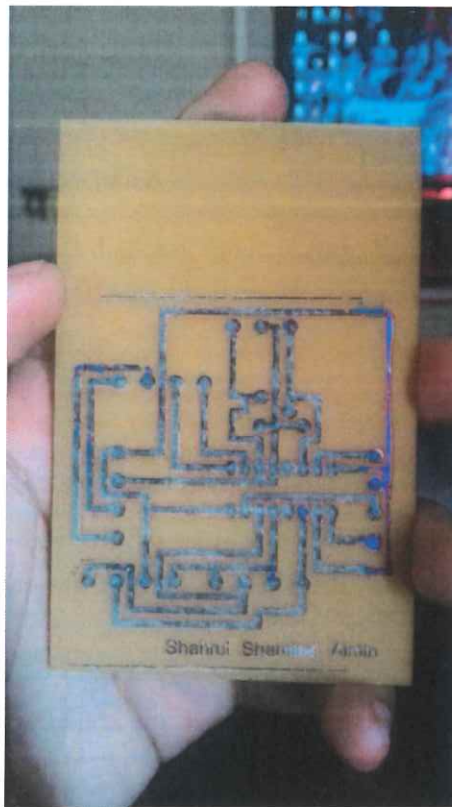


Figure 3.6 : Etching Board

Etching is a “subtractive” method used for the production of printed circuit boards .Acid is used to remove