KEMENTERIAN PENDIDIKAN MALAYSIA

POLITEKNIK MALAYSIA
SEBERANG PERAI

THE WHITEBOARD WIPER

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PROJECT REPORT COMFORMATION

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

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We believe that this report will be a valuable asset not only for academic institution, but will also be useful for all those who are interested to learn about our final year project process and experiences

ABSTRAK

Masa kini, papan putih digunakan untuk proses mengajar dan belajar. Ia telah digunakan secara meluas di hampir semua institusi. Semua bilik kuliah di institusi telah menggunakan papan putih. Papan putih ini besar saiznya, jadi ia mengambil masa untuk memadamkan papan putih tersebut dengan menggunakan pemadam. Seperti yang kita tahu, untuk memadamkan papan putih mesti menggunakan tenaga manusia. Ada masanya kita mengalami masalah kehilangan pemadam. Masalah ini selalu terjadi di sekolah menengah dan sekolah rendah. Pertimbangkan "*Whiteboard Wiper*", satu system automatic yang mampu menyelesaikan semua masalah ini. "*Whiteboard wiper*" akan mengurangkan masa untuk memadam dan tenaga. Sistem ini mempunyai "*push-button*" dan "*motor driver*" untuk mengawal "*DC geared motor*". Sistem operasi ini tertumpu pada "*Arduino Uno*". "*Push-button*" akan on selepas ditekan dan pemadam akan bergerak untuk memadamkan papan putih. Arah pergerakan pemadam dikawal oleh "*motor driver*" dan "*limit switch*". Pemadam akan bergerak secara melintang dan memadamkan papan putih dua kali ganda lebih cepat. "*Whiteboard wiper*" ini senang untuk dikawal dan semua peralatan senang dijumpai dengan harga yang murah. Jadi, "*Whiteboard wiper*" adalah satu penggantian pemadam yang hebat dan boleh digunakan oleh semua institusi untuk menjimatkan masa dan tenaga untuk memadamkan papan putih selain dapat memperbaharui kelas dengan sistem automasi.

ABSTRACT

Today the whiteboard is use for teaching and learning process. It also are widely used in almost every institute. Every classroom in the institute used the whiteboard. The whiteboard are large in size, so it take time to erase the whiteboard with duster. As we know, to erase the whiteboard must use a human energy. Sometimes we have problem with the loss of duster. This problem always happen in secondary and primary school. Considering the 'Whiteboard Wiper', an automatic system can solve these problem. The Whiteboard Wiper will reduce the time to erasing and also the effort. The system consist of the push button and motor driver to control the DC geared motor. The operation of the system is centered on Arduino UNO. The push button will ON if pressed and the eraser will move to erasing the whiteboard. The direction of the eraser is also controller by the motor driver and the limit switch. The eraser move horizontal and erasing the whiteboard 2 times at a short times. The whiteboard wiper easy to handle and the equipment are easy to find at a very low cost. So, 'Whiteboard Wiper' is the spectacular replacement of duster and it can be used for all institute to save time and effort to erasing the whiteboard and as well to introduce the classroom with an automation system.

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CHAPTER 1: INTRODUCTION PROJECT

1.0 Introduction

When said teaching and learning process it will focus on teacher and student, who are person that delivering and receiving information and knowledge. There are many methods which are used by lecturers to deliver their knowledge such as whiteboard and blackboard as medium to deliver the information to student.

Erasing writings on whiteboards is tiresome. Having to erase all the writings manually from one end to the other end causes hassle and wastes too much energy on the part of

the one using it. Lecturers would waste time and tend to get exhausted and would get sore muscles after doing the work.

There are many methods for cleaning the whiteboard such as use a button or remote. Therefore, the idea came up and this project that called 'Whiteboard Wiper' can tackle some problems related to the conventional whiteboard cleaning method.

1.1 Problem Statement

The increase in numbers of institutions and schools shows a sign of an increase of students entering their school every year. Sometimes the number of teachers in a school is not enough that will cause teachers to teach four or five times a day. This may lead to fatigue in teachers. They had to write the information that they want to convey to their students over and over again. A fix schedule in one day also can cause a fatigue to the teachers in cleaning all information that they write on the whiteboard.

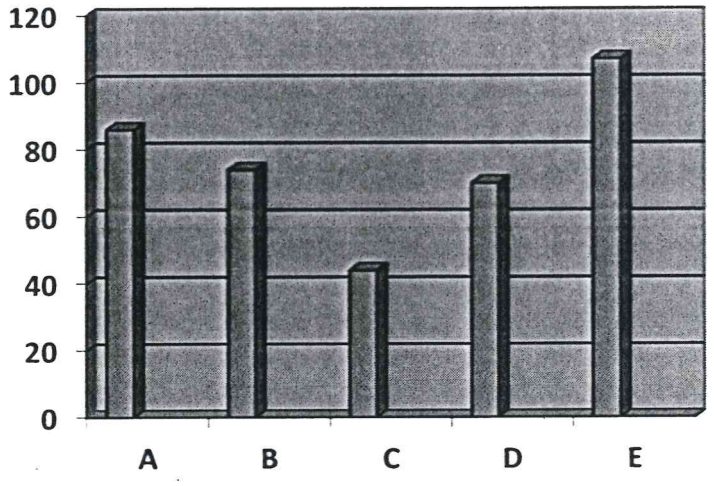
Sometimes, teachers or students they often forgot to clean the whiteboard after the class sessions. When the next class session is start teachers will complain when the board is not cleaned. Another problem is the mysterious loss of duster. This problem always happens to the primary school and secondary school. This will cause problem to clean a whiteboard.

So, with this solution it can improve this simple application from manual to automatic by create a 'whiteboard wiper'. The 'whiteboard wiper' uses is to erase the notes on the whiteboard without leaving any ink stains.

Statistic for erasing the whiteboard:

Students	Time taken to erase whole whiteboard
A	1m 26s
B	1m 14s
C	44s
D	1m 10s
E	1m 47s

Table 1.1 Time taken to erase whole whiteboard



Flow Chart 1.1 Time taken to erase the whiteboard

The time taken recorded is in second.

- Student C is the highest with 44s, so the whiteboard wiper should be faster than 44s. (Around 30s)

- The lowest is 107s by student E this proved that wiping a whiteboard take time for some student. (The time taken is not include time for the student to go for their next class, randomly take 5minutes to go to the class in same department/faculty and take more to go to the class in another department)

Human application is still needed for the design project to work. The user needs to run a certain program and push the appropriate buttons to use the prototype. The idea of the design being automatic is that with only a push of a button, the eraser can move.

1.2 Research Objectives

The general objective of the design project is to improve manual application of doing work to automatic application.

The specific objectives are:

- To save human energy and effort.
- To make feasible as it easy to use
- To provide a mechanism in which with only a push of a button, the user could set the eraser to move and erase the contents of the board.
- To use the preferred material that could easily erase the writings on the board.

1.3 Scope of Study

The idea of the design being automatic is with only a push of a button, the eraser can move. The movement of the eraser is y axis which is horizontal. The user will have to press the start button before the eraser could start the movement. This project will use an Arduino UNO that will control the motor.

In this project there will have 2 DC geared motor. Motor will control the wiper movement. Then, the L239D motor driver IC. The motor driver IC can drive two motor simultaneously.

The construction of the whiteboard wiper will include the combination of several element of hardware and software construction

1.4 Justification

The whiteboard wiper have many advantage than other whiteboard project. First and Arduino UNO is use as microcontroller. It is very to use and easy to understand. It also easy to write the program to move the wheel when press the push button.

Next, this project also use a limit switch. The eraser will move 2 times to wipe the whiteboard. So the whiteboard will clean without ink. The eraser will move horizontal after press the push button. Then it will move until it touch the limit switch and back to origin.

Furthermore, this projeet are easy to handle because only press the push button, the eraser will move to erasing the whiteboard. Lastly, the equipment to build the whiteboard wiper is easy to obtain. Among them are whiteboard and eraser.

1.5 Structure of the Report

The structure of this report for Chapter 1 it will discuss on introduction, problem statement, objectives, scope and. For Chapter 2 it will discussed on the literature review. This is including the related information such as how the Arduino UNO is works and the related works on the project before. For Chapter 3, it will discussed on the methodology. The method that is been used in finishing this project are included

such as the Gantt chart, flow chart for the process for this project, flow chart for making of PCB and so on.

The Chapter 4 discusses the implementation of the project in general in terms of design, circuits, and methods of use of the project. For Chapter 5 also tells about the test and the results of the project. This chapter describes the test results of the project and test the effectiveness of the test circuit project. Finally, the chapter 6 focuses on the conclusions and recommendations of improvement projects that can be brought to market soon.

CHAPTER 2: BACKGROUND STUDY

2.0 Introduction

There are many method for design this project. From the observation, too much energy is wasted when eraser the whiteboard. The process for eraser whiteboard is always do by manual.

So, with this solution it can to improve this simple application from manual to automatic by create a whiteboard wiper that is effective for cleaning and easy to use to save time and avoid straining oneself in erasing writings on whiteboards compared to manual operation.

2.1 Project Background

In this section will be explain about project especially in terms of throughput, equipment and components used.

In terms of throughput, this project use a simple one. As know, manual erasing of the contents of whiteboards is tiring. Too much energy is wasted when doing such work. So, the modification to the whiteboard can reduce time and lecturer able to continue lecturing by pressing the switch to move the eraser on the whiteboard.

While the equipment to build the whiteboard wiper is easy to obtained. Among them are whiteboard and eraser. Whiteboard is the main elements for this project where its function is for writing. The whole system is based upon two individual parts. One is the erasing system which ensure to erase writings and other is the controlling part which control the eraser to move. The erasing system consists of the necessary arrangement which enable the erase slide over the board and the controlling system consists of micro-controller which control the motor driver and DC geared motor.

Next, the main component for the project is Arduino UNO which function as micro-controller. For this project, 2 DC geared motor was used. It can function with current 12 volt. But, the Arduino UNO only support for 5V so to avoid the Arduino UNO from destroyed.

2.2 Review of existing products

There are several work that has been done before by somebody else. Here are some of the works.

a. XY Duster Machine

The machine was created by UTM student that studied in Mechatronics field. This machine was created in 2012 for his Final Year Project. The machine basically uses x and y axis cleaner to clean the board. X-axis is used to control the horizontal movement and y-axis is used to control the vertical movement.

The machine used linear motor to lift the duster up when the duster is not in used and to put the duster down for erasing process as in figure below. The sensor used is infrared sensor to detect the X-axis motor movement and four limit switch is used to detect the boundary of the whiteboard. The controller used is PIC microcontroller. Basically, this machine has 3 different modes. The first mode is clean the left side of the board. The second mode is clean the right side of the board and the third mode is clean the whole area of the board.

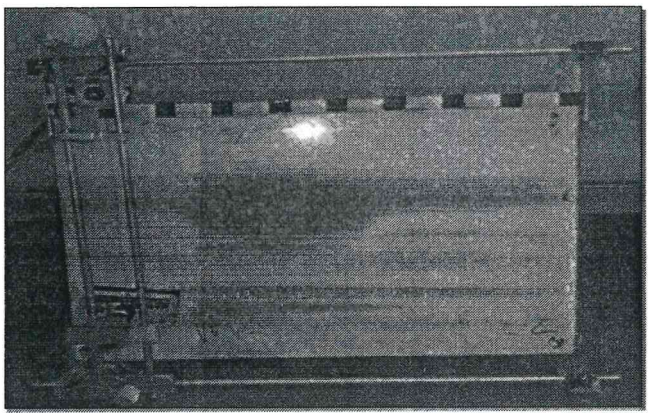


Figure 2.1 XY Duster Machine

b. Whiteboard Cleaning Mobile Robot

Whiteboard cleaning mobile robot was fabricate by Stefan Diewald, VMI, TU Munchen. The concept of cleaning task is the same with whiteboard erasing robot that were an autonomously robot that clean text on their own without human interface. But the different between these two projects is the mechanism. The mechanism is shown in figure

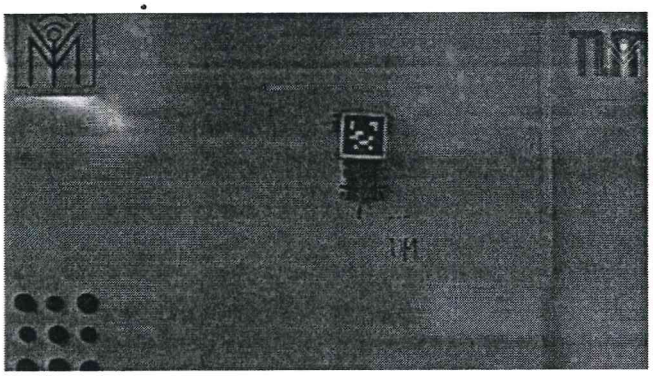


Figure 2.2 Whiteboard Cleaning Mobile Robot

Mobile robot used the suction concept to make the robot attached to the whiteboard, different with whiteboard erasing robot that used two parts of motion X-axis and Y-axis. The mechanism of mobile robot is quite simple, but the suction concept that make we difficult to build. Suction concept is also noisier when mobile robot doing its task.

For a vision part, the concept is the same with whiteboard erasing robot but the software that they used is different. This project used the Robot Operating System as the software to process the visual.

2.3 Analysis of the problems of existing product

This section discusses the comparative advantages and disadvantages of the XY Duster Machine. The advantages of the product is it use the infrared sensor to detect the X-axis motor movement and four limit switch is used to detect the boundary of the whiteboard. The machine basically uses x and y axis cleaner to clean the board. X-axis is used to control the horizontal movement and y-axis is used to control the vertical movement. The product used PIC as a microcontroller.

Next, for the disadvantages of the XY Duster Machine is it cannot operated if no power supply. The process for erasing whiteboard is very slow because there is 3 mode to clean the whiteboard. The first mode is clean the left side of the board. The second

mode is clean the right side of the board and the third mode is clean the whole area of the board.

After that the advantages and disadvantages of the Whiteboard Cleaning Mobile Robot. The concept of cleaning task is the same with whiteboard erasing robot that were an autonomously robot that clean text on their own without human interface.

Lastly, the disadvantage of the product is the suction concept that make it difficult to build. Suction concept is also noisier when mobile robot doing its task. Whiteboard erasing robot but the software that they used is different. This project used the Robot Operating System as the software to process the visual.

2.4 Studies on components and materials used.

The whole system is based upon two individual parts. One is the erase system which ensure to erase writings and other is the controlling part which control the erase system. The erase system consists of the necessary arrangement which enable the wiper slide over the board and the controlling system consists of Arduino UNO which control the motor driver and motor. The controlling unit contain the following elements.

a. L239D motor driver IC

From microcontroller cannot connect a motor directly because microcontroller (Arduino) cannot give sufficient current to drive the DC motors. Motor driver is a current enhancing device, it can also be act as switching device. Thus, insert motor driver in between motor and microcontroller (Arduino). Motor driver take the input signals from microcontroller (Arduino) and generate corresponding output for motor.

L239D motor driver IC can drive two motor simultaneously. L293D IC is a dual H-bridge motor driver IC. One H-bridge is capable to drive a dc motor in bidirectional. L293D IC is a current enhancing IC as the output from the sensor is not able to drive motors itself so L293D is used for this purpose. L293D is a 16 pin IC having two enables pins which should always be remain high to enable both the H-bridges.

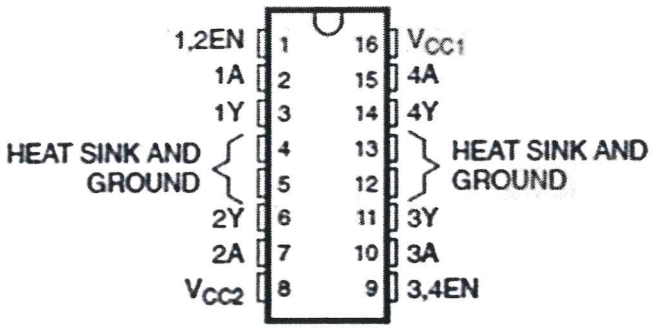


Figure 2.3 L239D motor driver IC

b. Arduino Uno

The microcontroller that is used is Arduino Uno. Arduino Uno is one of the type of microcontroller been developed and commercially produced. Arduino is an open-source computer hardware and software company. Uno microcontroller is using 32-bit AVR microcontroller as a central processing unit (CPU). It consists of a sets of digital and analog I/O pins that can be interfaced with shields or other circuits. It also features serial communication interfaces including USB.

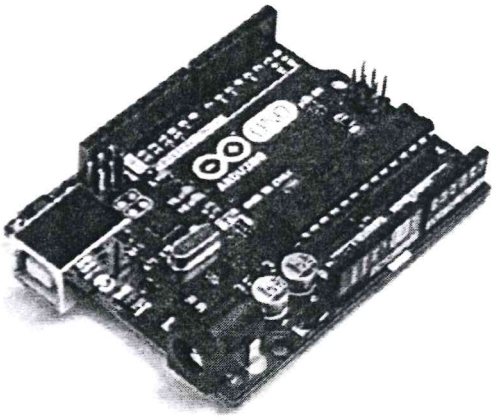


Figure 2.4 Arduino Uno

The hardware for Uno is consists of 32-bit AVR microcontroller, sets of I/O pins, USB hub, supply jack and many more. For the software, the most used programming languages in Arduino microcontroller is Arduino Software, C and C++ programming languages. The programming or coding can be upload using USB hub. In this project, one Arduino Uno is used. It is use because to control DC L239 motor diver IC and two motor.

c. DC Geared Motor

DC motor is an actuator that converts from direct current in form of electrical energy into a mechanical movements. DC geared motor is just DC motor with a geared assembly with it. The DC motor works on the principle of Lorentz force which states that when a wire carrying current is placed in a region having magnetic field, than the wire experiences a force. This Lorentz force provides a torque to the coil to rotate. As shown in figure 6 DC Geared Motor, DC geared motor has a gear assembled to the shaft and have a greater torque. This means that the shaft has more power to hold or to rotate on a higher load than a normal DC motor.

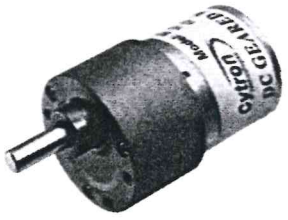


Figure 2.5 DC Geared Motor

Normal Dc motor has a greater rotation speed than DC geared motor but the hold torque are less than DC geared motor. The motor will be controlled by the L239D motor driver IC which will be integrate with an Arduino UNO to control the motor speed and direction.

d. Button

A switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch may be operated directly by a human operator to control a circuit (for example, a light switch or a keyboard button), may be operated by a moving object such as a door-operated switch, or may be operated by some sensing element for pressure, temperature or flow.

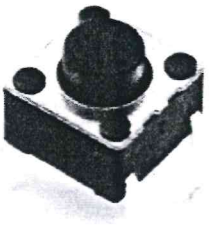


Figure 2.6 Button

e. Software Arduino UNO

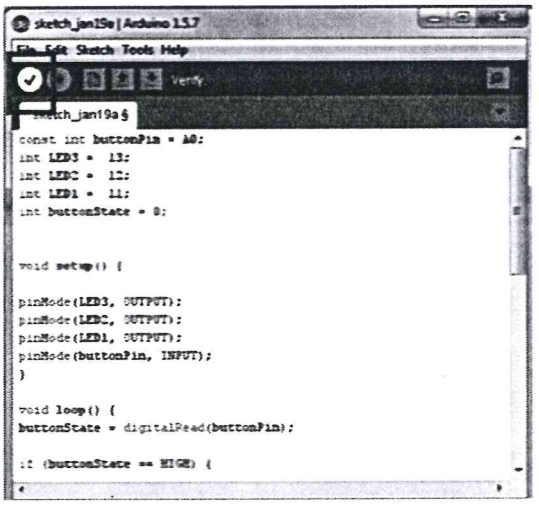


Figure 2.7 Software Arduino UNO

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow to verify and upload programs, create, open, and save sketches, and open the serial monitor.

2.5 Summary

To be conclude, this section will be explain about project especially in terms of throughput, equipment and components used. In terms of throughput can make the erasing process become easily. While, equipment and component is important to make the whiteboard function.

Next, also discuss some project related to this project. So, XY Duster Machine and Whiteboard Cleaning Mobile Robot are related to our project. The machine basically uses x and y axis cleaner to clean the board. X-axis is used to control the horizontal movement and y-axis is used to control the vertical movement. Furthermore, discusses the comparative advantages and disadvantages of the XY Duster Machine and Whiteboard Cleaning Mobile Robot.

Lastly, also know about the component and software that be use in this project. So there is no problem when do this project.

CHAPTER 3: METHODOLOGY

3.0 Introduction

Methodology is a study in describing the method or methods used in the completion of the project. There are various ways to obtain such information through the internet, looking for references at the library, analysis and so on. The purpose of this project is to create a whiteboard wiper that feasible and saving time.

The main objective is to provide a mechanism in which with only a push of a button, the user could set the eraser to move and erase the contents of the board. Besides that,