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AUTOMATIC WHITEBOARD CLEANER

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JABATAN KEJURUTERAAN MEKANIKAL

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ABSTRACT

Whiteboard is a glossy white surface for making non-permanent markings. It is known that marker board are analogous to blackboard but with a smoother surface and allowing rapid and erasing markings. Nowadays, whiteboards are widely used in almost every educational institute or working environments. About 70-80% educational institute around the world uses whiteboard as the writing medium in their classrooms. They are large in size and for that reason it is always related with a duster. However, it is a very time-consuming process to erase the writings from the board with the duster. In addition, the duster can be lost in matter of time as it is small in sizes. With Automatic Whiteboard Cleaner , these problems can be solved by using mobile application, Blynk to control the movement. It can reduce the time taken to wipe off as well as reduces the unnecessary effort to clean the whiteboard. The sensor known as Node MCU attached to the driven motor and acts as the controller to operate the AWC. The main components of the AWC are driven motor, Node MCU, voltage source , tt wheel motor and a mobile application, Blynk. The Node MCU was attached to the driven motor is used to detect the movement things. When the Node MCU and driven motor has detected the movement, it will send the signal to the tt wheel motor to move the Automatic Whiteboard Cleaner by using the Blynk application. To move the AWC, the users must turn on their wifi or bluetooth to control the movement. Thus, by controlling it, the duster will clean the whiteboard automatically. In conclusion, this project focus on the IR4.0 concept as it use in the Blynk application. Therefore, it will be easier and make the work more efficient without using the human's energy like before.

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CHAPTER 1
INTRODUCTION

1.1 RESEARCH BACKGROUND

A blackboard also known as a chalkboard is a reusable writing surface when using a chalk that are usually made of calcium sulfate or calcium carbonate. Blackboards are usually smooth and comes with thin sheets of black or dark grey slate stone. In the same way, there is an evolved version of the blackboard that we called as whiteboard [1]. A whiteboard is a glossy white surface for making non-permanent markings. Whiteboard or also known as marker board are analogous to blackboard but with a smoother surface and allowing rapid and erasing markings. The popularity of whiteboards increased rapidly in the mid-1990s and they have become fixture in many offices, meeting rooms, school classrooms and other work environment. In this case, this shows that whiteboard needs its own cleaner in our working or education environment [2]. Figure 1.1 and 1.2 shows the difference between blackboard and whiteboard.

Figure 1.1 A blackboard

Figure 1.2 A whiteboard

The whiteboard cleaner always relate to whiteboard duster or sometimes a piece of cloth to erase the markings. Duster is an eraser for removal of dry ink dust and for conditioning of whiteboards which includes a stack of fabric layers of semi rectangular shape. But in this case, the usage of whiteboard duster or a cloth are very limit as it can easy fall into pieces. To overcome that, the solution has been made to create AWC (Automatic Whiteboard Cleaner) by control the movement of it using phone applications . Figure 1.3 and 1.4 shows different type of whiteboard dusters.

Figure 1.3 A whiteboard duster with fabric layers.

Figure 1.4 Magnetic whiteboard duster.

Nowadays, technologies such as smartphones are very significant in people's daily lives. Hence, smartphones is used to develop the idea of AWC to make the job done better than it used to. Apps or mobile app is a computer program application that is designed to run a mobile device (smartphones). The apps can generally downloaded from application distribution platforms which are operated by the owner of the mobile operating system [3]. Beside, application distribution such as IOS and ANDROID are the most frequently used by the people.

1.2 PROBLEM STATEMENT

Today, most of lecturers, teachers and company staffs use whiteboard to deliver important information because this is the most effective way to make sure students and other staff members understand more about it. However, the markings will take a lot of time for the user to erase it by using the whiteboard duster. Also, whiteboard duster is not quite helpful because sometimes it can be lost anywhere when other classes use it. Plus, the stack of fabric layers can be easily tear off because of the frequently usage. Besides, the after effect of the markings will leave some dust that makes the whiteboard dirty.

Hence, the position when using the whiteboard duster for small people is not ergonomical as they cannot reach or sometimes force themselves to erase in higher parts of the whiteboard. As a result, this is a very serious problem that have to be solved so that it will not be a burden to the user itself.

1.3 RESEARCH OBJECTIVES

i. To develop automatic cleaner by using Blynk.

ii. To help the users clean the whiteboard without unnecessary effort (human energy).

iii. To reduce cleaning time for the users especially in schools and offices.

1.4 RESEARCH QUESTIONS

i. Is it possible that AWC will reduce a lot of time for the users ?
ii. Will this AWC suitable for all sizes of people ?
iii. Is it possible to follow today's technologies such as mobile application to apply it as a controller of the AWC ?

1.5 SCOPE OF RESEACH (LIMITATION)

i. Only suitable for whiteboard that has smooth surface.
ii. Automatic Whiteboard Cleaner only fit into the 58cm x 43cm whiteboard.
iii. Using material made from styrofoam and felt cloth to make erasing process is easier.
iv. Ultrasonic sensor which means nothing but the range of frequencies is being used.
v. Only Blynk application can control the movement of this AWC.

1.6 SIGNIFICANCE OF RESEARCH

The findings of this research will redound to the benefit of society especially in schools and offices. It is considering that whiteboard and duster play an important role in terms of studying and guiding the society. The greater demand for this project justifies the need for more effective technologies. With a mobile application that recommended can change people's perceptions and attract them to clean the whiteboards even more. Also, the mobile application helps the society to explore more with all the functions and reducing their time on cleaning the whiteboard. In fact, a revolution concept of IR4.0 has been introduced to make a better technologies to adapt people's understanding on this concept. Thus, it is hoped that this project will be the beginning of understanding the IR 4.0 concept and the issue will be fixed as soon as possible.

1.7 DEFINITION OF OPERATIONAL TERMS

AWC : Automatic Whiteboard Cleaner

Blynk : A mobile applications to control the movement of AWC.

IR 4.0 : Refers to a new phase in the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning and real-time data.

IOS : A mobile operating system created and developed by Apple Inc. Exclusively for its hardware.

ANDROID : A mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets.

1.8 CHAPTER'S SUMMARY

In this chapter, the studies were explained about its origin of ideas and inspirations. All the objectives were obtained by listing the problem statements. The main objective for this project along with the importance of using AWC with IR4.0 concept that will help the society to be more convenient. Also, the scope of this project will be focusing more on the Blynk application that will control the movement on smooth whiteboard and how it can be adapt by the society. Thus, this new invention could be beneficiary to all society especially teachers, lecturers, CEOs and offices' staffs. In fact, this invention also can intensify the knowledge of IR 4.0 technologies to the people.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, will be shown history of dusters for whiteboard to see why the automatic whiteboard cleaner using application is much easier than before. Albert Stallion invented whiteboard while working at the Alliance in the 1960s. Alliance produced enameled steel for architectural cladding but Stallion figured that it could be as a writing surface. Whiteboard was becoming commercially available in the early of 1960's but did not widely used until 30 years later [2]. Whiteboard in that years need to be cleared with a damp cloth and tendency for the markers to leave mark is high even after erasing the board.

Dry-erase markers for whiteboard had been invented in 1975 and it fixed the problem above. Whiteboard is commonly used due to the concerns over health problems in children with dust allergies in the early 1990's. This problem happened when the chalk produced plenty of dust which can absorb to the respiratory system and caused the difficulty in breathing and it is also affected the computer. In the modern days, chalk board is no longer in used because whiteboard is much efficient and it takes shorter time and effort to erase the information on whiteboard [4].

Automatic Whiteboard Cleaner (AWC) is made to reduce human's effort to erase the whiteboard and save a lot of time. Thus, with the average height of students in schools and university, not everyone can erase the whole whiteboard using the normal duster. Whiteboard is usually placed a little higher on the wall to make it visible to the people that receive information from the board. Now, with the modern technology and applications of IR.4, the whiteboard can be erased with just a tap on Code (cleaner) application.

2.2 RESEARCH ON WHITEBOARD CLEANING

2.2.1 Automatic Board Cleaning using Microcontroller

Modification on how to clean the whiteboard has been done such as the application of microcontroller to reduce human's effort to erase the whiteboard. Considering this automatic system can solve these problems because it takes shorter time and effort to erase the whiteboard without destroying the quality. The wiper has horizontally movements that allow it to wipes the board twice in a short period and consists of electric motor, supports, a wiper bar and a microcontroller to give that an automation figure [5]. It is possible to control the wiper using microcontroller from a reasonable distance in order to wipe the board.

Automatic Whiteboard Cleaning using Microcontroller is a spectacular replacement of duster because the whole wiper can be installed at a very low cost and it can be easily removed if it is necessary to clean. The wiper actually saving the cost that being spend on the duster alone because it cannot be cleaned and people had to buy a new one due to the limited usage[6] . Remote control motorized cleaners were innovated in this system to reduce these problems [5]. Thus, students that getting information will not getting their visual blocked by using this type of whiteboard cleaner because it does not require human efforts to erase the whole board at the front. Figure 2.1 shows the Automatic Whiteboard Cleaning using Microcontroller.

Figure 2.1 Automatic Whiteboard Cleaning using Microcontroller

2.2.2 Electric Whiteboard

The growth of technology required a high prestige machine for fulfilling community needs. For example, this electric whiteboard can clean the whole board automatically using electric source and reduce the time usage for cleaning. The report shows one type of the design mechanism, which the mechanism can clean the board immediately and keep it clean for the entire time. The duster includes a foundation structure to allow the benefit of the duster behind the long white frame [7].

A chain is connected through the duster with a drive motor to rotate the drive disc mounted on a white board frame. This schematic introduces new and useful improvements and more specifically to a tool where white boards can be easily cleaned. The main objective of having this electric whiteboard is to provide attachments for the whiteboard in the form of a cleaner that can be operated by only pressing the switch thus reducing human efforts and time needed to erase the whiteboard [8]. Electric Whiteboard as shown in Figure 2.2 below.

Figure 2.2 Electric Whiteboard

2.3 THEORY

Automatic Whiteboard Cleaner require a lot of measurement in order to make the operating system is moving accurately. It is the technology that generally being used nowadays. A device for automatically erasing a whiteboard board wherein a duster is mounted for longitudinal movement on the whiteboard and has a motor mounted there on that is mechanically interconnected to a drive assembly for producing the movement of the duster in an erasing operation [9].

Another important object of the invention is to provide an automatic apparatus of the character described, which is positive-acting in operation, and wherein the erasing elements can be conveniently replaced and the other details of the mechanism easily repaired in the event of the development of defects. The utility model relates to teaching aid [9]. The principal object of the present automatic whiteboard cleaner is to provide an attachment for the boards in the form of a power driven erasing apparatus which can be set in operation by the click in application.

These are the related formula to solve the designation of the project. One of the formulas that being used is a pressure formula which is force unit per area to measure the pressure happened between the duster and whiteboard surface. Measuring is important to make sure this cleaner can be working and clean the whiteboard with high efficiency. Figure 2.3 shows the formula of pressure.

$$P = \frac{F}{A} = \frac{Force\ (N)}{Area\ (m^2)}$$

Figure 2.3 Formula of pressure

Velocity formula also being used to study the velocity of motor while moving. Figure 2.4 shows the formula of velocity.

$$V = \frac{D}{t} = \frac{Distance\ (m)}{Time\ (s)}$$

Figure 2.4 Formula of velocity

2.4 RESEARCH ON SPECIFICATION

2.4.1 Whiteboard

Whiteboard also known as a rectangular board, dry erase boards, wipes, dry wipes are shiny surfaces usually white for not long-lasting mark. The white board corresponds to a chalkboard but with a smooth surface that allowing for quick writing and erasing of the surface. Using of whiteboard is rising in the in-1990s and has become a must have facility in school classrooms, meeting rooms and even in office environments. The term whiteboard also being used metaphorically to refer to the features of a computer software applications that simulating the whiteboard. A "virtual whiteboard" allows one or more people to write or draw images on a simulation canvas [10]. Clean whiteboard as shown in Figure 2.5 below.

Figure 2.5 Clean Whiteboard

2.4.1.1 History of Whiteboard

According to one account, the first whiteboard was invented by Martin Heit, who was a photographer and Korean War veteran. When he accidentally signs a negative image with the marker and tried to erase it from it. Then, he realized that the marker's ink came off easily. He created a white board which has similar look like laminate with those found on photography negatives. After that, his invention was caught in fire the night before he wanted to introduce his invention at a trade fair. Instead of making another prototype to replace the one that broken, he sold his patent to Dri Mark.

The second account claims that Albert Stallion created a whiteboard while working at Alliance in the 1960s. The Alliance (now known as PolyVision) produces enamel steel for architectural fixes but then Stallion said that it can also be used as a writing surface. He left the Alliance company to form its own whiteboard production company because he created it. Magiboards is the name of his new whiteboard company. Figure 2.6 shows the door sign to the offices of Magiboards The Cut in Waterloo, London, in 1966 made of enameled steel [2].

Figure 2.6 Door sign made of enameled steel

White boards were sold commercially in the early 1960s, but were not used widely until 40 years later. The first white board should be wiped with cloth damp and markers have a tendency to leave marks on back, even after deleting the board. Dry markers for white boards created in 1975. Posters began to become commonplace for businesses in the early 1990s. They are becoming more common in the classroom in the 1990s because of concerns about health problems in children with dust allergy and the potential for disrupt your computer from the chalk board dust. By the end of the 1990s, about 21% of the classroom in America has been transformed from whiteboards to white boards. [4]

2.4.1.2 Types of Whiteboard

The first white board is very expensive and is made of enamel steel. Cheaper versions were then made, including laminated ceramic boards, high pressure laminates and steel boards with white coating, usually polyester or acrylic. White board which is refined, also referred to as porcelain, and sometimes glass boards, has the advantage that the signs can be completely eradicated; Other ingredients tend to be colored all the time. Enameled boards are more expensive and less used in the commercial environment, but in the environment more challenging with heavier usage, such as educational establishments, porcelain boards are considered superior.

Other dry markers are also provided, such as high gloss vinyl and paper coated, detachable, high-glossy double-height, glass and coated acrylic and polypropylene magic whiteboard using static electricity to cling to walls, windows, and doors. A clear marker surface, made of glass or specially coated acrylic, can found around the mid-2000s. They are usually made from technical glass for optical coated monitor screen filters. The board material can be purchased in rolls, sheets, and boards was first formed. The adhesive white board comes with either a sheet or a roll has a backrest that allows the user to create a size board or custom projects with materials.

White board pen (also known as a white board marker or a marker can be erased) created by Jerry Woolf of Techform Laboratories and was later patented by Pilot Pen in 1975. It is a timeless marker and use removable ink that complies with surface writing without being bound or absorbed by it. Application consists of temporary writing with acetate sheets (for use with overhead projectors) onto a whiteboard and a glossy surface. Ineffective ink is not contains chemical compounds of xylene and / or toluene, unlike permanent markers [11].

2.4.1.3 Types of Surface

Melamine is a resin-coated paper that is commonly used on a substrate can consist of particle board to MDF (density fiber board simple). Melamine boards vary in quality mainly because of the amount of resin deposited on the base material. Some melamine boards remain clean for a long time, others were not. Generally, the cheapest whiteboard is usually used in non-institutional applications. They can be found in any office supply store with varying performance. These boards are not suitable for heavy use, as in many educational cases, with paint time scrapes and the original surface reappears [11].

Painted steel and dried aluminum are also of various quality. Painted surfaces tend to be fine, leading to a better to erase it. Painted surfaces usually consist of layers that consisting of a basic layer in color (white) and a clear performance layer is the drying component. Paint is different from coating an electron cured by UV and other coating systems. Good commercial grade painted steel or aluminum has excellent drying properties and many can have a permanent marker cleaned from the surface. Any surface that is coated are easy to scratch. Painted steel surfaces are magnetic and allows the use of magnets [12].

Laminate Hardcoat here again changes performance according to various depending on the amount of resin used in the manufacturer. Basically, this category mainly uses melamine as a dry and dry performance coat and it falls into the melamine universe. Depending on the manufacturer (and price) .These laminates are often less porous and are very resistant to coloring. Less common from other white board surfaces, as they are commonly used in a combination of something else (as a cabinet, door or desk top for example). (This statement applies to Porcelain steel which is the only lifetime guarantee available on the market)

Ceramic (Porcelain, enamel-on-steel) rolls the steel surface in the kiln. They are the most durable surface, and most carry lifetime guarantee. It is very common in industrial use heavy. They are highly resistant to scratches, even if the material is harder than glass, like diamonds, can scratch them. They do not absorb dry or ink permanent marker. They allow the use of magnets. This surface can cleaned with any non-coarse cleanser suitable for porcelain, then wash with water to avoid dilution [12].

2.4.1.4 Whiteboard Duster

Nowadays, a regular whiteboard duster or duster is a must in a modern classroom. Duster is a tool that being used to erase whiteboard, but rarely get the conscience of people when it is missing from the base of the white board. When the blackboard was first created, markers are used to write on it. At first, people used tissue and fabric to erase lines, formulas and signed writing. It does have many problems as the cloth disappear or it will be really dirty. The solution is none other than tissue paper that being used continuously with a huge amount of waste. However, in view of global warming, recycling, forest conservation and garbage issues are beginning to be known to the public, it is suddenly exposed to people that maybe it's not a great idea [2].

In the summer of 1995, an excellent Economics teacher came to an end come up with a method for cleaning white boards effectively. He has being called as a learned father, this man has taken initiative to create something that will change the way people clean white boards forever. He took the old glasses case and inserted it with cloth. Try to imagine the guy, taking his broken glasses case, cloth stuffed into it, is the innovator of one of the most versatile products used and ignored in today's classroom. That idea suddenly spread wide.

China is very helpful in the globalization that community see in the world today. Many people now have a whiteboard eraser for use, with a lot of 15 million such products are produced every day. The duster has a bit adjustment made to it but still maintained the same way and not having any kind of revolution during these past years. There are more to do, and more work can be used to create a new invented eraser. For one, the current white board eraser currently have magnet behind it. Why doesn't anyone think of putting a magnet into the cloth, up to the front, where it is used to clean the board, stuck to the board and not having to worry about the duster.

There are so many types of whiteboard duster today. For example, some whiteboard duster can now hold markers. Also, magnets was placed behind the whiteboard duster to enable them stick to the board, providing greater convenience to users. With the rapid growth of China, the community have seen many reproduction of items that the same, though it lacks any creativity or logic [13].

2.4.2 Interactive Whiteboard

An interactive whiteboard (IWB) is a great display of interactive in the form of white board. It can be a screen computer touch independently used to perform tasks and operations or a tool that can be used as a touch to control a computer from projector. The first interactive whiteboard was designed and made for office use. It was developed by PARC around 1990.In 1991 Smart Technologies produced Interactive whiteboards that use projection technology [14]. Figure 2.7 below shows the IWB at CeBIT 2007 and a student had writing on the Interactive Whiteboard as shown in Figure 2.8

Figure 2.7 IWB at CeBIT 2007

Figure 2.8 Student writing on IWB

This interactive whiteboard is used in a variety of settings, including classrooms in all education level in the corporate board and work group in the training room for professional sports coaching, in broadcasting studios, and more. The first interactive whiteboard was designed and made for office use. It is was developed by PARC around 1990. The board is used in meetings small groups and round tables. In 1991 Smart Technologies produced interactive whiteboards that use projection technology.

The interactive white board is expected to reach US $ 1 billion in sales worldwide by 2008; one of the seven classrooms in the world is expected has an interactive whiteboard by 2011 according to market research by Future source Consulting. In 2004, 26% of English major classrooms has an interactive whiteboard. Review of Becta Hope Technology School 2007 indicates that 98% of secondary schools have IWB. Interactive Whiteboard is an interesting way to attract the student ang focusing through the entire class [15].

2.4.2.1 General Operation and Use

An interactive white plate (IWB) device can be a standalone computer or touchpad that works for the computer you're using. Device drivers are usually installed on the computer attached to the white board interactive can act as a Human Input Tool (HID), just like a mouse[14]. Output computer video is connected to a digital projector so images can be projected on the interactive whiteboard surface. The user then changes the white board image by matching the position projected images refer to white boards using a pointer is required.

Later, another indicator or device can be used to activate programs, buttons, and menus from the whiteboard itself, as they usually do with the mouse. If text input is required, users can use the board on-screen keys or if white-plate software provides this, use the handwriting sensor. This makes it unnecessary to go to the computer keyboard to enter text. Therefore, the IWB emits both the mouse and the keyboard. Users can do a presentation or class almost exclusively from white boards.

Besides, most IWBs are provided with software that provides tools and features designed specifically to maximize interaction opportunities. This is normal including the ability to create virtual versions of flipchart paper, pens and options attackers, and possibly even virtual rulers, protractors, and compasses will be used in traditional classroom teaching. This whole process is making the interactive whiteboard are more effective as well reduce the effort from using marker pen to write on normal whiteboard [15].

IWB uses include running software loaded onto a connected PC, such as a browser browse the web or other software used in the classroom. Catch andsave a note written on a whiteboard to a connected PC. Next, captures a note written on a graphics tablet connected to a whiteboard and control the PC from the whiteboard using click and drag, markup provides program or presentation notes. Also, Using OCR software for translates cursive writing on a graphics tablet into text. The end of the world, using the Audience Response System to allow presenters to download classroom viewers or quizzes, capturing feedback on the board.

2.4.2.2 Common Types of Operations

Infrared interactive whiteboards are great interactive display connect to computers and projectors. The board is usually mounted on a wall or floor. The movement of the user's finger, pen, or other pointer over the projected image on the white board is captured by its interference with infrared light on the surface White board. When the white board is pressed, the software triangulates the location marker or stylus. Infrared IWB can be made from any material, none the dry erase marker is involved, and can be found in many settings, including various levels of classroom education, corporate boardrooms, training or rooms activities for organizations, professional sports coaching facilities, and studios broadcasting.

The majority of IWBs sold globally are in one of four forms the interaction between the user and the projected content on the board. This is a infrared scanning technology, a resistance-based board, touch electromagnetic and related software, and ultrasonic pen. Touch-based IWB also involves a simple pointing device. In case this is an important institutional material. In the most common resistance system, the membrane stretching above the surface is deformed under pressure to create touch by controlling the backplate. The location of the next touch can be specified electronically and registered as a mouse event.

An interactive whiteboard based on an electromagnetic pen involves a variety of embedded wire behind a solid board surface that interacts with coil at the end of the stylus to determine the horizontal and vertical coordinates of the stylus. The pen itself is usually passive, that is, it does not contain batteries or other power sources; it alters the electrical signal generated by the board. For example, when close to the surface of the board, the mouse pointer can be felt, giving "mouse-over" board capabilities. When it is pressed against the board in a way, the agency activates a switch in the pen to alert the mouse click to the computer; pressed another way, contact the one-click alert on the mouse right button [16].

2.5 STUDY OF THE COMPONENTS TO BE USED

2.5.1 Components of Automatic Whiteboard Cleaner

2.5.1.1 Magnetic whiteboard [1.9x1.4 feet]

Magnetic whiteboard is very versatile as it can be used for a variety of different functions in the schools and office's environment. Magnetic whiteboards can be used like a tack board, enabling users to tack in place any spreadsheets, artwork or notes with ease. The magnetised board eliminates the use of pins that leave unsightly marks and holes on the pages. The magnetic whiteboard is shown in figure 2.9 below.

Figure 2.9 Magnetic whiteboard

2.5.1.2 Styrofoam with felt cloth

Styrofoam is being coated with felt cloth to make the wiper that mounted on the whiteboard. The materials as shown in figure 2.10 below.

Figure 2.10 Felt cloth with styrofoam

2.5.1.3 Wooden pallets

Wooden pallets is a tool that being used as a passage for wheel to move the wiper along the whiteboard which can clean the whole board. It is also reducing the friction force for smoother movement of the wiper. The wooden pallets is illustrated in figure 2.11 below.

Figure 2.11 Wooden pallets

2.5.1.4 DC motor

DC motor is a device that function on power supply in order to move the wheel in smooth motion. Wiper motor rotates continuously in one direction which is converted into a back and forth motion. The DC motor is shown in figure 2.12 below.

Figure 2.12 DC motor

2.5.1.5 Wheel

The wheel that attached with DC motor move along the wooden pallets for wiper to erase the whole board horizontally. Besides, it also reduce the friction by digging in, rotate and turning around axles. The figure 2.13 below shows wheel.

Figure 2.13 Wheel

2.5.1.6 Battery

A battery is an electrochemical cell (or enclosed and protected material) that can be charged electrically to provide a static potential for power or released electrical charge when needed. A battery generally consists of an anode, a cathode, and an electrolyte. Battery is shown in figure 2.14 below.

Figure 2.14 Battery

2.5.1.7 NodeMCU ESP8266

NodeMCU is an open source firmware and development that helps with the prototype of IoT product like automatic whiteboard . It also include firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. The nodeMCU is shown in figure 2.15 below.

Figure 2.15 NodeMCU ESP8266

2.5.2 Applications and Sensor

2.5.2.1 Roomie and Beacon, apps imitating universal remotes.

Roomie and Beacon allow to remotely control from tablet or smartphone TV, Blu-Ray and media players. It is also allowing the users to play media content from sources such as iTunes and Netflix. A device must be connected to the local home network to be able controlled by Roomie or use an infrared (IR) adapter.

2.5.2.2 Smartphone Operated Robot

Android is an open-source OS (operating system) which means that any maker can use it in their gadgets free of charge. Besides, the control commands are sent via Bluetooth. The speed of the robot also can be controlled from a smartphone. The robot functioning by detecting and notify to the phone its distance from the nearer problem.

2.5.2.3 Infrared sensor

An electronic instrument that is used to sense certain characteristics of its surroundings. It does this by emitting or detecting infrared radiation.

2.6 SUMMARY

As to conclude in literature review, this chapter is important to showcase all studies of history, materials and method in more detailed in order to enhance the knowledge on this project. Every thesis, research and findings that are related to this automatic whiteboard cleaner is really handful as it came along with content that easy to understand it fully. Based on the research and findings, this project will get the chance of better development in the structure and mechanism of movement.

After a lot of materials and methods were discussed after the research had been done, the material that are the most compatible for automatic whiteboard cleaner is melamine which is a type of plastic polymer combined with a range of base materials. Melamine is widely used as a whiteboard material because it is cheaper compared to enameled steel or painted aluminium. Besides, it can be cleaned easier through this project due to the limitation for smoother whiteboard surface.

Moreover, Blynk is an established application that can build graphic interface of the final project and be able to control the movement of automatic whiteboard cleaner from smartphone. Smartphone is essential nowadays so the lectures and teachers validate to use this project in classroom for erasing whiteboards. Lastly, the wiper can be installed at low cost and easy for beginner’s use.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

What is methodology? A methodology is a plan-of-attack, especially when that plan-of-attack is used repeatedly. This might be obvious, but the word methodology is related to the word method. In fact, a methodology is a system of methods followed consistently. Scientists, for example, use various methodologies as they perform experiments. It might seem like the world is nothing but chaos and disorder. But actually, sometimes there is a method to this madness. And sometimes there's a methodology [17].

In this chapter, there will be a lot of information about the process and journey through out the making of our final project. There will be flow chart showing the process of making the whole project. This flow chart will explain the processes were took. Next, is the Gantt Chart, which will show the actual and planning throughout all the 15 weeks of the final year project journey.

However, in this chapter, will present the overall methodology of study. To overcome the number of disadvantages of conventional method used or to reduce the effort of teachers that have designed and implemented an approach called automatic whiteboard cleaner. As it operates in automatic manner it did not require a special attention to operate it. It uses the IR sensor as receiver to control the operations.

3.2 FLOW CHART

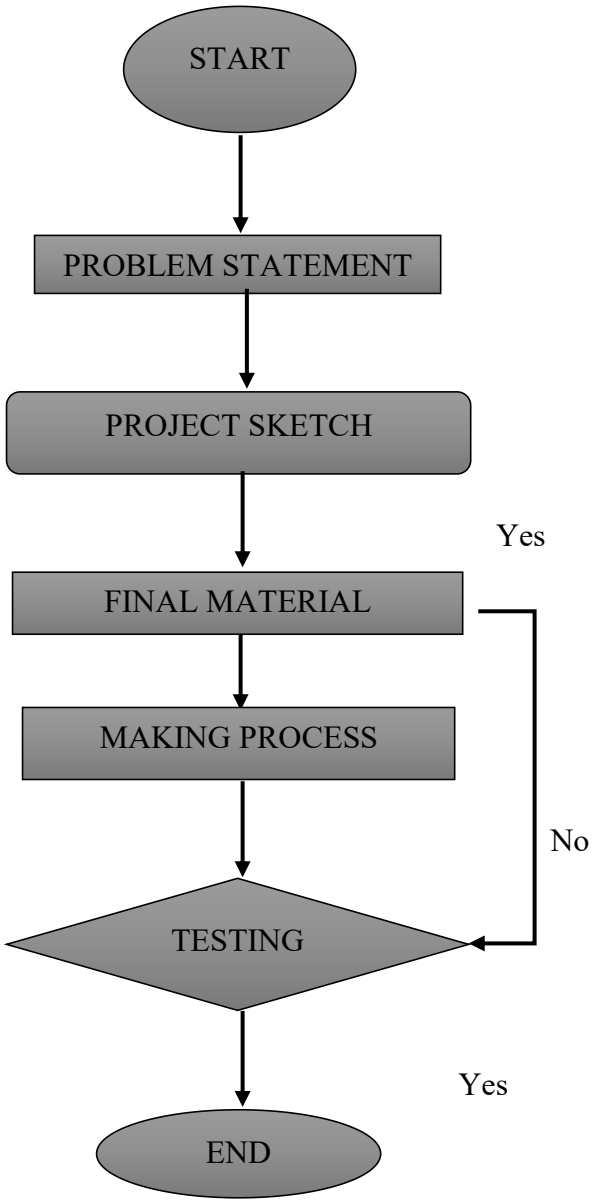

Figure 3.1 Flow Chart

3.3 PRIME WORK CONCEPT

3.3.1 PROBLEM STATEMENT

The time it takes for an individual to erase an entire whiteboard is a bit long and tiresome. Also, manual deletion is difficult is made for individuals of medium size to eliminate the top whiteboard surface. So, with this design it can save individual time and energy because there is no need to move and just by using the application AWC to move this automatic eraser. Besides, it can be used for short-term individuals because the eraser is controlled only by the app.

3.3.2 RESEARCH

Based on the research done in 2.2. The lack of whiteboard 'Cleaning System using microcontroller' is too much of a component of electronics and high manufacturing costs. For lack of cleaning system whiteboards, however, still use manual methods to move the extinguishers whiteboard and lack of electricity whiteboard requires electricity switch for turns on the whiteboard eraser and can only be used on the whiteboard static. While the project can overcome the shortcomings of the project earlier by using less expensive materials, did used the roller at the top and bottom of the extinguisher to reduce motor load to automatically move with the whiteboard eraser. Also, used a battery to supply electricity to the motor to replace it the white switch and smart whiteboards are designed for mobile even for us also use a remote control to turn on our automatic eraser. With the success of this project, then were able to solve the problem of losing the eraser whiteboards, save time individuals to erase the whiteboards and save costs individuals to buy a new whiteboard eraser every time they lose it [18] .

3.4 TOPIC SELECTION

The first step is to select a teammate and pick a topic that can be enjoy working. Start thinking about possible topics well before the project course begins. Consider ideas that sounds interesting because of desire to know more about a subject, a desire to learn how to use a particular software or hardware package, or a goal of working professionally in this area after graduation. Moreover, the project topic should be enjoyable and the research idea has been investigated and presented in one of the classes. A goal is to have a well-defined statement ready for design as early possible.

3.5 DISTRIBUTION ORGANIZATION OF WORK

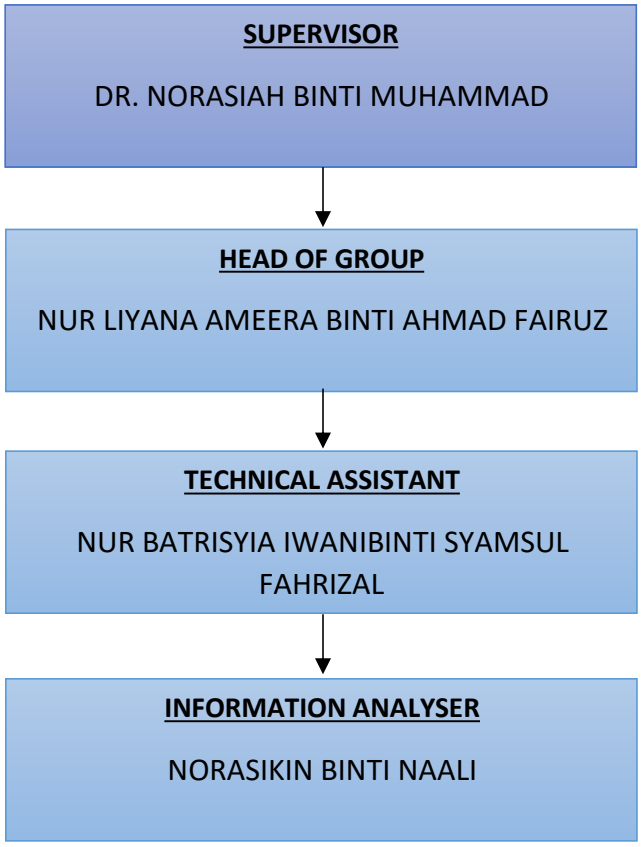

Figure 3.2 Organization Chart

Table 3.1 shows the type of work done by each member of our team.

Table 3.1 Type of Work

TYPE OF WORK	TEAMMATE ASSINED
Process of buying & designing project	**NUR LIYANA AMEERA BINTI AHMAD FAIRUZ** **NUR BATRISYIA IWANIBINTI SYAMSUL FAHRIZAL** **NORASIKIN BINTI NAALI**
Process of making framework for the project	**NUR LIYANA AMEERA BINTI AHMAD FAIRUZ** **NUR BATRISYIA IWANIBINTI SYAMSUL FAHRIZAL** **NORASIKIN BINTI NAALI**
Process of Doing Paper works **(Ex: Proposal, Report, Banner, etc)**	**NUR LIYANA AMEERA BINTI AHMAD FAIRUZ** **NUR BATRISYIA IWANIBINTI SYAMSUL FAHRIZAL** **NORASIKIN BINTI NAALI**

3.6 PROJECT SKETCH

The drawing that have constructed is a drawing of Automatic Whiteboard Cleaner. This was designed primarily for to clean the whiteboard faster and easier.

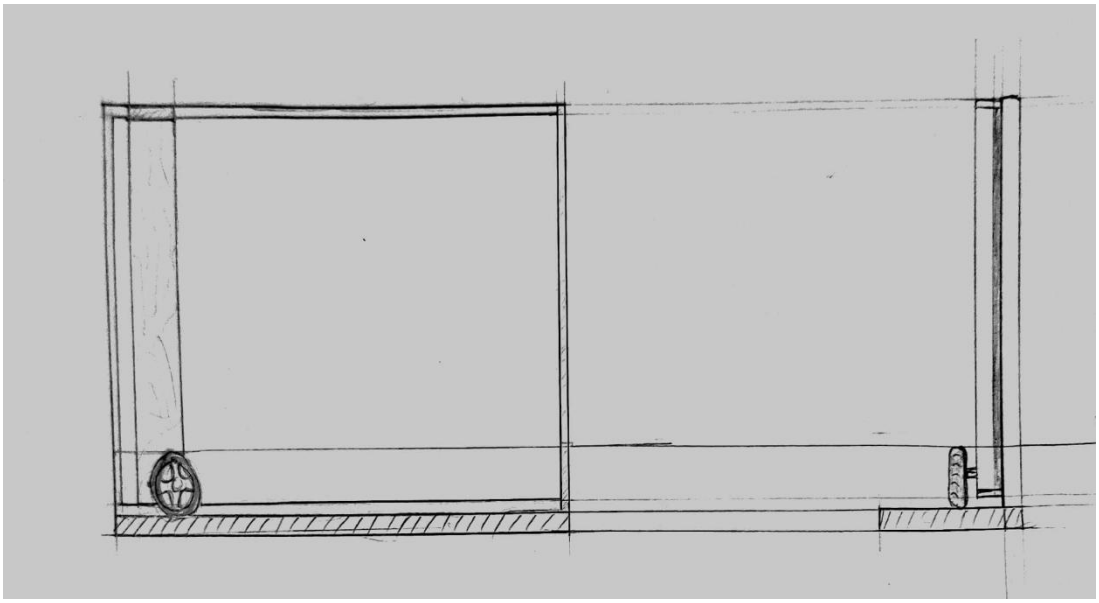

Figure 3.3 Project Sketch

3.7 AWC SYSTEM

The AWC system is created by using a coding system called Arduino program and has been applied to the Blynk application. The first command signal which is the voltage is given to NodeMCU and DC motor through the driven motor. This DC motor or tt wheel motor is rotated at speed according to the program setup. It also connected to the wooden palettes that act as a shaft to clean the whiteboard. Figure 3.4 presents the block diagram of the AWC system while Figure 3.5 shows the speed coding using Arduino program.

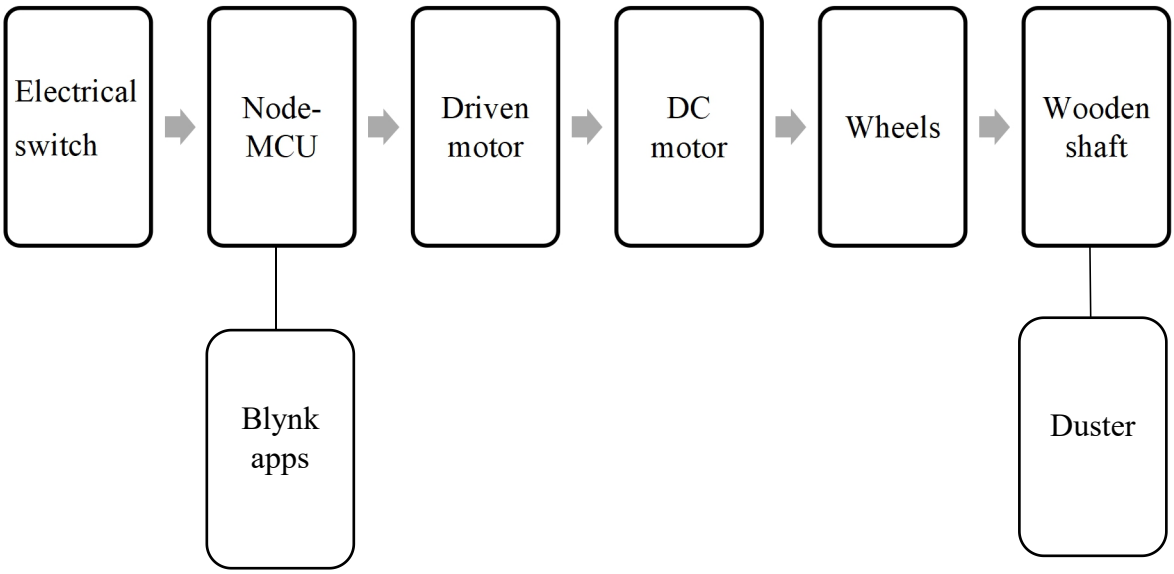

Figure 3.4 Block diagram of the AWC system

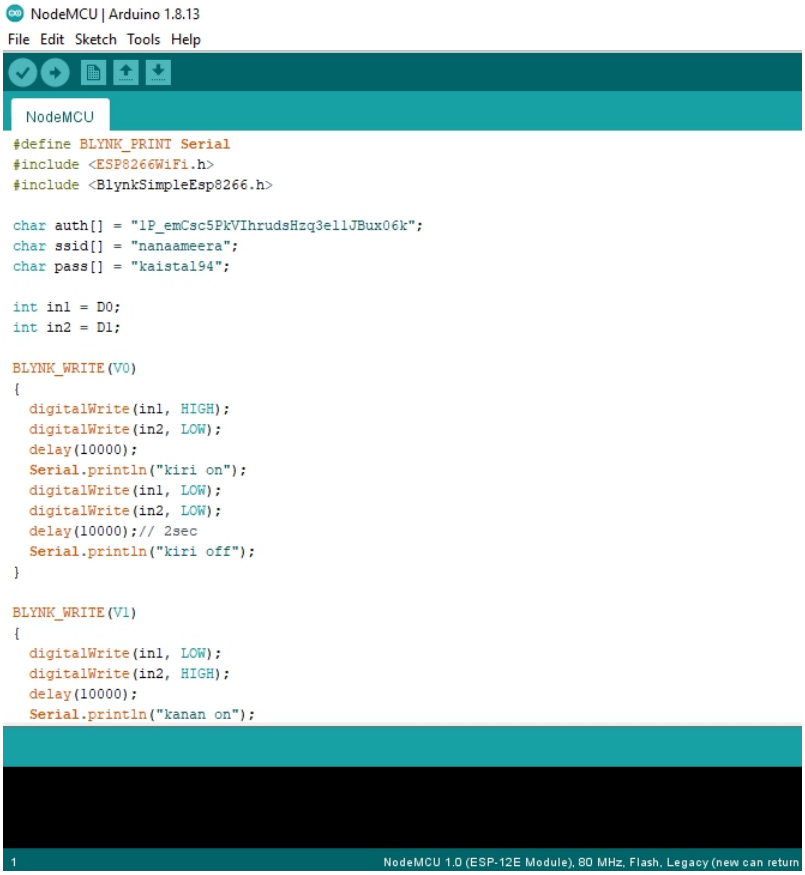

Figure 3.5 Coding using Arduino Program

3.8 SELECTION OF MATERIAL AND COST

The process of material selection is one of the most important process in this final year project. The main factor of material selection is to discuss and finalized which materials that will be use in the project in order to avoid wasting of money and time. The material selection need to be done precisely so that the risks could be avoided.

Table 3.2 Selection of Materials and Cost

NO	MATERIAL	QUANTITY	PRICE(RM)
1	Styrofoam	1	RM2.10
2	DC Motor	1	RM2.70
3	Battery 1.5V	3	RM30
4	TT wheel motor	1	RM2.90
5	Microfiber cloth	1	RM2
6	Pallet wood	4	RM16
7	Whiteboard 43 x 58 cm	1	RM23.52
8	Node MCU	1	RM22
9	Hot glue gun	1set	RM10.50
10	Carpenter glue	1	RM9.90
11	Flexible Cable	8F	RM20
	TOTAL	RM149.72	

3.9 SELLING PRICE FOR AWC

Table 3.3 shows the selling price for AWC.

Table 3.3 Selling Price of AWC

Product	**Quantity**	**Calculation Per Unit**	**Calculation sale price** **Margin = 55%**
AWC		DC Motor RM2.70 TT wheel motor RM2.90 Node MCU RM22.00 Duster RM4.10 Battery RM30.00 Flexible Cable RM20.00 Whiteboard RM23.52 Pallet wood RM16.00 Wages RM20.40 Cost Overhead + RM4.00 Total RM149.72	Sale price = $\frac{\text{Cost per unit}}{(1-\%\ margin)}$ $= \frac{\text{RM}149.72}{(1-0.55)}$ = RM332.711

3.10 MANUFACTURING PROCESS

The first step to starting a job or building a project is to draw sketches to facilitate the process or execution. Also, it can indirectly facilitate the implementation of work on building this final project. With a sketch drawing, the discussion can be done clearly and made the practical work better and smoothly. Project dimensions can be created as well.

3.10.1 The Process of Cutting and Assembling Whiteboard Frames

At first, metal parts were used from wadrobe attachments to make the whiteboard frames. But, the frames made were not supported enough for the wheels to move. So, wooden pallets were used to move the wheels horizontally. Frame works had been done by using handsaw and file tool. Also, the process of measuring and marking for the frames take place according to the whiteboard size. Figure 3.6 shows the process of the whiteboard measurements. Then, Figure 3.7 shows the process of cutting the metal parts. Lastly, Figure 3.8 presents the assembling of the whiteboard frames.

Figure 3.6 Whiteboard measurements process.

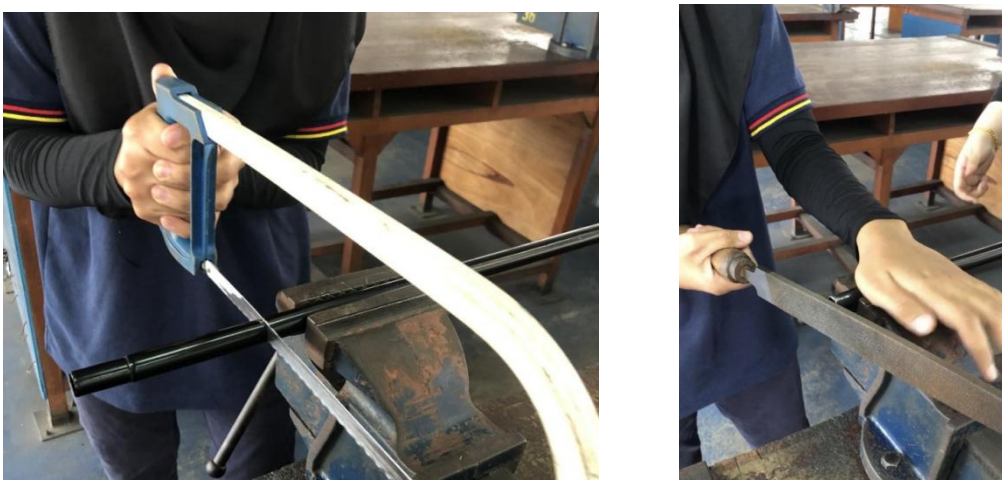

Figure 3.7 Cutting process using handsaw and file tool.

Figure 3.8 Assembling process.

3.10.2 The Whiteboard Eraser Process

Upon completion of the installation of the frame, the manufacturing process continues with the installation of whiteboards eraser. Styrofoam wrapped with felt cloth are used to act as a duster to make a better cleaning. Then, the duster is attached to the wooden pallets. Also, duster placement from the whiteboard is used to attach the wooden pallets to make the movement easier. Figure 3.9 shows styrofoam wrapped with felt cloth while Figure 3.10 shows the duster placement attached to wooden pallets.

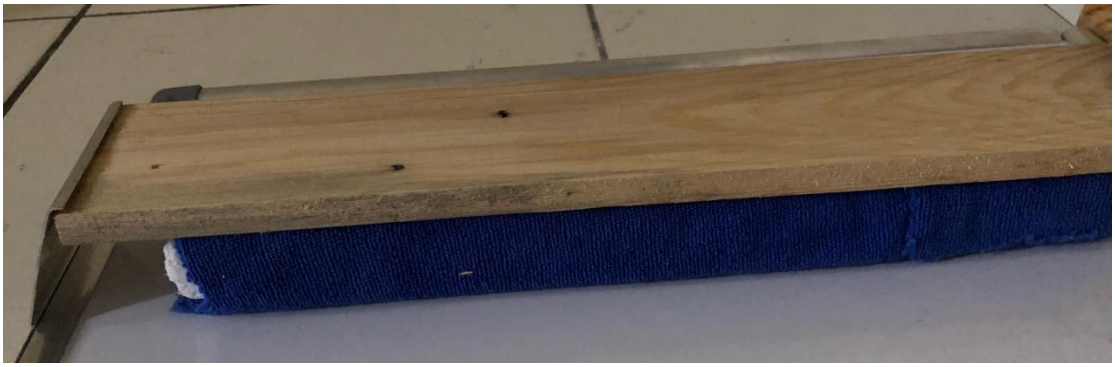

Figure 3.9 Styrofoam wrapped with felt cloth.

Figure 3.10 Duster placement attached to wooden pallets.

CHAPTER 4

RESULTS AND ANALYSIS

4.1 INTRODUCTION

Findings and data analysis are the areas where the results of the study will be presented. The results section aim to narrate the findings without trying to interpret or evaluate. Thus, it is to provide a direction to the discussion section of the research paper. Meanwhile, the analysis section is where the writer describes what was done with the data found. This chapter cannot be implemented if the final project is not completed. The final project is carried out must be tested in order to achieve the objectives that have been expressed by members of the group to prove that the project is working well and successfully or otherwise.

4.2 FINAL TEST

4.2.1 TEST 1 : FAILURE

Based on the first design, it consists of several failure caused by the frame work. The width of the metal frames were not support the wheels to move and caused the frame to fell apart.

Figure 4.1 Failure design

Solution : Redesign the frame and make the width twice bigger than the metal frame work.

Figure 4.2 Redesign the frame work.

4.2.2 TEST 2 : SUCCESS

Figure 4.3 shows how the automatic whiteboard cleaner move right and left to clean the whiteboard. The average speed value obtained was 5.875 secs after two and three sweeps. Meanwhile, Figure 4.4 and Figure 4.5 shows the button for AWC to move.

Figure 4.3 The duster move right and left.

Figure 4.4 Button to move the AWC to left.

Figure 4.5 Button to move AWC to right.

Then, Figure 4.6 shows the command from the Arduino Program when the buttons are pressed.

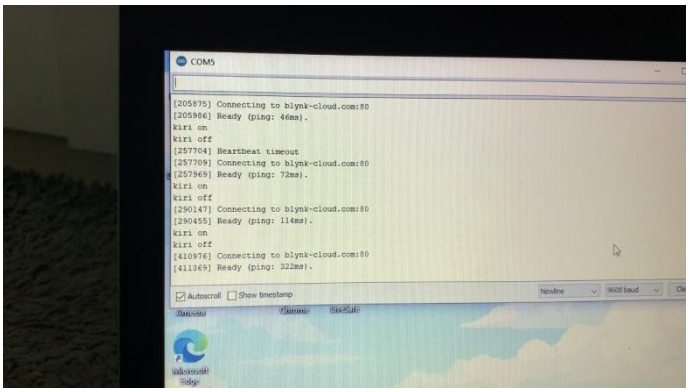

Figure 4.6 Button commands.

4.3 ADVANTAGES AND DISADVANTAGES

In each of the invention will have advantages and disadvantages. It relies on the idea of designs. Below are some advantages and disadvantages of the project:

Advantages

i. Shorten the time and effort used to erase the whiteboard.

ii. The wiper can be removed easily if it is necessary to clean.

iii. Automatic whiteboard cleaner has a higher demand in market nowadays.

iv. No external devices are used in making to control it.

v. Useful in college and schools application.

vi. The construction is simple and less maintenance is required.

Disadvantages

i. Not portable in size and not easily transportable.

4.4 DATA AND ANALYSIS

Comparison between manual process with duster and automatic process with Blynk application.

Table 4.1 Data of time cleaning.

Manual duster	Blynk application
- Takes 25 secs to clean the whole board.	- 1st sweep = 5.8 secs - 2nd sweep =5.82 secs

	- 3rd sweep = 5.95 secs Average speed = $\frac{5.8 + 5.82 + 5.95}{3}$ = 5.857 secs

4.5 SUMMARY OF CHAPTER

Time of cleaning process is one of the important factors that must be considered. The results obtained shows that manual duster takes a longer time compare to Automatic Whiteboard Cleaner. Besides, there are more advantages by using the AWC because it just use the Blynk application to move it.

CHAPTER 5

CONCLUSION

The objectives of this project which is to create an automated whiteboard cleaner has been achieved successfully. Besides, there is a need for further fabrication works regarding the look. The structures of tt wheel motor were conceived to fit properly into the cleaning mechanism but due to inadequately tension and prevent the automated whiteboard the required function adequately. The speed of motor can be reduced using a gear mechanism. Other than that, the whole system was designed with innovative features such as the uses of application which reduces human efforts and makes teaching efficient. This whiteboard could be one of the factors for increasing the interest of students to study with different kind of technology.

Automatic whiteboard cleaner will give effective cleaning after two or three sweeps when fully completed. Furthermore, the construction of automatic whiteboard cleaner consists of NodeMCU which is very common in programming world and the system also can be further developed according to one's own accord. It is recommended that the machine should be improved in terms of wheel is placed at the base just in front of the duster to create a groove where it can move. On the other hands, majority of the material used in the main structure of this project is easily accessible in the market. Last but not least, almost everyone has a smartphone and internet connection, therefore there should be no problem regarding with the access of automatic whiteboard cleaner.

APPENDIX

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Application No : LY2020005276

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Title of work *(Original language)* : AUTOMATIC WHITEBOARD CLEANER

Translation :

Transliteration :

Name of the Language *(*Language that been used in the work)* : BAHASA INGGERIS

If published in a periodical or serial *(Literary Work)* : (Volume / Number) (Issue Date) (On Pages)

Section A : Type of Works

☒ Literary ☐ Musical ☐ Artistic ☐ Film ☐ Sound Recording

Date of Fixation / First Published / Erected / Incorporated : 30 / 09 / 2020

Section B : Publication

The Work is : ☐ Published ☒ Unpublished

If published : 2020 (Year of Compilation) 30 / 09 / 2020 (Date of first publication) MALAYSIA (Country)

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Project Activity	Week														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Briefing and Project Planning															
Project Design															
Material Selection															
Materials Purchase															
Manufacturing Process															
Test Run															
Analysis Data															
Report Writing															
Video and Slide making															
Presentation															

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