FACULTY OF MECHANICAL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING (PACKAGING)

(PROJECT 2   DJJ 6143)

FINAL REPORT OF:

CLOTHES FOLDING MACHINE

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CLOTHES FOLDING MACHINE

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A project submitted in partial fulfillment of requirements for the award of Diploma in Mechanical Engineering (Packaging)

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JUN 2020

DECLARATION OF AUTHENTICATION AND OWNERSHIP

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2. We verify that 'Clothes Folding Machine' and its intellectual properties are our original work without plagiarism from any other sources.

3. We agree to release the project's intellectual properties to the above said polytechnic in order to fulfil the requirement of being awarded **Diploma in Mechanical Engineering(Packaging)**.

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Assalamualaikum dan Salam Sejahtera;

Alhamdulillah, In the name of Allah the most gracious and the most precious, first and foremost, we would like extend our deepest praise to Allah SWT who had given us the patient, strength and determination that help us to think wisely in making a decision and courage to complete this project. In addition, we wanted to show our highest gratitude and thanks to our supervisor, Dr. Mohd Elias bin Daud, which helped, lead and guided us with our project "Clothes Folding Machine".

Thank you.

ABSTRACT

The scope of this study focuses the designing and developing a Clothes Folding Machine as an idea for final year project. Nowadays, housewives are busy with other tasks and have no time to complete just a simple folding. They also need to take care of children especially babies. Then, a busy women and men also do not have much time to fold their clothes. This will cause major stress as they realise their unfolded clothes at home. Packaging are very important in the industry of packing activities. Currently, many clothing markets do not have sufficient folding machines. This is because of the market's expenses cannot be wasted on machines and employees have to manually fold the clothes. Thus, this production of Clothes Folding Machine helps to fabricate a machine that provides an ideal folding machine for users who are unable to manage their clothes due to works and surroundings factors. Other than that, this project used electronic components such as arduino, servo motor, circuit and others. Besides, this folding machine is fully automatic where users place the t-shirt on the board, press the start switch and within fraction of seconds the t-shirt will get folded. Moreover, this project will definitely be a helpful hand to the working women where at the same time, it saves energy, time and money. Last but not least, Clothes Folding Machine was expected to be prepared with low prices which affordable to all generations and friendly product to customer.

Keywords: Folding machine, Busy women, Folded, Clothing markets, Fully automatic.

ABSTRAK

Skop kajian ini memfokuskan kepada merancang dan membina Mesin Lipat Pakaian sebagai idea untuk projek tahun akhir. Pada masa kini, suri rumah sibuk dengan tugas lain dan tidak mempunyai masa untuk menyelesaikan tugas melipat kain. Mereka juga perlu menjaga anak-anak terutamanya bayi. Selain itu, wanita dan lelaki yang sibuk bekerja juga tidak mempunyai banyak masa untuk melipat pakaian mereka. Ini akan menimbulkan tekanan yang besar ketika mereka menyedari pakaian mereka yang belum dilipat di rumah. Pembungkusan sangat penting dalam industri aktiviti pembungkusan. Pada masa sekarang, banyak kedai pakaian tidak mempunyai mesin lipat yang mencukupi. Hal ini kerana, perbelanjaan pasaran tidak ingin dibazirkan pada mesin dan pekerja terpaksa melipat pakaian secara manual. Oleh itu, pengeluaran Mesin Lipat Pakaian ini membantu menyediakan mesin lipat yang sesuai untuk pengguna yang tidak dapat menguruskan pakaian mereka kerana faktor kerja dan persekitaran. Di samping itu, projek ini menggunakan komponen elektronik seperti arduino, servo motor, litar dan lain-lain. Seterusnya, mesin lipat ini automatik sepenuhnya di mana pengguna meletakkan t-shirt di papan, tekan suis mula dan dalam masa beberapa saat sahaja t-shirt akan dilipat. Lebih-lebih lagi, projek ini pastinya dapat membantu wanita yang bekerja dan pada masa yang sama, menjimatkan tenaga, masa dan wang. Akhir sekali, Mesin Lipat Pakaian diharapkan siap dengan harga rendah yang mampu milik untuk semua generasi dan produk yang mesra kepada pelanggan.

Kata kunci: Mesin lipat, Wanita sibuk, Dilipat, Pasar pakaian, Automatik Sepenuhnya.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

In modern times all the sophisticated electrical and electronic equipment is used daily. Therefore, the main scope we want to introduce is to focus on the industry sector which is one of the long-standing and indirect sources of economic growth in Malaysia. In addition, with today's ever-increasing technology, we can indirectly learn how to do things using existing technologies. Thus, we learned a single creation with many uses where we had agreed to come up with a project called a Clothes Folding Machine. Clothes Folding Machine is an automatic motor controlled clothes folding machine powered by a Arduino system. The aim of this project is to fold t-shirts merely by pressing a button. The folding machine is fully automatic where one has to place the t-shirt on the folding tray and press the button. It will then fold the t-shirt by itself. Usually, a person uses conventional method to fold the clothes which by hand folding. People nowadays have been living with tight schedule in their daily life. Household chorus despite gender discrepancy has been a burden for many. This work is a burden for many and sometimes tiring depending on the amount of clothing and number of people in a house. [1]

In addition, most of the clothes folding machine in market are either for industry use or too expensive. We are trying to build a portable automatic clothes folding machine with cheap cost to serve most people. The operation of the machine requires less manpower involvement, which is significantly useful for people who are not willing to organize their clothes. [2]
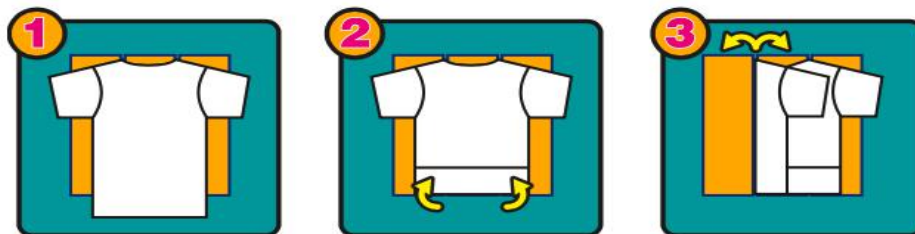

Figure 1: *T-shirt Folding Process*

1.2 PROBLEM STATEMENT

Strict daily routines at work often make one have no time to do their homework. If clothes are handed over to the washing machine, folding machine will now helps to do the folding work. Currently, many small industries do not have sufficient folding machines. This is because high prices cause an industry to receive low demand and high losses. Moreover, they can save their cost, energy and time by having this clothes folding machine. At the same time, a high-tech machines such as this folding machine should fabricated which emulated the sophistication of technology from abroad. Thus a low cost and quality machine created.

Figure 2: *Process Of Folding A Shirt By Hand*

1.3 RESEARCH OBJECTIVES

The objectives to the research are:

i. To fabricate a machine that provides an ideal folding machine for users who are unable to manage their clothes due to work and surrounding factors.

ii. To reduce folding machine process time.

iii. To investigate the survey from respondents and identify the problems.

iv. To build and innovate a Clothes Folding Machine that can be used by every generations.

1.4 RESEARCH QUESTIONS

This study will answer the following research questions:

  i.   Is it possible to create a folding machine that are high in quality?
  ii.   What type of material that can be used to make folding machine?
  iii.   What are the possibilities of making folding machine material?

1.5 SCOPE OF RESEARCH

The scopes and limits to this research are:

1) Design and develop prototype of t-shirt folding machine.

2) Specialized for any size clothes.

3) The machine should be programmed to fold, and stack simple clothes.

4) It will operate in a semi-automated process; the customer only need to lay the clothes flat on the platform and the machine takes them in for folding and stacking.

1.6 SIGNIFICANCE OF RESEARCH

The project was designed to meet the needs of folding clothes for housewives or anyone who has trouble folding clothes. Based on the survey among customers, lots of housewives were annoyed by spending to much time to fold clothes. In addition to that, most of clothes folding machine in market are either for industry use or too expensive. We are trying to build a portable automatic clothes folding machine at a cheap cost to serve most people. It is not only combine the metrics from existing products but also have two folding patterns, which is more convenient and efficient.

1.7 DEFINITION OF OPERATIONAL TERMS

1) Cloth folder- This cloth folder is ideal for this invention as it is lightweight and easy to handle.
2) Switch on off- The switch is a very important component of the clothes folding machine as it switches on and off the electrical current that flows for the process of folding the shirt.
3) Servo motor- Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire.
4) Arduino Uno R3- The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller.

1.8 SUMMARY OF CHAPTER

In this chapter, the studies has explained about its origin of ideas and inspirations. All the objectives were made out to satisfy all the problem statements. The objective for this project along with the importance of clothes folding machine are cheap and lightweight so that it is more convenient and efficient. Thus, this new clothes folding machine can be included in daily routine for a longer lifetime in a really good condition.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

The secret to getting boutique-worthy shelves and dresser drawers is a T-shirt folding board. It not only makes your piles of tees look pristine, but neatly folded clothing can be a serious space-saver, too. Best of all though, a T-shirt folding board is a faster, easier, and more efficient way to fold a variety of tops. But not all folding boards are the same, and depending on wardrobes, different styles and added features may be better suited to fit one desired folding preference. For instance, although any T-shirt folding board can conquer T-shirts with ease, some can also help fold blouses, thick sweaters, or kids clothing.

There are many types of folding machines in the market, each with different shapes and specifications. At the beginning of the creation of the folding machine, the design of the folding machine was simple and had limited functionality where this type of folding machine looks unattractive. This folding machine is also difficult to use for folding because it is not neat to fold. Thus, through various research, many improvements were made to satisfy all the problems to meet the prefect specifications.

2.2 HISTORY

Before the development of the technological age as now, a folding machine have never heard or seen even other technologies are less produced. Most people only use energy to complete all tasks and homework without any help from machines or technology. As we can see, the new cloth folding was designed during technology era but not in the previous year. So, during the traditional era, people just use their energy or manually to fold clothes although there is few creations of folding boards but it still takes a long time to complete folding job. That is why in the previous year, there just only folding boards and since then manufacturing started to develop the idea for machine production so that women or housewives do not have to spend time for folding clothes.

2.3 RESEARCH ON SYSTEM

2.3.1 Electric systems

An electric power system is a network of electrical components deployed to supply, transfer, and use electric power. An example of a power system is the electrical grid that provides power to homes and industry within an extended area. The electrical grid can be broadly divided into the generators that supply the power, the transmission system that carries the power from the generating centres to the load centres, and the distribution system that feeds the power to nearby homes and industries. Smaller power systems are also found in industry, hospitals, commercial buildings and homes. The majority of these systems rely upon three-phase AC power, the standard for large-scale power transmission and distribution across the modern world. Thus, a single creation with many uses had learned where we had agreed to come up with a project called a Clothes Folding Machine. Clothes Folding Machine is an automatic motor controlled clothes folding machine powered by an electric system. The aim of this project is to fold t-shirts merely by pressing a button. The folding machine is fully automatic where one has to place the t-shirt on the folding tray and press the button. It will then fold the t-shirt by itself.

For this project, an electric current is conducted by using a plug adapter. The system used to obtain product usage accuracy. When the switch is turned on, the current will flow from the main switch through the arduino panel box to transfer energy to the motor servo where the servo motor will receive electric current. The arm of servo will rotate 180 degrees to begin the process of folding the shirt.

2.4 TYPES OF CLOTHES FOLDING

2.4.1 Automatic Folding Machine

The automatic cloth folding and stitching machine which is produced by the factory is a highly automated machine and developed according to market demand. It is often used in conjunction with automatic fabric strip slitting machine and straight twill cloth rolling machines, which can replace traditional cutting machine, will greatly improve working efficiency. [3]

This machine is about two-thirds the size of your washer or dryer. The user, perhaps a teenager convinced to help with chores, simply hangs or clips the shoulder area of the shirt on two hooks and steps back. The device pulls the shirt in. A series of rollers and arms that also move up-down-sideways straighten and fold the item of clothing. [3]

Optionally, the device can spray the clothing with a wrinkle-reducing agent or fragrance. It is not completely hands-off after clipping the item. User have to button a shirt before handing off to automatic folding machine. It also cannot handle big items such as a beach towel and possibly not loose-fit XXL athletic shirts, for instance. Still, most shirts, undershirts, T-shirts and pants should fit into the auto-folder. Socks are too small to be folded. [3]

Figure 3 : *Automatic Folding Machine*

2.4.1.1 Advantages Of Automatic Clothes Folding Machine

If one have ever spent hours to hand folding clothes, scarves or pants then stacking into bunches and putting it on the table or in their wardrobe, then the benefits of owning a machine may be of interest to them and their business.

Speed: A folding machine can fold many more clothes per hour than even than someone doing it manually.

Cost: A folding machine has the potential to greatly reduce the manpower and time required to fold clothes. Think about it, folding that traditionally may have required a team of manpower to manually fold and stack the clothes could be automatically completed in a fraction of the time.

Consistency: If one have ever spent time ironing, folding and stacking clothes, they knew how hard it is to be consistent. The chances of folding and stacking every clothes in exactly the same way are pretty slim.

Accuracy: Another common issue with manually-folded clothes is accuracy. When people are folding a lot of clothes, they will get tired. Fatigue sets in. Mistakes happen. Most modern folding machines are fitted with advanced features, such as fast folding time and ironing, which helps greatly to reduce the chances of these issues occurring.

2.4.2 T-Shirt Folder

It is easy to see why this is the most popular folding board. In three simple steps this board folds anything from T-shirts to pants to sweaters. Unlike a lot of similar boards on the market, this board features adjustable hinges so that you can easily fold thinner or thicker garments. Folded up it is 11 inches by 9 inches, 1.2 inches thick, and features a hook that makes it super easy to store. [4]

FIGURE 4: *T-shirt Folder*

2.4.2.1 Advantages of T-shirt Folder

- **Durable And Reusable:** The T-shirt folder is manufactured using the best quality material. Made out of tough but smooth plastic it never requires any maintenance or repair, is very easy to clean and will last a lifetime.

- **Fast And Fun:** Use the shirt folding board to make one's clothes flatter and neater. Fold all garments to a perfect uniform size and shelves looking nice and neat. The T-shirt folder is so easy and so much fun to use that even kids and spouse will love folding, which in and of itself is a miracle. The T-shirt folder is beautifully and masterfully designed, featuring a "no slip" back, retro shaped apertures, and dedicated hand slots.

- **Multifunctional:** Fold shirts, pants, towels and thick clothes in just minutes using this expert laundry folder. Great to have around the house and is a perfect gift idea.

- **Easy Storage:** A cloth folder is made with a space-efficient design and has a hanging slot. It collapses to allow hanging the folder conveniently on laundry room wall or back of one door and user can access it whenever they want to use it.

2.4.3 Sturdy Plastic Board

Besides that, this sturdy plastic board is style of T-shirt folder that most retail professionals use — and for good reason, too. It is simple, compact, and the handle makes it easy to slide out of a folded top. This one even comes with directions engraved on it for easy reference. It is a little more than 12 inches tall and 8.5 inches wide, so it is ideal for tees and collared shirts. [4]

FIGURE 5: *Sturdy Plastic Board*

2.4.3.1 Advantange Of Sturdy Board

- Helps fold shirts uniformly.
- Includes step by step instructions for collared and non-collared shirts.
- Easy-glide handle makes it easy to slip out of folded shirts.
- Handle double as a hook for hanging
- Saves time and closet space.

2.5 MATERIAL & COMPONENT SELECTION

2.5.1 Cloth folder

The cloth folder type plastic is best used in the manufacturer of folding machine. This cloth folder is ideal for this invention as it is lightweight and easy to handle. When folding is done via the switch on the Arduino system will move the dc motor to the garment folding process.
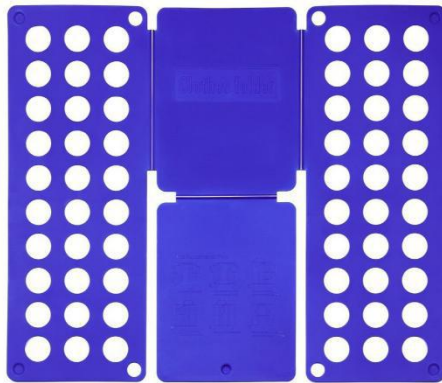
FIGURE 6: *Cloth Folder*

2.5.2 Servo motor

Figure 7: *Servo Motor MG966R*

The MG996R is a metal gear servo motor with a maximum stall torque of 11 kg/cm. Like other RC servos the motor rotates from 0 to 180 degree based on the duty cycle of the PWM wave supplied to its signal pin.Most of the hobby Servo motors operates from 4.8V to 6.5V, the higher the voltage higher the torque we can achieve, but most commonly they are operated at +5V. Almost all hobby servo motors can rotate only from 0° to 180° due to their gear arrangement so make sure your project can live with the half circle if no, 0° to 360° can be refer motor or modify the motor to make a full circle. The gears in the motors are easily subjected to wear and tear, so if the application requires stronger and long running motors it can be changed with metal gears or just stick with normal plastic gear. [5]

Next comes the most important parameter, which is the torque at which the motor operates. Again there are many choices here but let us assume the one with 2.5kg/cm torque which comes with the MG996R Motor. This 2.5kg/cm torque means that the motor can pull a

weight of 2.5kg when it is suspended at a distance of 1cm. So if you suspend the load at 0.5cm then the motor can pull a load of 5kg similarly if you suspend the load at 2cm then can pull only 1.25. Based on the load which you use in the project you can select the motor with proper torque. The below picture will illustrate the same. [5]

After selecting the right Servo motor for the project, there are three wires coming out of this motor. The description of the same is given on top of this page. To make this motor rotate, we have to power the motor with +5V using the Red and Brown wire and send PWM signals to the Orange colour wire. Hence we need something that could generate PWM signals to make this motor work, this something could be anything like a 555 Timer or other Microcontroller platforms like Arduino, PIC, ARM or even a microprocessor like Raspberry Pi. Now, how to control the direction of the motor? To understand that let us a look at the picture given in the datasheet.
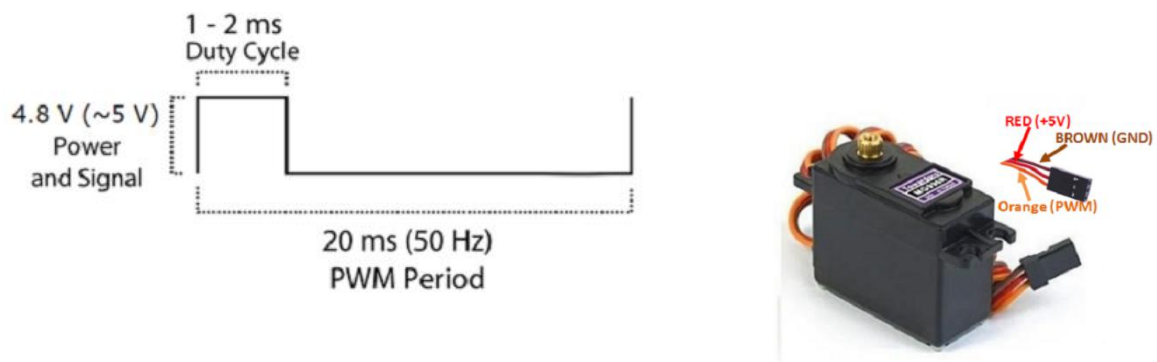

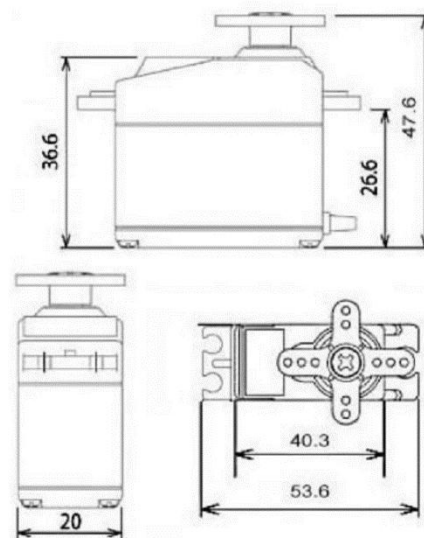**Figure 8:** *MG996R Servo Motor Wiring Diagram*

Figure 9: *MG996R Servo Motor Dimensions*

2.5.3 Arduino Uno R3

Figure 10: A*rduino Uno R3*

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno. [6]

2.5.4 Power Supply

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:
➢ **VIN**. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- **5V.** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3. A 3.3** volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**. Ground pins. [6]
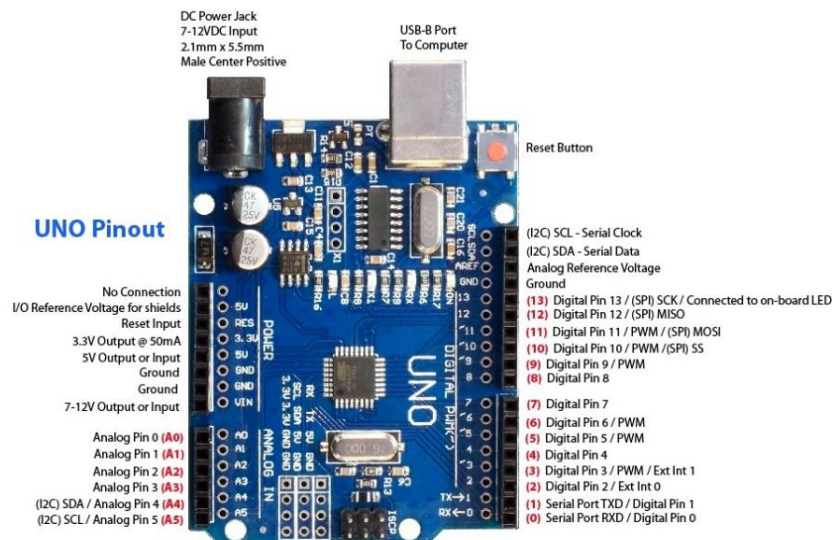
Figure 11: A*rduino Uno Labels*

2.5.5 Buzzer

Figure 12: *Buzzer*

A "piezo buzzer" is basically a tiny speaker that it can connected directly to an Arduino. "Piezoelectricity" is an effect where certain crystals will change shape when you apply electricity to them. By applying an electric signal at the right frequency, the crystal can make sound.In this project a buzzer was used.this is to emit the sound when the button wast turned on and no clothes dectected so thebuzzer will sounded as a alarm.but buzzer must be connect

with sensor to detect wether it can detect the light or not.same as buzzer the sensor will detect the light.when there is no light the sensor will working. Buzzers are devices classified as "annunciators". Their main purpose is to signal to a user that a certain condition has occurred such as a timer cycle has completed. [7]
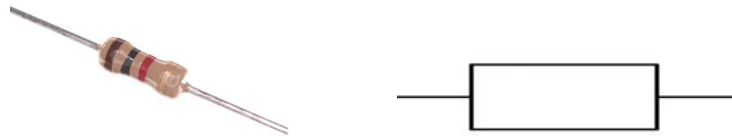
2.5.6 Resistor 1k

Figure 13: *Resistor*

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity. [8]

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits. [8]

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.
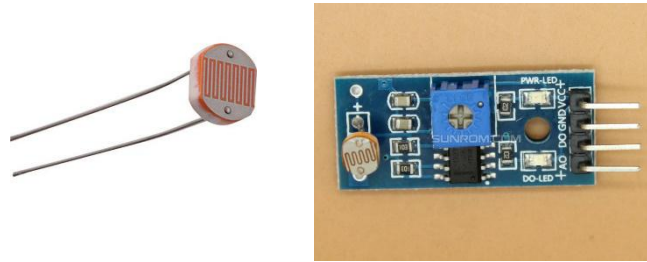
2.5.7 Sensor light dependant resistor (LDR)

Figure 14: *Sensor*

A photoresistor (acronymed LDR for Light Decreasing Resistance, or light-dependent resistor, or photo-conductive cell) is a passive component that decreases resistance with respect to receiving luminosity (light) on the component's sensitive surface. The resistance of a photoresistor decreases with increase in incident light intensity. It is not uncommon for the values of resistance of an LDR or photoresistor to be several megohms in darkness and then to fall to a few hundred ohms in bright light. With such a wide variation in resistance, LDRs are easy to use and there are many LDR circuits available. The sensitivity of light dependent resistors or photoresistors also varies with the wavelength of the incident light. [9]

LDRs are made from semiconductor materials to enable them to have their light sensitive properties. Many materials can be used, but one popular material for these photoresistors is cadmium sulphide, CdS, although the use of these cells is now restricted in Europe because of environmental issues with the use of cadmium. LDR working principle is when light falls on the semiconductor, the light photons are absorbed by the semiconductor lattice and some of their energy is transferred to the electrons. This gives some of them sufficient energy to break free from the crystal lattice so that they can then conduct electricity. This results in a lowering of the resistance of the semiconductor and hence the overall LDR resistance.The process is progressive, and as more light shines on the LDR semiconductor, so more electrons are released to conduct electricity and the resistance falls further. [9]
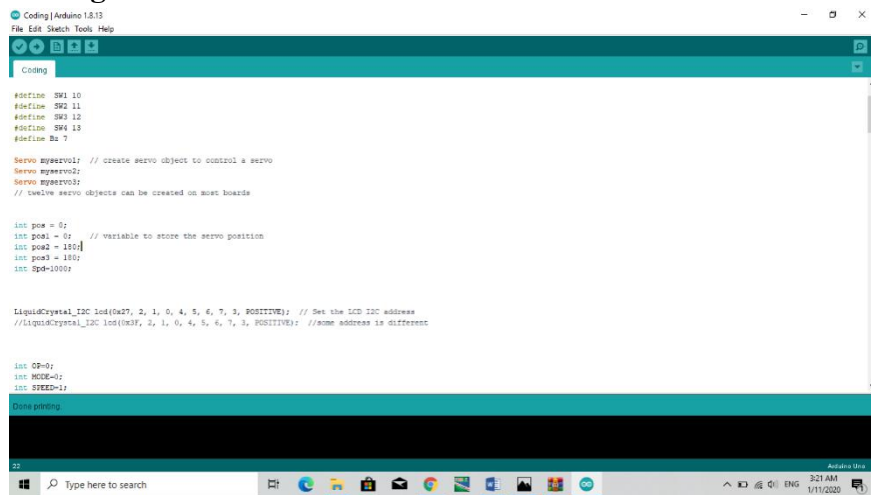

Figure 15: *Light Dependant Resistor*

2.6 METHOD SELECTION

This method selection process is important so that the method chosen were accurate and suitable for the project. This method selection will avoid money-lost and time taking processes. Hence, it is important to carry out this method selection process.

In method selection programming method was used with arduino software(IDE):-

2.6.1 Programming

Figure 16: *Programming software(IDE)*

Computer programming is the process of designing and building an executable computer program to accomplish a specific computing result or to perform a specific task. Programming involves tasks such as: analysis, generating algorithms, profiling algorithms' accuracy and resource consumption, and the implementation of algorithms in a chosen programming language (commonly referred to as coding).
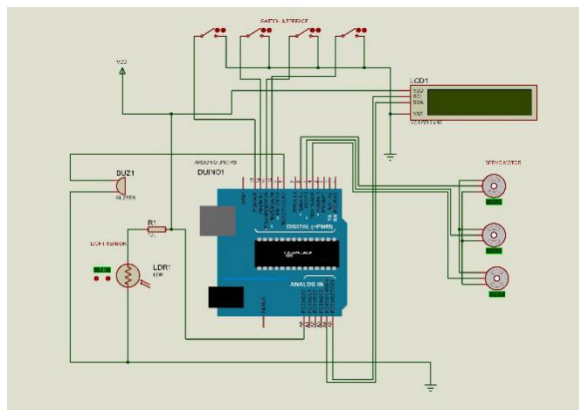

Figure 17: C*loth Folding Machine Circuit*

2.6.1.2 Programming

1. Install and open the Arduino software.
2. Insert the coding into the software.this is to send the data into the Arduino module.
3. Connect the usb to laptop port the arduino port and turn the button then upload the code in the software and wait until complete.
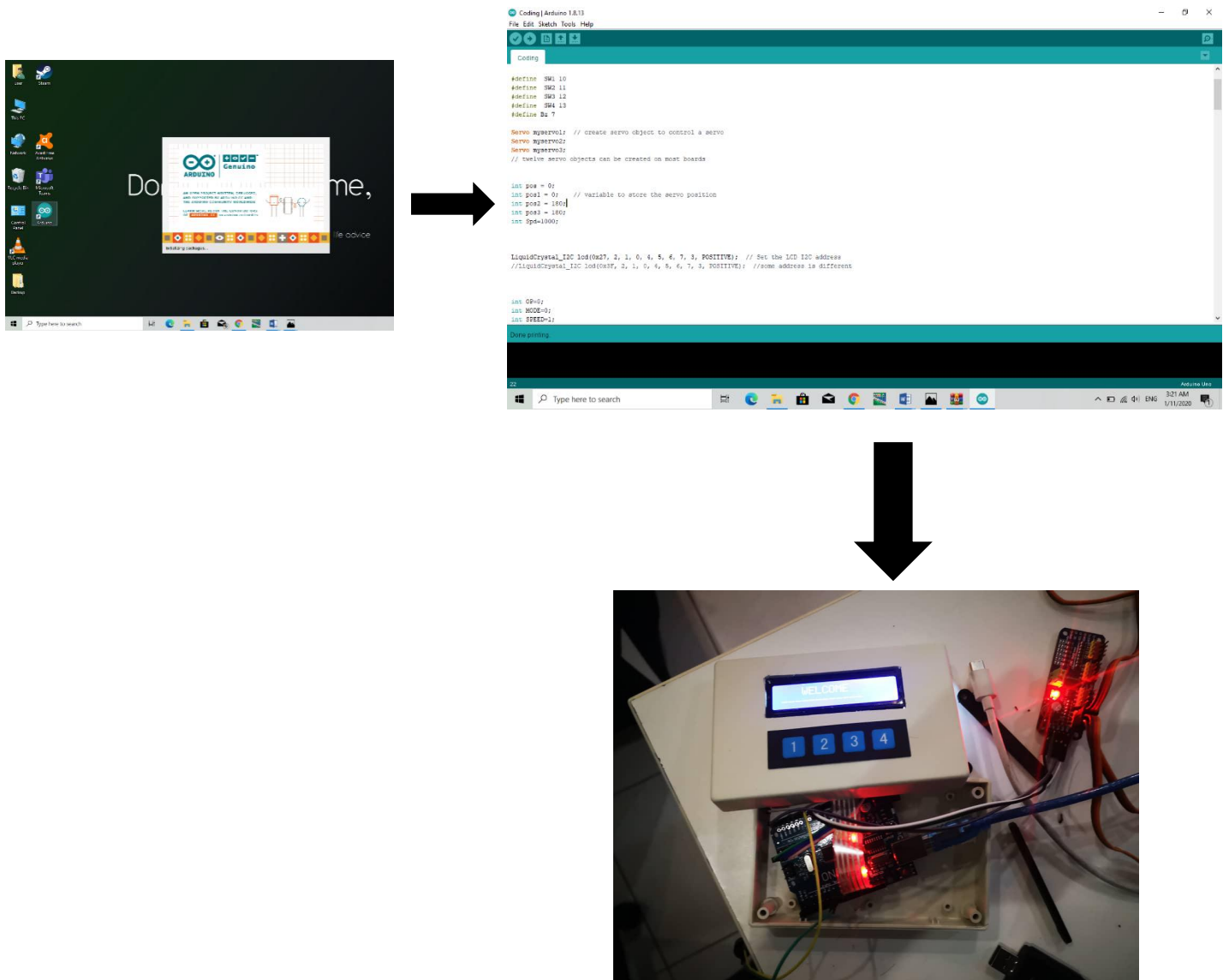

Figure 18: *Programming*

2.6.2 Fabrication

2.6.2.1 Assemble Of Material

Assembling process is important because it is to ensure the position of component is suitable or not.

i.   First we put the folding board on the plywood and glue it

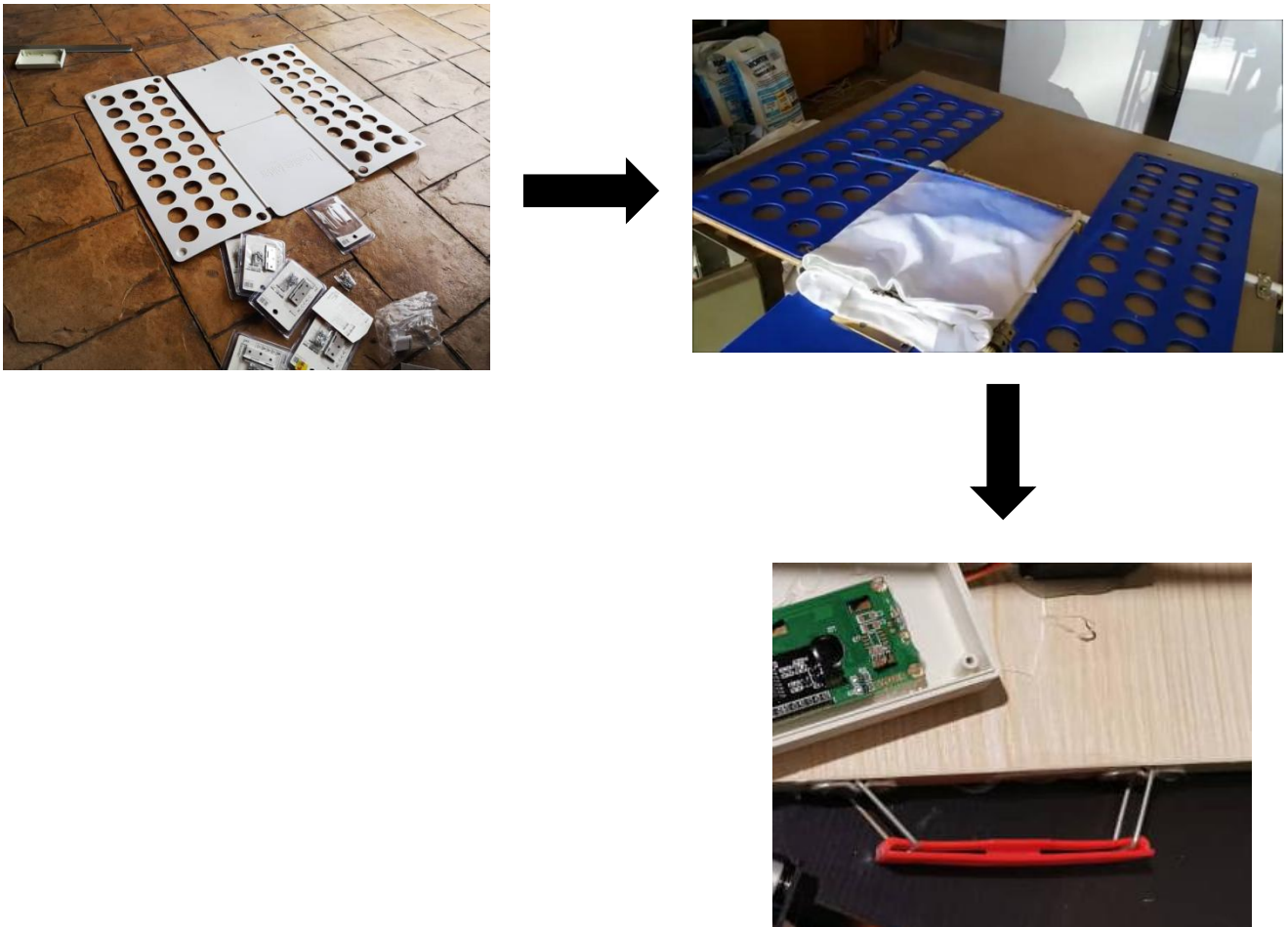ii.   Assemble the holder beside the ply wood using screw and glue

Figure 19: *Fabrication*

2.7 SUMMARY OF CHAPTER

As to conclude this chapter, literature review is important to showcase all the studies of materials and methods to enhance the knowledge on this project. Every thesis and others projects that are related to this Clothes Folding Machine is really helpful especially for us to understand it fully. After a lot of materials and methods were discussed and researches were done, the materials that are the most compatible for this project is thermoset. Due to its characters and advantages.

This machine also was develop to help the clothing printing industry where with this idea, every small or large industry can invest to use this project, so that there is no need to spend a lot of money to buy sophisticated machines. Thus, saving the economic system of the newly developed industry by encouraging locals to buy local machines that is made from Malaysia.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic. In a research paper, the methodology section allows the reader to critically evaluate a study's overall validity and reliability.it also a system of methods used in a particular area of study or activity.

This chapter looks at the various research methodologies and research methods that are commonly used by researchers in the field of information systems. The research methodology and research method used in this research is acknowledged and discussed. The chapter starts off by providing a comprehensive introduction to research. Then the research methodologies and research methods particularly used in information systems are discussed. A significant effort has been made to clarify and provide distinctions between research methodology and research method. During the course of this research, when investigating the literature on research methodology and research methods, it was found that many researchers were using the two interchangeably. Therefore the two sections on research methodology and research methods have been treated separately. A section that compares and differentiates between the two is presented first, followed by the section on research methodology. Then the different types of research methodology are described and the two main types of research methodologies namely qualitative research methodology and qualitative research methodology is discussed. The research methodology that has been utilised for this research is discussed and the reason why the particular research method was chosen with proper justification is explained. Then research methods in general are discussed and the types of research methods suitable for information systems research are explained. The differences between the qualitative and quantitative research methods are elaborated upon.

In this chapter, more information on the process of making a folding machine from step by step. At first there will be a flow chart to show the process of developing this whole project. More details about the design, the component, data, survey, components that were used will be explained in this chapter.
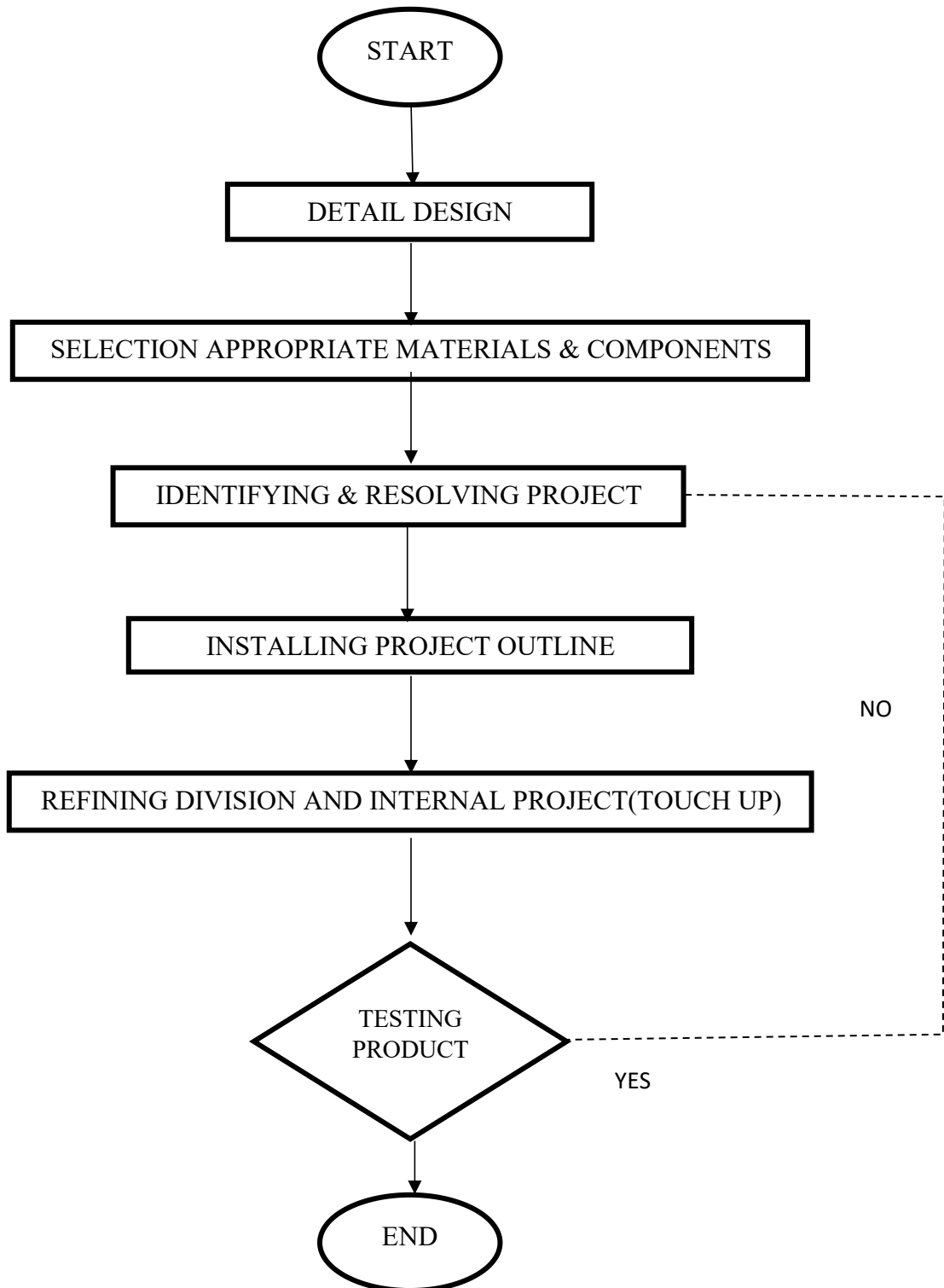
3.2 FLOW CHART

Figure 20: *Flow Chart of Clothes Folding Machine*

3.3 FLOW CHART EXPLANATION

3.3.1 Details Of Design

For the detailed design, Autodesk Inventor and Autocad were used to make design that were chosen. The design was simple and easy to handle for everyone and to save on the use of unnecessary components. In addition, the design and size of the existing folding machine on the market is large and the way of use is also quite difficult to understand so we come with a simple design, inexpensive, smaller in size and easy to operate. The aim is to help small clothes business, housewives, students, women get this machine with affordable price.

Autodesk Inventor and Autocad allows 2D and 3D data integration in a single environment, creating a virtual representation of the final product that enables users to validate the form, fit, and function of the product before it is ever built. Autodesk Inventor can be used for mechanical design, product simulation, and tooling creation. It can aid greatly in simulation and visualization even before the project are built. Inventor is a dimension driven CAD application that is used in engineering designs, visualization simulation, and documentation. For this project, autodesk was used to get a good quality of image and design along with the dimension. Figure 21 shows the design of clothes folding machine which has been sketched using autodesk inventor

Figure 21: *Software Autodesk Inventor*

3.3.2 Selected Components and Material

Table 1: *Description of Raw Materials and Components*

| NO.	ITEM	FUNCTION	MATERIALS	DESCRIPTION(mm)
1	Cloth folder	This cloth folder is ideal for this invention as it is lightweight and easy to handle.	Plastic	590m x690mm
2	Switch on off	Switch on and off the electrical current that flows for the process of folding the shirt.	Plastic	-
3	Arduino R3	Programs can be loaded on to it from the easy-to-use Arduino computer program.	- Electric component - Plastic	-
5	Servo motor	A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.	-Electric component -Plastic	-
6	Board	Base for clothes folder and handle to grip.	Wood	590mmx490mm
7	Male to male jumper wire	Jumper wires are used for making connections between breadboard and Arduino's header pins. Using them to wire up all circuits.	Plastic	-

3.3.3 Project Design
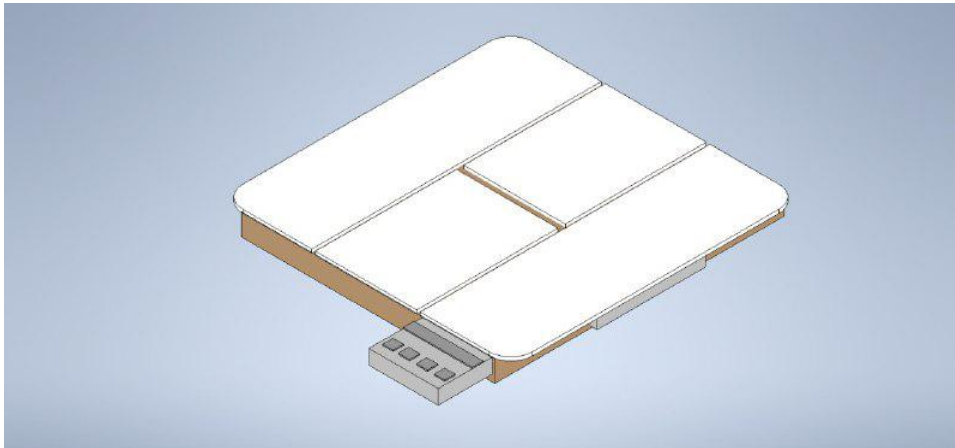
Figure 22: *Design of Clothes Folding Machine*

Figure 23: *Top view*
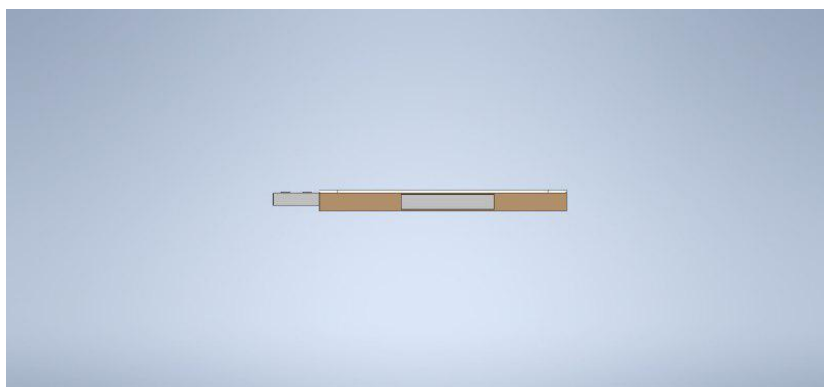

Figure 24: *Side view*
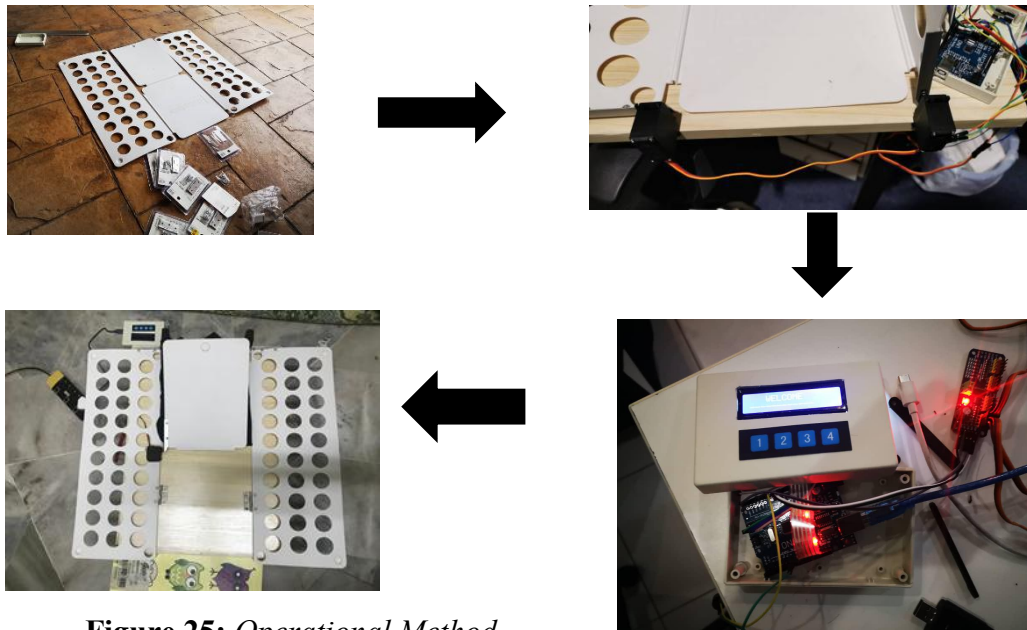
3.3.4 Operational Methodology

Figure 25: *Operational Method*

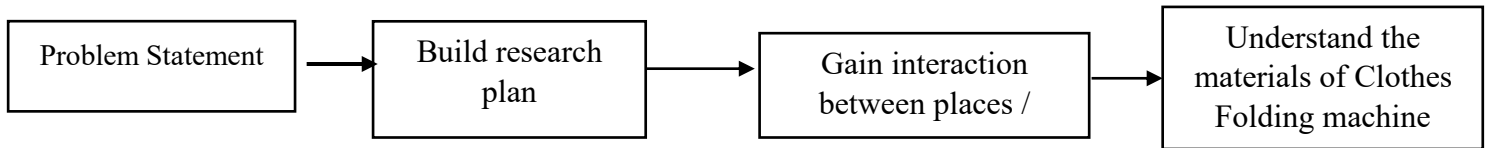## 3.3.4.1 Assemble Components and Board Folder

Assembling process is carried out by preparing a board folder and plywood. Hot glue has been used to attach folder boards to the plywood and put the board at the middle plywood. This is to ensure the product looks neat and orderly. Next, left it for a few minutes until the glue dries and after that screw the folder board using screw driver. It is to make sure the project can use for a long time and not easily uprooted. Next is glue and screw the servo motor on the plywood on the servo arm, we put a stick and glue which is a piece of aluminum that has been cut to fold the board. Lastly connect all the wire jumper with Arduino board.
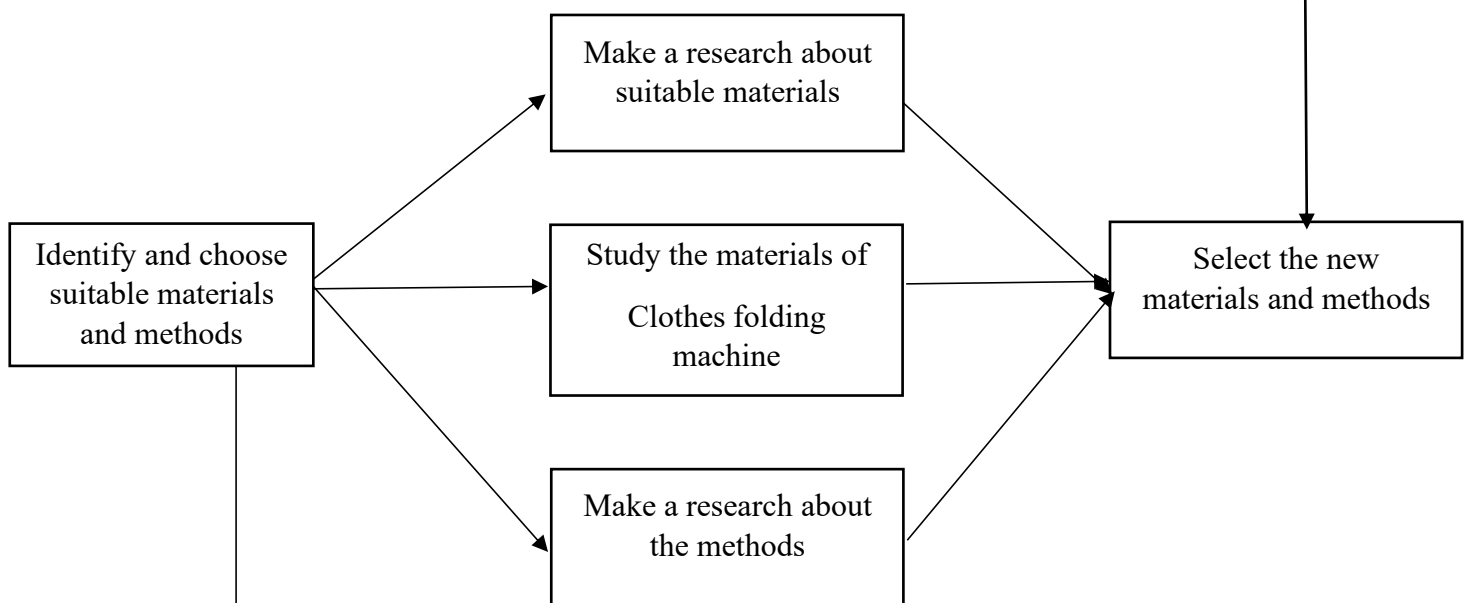
3.3.4.2 Programming

Programming into the Arduino board is called as sketches. Each sketch contains of three parts such as Variables Declaration, Initialization and Control code. Where, Initialization is written in the setup function and Control code is written in the loop function. The sketch is saved with .ino and any operation like opening a sketch, verifying and saving can be done using the tool menu. The sketch must be stored in the sketchbook directory. The suitable board were selected from the serial port numbers and tools menu. Then, the tools menu were selected and clicked on the upload button, then the boot loader uploads the code on the microcontroller. For the programming process, the Arduino software need to installed. So, after installed, the software was opened and inserted the programming code of clothes folding machine into the software. But, before upload the code programming the usb must be connected to the Arduino port and laptop port. Finally, the code programing was upload and waited until the process completed. Without using the coding, the Arduino module will not accept the data and the servo will not working
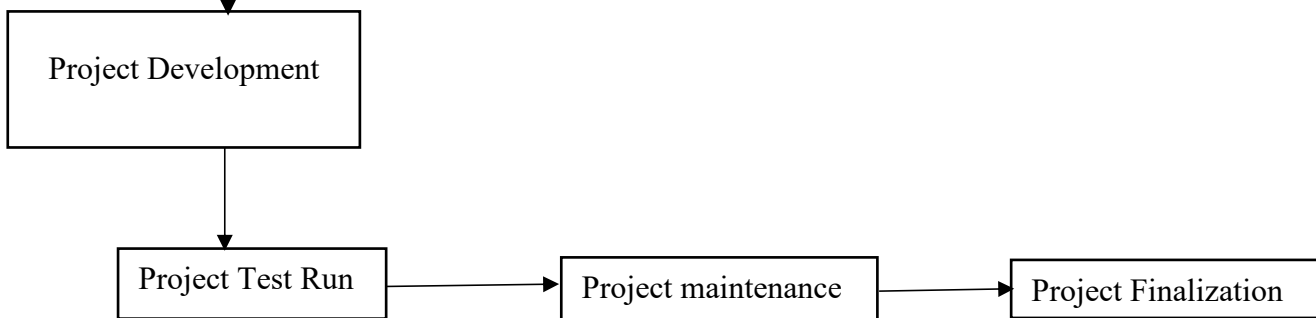
3.4 METHODOLOGY PHASE

Phase 1: Data analysis

| Problem Statement | → | Build research plan | → | Gain interaction between places / | → | Understand the materials of Clothes Folding machine |

Phase 2 : Method and Materials&components

Identify and choose suitable materials and methods	→	Make a research about suitable materials
		Study the materials of Clothes folding machine
		Make a research about the methods
		Select the new materials and methods

Phase 3 : Preliminary Study

| Project Development | → | Project Test Run | → | Project maintenance | → | Project Finalization |

3.5 BUDGET CALCULATION

NO	COMPONENTS AND MATERIAL	PRICE (AMOUNT)
1.	EXTERNAL POWER SUPPLY 3V 1A AC/DC 1 PCS	RM25 (1unit)
2.	SERVO MOTOR 3 PCS	Rm39.00 (3 unit)
3.	CONTROL PANEL BOX 1 BOX	RM5.00 (1BOX)
4.	LCD FOR ARDUINO 1 SET	RM9.50 (1SET)
5.	DC FEMALE CONNECTOR 1PCS	RM1.50 (1UNIT)
6.	BUZZER	RM10.00
7.	ARDUINO UNO R3-SMD 1 UNIT	RM32.00 1UNIT
8.	RESISTOR (1 UNIT)	RM0.50 (1 UNIT)
9.	LDR SENSOR (1 UNIT)	RM 0.50 (1 UNIT)
10.	LDR MODULE SENSOR	RM29.00 (1UNIT)
11.	JUMPER WIRE MALE+FEMALE (3 UNIT)	RM1.50 (3UNIT)
12.	FOLDING BOARD	RM11.00 1 PCS
13.	PLYWOOD	RM6.50 1 PCS
14.	HOLDER 1UNIT	RM2.00 (1 UNIT)
15.	PROGRAMMING	RM300
	TOTAL :	RM473

Table 2: *Project Budget*

ACTIVITIES	W1 (10-16/8)	W2 (17-23/8)	W3 (24-30/8)	W4 (31-6/9)	W5 (7-13/9)	W6 (14-20/9)	W7 (21-26/9)	W8 (5-11/10)	W9 (12-18/10)	W10 (19-25/10)	W11 (26/10-1/11)	W12 (2-8/10)	W13 (9-15/10)	W14 (16-22/10)	W15 (23-29/10)
PLANNING (planning)	■														
PLANNING (actual)	▥														
LITERATURE AND REVIEW (planning)		■	■												
LITERATURE AND REVIEW (actual)		▥	▥												
COMPONENT ASSEMBLY (planning)			■	■	■	■									
COMPONENT ASSEMBLY (actual)			▥	▥	▥	▥									
ABSTRACT AND POSTER (planning)				■											
ABSTRACT AND POSTER (actual)				▥											
TIDYING UP PROJECT (planning)					■	■									
TIDYING UP PROJECT (actual)					▥	▥									
TEST PROJECT (planning)							■	■							
TEST PROJECT (actual)							▥	▥							
PROJECT IMPROVEMENT (planning)									■	■					
PROJECT IMPROVEMENT (actual)									▥	▥					
COMPLETE PROJECT & TESTING (planning)											■	■			
COMPLETE PROJECT & TESTING (actual)											▥	▥			
PITEX PREPARATION (planning)												■	■		
PITEX PREPARATION (actual)												▥	▥		
PITEX PRESENTATION (planning)														■	■
PITEX PRESENTATION (actual)														▥	▥

■ PLANNING

▥ ACTUAL

3.7 REPORT WRITING

Report writing is one of the most crucial step in every project invented. It is important to make a report based on the project, test run and analysis so that future improvements nor expansion of knowledge could be done. Our report writing is based on the analysis and findings that we collected throughout this whole process of completing this project.

3.7.1 Research and Survey

In research, we make a survey on clothes factory to further strengthen the evidence to produce this product. We meet with a programmer to get help and opinion from him. We learn how to make coding from him and told him about this project. Finally, he agreed to help us on the coding. He said that this project was a good idea because it can help everyone to get this product with affordable even though this machine was simple but it gets the best result.

Figure 26: *Meet En. Tarmizi*

3.8 SUMMARY OF CHAPTER

In conclusion, the methods implemented in this project are very crucial and important to complete the project. The materials and components used in the project created a lightweight and very strong product making this project to be very convenient to everyone because the design of clothes folding machine is simple. The aim is easy to handle, operate and understand in using it but at the same time gave the high quality results.

CHAPTER 4

FINDINGS AND ANALYSIS

4.1 INTRODUCTION

      The questionnaire was distributed to the public both by hand and online. A total of 182 questionnaires were collected. There were 122 questionnaires collected from online and 60 from physical questionnaires. This data and analysis are very important for this project to achieve the objectives and scope of the project. This data indicates the successful results of the materials testing. After getting all of this data, we analyze every single possible to make it perfect.

4.2 ADVANTAGE AND DISADVANTAGE

Every project has its own pros and cons, the pros will help the people and also the environment. However, the cons or the disadvantages must be improved or change for the future so that it could enhance the good and very efficient project and to make it perfect for everyone.

The Advantage of Clothes Folding Mahine are shown in table 3:-

◆ Help those who do not have time to fold clothes.
◆ Friendly user.
◆ There are no tools or components that endanger the safety of users, especially children.
◆ Lightweight.

The Disadvantage of Clothes Folding Machine are shown in table 4:-

❖ At the beginning of the use of this machine, the clothes folder is vertically upwards. So, we need to push the clothes folder down to be able to place clothes on it.
❖ There is no cover as a casing on the side of this machine. If without a casing it is possible the tools and components could be damaged or broken.

4.3 BACKGROUND ANALYSIS OF RESPONDENTS

In this section, the gender distribution, age distribution and occupation of the research population were discussed.
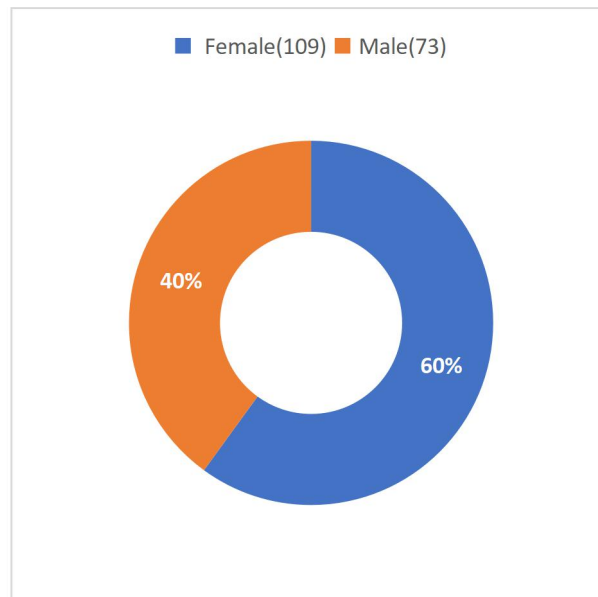
Figure 27: *Gender Distribution*

Figure 27 shows the number of citizens and the public who responded to the study conducted. A total of 40% of respondents are 73 men while 60% of respondents are 109 are women. The number of female respondents is high because most of the respondents spend more time doing housework such as folding clothes compared to men, especially those who are busy working in the office. Most women are more diligent in folding clothes manually.
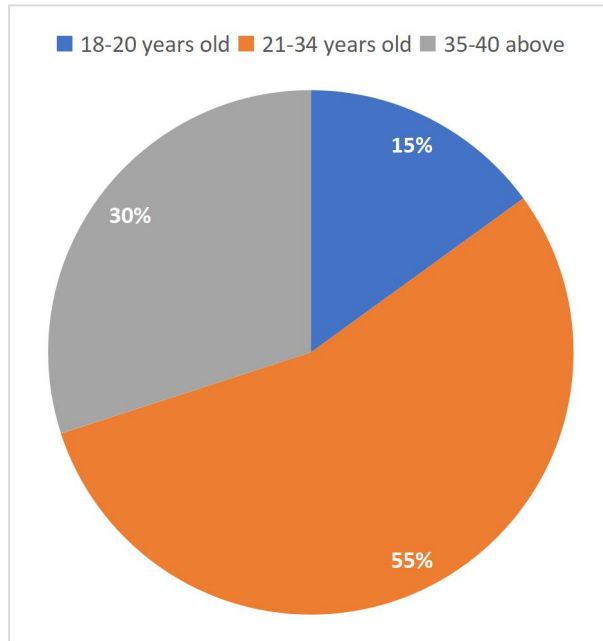
Figure 28: *Age Distribution*

The results of the study found that a total of 55% (100 people) aged between 21-34 years more answered this questionnaire. Most of them are busy working to support their daily lives or are still studying. In addition, a total of 55 respondents, as many as 30% aged 35-40 years over the year. These people have started to step into old age and they may be tired of doing housework like one of them folding clothes. Meanwhile, a total of 27 respondents aged 18-20 years, which is 15% in the category of PSA students.
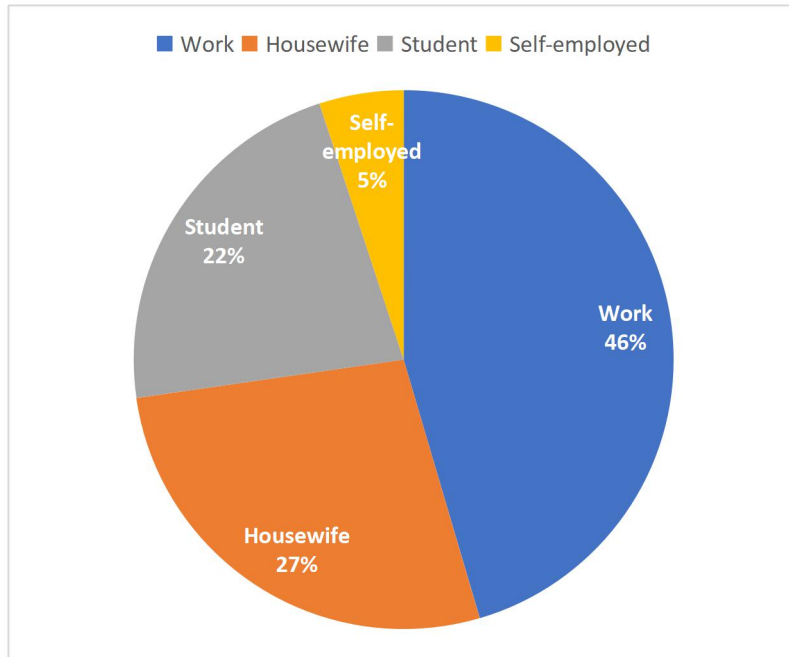
Figure 29: *Occupation Distribution*

Figure 29 represents the total number of workers at 84 (46%). This is because our objective is focused on those who do not have time to fold clothes. In addition, 49 people (27%) are housewives who always manage the household at all times while a total of 40 people (22%) are students. Next, the results of this questionnaire have found a total of 9 people (5%) for those who are self-employed such as opening a pet food and laundry (non-self-service) business around our home.

4.4 QUESTIONNAIRE ABOUT THEIR PERSPECTIVE ON THE CLOTHES FOLDING MACHINE

4.4.1 Public Who Don't Have Clothes Folding Machine
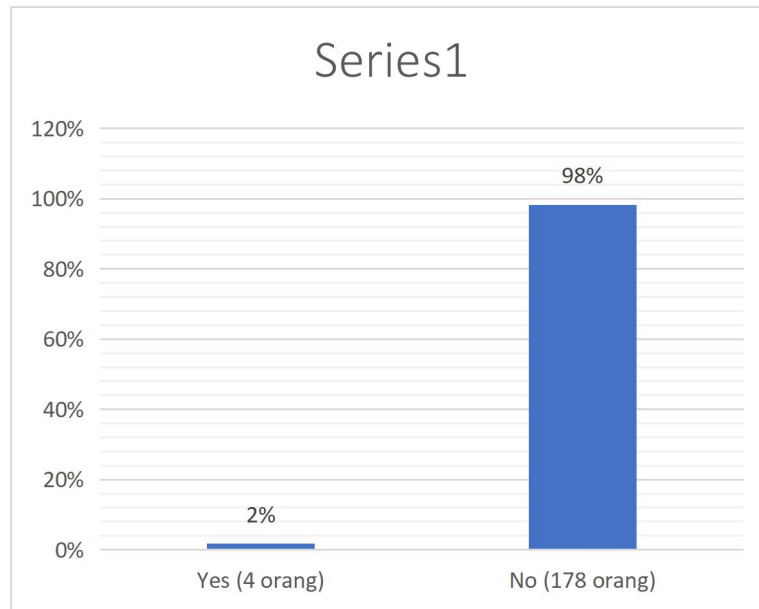
Figure 30: *Graph of Public Owning Clothes Folding Machine*

The general view of this study shows that only 2% (4 people) have a folding machine and this proves the number of Malaysians that have this machine is less than the number of Malaysians not owning it. In addition, we can see as many as 98% (178 people) who do not have this folding machine. There may be several factors that make them do not have this machine. For example, they are not exposed to advanced technology such as the existence of folding machines. Therefore, we made a few questions to see how far this machine can be marketed in Malaysia.

4.4.2 Not Enough Time To Fold Clothes In Manually
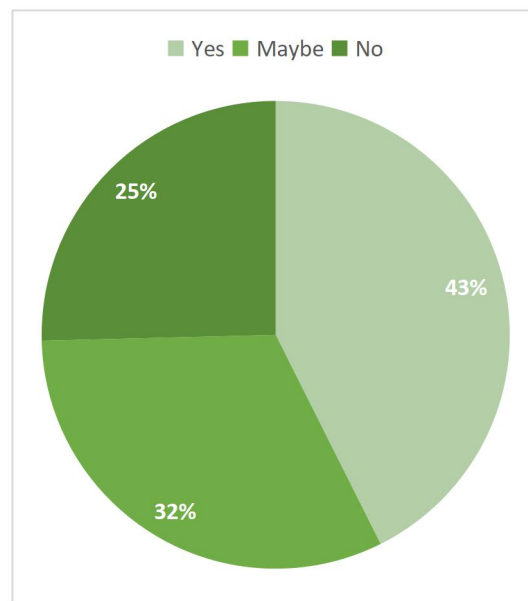
Figure 31: *Pie Chart Of Time Taken To Fold Clothes In Manually*

Figure 31 shows that 43% (78 people) said they did not have time to fold clothes manually by hand. So, it is clear that they are busy and do not have much time to spend time folding clothes. In addition, 32% (58 people) showed them there may be little time to spend with folding activities. Finally, 25% (46 people) disagree on the question and agree that they have a lot of time and no problem to fold clothes manually.

4.4.3 Time Saving Rates & Facilitates Affairs In Daily Life
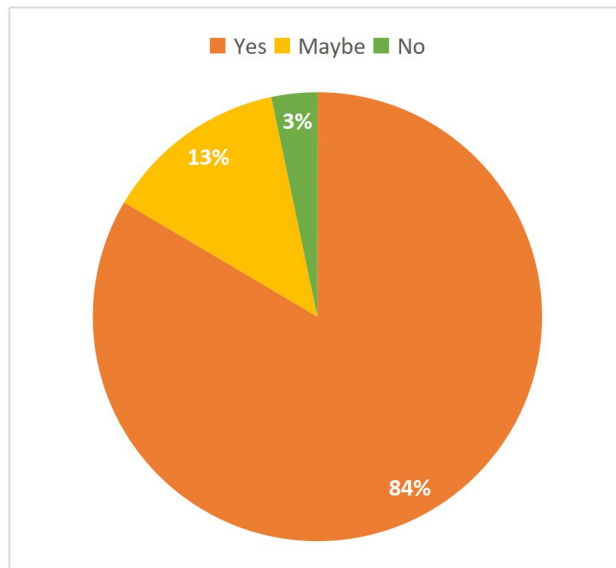
Figure 32: Pie Chart Of Time Saving Rates & Facilitates Affairs In Daily Life

Figure 32 showing data of 84% (153 people) agreed where this machine can also help them in terms of saving time and facilitate business. At the same time, they can drink, read newspapers or do other light work while waiting for the clothes to be folded. After that, as many as 13% (24 people) said maybe this machine can save time and make things easier. This is because, they are not confident in the ability of this shirt folding machine. Next, only 3% (5 people) disagreed on the ability of this machine to help them in saving time and simplifying matters. So, it is clear that they have no problems in terms of time and affairs and they are comfortable to fold clothes on their own (manual).

4.4.4 Size Of Folded Clothes Not Same
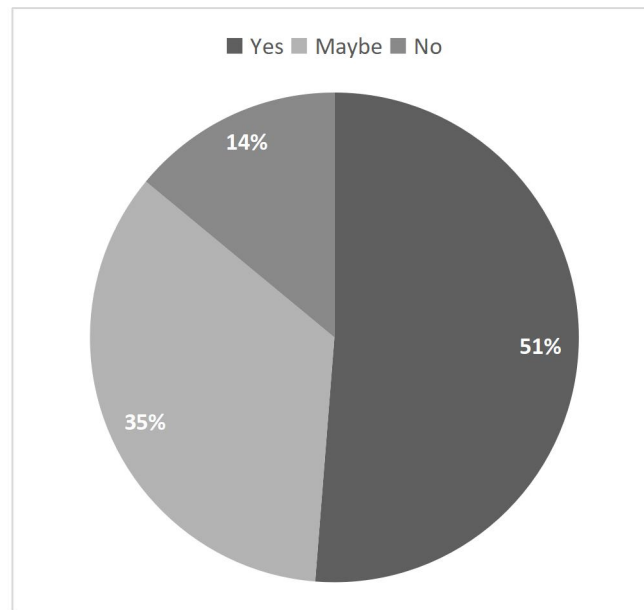
Figure 33: *Pie Chart Of The Size Of Folded Clothes*

Based on Figure 33 which displayed data of 51% (93 people). It is clear that they agreed if folding the shirt the size is not the same size and will also cause it to look untidy by hand. Meanwhile, 35% (64 people) are not confident to agree or disagree. This is because they may not believe in the ability of this machine to fold clothes properly and neatly like using manpower. Next, as many as 14% (25 people) disagreed because they themselves are able to fold clothes more neatly.

4.4.5 Respondents Who Want To Buy a Folding Machine At An Affordable Price
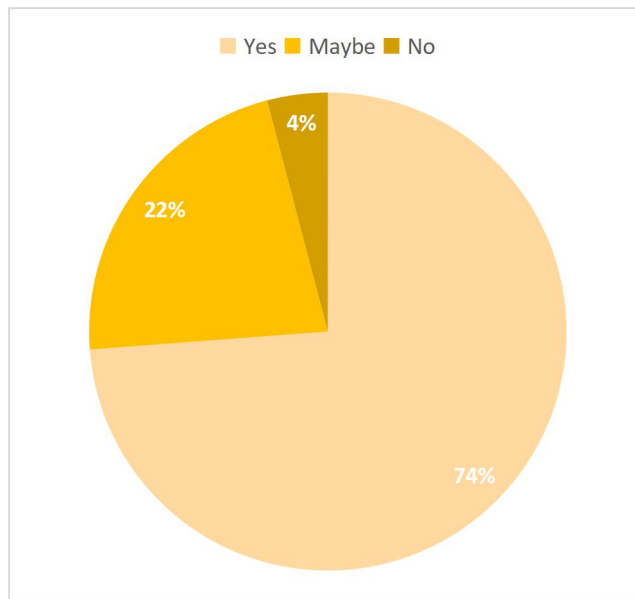
Figure 34: *Pie Chart Of Respondents Who Want To Buy a Folding Machine At An Affordable Price*

A percentage of 74% (135 people) agreed to buy it if they were offered at an affordable price for this folding machine. As a result, this seems to have a positive effect because there are people who want to buy this machine when it is marketed later. In addition, 22% (40 people) are not sure to buy it. Maybe they do not believe in the ability, durability and quality of this machine if the price is cheaper than others while only 4% (7 people) do not want to buy even if it is sold at an affordable price.

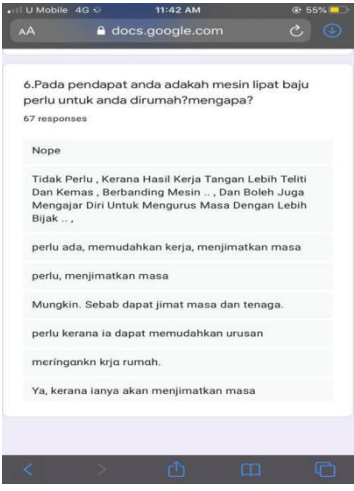**4.4.6 In Your Opinion, Does This Folding Machine Need To Be At Home? Why?**
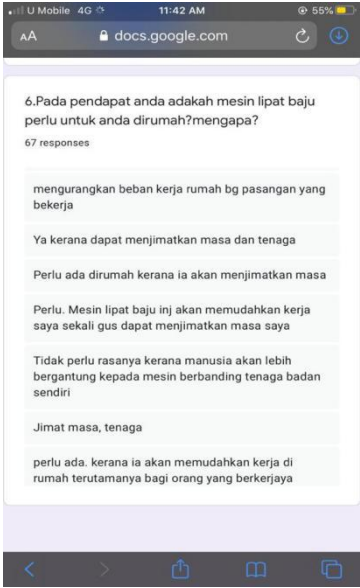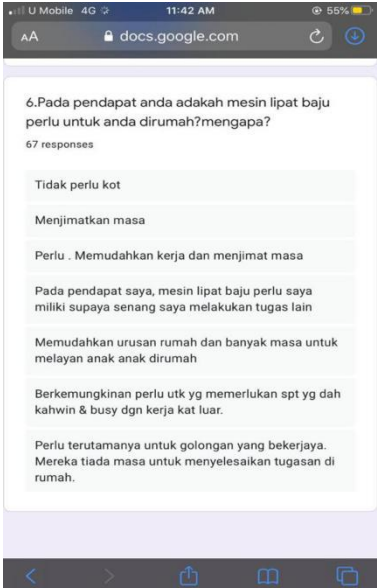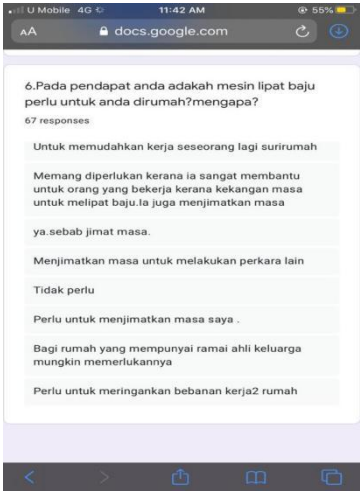
Table 5: *Example Answer of Analysis from Respondent*

Based on questionnaire given, most of people gave opinion on this folding machine is very helpful and ease the burden of house chores, especially a busy women, students and housewives. Besides that, they have said that it also saves time, less manpower and facilitates affairs in daily life.

4.5 TEST RUN

4.5.1 Test Run 1

We had conducted a running on the standard clothes folder. Meanwhile, the table 6 below shown the battery that we used and time taken for a person to fold their clothes by hand.

NO.	TYPE OF MODEL	ACTION	TOOLS	Voltage	Time Taken	EFFECT OF ACTION
1	T1	Folding the t-shirt by machine	Battery	6 volt	40 seconds	The clothes folder was stucked.
2	T1	Folding the t-shirt by hand	Hand	-	1 minutes	The t-shirt was not neat.

Table6: *Data of Running Test 1*

Remarks:

The clothes folder stucked because they do not have enough power when using the battery that has low capacity voltage.
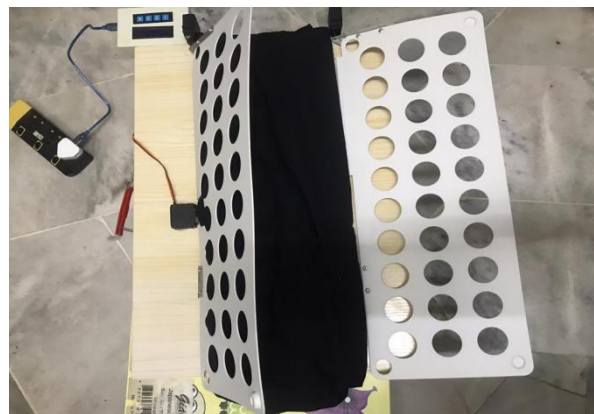
Figure 35 : *Condition of Clothes folder after Running Test 1*

4.5.2 Test Run 2

Finally,condition of Clothes Folding Machine are shown in Table 7.

NO.	TYPE OF MODEL	ACTION	TOOLS	VOLTAGE	TIME TAKEN	EFFECT OF ACTION
1	T2	Folding the t-shirt by machine	External power supply	6 volt	10 seconds	Easy to fold the cloth by use the high capacity voltage.
2	T2	Folding the t-shirt by hand	Hand	-	1 minutes	No need to fold by hand.

Remarks:

The folding machine is ready to be used perfectly and well.This folding machine is faster,neat folding and friendly user than folding the shirt itself by hand.

i.

ii.

iii.

iv.

v.
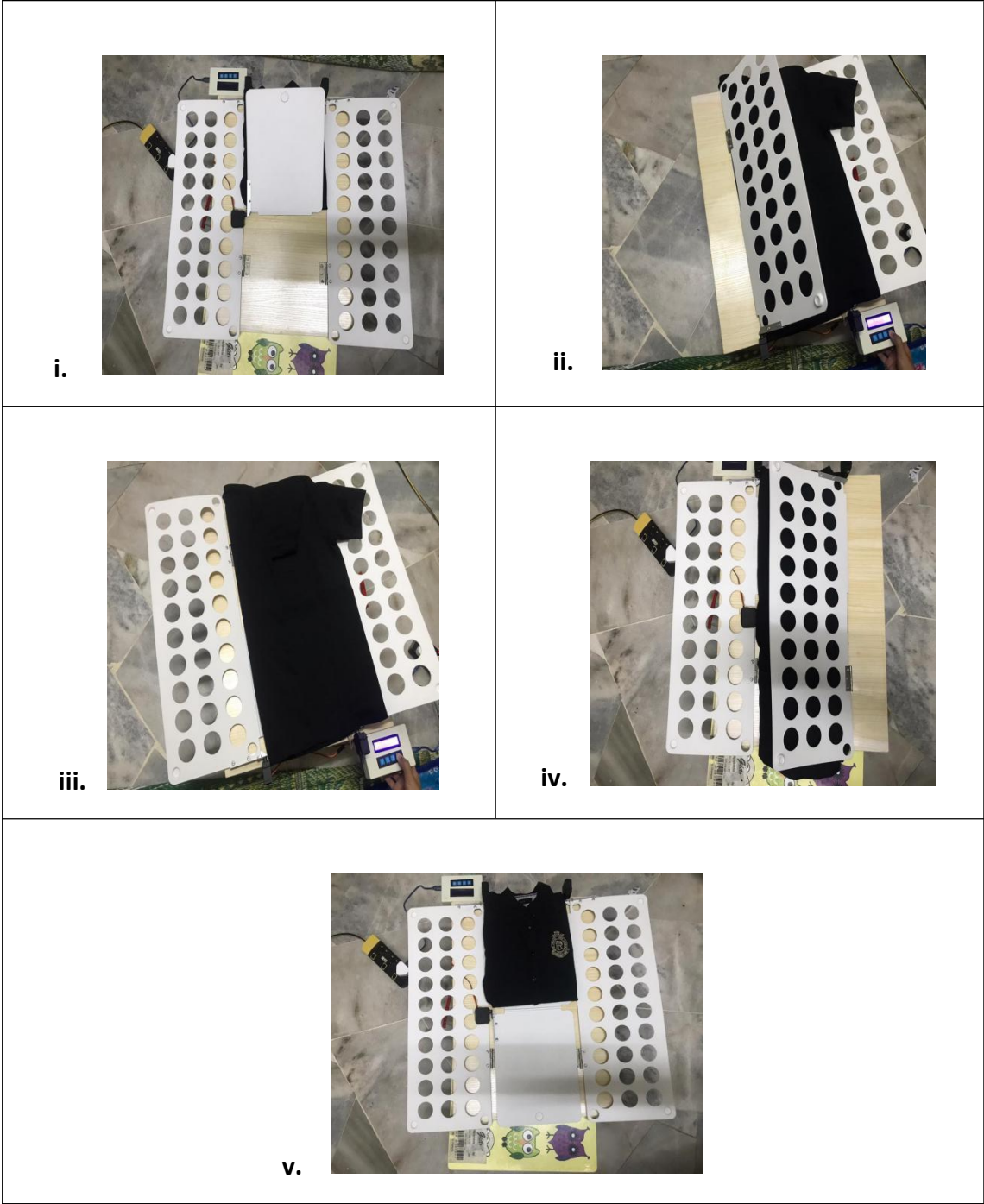
Table8: *Condition of Clothes Folding Machine after Running Test 2.*
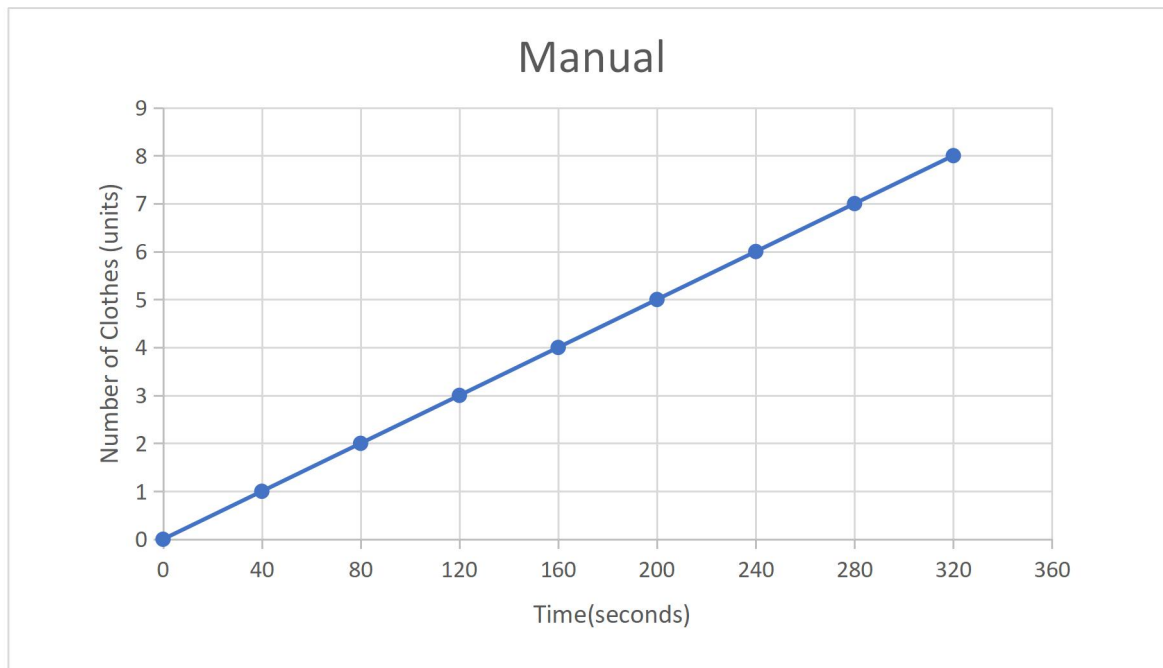
4.6 RESULT

Figure 36: *Graph of Number of Clothes (Units) Versus Time (Seconds) Manually*

Figure 36 shows that the number of shirts per unit can be folded manually should take 40 seconds. In fact, we can see here that the more the number of shirts, the more time used. For example, in this graph, it has proven if someone want to fold 2 pieces takes more than 40 seconds and will continue for the rest. In addition, anyone who uses this manual method requires more time and more manpower is used. In addition, this manual method can cause the size and finish of the fold will also be not the same between the shirt with other clothes unless those who are really careful will be able to result in a neat and orderly fold.
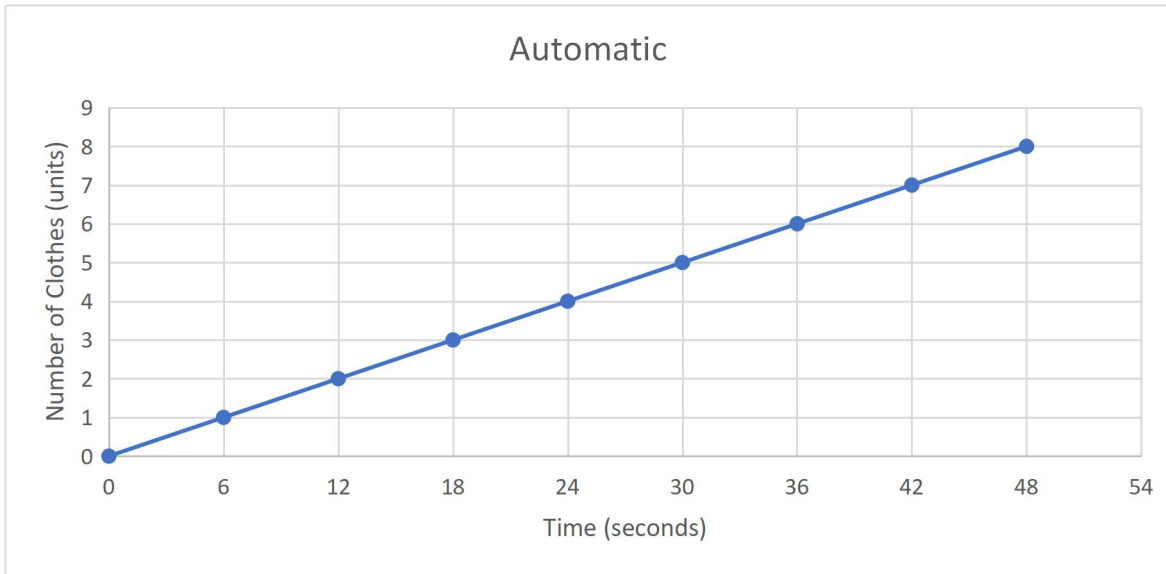
Figure 37: *Graph of Number of Clothes (Units) Versus Time (Seconds) Automatically*

The data in this Figure 37 states that a shirt can be folded automatically only takes 10 seconds. This has proven that the use of automatic folding machine can save time. In addition, the method of using automatic machine can reduce human labor compared to manual. However, this machine should also use a little energy to press the Start / Stop switch for this machine can be moved but it is not a big problem to worry about. Next, the more the number of shirts, the more time used. For example, we can see the number of shirts of 2 pieces can be folded in 20 seconds and it will continue in multiples. In addition, anyone who uses this automatic folding machine will be guaranteed to get neat folding clothes.

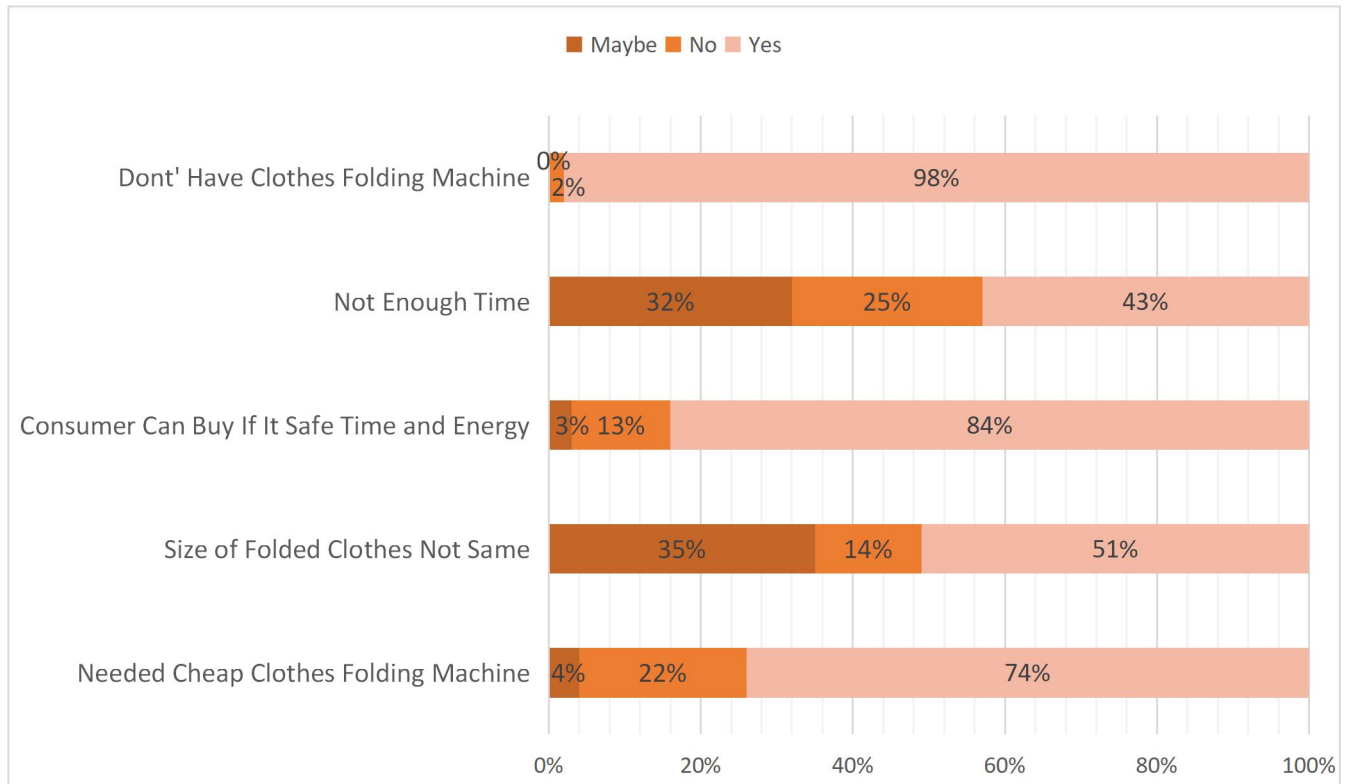**4.7 COLUMN OF CLOTHES FOLDING MACHINE**

Table 9: *Bar for Analysis Respondents*

In conclusion, based on the diagram above found that people want this product and this is also a positive sign as well as giving an opportunity to be marketed for a Folding Machine in Malaysia.

CHAPTER 5

DISCUSSION , CONCLUSION AND UPGRADE PLAN

5.1 INTRODUCTION

This chapter explains about discussion, conclusion and upgrade plan all together for the project. From the data from the test run of the project, the analysis have been done. Hence, the discussion from all the results of test run and analysis will be explain in this chapter. Then, the conclusion will be made based on the discussion and upgrade plan that have been made.

5.2 DISCUSSION

Initially, we used a battery to turn on this machine but it needs to put 3 batteries equivalent to 6volts. As a result, the machine can not move due to lack of power provided. Therefore, we change the component tool from battery to external power supply. This external power supply will provide enough power to turn on the folding machine so that the clothes folder can be moved properly plug the wall and the machine will turn on by itself.

5.3 CONCLUSION

In conclusion, it also useful for some industries such as home, clothes industry, laundry services, hospitals, boutique and so on. This machine can help users to reduce their load and is very useful for users with many clothes to fold. The time spent in folding the clothes has been cut in half as the machine is able to fold almost half the time taken manually. This is because, this machine is completely automatic and is proven by a complete cycle of folding the shirt by just pressing a button. It is recommended that the promotion to be carried out for home, living and clothing purposes.

The results of the experiments conducted on this clothes folder with other electrical components such as arduino and external charge power supply, can be concluded that Clothes Folding Machine has achieved the objective of the study which is to fabricate a machine that provides an ideal folding machine for users who are unable to manage their clothes due to works and surroundings factors, to reduce folding machine process time, to investigate the survey from responded and identify the problem, build and innovate this machine that everyone can use it even for all 10 and above age generations.

Furthermore, now is the covid-19 pandemic season where Recovery Movement Control Order(RMCO) has been carried out causing our movement to be limited to find more items to make this product more compact. However, this is not a big deal to worry about as we have done our best to complete the Clothes Folding Machine successfully.

5.4 UPGRADE PLAN

Here are some things that are suggested to further enhance the study that will be done on the folding machine to further strengthen this product: -

➢ Suggest a transparent cover using perspective as a casing to make it look more attractive and beautiful.

➢ Recommend to place the foot using plywood under the body of this machine so that the condition of this machine looks higher and easier to use.

➢ Since we use an arduino, it must have wires on the side of the machine. So, we would like to suggest to provide one container on the side of the machine so that all the wires can be placed in the container. Therefore, the folding machine will look more neat and in order.

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POLITEKNIK
MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

BORANG SOAL SELIDIK

PERSEPSI PENGGUNA TERHADAP PENCIPTAAN ALAT INOVASI.

PENGENALAN

Borang soal selidik ini digunakan untuk mendapat maklum balas daripadapengguna untuk menambah baik dan inovasikan peralatan tersebut.Borang ini bagi membuat kajian terhadap persepsi pengguna.Kerjasama tuan-tuan dan puan-puan untuk menjawab soal selidik ini dengan jujur dan telus amat dihargai.

TAJUK KAJIAN(PRODUK)

Mencipta sebuah mesin lipat baju yang dapat membantu pengguna suri rumah melipat baju dengan kemas dan cepat tanpa memenatkan.

BAHAGIAN A: LATAR BELAKANG RESPONDEN

Arahan: Bahagian ini merupakan soal selidik mengenai latar belakang anda.Sila tanda (/) pada ruang yang disediakan.

1)   Jantina

Lelaki ☐   Wanita ☐

2)   Umur

18 tahun ke bawah ☐   19-25 tahun ☐

26-30 tahun ☐   30 tahun dan keatas ☐

3) Pekerjaan

Pelajar ☐   Bekerja ☐

Suri rumah ☐   Lain-lain ☐

BAHAGIAN B: SOALAN KAJIAN

1) Adakah anda memiliki mesin lipat baju di rumah?

Ya ☐   Tidak   ☐

2) Adakah anda tidak mempunyai masa untuk melipat baju secara manual(menggunakan tangan)?

Ya ☐   Tidak ☐   Mungkin ☐

3) Jika adanya mesin lipat baju,adakah ia akan menjimatkan masa sekaligus dapat memudahkan urusan anda?

Ya ☐   Tidak ☐   Mungkin ☐

4) Adakah baju yang dilipat secara manual tidak memenuhi kehendak anda seperti saiz dan kemasan?

Ya ☐   Tidak ☐   Mungkin ☐

5) Adakah anda akan membeli mesin lipat baju jika dipasarkan dengan harga yang mampu milik?

Ya ☐   Tidak ☐   Mungkin ☐

6) Pada pendapat anda,adakah mesin lipat baju perlu untuk anda di rumah?

Ya ☐   Tidak ☐   Mungkin ☐

Sekian,terima kasih atas kerjasama anda.

Tandatangan Responden

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Tarikh:

Figure 1 : *Survey Form by Hand*

Table 1: *Survey Form by Online*