POLITEKNIK MALAYSIA

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SMART LINE MARKING MACHINE

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2. We acknowledge that the 'Smart Line Marking Machine' and its intellectual property are the original work/copy of our work without taking or imitating any intellectual property from others.

3. We agree to give up the intellectual property ownership of 'The Project' to the Polytechnic in order to meet the requirements for awarding us Diploma in Mechanical Engineering.

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) ……..……...

) MADYA MASTIKA BINTI AHMAD

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ABSTRACT

There are various types of tools used by contractors to create marking lines automatically and manually. In this modern age, most contractors use machine to save more time. However, the high cost of purchasing the machine restricts line marking work especially in educational institutions. Based on observations, there are some problems faced by educational institutions while doing line marking work. The manual process while refilling the marking medium and requires a lot of time. In addition, old marking tools are difficult to operate by unskilled operators especially large-scale marking products and difficult to carry due to their large size. The objective of this project is to design and fabricate tools that can facilitate the marking process. It is also devised to be an affordable line marking tools for commercial use. The first step in methodology is to get a design that fits the objectives of the product. Then, the fabrication process uses certain methods such as using lathe machine to produce threads on adjustable rods. The field-testing process is also carried out to ensure that the tool works properly. A modification process is made to fix the problem during the test. The Smart Line Marking Machine product has been proven to be light, easy to use and affordable. Suggestions for improvement are to increase the variety of functions of the device, increase the capacity of the battery so that it can work for a long time and add aesthetic value.

Keywords: line marker, line marking tool, portable

ABSTRAK

Terdapat pelbagai jenis alat yang digunakan oleh kontraktor untuk membuat garisan penandaan secara automatik dan manual. Di zaman moden ini, kebanyakan kontraktor menggunakan mesin untuk menjimatkan lebih banyak masa. Walau bagaimanapun, kos membeli mesin yang tinggi menyekat kerja penandaan garisan terutama dalam institusi pendidikan. Berdasarkan pemerhatian, terdapat beberapa masalah yang dihadapi oleh insitusi pendidikan semasa melakukan kerja penandaan garis. Proses manual semasa mengisi semula medium penandaan dan memerlukan banyak masa. Di samping itu, alat penandaan lama sukar dikendalikan oleh pengendali yang tidak mahir terutamanya mesin penanda skala besar dan sukar dibawa kerana saiznya yang besar. Objektif projek ini ialah mereka bentuk dan membina alatan yang memudahkan proses penandaan disamping alatan penandaan garis yang berpatutan untuk kegunaan komersial. Langkah pertama dalam penghasilan produk ialah mendapatkan reka bentuk yang sesuai dengan objektif. Kemudian, proses pembinaan produk menggunakan kaedah tertentu seperti menggunakan mesin larik untuk menghasilkan ulir pada batang boleh laras. Proses ujian di lapangan turut dijalankan bagi memastikan alat berfungsi dengan baik. Proses pengubahsuaian dibuat untuk memperbaiki masalah semasa ujian dijalankan. Produk Smart Line Marking Machine ini telah terbukti ringan, senang digunakan dan mempunyai harga berpatutan. Cadangan untuk penambahbaikkan ialah menambah kepelbagaian fungsi alatan, meningkatkan kapasiti bateri agar boleh bekerja boleh lama dan menambah nilai estetika.

Kata kunci: penanda garisan, alat penandaan garisan, mudah alih

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CHAPTER 1
INTRODUCTION

(Prepared by: Muhammad Farid Bin Che Long)

1.1 Introduction

The Industrial Revolution 4.0 was inspired by Gordon Moore in 1965. It is transforming our daily lives for the better with technology and engineering [1]. These changes are driven by 3 key technology domains, physical, digital and biological. In line with the Industrial Revolution 4.0, students in IPTA and IPTS must break out the habit by mastering the four elements of Critical Thinking & Problem-Solving Communication, Collaboration and Creativity [2].

Most developed countries such as Japan and Germany have made many advances in technology and engineering in the wake of this revolution. Our country strives in various fields of performance and engineering to compete to prove the power of each other while exchanging ideas with each other. As such, the project aims to create new products to facilitate the day to day business of Smart Line Marking Machine.

1.2 Background Research

There are many types of tools used by contractors to make marking line such as football fields automatically and manually. In this modern age, most contractors use products to save more time.

However, the high cost of buying a product restricts the work of line marking especially in educational institutions. In addition, these products require skilled operators cause the educational institutions often use manual method for line marking. Therefore, the project was undertaken to facilitate and reduce the cost of doing line marking work at educational institutions.

These marking tools are affordable and easy to operate. The large capacity of the marking medium saves time as it automatically works. In addition, various marking mediums should emphasize in this project as there are various types of marking mediums such as oil and paint. This tool allows various marking mediums to be used during line marking process.

In conclusion, this tool makes marking working work easier because the product easy to handle and save more time during the line marking process.

1.3 Problem Statement

Based on the observation, there are some problem that this education institution faces when doing line marking work. The manual process requires medium refill regularly and take a considerable amount of time. In addition, old marking tools are difficult to handle by unskilled operators especially large-scale marking product and difficult to carry because of their large size.

1.4 Research Objectives

1. To design and develop an equipment that can make the line marking process easier.
2. To fabricate a line marking equipment.
3. To fabricate an affordable line marking equipment for commercial use.

1.5 Research Questions

This study will answer the following questions:

- Does the innovation of the smart line marking machine is effective in solving the problem manual process requires medium refill regularly and does it will give benefit to everyone?

Hypothesis will be studied in this research earlier:

H0: The different between the original line marking at the market with the smart line marking machine that us develop.

H1: Is there any different between the original line marking machine with smart line marking machine.

1.6 Scope and Limitations

This tool is used in educational institution and utilized for outdoor and indoor setting. The functionality is limited to line marking work only.

1.7 Contribution

There are many lines marking machine now is use in this era but the current line marking machine is don't have improvement on it and many education institutions that use old method while do line marking work. This project will be helping educational institutions purchase affordable products as well as easy-to-find spare parts in spare parts store. This product also does not require skilled operators which requires high cost to hire a contractor to do the marking work especially educational institutions.

1.8 Summary of Chapter

In conclusion, through the research done to produce this project, the problem can overcome in line marking machine especially education institution. Although the main purpose of this project is to design and develop an equipment that can make line marking process easier. This project will also to fabricate an affordable line marking equipment for commercial use.

CHAPTER 2
LITERATURE REVIEW

(Prepared by: Muhammad Idham Bin Ismail)

The study of literacy in some terms is the previous research that has been made before. Every good research, it must have a reference to every opinion or statement that is presented. It shows that the research is a mature research and has a valid source.

Every research carried out requires a clear source or opinion and is believed to be valid. This is to make the study sound and strong in defending its opinion.

2.1 Introduction

This chapter discusses the concepts thoroughly. Based on the internet, reference books and observations. The purpose of this discussion is to describe the existing design and to see how far the project can be implemented. Objective this project is done to innovating a project design is in terms of line marking product. Most of the production of the line marking product need skilled operators to handle the product and high price to buy. So, produce an easy line marking product that affordable.

The purpose of this discussion is to describe the method used in designing project models. Uses of equipment and components that have a relationship with the design chosen to meet the criteria as a student Diploma in Mechanical Engineering.

General issues of issues or areas of focus should be identified thus providing the appropriate context for literature review. Term “Literature” means a review article referenced to understand and study research problems. Literature study is used to provide a study with to see the research done in the field of study and not just summarizes the studies conducted by other researchers. Overall trend suggestive titles in theory, methodology, evidence and conclusions. To clarify yet the projects that have been produced here are about advantages “Smart Line Marking” which is produced in comparison with a tool is already available in the market today.

2.2 Theory/Concept

2.2.1 History

Regular line markings on sports pitches have been in existence since the 19th century. This coincided with the formation of the Rugby Football Union and the Football Association. Each governing body started to introduce their own rules and regulations, which led to different pitch markings for the different sports. Also, around the same time, the All England Croquet Club began to offer lawn tennis.

The vast majority of these sports were played on grass surfaces, which required some form of line markings. Some of the earliest materials used to create pitch markings include dust and wood shavings. Eventually, this progressed to limestone materials and chalk, which could easily be crushed to create simple dry marking compounds. These compounds were easy to spread. Plus, the chalk and limestone materials were white, which meant they reflected the light. This improved the visibility of the pitch lines.

Early pitch marking materials did not last long, as they were easily washed away during the rain. To help overcome this problem, weed killer was substituted for white line marking materials or creosote was used. This was an acceptable practice between the 1960's and 1980's, however, it is now illegal to use lime and creosote. It was also during this period of time that a wide range of marking products became readily available. These new products offered enhanced engineering techniques and a better design [3].

2.2.2 Line Marker

A line marker is a device or product with which line or marking are drawn on a sport field or pitch. They were originally developed to mark out lawn tennis court on grass, but later also become used in many others sports with outdoor pitches. The marked lines are often white, but may in any colour. A variety of devices have been used, some of them are robotically controlled [4].

Figure 2.1 Manual Line Marking

Device for line marking as shown in Figure 2.1, include wheel to wheel transfer, wheel and gravity feed, belt feed and gravity feed. Later use professionally include pressure pump systems. Major League Baseball recommends a line marker as essentials equipment for maintaining baseball and softball fields [4].

In 2010, companies began developing completely robotic lines marker which use GPS input to navigate, intended to eliminate the need for human to operate the product or direct the location of the lines being laid [4]. There are several concepts used in this product such as pressure concept, electrical concept and mechanical movement concept.

2.2.3 Pressure Concept

Pressure is defined as force per unit area. It is usually more convenient to use pressure rather than force to describe the influences upon fluid behavior. The standard unit for pressure is the Pascal, which is a Newton per square meter. There are many physical situations where pressure is the most important variable. If you are peeling an apple, then pressure is the key variable: if the knife is sharp, then the area of contact is small, and you can peel with less force exerted on the blade. When you deal with the pressure of a liquid at rest, the medium is treated as a continuous distribution of matter. But when you deal with a gas pressure, it must be approached as an average pressure from molecular collisions with the walls.

Pressure in a fluid can be seen to be a measure of energy per unit volume by means of the definition of work. This energy is related to other forms of fluid energy by the Bernoulli equation [5].

The concept of pressure applied is to pump the medium in the storage. It requires pressure to pump out the marking medium out of the storage. It makes the medium outward movement smoother to create lines.

2.2.4 Electrical Concept

The concept of electrical applied in this project is power supply. A power supply is a component that supplies power to at least one electric load. Typically, it converts one type of electrical power to another, but it may also convert a different form of energy – such as solar, mechanical, or chemical into electrical energy.

A power supply provides components with electric power. The term usually pertains to devices integrated within the component being powered. For example, computer power supplies convert AC current to DC current and are generally located at the rear of the computer case, along with at least one fan. A power supply is also known as a power supply unit, power brick or power adapter [6].

This product using chemical into electrical energy power supply to produce electric in pump. It is using DC current that can recharge after 4 hours using it. It also has indicator to monitor battery percentage. The battery also can replaceable.

2.2.5 Concept of Mechanical Movement

Mechanical movement is a state of motion that moves from one point to another. Mechanical movement is the mechanism or system that enables the product to function, move or rotate. Mechanical movements are often used in everyday life to facilitate human daily work. In general, mechanical movement, as shown in Figure 2.2 is used to move a source (input) through the process of producing a movement (output).

Figure 2.2 Concept of Mechanical Movement

Mechanical systems used in everyday life often combine both linear and rotational motion to produce work. Mechanical movements can be generated either manually or by electric motors. Mechanical movement is manually controlled using human hands or physical force. Example like bicycle, screwdriver and hand drill. The movement produced by the engine is the result of the use of chemical energy. Petrol or diesel is a commonly used source of energy. Example like lawn mowers, motorcycles and cars. The next movement is the movement of the electric motor. This movement is done with the application of electric motors. This movement requires an electric circuit which allows the electric energy to be transferred to the motor.

This product using two type of mechanical movement that is manually and movement using electric motor. Manual movement by pressing the brakes to drain the medium. Movement using an electric motor is the movement of a pump in storage.

2.3 Existing Design

2.3.1 SS And Plastic Paint Line Marking Product

SS and Plastic Line Marking Product. Good quality product for marking line on sports ground grass. It has front wheel marking for convenience, tank capacity of 20 liter to cover 2.5 football pitches in one filling and removable tank wheel, easy to lift for cleaning. The line marking has a knurled transfer wheel for improved fluid pick up. As wheel as easily fitting spare parts available. Complete with large rigid handle. Furthermore, it is equipped with heavy duty 305 mm solid rubber wheels for 60 mm extra ground clearance and 100 mm steel rollers. The diameter of rear rollers are 135-140 mm, center 105-110 mm, front 160-165 mm and tank lip-3” wide. This line marker for use by professional ground men. Figure 2.3 shows SS and Plastic Paint Line marking Product

Figure 2.3 SS and Plastic Line Marking Product

2.3.2 **Spray Line Marker FM 500**

Spray Line Marker FM 500. Spray line marking cart with automatically pressure generating. The needed spray pressure will be generated by pushing the cart with a newly developed impeller-pump (rear wheel-drive). The spraying unit is positioned in front of your view, flexibly for adjust in height and lateral and to operate easy by a hand lever at the guiding shaft. Line width is adjustable from 50 up to 150 mm. Cart has 2 plastic paint containers with 13 and 19 liters. Wheels 260 x 85 mm with roller bearing ensures an easy working and an exact lining. Figure 2.4 shows Spray Line Marker FM 500.

Figure 2.4 Spray Line Marker FM 500

2.3.3 **Permanent Aerosol Line Marking**

Permanent Aerosol Line Marking. Permanent aerosol traffic line marking paints exhibits excellent exterior durability, water, weather and abrasion resistance. Easy and strong locking handle to adjust line width from 5 to 10 cm. Thinner lines also possible from 3 to 5 cm. 4 wide wheels for a better stability. Figure 2.5 shows Permanent Aerosol Line Marking.

Figure 2.5 Permanent Aerosol Line Marking

2.3.4 **DP-LC88OTD Hydraulic Airless Two Component Line Striper**

DP-LC88OTD Hydraulic Airless Two Component Line Striper product is the high-performance hydraulic stripper. Requires precise line and demand reflective beads. Specification are model number DP-LC88OTD. HONDA GX200 engine are using to give power to the machine. It can controls using Hand Mounted Controls [7]. Figure 2.6 shows DP-LC88OTD Hydraulic Airless Two Component Line Striper.

Figure 2.6 DP-LC88OTD Hydraulic Airless Two Component Line Striper

2.3.5 **RS-1 Thermoplastic Road Marking Product**

RS-1 Thermoplastic Road Marking Product special purpose equipment for road marking. Specification are model number RS-1 Thermoplastic Road Marking Product. Product dimension 1210*760*1000mm. Weight 125 KG. Marking Speed 500-1200 m [8]. Figure 2.7 shows RS-1 Thermoplastic Road Marking Product.

Figure 2.7 RS-1 Thermoplastic Road Marking Product

2.4 Summary of Chapter

In conclusion, a line marker is a device or product with which line or marking are drawn on a sport field or pitch. This product using three concept to fabricate line marking machine such as pressure concept, electrical concept and mechanical concept. The concept of pressure applied is to pump the medium out from storage. It requires pressure to pump out the marking medium. This product using rechargeable battery to generate electrical energy. It using rechargeable battery that can recharge after 4 hours using it. Two type of mechanical movement that is manually and movement using electric motor apply in this product. Manual movement by pressing trigger to drain out the marking medium. Movement using an electric motor is the movement of a pump. Research about existing design line marking machine to design and develop this product.

CHAPTER 3

METHODOLOGY

(Prepared by: Wan Nur Athirah Binti Wan Mohamed)

3.1 Introduction

Methodology is a method and technique of designing, collecting and analysing data in order to produce evidence that can support a study to continue what is being studied. Methodology describes how a problem is studied and why a particular method and technique is used. The purpose of the methodology is to help provide a broader and more detailed understanding of the application of the method by providing a description of the research process.

The discussion and elaboration of an idea must be carried out as it is essential to the development of a project. Each step in the project is the process of completing the project. Therefore, each step should be carefully planned and followed. If there are any problems, it can have a negative impact on the project, thus making the project work poorly. Before completion, various processes need to be followed in the correct and proper procedure to ensure the project is completed without any problems. For example, a project should be accurate and accurate and use the right materials according to the work required.

3.2 Flow Chart

Figure 3.1 shows the actual product process flow charts.

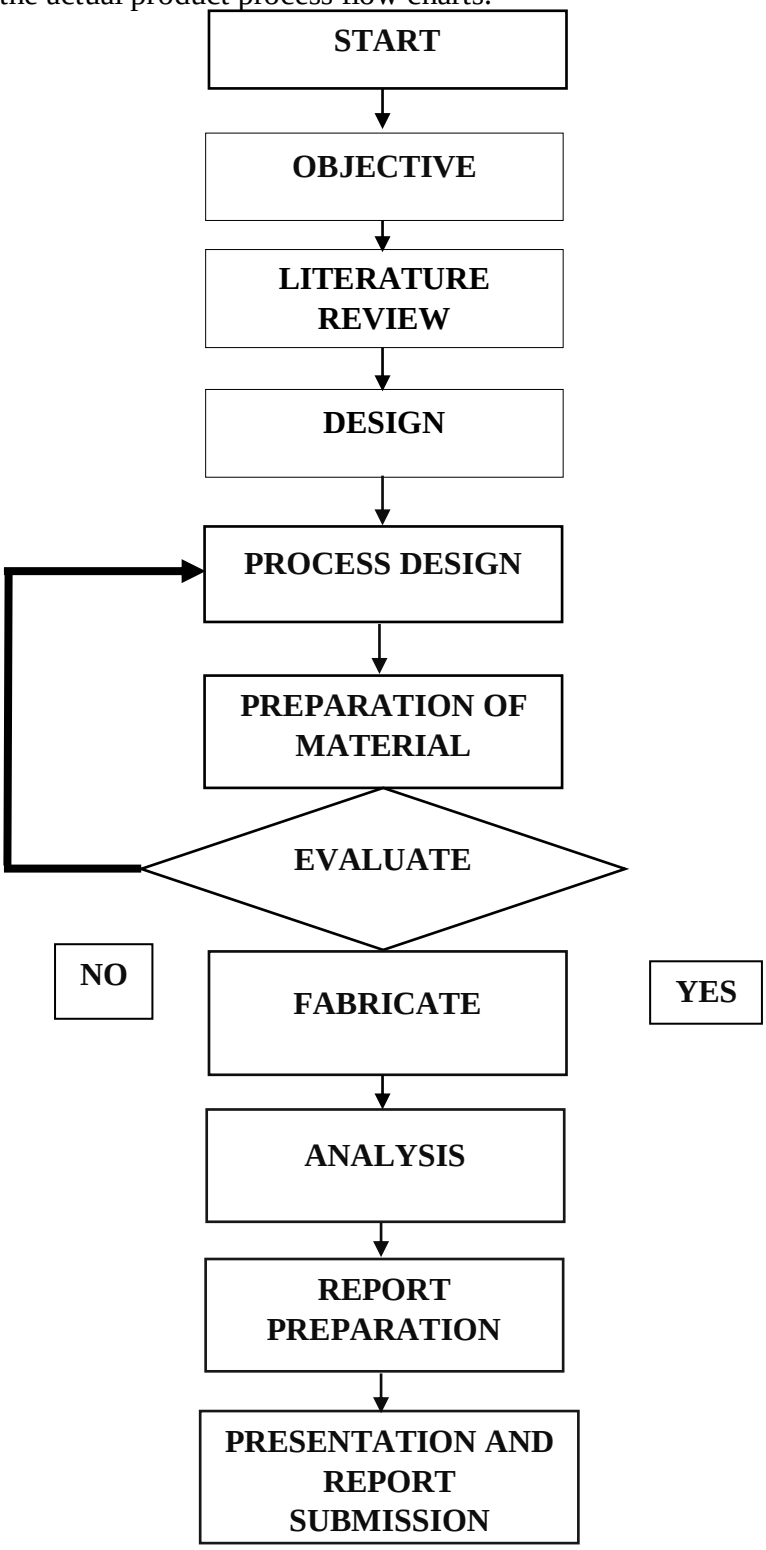

Figure 3.1 The actual product process flow chart

3.3 Methodology Phases

This work project goes through few phases. The length and details may vary from project to project, but all will still follow the same basic framework. While some project, methodologies such as agile approaches compare or repeat the following stages in faster, interactive cycle, the work of each phase is visible and distinct in every project. Phases or stages are very important to manage project. It is to ensure that the deliverable produces at the end of the each phase meet their purpose. The phase introduction, objective, literature review, design, process design, preparation of material, evaluate, fabricate, analysis, report preparation and presentation and report submission.

Firstly, introduction is to briefing and got title for final year project. A solid project initiation is to set the project up for success. During introduction, the project team members were brief on the overall project and brainstorming about problem faces by education institution while do line marking work.

Secondly, state objective to design and develop idea. Project objectives must be measurable and contain key performance indicators that will be used to assess a project's overall success. These indicators will often include criteria such as budget, quality, and time to completion. Project objectives also let teams know what they should be focus on to achieving overall project success.

Next, study and gather information about this project in literature review. At this phase, team discusses the concept thoroughly. The purpose of this discussion is to describe the existing design and to see how far the project can be implemented. This group is innovating a project design is in terms of line marking product. Most of the production of the line marking machine need skilled operators to handle the product and expensive price. So, fabricate this product easy to use and affordable price especially for education institution.

Then, design is another step to success this project. In this phase, some sketches are drawn based on the information that has been collected. The best sketches have been selected according to product specifications.

After that, preparation and evaluate of material by list the part and material to use to fabricate this product. The materials management goal is to ensure that building materials in their perspective when you need to. Materials management system attempts to ensure that the correct quality and quantity of material is appropriate, purchase, delivery and on-site processing in a timely manner and at a reasonable cost. Materials management system

attempts to ensure that the correct quality and quantity of material is appropriate select, purchase, delivery and on-site processing in a timely manner and at a reasonable cost. Fabrication process begin after preparation and evaluate material.

In analysis phase, team calculate the information have been gathered to identify and understand the needs of the project. The project is using mini diaphragm pump to pump marking medium out from storage. Speed valve install to control speed marking medium by adjusting the speed valve according to the suitability of the marking work.

Lastly, report preparation by gather data and information from beginning project and write report with actual format.

3.4 Smart Line Marking Machine Component

1. Storage Tank

Storage tank to store marking medium with a capacity of 16 liters. Motors, switches and speed valves are also installed on the tank. Figure 3.4.1 shows storage tank at Smart Line Marking Machine.

Figure 3.4.1 Storage Tank

2. Mini Diaphragm Pump

Mini diaphragm pump with a pressure 300 psi or 12 bar. It helps pump the marking medium out of the storage faster. Figure 3.4.2 shows mini diaphragm pump at Smart Line Marking Machine.

Figure 3.4.2 Mini Diaphragm Pump

3. Rechargeable Battery

This 12V battery has been used because it can last up to 4 to 5 hours depend on its usage. Figure 3.4.3 shows rechargeable battery at Smart Line Marking Machine.

Figure 3.4.3 Rechargeable Battery

4. Speed Valve

User can control the speed of the marking medium by adjusting the speed valve according to the suitability of the marking work. Figure 3.4.4 shows speed valve at Smart Line Marking Machine.

Figure 3.4.4 Speed Valve

5. Switch

Switches are used to conduct electric current. Figure 3.4.5 shows switch at Smart Line Marking Machine.

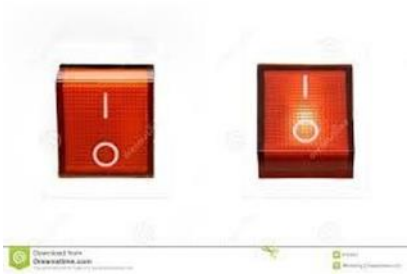

Figure 3.4.5 Switch

6. Adjustable Aluminium Stick

Adjustable toolbar can provide comfort to users when doing line marking work. Figure 3.4.6 shows adjustable aluminium stick.

Figure 3.4.6 Adjustable Aluminium Stick

7. Paint Roller

This smart line marking product also comes in a variety of sizes and types of paint roller to suit your desired size. Figure 3.4.7 shows paint roller at Smart Line Marking Machine.

Figure 3.4.7 Paint Roller

3.5 Concept Design

This design has a height of 120cm. The weight of this product is 7kg without carrying any marking medium load. The power source uses a rechargeable 12V battery. It is operated using a 12 V water pump with a pressure of 300 psi or 12 bar. Medium storage can store 4 liter marking medium. It comes in a variety of colors and sizes such as 16 liter, 18 liter and 20 liters. The product uses the concept of pressure in storage to pump out the medium. It also uses a rechargeable battery to power the pump in storage and has a speed valve to control the speed of fluid flowing out of the nozzle. This toolbar can also be adjustable to the user's comfort. This product nozzle cannot be changed.

Figure 3.5. shows Design 1.

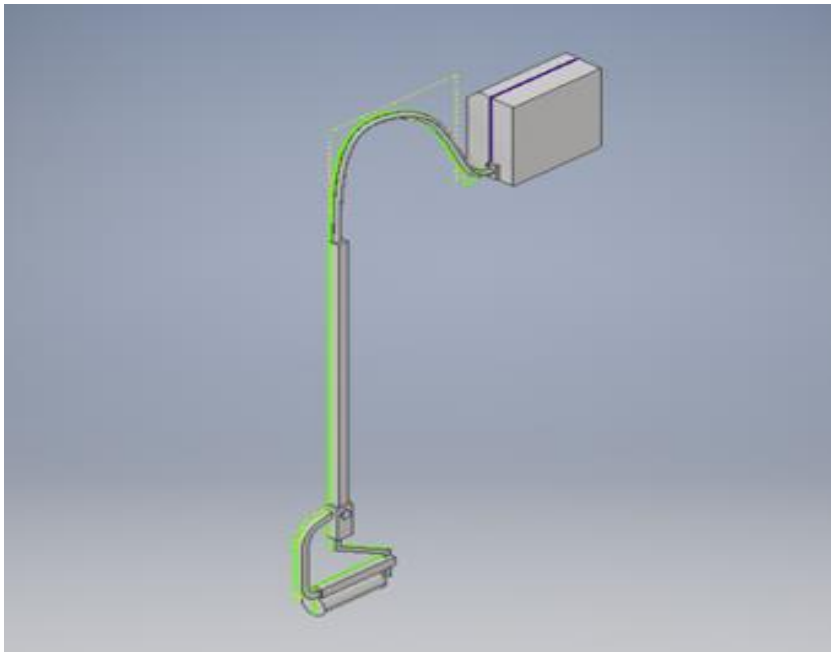

Figure 3.5.1 Design 1

3.6 Final Design

The design has a size 36.5 × 19 × 52 cm. The weight of this product is 4.7kg without carrying any marking medium load. The power source uses a rechargeable 12V battery. It is operated using a 12 V water pump with a pressure of 300 psi or 12 bar. Medium storage can store 4 liter marking medium. It comes in a variety of colors and sizes such as 16 liter, 18 liter and 20 liters. The product uses the concept of pressure in storage to pump out the medium. It also uses a rechargeable battery to power the pump in storage and has a speed valve to control the speed of fluid flowing out of the nozzle. This toolbar can also be adjustable to the user's comfort. This smart line marking product also comes in a variety of sizes and types of rollers to suit your desired size. Figure 3.6.1 shows final design for this product.

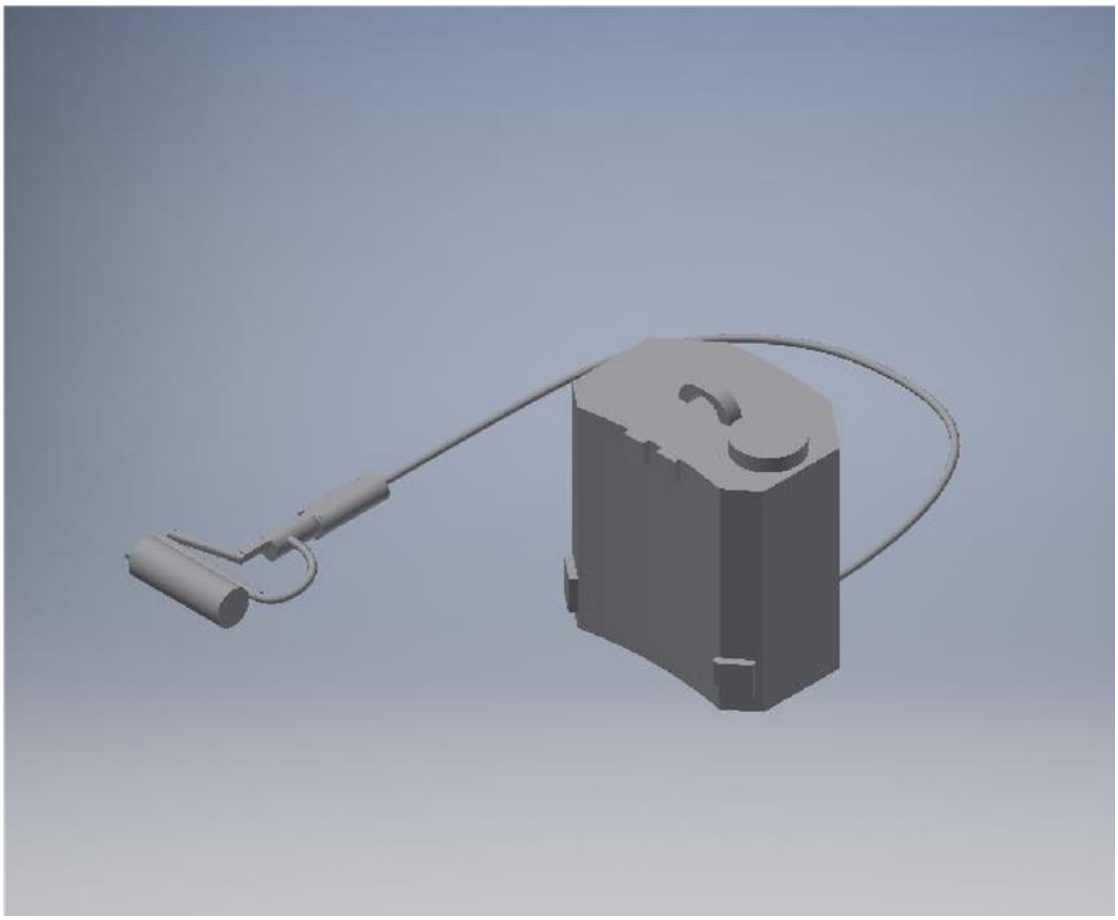

Figure 3.6.1 Final Design

3.7 Summary of Chapter

In conclusion, methodology is a technique of designing, collecting and analyzing data in order to produce evidence that can support a study to continue what is being studied. Safety measures are very important while fabricate this product such as trigger to control flow of medium out to roller. Project test run done after assembling product to identify and fix problem to avoid any issues to users.

CHAPTER 4
RESULT AND ANALYSIS

(Prepared by: Muhammad Farid Bin Che Long)

4.1 Introduction

After completing all the process, the project will be built and run. From the complete project see the result and analyse the result. This chapter will explain about the result of the project testing on this product which is Smart Line Marking Machine and the tools that has been used in this project.

4.2 Results

A line marker is a device or machine with which lines or markings are drawn on a sports field or pitch. After the final test run, the flow rate of the marking medium moves smoothly through a roller controlled using a speed valve. Speed valve functions to control the flow rate of the marking medium by adjusting the knob clockwise. Based on the test, find out that the lines that have been produced are more accurate and in accordance with the set standards. In addition, the work produced is neater and more precise. Maximum capacity battery of the machine when in use is 4 hours. It saves time and is easily handled by less skilled operators. Figure 4.2 shows line marking work result.

Figure 4.2 Line Marking Work Result

4.3 Safety Measures

Through the research done to produce this project, team put some effort in design and material selection so that this product able to reduce the accident and injury while operating the machine. A lot of test and simulation was held to ensure the project able to do the work without any problem. Firstly, the function of the trigger to control the flow of marking medium out of the roller. Next, put the speed valve to control the spreading and consistency of the marking medium out to the roller. Moreover, reflective material was stick at the tank to make sure the user can be notice while using the machine. Also make sure that electrical part of the machine is separated and not expose to avoid shock circuit. Lastly, this shows that the project will have a complete design and safety feature.

4.4 Standard Operating Procedure

A line marker is a device or machine with which lines or markings are drawn on a sports field or pitch. Firstly, pour the paint into the tank as shown in Figure 4.4.1.

Figure 4.4.1 Smart Line Marking Machine product

Then, close the lid tightly as shown in Figure 4.4.2.

Figure 4.4.2 Smart Line Marking product

Thirdly, press and lock the trigger so that the paint can flow to the roller as shown in Figure 4.4.3.

Figure 4.4.3 the trigger at Smart Line Marking Machine

After that, adjust the speed valve clockwise to increase the speed. Next, press the switch to turn on the pump as shown in Figure 4.4.4.

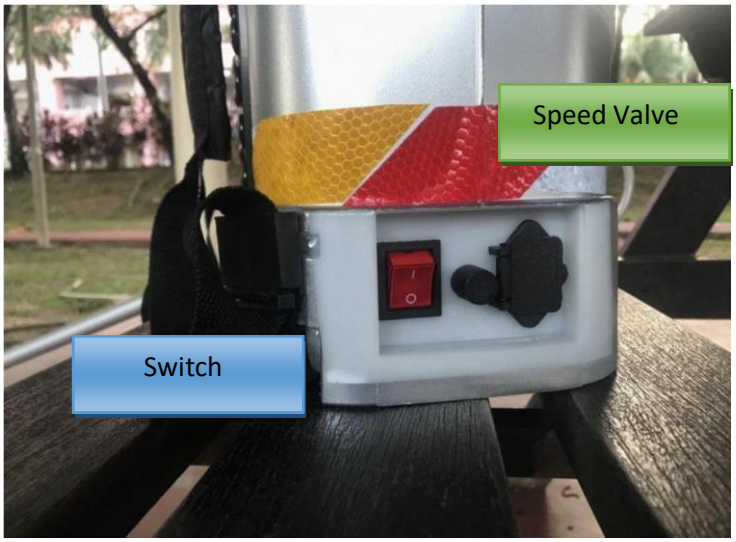

Figure 4.4.4 the speed valve and switch at Smart Line Marking Machine

Lastly, start line marking work as shown in Figure 4.4.5.

Figure 4.4.5 Line Marking Work

4.5 Project Testing

After done assembling the product, test run has been done:

1. Maximum capacity battery of the machine when in use is 4 hours.

Line marking work is performed to the maximum to test the durability of the battery. This test is done by taking time using a stopwatch when the line marking work is done. The time taken starts from the machine being turned on until the machine battery needs to be recharged.

2. Maximum speed valve control test.

The speed valve is rotated clockwise to the maximum level to test the speed valve function. This test is done by testing the speed valve by turning the speed valve knob clockwise. The machine is turned on after the line marking medium is inserted into the storage tank and the speed valve is adjusted according to a certain set speed. The results of this test can be seen through the flow rate of the marking medium coming out of the paint roller.

3. Effectiveness of the motor to pump the marking medium.

Test the motor to pump out the marking medium to the maximum level. This test is done by pumping the marking medium to the maximum level that has been filled into the storage tank. Motor inspection is done visually and mechanically. Visual inspection is done by looking at whether there is a concussion on the motor when pumping the marking medium. Mechanical inspection is done whether there is a malfunction in the motor as the motor is suddenly turned off due to overwork and the motor is unable to pump the marking medium for a long time. Electrical tests are also performed to assess whether there is a short circuit in the motor and the amount of electrical energy consumed through the battery.

4. Able to do the marking line according to marking standard accurately.

Perform line marking work on various types of surfaces and draw lines according to pre-defined lines. This test is done by doing line marking work such as on the surface of the field, cement and tar to see the effectiveness of the machine to do line marking work. It is evaluated through the results of lines performed on various types of surfaces such as lines produced straight and having a uniform colour.

4.6 Demographic Profile

Basic information for 30 respondents for the questionnaire shows that the respondent consists of 24 males and 6 females. Which respond to the feedback had been given to the respondents.

Respondent that respond are from, 25 of them are from Mechanical Engineering Department, 2 of them from Civil Engineering Department, 2 of them from Electrical Engineering Department and lastly 1 of them from Department of Commerce. To wrap the feedback from result, all of the respondent agrees and on developing Smart Line Marking Machine which emphasize safety features and help them in line marking process. They also give comment and feedback.

4.7 Questionnaire Analysis

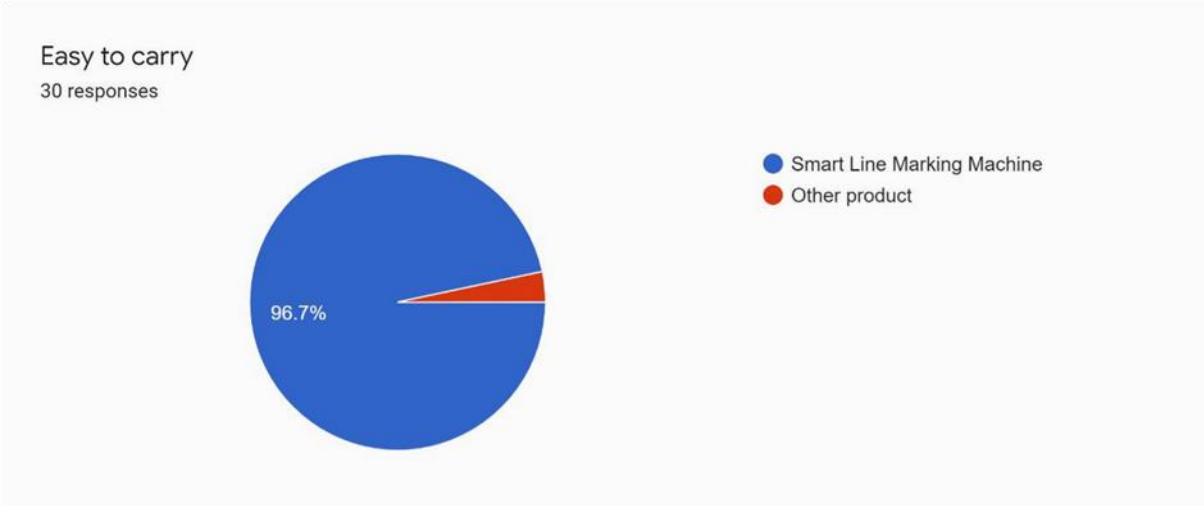

Figure 4.7.1 Easy to carry

Figure 4.7.1 shows the respond Question 1: Easy to carry. Based on the questionnaire conducted by 29 respondents agreed that Smart Line Marking Machine is easy to carry some respondents do not agree that this machine is easy to carry.

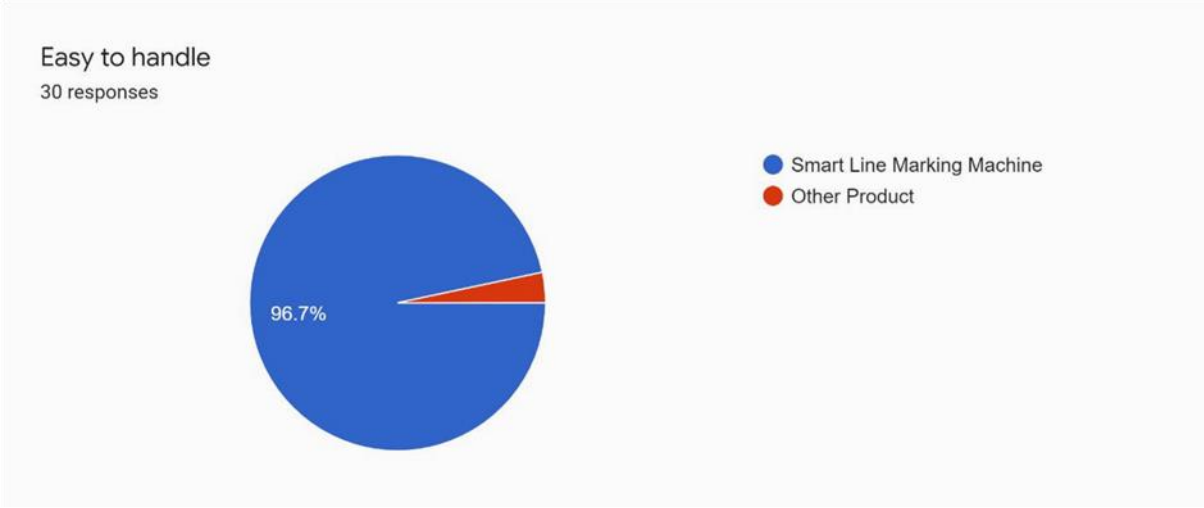

Figure 4.7.2 Easy to handle

Figure 4.7.2 shows the respond for Question 2: Easy to handle. Based on the questionnaire conducted, 29 respondents agreed that Smart Line Marking Machine is easy to handle while some respondents do not agree that this machine is easy to handle.

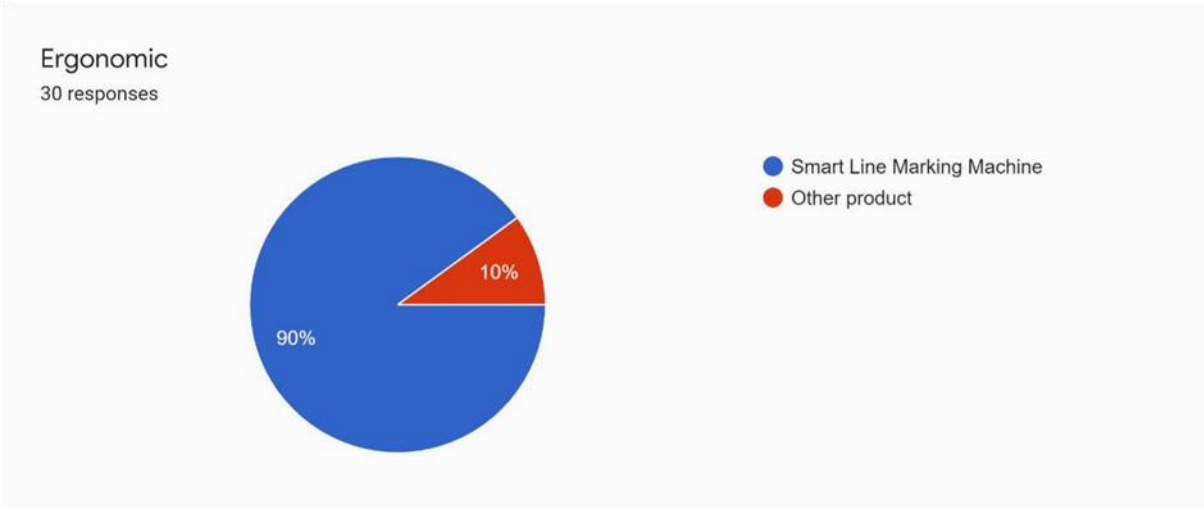

Figure 4.7.3 Ergonomic

Figure 4.7.3 shows the respond for Question 3: Ergonomic. Based on the questionnaire conducted, 27 respondents agreed that Smart Line Marking Machine is ergonomic while 3 respondents do not agree that this machine is ergonomic.

4.8 List of Feedback and Comment

Table 4.7 shows some feedback and comments that was fill up in the feedback form. This feedback and comment are from Polytechnic Sultan Salahuddin Abdul Aziz Shah.

Table 4.8 Feedback and Comment

No.	Feedback and Comment
1.	Easy to use, cheaper than other product and more comfortable
2.	Producing more tank variations that have more colours
3.	Adds variation in terms of the size of the barrel and the quantity that can be filled with paint
4.	Very suitable for sale in the market because it makes it easier for consumers
5.	Good innovation

4.9 Final Result

1. Front view

Figure 4.9.1 shows the front view of the smart line marking machine with storage tank and adjustable aluminium stick with paint roller.

Figure 4.9.1 Smart Line Marking Machine Front View

2. Side View

Figure 4.9.2 shows the side view of the smart line marking machine with storage tank and adjustable aluminium stick with paint roller.

Figure 4.9.2 Smart Line Marking Machine Side View

4.10 Comparison between this product and other product

Table 4.10 Line Marker Comparison

Characteristic	Smart Line Marking Machine	Other Line Marking Machine
Medium refill process	Storage	Regularly
Difficulty handling	Easy	Difficult
Size	Medium	Large
Battery Capacity	4 Hours	Limited
Effectiveness of the motor	Medium	High
Accuracy	Medium	High

Smart Line Marking machine has been through trial according to the specific test likes maximum capacity battery other machine, maximum speed valve control test, effectiveness of the motor to pump marking medium and able to do line marking work according to marking standard accurately. The test imposed on the smart line marking machine has followed the specification and the data is shown in Table 4.10.

This product using medium tank to store line marking medium. Other product also using tank but it must refill regularly. This causes a lot of time to be wasted when refilling the marking medium. Other than that, this machine also easy to handle by operator. It using trigger to control line marking medium out from paint roller and using speed valve to control speed line marking medium out from the tank. This machine has a medium size while other line marking machines have a large size. It makes it difficult for operators with small body size, especially from educational institutions, to lift or move this machine when doing line marking work from one place to another.

4.11 Summary of Chapter

This chapter will explain about the result of the project on this product which is Smart Line Marking Machine. The project will be built and run. From the complete project, see the result and analyse the result. A line marker is a device or machine with which lines or markings are drawn on a sports field or pitch. Smart Line Marking Machine saves time and is easily handled by less skilled operators. It is more accurate and in accordance with the set standards. In addition, the work produced is neater and more precise.

CHAPTER 5

BUSINESS PLAN OUTLINE

(Prepared by: Muhammad Farid Bin Che Long)

FIAT Enterprise is selling a type of line marking machine which is Smart Line Marking Machine. It is situated at Seksyen 13, Shah Alam. The company is involved in fabricate, sale and rent the line marking machine. The Smart Line Marking Machine is easy to use and affordable line marking machine line marking machine. It is also ergonomic with various size and colour.

5.1 Introduction

Name of the company	:	FIAT Enterprise
Nature of business	:	Build, Sale and Rent Smart Line Marking Machine
Location of business	:	Brunsfield Riverview Apartment
		No 406, Seksyen 13, 40150, Shah Alam Selangor
Date of commencement	:	June 2020

5.1.1 Factor in selecting the propose venture

1. Convenience

It is easily operated by less skilled operators and has various size and colour.

2. Promote innovative product

This business is one way that can introduce the world the innovative product that can help people especially education institution and middle wage income.

3. Ergonomic

This line marking machine has a light weight suitable for all ages especially student at education institution.

5.1.2 Future prospect of the business

The company targeting to the type of prospects education institution like school and university. Contractor and middle wage income also company target for prospect of the business.

5.2 Purpose of Preparing The Business Plan

Reason of choosing this business because to introduce SLiM (smart line marking machine) adjustable and smart line marker that can use indoor and outdoor work. Using mechanical and electrical components. It is semi-automatic product.

5.3 Business Background

Name of business: Named as FIAT because it is acronym to name of founder this company

Address of business: No 406, Brunsfield Riverview Apartment, Seksyen 13, 40150, Shah Alam Selangor

Telephone number: 014-578660

E-mail address: mfaridchelong@gmail.com

Date of commencement: June 2020

5.4 Background of Partners

5.4.1 Partner 1

Name : Muhammad Farid bin Che Long

Identity card number : 000910-13-0657

Address : SL 495, Lrg. 1F3, Tmn Kopodims, Matang, 93050, Kuching Sarawak

Telephone number : 014-5786680

Email address : mfaridchelong@gmail.com

Date of birth : 10 / 09 / 2000

Age : 21 years old

Marital statues : Single

Academic qualification : Diploma in Mechanical Engineering

Course attended : Project 2

Skills : Good in Microsoft software, Autocad and Inventor

Experience : Used to work at Serba Dinamik Sdn. Bhd. (Internship)

Present occupation : Student in Politeknik Sultan Salahuddin Abdul Aziz Shah

5.4.2 Partner 2

Name : Muhammad Idham Bin Ismail

Identity card number : 000313-11-0973

Address : 184, Kg Baru Jambu Bongkok. 21610, Marang, Terengganu

Telephone number : 011- 35521303

Email address : Idhamismail1303@gmail.com

Date of birth : 13 / 03 / 2000

Age : 21 years old

Marital statues : Single

Academic qualification : Diploma in Mechanical Engineering

Course attended : Project 2

Skills : Good in maintenance and Inventor

Experience : Used to work at Elektro Serve (M) Sdn. Bhd. (Internship)

Present occupation : Student at Politeknik Sultan Salahuddin Abdul Aziz Shah

5.4.3 Partner 3

Name : Wan Nur Athirah Binti Wan Mohamed

Identity card number : 000111-03-0334

Address : Terengganu

Telephone number : 014- 2127550

Email address : wannathirah11@gmail.com

Date of birth : 11 / 01 / 2000

Age : 21 years old

Marital statues : Single

Academic qualification : Diploma in Mechanical Engineering

Course attended : Project 2

Skills : Good in financial management

Experience : Used to work at coffee bean, tea leaf and taxas chiken smdt

Present occupation : Student at Politeknik Sultan Salahuddin Abdul Aziz Shah

5.5 Organization / Management / Adminstration Plan

5.5.1 Logo, Mission, Vision & Objective

Table 5.5.1 Logo, Mission, Vision & Objective

Logo	
Mission	To provide better solution whilst creating better technology that benefit both customer and the environment
Vision	1. To maximize profit This is important to ensure that the business are successful. 2. To increase the number of buyer For long-term business, our company's target is to increase the number of buyer. This is important for maximize the profit year by year. 3. Expand the business and be known Other than that, we also want to expand the business throughout Malaysia and be the known brand with quality
Objective	1. To fabricate and affordable line marking equipment for commercial use. 2. To design and develop an equipment that can make the line markng process easier. 3. To fabricate line marking equipment.

5.5.2 Manpower Planning

Currently, company only have 3 workers as shown in table 5.5.2:

Table 5.5.2 Manpower in company

Position	Number of personnel
Manager	1
Technician	1
Accountant	1

5.5.3 Organization Chart

The organization chart of the company is shown in Figure 5.5.3 and this organization chart are still contains only one level of management.

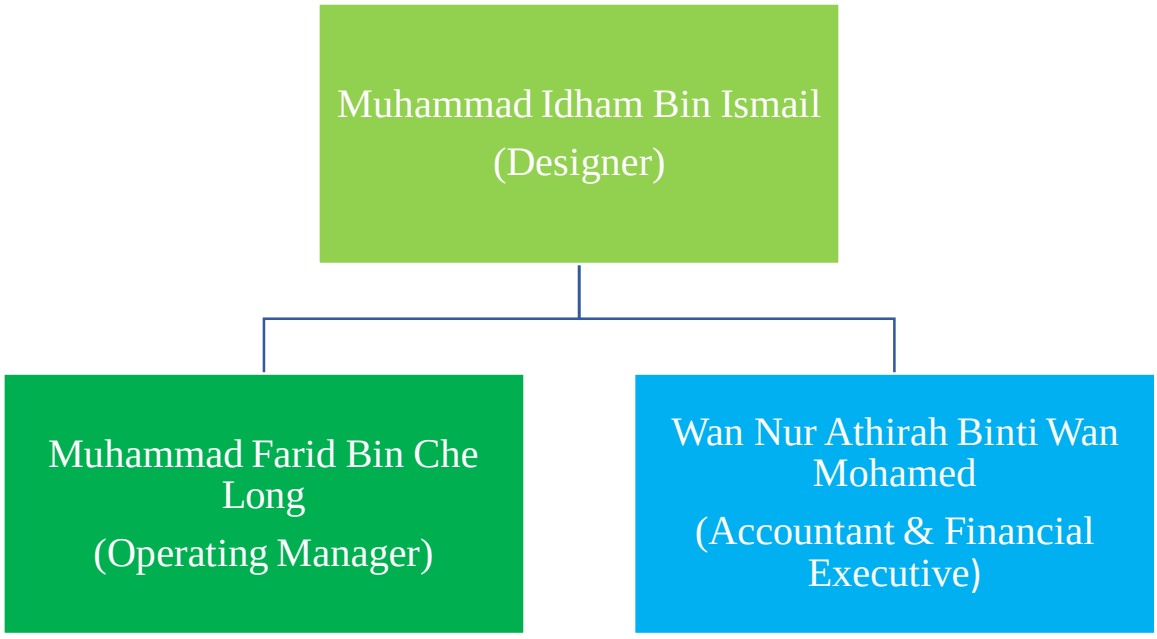

Figure 5.5.3 Organization Chart

5.5.4 Schedule of task and responsibilities

Table 5.5.4 Schedule of task and responsibilities

Task	Responsibilities description
Manager	• Responsible to carrying out and attaining the mission and manage business unit • Manage the overall operational , budget and activities of the department • Make business decision in accordance with organization policies and procedures
Technician	• Responsible to diagnose the problems, replace or repair parts, test and make adjustments. • Comply with safety regulations and maintain clean and orderly work areas
Accountant	• Preparing balancing sheet, profit and loss statement • Monitor the incoming data • Process the invoices

5.6 Marketing Plan

1. Customer Segments

Figure 5.6.1 shows the Customer Segments. The customer segments consist of educational institution, labour worker, hardware and middle range income.

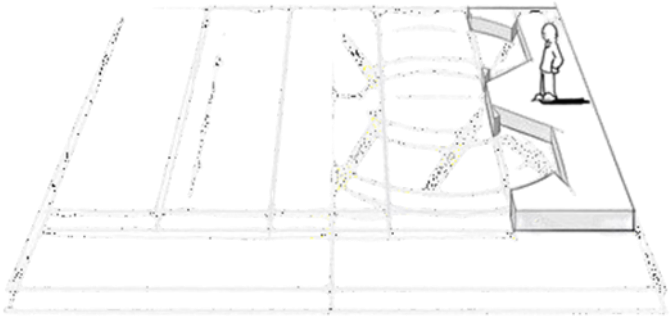

Figure 5.6.1 Customer Segments

2. Value Proposition

Introduce SLiM (smart line marking machine) adjustable and smart line marker that can use indoor and outdoor work. Using mechanical and electrical components. It is semi-automatic product. Figure 5.6.2 shows the Value Proposition.

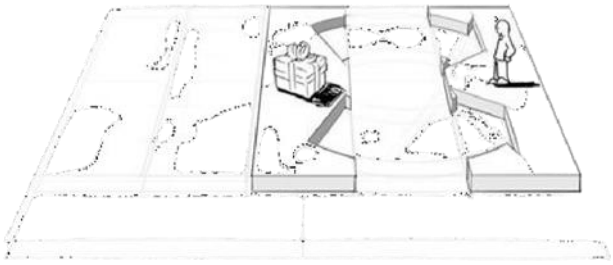

Figure 5.6.2 Value Proposition

3. Channel

Figure 5.6.3 shows the Channel. The channel consist store location like the hardware shop and online marketing like social media marketing and eCommerce marketplace.

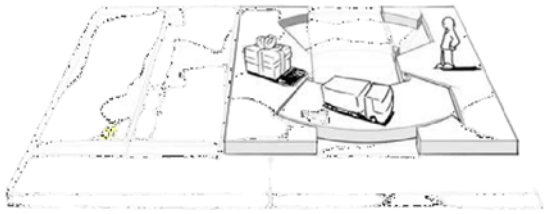

Figure 5.6.3 Channel

5. Customer Relationship

Figure 5.6.4 shows the Customer Relationship. The customer relationship consist customer service face to face and delivery service to direct buyer.

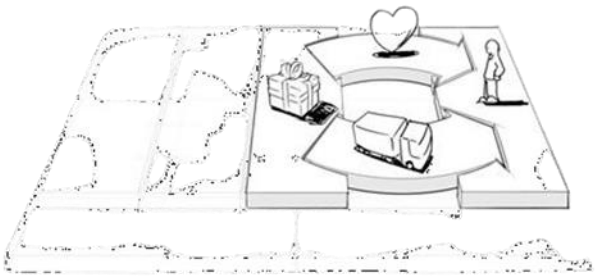

Figure 5.6.4 Customer Relationship

5. Revenue Stream

Figure 5.6.5 shows the Revenue Stream. The revenue stream consist selling, delivery service and renting or lending.

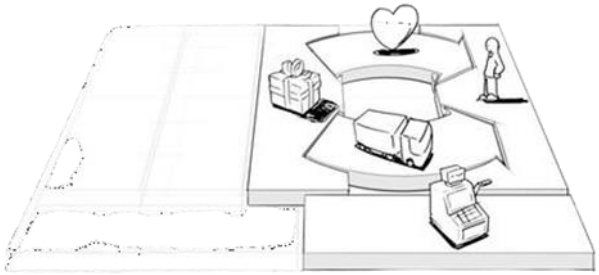

Figure 5.6.5 Revenue Stream

5. Key Resources

Figure 5.6.6 shows the Key Resources. The key resources consist patterning, capital like equipment, manpower and machine and entrepreneurship.

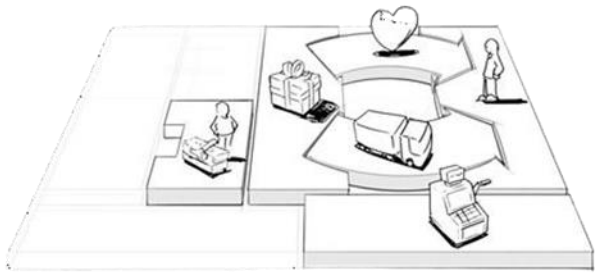

Figure 5.6.6 Key Resources

7. Key Activities

Figure 5.6.7 shows the Key Activities. The key activities consist selling and marketing, event and exhibition, research and development and collaboration.

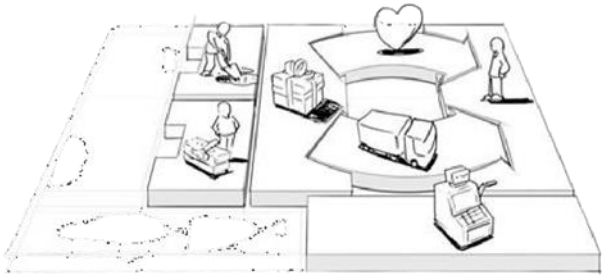

Figure 5.6.7 Key Activities

8. Key Partners

Figure 5.6.8 shows the Key Partners. The key partners consist agent and drop ship, courier company, eCommerce marketplace and buyer-supplier relationships.

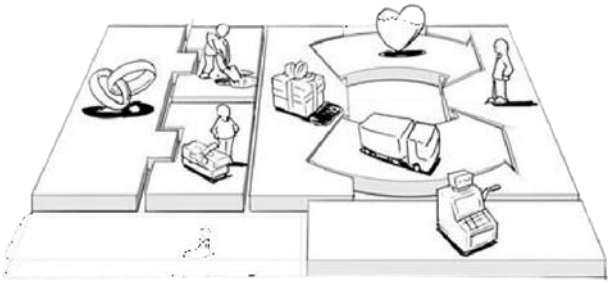

Figure 5.6.8 Key Partners

9. Cost Structure

Figure 5.6.9 shows the Cost Structure. The cost structure consist logistics, store location online and offline, marketing staff and advertising.

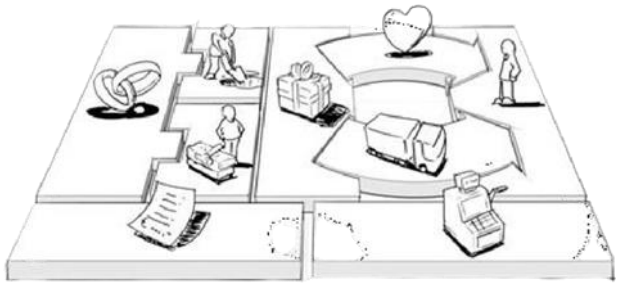

Figure 5.6.9 Cost Structure

5.7 Summary of Chapter

FIAT Enterprise main product is a Smart Line Marking Machine and its main consumer's targets are education institution and middle wage income which involved in fabricate, sale and rent the line marking machine to customers. FIAT company introduce the world the innovative product and ergonomic product. FIAT team prefer to easily operated by less skilled operators and has various size and colour to make sure that customer have their satisfaction after purchasing from the company. After several research been conducted, the demand for new product is really high as the product is far more convenience and improve the quality of life Therefore, this is as an advantage to grab the opportunity of making large profit.

In conclusion, FIAT Enterprise are able to satisfy the needs and demands of the marketing target. FIAT Enterprise hope can be the best company that sells Smart Line Marking Machine not only in Shah Alam but throughout Malaysia. The teams will give all of commitment and support to make company's mission and vision comes true.

CHAPTER 6
DISCUSSION, CONCLUSION AND UPGRADE PLAN

(Prepared by: Muhammad Idham Bin Ismail)

6.1 Introduction

For this chapter, decisions are made based on all decisions obtained from testing conducted and discussions in chapters the previous one. In this chapter as well, the relevant matters are relevant objectives of the study as well as recommendations on the study conducted. Besides, conclusion have been made for the testing.

6.2 Discussion

For this project, first objective is to design and develop equipment that can make the line marking process easier. Smart Line Marking Machine is a machine that helps users, especially in educational institution in line marking work. This machine has cheap price as well as easy to operate by less skilled operators. Thus, educational institutions can own these machine to make lines in the field without having to buy machines that are expensive and easy to operate by students.

Besides that, this machine has a maximum battery capacity of 4 hours. With a battery that has long lifespan can help line marking work more effectively without having to recharge the battery in addition a storage tank with capacity of 16 litre that does not require the user to refill the marking medium regularly. The rollers can also change according to the line size desired by the user.

For the cost of the making this project is more affordable and reasonable than other line marking machine in the market. The budget to fabricate this project are below RM200. The budget is not been included with accessory cost like spray and reflective tape. With the reasonable cost, education institution can buy this product for it is affordable and make life easier.

The result after test run, the flow rate of the marking medium moves smoothly through a roller controlled using a speed valve. Speed valve functions to control flow rate of the marking medium by adjusting the knob clockwise. Lines that have been produce are more

accurate and in accordance with the set standards. In addition, the work produces is neater and more precise.

6.3 Conclusion

In conclusion, overcome the problem that faced while do line marking work. Although the main purpose of this project to design and develop an equipment that can make the line marking process easier. This project also to fabricate an affordable line marking equipment for commercial use. This Smart Line Marking Machine also easy to operate by less skilled operators while do line marking work. After the test run is done, the maximum capacity battery used to perform the marking work is for 4 hours before it is recharged for 1 hour. Other line marking machines use energy sources from petroleum such as diesel to move the engine. This will cause air pollution in addition to the occurrence of noise pollution due to the noise produced by the motor. The motor effectiveness of this product is modest as it prioritizes educational institutions that do not do heavy line marking work. However, this machine will be upgraded in line with the wants and needs of users such as motors that have greater power. Moderate accuracy as it still requires human energy to ensure the lines are made according to user specifications. However, some additions will be proposed to improve accuracy such as using the help of electronic devices.

6.4 Upgrade Plan

For the upgrade plan, one of the plans that want to upgrade is redesign the tank to make it more comfortable and ergonomic for the user. Secondly, adds a buzzer to inform users when the battery is low. Next, to being used for marking work, added functions such as painting. Then, increase the capacity of the battery so that it can work longer. Lastly, variety of sizes and colours according to the needs of consumers, especially educational institutions.

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APPENDIX

APPENDIX A – Project Budget

NO	MATERIAL	PRICE PER UNIT	QUANTITY	AMOUNT
1	Portable rechargeable battery knapsack chemical sprayer	RM95.00	1	RM95.00
2	Adjustable Aluminium Stick	RM9.90	1	RM9.90
3	Paint Roller	RM3.90	4	RM15.60
4	Rubber Tube	RM13.00	1	RM13.00
5	PVC Pipe	RM10.00	1	RM10.00
6	Steel band	RM5.20	10 meters	RM5.20
7	Plastic Board	RM14.90	1	RM14.90
8	Adapter	RM5.00	1	RM5.00
9	Glue PVC	RM4.50	1	RM4.50
			TOTAL	RM173.10

APPENDIX B – Project Planning

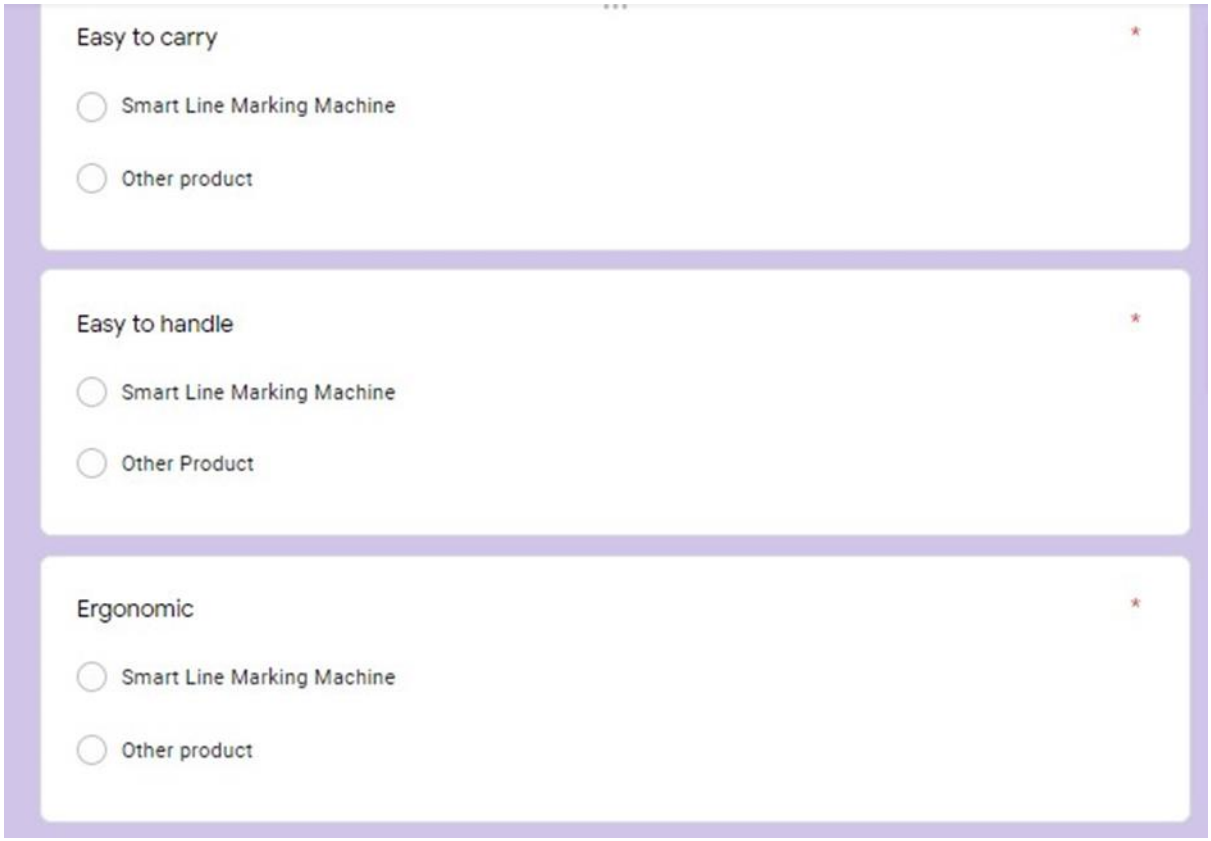
Week/activities project	Status	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
Introduction and planning Gantt Chart	P															
	C															
Component survey	P															
	C															
Component selection	P															
	C															
Fabrication process	P															
	C															
Testing	P															
	C															
Modification/ improvement	P															
	C															
Writing report	P															
	C															
Preparing for banner and presentation skill	P															
	C															
Final project presentation	P															
	C															
Correction and submission report	P															
	C															

P	Planning
C	Complete

APPENDIX C – The Comparison Between Our Product and Other Product

Characteristic	Our Product	Other Product
Name	Smart Line Marking Machine	SS And Plastic Paint Line Marking
Price	RM259.90	RM 2,403.00
Weight	6kg net weight	21kg net weight
Continuous Run Time	4 hours	unlimited
Battery use	12V rechargeable battery	does not use batteries
Capacity	16 litres	15 litres

APPENDIX D – Survey Form



APPENDIX E – PITEX 2020 Poster

SMART LINE MARKING MACHINE

Muhammad Farid Bin Che Long
Muhammad Idham Bin Ismail
Wan Nur Athirah Binti Wan Mohamed
Politeknik Sultan Salahuddin Abdul Aziz Shah

PENERANGAN INOVASI

There are various types of tools used by contractors to create marking lines automatically and manually. In this modern age, high technology machine is the preferred option for most contractors. However, the cost of purchasing the machine is too expensive especially in educational institutions. Based on observations, there are some problems faced by educational institutions while doing line marking work. The manual process while refilling the marking medium requires a lot of time. In addition, current marking tools are difficult to operate by unskilled operators especially large-scale marking products and difficult to carry due to their large size. The objective of this project is to design and fabricate tools that can facilitate the marking process. It is also devised to be an affordable line marking tools for commercial use. The fabrication process comprises of attaching paint roller to a box of paint. Then, by using socket connection method, this two part is attached. The motor helps to direct flow of the paint to the paint roller. The prototype is tested and adjustment were made accordingly before it is deemed ready to use. The Smart Line Marking Machine product has been proven to be light, easy to use and affordable. Suggestions for improvement are to increase the variety of functions of the device, increase the capacity of the motor battery and add aesthetic value.

IMPAK INOVASI

- Easy to store and carry
- Can be used for a long time
- Affordable price
- Utilized for outdoor and indoor setting

OBJEKTIF

- To design and develop a line marking equipment that can make the line marking process easier.
- To fabricate a line marking equipment.
- To fabricate an affordable line marking equipment for commercial use.

BLOK DIAGRAM/CARTA ALIROPERASI

Front view Top view Side view