POLITEKNIK MALAYSIA

SULTAN SALAHUDDIN ABDUL AZIZ SHAH

Department of Mechanical Engineering

PROJECT 2: DJJ50193

Diploma in Mechanical Engineering

Title	**RoBO Farmer**
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This report is submitted to the Department of Mechanical Engineering in partial fulfillment of the requirements for Diploma in Mechanical Engineering.

SESSION 1: 2022/2023

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE: ROBO FARMER

1. We,
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    are final year students of **Diploma in Mechanical Engineering, Department of Mechanical Engineering, Politeknik Sultan Salahuddin Abdul Aziz Shah,** which is located at Persiaran Usahawan, 40150 Shah Alam, Selangor.

2. We recognize that the 'project on' and intellectual property contained in it is our original work/design without taking or imitating any intellectual property rights of other parties.

3. We agree to relinquish ownership of the project to fulfill the requirements of the Diploma in Mechanical Engineering course.

    Truthfully recognized by:

    a. MUHAMMAD FADHILAH BIN ABD KADIR
    (IC NO: 020120-08-0593) _____

    b. HARRIZ BIN MORHAIMIE
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    Witnessed by,

    MUHAMMAD FAIZ BIN ABDULLAH (761010-03-5327)

    As the supervisor of our team on

    Date:..... _____

ACKNOWLEDGEMENT

First and foremost, we want to give thanks to God for providing us with the opportunity to complete this research and project.

In today's competitive environment, there is a race in which the early birds will succeed. This project serves as a link between theory and practice. Our team put in a lot of effort in the process of project completion. However, it would not have been possible without the support and assistance of several individuals and organizations. We would like to express our heartfelt gratitude to each one of them.

We are grateful to our supervisor, Mr Muhammad Faiz Bin Abdullah, for his guidance throughout our study, valuable suggestions, encouragement to complete our project research, and for helping us in project coordination, particularly during the writing of the proposal and fabrication process. Additionally, our supervisor never tires of devoting his precious time to assist us in managing the assigned research and never disappoints us when we seek his advice and direction.

We are also glad to our course mates who provided strong moral support that assisted us in finishing this report, contributed ideas in certain parts, and assisted us in completing this report. It would be impossible to achieve what we did today without their unending assistance in finishing this project report.

We highly appreciate every helpful advice and comment given as we conduct our research and study for our project 'RoBO Farmer.'

ABSTRACT

Fertilizers and pesticides contribute to the agriculture sector of Malaysia. With Arduino coding, RoBO Farmer sprays liquid fertilizers and pesticides using remote-control. It is suitable for flat and non-hilly areas that has a path that is at least 60cm wide. It can be controlled from as far as 100 meters and works best on small and medium-sized plants. With the fabrication of RoBO Farmer, health risks caused by chemical exposure can be significantly reduced. Additionally, this machine helps in reducing expenses as well as lighten the burden caused by carrying heavy tools. After multiple trials in the testing phase, the Arduino radio signal reception distance is found to reach up to 100m. Besides preparing the agricultural chemicals by hand, there is virtually no human involvement. Proposed improvements include the upgrading of safety, implementation of 360º camera, lights, AI, Wi-Fi, more powerful motors, larger batteries, tire with larger grip and endurance, as well as structure redesigning in terms of versatility and replacing the frame material with carbon fiber. In a nutshell, RoBO Farmer deploys an advanced & innovative way for farmers to grow crops more efficiently.

Keywords : *fertilizers, pesticides, remote control, non-hilly area, improvement.*

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CHAPTER 1: INTRODUCTION

1.1Introduction

The agricultural sector is one of the most important sectors for developing countries like Malaysia. The agricultural sector is a fundamental contributor to the formation of Malaysia's economy in the post-independence era where at that time most of the population was focused on economic activities based on agriculture and mining. Most profits for the agricultural sector depend on the production of crops. The more crops that are produced, the more crops that can be marketed.

Therefore, farmers should take care of crops using fertilizers and poisons to increase crop yield. Fertilizers are usually sprayed on plants to provide additional nutrients that help to increase crop yields. Poisons for the agricultural sector are divided into two, herbicides and insecticides. Herbicides are pesticides used to kill unwanted weeds and plants.

1.2Background

However, the process of fertilizing and poisoning that is still practiced by farmers is very far from the passage of time. Many farmers still use chemical sprayers to fertilize and poison their crops. The use of this tool is very energy consuming as the user must carry it on their back during the fertilizing and poisoning process. In addition, the use of this tool also exposes the user's body to fertilizers and poisons directly which can cause health complications.

In this project, we want to produce a remote-control fertilizer and poison sprayer. This device operates one hundred percent using electricity that is controlled using a remote-control device. This allows users to fertilize and poison the crop area easily without tiring their bodies. Next, the control device system built in this project can be controlled as far as 500 meters from the user. This can provide a safe environment for users when fertilizing and poisoning.

1.3 Problem Statement

a) Farmers are forced to carry heavy tools on their backs. This causes farmers to use up a lot of energy. In addition, farmers can also experience back pain when using this tool for a long time.

b) The farmers' body will be exposed to dangerous chemicals found in fertilizers or poisons. Exposure to these chemicals can cause farmers to experience skin and respiratory problems.

c) Farmers must spend a lot of money to use high-tech fertilizer and poison sprayers. There is no denying that there are modern fertilizer and pesticide sprayers such as farming drones on the market. However, the high cost of purchase and maintenance makes farmers unable to afford it.

1.4Objective

Listed below are the research objectives:

a) Design a machine that can spray fertilizers and poisons with remote control.

b) Reduce the use of manpower.

c) Save on purchase and maintenance costs.

1.5 Scope and Limitation

In order to make this project a success, there are some limits that the project is made to adhere to. Listed below are the limitations imposed on the project:

a) Only suitable for use in flat and non-hilly areas.

b) The area to be fertilized must have a path that is at least 60cm wide.

c) Only suitable for small and medium plants such as vegetables.

d) Can only spray fertilizer or poison in liquid form.

e) The maximum distance for the remote control is 100 meters.

1.6 Research Importance

The RoBO Farmer offers satisfying results in reducing the burden of local farmers of medium sized plantations by reducing the energy used by the farmers in carrying heavy tools and the exorbitant cost of purchase and maintenance of high-tech equipment. Aside from that, this product can overcome the problem of liquid fertilizer and poison wastage in the spraying process because of its spraying muzzle of high concentration and accuracy. In addition, the prototype creates a safer environment for farmers in terms of reduced exposure to fertilizers and poisons that contain hazardous contents to the skin.

1.7 Chapter Summary

With the fabrication of the RoBO Farmer prototype, the productivity and safety of local farmers can increase significantly. Therefore, in Chapter 2: Literature Review, there will be a more detailed study and examination of the problems and issues regarding this field of research. Chapter 2 is a study that must be conducted to ensure the success of the project.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter discusses previous studies resulting from our project. A literature review is a search and evaluation of the literature found in a chosen area or topic. This review is based on the latest document on the topic we wrote about. In this study, we discuss the importance of fertilizing and poisoning, fertilizer and poison spraying equipment, types of remote-control systems and spraying methods.

2.2 Existing Technology

The activities of fertilizing plants and spraying pesticides are essential in plant care. However, it is fraught with difficulties, particularly in terms of health and effectiveness. Products on the market that address this issue are extremely difficult for farmers to obtain due to the high cost of purchase and maintenance. The starting price for the products is RM5000, and the price can go up to RM50000.

Each product has advantages that make it superior in certain situations. Agriculture drones, for example, are ideal for remotely monitoring crop conditions, whereas boom sprayers are ideal for fertilizer application. All of this, however, does not solve the farmers' problem of finding low-cost products that can solve health problems caused by fertilising and spraying pesticides.

In the table below we have made some comparisons between different agricultural chemical sprayers on the market today.

PRODUCT	ADVANTAGES	DISADVANTAGES	OPERATION
Knapsack sprayer 	• Low purchase cost • Easy to use • Easy to maintain • Efficient chemical spraying	• Exposing users to harmful chemicals • Cause back pain and joint pain • High use of manpower • Not suitable for hilly areas	• Manual
Agricultural spraying drones 	• Low manpower consumption • Suitable for all terrains	• Requires high expertise • High purchase cost • Difficult to maintain • Inefficient spraying of chemicals • Chemicals are at risk of being blown away by the wind	• Manual (remote control) and automatic
Fertigation 	• More productive • Reduce management and operational costs • Save water and fertilizer	• High starting cost • Need high quality water • Must use only specific fertilizers and it is high cost	• Automatic

	• Clean and environmentally friendly • Produce healthy plants	• Can only be used for fertilizing	
Boom Sprayer 	• Large tank size • Solid shape • More accurate spraying	• Low pressure on spraying • High purchase cost • Not suitable for small/medium farm areas • The large size of the tractor requires a large farm area to operate	• Manual and automatic

2.3 Type of Plant Fertilizer

Fertilizer is a chemical compound given to plants to promote growth. This fertilizer is often applied to the soil but can also be placed directly on the roots or sprayed on the leaves of plants. Fertilizers are divided into two, namely organic fertilizers and chemical fertilizers.

i. Organic fertilizers

Figure 2.1: Liquid organic fertilizers

Organic fertilizers are fertilizers produced using natural materials without chemical treatments. The way organic fertilizers are produced is from decomposing agricultural waste or easily decomposed food, for example plant waste and animal waste. This organic fertilizer comes in two forms, solid and liquid. Solid organic fertilizers are often sown to the plant roots or can also be mixed with the plant's soil base. Meanwhile, liquid organic fertilizers can be sprayed onto the roots or leaves of plants using a sprayer

ii. **Chemical fertilizers**

Figure 2.2: Chemical fertilizer

Chemical fertilizers are fertilizers commonly used by farmers. Chemical fertilizers are fertilizers produced using a mixture of chemical and inorganic materials such as a mixture of materials containing ammonia gas and sulfuric acid in the manufacture of ammonium sulfate fertilizers. The nutrient content for plant nutrition is high in chemical fertilizers. This chemical fertilizer also comes in two forms which are solid and liquid. Solid chemical fertilizers can be sprinkled on the roots or leaves of plants while liquid chemical fertilizers can be sprayed on the roots or leaves of plants. There are also solid chemical fertilizers that can be dissolved in water for spraying.

2.4 The Effect of Chemical Fertilizers And Pesticides On Farmers' Health

Bhandari (2014) reviewed an overview of agrochemicals and their impact on the environment in Nepal and concluded that agrochemicals are considered a powerful weapon or magic bullet in developing countries to increase agricultural productivity. However, it has been noted that agrochemicals cause serious harm and certain pesticides can affect the endocrine and immune systems of humans and can promote the development of cancer.

It has been established that farmers do not use safety masks, gloves, and other protective equipment during pesticide spraying which results in pesticide access in the bloodstream through inhalation and skin exposure that can affect their eyes, skin and breathing. system. The study showed a relationship between levels of pesticide use and signs and symptoms of exposure-induced disease among spray farmers of Bhopal, Madhya Pradesh India, who spray pesticides themselves and were therefore directly exposed to the assessed pesticides. During 18 months exposed farmers reported maximum acute signs and symptoms such as burning/stinging eyes (18.42%), blurred vision (23.68%), skin redness/itching (50%), excessive sweating/shortness of breath (34.2). %), dry sore throat (21.05%) and burning nose (28.9%). Signs and symptoms are found depending on the interval between sprays. It was concluded that there is a need to create more awareness among farm sprayers and authorities in implementing and ensuring the use of protective equipment when handling pesticides (Choudhary 2014).

Figure 2.3: Protective clothing for spraying pesticides

2.5 Issues of The Russia-Ukraine War

The war that took place between two big countries, namely Russia and Ukraine, which happened a few months ago certainly upset the world, when the conflict between the two countries was feared to end in a very terrible war. This conflict took place over Russia's invasion of Ukraine. On February 24, 2022, the State Border Guard Service of Ukraine stated that a border post with Russia had been attacked. Two hours later, Russian ground forces began entering Ukraine. The President of Ukraine, Volodymyr Zelensky, responded by declaring a state of emergency, immediately cutting off diplomatic relations with Russia and announcing civilian conscription to prepare for an imminent attack from the Russian military.

Figure 2.4: The Russian president launched a war against Ukraine

The ongoing conflict between Russia and Ukraine has sent commodity prices around the world skyrocketing amid global anxiety and a sudden reaction to a possible collapse and shortage in terms of supply. This is because both countries are major producers such as sunflower oil, wheat, and corn. In addition, the supply of fertilizers for crops is also affected. This is because the interruption of fertilizer supply became one of the visible effects after Russia bombed a large fertilizer production plant. Fertilizer capacity has been destroyed. Russia and Ukraine are the largest exporters of fertilizers, and this will lead to a very significant impact on production costs and crop availability.

For this reason, the Malaysian Ministry of Agriculture and Agro-based Industry is now actively looking for fertilizer supplies and sources of raw materials including agricultural inputs from several other countries following the ongoing war between Russia and Ukraine at that time. The conflict that broke out so far has not given a big implication in the country's agricultural sector. The lack of agricultural inputs such as fertilizer supply makes it difficult for commercial crops to produce large-scale yields. This is due to a lack of nutrients from the fertilizer supply.

2.6 Study on The System Used

2.6.1 Remote Control System

A remote-control system is a system in which the production of control instructions and their execution are separated by a significant distance. This system contains two main components which are the control device where the control commands are entered, and the receiver module which receives and executes the commands. Most remote-control systems use radio waves to send commands to the receiver module.

2.5.1.1 Radio Control

Radio control (radio control) also known as the abbreviation RC is the use of control signals sent by radio to control devices remotely. Examples of simple radio control systems are garage door openers and keyless entry systems for vehicles, where a small hand-held radio transmitter opens or unlocks the door. Radio control is also used to control model vehicles from a handheld radio transmitter. Industrial, military, and scientific research organizations also use radio-controlled vehicles. A rapidly growing application is the control of unmanned aerial vehicles (UAVs or drones) for civilian and military use, although these have more sophisticated control systems than traditional applications. The radio control system is divided into two, namely One-way radio control and multi-way radio control.

2.6.1.2 Radio Control Type

Single channel radio control

- Acts as an on-off switch operated remotely by radio waves. For example, single channel radio control can be used to turn lights on or off in the garden using only a handheld radio transmitter.
- The transmitter unit will consist of a low-power radio transmitter, while the lamp requires a radio receiver and a relay (to convert the low-power incoming radio signal into a high-power electrical current large enough to operate the lamp).
- Single channel radio control will only work to switch something on or off completely.

Multi-channel radio control

- used to output more complex and useful signals to a remote piece of equipment. For example, to make a radio-controlled car accelerate, decelerate, or steer from side to side.
- sends a series of coded analog or digital pulses that are decoded by the receiver and used to produce a specific action. For example, turning the steering wheel on a radio control transmitter will send a series of pulses that make the electric motor rotate by the corresponding amount to steer the radio-controlled car one way or another.
- A motor that works in this way is known as a servo motor. Unlike a typical electric motor, which spins an arbitrary number of times depending on how long it receives an electric current, a servo motor is much more controllable and has electronics built in feedback mechanism that allows you to spin it by a fairly precise amount.

2.6.2 3d Printing System (3d Printing)

3D printing is a process of creating objects directly, by adding materials layer by layer in various ways, depending on the technology used from CAD models or digital 3D models.

This innovation has many advantages compared to other manufacturing methods. Among them is being able to produce flexible designs. 3D printing enables the design and printing of more complex designs than traditional manufacturing processes. More traditional processes have design restrictions that no longer apply with the use of 3D printing. Also, able to produce prototypes quickly. 3D printing can produce parts in hours, which speeds up the prototyping process. This allows each level to be completed faster. Compared to prototyping, 3D printing is cheaper and faster in creating parts because the part can be completed in hours, allowing each design modification to be completed at a more efficient rate. Next, fast design and production times. Depending on the design and complexity of a part, 3D printing can print objects in hours, which is much faster than molded or machined parts. It is not only the manufacturing of parts that can offer time savings through 3D printing but also the design process can be very fast by creating STL or CAD files ready for printing. In addition, the use of 3D printers can reduce waste. The production of the part requires only the material required for the part itself, with little or no waste compared to alternative methods that are cut from largely non-recyclable materials. Not only does the process save resources but it also reduces the cost of materials used.

However, there are also drawbacks to this technology. Among them are limited materials. Although 3D Printing can create items in a selection of plastics and metals, the choice of raw materials available is not extensive. This is since not all metals or plastics can be temperature controlled enough to enable 3D printing. In addition, it has a limited build size. 3D printers currently have a small print space which limits the size of parts that can be printed. Anything larger needs to be printed in separate sections and spliced together after production. This can increase cost and time for larger parts because the printer has to print more parts before manual work is used to connect the parts. Next, the difficult packaging process. Most 3D printed parts require some form of cleaning to remove support material from the build and to smooth the surface to achieve the required finish. Finishing processes used include water jetting, sanding, chemical soaking and rinsing, air or heat drying, assembly and others. The amount of finishing process required depends on factors including the size of the part being produced, the intended application and the type of 3D printing

technology used for production. This packaging process slows down the speed of component manufacturing.

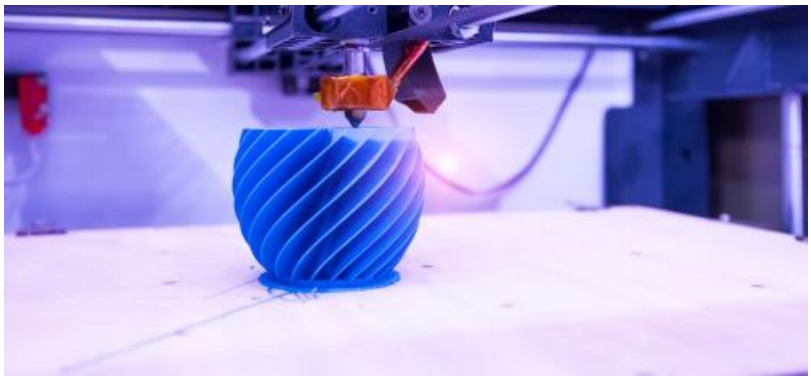


Figure 2.5: 3D printing process.

2.6.3 Airless Tires

Airless tires are tires that are not supported by air pressure. Most airless tire designs use strong interlaced spokes or mesh-like structures that surround the wheel and can flex and change shape as the car drives and goes over bumps. They are used on some small vehicles such as riding lawn mowers and motorized golf carts. They are also used on heavy equipment such as backhoes, which are required to operate on sites such as building demolition, where the risk of tire punctures is high. Tires composed of closed-cell polyurethane foam are also made for bicycles and wheelchairs. They are also commonly found on wheelbarrows which may be used for yard work or construction.

Figure 2.6: Airless tire

The main advantage of airless tires is that they do not go flat. Other advantages are that airless tires need to be replaced less frequently, resulting in savings. Heavy equipment outfitted with airless tires will be able to carry more weight and engage in more rugged activities. Airless tires generally have higher rolling resistance and provide somewhat less suspension than similarly shaped and sized pneumatic tires. Other problems for airless heavy equipment tires include dissipating the heat buildup that occurs when they are driven. Airless tires are often filled with compressed polymers (plastic) rather than air or can be a solid molded product.

The differences between airless tires and air tires

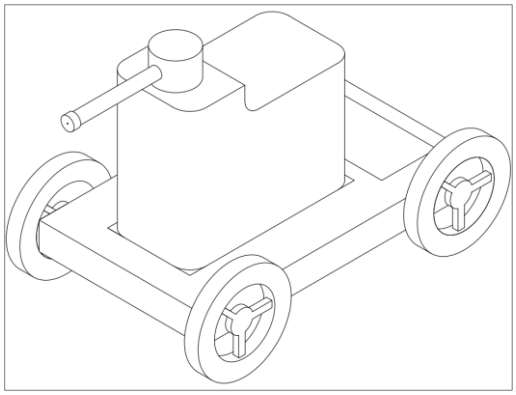
Airless tires	Air tires
Not supported by air pressure	Can manually adjust the tire pressure
More maneuverability	Less maneuverability
Expected to be high cost to get a new one	It is easy to repair and low cost

CHAPTER 3: METHODOLOGY

3.1 Design of RoBO Farmer

Their process shape RoBO Farmer is divided into 3 phases main namely idea 1, idea 2 and the final idea. Each phase this have its own characteristics, advantages, and disadvantages. Table and diagram below show information for each phase them shape RoBO Farmer.

Idea 1



Features:

i. Have one axis move nozzle

ii. Wheel continue attached to the motor

iii. Has a solar panel

iv. Each have their own motorbike

Advantages:

i. Summary ii. Compact

iii. Easy fabricated

iv. Cheap cost

Disadvantages:

i. Movement limited nozzles

ii. Nope can absorb bump

iii. Simple motor damaged

Idea 2

Features:

i. Have two axis move nozzle.

ii. Wheel connected to the transmission system

iii. Have no solar panels

iv. Each have their own motorbike

v. Has a suspension system

vi. Have nozzle on the part back

Advantages:

i. Movement independent nozzle

ii. Able to absorb bump

iii. Durable motor

Disadvantages:

i. Difficult fabricated

ii. High cost

iii. Complex

Final idea

Features: -

i. Combining idea 1 and idea 2

ii. Replaces a complex suspension system to airless tires.

iii. Elevate position nozzle front

iv. Maintain the transmission system

Advantages: -

i. Briefly

ii. Able to absorb bump

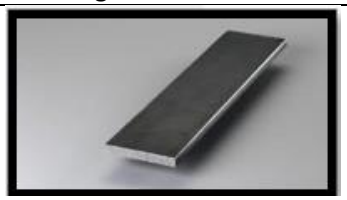
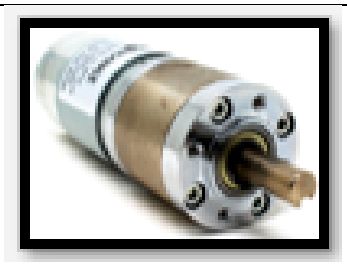
iii. Low cost

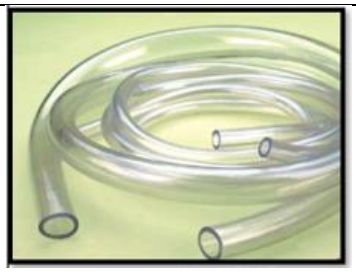
iv. Durable motor _

3.2 PROJECT FABRICATION METHODS

NO	METHOD NAME	METHOD TOOLS	FUNCTION
1	WELDING (MIG)	• carbon gas dioxide • wire electrode • shooter welding • motor generator	Connecting mild steel hollow bar and flat bar for produce skeleton
2	GRINDING	• machine foot walker • machine grinder easy moved • eyes tools machine addict easy move _	Cutting iron and steel section iron that has been welded .
3	LAUGHING	• machine lather • eyes tools lather _	Turning steel rods soft for for get the right length
5	WIRING	• wire • test pen • pliers • electrical tester	For connect blower wire and fan motor with an emergency switch .
6	DRILLING	• Drill Bits and Wall • Plug • drilling set	For make holes on drum barrels and emergency switch boxes .
7	3D PRINTING	• Ender 3	Generate the part made from plastic .

3.3 RoBO Farmer Materials and Components

Materials and Components	Details
 Rectangular hollow section	• Used as basic for section frame project • Made from steel soft • Got sufficient resistance to accommodate the load under it
 Flat bar	• Used as floor for accommodate tank liquid plantation. • Made from mild steel • Got it give endurance
 Gear DC motor 24V	• Able to move tire with high torque • The gearbox system found on this motor works for increase torque output by reduce output rpm. • Cheaper compared to a stepper motor
  FPV camera/receiver	• **FPV Camera (left side)** this used for show view from perspective machine when it is controlled regularly away _ This camera will sending a video signal in a radio medium to the receiver. • **FPV receiver (right side)** this role for receive the radio signal delivered by the FPV camera and change it to video. This FPV camera and receiver can communicate until 100m distance.
 Servo Motor	• This servo motor used for control movement for tools sprayer • Be found a movement sensor in this servo motor that allows us for control movement the angle by exactly _ • This servo motor is waterproof.
 Water Pump	• Pump this water works for pumping out of water nozzle. The speed of this pump is about 4 liters per minute • Got it produce pressure maximum that is around 130 PSI.

Materials and Components	Details
 Motorcycle battery	• Battery motorcycle this used for give energy electricity to our project. • Its small form and capacity worth the battery if based on cost.
 Radio transmitter/receiver	• **Transmitter** this used for emitting a radio signal at a distance for give instructions on the receiver. • This **receiver** used for receives the radio signal emitted by the transmitter and converts it to instructions for components project such as servo motor, water pump and dc motor.
 Arduino Uno	• Used for converting the radio signal to instructions to components project.
 PVC hose	• Channeling material chemistry farming from tank savings to nozzle spraying • Its flexible nature facilitate it is for done
 Water tank	• 20-liter water barrel as tank for store liquid plantation that will sprayed to plants. • This water tank does from resistant material which is PVC. • Endurance this important because the machine This RoBO Farmer used outdoors and often exposed to bad weather.
 PETG filament	• Used for producing the part made from using plastic method 3d printing. • Is a simple budget filament done because of its nature stable when printed. • Have strength enough tension for accommodate load on the machine.

3.4 Cost of materials and components

	Materials and Components	Quantity	Price per unit	Total
1.	Gear DC Motor	4	43	172
2.	Bearing	8	2	16
3.	PETG Filament 1 kg	1	60	60
4.	TPU Flexible	1	48	48
5.	Servo Motor	2	18	36
6.	Arduino Uno	1	48	48
7.	Arduino Mega	1	66	66
8.	NRF24L01+PA+LNA	2	16	32
9.	Kompenan elektrik (pendawaian)	~	~	15
10.	Water Pump	1	25	25
11.	Rod Stainless Steel (10 mm)	1m	19	19
12.	Hollow rectangular mild steel (T1.2mm ½ x 1)	3m	10	30
13.	Hollow square mild steel (T1.2mm 3/4 x 3/4)	5m	11.5	57.50
14.	Flange Coupling 6mm	4	3	12
15.	Flange Coupling 8mm	12	4	48
15.	Servo Motor Hub	2	5	10
16.	Flat Bar (3mm x 50mm)	1.5m	6	9
17.	Skru dan nut	~	~	20
18.	Yellow can spray	2	10	20
19.	Clear can spray	2	8	16
20.	Eachine TX02 FPV Camera	1	70	70
21.	Eachine ROTG01 FPV Receiver	1	80	80
22.	Spotlight	1	30	30
23.	Motorcycle Battery	2	30	60
			Total	RM 999.50

3.5 3D Printing

We do our own 3d printing for all plastic components found in our projects. We use Ender 3 and Ender 3 v2 machines. Our filament of choice is PETG. Each printed component has a unique position when on the print bed for maximum strength.

3.6 Coding

Coding and wiring this is an important process for fabrication our project because it is key for enable our project for controlled. Before this process done, we produce over first block diagram for organize coding and wiring journey.

Figure 3.1: Block diagram

For coding and wiring, we deliver to Xenix Robotics for the coding and wiring process. We give block diagram and all components' electronics we have.

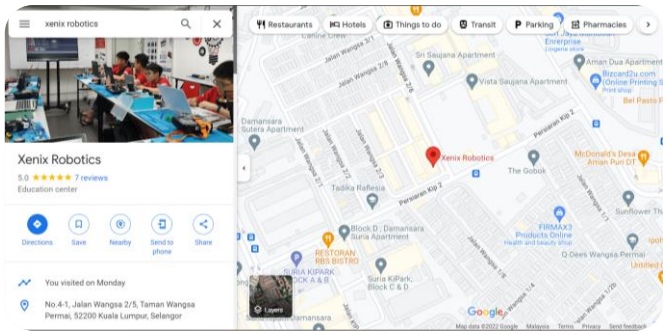


Figure 3.2: Location Xenix Robotics

We choose Xenix Robotics because of the store this already train many students representing the country in robotic competition. Expertise them this make them is choice exactly for us to hire them programming our project.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter discusses the results of the RoBO Farmer innovation test. This also includes the preparation and implementation of innovations.

4.2 Frame stress analysis

Frame is the most important part of our project. This is because it is the most part experience pressure when operate. Stress analysis this intended for make sure the frame is always in situation good though experience great pressure when operate. The figure below shows the state of the frame when receiving a load of 500N on it using Fusion360 simulation.

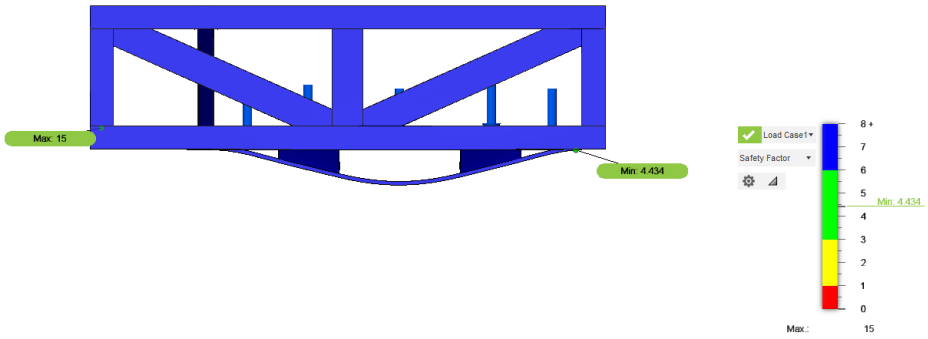


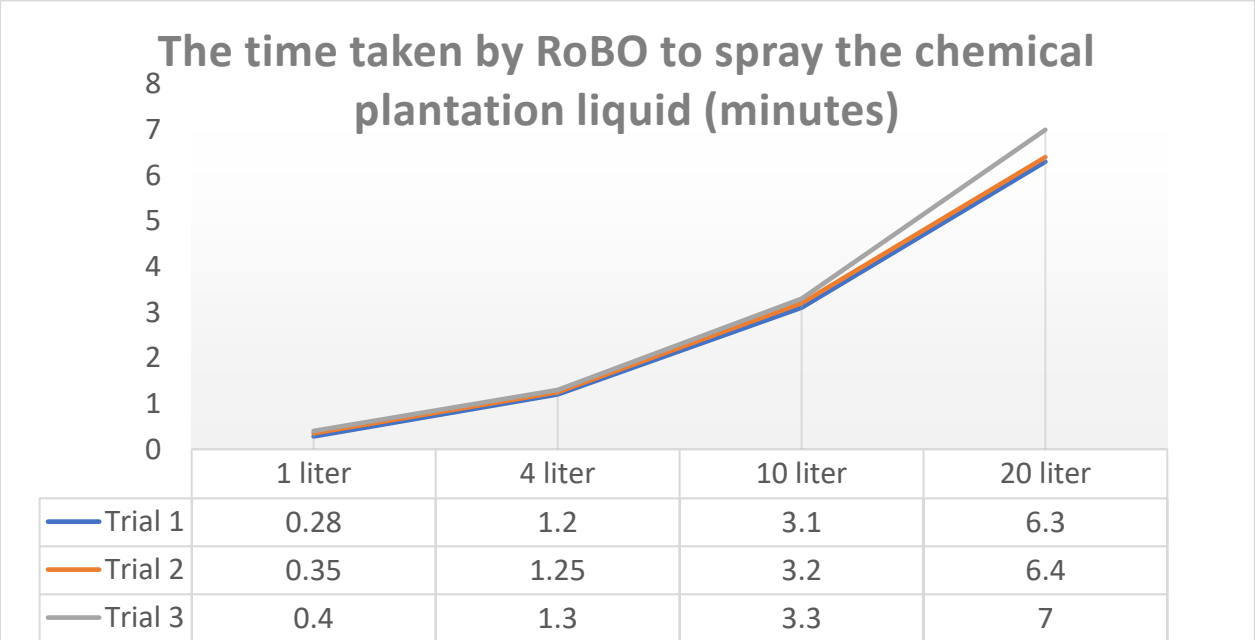
Figure 4.1: Fusion 360 stress analysis simulation

Simulation only no sufficient for test durability of the frame because there is enabler change as much as possible change frame properties when operate in nature. Therefore, we test prisoner the skeleton that has been welded by park load real on it.

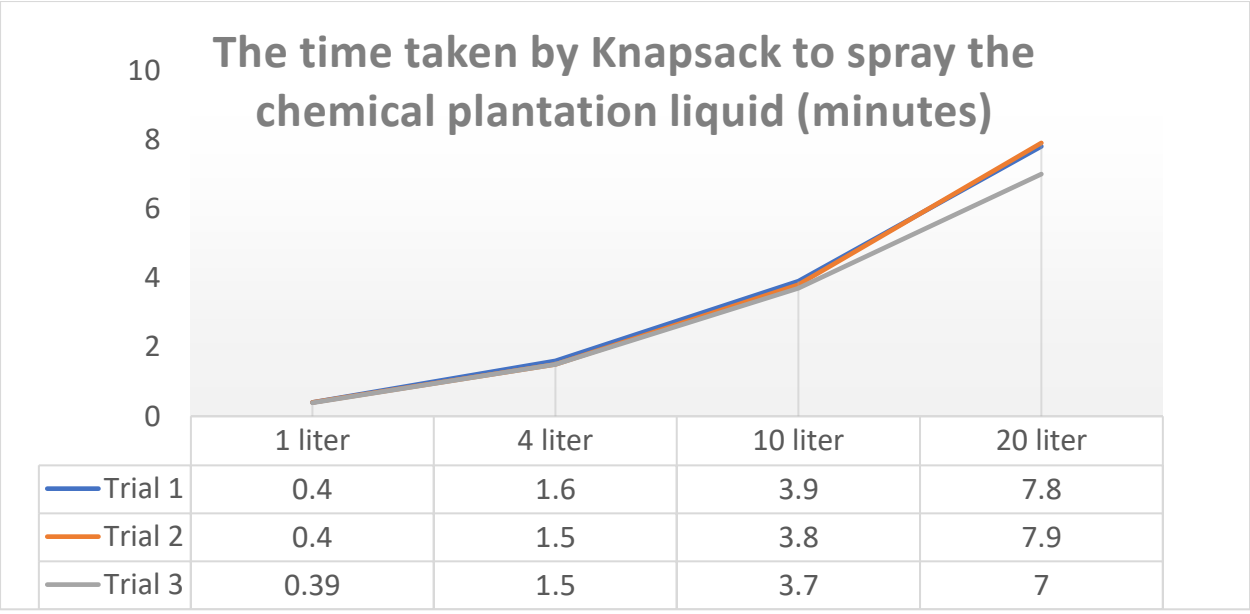
Figure 4.2: Frame accommodate load 67kg

4.3 Time taken for spraying chemical plantation liquid.

We do time comparison is taken for spraying chemical plantation liquid between RoBO Farmer and Knapsack. Graph below shows the time taken for spraying chemical plantation liquid by RoBO Farmer and Knapsack.



	1 liter	4 liter	10 liter	20 liter
Trial 1	0.28	1.2	3.1	6.3
Trial 2	0.35	1.25	3.2	6.4
Trial 3	0.4	1.3	3.3	7



	1 liter	4 liter	10 liter	20 liter
Trial 1	0.4	1.6	3.9	7.8
Trial 2	0.4	1.5	3.8	7.9
Trial 3	0.39	1.5	3.7	7

4.4 Time taken for spraying chemical plantation liquid.

The time taken to empty the battery charge (hours)			
	RoBO Farmer		Knapsack
	Without load	**With load**	
Trial 1	5.0	3.5	3.2
Trial 2	4.2	3.65	3.3

4.5 End product

After doing all the fabrication activities, our final project is produced. The diagram below is the final product of our project.

Figure 4.3: End product

CHAPTER 5: DISCUSSION AND CONCLUSION

5.1 Introduction

In this chapter, the conclusion and discussion of RoBO Farmer will be drawn. As a result, this chapter also discusses the recommendations and the impact on the community.

5.2 Discussion

Based on the literature review that has been done in chapter 2, several studies have been conducted for this project. First, research methods to identify existing products on the market, then 3d printing technology. We have successfully achieved the objectives of this project as stated in chapter one.

5.2 Conclusion

Through Arduino programming, the RoBO Farmer can spray liquid fertilizers and pesticides using remote control. This innovation helps reduce the burden and cost of farmers. The development process includes the designing, fabrication, and testing phases

5.4 Recommendation for Improvement

There are many flaws in our project that can be improved. Among them are: -

- Implementation of 360º Camera, lights, AI, Wi-Fi
- Replace with powerful motor & larger batteries
- Improvement of design in terms of versatility, and to produce a frame using carbon fiber
- Improvement handling of the project

5.5 Project limitations

This project has a few limitations, and this is also considered as the scope of this innovation. The limitation is stated as below: -

a) Only suitable for use in flat and non-hilly areas.

b) The area to be fertilized must have a path that is at least 60cm wide.

c) Only suitable for small and medium plants such as vegetables.

d) Can only spray fertilizer or poison in liquid form.

e) The maximum distance for the remote control is 100 meters.

5.6 Impact to the communities

Production of our project can bring positive impacts to the consumers, industry and country. These include: -

Users	i. Guarantee the health of users ii. Reduce users' energy consumption
Institution	i. Increase farm productivity ii. Reduce operating costs iii. Changed the way farm keeper from manual to automatic.
Country	Develop the plantation sector

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