DEPARTMENT OF MECHANICAL ENGINEERING

GOVERNMENT POLYTECHNIC, PUNE

(An Autonomous Institute of Government of Maharashtra)

Project report on

PISTON PUMP FERTILIZER

Submitted by,

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Under the guidance of :

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Submitted To

GOVERNMENT POLYTECHNIC, PUNE

DEPARTMENT OF MECHANICAL ENGINEERING

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CERTIFICATE

This is to certify that the following students have successfully completed the project entitled "**PISTON PUMP FERTILIZER**" under my supervision and guidance in partial fulfillment for the award of 'Diploma in Mechanical engineering' of 'Government Polytechnic Pune an autonomous institute of government of Maharashtra state'.

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(Project Guide)	(Head of Department)	(Principal)

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Umesh Shivraj Havarage

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CONTENTS

INTRODUCTION

- We have selected this project to reduce the efforts of farmers. In this project we are using piston pump to spray the fertilizer.Due to high pressure piston pump fertilizer effectively sprayed on the crops.To drive the piston pump we are using AC motor which can be powered through Electricity as well as solar panels. This project will save the spraying time and cost. Also we are making a cart to transport this piston pump and motor assembly to long distance. This can be connected to tractor or car as a trolley,This fertilizer pump will be easy to operate and transport.this pump can be used for spraying up to 2 to 3 acres at a time.

- The main purpose of producing this product is to enable farmers and gardeners to make the process of spraying pesticides and herbicides to their gardens becomes more effective. It helps the gardeners work because they no longer need to carry the tank on their back that can cause their back strain and hurt. This product only has to be push to forward just like how the trolley function and then it will generate mechanically pump by the set of power transmission part by using shaft, bearings and set of sprockets. Energy to pump the tank pump can be reduced. Next, it also comes with a pair of nozzles on the wing. With nozzles on the wing, it can speed up the spraying process as it can spray left and right side at the same time. In conclusion, this product can help gardeners in terms of comfort during spraying, reducing energy to pump tanks, and effectively utilizing spraying time

- Piston Pump Fertilizer is basically designed for spraying pesticide, herbicide and water in vegetable gardens. Usually, gardeners will do the water spraying process every day while pesticide and herbicide spraying process at least once a week. Gardeners need to spray their gardens with pesticide and herbicide to ensure that there are no bushes grow and prevent the gardens from bugs, caterpillar and others pests. Normally, gardeners will use the 16 litres manual Knapsack sprayer to spray their gardens, these may take a long time to finish spraying their gardens. Plus, this manual Knapsack sprayer is provided with only one nozzle

OBJECTIVES

◆ To give farmers more ergonomic working environment while spraying because they don't need to lift or carry the poison tank but only push and pull the Piston Pump Fertilizer.

◆ To add more efficiency to spraying because contains more than one nozzle. When do the spraying process, both wings of host will flow the liquids to the plans.

◆ To provide a comfortable spraying action because farmers just need to pull and push the Piston Pump Fertilizer based on their comfort level and don't need to bend their back.

SCOPE &RESEARCH

- We are making this project specially for farmers.
- Can be use in vegetable gardens.
- Can be use in fruit gardens.
- We are reducing the farmers efforts.
- Tanks can be fill either with water for watering plants or poison for poisoning plants.
- We can get high pressure from this project .
- Farmers can effort this piston pump fertilizer economically.

CONSTRUCTION

As shown in the above figure, the piston pump consists of different parts. Each part is explained in brief :

PISTON PUMP FERTILIZER

◆ **Intake-** This is part of the pump where the input is given. It may be liquid or high-pressure gas etc.

◆ **Port Plate-** This acts as the separating medium between the input port and output. The compressed gas or liquid is sent out through this medium.

◆ **Discharge-** This forms the output of the pump.

◆ **Rotating Barrel**: This is a dynamic part of the pump, in which the pistons are inserted in their specific slots. When the barrel rotates, along with that the pistons rotate and displace the liquid or compressed gas.

◆ **Piston**- This forms the most important part of the pump. They are the interfacing medium between the non rotating swash plate and the barrel. Pistons do have a spring-like system such that they reshape their size when the barrel revolves.

◆ **Shaft**- The shaft is coupled to the rotating barrel and the swash plate. On the shaft, the complete assembly is

◆ **Non rotating Swash Plate**- This is the interface for the external system and pistons. The pistons reshape themselves, get compressed when they come down under a force by the swash plate. The swash plate is a non-rotating part. It is fixed to the shaft.

◆ This sprayer contains a chain, sprocket, wheel, chassis (frame) with handle, connecting rod and a pump.

◆ Square tubes are used for the fabrication of chassis. All other parts such as sprocket, chain, wheel, and pump are the standard parts.

◆ Also it consists of AC Motor, high pressure pipes and buggy.

◆ **AC Motor :-** An AC motor is an electric motor driven by an alternating current. The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field.

◆ **High pressure pipes :-** Fuel entering and ejecting high-pressure fuel pipe is the basis of many fuel engines. When the high-pressure fuel system is working, fuel enters the high-pressure fuel pipe from the oil inlet valve and then ejects from the fuel injector at the other end.

WORKING PRINCIPLE

- Piston Pump Working Principle
  The operating principle is explained in points below-

1. It is a heavy and effective sprayer and requires an engine to operate the power sprayer. It consists of a triplex pump with stainless steel piston with oil bath lubrication. It can develops 250 to 350 pounds and can deliver the solution up to 15m. The pressure needs to use a long hose to do the spraying and cost for this sprayer is very expensive.
2. The figure shown is for axial flow variable displacement piston
   The outlet port and inlet port are used intake and exhaust of the operating liquid or gas. These are placed in a casing made up of iron.The driveshaft is coupled to a swash plate and rotating barrel. The swash plate adjusts itself based on the position of barrel and pistons. As shown in the figure, we have two colors for the inlet and outlet port. When the barrel rotates, the piston which is placed upside, and pressed inside and similarly the piston which is place downsides, is pressed outside. There is an inclination in the position of the swash plate. The same position is reversed for the next cycle of operation such that the location of piston completely forms a cycle. This helps in gas or liquids to be displaced from one location to other i.e. from the input port to outlet port.

PISTON PUMP

PRESSURE GAUGE

3. The pistons rotate along with the barrel in line with the position of the swash plate. The pistons are placed inside a cylindrical block. The movement of the pistons causes a difference in pressure, which causes suction of the inlet liquid or compressed gasses. The inclination in the vertical position of the swash plate is up to 10 to 15 degrees. Because of this reason, it is called, axial flow and variable displacement piston.

PISTON PUMP FERTILIZER

4. The motion of the piston is called reciprocating motion. The continuous motion i.e. suction and discharge by the pistons cause the displacement in the liquid or compressed gasses. When the angle decrease, we have less suction, and when the angle increase we have more. For that reason, it is called a variable displacement piston. The variable displacement depends on the swash plate angle.

5. The connecting rod is engaged with the piston of the sprayer which reciprocates causing pumping action resulting in increased pressure inside the pump which is further used to spray chemicals when the nozzle is opened on the sprayer line.

6. Agricultural sprayers come in various design types, sizes, equipment and performance specifications. They range from small spot-spraying machines to very large sprayers with extensive land and plant

coverage. Agricultural sprayers have been engineered to optimize their applicability and performance for the many purposes that the machines are put to, whether being used on crops, vegetation, or soil. Agriculture sprayers are often used for applying water and water/chemical solutions containing acids or caustic materials for crop-performance or pest-control; i.e. fertilizers and pesticides.

7. Examples of general sprayer types include :

- Boom sprayer
- Boomless sprayer nozzle
- Mist sprayer
- Three-point hitch sprayer
- Truck-bed sprayer
- Towing-hitch sprayer
- UTV sprayer
- ATV sprayer
- Spot sprayer
- Backpack sprayer

COMPONENTS

1. **PISTON PUMP :-**

PISTON PUMP

1. A piston pump is a type of positive displacement pump where the high-pressure seal reciprocates with the piston. Piston pumps can be used to move liquids or compress gases. They can operate over a wide range of pressures. High pressure operation can be achieved without a strong effect on flow rate. Piston pumps can also deal with viscous media and media containing solid particles.

2. This pump type functions through a piston cup, oscillation mechanism where down-strokes cause pressure differentials, filling of pump chambers, where up-stroke forces the pump fluid out for use. Piston pumps are often used in scenarios requiring high, consistent pressure and in water irrigation or delivery systems.

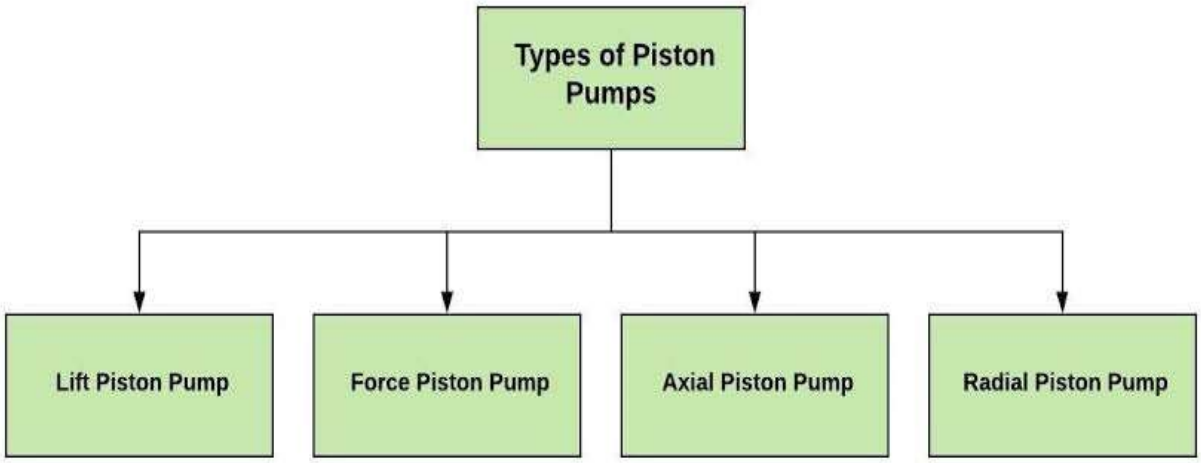
3. Piston pump specifications :

TS-22A1 POWER SPRAYER		
IRRIGATION		**SPRAY**
800	**R P M**	1200
13	**Suction (L/min)**	22
1.0	**Pressure (mpa)**	4.0
1.5	**Require Power (KW)**	2

4. Specifications :

SR.	Specifications	Type / value
1.	Normal pressure	300 PSI
2.	Maximum pressure	370 PSI
3.	Pump RPM	1200 RPM
4.	Stroke length	20 MM
5.	Piston diameter	30 MM
6.	Piston and pump material	Stainless steel
7.	Electric motor	2 HP - 1440 RPM

5. Types of piston pump :



2. AC MOTOR :-

AC MOTOR

1. An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field.

2. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.Less common, AC linear motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation.

3. AC Motor Specifications :

4.

SR.	Specifications	Type / value
1.	Horse power (H.P)	2
2.	Revolution per minutes (R.P.M)	1440
3.	Voltage	230
4.	Ampere	9
5.	Friquency	50 HZ
6.	Phase (P.H)	1

3. HIGH PRESSURE PIPES :-

HIGH PRESSURE PIPES

Fuel entering and ejecting high-pressure fuel pipe is the basis of many fuel engines. When the high-pressure fuel system is working, fuel enters the high-pressure fuel pipe from the oil inlet valve and then ejects from the fuel injector at the other end. The intermittent working process of fuel entering and ejecting will lead to the change of the pressure in the high-pressure oil pipe, which will cause the deviation of the quantity of fuel ejected, thus affect the working efficiency of the engine, and even cause the direct economic loss due to the fault. therefore, it is of great significance to reasonably control the pressure of the high-pressure oil pipe so as to stabilize the pressure in the pipe.

In this paper, a dynamic differential equation of fuel oil inlet and outlet is established based on the theory of mass conservation and a Matlab visual simulation tool is developed. To be more specific, three questions are answered: How to determine the oil supply time of the one-way oil inlet valve? How to determine cam angular velocity? How to adjust the oil supply strategy if adding another injection nozzle?

The following example is used to illustrate the model development and problem-solving process. Figure 1 is the structure of a high-pressure oil pipe. As shown in the picture, the length of the inner cavity of the high-pressure oil pipe is 500 mm, the inner diameter is 10 mm, and the diameter of the small hole A at the oil supply inlet is 1.4 mm

4. NOZZLE :-

NOZZLE

1. Nozzles perform at 4 Bar (60 PSI) pressure

2. After a few weeks discuss about the nozzles, finally the best nozzle has been found. This nozzle has been made to provide ergonomic spraying sessions for gardeners to make sure the spray more efficiency. The nozzle efficiency can be defined as the ratio between the energy available at the nozzle inlet.

3. The main advantage of these over other types of misting nozzle is that they can form a fog pattern with very low flow rates and pressures. Then when it is low pressure it causes the chemical to exit the nozzle quickly.

5. TYRE :-

TYRE

Tire selection is very important because of the ergonomic for the user. These tires are used to move the sprayer more easily and also help with the transmission part. For piston pump fertilizer project we used 16inc tires as they were not too big and not too small and provide user comfort.

Used to make a Tyre for the product. Resilience, also known as rebound, is the ability of rubber to return to its original size and shape following a temporary deformation. Rubber also not easily corroded when contact to water. Is this case, rubber is good material to make the product Tyre and host

6. SOLAR PLATES :-

SOLAR PLATES

1. A solar panel, or photo-voltaic (PV) module, is an assembly of photovoltaic cells mounted in a framework for installation. Solar panels use sunlight as a source of energy to generated direct current electricity. A collection of PV modules is called a PV panel, and a system of panel,and is an array. Arrays of a photovoltaic system supply solar electricity to electrical equipment.

2. Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. Most modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can be either the top layer or the back layer. Cells must be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones based on thin-film cells are also available. The cells are usually connected electrically in series, one to another to the desired voltage, and then in parallel to increase current. The power (watts) of the module is the mathematical product of the voltage (volts) and the current (amps) of the module.

3. Solar plates specification for piston pump fertilizer :

AC Motor HP	Volts	Controller	Solar Panel (watt-peak)	Battery Capacity
2 HP	96	6 kVA	2400 Wp	100 Ah-8 Nos.

SR.	Particular	Description
1.	Maximum input current	8.2 Ampere
2.	Input Power	18800 W DC
3.	Protections	Over current, high and low voltage , dry run, overflow etc.
4.	Accessories	Solar panels, stand, Structure, wires, nut bolt etc.
5.	Discharge	12000-40000 liters \ day

MATERIAL SELECTION

- Materials selection in technical design The materials selection process already described is more closely associated with the activities of technical (or engineering) design. As a consequence, the approaches adopted for materials selection are by far the most developed for this design discipline.

- There are many systematic methods, most numerically based, with some implemented as computer software tools, for matching material properties with technical design requirements. There is also relatively easy access to a lot of detailed and verifiable technical information (materials and design) available from many different sources (organizations and publications).

- These facilities are particularly useful for novice product designers involved in materials selection.Steel hollow sections are commonly used in welded frames, columns and as beams providing various benefits to a range of construction and mechanical applications. piston pump fertilizer prayer we use mid steel (SHS) steel hollow section for body frame

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- This kind of steel has good reliability. Low carbon steel with low carbon content has medium hardness and poor workability. It is because the body will should bear the load on the tank when it is added to the chemical. For the wings, we choose aluminium because its lightweight and not easily corrosive. These wings are used to hold hoses and nozzles to make sure the sprayer can spray more efficiently.

1. MILD STEEL :-

MILD STEEL

- Mild steel is a type of low carbon steel. Carbon steels are metals that contain a small percentage of carbon (max 2.1%) which enhances the properties of pure iron. The carbon content varies depending on the requirements for the steel. Low carbon steels contain carbon in the range of 0.05 to 0.25 percent.

- There are different grades of mild steel. But they all have carbon content within the above-mentioned limits. Other elements are added to improve useful properties like corrosion resistance, wear resistance and tensile strength.Used to make body parts. This material was chosen because it is more resistance to corrosion. Allows products of mild steel to be basically formed close to the end of the product's design.

2. FABRICATION :-

FABRICATION

- fabrication is the creation of metal structures by cutting, bending and assembling processes. It is a value-added process involving the creation of machines, parts, and structures from various raw materials.

- Typically, a fabrication shop bids on a job, usually based on engineering drawings, and if awarded the contract, builds the product. Large fab shops employ a multitude of value-added processes, including welding, cutting, forming and machining.

- As with other manufacturing processes, both human labor and automation are commonly used. A fabricated product may be called a fabrication, and shops specializing in this type of work are called fab shops. The end products of other common types of metalworking, such as machining, metal stamping, forging, and casting, may be similar in shape and function, but those processes are not classified as fabrication.

3. **POWER TRANSMISSION PART :-**

Pillow block bearing
(size 6300)

Stainless steel shafts

sprocket And Chain

- Mechanically power transmission was applied to the piston pump fertilizer to ensure this project is free from any power source from battery or petrol. When there is no use of dry cells and fuel, this project is also environmentally friendly. Things that are combined to make the transmission part are bearings, a set of sprockets and a shaft. So, when the piston pump fertilizer is push forward or backward, this transmission part will make the tank mechanically pump.

ADVANTAGES

1.	Human effort in pumping is reduced.
2.	Increased capacity of spraying.
3.	Fatigue load reduced.
4.	Cost-effective.
5.	Increased rate of spraying thus reducing time in spraying.
6.	Can be fit up to 1000 liters of water/poison in drum or any other water drainage.
7.	Convenient maintenance and low price of accessories
8.	Low price
9.	High efficiency because have a piston pump.
10.	No need to generate a pressure by hand.

DISADVANTAGES

1.	Very heavy to lift and carry
2.	Repair rate is high too much trouble
3.	Low efficiency
4.	This sprayer is heavy to carry
5.	Need electricity to generate pump

APPLICATION

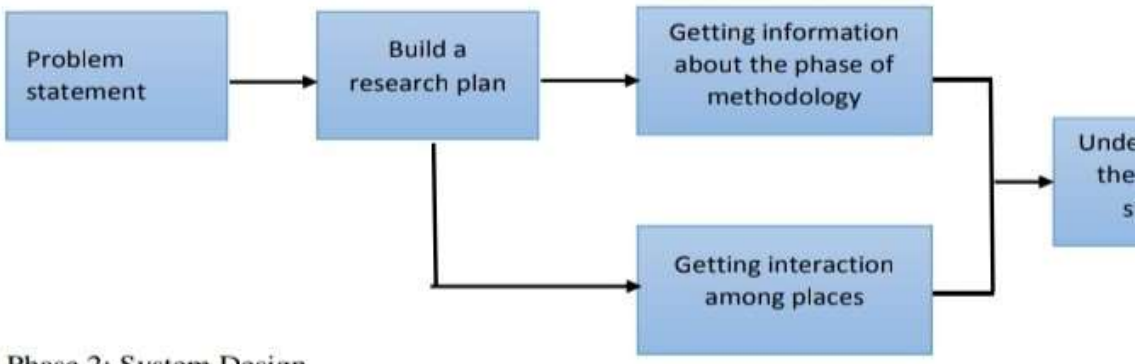
1.	Used in Agriculture.
2.	Used in Horticulture.
3.	Used in Floriculture.
4.	Used in Spraying of germicide.
5.	Used in Garden
6.	Used for fertilizing crops

METHOD STEP

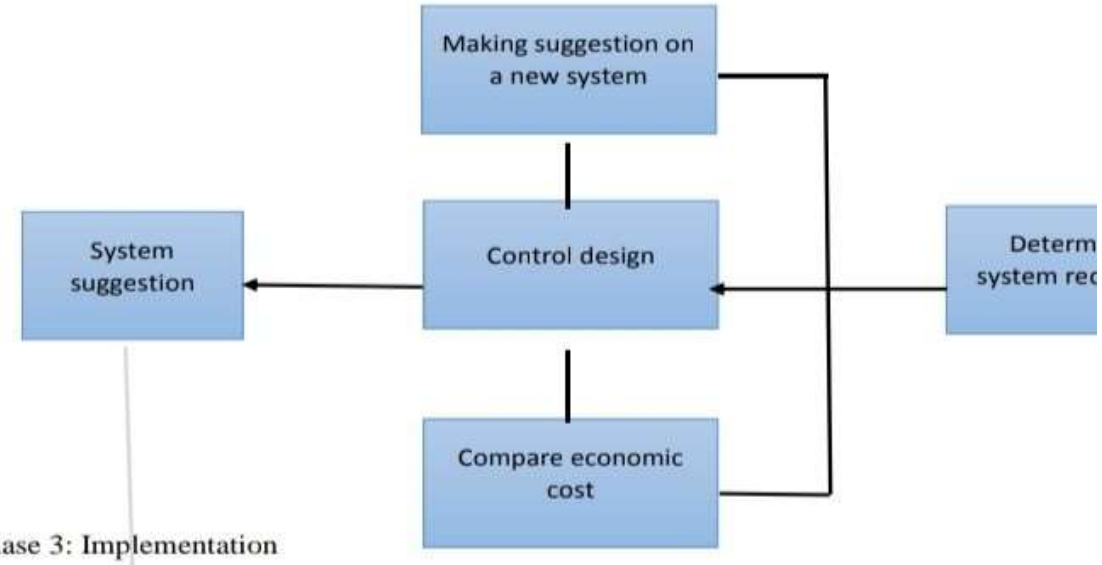
PREPARED BY: BOTH

3.6 Method step

Phase 1: Data Analysis



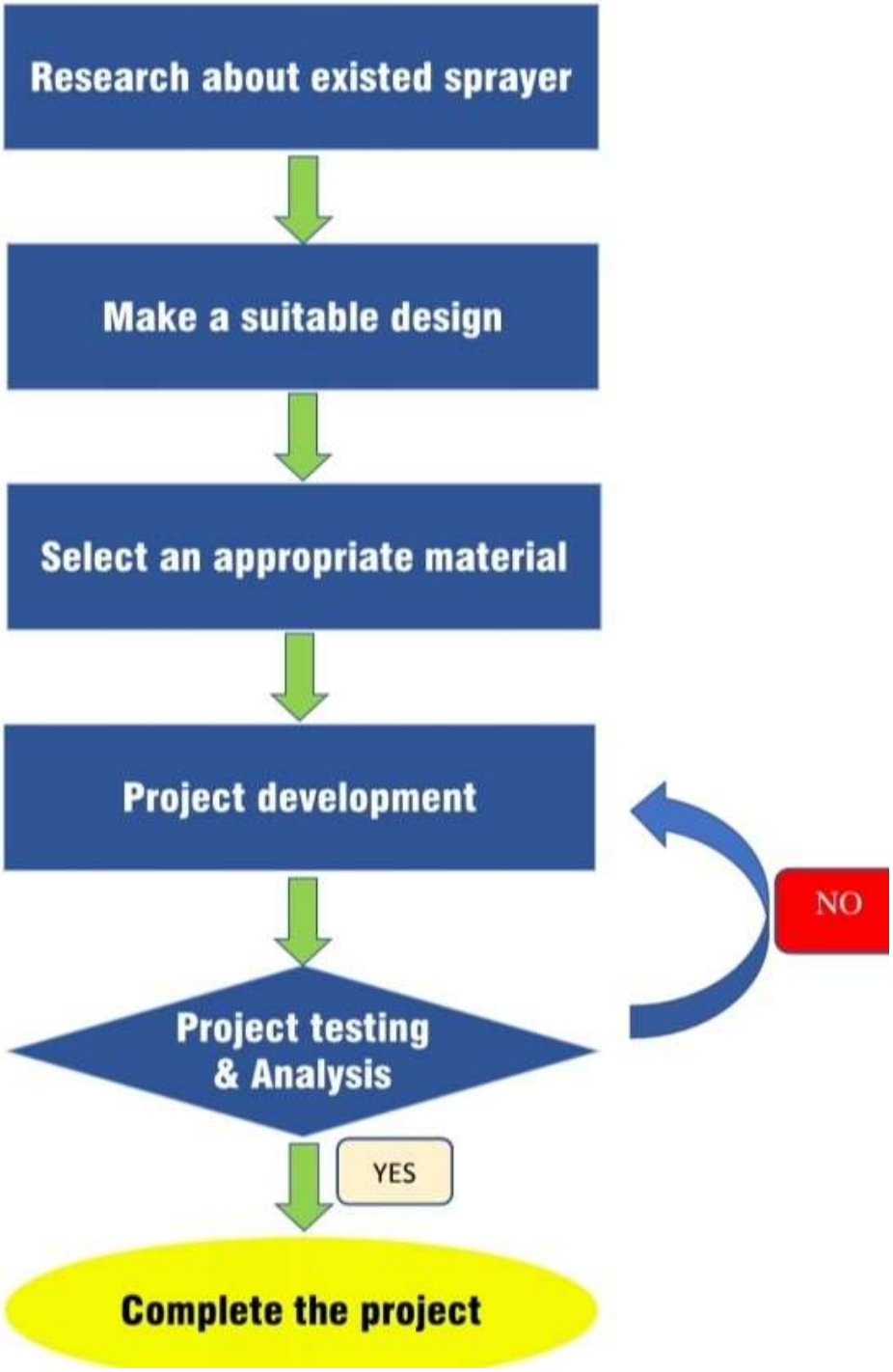
Phase 2: System Design



Phase 3: Implementation

METHOD PROCESS

3.7 Method process



COST ESTIMATION

A project can only come together with all the necessary materials and labor, and those materials and labors cost money. Putting together a budget that keeps costs to a minimum, while maximizing the project's quality and scope can be challenging. This is why proper cost estimation is important.

Cost estimation in project management is the process of forecasting the financial and other resources needed to complete a project within a defined scope. Cost estimation accounts for each element required for the project from materials to labor and calculates a total amount that determines a project's budget. An initial cost estimate can determine whether an organization green-lights a project, and if the project moves forward, the estimate can be a factor in defining the project's scope. If the cost estimation comes in too high, an organization may decide to pare down the project to fit what they can afford (it is also required to begin securing funding for the project). Once the project is in motion, the cost estimate is used to manage all of its affiliated costs in order to keep the project on budget.

NO	MATERIAL	COST PER UNIT (RS)	QUNTITY	TOTAL
1.	Piston Pump	2500	1	2500
2.	AC Motor	3000	1	3000
3.	Pressure Pipes	500	2	1000
4.	Buggy	2500	1	2500
5.	Gun	1000	1	1000
ESTIMATION COST				10000/-

CONCLUSION

The Piston Pump Fertilizer a proven the time of spraying is faster and it more efficient compare to the normal type hand sprayer. The farmers will be more efficient when to do the work and to produce better crops for sale. After than that, Piston Pump Fertilizer can comfortable spraying action because farmers just need to pull and push based on their comfort level and don't need to bend their back.

Water sprayer and poison sprayer is very important in farm or garden and it is very well known by all people especially by farmers. These sprayers are used to spray pesticide or liquid to plants. Without these sprayers it will burden farmers and people to make sure their plants stay fresh because not get a water and stay in protection from bugs and pests because not been spray with pesticide or poison.With this idea and innovation, it can help people to spray their farms and gardens because it is more ergonomic to use and handle. Plus, with this new sprayer, it can help us to reduce our time to spraying because they got a wing on right and left side of the sprayer so that when we do the spraying, both side of wing will spray plants near them.This new innovation will give many benefits to people who use it. Hoping that this new innovation will contribute a good results and productiveness in farming industries.

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