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Project Work, Phase-I (18MEP78)

Report on

“PESTICIDE SPRAY PUMP”

Submitted in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING

in

MECHANICAL ENGINEERING

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CERTIFICATE

This is to certified that the **Sharat Kumar M (4SF19ME413)**, **Sooraj D (4SF19ME416)**, **Srivardhan (4SF19ME417)**, **Yojan G (4SF19ME420)** have satisfactorily presented the Project work (Phase I, 18MEP78) entitled with **“Pesticide Spray Pump”** as prescribed by **Visvesvaraya Technological University** for VII semester B.E degree in Mechanical Engineering course for the year 2021-22. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the said degree.

NAME	USN	MAX. MARKS	MARKS OBTAINED
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CHAPTER 1

INTRODUCTION

1.1 Background of the Project:

India is an agricultural nation. It has a land source which is the most appropriate for horticulture and 75% of populace in India is straightforwardly or by implication subject to cultivating. Country individuals, who establish almost 70% of populace, are subject to horticulture as a fundamental occupation. It is exceptionally fundamental to foster strategies for better farming. There is a need of advancement in this area and most normally on composts and pesticide spraying procedure, since it requires more endeavors and time to shower by customary way. On many farms production suffers due to delay in sowing of seeds, inappropriate dissemination of pesticides and composts, gathering, and so on, technology can effectively alter the production rate by providing various modern agricultural implements which save man hour and money. It is additionally well - well established reality that India is portrayed by low per capita pay. In this way, it requires the innovative individuals or the agricultural engineering who provide agricultural implements, which are generally complex and can be secured by the farmers at plausible rates.

Motorization takes care of the multitude of issues which are liable for lower creation. It saves the info and accuracy in work and improves and equivalent circulation. It diminishes amount required for better reaction, forestall the misfortunes and wastage of input applied. This outcomes in higher efficiency and financially usage of agricultural implements.

A significant portion of horticulture in India is contributed by vegetables, grains and pluses, and spices. India has a splendid future concerning the creation and commodity of spices. Pepper, cardamom, chilies, and turmeric are a portion of the significant species delivered in India. India is an exporter of spices. Chili is among the significant zest crop created in India. The yield is developed to a great extent for its organic products all over India. The significant vegetable yields filled in India, which represents 11.2 percent of worldwide vegetable creation, are potato, tomato, onion and okra. Tomato is perhaps the main vegetable yield with respect to both pay and nourishment. India is the world's second-biggest maker of rice, and the biggest exporter of rice on the planet.



Fig 1.1 Crop Field

Chili (*Capsicum annum* L.) is one of the significant zest yields of India and generally developed all through warm calm, tropical and sub-tropical nations. Chili is remembered for the family Solanaceae. It is utilized in India as a vital element of different dishes. Chili can be filled in a wide range of soil from light sandy to weighty soils. Chili is definitely not a yearly yield and in the two shortfall of winter harvest can endure a few seasons and develop into an enormous lasting bush. While the species can endure most environments, it is exceptionally useful in warm and dry environment. India is the significant maker, purchaser and exporter of chili on the planet. Pusa Sadabahar, Pusa Jwala, Ujwala is a portion of the significant assortments of chili filled in India. They are principally developed in Andhra Pradesh, Karnataka, Maharashtra, U.P, Bihar and Tamil Nadu.

Tomato (*Solanum lycopersicum* L.) is a vital vegetable utilized in practically all dinners and is consumed in different ways. Tomato development in India is perhaps the most beneficial agribusiness. The mastery of cultivators, an optimal environment, and great soils add to creation of tomatoes for handling. Outrageous harm from infections and bugs can deliver tomatoes unusable. High worth items expect tomatoes to be liberated from imperfections brought about by sicknesses and bugs. Creation of tomatoes for handling would be incomprehensible without fungicides and copper bactericides to control illnesses. Deterrent utilizations of pesticides should be made to stay away from or lessen misfortunes from sicknesses.

Rice is one of the main grains of India. Additionally, India has the biggest region under rice development, as it is one of the foremost food crops. Rice is for the most part filled in

rainfed regions that get weighty yearly precipitation. India is the main exporter of the Basmati rice to the worldwide market. They are fundamentally developed in Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, Uttarakhand and Western Uttar Pradesh. In any case, the majority of the paddy designers face immense financial misfortunes in paddy development because of harm brought about by insect pests.

Plant security assumes a huge part in enhancing the usefulness of a given yield. Agricultural pests cause impressive harm to crops and represent a significant production constraint. Successful plant security in this manner becomes fundamental to limit the misfortunes caused and to guarantee that full advantage is drawn from other creation inputs.

Compound application has been extremely fruitful in pest control however should be dealt with appropriately, applied in apportioned extents and spray efficiently. Specialized equipment is thus essential for chemical application as the only fully mechanized farming operation. Spraying pesticide is a significant process in cultivating. The goal of the utilization of pesticide is to hold the pest under check. The pest populace must be kept minimum to avoid financial loss of harvest yield. The goal of pesticide application other than holding the pest populace under check ought to likewise be to stay away from contamination and harm to the non-targets. These herbicides, pesticides, and manures are applied to agricultural fields with the help of uncommon device known as "Sprayer". The sprayer gives ideal execution with least endeavors. The innovation of a sprayer, pesticides, manures, get upset the agribusiness or cultivation area just as empower ranchers to get greatest horticultural result. Machines recently produced for compound application incorporate rucksack sprayers, ultra - low volume sprayers and farm hauler blast sprayers. By and large, gear utilized for showering synthetics to secure yields against bugs, sicknesses and weeds range from enormous farm truck mounted sprayers to physically worked rucksack sprayer.

Limited scope farmers are exceptionally intrigued by physically switch worked rucksack sprayer as a result of its flexibility, cost and design. In any case, this sprayer has specific limits like it can't keep up with required tension and it prompts issue of back pain. Nonetheless, this hardware can likewise prompt misapplication of chemical substances and inadequate control of pests which ultimately prompts to the loss of pesticides because of spilling or float during application. Additionally, the nature of some of these sprayers, and their capacity to be utilized to apply pesticides precisely and productively is of incredible worry because of their

design and activity. Sprayer configuration cause significant contrasts in spray distribution. Most of the sprayers performed ineffectively, demonstrating that they are inadequately planned with poor designed materials and misused by the framers. Another sort is fuel worked which requires a costly fuel petroleum or diesel. A trouble of a petroleum sprayer is the need to buy the fuel which in expands the running expense of the sprayer and it additionally delivers vibrations and commotions that disturbs the administrator.

A pesticide sprayer must be compact and with an expanded tank limit just as should bring about cost decrease, work and splashing time. To lessen these issues, there is various sprayers presented on the lookout, yet these gadgets don't meet the above issues or requests of the ranchers. Today we utilize different showering and seed planting innovations including utilization of electrical energy, synthetic energy. This reality makes us realize that how huge substance of energy is getting utilized at such spots where mechanical energy can be utilized rather than direct energy sources. In business sectors battery worked and fuel worked pesticide sprayer are accessible. However, this requires a few outside well spring of energy and increases cost of production. In customary techniques, the pesticide sprayer is mounted on the back which causes back torment and furthermore inappropriate splashing of pesticides. The weighty tank containing pesticide is conveyed by the rancher and requires a ton of human endeavors for splashing.

In after the above requirements, a physically worked wheel driven sprayer was proposed which is chiefly intended to decrease human exertion. It is centered around showering pesticides at greatest rate in least time by utilizing wheel worked system. The objective of clients is more modest enterprises and little gardens. Typically, gardeners will utilize the manual rucksack sprayer that is weighty and need to carry on their back to do spraying session. But proposed wheel sprayer needs only a forward push to operate it in field. So that the time taken is less, more area can be covered and effort is less than that of normal rucksack sprayer.



Fig 1.3 Rucksack Sprayer

1.2 Problems caused by the traditional sprayers are:

- Significant burden of the sprayer cause trouble in carrying on posterior or shoulder of administrator.
- Fatigue to the administrator due to overwhelming weight.
- Oversized pump causes burden to the administrator.
- Poor choice and quality of equipment.

Considering the above views, we have proposed study entitled on “Design of Portable-Pesticide Sprayer Pump”.

CHAPTER 2

LITERATURE SURVEY

Arora et al., In their work they proposed a portable system which makes use of the renewable source of energy to operate the spraying system which is compressed air. They have made use of the double acting cylinder piston, flywheel and a reciprocating pump for the spraying of the pesticide. They have designed a special interlink system to connect the double acting cylinder to the reciprocating pump known has the strip mechanism, which results in the control of the compressed air in and out of the double acting cylinder. It reduces the discomfort to the operator while spraying system and it creates the awareness about renewable energy to the farmers. It is easy to carry, portable and environmentally friendly.[1]

Parikh Vaibhav D et al., In their work they have proposed a portable system wherein they have used battery operated sprayer system which uses a lithium-ion operated battery of 12V as the power source and the is attached which pump starts to draw the liquid from the storage tank which is pressurized, this pressurized liquid is made to flow through the hose pipes and then to the nozzle for spraying of the pesticide in the farms. This system is used for small lands. They have also attached a weeder remover machine which can remove the unwanted plants that grow near the plants. The width and height of the machine can be changed by simply adjusting the screws and nuts.[2]

S R Kulkarni et al., Pesticides are utilized to control different illnesses in crops. Farmers utilize different sort of sprayers for pesticide sprayers. Primarily there are four sorts of sprayers Rucksack (Backpack) Sprayer, Machine mounted sprayer, Bike Driven sprayer and aerial sprayer utilized. To diminish the backpain, fuel utilization they have come up with this thought wherein in their work they have proposed a versatile foot worked pesticide showering pump which makes utilize of the kinetic energy being connected on it wherein it actuates the cylinder inside the barrel to pump within the air to the tank they have made utilize of the two sprayers for both the hands to cover more extensive zone in less sum of time.[3]

Ghodkhande&Dhote, In their work they have developed and fabricated manually operated spray pump which is wheel driven. They have successfully used the two wheels rotary motion into reciprocating motion the piston for spraying purpose. They have successfully tested the model and have found fare results as compared to other manually operated sprayer system. With this the operator can larger area of the field compared to the traditional pesticide spray.[4]

Poratkar & Raut, In their work they have proposed what are the drawbacks of knapsack sprayer machine and some of the expensive pesticide sprayer machine used. So, to limit all these expenses they successfully developed a multi-nozzle pesticide spray pump with taking into consideration the height of some of the plants. For the transmission of the system, they have used the chain and sprocket arrangement with plunger system arrangement and also, they have attached six nozzles to the system to cover a wider area. This alone pump can be used to spray over multiple crops at a time.[5]

Ghadge et al., In their work they have proposed the backpack sprayer which is not efficient and it can store around 10-20 liters of pesticide in one go and because of constant pumping which results in muscular disorder and also small area gets covered at a time so, to overcome this they have designed a reciprocating pump which is based on a single slider crank mechanism in which one of the sprockets is attached to the wheel axle and the other one is connected to connecting rod with the help of disc. The control is given to cylinder of the reciprocating pump through the revolution of the wheel. The pump used for spraying 20 liters generates a pressure of 2-4 bar. They have also made the simulation and analysis for the stress levels of the system and to know about the nodal displacement in the system.[6]

Malek et al., In their work they have proposed that instead of carrying the whole pesticide tank on his shoulders it is easy to drag the component mounted on the trolley to function the pump and shower the bugs. The concept is based on slider crank mechanism, they have used a shaft with a U- bent (MS-558C8) to transmit motion to the piston via the connecting rod. In this system there are two outlet pipes mounted at the top to throw out the spray to two rows simultaneously. The materials selected in this system is more lesser compared to the others mechanically operated system.[7]

Bhuvaneshwari et al., In their work they have proposed that their system is best suited for spraying of pesticide which uses a DC motor operated with help of 12V battery which helps in the rotation of the wheel the, rotary motion of the wheel is converted into reciprocating motion with the help of disk which is connected to the connecting rod which then pumps the pesticide to the sprayer. This requires less man power compared to other systems. They have made an analysis that the discharge is 0.108-meter cube per second for the area of 180 square meters the time taken for covering the entire area was recorded as 1.15hrs. [8]

Gunjal et al., In their work they have proposed that their system comes with the fertilizer dispenser. The technique used in their system has a gear and pinion arrangement to it and has three-wheel arrangement with two rear wheels and one fore wheel. The proposed model is less expensive as compared to tractor sprayer. They have also noted down the performance

characteristics of the system.[9]

Olatunji et al., In their work they have proposed that their framework is five times quicker than backpack sprayer. They have carried out the execution test, the working speed, discharge/flowrate, the rate of application to induce the result. It comprises of 7litre tank capacity for holding the spray material. The tallness and width of framework can be changed utilizing rise posts. Essentially, the pump is worked to trap air to construct up pressure and when the stream cut lever is squeezed, the liquid passes through the spout and spraying is done.[10]

2.1 Objectives

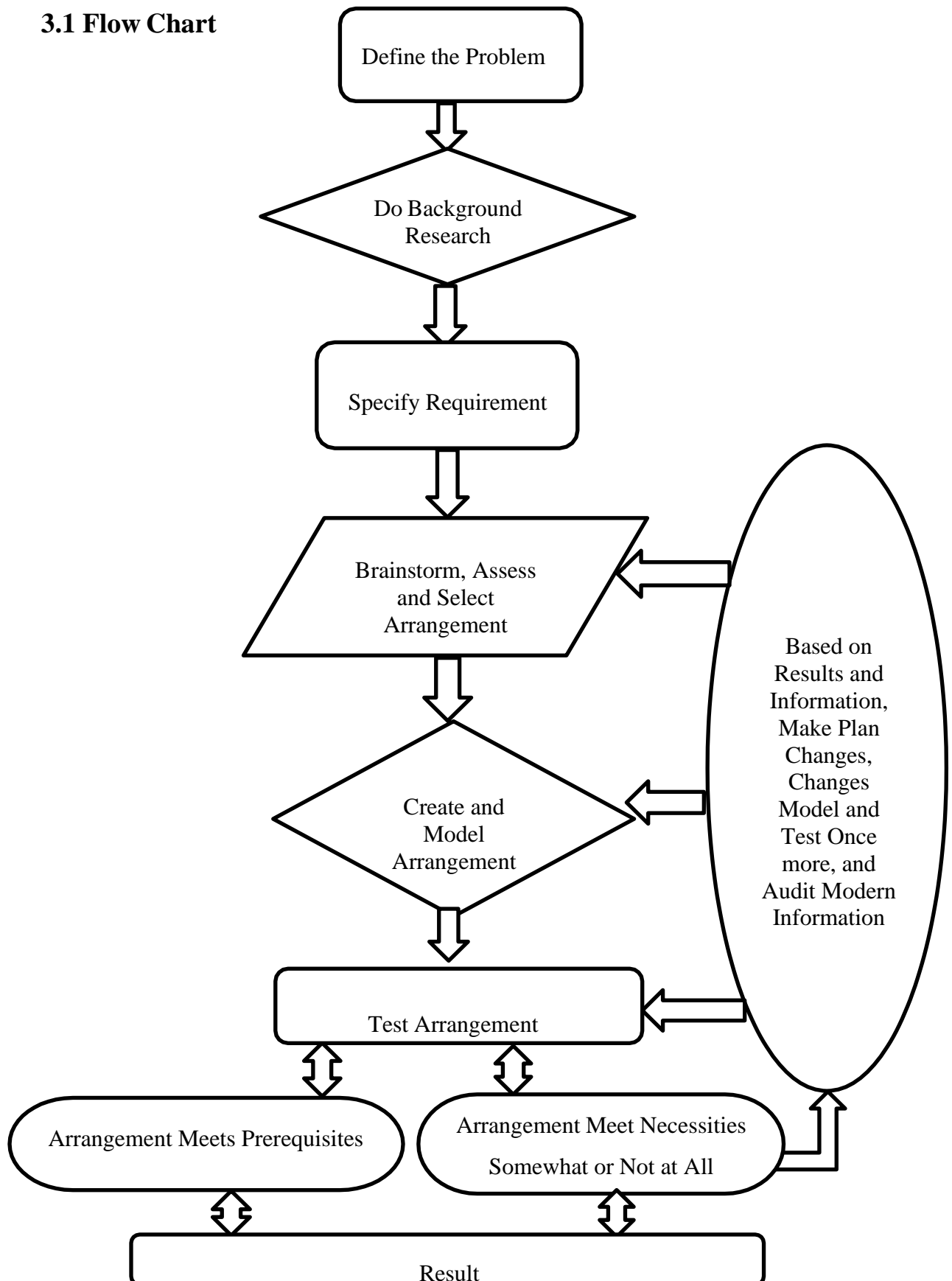
- To design and develop a portable telescopic arm pesticide sprayer.
- To decrease time required for pesticide spraying process so as to reduce human fatigue.
- To cover maximum land area of certain types of crops during the spray process.

CHAPTER 3

METHODOLOGY

- Construction of telescopic arm, made from PVC pipe of different diameter and the length of each pipe is 170cm, 150cm and 144cm respectively. In each of these pipes there are slots provided for the rope and with the help of the rope and pulley mechanism the telescopic arm extracts out and retracts in.
- The storage tank is used to store the chemical solution and is usually made up of CI (cast iron), on the inside with primer coating as well as the outside to reduce corrosion and it has the capacity of 50 liters to store the chemicals.
- The foot operated pump, it comes with rubberized grip and features an analog dial to indicate the pressure, and has a pressure of 120-150 psi which is used to pressurize the pesticide from the tank.
- One-way gate valve is manually operated by hand, which is used in the system to restrict the backflow of the pesticide into the tank.
- For the base of the model L-frame is used which is made up of mild steel and has an overall dimension of 90×26×15cm.
- Hose pipe which is made from polyester material and has dimensions with diameter of 1.27cm and length of 415cm which is used to supply the pesticide from the pressurized tank into the spray nozzle.
- Four wheels with diameter of 8cm is attached to the base of the model, which is used to move the system around the field.
- Spray nozzle is made from brass and has diameter of 1.27cm is connected to the tip telescopic arm to spray the pesticide onto the field.

3.1 Flow Chart



3.2 Conceptual Design

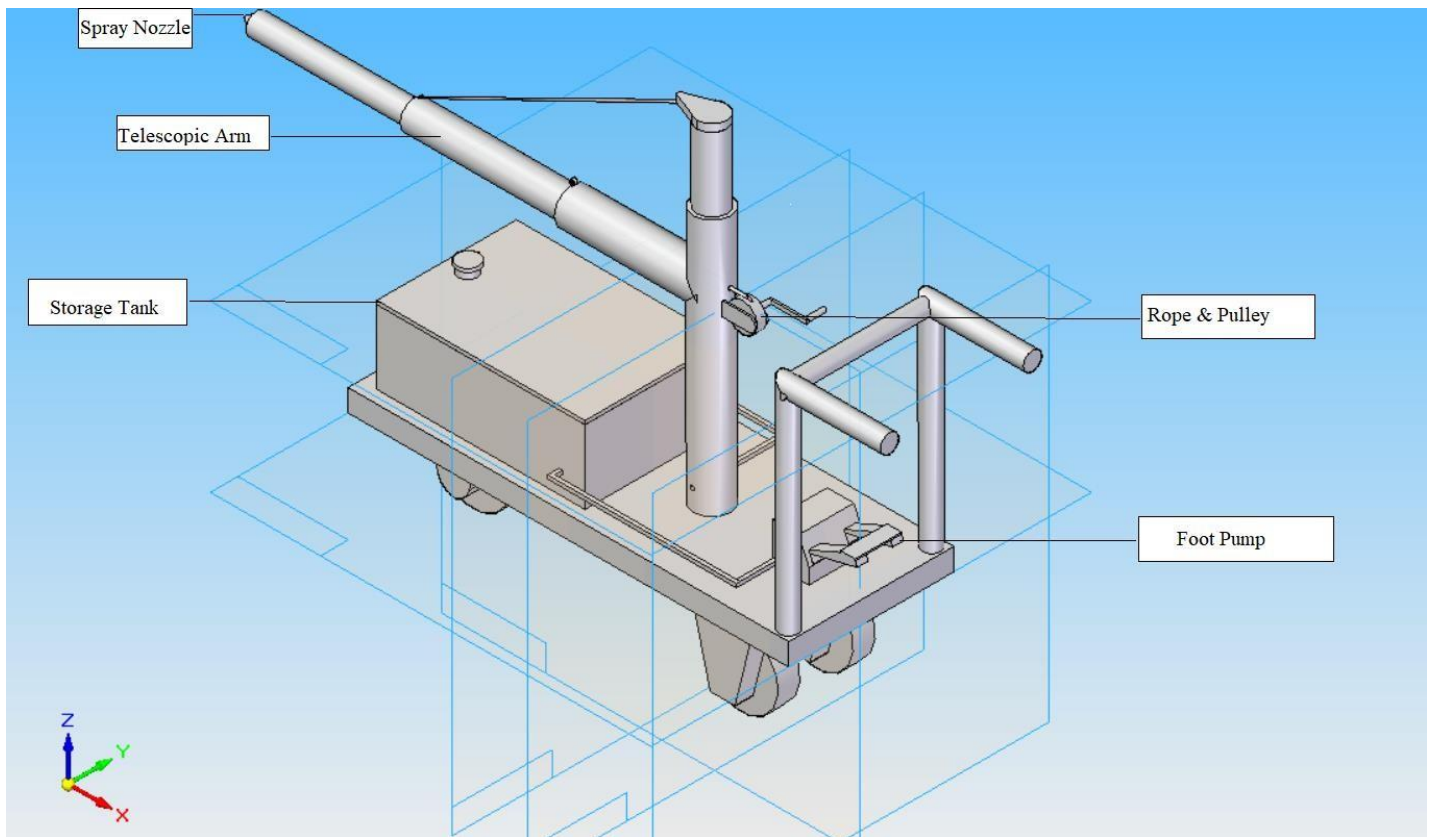


Fig 3.2 3D Model Design

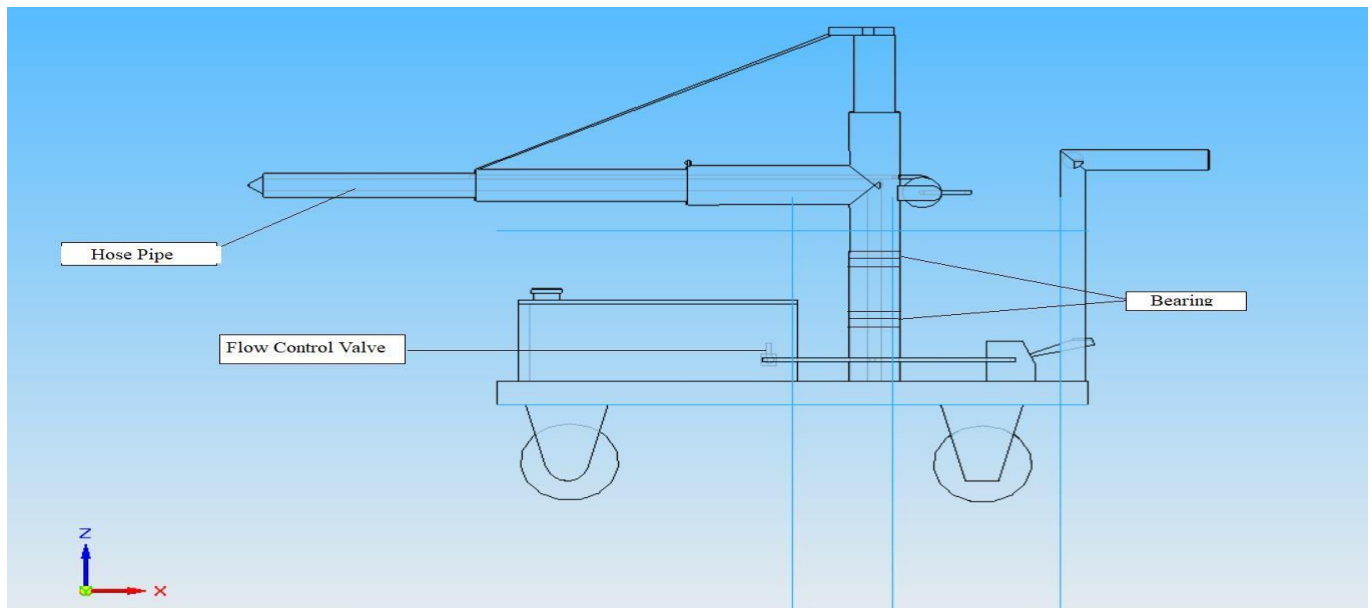


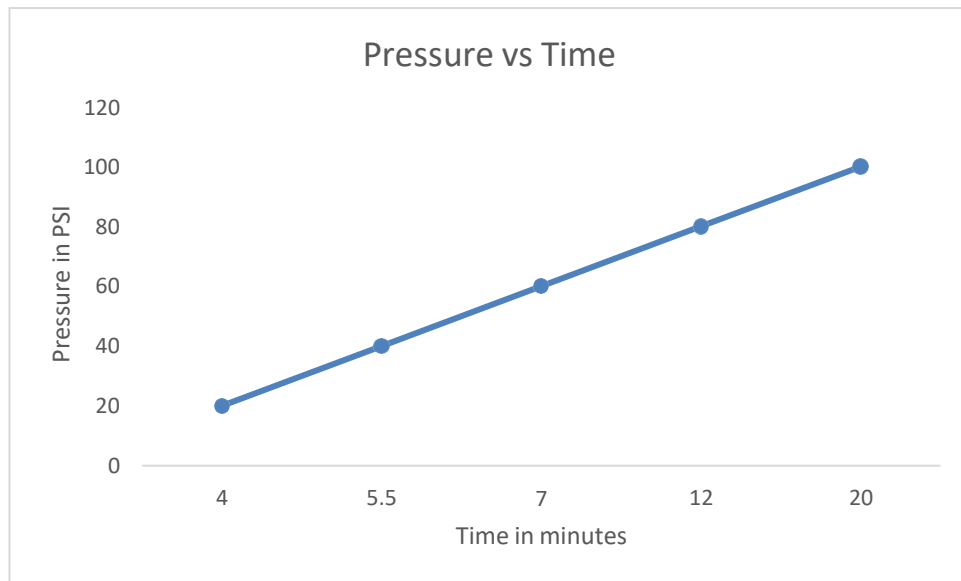
Fig 3.21 3D Model Design

CHAPTER 4

RESULT AND DISCUSSION

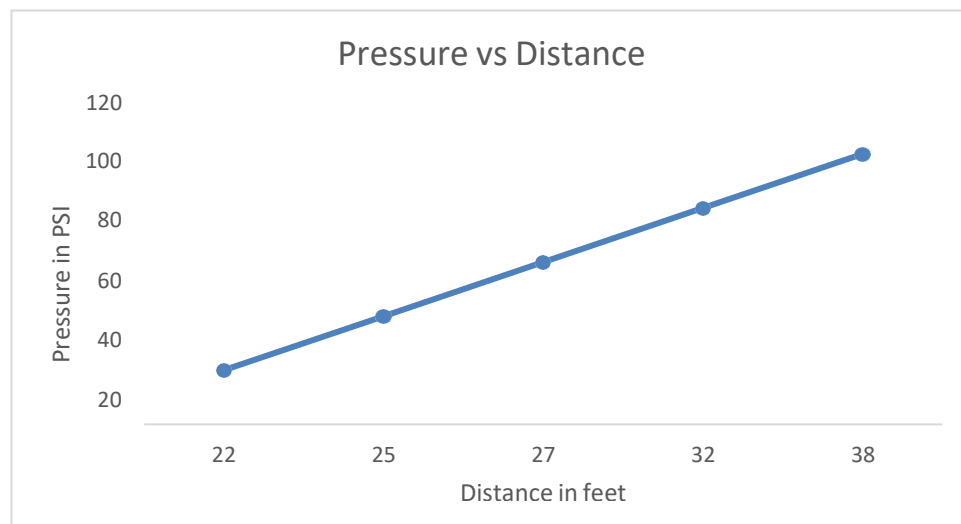
Single Point Nozzle:

Through testing the model, we found that for the given psi the pump can cover over larger distance, and for time taken to spray a field goes on increasing as there is a change in psi



Graph 1 Pressure vs Time

The above graph shows the pressure and time graph as the pressure in the tank increases the time duration to spray the pesticide also increases.



Graph 2 Pressure vs Distance

The above graph shows the pressure and distance graph as the pressure in the tank increases the distance travelled by spray increases.

CHAPTER 5

CONCLUSION

- The suggested model can ease the farmers from back pain, since there is no need to carry the tank on their backs.
- The model can cover over a larger distance area with minimum time with less effort.
- This alone pump can be used for multiple crops.

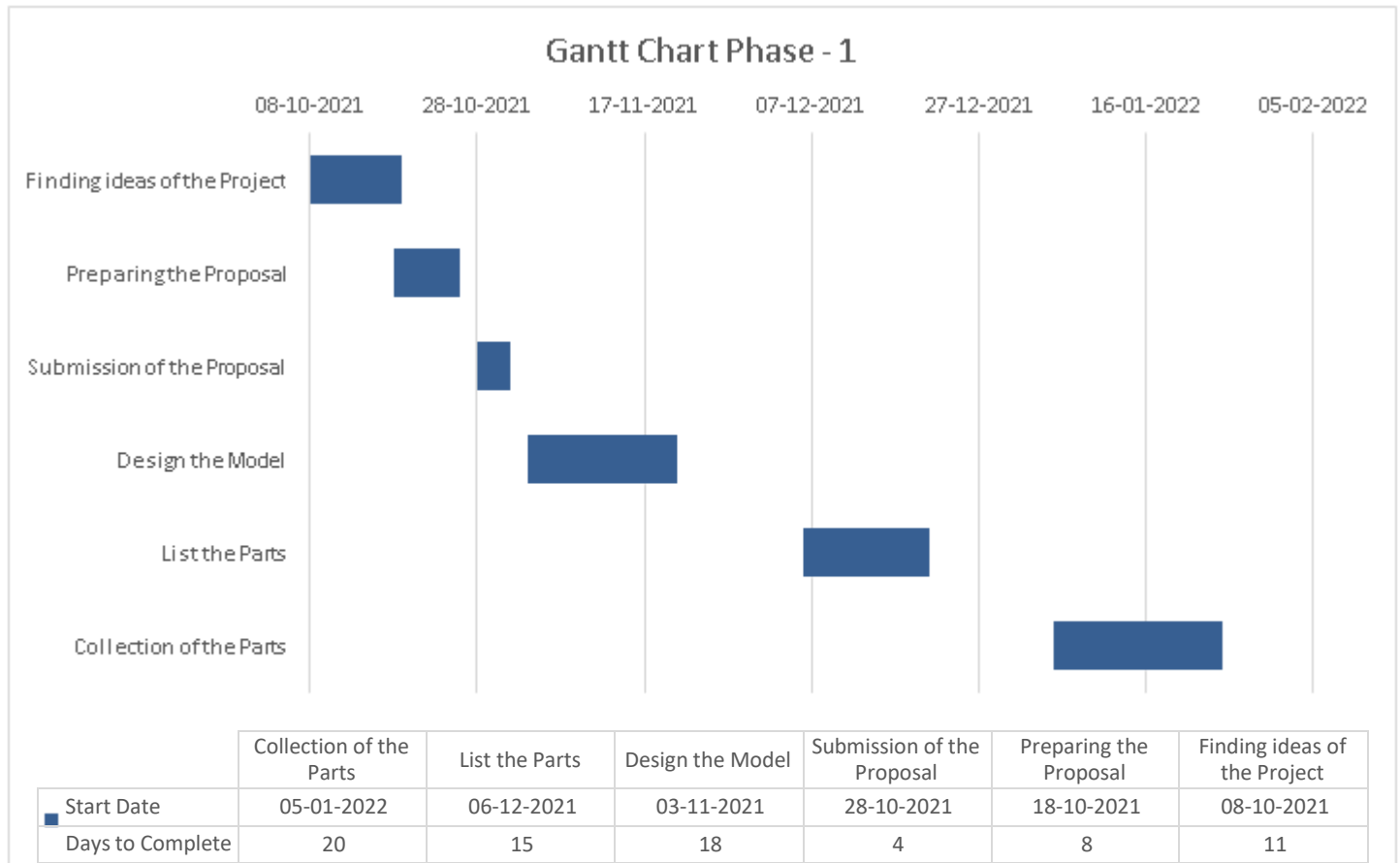
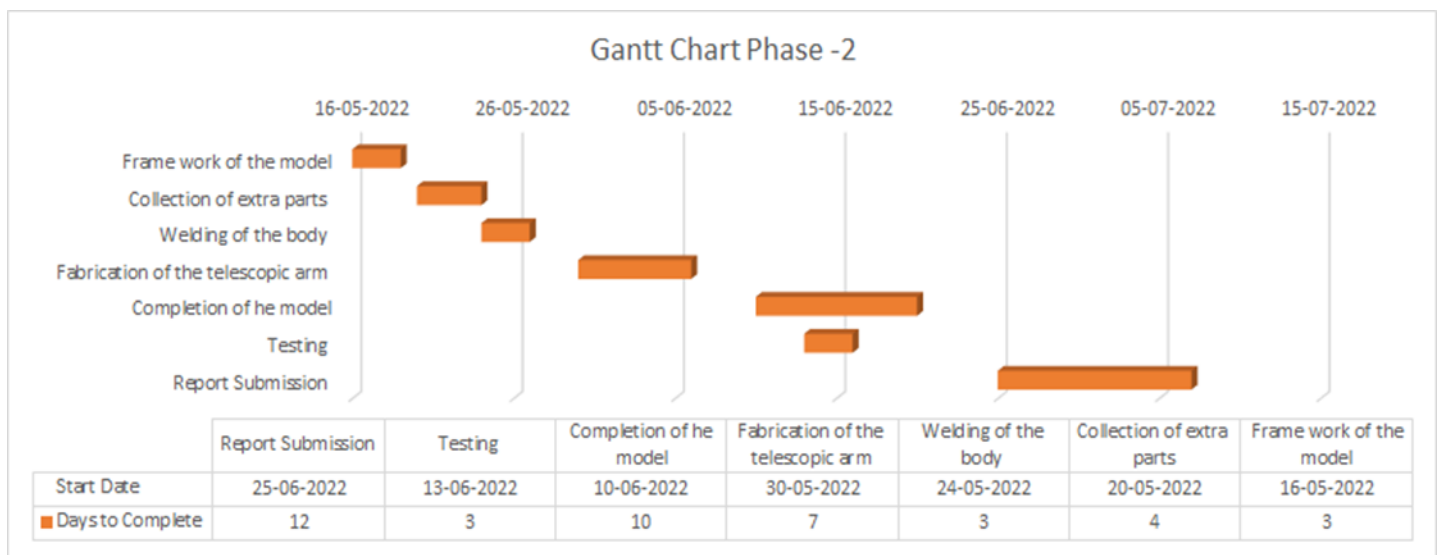
CHAPTER 6

SCOPE FOR THE FUTURE

- Instead of using a foot operated pump one can use the solar operated pump and get the required output.
- The use of multi-nozzle can improve the efficiency of the pump.
- To modify the capacity of the pump.

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ANNEXURE-I**PROJECT GANTT CHART****Project Gantt Chart Phase 1****Project Gantt Chart Phase 1****Project Gantt Chart Phase 2**

ANNEXURE -II**BUDGET**

Table 1 Project Cost Analysis

Material/Component	Dimensions/Specifications	Price (in ₹)
Wheels	φ16 cm	500
Storage Tank	50 Liter	1500
Foot Operated Pump	150psi	1800
Telescopic Arm	464 cm	1500
Hose Pipe	415cm	356
Spray Nozzle	φ1.27cm	870
Rope	500cm	100
Supporting Arm	22×100×9cm	1000
Arm Holder	18×7×3cm	300
Support Cable	160cm	50
L Frame	26×90×1.5 cm	900
Gate Valve	Φ1.27cm	540
Total		9416

ANNEXURE - III

PHOTO GALLERY

1. Images of Fabrication Work

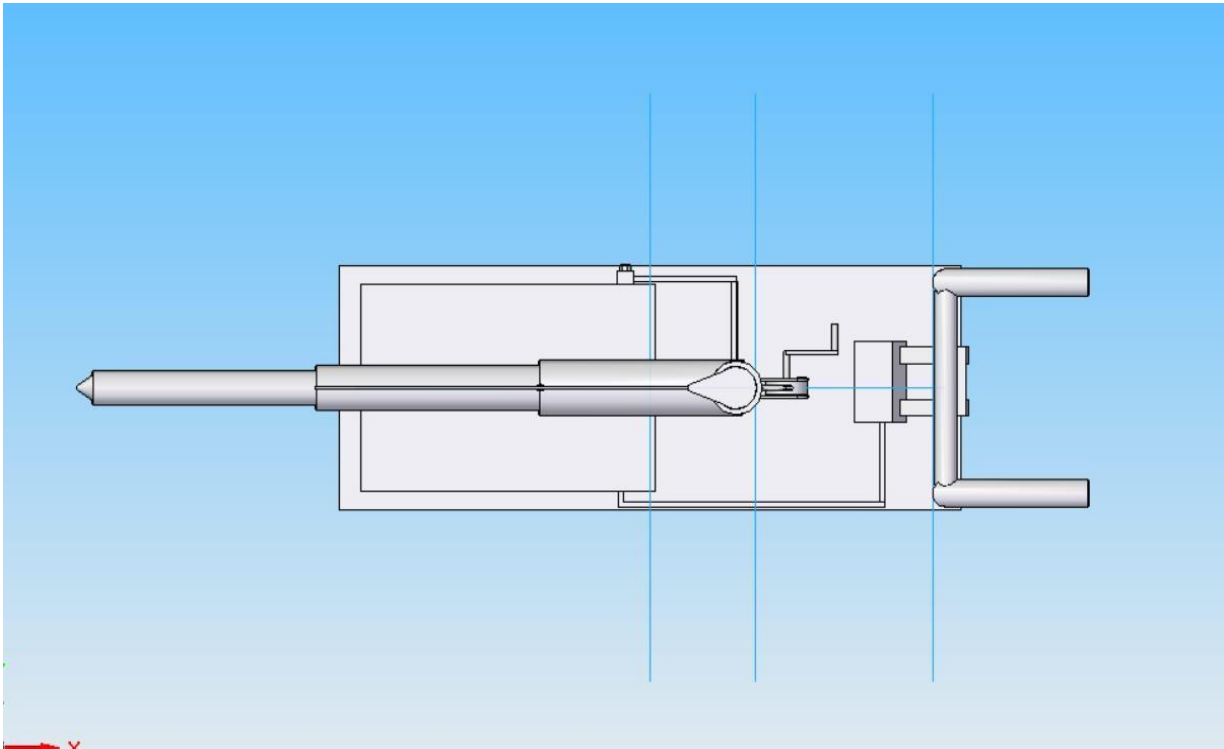




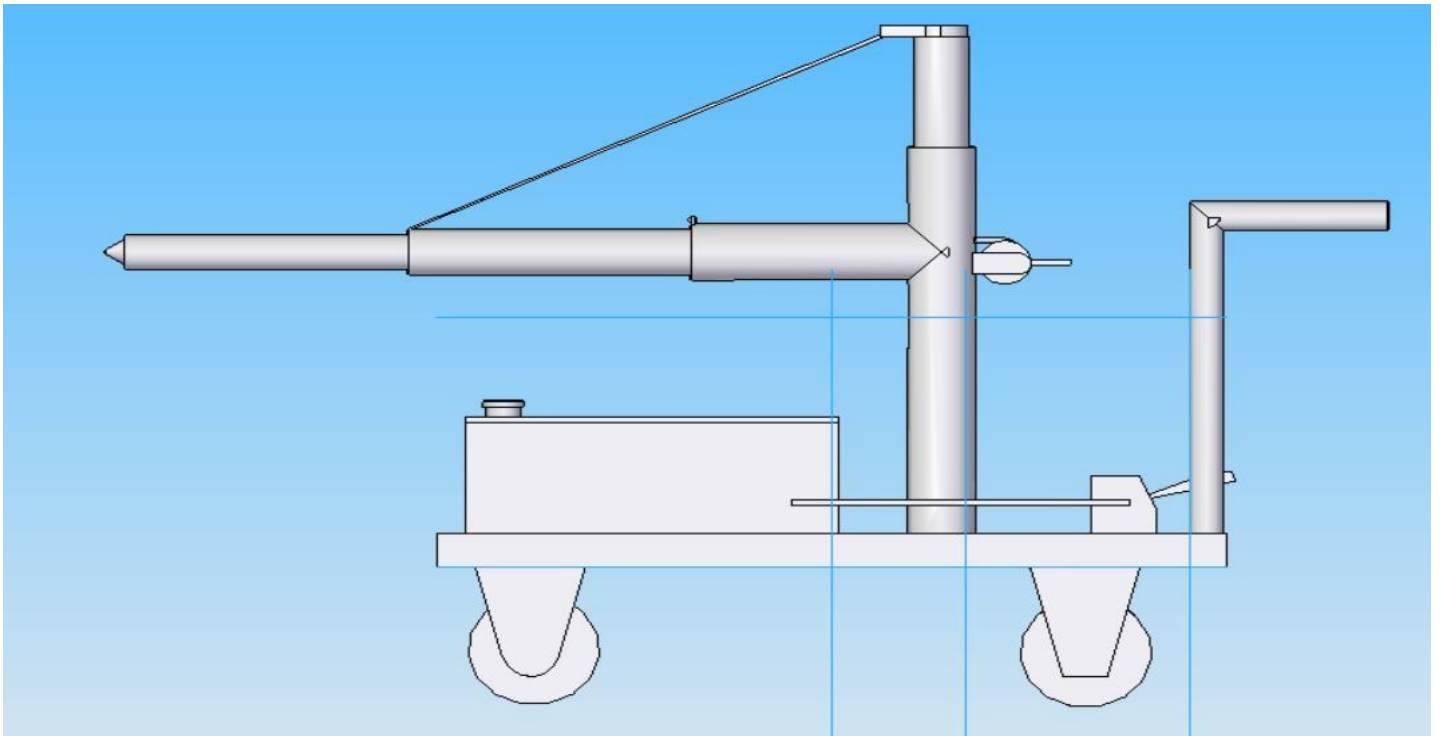








3D Top view of the Model



3D Front view of the Model