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Sonargaon University (SU)

সোনারগাঁও ইউনিভার্সিটি (এসইউ)

Wheel Operated Automated Fertilizer Sprayer

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Of

Bachelor of Science in Mechanical Engineering

April, 2023

LETTER OF TRANSMITTAL

April, 2023

To

Md.Mostofa Hossain

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Sonargaon University

Subject: Submission of Project Report**.**

Dear Sir,

We are pleased to submit the project report on "**Wheel Operated Fertilizer Sprayer".** It was a great pleasure to work on such an important topic. This project has been done as per instruction of your supervision and according to the requirements of the Sonargaon University.

We expect that the project will be accepted by the concerned authority we will remain happy to further explanation that you may feel necessary in this regard.

Thank You

Sincerely yours,

Signature of the Candidates

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DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for award of any degree or certificate

We hereby ensure that the works that has been presented here does not breach any existing copyright.

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ABSTARCT

Different kinds of insecticides sprayer are available in our country. As a land of agriculture which comprises of small and rich farmers. Small scale farmers are very interested in manually level operated knapsack sprayer because of its versatility, cost and design. Spraying is an important operation to be performed by the farmers to protect the cultivated crops from insects, pests, funguses and diseases in which various insecticides, pesticides, fungicides and nutrients are sprayed on crops. So this gadgets which we called wheel operated fertilizer sprayer can be operated manually for spreading granular materials in farms especially for solid fertilizers like urea. When the vehicle is pushed, motion is transferred form rear axle wheels which through sprocket and chain mechanism which in turn rotates second sprocket connected to a shaft having screw conveyor at both the ends. This rotation of screw conveyor will discharge the fertilizer which is supplied through a hopper acting a storage tank.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

As a agriculture, around 66% of population depends upon agriculture. However, its contribution to GDP is now around one sixth, it provides 58% of a work force. As spraying is an important operation in agriculture. Therefore the application of liquid fertilizers, insecticides, herbicides and pesticides are done with the aid of sprayers. The benefits of using sprayers for chemical application includes, capability of applying at the desired level, case to operate, little or zero maintenance, enhancement of uniform distribution of the contents. The current backpack sprayer has lot of limitation and it required more energy to operate. So the aim of developing such a concept is primarily because of preventing 3 major drawbacks of the pump being used currently firstly, the farmer has to carry the entire weight of the pesticide spraying pump on his shoulder; secondly, he has to continuously use his one hand to pump using the handle; thirdly, reduction in spraying time. All these factors have been taken care of in this project along with being cost effective, light in weight and good in strength. The pump already available with the farmer can be directly used in this mechanism. The handle of the sprayer will be mechanically operated through the rotation shaft of the wheel of the cart using an efficient mechanism.

This will result into the reciprocating motion of the piston and now just have to push the cart and the whole mechanism will be operated with case. This will be a case of pure mechanical Automation. Farmers use the same methods and equipment to plant seeds, spraying pesticides. The method used by gardeners perform the process of spraying pesticides and herbicides. Gardeners need to cover their gardens with pesticides and pesticides to ensure that no shrubs grow and are used free of insects, caterpillars, and other pests. While gardeners will use a Knapsack manual sprayer to spray their garden, this may take a long time to finish spraying their garden. In addition, this manual Knapsack sprayer uses only one nozzle. There is a need for the development of effective spraying and weeding machines to increase productivity. Small farmers are particularly interested in manually operated backpack sprayers because of their flexibility, cost, and design. With a wheel spray pump combined with wheels and easier to move makes the working system very easy. This one trolley system by using this we can reduce the maximum effort required to spray

pesticides as well as we can spray pesticides in any direction or around the plant at crop height. This paper shows a model of a wheeled spray pump that will perform spraying at the maximum rate in the minimum time.[1]Pesticide spraying is an important work in agriculture to protect crops from insects. Farmers mainly use manual or fuel-powered spray pumps for this work. Because of its bulky and heavy build, this typical sprayer creates user fatigue. This prompted us to design and produce a model that is essentially a solar sprayer in our design, where we were able to eliminate the rear mounting of the sprayer. Convenient, it is not good for farmers' health while spraying. In this way, we can reduce the level of user.

a land of agriculture which comprises of small, marginal and rich farmers. Small scale farmers are interested in manually lever operated knapsack sprayer because of its versatility, cost and design. As the pests and insects nowadays have been growing up in abundance throughout the vegetation and also having developed their immunity towards the surrounding environment, it becomes compulsory for the farmers across the globe to spray pesticides and insecticides frequently in order to protect their crops from getting rotten and consumed by insects. Protection from parasites is an important factor in all the agricultural operations, and calls for continual monitoring and prompt action when needed. In many cases, different equipment‟s, pesticides and manpower are required for this purpose which accounts for the majority of production expenses.

This would ultimately affect the economy of the farmer, hence it needs serious consideration. India is set to be an agricultural based country approximately 75% of population of India is dependent on farming directly or indirectly. Our farmers are using the same methods and equipment for the ages e.g. seed sowing, spraying, weeding etc. There is need for development of effective spraying and weeding machine for increasing the productivity. India is a land of agriculture which comprises of small, marginal, medium and rich farmers. Small scale farmers are very interested in manually lever operated knapsack sprayer because of its versatility, cost and design. Multiple pesticide sprayer pumps is combination of both knapsack & Battery operated pump for better efficiency. This one is trolley operated system by using this we can reduce maximum effort required for spraying Pesticides as well as we can Spray Pesticides in any direction or around the crops at any height of crops. This is used for weeding, plugging etc. This paper suggests a model of manually operated multi nozzle pesticides sprayer pump which will perform

spraying at maximum rate in minimum time.y. The 2010 world statistics of agriculture says, India to be the world's highest producer of several vegetables, fresh fruits, major spices, milk and also some fibrous crops. Lack of mechanization or automation is one of the major roadblocks to improving the productivity of agriculture. In addition to harming cultivated plants, many pests, such as Canada thistle, can poison livestock if eaten.

Although livestock poisoning is not a serious problem in the eastern United States, the western states, having many poisonous species, report a considerable loss each year. For example, the wild onion, although not poisonous, spoils the flavor of milk produced by cows that consume this weed. Although generally harmful or undesirable, weeds can also provide benefits for agriculture. Pests prevent or retard Soil erosion in open pasture sand stabilizes the thin, fragile soils of tropical farmlands. They conserve water in semi-arid and Mediterranean climates by enhancing water storage, increasing shade, and breaking up the soil with their root growth.

1.2 Background Study

There many types of sprayers have been invented since 1947, by Ray Hagie, the founder of Hagie Manufacturing. Automatic sprayers and sprayer motors are used by large agricultural industries to perform many spraying activities on their farms. Unlike small industries or vegetable gardens, they are accustomed to using manual Knap sack sprayers. Through this research, to transform a manual backpack sprayer into a mechanical sprayer will require more rewarding and faster working time to all gardeners working in small industries.[2] Sprayer is well known by all people in nowadays. There is various type of sprayer that have been invented until 2021 such as Plastic Knapsack Sprayer, Pressure Water Sprayer, Ogawa sprayer, Shizuka Sprayer, 2L Pressure Sprayer and Typical Garden Sprayer. These sprayers usually used by gardeners and small farming industries to spray pesticide or to watering their plants in farms and gardens. Finally, this study also allows other researchers to conduct further research that is more focused to help gardeners in Malaysia and other countries to do their best in spraying activities in the garden

1.3 Problem Statement

Existed spray is unable to spray effectively and need extra time for spraying. Prolonged use has detrimental effect on the body of the user because the sprayer is heavy and may

causes back pain if used in a long time.A backpack sprayer consists of tank 10 -20 liter capacity carried by two adjustable straps. Constant pumping is required to operate this which results in muscular disorder. Also the backpack sprayer can‟t maintain pressure, results in drifts/dribbling .Developing adequate pressure is laborious and time consuming .Pumping to operating pressure is also time consuming. Moreover, very small area is covered while spraying. So, more time are required to spray the entire land.Back pain problems may arise during middle age due to carrying of 10-20 liter tank on back.

1.4 Objective

We have some specific objectives for this project and they are pointed below:

- To design and develop an ergonomic **Wheel Operated Fertilizer Sprayer.**
- To reduce the spraying time in the vegetables garden or fruit garden.
- To increase efficiency on spraying because it contains more than one nozzle During the spraying process.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In this section topics related to Wheel Operated Fertilizer Sprayer are included. These provide a sampling of problems appropriate for application of Wheel Operated Fertilizer Sprayer System. The references are summarized below.

2.2 Literature Review

1. R.D. Dhete has worked on “Agricultural fertilizer & pesticides sprayers”. In his work he emphasizes on different method of spraying devices Day by day the population of India is increasing and to fulfil the need of food modernization of agricultural sectors are important. Due to chemical fertilizers the fertility of soil is decreasing. Hence farmers are attracted towards organic farming. By mechanization in spraying devices fertilizers and pesticides are distributed equally on the farm and reduce the quantity of waste, which results in prevention of losses and wastage of input applied to farm. It will reduce the cost of production. It will reduce the cost of production. Mechanization gives higher productivity in minimum input. Farmers are using same traditional methods for spraying fertilizers and pesticides. Equipment is also the same for ages. In India there is a large development in industrial sectors compared to agricultural sectors. Conventionally the spraying is done by labours carrying backpack sprayer and fertilizers are sprayed manually. The efforts required are more and beneficial by farmers having small farming land.

2. Pavan B. Wayzode, Sagar R. Umale, Rajat R.Nikam, Amol D.Khadke, Hemant carried out their work in “Design Fabrication of Agricultural sprayers, weed with cutter Chemicals are widely used for controlling disease, insects and weeds in the crops. They are able to save a crop from pest attack only when applied in time. The chemicals are costly. Therefore, equipment for uniform and effective application is essential. Dusters and sprayers are generally used for applying chemicals. Dusting, the simpler method of applying chemical, is best suited to portable machinery and it usually requires simple equipment. But it is less efficient than spraying, because of the low retention of the dust. In this work we have proposed an equipment that is wheel and pedal operated sprayer, it is a portable device and no need of any fuel to operate, which is easy to move and sprays the pesticide by moving

the wheel and also peddling the equipment. In this equipment using reciprocating pump and there is a accumulator provided for the continuous flows of liquid to create necessary pressure for the spraying action. This wheel operated pesticide spray equipment consumes less time and avoids the pesticide from coming from front of the nozzles which will in contact of the person who sprays pesticides. Weed management is one of the tedious operations in crop production. Because of labour costs, time and fully manual weeding is unfavourable. Hence effort is made to design and develop efficient Farm equipment to perform weeding without using electric power.

3. According to literature published on flow control of agricultural spraying machine by massey university Newzeland on different spraying mechanism are studied New Zealand relies heavily on its agricultural industry. A large portion of this industry is pastoral farming, where livestock are raised to graze on pasture. This includes beef, sheep and dairy farming. An important aspect of this style of farming is maintaining pasture quality. In order to increase growth fertilisers are often applied to the pastures. This increase yields in both meat and milk production. However, the increased application of fertiliser is linked with diminishing water quality. While the effects of nitrogen leaching and the best ways to manage fertiliser use are still being investigated, it is clear that control over the application will become more and more important. The Tow and Fert is a range of fertiliser machines designed and built in New Zealand by Metalform Dannevirke. The Tow and Fert range is capable of spraying a wide range of fertilisers including both soluble and non-soluble fertilisers. The Tow and Fert is unique in its ability to spray fertiliser slurries consisting of mixture ratios of up to three-parts fine particle fertiliser to one-part water. This is achieved by the use of a recirculating system. Currently there is next to no control on the flow rate of the machines and the application rate is determined by the speed the operator maintains. The purpose of this thesis is to design and build a flow control system for the Tow and Fert product range and investigate the effect of the changing flow rate on the spray characteristics. The ability to spray such a wide range of fluids with drastically different properties presents many challenges. Many flow meters were considered and a low-cost ultrasonic sensor (TUF2000M) was installed and investigated. After limited success of the ultrasonic sensor, a simple turbine flowmeter was installed. A flow controller was developed and tuned. Based off a PID control loop, the controller was able to maintain flowrate well between 10 L/min and 25 L/min depending on the installed nozzle.

4. Sandeep H. Poratkar, Dhanraj R. Rout carried out their work in “Development of Multinozzle Pesticides Sprayer Pump” India is a land of agriculture which comprises of small, marginal, medium and rich farmers. Small scale farmers are very interested in manually lever operated knapsack sprayer because of its versatility, cost and design. But this sprayer has certain limitations like it cannot maintain required pressure; it leads to problem of back pain. However, this equipment can also lead to misapplication of chemicals and ineffective control of target pest which leads to loss of pesticides due to dribbling or drift during application. This phenomenon not only adds to cost of production but also cause environmental pollution and imbalance in natural echo system. This paper suggests a model of manually operated multi nozzle pesticides sprayer pump which will perform spraying at maximum rate in minimum time. Constant flow valves can be applied at nozzle to have uniform nozzle pressure.

5. Prof. S.V. Deshpande, Damre Mayur & Diwanale Swapnil has worked on “Agricultural Reciprocating Multi Sprayer”. In agricultural sector generally farmer uses traditional way that is spray carried on backpack and spraying crop. This becomes time consuming, costly and human fatigue is major concern, these problems can be overcome by using agricultural reciprocating multi sprayer. It facilitates uniform spread of the chemicals, capable of throwing chemicals at the desired level, precision made nozzle tip for adjustable stream and capable of throwing foggy spray depending on requirement. In our project we use slider crank mechanism to convert rotary motion into reciprocating motion to operate the pump, thus the pesticide is spread through the nozzle. This work gives continuously flow of pesticide at required pressure and height. A special arrangement is implemented in this project to adjust the pressure as high or low. We also use a weed cuter in our model for removing unwanted plants. By using agricultural sprayer, spraying time and weeding time, human efforts reduces and results in cost reduction.

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2.3 Summary

We try to do this project by reading the above literature, and we have been able to make our project successful by reducing the mistakes of last year's project.

CHAPTER 3
HARDWARE ANALYSIS

Hardware List:

1. Frame
2. Sprayer Tank
3. Pump
4. Nozzle
5. Wheel
6. Chain Sprocket
7. Ball Bearing

3.1 Frame

A frame base typically refers to a structural support frame that serves as the foundation for a piece of equipment, machinery, or a structure. The frame base is designed to provide stability, support, and a level platform for the equipment or structure it is supporting. A frame base can be made of various materials such as steel, aluminum, or wood, depending on the intended use and load capacity requirements. The design of a frame base typically takes into account factors such as the weight and size of the equipment or structure, the type of load it will bear, and the environmental conditions it will be exposed to.

Figure 3.1: Frame Base

The construction of a frame base generally involves the following steps:

Determine the size and shape of the frame base based on the equipment or structure it will support.

Select appropriate materials for the frame, taking into account factors such as load capacity, durability, and resistance to environmental conditions.

Cut and weld the frame components together to form the desired shape and size.

Install any necessary braces, gussets, or cross members to provide additional support and stability.

Attach the equipment or structure to the frame base using bolts, screws, or other fasteners. Test the stability and levelness of the frame base to ensure that it can support the weight of the equipment or structure. Overall, a frame base is an essential component for many types of equipment and structures, providing a solid foundation and ensuring stability and safety. Proper design and construction of a frame base are critical to the longevity and functionality of the equipment or structure it supports.

3.2 Sprayer Tank

A sprayer tank is a container used to hold liquid pesticides, herbicides, or fertilizers that are applied to plants or crops using a spray mechanism. Sprayer tanks are an essential component of any agricultural spraying system, and they come in different sizes and shapes depending on the specific application and the volume of liquid that needs to be sprayed. Some common materials used in the construction of sprayer tanks include polyethylene, fiberglass, and stainless steel. The choice of material depends on the specific application and the chemicals being sprayed. For instance, some chemicals are highly corrosive and may require a more durable and corrosion-resistant material such as stainless steel. The design of a sprayer tank typically takes into account factors such as capacity, ease of use, and safety. Some sprayer tanks are equipped with baffles or agitators that help mix the liquid inside, ensuring a consistent mixture and preventing sediment from settling at the bottom.

Figure 3.2: Sprayer Tank

Other features that may be included in sprayer tanks include:

Agitation system: This helps keep the liquid in the tank mixed, preventing sediment from settling and clogging the sprayer nozzle.

Drain valve: This allows for easy draining of the tank when it is not in use.

Fill port: This is where the liquid is added to the tank, and it is typically located on the top of the tank.

Pressure relief valve: This helps prevent over-pressurization of the tank and can prevent accidents.

Sight gauge: This is a clear window or gauge that allows the user to see how much liquid is left in the tank.

Tank strainer: This helps filter out any large particles that may clog the sprayer nozzle.

Overall, the design and construction of a sprayer tank are critical to the functionality and safety of an agricultural spraying system. Proper selection of materials and features can ensure efficient and effective application of chemicals while minimizing the risk of accidents or environmental damage

3.3 Pump

A pump is a mechanical device that is used to move fluids (liquids or gases) from one location to another. Pumps are used in a wide range of applications, including agriculture, manufacturing, and transportation, among others. In agricultural applications, pumps are often used to move water, fertilizers, pesticides, and other liquids through irrigation systems, sprayers, and other equipment.

Figure 3.3: Pump

There are several types of pumps commonly used in agricultural applications, including:

Centrifugal pumps: These pumps use a spinning impeller to create a flow of liquid through the pump. They are commonly used for pumping large volumes of water and are relatively simple and low-maintenance.

Positive displacement pumps: These pumps work by trapping a fixed amount of fluid and then forcing it through the pump. They are commonly used for pumping thick or viscous liquids, such as fertilizers or slurry.

Diaphragm pumps These pumps use a flexible diaphragm to move the liquid through the pump. They are often used in applications where precise flow control is required, such as in chemical injection systems.

Submersible pumps: These pumps are designed to operate underwater and are often used for pumping water from wells, lakes, or rivers. The selection of a pump depends on several factors, including the type of fluid being pumped, the desired flow rate, and the pressure required to move the fluid through the system. Additionally, pumps can be powered by various sources, including electric motors, gas engines, or hydraulic systems, depending on the specific application.

Overall, pumps are an essential component of many agricultural applications, allowing for efficient and effective movement of fluids through irrigation systems, sprayers, and other equipment. Proper selection, maintenance, and operation of pumps are critical to ensuring optimal performance and minimizing downtime and maintenance costs.

3.4 Nozzle

A nozzle is a device that is used to control the flow of a fluid, such as a liquid or gas, as it is expelled from a pipe or other source. In agricultural applications, nozzles are commonly used in sprayers and other equipment to apply liquids such as pesticides, herbicides, and fertilizers to crops.

Figure 3.4: Nozzle

Nozzles come in many shapes and sizes, and the choice of nozzle depends on the specific application and the desired spray pattern. Some common types of nozzles used in agricultural spraying applications include:

Flat fan nozzles: These nozzles produce a fan-shaped spray pattern and are commonly used for applying herbicides and other chemicals to crops.

Cone nozzles: These nozzles produce a conical spray pattern and are commonly used for applying pesticides and other chemicals to crops.

Hollow cone nozzles: These nozzles produce a circular spray pattern with a hollow center and are commonly used for applying pesticides and other chemicals to crops.

Floodjet nozzles: These nozzles produce a flat spray pattern with a wider angle than flat fan nozzles and are commonly used for applying liquid fertilizers to crops.

Air induction nozzles: These nozzles mix air with the liquid being sprayed to create larger droplets that are less likely to drift in the wind, reducing the risk of off-target application.

The selection of a nozzle depends on several factors, including the type of liquid being sprayed, the desired spray pattern, and the application rate. Proper selection and maintenance of nozzles are critical to ensuring accurate and efficient application of chemicals to crops, while minimizing waste and environmental impact.

3.5 Wheel

A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the key components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel, and flywheel.

Figure 3.5: Wheel

3.6 Chain Sprocket

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. Most often, the power is conveyed by a roller chain, known as the **drive chain** or **transmission chain**, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth. Sometimes the power is output by simply

rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attaching shafts or hubs to this gear.

Figure 3.6: Chain Sprocket

Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotate once, it causes the gear that drives the wheels to rotate more than one revolution. Duplex chains are another type of chain which are essentially two chains joined side by side which allow for more power and torque to be transmitted.

Belt drive

Most chain drive systems use teeth to transfer motion between the chain and the rollers. This results in lower frictional losses than belt drive systems, which often rely on friction to transfer motion. Although chains can be made stronger than belts, their greater mass increases drive train inertia. Drive chains are most often made of metal, while belts are often rubber, plastic, urethane, or other substances. If the drive chain is heavier than an equivalent drive belt, the system will have a higher inertia. Theoretically, this can lead to a greater flywheel effect, however in practice the belt or chain inertia often makes up a small proportion of the overall drive train inertia. One problem with roller chains is the variation in speed, or surging, caused by the acceleration and deceleration of the chain as it goes

around the sprocket link by link. It starts as soon as the pitch line of the chain contacts the first tooth of the sprocket. This contact occurs at a point below the pitch circle of the sprocket. As the sprocket rotates, the chain is raised up to the pitch circle and is then dropped down again as sprocket rotation continues. Because of the fixed pitch length, the pitch line of the link cuts across the chord between two pitch points on the sprocket, remaining in this position relative to the sprocket until the link exits the sprocket.

This rising and falling of the pitch line is what causes chordal effect or speed variation. In other words, conventional roller chain drives suffer the potential for vibration, as the effective radius of action in a chain and sprocket combination constantly changes during revolution ("Chordal action"[10]). If the chain moves at constant speed, then the shafts must accelerate and decelerate constantly. If one sprocket rotates at a constant speed, then the chain (and probably all other sprockets that it drives) must accelerate and decelerate constantly. This is usually not an issue with many drive systems; however, most motorcycles are fitted with a rubber bushed rear wheel hub to virtually eliminate this vibration issue. Toothed belt drives are designed to limit this issue by operating at a constant pitch radius Chains are often narrower than belts, and this can make it easier to shift them to larger or smaller gears in order to vary the gear ratio. Multi-speed bicycles with derailleurs make use of this.

Also, the more positive meshing of a chain can make it easier to build gears that can increase or shrink in diameter, again altering the gear ratio. However, some newer synchronous belts claim to have "equivalent capacity to roller chain drives in the same width". Both can be used to move objects by attaching pockets, buckets, or frames to them; chains are often used to move things vertically by holding them in frames, as in industrial toasters, while belts are good at moving things horizontally in the form of conveyor belts. It is not unusual for the systems to be used in combination; for example the rollers that drive conveyor belts are themselves often driven by drive chains.

Drive shafts

Drive shafts are another common method used to move mechanical power around that is sometimes evaluated in comparison to chain drive; in particular belt drive vs chain drive vs shaft drive is a key design decision for most motorcycles. Drive shafts tend to be tougher

and more reliable than chain drive, but the bevel gears have far more friction than a chain. For this reason virtually all high-performance motorcycles use chain drive, with shaft-driven arrangements generally used for non-sporting machines. Toothed-belt drives are used for some (non-sporting) models. A **sprocket**,[1] **sprocket-wheel**[2] or **chain wheel** is a profiled wheel with teeth that mesh with a chain, track or other perforated or indented material.[3][4] The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it.

It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth except for timing pulleys used with toothed belts. Sprockets are used in bicycles, motorcycles, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

Sprockets are of various designs, a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a flange. Some sprockets used with timing belts have flanges to keep the timing belt centered. Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys. They can be run at high speed and some forms of chain are so constructed as to be noiseless even at high speed.

3.7 Ball Bearing

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the

directions of the loads (forces) applied to the parts. Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole.

Lubrication is often used to reduce friction. In the ball bearing and roller bearing, to prevent sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance. The purpose of Bearing is to reduce rotational friction and support radial and axial loads Types of bearings There are at least 6 common types of bearing, each of which operates on different principles:- Plain bearing, consisting of a shaft rotating in a hole. There are several specific styles: bushing, journal bearing, sleeve bearing, rifle bearing, and composite bearing.

Rolling-element bearing, in which rolling elements placed between the turning and stationary races prevent sliding friction. There are two main types Ball bearing, in which the rolling elements are spherical balls Roller bearing, in which the rolling elements are cylindrical, taper and spherical rollers Jewel bearing, a plain bearing in which one of the bearing surfaces is made of an ultra hard glassy jewel material such as sapphire to reduce friction and wear Fluid bearing, a non contact bearing in which the load is supported by a gas or liquid, Magnetic bearing, in which the load is supported by a magnetic field Flexure bearing, in which the motion is supported by a load element which bends.

Figure 3.7: Ball Bearing

CHAPTER 4
METHODOLOGY

4.1 Our methodologies for the project

Our methodologies for the project:

- Creating an idea for Wheel Operated Fertilizer Sprayer.
- And designing a block diagram & circuit diagram to know which components need to construct it.
- Collecting the all components and programming for the micro controller to controlled the system.
- Setting all components in a PCB board & soldering. Then assembling the all block in a board and finally run the system & checking.

4.2 Structural 3D Design

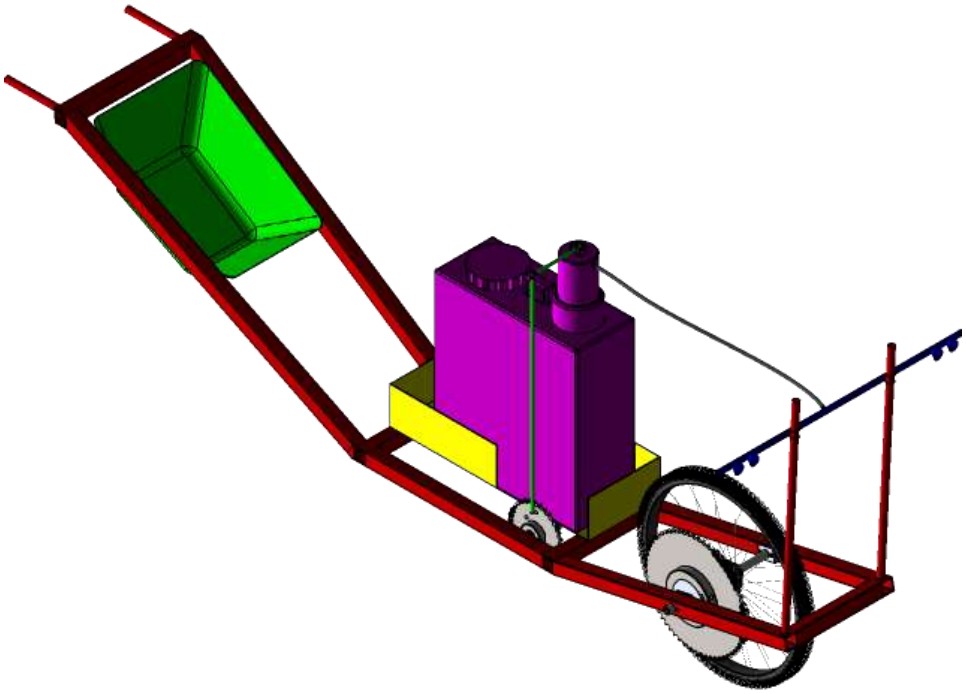

Figure 4.1: Our Project Structural 3D View

4.3 Working Principle

The working principle of a wheel-operated fertilizer sprayer involves a combination of mechanical and hydraulic systems to apply liquid fertilizers or other agricultural chemicals to crops. Here are the general steps involved in the working of a wheel-operated fertilizer sprayer: The sprayer is mounted on a frame base, which is attached to the wheels. The operator pushes or pulls the sprayer across the field. The fertilizer is stored in a tank located on the frame of the sprayer. The tank is pressurized using a pump, which can be powered by a variety of sources, such as an electric motor or a small gasoline engine. The pressurized fertilizer is then delivered to the spray nozzles located on the boom arms of the sprayer. The nozzle type and configuration are selected based on the desired spray pattern and the type of chemical being applied. The operator controls the flow rate and direction of the spray by adjusting the pressure and angle of the nozzles using valves or other controls. As the sprayer moves through the field, the boom arms extend to cover a wide area. The operator can control the height of the boom arms to ensure proper coverage of the crop. The liquid fertilizer is evenly distributed over the crop, providing the necessary nutrients for growth and development.

4.4 Our Final System View

Figure 4.2: Our Final System Overview

CHAPTER 5
RESULT AND DISCUSSION

5.1 Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features for more efficient.

5.2 Result

Now, it's time to talk about the results. We have written our commands using the following things can happen:

- Firstly we push the sprayer trolley, work done by the pusher get transmitted first to wheels, due to which wheels rotate and trolley proceeds further.
- Then the power applied is get transmitted to driving shaft attached to main wheels.
- Then drives the driving sprocket attached to it, giving rotational motion to it. Rotational motion of driving sprocket is then transmitted to driven sprocket by means of chain drive.
- Then driven sprocket thus transmits power to the driven shaft and thus to crank attached to it and it rotates. Crank transmits motion through connecting rod to the slider attached to it inside cylinder of pump producing pressure required for spraying and thus we will get the output.

5.3 Advantage

There are many advantages of our project because of its accuracy. Some of the advantages are pointed out below:

- It can cover more area of land during spray.
- It reduces the fatigue of operator during the operation.
- It increases the efficiency of operator.
- It can adjust the height of spray by using adjustable.

5.4 Application

Some of the application areas of the project have been pointed out below:

- Its major use in agriculture to spray fertilizer.
- In city and urban area, it can use for spraying water on lawn.
- It may be exercise device and morning during utilize in lawn.Use from spray chemical pesticide in plant in farm.
- It is used for spray painting in industry. It is used for spray water in garden on the plants.
- It is used for transfer water from one place to its nearer place.

5.5 Limitation

Some of the Limitation areas of the project have been pointed out below:

- There is a requirement to fill the sprinkler tank again with the pesticide after the quantity inside it gets over.
- It is not effectively used for wet lands.
- Cannot be used for all crops.

CHAPTER 6
CONCLUSION

6.1 Conclusion

The project focuses on the design and manufacture of spraying systems with a focus on light weigh t and portable nozzles. This project has an innovative method of minimizing manual stress. The main focus of our design is to reduce human effort and ease of operation in the case of spraying operations. We use past data and techniques to develop the dual power agriculture sprayer. A new type of mechanism is being manufactured which is different from other machines; in addition to this mechanism, we also make use of non-conventional energy sources in our project. Such a dual-power sprayer for agriculture will help to a large extent to improve spray area per acre and uniform spraying.

6.2 Future Scope

We are thinking about adding many features to our project in the future to get more desirable outcomes. Some of the steps that we are thinking about taking are given below:

- In the future it can be More number of nozzles can be used.
- In the future, A new design can be implemented to eliminate the need for pulling the machine manually.

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