Development and Evaluation of Solar Powered Multi-Purpose Agricultural Machine.

A PROJECT REPORT

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Prof. N.A.Dukare

in partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

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Department of Mechanical Engineering

Prof. Ram Meghe Institute of Technology & Research, Badnera

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CERTIFICATE

This is to certify that the project entitled

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is a bonafide work and has been successfully completed under my guidance. This project report is submitted in the partial fulfilment of the requirement for the award of the degree of Bachelor of Engineering In Mechanical Engineering, Sant Gadge Baba Amravati University, Amravati, during the academic year

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This is to certify that the Dissertation entitled, **"**Development and Evaluation of Solar Powered Multi-purpose Agricultural Machine**"** which is submitted by me in partial fulfilment of the requirement for the award of degree of Bachelor of Engineering in Mechanical Engineering to Sant Gadge Baba Amravati University, Amravati comprises only my original work and due acknowledgement has been made in the text to all other material used.

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ABSTRACT

"Energy - demand" is one the major need for our country. Finding solutions, to meet the "Energy - demand" is the great challenge for Social Scientist, Engineers, Entrepreneurs and Industrialist of our Country. Applications of Nonconventional energy are the only alternate solution for conventional energy demand. Like other development activities, agriculture sector is one of the major areas, which finds number applications of making it work using non-conventional sources. Solar energy plays an important role in agriculture products and for irrigation purpose for pumping the well water in remote villages without electricity. Mechanization involves the use of a hybrid device between the power source and the work. The paper deals with multi-purpose agriculture machine for spraying pesticides, fungicides, and fertilizers and cutting. Thus paving way for a more economical and multi-usable equipment for farmer which is also easy to clean and maintain, easy to handle and do not require fuel, hence cost gets reduced and helping farmers to a great extent in their fields**.**

In present generation grass cutter machines are becoming very popular today. Pollution is manmade, which we can be seen in our daily life. In old model of grass cutter IC engine was used and hence because of its environmental impact, pollution level rises. IC engine driven cutter is more costly. Maintenance of such conventional machine is more. To avoid these drawbacks, we plan to build new type of grass cutter which runs on solar energy and this model is economical compared to previous one. The aim of our project is to make the grass cutter which operates on solar energy, hence save the electricity and reduces manpower. Also the grass cutter has Ultra sonic sensor for obstacle detection. Grass cutter operates automatically hence it does not require skilled person to operate.The Multipurpose machine is used to fertilizer spray into land and grass cutting for making lots of plant production in agricultural field.This equipment which we build will do the mentioned functions automatically. It will be very useful for agricultural purpose and very simple in construction and economical.

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CHAPTER NO 1

INTRODUCTION

1.INTRODUCTION

Agriculture is the backbone of India. Paddy and Wheat is one of the new targets in agriculture where still, not many researchers and manufacturers participate. This field faces some problems such as how to maximize the profit, how to increase productivity and how to reduce the cost. In India, two types of agricultural equipment are used, manual method (conventional method) and mechanized type. Mechanization involves the use of a hybrid device between the power source and the work. This hybrid device usually transfers motion, such as rotary to linear, or provides ample of mechanical advantages such as increase or decrease or leverage of velocity. Agricultural machinery is machinery used in farming or other agriculture. Mechanized agriculture is a process of using agricultural machinery to mechanize the work of agriculture, greatly increasing farm worker productivity. In modern times, powered machinery has replaced many farm jobs formerly carried out by manual labor or by working animals such as oxen, horses, and mules. The entire history of agriculture contains many examples of the use of tools, such as the hoe and the plough. But the ongoing integration of machines since the Industrial Revolution has allowed farming to become much less labor-intensive. The biggest profit of automation is that it saves the labor. However, it also saves energy and materials and to improve the quality, accuracy, and precision. The pesticides sprinkling and crop cutting are the important stages in the agriculture field.The design of multipurpose agro equipment machine will help Indian farmers in rural side and small farm. It will reduce the cost of pesticides sprinkling and crop cutting the field and will help to increase economic standard of an Indian farmer.

The very first "multi utility vehicle" was known as the Brubaker Box. This was a custom car designed in 1972 and produced in limited numbers by Curtis Brukbaker, a designer and car enthusiast. It was built on the Volkswagen Beetle chassis and included an original fiberglass body. There was a sliding door on the passenger-side of the vehicle. Agriculture is demographically the broadest economic sector and plays a significant role in the overall economy of India. For the growth of Indian economy, mechanization is necessary. The main purpose of mechanization in agriculture is to improve the overall productivity and production. Planting is conventionally done manually which involves

both animate (humans and draught animals), this result in higher cost of cultivation and delay in planting. This machine reduces the power consumption, sowing time, human efforts and labor cost.

The entire history of agriculture contains many examples of the use of tools, such as the hoe and the plough. But the ongoing integration of machines since the industrial revolution has allowed farming to become much less labor intensive current mechanized agriculture includes the use of tractors, trucks, combine harvesters, countless types of farm implements, airplanes and helicopters and other vehicles. Precision agriculture even uses computers in conjunction satellite imagery and satellite navigation to increase yields. Mechanization was one of the large factors responsible for urbanization and industrial economies. Besides improving production efficiency, mechanization encourages large scale production and sometimes can improve the quality farm produce on the other hand it can displace unskilled farm labor and can cause environmental degradation especially if it is applied shortsightedly rather than holistically.

Development and evaluation of solar powered multi-purpose agriculture machine basically designed for spraying pesticide, herbicideand cutting the grass in the agriculture field or gardens. Usually, gardeners will do the water spraying process every day while pesticide and herbicide spraying process at least once a week and cutting of the unnecessary grass in every 2-3 weeks. Gardeners need tospray their gardens with pesticide and herbicide to ensure that there are no bushes grow andprevent the gardens from bugs, caterpillar and others pests. Normally, gardeners will use the16 litres manual Knapsack sprayer to spray their gardens, these may take a long time to finishspraying their gardens. Plus, this manual Knapsack sprayer is provided with only one nozzle.

Automated grass cutterhas been made available to the general public for over 30 years; its widespread or public use on the other hand has been limitedmainly due to the current costs of such devices. So by creating the multi-purpose agriculture machine we can reduce the cost of both the process significantly and carry out the spaying and cutting process smoothly with solar power.

1.1 CURRENT RESEARCH

The economic contribution of agriculture in India's GDP is continuously decreasing with the country's broad-based economic growth. Still, agricultural research and development (R&D) in India has made impressive contribution in the past. But the system is under significant stress today due to lack of clarity on focus and inefficient use of financial resources. Links among sister institutions have weakened and accountability has declined over time.

Backpack sprayer which can be carried on the operator back, having tank capacity as large as 20 liters. A hand lever is continuously operated to maintain the pressure which makes the backpack sprayers output more uniform than that of a handheld sprayers. Basic low cost backpack sprayer will generate only low pressure and lack feature such as high-pressure pumps, pressure adjustment control (regulator) and pressure gauge found on commercial grade units. The engine operated sprayers typically produce more consistent sprayer's outputs, covers the sprays swath more uniformly, operate at constant speed and results in much more uniform coverage than the hand spraying. Motorized sprayers are also capable of higher pressure spray useful to provide a better coverage. There are many other types of hand operated sprayer that are not widely used throughout the agriculture. Some may be used wide extensively for the productions of specific commodities. Jeremy, in 2005 designed and fabricated solar charged cutter machine. The machine was dependent on weather since the battery would be charged using solar panel. The common drawback was that the engine runs slowly and the production cost was high for an average individual to purchase. Victor and Vern's, (2003) designed and developed a power operated rotary weedier for wet land paddy. The complex nature of the machine makes its maintenance and operation difficult for the peasant farmers. In India, the conventional methods for agriculture are generally involved which are more complicated and time and labour intensive. The usage of agriculture equipment in the world is increasing. In the usage of agriculture tools, India contributes only 16% according to the survey conducted in the year 2011.

Harvesting crop includes removing crop by hand by small farmers. The agro equipment includes the crop cutter which focuses on easy of cutting operation for cutting

variety of crops in less time and at low cost by considering different factors as power requirement the cost of equipment, ease of operation in the field . The operating, adjusting and maintaining principle are made simple for easy and properly handling by unskilled operators.

1.2 PBOBLEM STATEMENT

Existed pesticide sprayer is heavy and hard to carry. Next, the sprayer that nowadays farmer use to spray their farm takes so much time for them to finish spraying. Farmers need to direct the nozzle straight to the plant. Then, farmers need to bend them back a little bit when they want to start spraying their farm. They need to bend a little bit because want to carry up the sprayer that is heavy that can cause strain to their back. In addition, only can load with not large amount of water, pesticide, herbicide.Moving the grass cutters with a standard motor powered grass cutters is an inconvenience, and no one takes pleasure in it. Cutting grass cannot be easily accomplished by elderly farmers, grass cutter moving with engine create noise pollution due to the loud engine, and local air pollution due to the combustion in the engine.Also, a motor powered engine requires periodic maintenance such as changing the engine oil. Electric solar grass is environmentally friendly**.**

CHAPTER NO 2

PRINCIPLE

2. PRINCIPLE

2.1 OBJECTIVES

1. 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 Solar powered Multi-purpose agriculture machine.

2. To add more efficiency to spraying because contains more than one nozzle. When do the spraying process, and to cut the grass with less effort and with more efficiency

3. To provide a comfortable spraying action because farmers just need to pull and push Solar powered multi-purpose machine based on their comfort level and don't need to bend their back.

4. The primary objective is to develop a harvester which is simple and cost effective.

5. Decrease labor cost by advancing the spraying method.

6. The life of the Ploughing tool is increase

7. Decrease the operational cost by using new mechanism.

8. Work reliably under different working conditions

2.2 SCOPE OF RESEARCH

1. Can be use in vegetable garden.

2. Can be used in farmlands.

3. Tanks can be filled either with water for watering plants or poison for poisoning plants.

4. The multipurpose agriculture vehicle is designed for small farmers in future

5. Attach the multiple nozzle & trolley.

6. No. of instrument can added such as pilling, hilling, ploughing etc.

2.3 SIGNIFICANT OF RESEARCH

There were many types of agriculture machine that have been invented since 1947, by Ray Hagie, founder of Hagie Manufacturing. Automatic sprayer and motor sprayer are commonly used by big farming industries to perform a lot of spraying activities in their farms. Different with small industries or vegetable gardens, farms, they commonly used the manual sprayer which is manual Knap sack sprayer. Through this research, to transform a manual knapsack sprayer into a mechanically sprayer that will contribute more comfy and faster working time to all farmers and gardeners that work in the small industries. Last but not least, this study also allows other researchers to perform further studies which focusing more to help farmers in Malaysia and other country to performs their best in spraying and cutting activities efficiently.

2.4 WHY SOLAR POWER?

Solar energy is radiant energy that is produced by sun. Every day the sun radiates, or sends out, an enormous amount of energy. The hydrogen atoms in the sun's core combine to form helium and generate energy in a process called **nuclear fusion.** During nuclear fusion, the sun's extremely high pressure and temperature causes hydrogen atoms to come apart and their nuclei (the central cores of the atoms) to fuse to become one helium atom. But the helium atom contains less mass than the four hydrogen atoms that fused. Some matter is lost during nuclear fusion. The lost matter is emitted into space as radiant energy .It takes millions of years for the energy in the sun's core to make its way to the solar surface, and then just a little over eight minutes to travel the 93 million miles to earth. The solar energy travels to the earth at a speed of 186,000 miles per second, the speed of light.

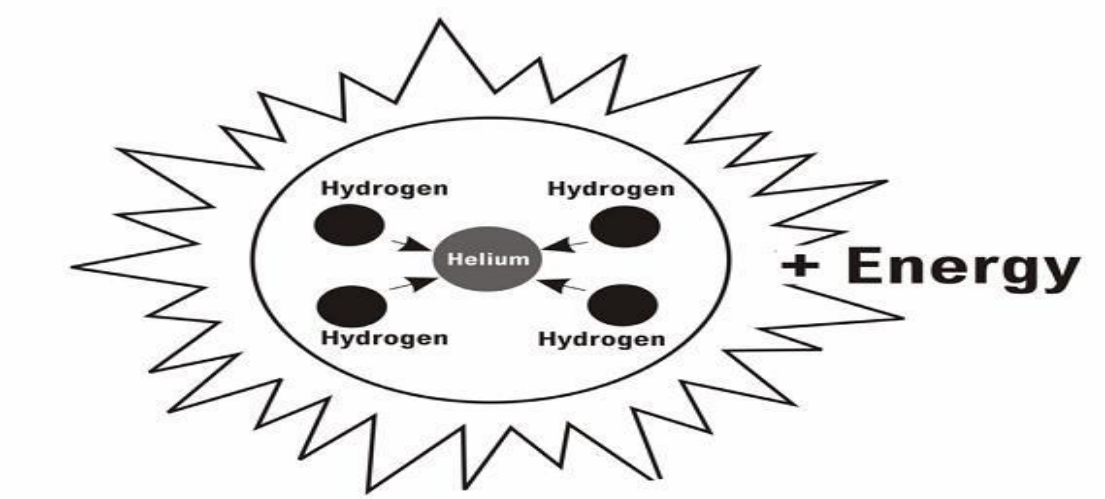

Figure 1.2.a: During a process called FUSION, four hydrogen atoms combine to form one billion atom, with a loss of matter. This matter is emitted as radiant energy.

Solar energy is very large, inexhaustible source of energy. The power from the sun interrupted by earth is approximately 1.8/10MW,which are many thousands of times larger than the present consumption rate on the earth of all energy sources. The quantum of energy India's land area receive from sun is equivalent to 15,000 times its consumption requirement (500 billion kWh) as projected for 2004.In addition to its size, solar energy has two other factors in its favor .Firstly, unlike fossil fuels and nuclear power, it is an

environmentally clean source of energy. Secondly, it is free and available in adequate quantities in almost all parts of the world people live. But there are some problems associated with it. The real challenge in utilizing solar energy is of and economic concern. One has to strive for the development of cheaper methods of collection and storage so that large initial investments required at preset in most applications are reduced, solar energy in India. A large amount of solar radiation fall on India and for most of the country very few days are without sunshine. India lies within the latitude of 7 N to and 37 N with annual average intensity of solar radiation as 500 to 600 cal/cm/day with more such insulations available in arid and semi arid regions.

Average solar radiation falling on India in arid and semiarid regions is 7.5 K w h/m/day. Solar energy 5× 10 Kw h/year potential to meet basic energy needs of teeming millions who live in rural India. Solar energy is an important, clean, cheap and abundantly available renewable energy. The sun produces enormous amount of energy of heat and light through sustained nuclear fusion reactions. The solar energy received on the earth in the form of radiation is used for heating and producing an electrical energy. Among the non-conventional sources of energy solar energy is the most promising. Hence our project is based on the solar energy conversion to mechanical energy to run the multi-purpose agriculture machine.

CHAPTER NO.3

LITERATURE REVIEW

3. LITERATURE REVIEW

1. Ramesh D [2019] This research paper present "Agriculture Seed Sowing Equipment: A Review". The present review provides brief information about the various types of innovations in seed sowing equipment. The basic objective of sowing operation is to put the seed and the fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed.

2. Nithin P V [2016] The paper aims on the look, development and therefore the fabrication of the mechanism which digs the soil, places the seed, leveler to shut the mud and sprayer to spray water, these whole systems of the mechanism works with the battery and also the solar energy. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles in the agriculture has experienced increased interest. The vehicle is controlled by Relay switch through IR detector input. The language input permits a user to move with the mechanism that is acquainted to most of the individuals. The advantages of those robots square measure hands-free and quick information input operations. In the field of agricultural autonomous vehicle, an idea is been developed to analyze if multiple little autonomous machine may well be lot of economical than ancient tgiant tractors and human forces.

3. Kannan A [2015] This research paper presents design modification in multipurpose sowing machine which describes the sowing purpose and the import of the machinery, which are bulk in size having more cost. To prevent this they design multipurpose sowing machine which consists of hopper, seed metering mechanism, ground wheel, power transmission system, seed distributor, and tiller. It is designed on PRO-E software.

4. P. Sarec, O. Sarec [2015] the lowest values of soil penetration resistance below the cultivated profile were determined with the cultivators equipped with chisel shaped shares i.e. in the case of Farmet and Köckerling. Cultivators Väderstad Topdown 400 and Farmet Turbulent 450 showed good capacity in embedding plant residues. These results have taken for our research basis.

5. Swetha S, Shreeharsha G.H [2015]. In this research paper author said that the real power needed for machine instrumentality depends on the resistance to the movement of it. Even

now, in our country ninety eight percent of the up to date machines use the facility by burning of fossil fuels to run IC engines or external combustion engines. This evident has led to widespread air, water and noise pollution and most significantly has led to a sensible energy crisis in the future. Now the approach of this project is to develop the machine to reduce the operating value and additionally to cut back the time for digging and seed sowing operation by utilizing solar energy to run the robotic machine. In this machine electrical device is employed to capture alternative energy and soit'sre born into voltage that successively is employed to charge 12V battery, which then provides the required power to a shunt wound DC motor. This power is then transmitted to the DC motor to drive the wheels. And to more reduction of labor dependency, IR sensors used to maneuver automation machine within the field.

6. F.A. Adamu [2014] In this paper authors draws our attention towards the performance factor of a power tiller. Among those demand for light weight power tiller was sought out most .Fuel efficiency and field capacity such parameters are also discussed. We have taken those points in consideration while designing a sustainable multifunctional agricultural vehicle.

7. Amol B. Rohokale [2014]. In this research paper author said that Agriculture is demographically the broadest economic sector and plays a big role within the overall economy of Asian nation. For the expansion of Indian economy, mechanization is critical the main purpose of mechanization in agriculture is to enhance the general productivity and production. Planting is conventionally done manually that involves each animate (humans and draught animals), this lead to higher value of cultivation and delay in planting. The main purpose of this paper is to match between typical sowing technique and new planned machine which might perform range of operation. The required row to row spacing, seed rate, seed to seed spacing and fertilizers placement varies from crop to crop may be achieved by the planned machine. This machine reduces the sowing time, human efforts and labor value.

8. D.A. Mada, [2013], In this research paper author has mentioned importance of mechanization in agricultural by giving examples. The conclusion from the paper was need of multifunctional single axel vehicle for pre and post harvesting. We have taken this as base for our research and further production of our multifunctional agricultural vehicle.

9. V.K. Tewari[2012] In this research papers author have done case study on farm mechanization in west Bengal as being part of India it give clear status about availability and progress in India. This ensured us to take right steps compared to current steps.

10. Jeremy, [2005] in designed and fabricated solar charged cutter machine. The machine was dependent on weather since the battery would be charged using solar panel. The common drawback was that the engine runs slowly and the production cost was high for an average individual to purchase.

3.1.1 PLASTIC KNAPSACK SPRAYER

16 litre knapsack sprayer are conventional and most popular equipment used worldwide. They are ideal for spraying insecticides, pesticides, fungicides, herbicides etc. infield areas to protect the crop from pest attack. This sprayer has multiple applications and are widely used in agriculture, horticulture, sericulture, plantations, forestry, gardens etc.

Figure 3.1.1: Plastic Knapsack Sprayer

Table No 3.1.1 : Advantages and Disadvantages Plastic Knapsack Sprayer

ADVANTAGES	DISADVANTAGES
Can be fit up to 20 litre of water/poison	Very heavy to lift and carry
Convenient maintenance and low price of accessories	Repair rate is high too much trouble
Low price	Low efficiency

3.1.2. KNAPSACK SPRAYER (HAND OPERATE)

This sprayer is suitable for applying chemical to several field crops The operator carries the sprayer on this back and it has a fat tank of 10- 16 litres capacities. The hydraulic pump fitted inside the tank for operate the pump, agitator filter, delivery hose and nozzle. When pump is operated, fluid through the suction hole and delivery to cut lever before through the nozzle.

Figure 3.1.2: Knapsack Sprayer (Hand Operated)

3.1.3. SILENS MESSOR (MEANING SILENT CUTTER)

This used a chain to transmit power from the rear roller to the cutting cylinder.

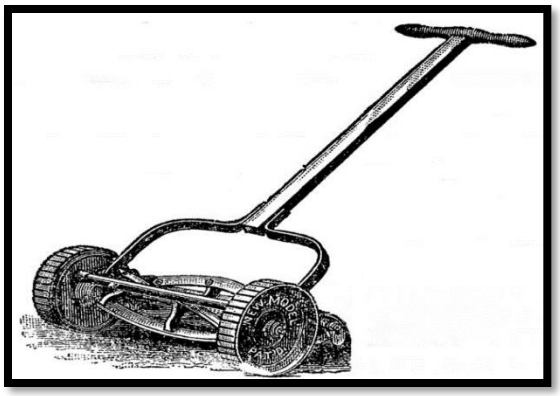

Figure 3.1.3: Silens Messor

3.1.4. ROTATRY MOWERS

Rotary mowers were not developed until engines were small enough and powerful enough to run the blades at sufficient speed. Many people experimented with rotary blade mowers in the late 1920s and early 1930s,and Power Specialties Ltd. introduced a gasoline-powered rotary mower.

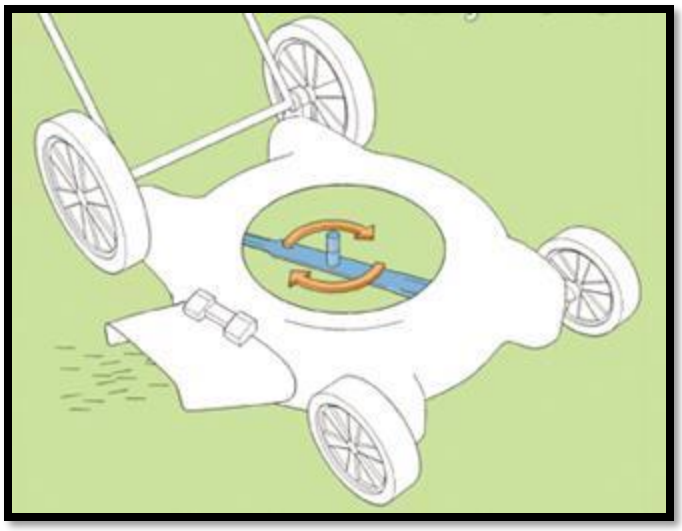

Figure 3.1.4: Rotary Mowers

CHAPTER NO 4

RESEACRH METHODOLOGY

4. RESEACRH METHODOLOGY

This product can widely use in many vegetable farms and garden. But their user's targets have been reduced to a smaller scale to get the best results while spraying and cutting. It can be use in big industries, but bigger industries must provide more pressure on spraying because the size of field is wide and usually used a machine to make spraying sessions faster. So, the target of users is to a smaller industries and small farms. Why choose vegetable farmland because usually farmers will use the manual knapsack sprayer that is heavy and need to carry on their back to do spraying and cutting session, but with this product they only need to push to forward and backward only. Plus, this product can spray both side of boundary so that the time taken is lesser than normal knapsack sprayer took.

4.1 RESEARCH DESIGN

After a few weeks of discuss about the design, finally the best design has been made. This design has been made to provide ergonomic spraying and cutting sessions for farmers to make sure they do not have to carry the heavy tank anymore. So, they can hold the handle on their comfort level zone. The product also provided with stand to make sure farmers can stand the product when they are exhausted while spraying or cutting or stand the tank when they are finish any of the process.

4.2 MATERIAL SELECTION

4.2.1 MILD STEEL

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.

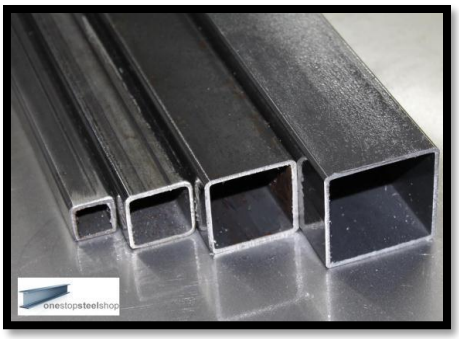

Figure 4.2.1: Mild Steel

4.2.2 RUBBER

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.

Figure 4.2.2: Bicycle Tyres

4.2.3 POLYMER

Used to make the product tank. Polymer is typically low densities, where as their mechanical characteristic is generally dissimilar to metallic and ceramic materials and they are not as stiff nor as strong as these other material types.

Figure 4.2.3: Plastic Tank

4.2.4 FABRICATION

In this project, a lot of fabrication work need to be applied to make sure the project done well and satisfying. The main adhesive agent that have been used are welding, which is MIG welding. Metal inert gas or known as MIG is widely used by fabrication industries. The main reason why MIG is applied to the project is because it is an easy welding process compared to others. Other than that, MIG also produce a good weld surface and clean.

Figure 4.2.4: MIG Welding On Mild Steel

4.2.5 SOLAR PANEL

A solar panel is a device that collects photons of sunlight, which are very small packets of electromagnetic radiation energy, and converts them into electrical current that can be used to power electrical loads.

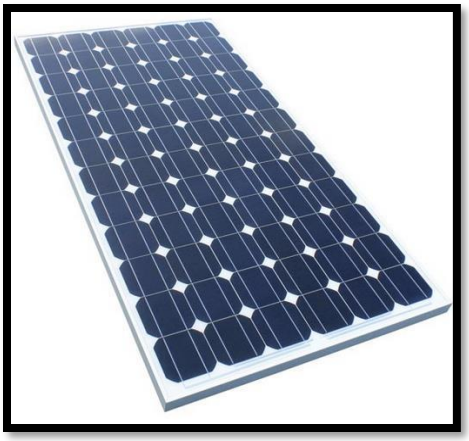

Figure 4.2.5: Solar Panel

4.2.6 BATTERY

The common battery (dry cell) is a device that changes chemical energy to electrical energy. A battery consists of an outer case made of zinc (the negative electrode), a carbon rod in the center of the cell (the positive electrode), and the space between them is filled with an electrolyte paste. In operation the electrolyte, consisting of ground carbon, Manganese dioxide, Sal ammoniac, and zinc chloride causes the electrons to flow and produce electricity.

Figure 4.2.6: Battery

4.2.7D.C MOTOR

DC motor is any of a class of rotary electrical motor that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current in part of the motor.

Figure 4.2.7: DC Motor

4.2.8 ROTATING BLADES/ CUTTER

Blade or cutter is a device which is used for cutting purpose. A rotary blade cutter is used for fast cuts.

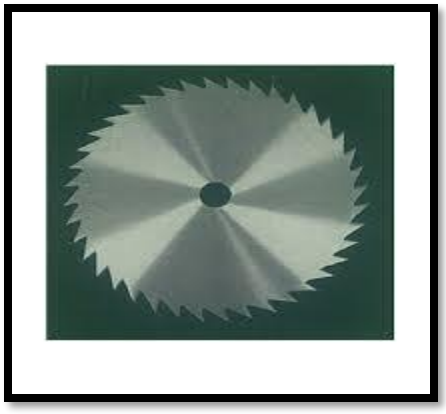

Figure 4.2.8: Blade/Cutter

4.2.9 NOZZLE

This nozzle has been made to provide ergonomic spraying sessions for farmers to make sure the spray more efficient.

Figure 4.2.9: Nozzles

4.2.10 POWER TRANSMISSON PART

Mechanically power transmission was applied to the solar powered multi-purpose machine 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.

Figure 4.2.10: Pillow Block Bearing

CHAPTER NO 5

WORKING AND APPLICATIONS

5. WORKING AND APPLICATIONS

5.1. FABRICATION OF SOLAR SPRAYER

Solar operated pesticide sprayer is fabricated to meet the demands of farmers such as reduced maintenance cost, shortage of electricity and fuel. The main parts of solar operated pesticide sprayer consist of Solar panel, DC Pump, Battery, Chemical tank, Nozzle, Spray gun etc.

5.1.1. WORKING PRINCIPLE

The system consists of Solar panel, charging unit, battery, pump and sprayer. The solar panel delivers an output in the order of 12 volts and 20 Watts power to the charging unit. The charging unit is used to strengthen the signal from the solar panel. The charging unit delivers the signal which charges the battery. According to the charged unit, the pump operates, such that the sprayer works. Here fertilizer can be stored in tank. When the sun rays are falling on the solar panel electricity will be generated through the solar cells and stored in the battery. By the electric power in the battery the pump operates and therefore fertilizers from the tank is sprayed out through the sprayers. The layout of solar sprayer is shown in fig5.1. There is no maintenance cost and operating cost as it is using solar energy and no pollution problem. Its working principle is very easy and it is economical for the farmers, which has one more advantage that it can also generate power that power is saved in the battery and it can be used for both for spraying and well as to light in the houses when there is no current supply.

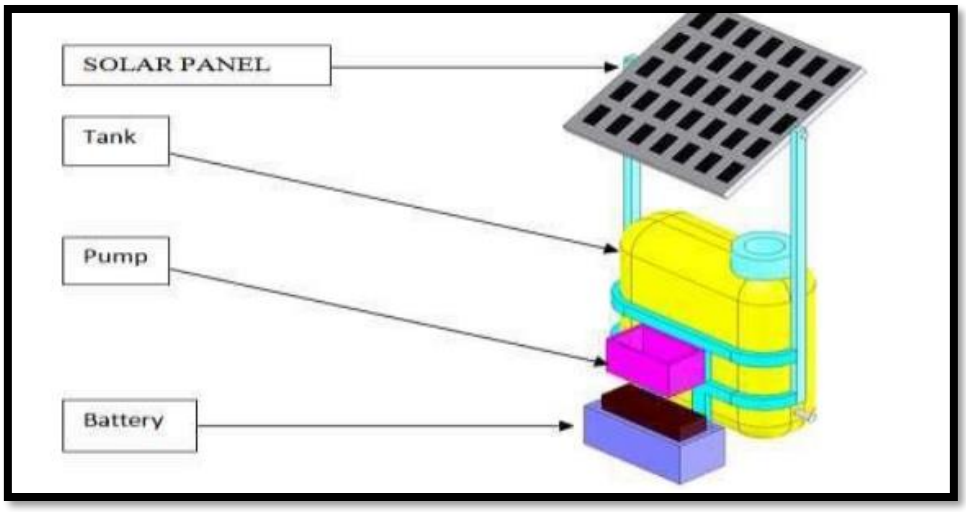

Figure 5.1.1 : Layout of Solar pesticide sprayer

5.1.2. BLOCK DIAGRAM

The block diagram of solar spray system is shown in Fig5.2. It consists of five units namely: solar panel, charge controller, electrical circuit, pump, nozzle discharge. The details of each unit are described below.

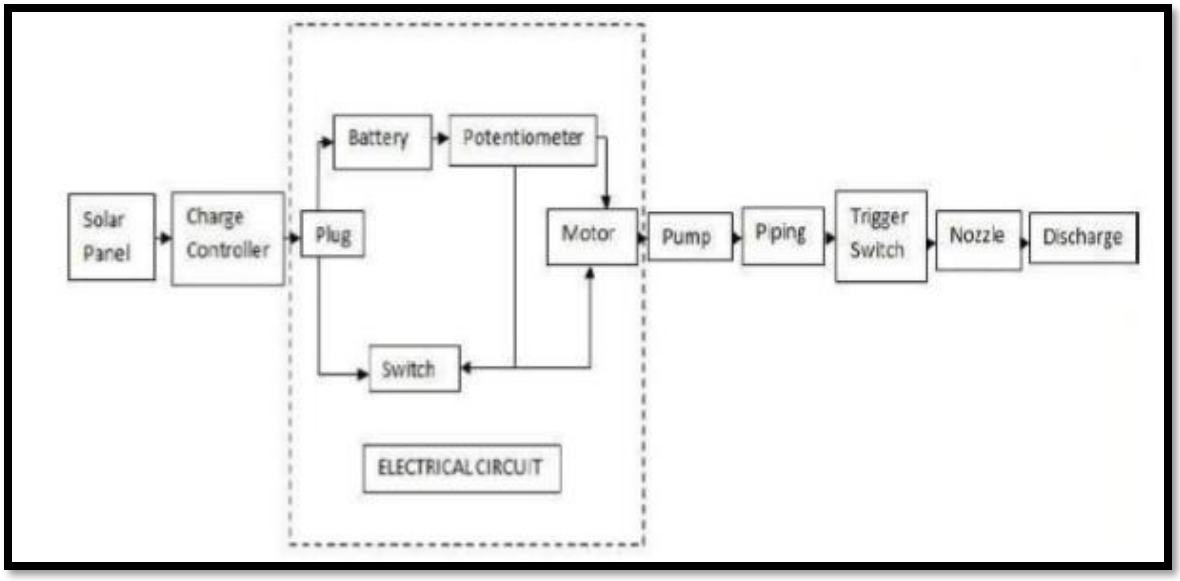

Figure 5.1.2 : Block diagram of Spraying System

In solar energy mode, solar energy obtained by the sun is converted into electrical energy using solar panel by photovoltaic effect. The output of energy conversion was used to charge a deep cycle battery. The number of times a battery can be discharged is known as its life cycle. For solar applications, a battery should be capable of being discharged in several times. In such cases a deep cycle battery is used. In this work a lead-acid accumulator serves the purpose. The lead-acid battery has the properties such as high current availability, contact voltage, longer life and more ability to charge as compare to conventional batteries.

The output of battery is connected to a DC pump through protection circuit. The DC pump is selected because of the advantages such as less in noise, longer in life, maintenance free, motor speed can be varied in the larger extent by varying the supply voltage and is self-lubricated. Pump is used to suck the spraying liquid from the sprayer tank and spray it through nozzle. The sprayer consists of sprayer tank and sprayer pipe. The sprayer tank is made up of plastic or fiber material in order to reduce the weight of the tank. The capacity of the tank is 16 liters and connected to the sprayer pipe with adjustable nozzle. By adjusting the nozzle the output of flow can be controlled. The whole unit can be carried conveniently at the back of human body with the help of shoulder straps. The supporting base of entire unit needs to be strong and light in weight.

5.2 SPECIFICATIONS OF EQUIPMENT

The equipment details are mentioned in this section and the equipment's are pesticide tank, DC motor, DC battery, nozzle type, solar panel.

5.2.1 LIQUID STORAGE TANK

- Tank capacity =16 liters.
- Material = PVC

5.2.2 DC MOTOR

DC motor is used to lift the pesticide from tank and delivers to spray gun. DC motors has following specifications.

- Model name: KF-2203
- Voltage = 12 volts
- DC Maximum current = 1.8 A
- Maximum Pressure = 0.45 MPa
- Liquid discharge = 2.9 lit/min
- Speed = 0-6,000 rpm

5.2.3 DC BATTERY

- Model name: Sealed lead acid battery 6DFM8.
- Weight= 2.5 kg
- Capacity = 12 volts, 8 Ah
- Charging current = 2.4 A (Max)
- Standby use: 13.5 V - 13.8 V
- Cyclic use: 14.5 V - 14.9 V

5.2.4 NOZZLE

- Nozzle discharge rate is 2.9 lit/min.

5.2.5 SOLAR PANEL

Table No 5.2.5 : Characteristics of Solar panel

MODEL	ASL-S 2012
Electrical Characteristics	
Nominal power (Pmax)	20 W
Maximum voltage at Pmax, (Vmp)	18 V
Maximum current at Pmax, (Imp)	1.111 A
Open circuit voltage, (Voc)	21.6 DC
Short Circuit Current, (Isc)	1.244 A
Nominal Operating cell temperature	47˚C ± 2°C
Temperature coefficient- power	0.00157%/˚C
Standard Test Condition	Irradiance of 1000W/m², Module temperature at 25° C
Primary Packing Box Dimension (LWH)	500 x 22 x 340 mm
Weight of Individual Module	2.0 Kg
Cell Characteristics	
Type of Solar Cell	Poly Crystalline, 156x156mm±0.5mm
Number of Cells /Cell Size	36 / 22 x 156 mm
Arrangement of Cells	18 x 2
Frame	Anodized Aluminum alloy
Front Glass	3.2mm Tempered and Textured glass
Type of Junction Box	2 Terminal Polycarbonate

5.3 WORKING PRINCIPLE OF SOLAR CUTTER

Coming to the working of solar powered grass cutter, it has panels mounted in a particular arrangement at an angle of 45 degrees in such a way that it can receive solar radiation with high intensity easily from the sun. These solar panels convert solar energy into electrical energy as studied earlier. Now this electrical energy is stored in batteries by using a solar charger. The main function of the solar charger is to increase the current from the panels while batteries are charging, it also disconnects the solar panels from the batteries when they are fully charged and also connects to the panels when the charging in batteries is low. The motor is connected to the batteries through connecting wires. Between these two mechanical circuit breaker switch is provided. It starts and stops the working of the motor. From this motor, the power transmits to the mechanism and this makes the blade to slide on the fixed blade and this makes to cut the grass.

The working principle of solar grass cutter is it has panels mounted in a particular arrangement at an in such a way that it can receive solar radiation with high intensity easily from the sun.

The designed solar powered cutter comprises of direct current (D.C) motor, a rechargeable battery, solar panel, a stainless steel blade and control switch. Mowing is achieved by the D.C motor which provides the required torque needed to drive the stainless steel blade which is directly coupled to the shaft of the D.C motor.

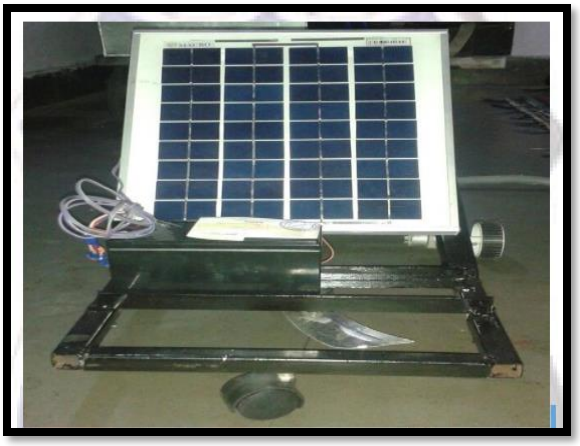

Figure 5.3.1 : Solar Panel

The solar powered cutter is operated by the switch on the board which closes the circuit and allows the flow of current to the motor which in turn drive the blade used for mowing. The battery recharges through the solar charging controller. Performance evaluation of the developed machine was carried out with different types of grasses.

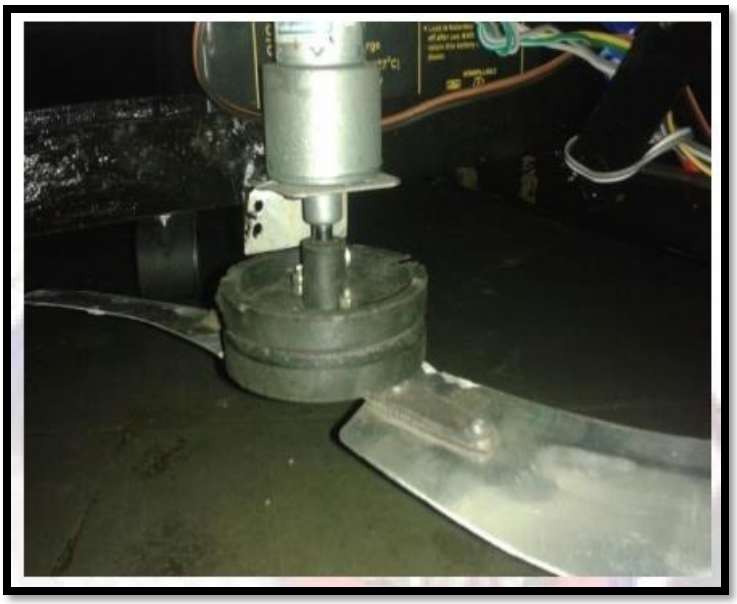

Figure 5.3.2: Solar Cutter/ Blades

5.4 ADVANTAGES

- It is multipurpose machine.
- The costing of multipurpose agriculture machine is very low.
- The machine is easy to construct and also easy to operate.
- Solar energy is a renewable energy and the battery is charged continuously.
- This machine has highly reliable and also high efficiency.
- No need of skilled operators to operate this system.
- It does not create air pollutant & noise.
- Does not require fuel hence cost reduce and light in weight.
- It is easy to clean and maintain.
- It is portable and easy to assemble.
- It can use in municipality for killing insects and mosquitoes.
- The prepared solar operated sprayer can be used largely in agriculture field effectively.

5.5 DISADVANTAGES

- The panels are weather dependent. Thus the power will have to be generated by any others means.
- There is a requirement to fill the sprinkler tank again with the pesticide after the quantity inside it gets over.
- Repairing and replacing is not an easy task.

CHAPTER NO 6

CONCLUSION

FUTURE SCOPE

REFERENCES

6.1 CONCLUSION

The top concentration of our design is the cost and operational ease in case of small farm units. This multipurpose ago equipment is thus designed to reduce the cost of harvesting, spraying and seed feeding. In the development of multipurpose ago equipment we utilize the past data and techniques. In this way the design of multipurpose agro equipment is safe. Such human powered machine systems will help to a great extent in improving the production per acre and increase profitability of small and middle class farmers. A new type of multipurpose mechanism is fabricated which is different from other machines and will work on non-conventional energy source which is purely human operated. Such systems are of much importance in Asian countries, as almost all Asian countries are facing electricity and power scarcity which results in twelve to fourteen hours load shedding in rural areas especially in India. Therefore, there is the need to develop a locally, fabricated multiple multipurpose agro equipment.

This project demonstrates the implementation of robotics and mechatronics in the field of agriculture. This being a test model the robustness of the vehicle is not very high. The performance is satisfactory under laboratory condition. The model gave a fairly good rate of area coverage and the cost of operation as calculated was also reasonably low. In addition the safety and long term health of the farmers is ensured by eliminating human labor completely from this process. It does not compromise the performance of a petrol based pesticide sprayer.

By doing this project we conclude that ,we can reduce the human efforts and this will be helpful for farmer . As it is operated on solar energy so the it is best application that does not affects on environment.

This project work has presented progress towards achieving a future precision autonomous farming system. This system is designed to help farmers in reducing their time and energy spent for pesticide spraying and weed cutting. This system can be operated on +12V rechargeable battery. This system will reduce labor problem in future. So, this system will be the best replacement for currently used systems like hand sprayers and tiller mounted sprayers.

6.2 FUTURE SCOPE

- There could be continuous supply of liquid pesticide/ fertilizer generated for sprinkler.
- The Solar panel unit could be enhanced in order to generate more prolonged electric supply. Moreover, the electricity could be stored; to be used at night or in no sun condition.
- A more with greater efficiency could be used.
- More equipment like soil testing tasks could be added to this project.
- By increasing the equipment strength and quality to its peak, we can have multipurpose agricultural equipment for life time usage. By providing hydraulics, gear arrangements and some minor adjustments the equipment can also be made as tractor powered equipment.
- The suggested model has removed the back pain problem, also by using control valve we can maintain the fluctuation pressure.
- Imported different kind of nozzle we can achieve the better performance like as hollow cone nozzle we reduce the drifting problems.
- By using a flexible hose & lance we can spray the pesticides around the crop with respect to their size from one position
- By using a sensor a required quantity or required proportion of pesticides can be sprayed respect to crop growth requirement.

6.3 REFERENCES

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