

Automatic Solar Sprayer

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Abstract: - The population of India is rapidly in order to fulfil their diet & needs. The production of foods is increase by day but it must at affordable rate to everyone. In India, farming is done by traditional ways beside that there has been larger development of industry and service sector as compared to that of agriculture sector. In mechanization of agriculture sector in India some equipment has been developed the pesticide sprayer is one among them and it is done by traditional farm worker by carrying backpack type sprayer, which requires human effort or by using electric pump. To improve the agriculture system and to reduce the human effort and problems associated with the backpack sprayer new equipment is fabricated which will be beneficial to farmers. The equipment utilizes renewable energy sources (Solar energy) which is eco-friendly to function. In this equipment solar panel gives out electric supply to system, the radio-controlled transmitter and receiver minimize drudgery of farmer. It minimize the wastage of pesticide and time. Our contribution on our project is by using eco-friendly reliably available solar energy as a main source of energy making this multifunctional sprayer device by the spraying methods which make friendly to use and operate which can be useful in different stages of farming as per process requirement. It can be operated in small farming land with the standard spacing decreasing the labour cost and human effort. The proposed sprayer uses solar power and solar energy as a source of power for spraying purpose. One person is sufficient for operating the proposed sprayer. The performance evaluation of the sprayer was carried out for spraying pesticide in different agricultural fields.

Key Words: —Solar power control, Dc motor, Spraying system and Battery.

I. INTRODUCTION

The population of India is rapidly in order to fulfil their diet & needs. The production of foods is increase by day but it must at affordable rate to everyone. In India, farming is done by traditional ways beside that there has been larger development of industry and service sector as compared to that of agriculture sector. In mechanization of agriculture sector in India some equipment has been developed the pesticide sprayer is one among them and it is done by traditional farm worker by carrying backpack type sprayer, which requires human effort or by using electric pump.

To improve the agriculture system and to reduce the human effort and problems associated with the backpack sprayer new equipment is fabricated which will be beneficial to farmers. The equipment utilizes renewable energy sources (Solar energy) which is eco-friendly to function. In this equipment solar panel gives out electric supply to system, the radio-controlled transmitter and receiver minimize drudgery of farmer. It minimize the wastage of pesticide and time. Our contribution on our project is by using eco-friendly reliably available solar energy as a main source of energy making this multifunctional sprayer device by the spraying methods which make friendly to use and operate which can be useful in different stages of farming as per process requirement. It can be operated in small farming land with the standard spacing decreasing the labour cost and human effort Spraying of liquids like pesticide, hypo liquid, sanitizer is an important task in day-to-day applications like agricultural applications, health care applications and environmental applications. For all these applications, a liquid sprayer is required. In agricultural applications, the liquid sprayer sprays the

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pesticides to protect the crops from insects. In environmental applications, the liquid sprayer sprays the hypo liquid or bleaching liquid to kill the bacteria and insects in the street drainages and street dustbins. In health care applications, the liquid sprayer sprays the chemicals to kill the bacteria and to spray the sanitizer to kill the corona virus of COVID-19. There are different conventional liquid sprayers available for spraying purpose. They are (i) Hand operated sprayer (ii) Engine operated sprayer or fuel operated sprayer (iii) Electric Motor operated sprayer. The conventional sprayers are outdated now-a-days is because of their weight and construction.

There are different conventional liquid sprayers available for spraying purpose. They are (i) Hand operated sprayer (ii) Engine operated sprayer or fuel operated sprayer (iii) Electric Motor operated sprayer. The Hand operated sprayer is shown in fig.1. The Hand operated sprayer is operated by hand. This makes the operator discomfort while spraying. So, the Hand operated sprayer cannot be used long time spraying. Hence, this type of sprayer is not suggestible.



Fig.1. Hand operated sprayer

The Engine operated sprayer or fuel operated sprayer is shown in fig.2. The Engine operated sprayer works with fuel like petrol, diesel and kerosene etc. The cost of the fuel is very high in the economical point of view. Hence, this type of sprayer is not suggestible.



Fig.2. Engine operated sprayer

The Electric Motor operated sprayer is shown in fig.3. It uses electric motor which works on electricity. The electricity can be obtained from a DC Battery. The battery will be charged by Government Electricity Supply. In rural areas, there will be insufficient electricity supply from the government. Hence, this type of sprayer is not suggestible.



Fig.3. Electric Motor operated sprayer

Solar energy is clean and green electricity, derived from sunlight or heat from the sun. Solar energy is a renewable energy source or unconventional source of energy that, unlike finite fossil fuels, is stable and completely indescribable. It is a non-polluting energy source and does not emit any greenhouse gases while generating electricity.

There are so many advantages of solar power There are so many advantages of solar power compared with other powers. They are It is a renewable source of energy, It is a non-conventional source of energy, It is sustainable for long duration, It is inexhaustible, It is clean and green energy source, No Production Cost, Low Maintenance Cost, Less Transmission Losses, High Efficiency, It has versatile installation.

Hence, the solar power is a best solution for electric power supply in the modern days. Hence, Solar Power based Liquid Sprayer is a best solution for so many applications.

Now-a-days, so many applications are using Renewable energy (non-conventional energy) sources. Renewable Energy is generally defined as energy that comes from long lasting resources. The sun is the most abundant and unlimited source of energy. As solar energy is one of the most important non-conventional sources of energy. This energy is environmentally friendly, which is mainly free from pollution. Solar energy get from the sun is harvested on the solar panel the panel is made up of photovoltaic cells, which converts energy from photon to electric. And these cells are made up of silicon semiconductor. Solar panel is used to store electric

energy or charge the battery from the solar energy. And the battery charged is used to operate DC pump for spraying the pesticides. The prevalence of traditional agriculture equipment intensifies these issues. In addition, most farmers are desperately seeking different ways to improve the equipment quality while reducing the direct overhead costs (labour) and capital. Thus, a significant opportunity rests with understanding the impact of a pesticide sprayer in an agriculture field.

II. LITERATURE REVIEW

The applications of pesticides using spraying equipment play an important role. The chemicals are widely used for increasing agricultural production through better insect and pest management. Spraying is one of the most effective and efficient technique for applying small quantity of liquid through fine droplets to protect the crops. In India, many versions of hand operated and power operated spraying equipments are being used. At present, the farmers generally using all kinds of manually operated knapsack sprayer which can cover 0.4 ha/hr and motorized sprayer can cover 1.2I .6 ha."hr for spraying of pesticides on crops like cotton, red gram. Farmers are facing the problem of coverage of large area within a short period of time as the pest attack is serious problem and spreads quickly.

In the market, different versions of tractor operated or bullock operated sprayers are available, many of the farmers generally spray 6-8 times in a season using manually operated or motorized sprayer to cover large area within a short period of time. Modern spraying technique will improve the operator's comfort, safety and spraying effectiveness which would go a long way in increasing crop yield.

Generally, the power required for spraying is met out from either alone or combination of human source and mechanical power viz., either petrol engine or dual fuel engines for operating the pump. Sometimes the batteries are used for running the motor which operates the pump for discharging the chemicals. But these batteries require electricity for charging them. However, due to rapid rise in the price of fossil fuels and their limited availability, there is now greater awareness of the need for development of renewable energy gadgets, which is the need of the hour. Because Of inadequate supply of electricity, there is a frequent power cut and this situation is still worse in the rural areas. Hence, there is a greater scope for utilization of solar energy for generation of electricity using solar photovoltaic cells and further to utilize

the same for spraying, water pumping, lighting etc.

Spraying of liquids like pesticide, hypo liquid, sanitizer is an important task in day-to-day applications like agricultural applications, health care applications and environmental applications. For all these applications, a liquid sprayer is required. In agricultural applications, the liquid sprayer sprays the pesticides to protect the crops from insects. In environmental applications, the liquid sprayer sprays the hypo liquid or bleaching liquid to kill the bacteria and insects in the street drainages and street dustbins. In health care applications, the liquid sprayer sprays the chemicals to kill the bacteria and to spray the sanitizer to kill the corona virus of COVID-19. [1]

There are different conventional liquid sprayers available for spraying purpose. They are (i) Hand operated sprayer (ii) Engine operated sprayer or fuel operated sprayer (iii) Electric Motor operated sprayer. The conventional sprayers are outdated now-a-days is because of their weight and construction. [2, 3] Now-a-days, so many applications are using non-conventional energy sources. The solar energy is the one among these energy sources. The energy available from the sun is available for free. In India, solar energy is available for eight months in a year. Therefore, it can be used for spray action. [4-8]

Light Energy Solar energy is absorbed by a solar panel consisting of photovoltaic cells. The conversion of solar energy into electrical energy is done by these cells. This converted energy stores the voltage in the DC battery and is further used for the operation of that battery sprinkler. Solar powered sprayer is the ultimate cost-effective solution where spraying is required. This solar energy-based sprayer uses solar energy as a source. Solar energy is first used to charge a storage battery. The solar energy stored in the battery is used to run the motor which acts as a pump. The solar energy-based sprayer concept deals with the constant discharge of liquid, solar energy, battery charging, monitoring and timer and unusual power control techniques. [9]

In this paper, a solar power based liquid sprayer is presented to spray the liquids like the pesticides for agricultural applications, the hypo liquid for environmental applications and the sanitizer for health care applications. The proposed liquid sprayer can reduce the fatigue level of user. There is no need of fuel which makes the proposed system ecofriendly.

The existing products for pesticide sprayers are either hand operated (manpowered) or fuel operated (fossil power) which requires high human effort and needs regular maintenance like

refilling of fuel which are quite expensive. Traditional agricultural sprayers are in the form of backpack which on continuous usage creates back pain or becomes stressful for the users and also can only carry maximum of 10 liters. Our product which is basically a trolley based that eliminates these problems and restrictions. It can be easily movable with very less human effort and can carry sufficient amount of pesticide. And the most common problem along with electrical sprayer is there is need of regular charging, the complete discharge of battery with some instances causes permanent chemical changes in battery which reduces the battery life. so, to overcome these situations we used solar continuous charging of system so such situations are avoided.

III. OBJECTIVES

- ECO friendly (Because we are using solar power and charged battery for operation)
- Easy of construction.
- More economical.
- Easy to clean and maintain.
- Its works on renewable energy source called solar energy.
- It does not create air pollution & noise.
- Easy to handle.
- Does not require fuel for working hence operation is cost reduced.

IV. METHODOLOGY

The frame is designed to with stand all the loads of the robot. The other components are getting assembled on the frame by means of Bolt and Nut. The material used is CR-Mild steel bar and it is welded. The Project consist of following parts,

the cast iron Frame with four Wheel. The wheels are driven by 48V Hub motor (i.e., it is brushless dc motor used in electrical vehicle drives, a 12V Wiper motor is used to make 120-degree movement of Nozzels to make uniform spread of chemical, a 12 V, 7.5-amp lead acid battery is used. The Solar panel of 17v, 20-watt rating is used, Circuit board and Controllers are used to control the switching operations of motors. A 12V DC Pump is used to pump the chemical. Pesticide Tank- 16 liter Capacity and 2 nozzels are used.

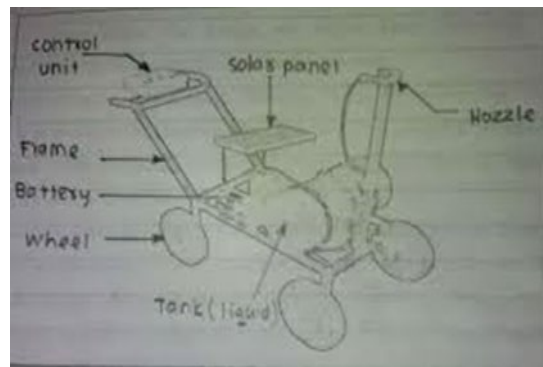


Fig.4. Expected image of sprayer

4.1 Working Principle

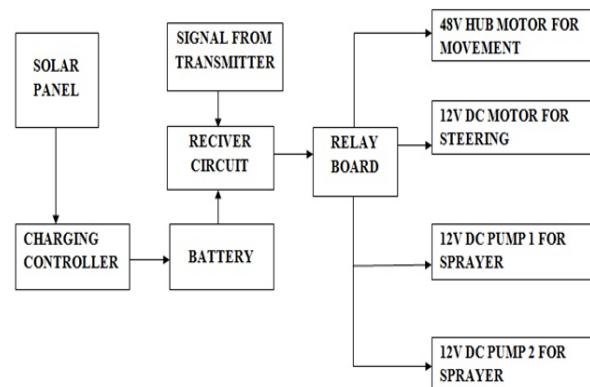


Fig.5. Circuit diagram of automatic sprayer

This project operates on solar energy. The concoction is accomplished by the use of solar panel, a centrifugal pump which runs on dc supply is attached to the solar panel the solar panel generates the power that power is dc power its positive and negative charges are connected to a batter in order to save the power and use it when the sun rays are not present by using this device we can spray pest ices to the herbs and plants and any agriculture spraying it is economical as compared to the other means used like petrol/diesel pesticides sprayers.

There is no much maintenance cost and no operating cost as it is using solar energy it is free of cost and there is no pollution its working principal is very simple and the it is economical of 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 are not there that time, we can charge the battery and use it to spray pesticides to the herbs and plants as compared to petrol/ diesel it is economical no efforts to human just he has to carry the device the device is light in i so it is much feasible.

4.2 Sample calculations:

1) Solar panel watts x average hours of sunlight x 75% = daily watt-hours. As an example, let's say you have 250-watt solar panels and live in a place where you get 5 hours of sunlight per day. ...

$$250 \text{ watts} \times 5 \text{ hours} \times .75 = 937.5 \text{ daily watt hours. ...}$$

$$937.5 / 1000 = 0.937.$$

2) current rating = 7 Ahr, 12 V, 250 watt

3) battery rating: 12V, 7.5 Ahr

4) dc motor rating: 12V, 7A

4.3 Advantages:

- There is no running cost associated with the sprayer.
- The maintenance cost is only restricted to life of battery and PV (Photo Voltaic) module. No requirement of skilled operator. The sprayer is very economical in case of mass manufacture of the entire unit.
- The flow rate calculation demonstrates the optimization of output flow rate of pesticide within time constrains which reduces the wastage of pesticide.
- In case of unavailability of sunlight, the sprayer batteries can be charged by electric supply available at home. The need for handling long electric cable to operate the machine is eliminated which makes it portable to use.
- The sprayer prevents biological hazards of spraying powder pesticide by means of conventional methods. Micronutrients can also be sprayed with the help of it. 6) The sprayer is highly economical and can be used on small land area to large.

4.4 Scope for Future work:

- By adopting new Advanced Computer Technology, we can make fully automatic spray.
- Implementing the Telescopic Nozzle, we can adjust the length of the spray required.
- Using the Hydraulics System to the wheel, helps in varying the ground clearance.

V. RESULT

The proposed system is very efficient and can be used in agricultural field very effectively. This technology is most suitable for Energy Alternate Device for power sprayers. This system is user friendly and also environment friendly as it doesn't produce any pollution. Also, this robot can be used at very remote place where fuel and power are not available. As this sprayer is economical than that of the conventional engine operated sprayers. Moreover, the same technique and technology can also be extended for all types of power sprayers.



Fig.6. Realtime images of automatic solar sprayer

VI. CONCLUSION

This project operates on solar energy. The concoction is accomplished by the use of solar panel, a centrifugal pump which runs on dc supply is attached to the solar panel the solar panel generates the power that power is dc power its positive and negative charges are connected to a battery in order to save the power and use it when the sun rays are not present by using this device we can spray pesticides to the herbs and plants and any agriculture spraying it is economical as compared to the other means used like petrol/diesel pesticides sprayers.

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