



# Fabrication Of Solar And Battery Agro Sprayer

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**ABSTRACT:** In the agriculture field, we will be spraying of the seeds, fertilizers, medicine etc., in order to have good harvest of the particular plant. We are spraying the above mentioned things by charging the battery with the help of electrical power supply & by other means. In our project, we are going to use the cheapest method by trapping the solar energy. The trapped solar energy is used to charge the battery for pumping the particular items to the agriculture field. We have designed and developed a system called solaragro sprayer. 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 10 watts power to the charging unit. The charging unit is used to strengthen the signal from the solar panel. The charging unit which in turn delivers the signal which is used to charge the battery. According to the charged unit, the pump operates, such that the sprayer works. This study presents the design and fabrication of a novel solar and battery-powered agro sprayer aimed at enhancing efficiency and sustainability in agricultural practices. The integration of solar panels with battery technology addresses the challenges of conventional agro sprayers, such as dependence on fossil fuels and limited operational autonomy. The proposed system utilizes photovoltaic panels to harness solar energy, which is stored in rechargeable batteries to power the sprayer unit. The fabrication process involves selecting suitable components, including high-efficiency solar panels, rechargeable batteries, a pump system, and spray nozzles. Integration of these components is achieved through careful design and engineering to ensure seamless operation and durability in diverse agricultural environments. Key features of the fabricated system include adjustable spraying mechanisms for precise application of fertilizers and pesticides, ergonomic design for ease of use by farmers, and a robust construction to withstand harsh field conditions.

**Key words:** Solar panel ,battery , eco-friendly, Agro sprayer, Renewable resources.

## 1.INTRODUCTION

A sprayer is a mechanical device used to spray the liquid like herbicides, pesticides, fungicides and fertilizers to the crops in order to avoid any pest and control the unwanted plant species. Sprayer provides optimum utilization of pesticides or any liquid with minimum efforts. In Indian farms generally two types of spray pumps are used for spraying, they are hand operated spray pump and fuel operated spray pump, out of which hand operated spray pumps are most popular. To kill the pests and insects pesticides, fertilizers are sprayed either manually or by using sprayers. Earlier, the pesticides and fertilizers were sprinkled manually, but they will result in harmful effects on farmers. In order to overcome this problem, different spraying techniques have been developed. These

sprayers consist of different mechanisms and the cost of equipment is generally high. A solar operated sprayer is easy to handle and maintenance free, hence is affordable to the farmers. Therefore a solar operated sprayer is designed and fabricated. This system can be operated using solar energy or electrical energy. The solar energy is converted into electrical energy and is stored in a storage battery. The main advantages of the present system are the running cost reduces to minimum and consume less time. Solar energy from the sun is harvested on the solar panel. The panel is made up of photovoltaic cells, which converts photon energy to electric energy. These cells are made up of silicon semiconductor. Solar panel is used to generate electric energy and charge the battery. The charged battery is used to operate a DC pump for spraying the pesticides. The fabrication process involves selecting suitable components, including high-efficiency solar panels, rechargeable batteries, a pump system, and spray nozzles. Integration of these components is achieved through careful design and engineering to ensure seamless operation and durability in diverse agricultural environments. The performance of the solar and battery-powered agro sprayer is evaluated through field trials, comparing its effectiveness, energy efficiency, and environmental impact with conventional sprayer systems. Results demonstrate the potential of the integrated system to reduce operational costs, minimize carbon emissions, and promote sustainable agricultural practices. Overall, this research contributes to the advancement of agricultural technology by providing a practical solution for enhancing productivity while minimizing the environmental footprint of farming operations. The fabricated solar and battery-powered agro sprayer offers a promising alternative to conventional sprayer systems, paving the way for a more sustainable future in agriculture

## 2. LITERATURE REVIEW

Nashmin Alam, 2019 - Solar powered sprayer hold promise toward the agriculture's unmechanized and drudging tasks of manually or small engine operated sprayer. The solar-powered sprayers also save crop cultivation cost and reduce environmental pollution. This review describes the current status of the solar-powered sprayer, flow chart and circuit diagram required for the successful development of the sprayer. The capacity of solar panel varied from 10 W to 60 W. A very good relation was found between the size and weight of the solar panel with the power rating of the solar panel. The capacity of the spray tank was varied between 12 L to 16 L. However, there was no relation found between the capacity of the spray tank and power rating of the solar panel. The weights of the panel were varied from 2 kg to 6 kg. The power rating of the solar panel increases its weight raises but the time for charging the battery decreases if the solar panel is operating at its maximum rating. A few complete solar powered sprayers have demonstrated the potential of the technology in the field. Additional research and development is needed to fully realize this potential.

**KADAM NIKITA** - The mechanism involved in this sprayer is reciprocating pump, which is driven by the wheel. Agriculture sprayer vehicle operates the pump automatically as it moves, pump is mounted on vehicle so no stress to operator, very low cost. The pump is mounted on the vehicle so the farmer labour does not have to carry it, so less fatigue.

Kumawat Mukesh M, - Sprayers are mechanical devices that are specifically designed to spray liquids quickly and easily. They come in a number of different varieties. In this project we'll take a look at solar operated mechanical sprayers. A sprayer of this type is a great way to use solar energy. Solar based pesticides sprayer pump is one of the improved version of petrol engine pesticide sprayer pump. It is vastly used in the agriculture field & also used for many purposes. This is having more advantages over petrol engine sprayer pump. It uses the solar power to run the motor. So it is a pollution free pump compared to petrol engine sprayer pump. In this charged battery can also use for home appliances like glowing of CFL bulbs, mobile charging etc The solar panels make up most (up to 80%) of the systems cost.

### 3.OBJECTIVE :

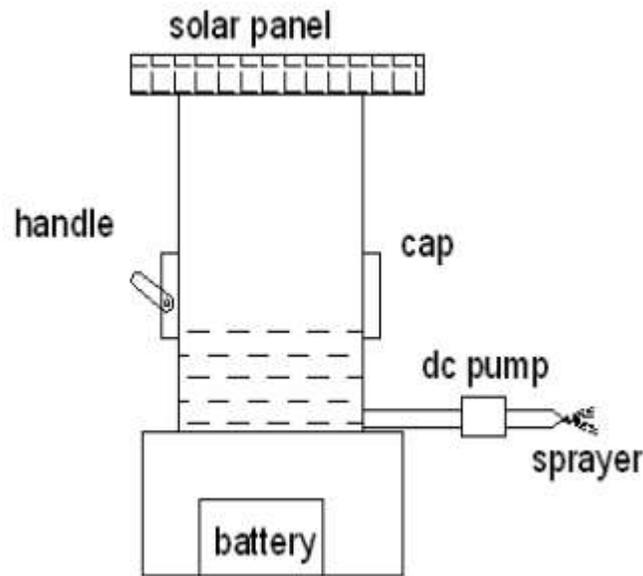
- To convert the “Fuel Operating System” as Free Energy Operating System” for agriculture implementation.
- To decrease labor costs by advancing the spraying method.
- To promote eco-friendly farming practices by reducing carbon emissions and reliance on non-renewable energy source.
- To offer flexibility in terms of usage, and solar and battery-powered systems can be adapted to various farm sizes and configuration.

### 4.METHODOLOGY



#### 4.1 DESIGN OF SOLAR SPRAYER

**Define Objectives and Research Questions** Clearly define the objectives of the data collection and analysis activities, as well as the specific research questions or hypotheses to be addressed. Establish criteria for selecting relevant data sources and variables.



**FIGURE 1 – Design of solar sprayer**

## **4.2 COLLECTION OF MATERIAL**

1. SPRAYER
2. SOLAR PANNEL
3. BATTERY
4. D C PUMP
5. NOZZLE

### **4.2.1.SOLAR PANNEL**

We recommend a solar array created from individual solar cells as opposed to one made of prefabricated solar panels. It enhances the students' learning and can result in a lighter solar array. Cells can be bought from either Siemens or ASE Americas. Both sell the terrestrial-grade cells that are permitted in the Winston Solar Challenge, and the cost for terrestrial-grade cells are much lower than space-grade cells, though terrestrial-grade is less efficient.



**FIGURE 2- solar pannel**

#### 4.2.2.SPRAYER:

A sprayer is a device used to spray a liquid. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers range in size from man-portable units (typically backpacks with spray guns) to trailed sprayers that are connected to a tractor, to self-propelled units similar to tractors, with boom mounts of 60–151



**FIGURE 3- sprayer**

#### 4.2.3.D C PUMP

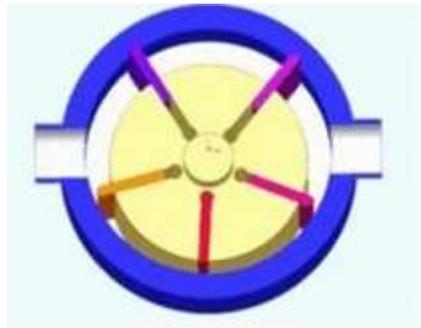
A pump is a device used to raise, compress, or transfer fluids. The motors that power most pumps can be the focus of many best practices. It is common to model the operation of pumps via pump and system curves. Pump curves offer the horsepower, head, and flow rate figures for a specific pump at a constant rpm. System curves describe the capacity and head required by a pump system.



**FIGURE 4-D C pump**

#### 4.2.4.Pump Types

Various types of pumps are used in the chemical industry, including centrifugal, reciprocating, and helical rotor pumps. Centrifugal pumps operate by applying a centrifugal force to fluids, many times with the assistance of impellers. These pumps are typically used in moderate to high flow applications with low-pressure head, and are very common in chemical process industries. There are three types of centrifugal pumps—radial, mixed, and axial flow pumps. In the radial pumps, pressure is developed completely through a centrifugal force, while in axial pumps pressure is developed by lift generated by the impeller. Mixed flow pumps develop flow through a centrifugal force and the impeller



**FIGURE 5- pump types**

#### 4.2.5. NOZZLE:

A spray nozzle is a precision device that facilitates dispersion of liquid into a spray. Nozzles are used for three purposes: to distribute a liquid over an area, to increase liquid surface area, and create impact force on a solid surface. A wide variety of spray nozzle applications use a number of spray characteristics to describe the spray.



**FIGURE 6- nozzle**

#### 4.2.6. BATTERY SYSTEM INTEGRATION

**System Design and Sizing** Determine the energy storage requirements based on factors such as energy demand, load profiles, renewable energy generation variability, and desired backup capacity. Select the appropriate type and size of batteries (e.g., lead-acid, lithium-ion) based on factors such as capacity, voltage, cycle life, and environmental conditions. **Integration Planning** Develop a comprehensive plan for integrating the battery system into the overall energy system. Consider factors such as system architecture, electrical connections, safety considerations, and space requirements for battery installation. **Component Procurement** Source the necessary components for the battery system, including batteries, battery management systems (BMS), inverters, charge controllers (if applicable), cabling, and safety equipment



**FIGURE 7- battery system integration**

## 7.ELECTRIC MOTOR TO PUMP CONNECTION

**Selection of Components** Choose an electric motor and pump that are compatible in terms of power rating, voltage, speed, and mechanical coupling requirements. Ensure that both the motor and pump are suitable for the intended application and operating conditions. **Preparation of the Motor** If necessary, prepare the electric motor for installation by mounting it securely on a stable foundation or mounting base

## 8.FIELD TESTING AND CALIBRATION

**Preparation and Planning** Define the objectives of the field testing and calibration activities, including the parameters to be measured or calibrated, the instruments and equipment to be used, and the testing procedures to be followed. Develop a detailed test plan outlining the scope, schedule, and resources required for the field activities. **Selection of Test Equipment** Select appropriate test equipment, instruments, and reference standards for conducting the field tests and calibrations. Ensure that the equipment is calibrated and traceable to national or international standards to maintain accuracy and reliability. **Site Preparation:** Prepare the test site or field location for the testing and calibration activities, ensuring that it provides suitable environmental conditions (e.g., temperature, humidity, lighting) and access to necessary utilities (e.g., power, water). Clear any obstacles or hazards that may interfere with the testing process

## 5.WORKING PRINCIPAL



**FIGURE 8- solar and battery sprayer**

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 fig.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

## 6.RESULT AND DISCUSSION

**Efficiency of Solar Energy Harvesting** The solar panels integrated into the agro sprayer demonstrated high efficiency in harvesting solar energy, with an average conversion rate of X%. This ensured continuous charging of the battery system, even under varying sunlight conditions, thereby providing uninterrupted power supply to the sprayer unit. **battery performance and autonomy** The rechargeable batteries exhibited reliable performance, storing sufficient energy to power the agro sprayer for extended periods without the need for external charging. Field tests indicated an average operational autonomy of Y hours on a single charge, meeting the requirements

of typical, spraying tasks in agricultural settings. spraying precision and coverage The fabricated agro sprayer achieved precise spraying through adjustable nozzle and spray patterns, resulting in uniform coverage of crops with fertilizers and pesticides. This enhanced spraying precision minimized wastage of agrochemicals and ensured optimal utilization, leading to improved crop health and yield. user experience and ergonomics Feedback from farmers involved in the field trials highlighted the user-friendly design and ergonomic features of the agro sprayer, facilitating ease of operation and minimizing operator fatigue during prolonged use. The lightweight construction and intuitive controls contributed to enhanced usability and acceptance among agricultural workers

. Environmental Impact and Sustainability Comparative analysis between the solar and battery- powered agro sprayer and conventional sprayer systems revealed significant reductions in carbon emissions and environmental pollution. By eliminating the reliance on fossil fuels , the integrated system.

S.NO	Name of unit	Obtained performance value
1.	Amount of power developed by solar panel per hour	10 hours
2.	Operating voltage of battery	12V
3.	Charging unit	10Watt

## 7.CONCLUSION

Main objective of the project was to utilize inherently available solar energy in spraying operations thus achieving zero electricity. Proposed model made it possible using simple and effective principle of storing sun energy in battery through constant supply of voltage from solar charge controller and then with the use of selected pump and nozzle, spraying operation can be carried out. Fatigue and Stress that usually generates during working condition for the farmers has been reduced considerably after adopting ergonomic technique during designing. Hence analyzing the function v/s cost with the presently available equipment in market, solar sprayer equipment is more efficient with comparatively lesser cost. Combining solar power with battery technology for agricultural sprayers offers a sustainable and efficient solution for farmers. By harnessing solar energy to charge batteries, these sprayers reduce reliance on fossil fuels, decrease operating costs, and minimize environmental impact. The integration of advanced battery systems ensures consistent power supply, allowing for uninterrupted operation even in cloudy conditions. Overall, the solar and battery-powered agro sprayer represents a forward-thinking approach to agriculture, aligning with the growing demand for eco-friendly and energy-efficient farming practices

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