Introduction:

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 used for home appliances like glowing of CFL bulbs, mobile charging etc..

Motivation:

Solar based pesticide sprayer is one of the improved model of pesticide sprayer pumps. Sun is the source of all energy on the earth. It is most abundant, inexhaustible and universal source of energy. All other sources of energy draw their strength from the sun. India is blessed with plenty of solar energy because most parts of the country receive bright sunshine throughout the year except a brief monsoon period. India has developed technology to use solar energy for cooking, water heating, water dissimilation, space heating, crop drying etc.
Most used pesticide sprayer available in market is petrol engine sprayer, which is bulky to carry, needs lot of maintenance (to engine and carborators) and cost incurred to maintenance, petrol to operate is noticeable. The another model which is inspired us to take this project is electrical pesticide sprayer in which battery is charged using conventional electricity but operates only for four hour once battery is fully charged. So improving operating time and solar energy harvesting is motivation of project.

**Basic block diagram:**

![Solar Based Pesticide Sprayer Block Diagram](image)

**Principle of operation:**

The basic block diagram of the solar based pesticide sprayer is as shown in the figure. It consists of solar panel, buck and boost converter, battery charging kit, limit switches, dual battery, DC motor, pesticide tank, spray nozzles, etc.
It uses solar energy to operate. First the solar energy is absorbed by the solar panel. This solar energy is then converted into electrical energy by the photovoltaic cell. Here buck and boost converter is used to supply a required voltage from solar panel to the battery. Charging of the both batteries are controlled by the microcontroller. When the battery1 is fully charged and battery 2 is partially charged or may be empty, at that time microcontroller switches to battery2 to be fully charged. Motor uses energy from battery1 to run. When the battery1 will be fully discharged by the motor, microcontroller automatically switches to battery 2 to run the motor. And battery 1 will start charging. This process repeats continuously as we use the sprayer.

To spray the pesticides a 12v, 2.1amp DC motor is required. DC motor is driven by the 12v 8AH battery. Motor consists of one inlet & one outlet. Inlet opening is connected to pesticide tank and outlet is connected by the sprayer nozzle. Motor creates the suction & helps to spray the pesticides to the crops, Pesticide tank is having capacity of 12 litre. Different types of nozzles are used for different kind of spray for example F nozzle, taper nozzle, sector nozzle.

Results and Conclusions:

Results:

Based on the experimentation, it is found in this project that the Solar panel provides 17V, 1A during day time between 9.30 AM to 4.30 PM. Since the pesticide sprayers are used in this duration, testing is as carried out in this time. The 12V, 8Ah battery can be charged fully in 7 hours during this time at 1.3A. Hence this module can be operated to spray continuously 7 to 8 hour which is not possible with electrical pesticide sprayer. The model cost will not exceed Rs.7000. Hence the proposed model is cost effective and compatible with other models available commercially.

Merits:

- The pesticide sprayer operates with minimal pollution.
- Low power consumption.
- The solar energy stored in the battery bank is 8Ah.
- Low maintenance cost and low operating cost.
**Advantages:**

- It is multipurpose machine.
- Easy to operate and user friendly.
- Very less pollution on other models.
- It is portable
- Unit cost is very cheap one.
- Maintenances cost is low.
- Easy to assemble.

**Conclusion:**

It does not compromise the performance of a petrol based pesticide sprayer. In addition, the model is designed to be eco friendly and lower cost, and thus will prove to be more efficient when compared to petrol based pesticide sprayer. A minor modification to the form factor, the module can be brought out as a commercial product.

In order to verify the performance we mounted an attachment on the frame and carried out the testing. We are happy to find that 8Ah battery can run the pump for 3 hours; one fully charged battery can be used to spray 2Acres, while 1litre of petrol can cover 1Acre. Thus, cost of 1litre petrol is Rs.80 and cost for charging the battery is negligible. So no operating cost is required in solar based pesticide sprayer

**Scope for future work:**

The model weighs 21Kgs with full pesticide in tank. The weight can be reduced by 3 to 4kgs by using plastic molding for mechanical structure. Further battery energy can be saved by using PWM scheme for driving pump.