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. Sprayer provides optimum utilization of pesticides or any liquid with minimum efforts.

Dusters and sprayers are generally used for applying chemicals. Dusting is the simpler method of applying chemicals and dusters are best suited for portable machineries and this usually requires simple equipment. But these devices are less efficient than sprayers, because of the low retention of the dust.

In Indian farms generally two types of spray pumps are used for spraying; hand operated spray pump and fuel operated spray pump, out of which hand operated spray pumps are most popular. The main drawback of hand operated spray pump is that the user can’t use it continuously for more than 5-6 hours since he gets tired after such a long duration. Also the fuel operated spray pump requires fuel which is expensive and availability of fuel at rural areas is difficult.

Shivarajkumar.A and Parameswaramurthy.D have developed wheel driven sprayer. This wheel operated pesticide spray equipment consists of reciprocating pump to pressurize the liquid. Here the to and fro reciprocating action of the pump takes place by moving the equipment.

These conventional sprayers and developed spraying systems have their own difficulties such as they need lot of effort to push the liver up and down in order to create the pressure to spray.
Another drawback of fuel operated sprayer is the need of fuel which increases the running cost of the sprayer also availability of fuel in rural areas is difficult. In order to overcome these difficulties, “a portable solar operated chemical sprayer” has been proposed. This system can be operated using solar energy or electrical energy. The solar energy is converted into electrical energy is stored in storage battery. The main advantages of the presented system are the running cost reduces to minimum and consume less time. Most often the device can used at various locations such as farms, gardens etc. and also they are more popular in rural areas as well. The additional advantage of this project is it can be used as home lighting system as its charged battery can be used as lighting source at night.

**Objectives of the project:**

- To utilize renewable energy sources for the purpose of pesticides sprayer.
- To reduce the discomfort occurs to the farmers during spraying.
- To create the awareness to the farmers about the renewable energy sources.
- To eliminate environmental pollution by using natural energy source.
- To Work efficiently under different working conditions.
- To Decrease the cost of machine
- To Decrease labour cost and maintenance cost.

**Methodology:**

**Block diagram**

The heart of the sprayer is diaphragm pump. Sprayer pump starts its working cycle by spraying the liquid to a predefined area. First the motor is run by using stored electric power from the DC battery. The battery is charged by solar power. In Diaphragm pump a certain amount of vacuum pressure is created in the pump casing and as a result the low pressure liquid is converted into high pressure liquid at the outlet. This pressure energy is then converted into kinetic energy by using nozzle at the sprayer end. The control valve is used to control the pressure of the liquid. Nozzle can deliver a delicate mist, high volume spray, or long-range steam to meet any spraying need. The block diagram of solar operated sprayer is as shown in fig.1.
Circuit diagram:

The circuit diagram of proposed system is as shown in figure 2. It consists of four units namely: energy conversion, control unit, storage, DC drive and sprayer. The details of each unit are discussed as follows.

The first unit of proposed system is energy conversion unit. The energy conversion can be done by solar energy mode; solar energy obtained by the sun is converted into electrical energy using solar panel by photovoltaic effect. The red colour indicate electrical energy transfer from energy source to utilizing point during day time, and blue colour indicates electrical energy transfer from battery to utilizing point during night time. Control unit acts as 3-way direction control valve, because it takes the energy from solar panel, to sends the require energy to motor to run...
the diaphragm pump, the remaining energy stored the battery so in this it is called 3 way direction control valve.

**Results and Conclusion**

**Table 8.1 Comparison of parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Hand operated sprayer</th>
<th>Proposed sprayer</th>
<th>Fuel operated sprayer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>4 – 7 kg</td>
<td>8.75 kg</td>
<td>12 – 16 kg</td>
</tr>
<tr>
<td><strong>Discharge</strong></td>
<td>0.8 – 1.5 Lit/min</td>
<td>2 – 2.8 Lit/min</td>
<td>6 – 8 Lit/min</td>
</tr>
<tr>
<td><strong>Product cost</strong></td>
<td>Rs. 2000</td>
<td>Rs. 6000</td>
<td>Rs. 15000</td>
</tr>
<tr>
<td><strong>Maintenance cost</strong></td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td><strong>Pressure</strong></td>
<td>1.5 – 2 bar</td>
<td>4.8 – 5 bar</td>
<td>8- 12 bar</td>
</tr>
</tbody>
</table>

Comparison of proposed sprayer with conventional sprayer is shown in table 8.1. It is clear from the table 8.1 that the proposed sprayer is having an average value in all the aspects like weight, discharge, product cost, maintenance cost, pressure.

**Weight:** Though the weight of the proposed sprayer is more than hand operated sprayer, the requirement of manual effort for the operation is eliminated, and obviously the weight is less than the fuel operated sprayer.

**Discharge:** The hand operated sprayer gives a discharge of about 0.8 to 1.5 lit/min it needs the operator to operate the sprayer till the pesticides are deposited by a sufficient amount. However the fuel operated sprayer gives a discharge about 6 to 8 lit/min which leads to wastage of pesticides. These problems are eliminated in the proposed sprayer system.

**Pressure:** The hand operated sprayer having a pressure about 1.5 to 2 bar is not sufficient for large crops. The fuel operated sprayer having a pressure about 8 to 12 bar it may damages the crops. The moderate pressure achieved by the proposed device can efficient spraying.

**Conclusion**
• The proposed sprayer gives the average values in all aspects like weight, discharge, pressure and cost.
• The proposed sprayer requires 10 hours for complete charging and fully charged battery gives 4 hours of backup to the application.
• It reduces the discomfort to the operator while spraying and it creates the awareness about renewable energy to the farmers.
• The proposed system has got very good aesthetic design and the operator feel easy to operate this new sprayer because of it is light weight, easy to carry, portable and environmental friendly.
• The proposed sprayer is most suitable for small and medium scale farmers and remote areas like field, forest where fuel is not available easily.

Scope for improvement.

• The weight of stand can be still reduced by incorporating fiber reinforced plastic (FRP) instead of mild steel.
• The whole system can be made automated by using micro controller.
• By incorporating the concentric collector instead of flat plate collector the charging efficiency can be increased.
• The sprayer can also be charged by AC by adopting AC converting system.