Fabrication of Solar Operated Agricultural Sprayer
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Abstract— in the agriculture field, we will be spraying fertilizers, medicine etc., in order to have good harvest of the particular crops. We are spraying the above mentioned things by charging the battery with the help of solar energy. 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 solar agro sprayer. The solar sprayer has many advantages. The farmer can do the spraying without engaging labour, thus increasing spraying efficiency. This system is also made portable. The solar Agro sprayer is mainly used for spraying liquefied pesticides and with some arrangements we can spray the powered (dust) pesticides.

Key words: Solar Energy Sprayer, Spraying Efficiency, Portable

I. INTRODUCTION

Spraying of pesticides is an important task in agriculture for protecting the crops from insects. Farmers mainly use hand operated or fuel operated spray pump for this task. This conventional sprayer causes user fatigue due to excessive bulky and heavy construction. Fuel operated spray pump exhaust carbon dioxide as pollutant which has a detrimental effect on our environment. Hence, these conventional sprayers are not very efficient. This motivated us to design and fabricate a model that utilizes solar energy for spraying pesticides. In our design, the hand lever will be eliminated to reduce the user’s fatigue level. There will be elimination of engine of fuel operated spray pump by which there will be reduction in vibrations and noise. The elimination of fuel will make our spraying system eco-friendly. So with this background, we are trying to design and construct a solar powered spray pump system. Solar energy technologies can provide electrical generation by heat engine or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes. Sunlight can be converted into electricity using photovoltaic (PV), concentrating solar power (CSP), and various experimental technologies. PV has mainly been used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array. The term "photovoltaic" comes from the Greek (phos) meaning "light", and "voltaic", meaning electrical, from the name of the Italian physicist Volta, after whom a unit of electrical potential, the volt, is named. A solar cell, or photovoltaic cell (PV), is a device that converts light into direct current using the photoelectric effect. The first solar cell was constructed by Charles Fritts in the 1880s. Although the prototype selenium cells converted less than 1% of incident light into electricity, both Ernst Werner von Siemens and James Clerk Maxwell recognized the importance of this discovery.

II. CONSTRUCTION

A. Solar Panel

A solar panel is a device that collects and converts solar energy into electricity or heat. It is known as Photovoltaic panels, used to generate electricity directly from sunlight. Solar thermal energy collection systems, used to generate electricity through a system of mirrors and fluid-filled tubes solar thermal collector, used to generate heat solar hot water panel, used to heat water. It is energy portal. A solar power technology uses solar cells or solar photovoltaic arrays to convert light from the sun directly into electricity. Photo voltaics, in which light is converted into electrical power. It is best known as a method for generating solar power by using solar cells packaged in photovoltaic modules, often electrically connected in multiples as solar photovoltaic arrays to convert energy from the sun into electricity. The photovoltaic solar panel is photons from sunlight knock electrons into a higher state of energy, creating electricity. Solar cells produce direct current electricity from light, which can be used to power equipment or to recharge a battery. A less common form of the technologies is thermo photo voltaics, in which the thermal radiation from some hot body other than the sun is utilized. Photovoltaic devices are also used to produce electricity in optical wireless power transmission.

Fig. 1: Solar panel

B. Battery

A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy. Primary batteries can only be used once because they use up their chemicals in an irreversible reaction. Secondary batteries can be recharged because the chemical reactions they use are reversible; they are recharged by running a charging current through the battery, but in the opposite direction of the discharge current. Secondary, also called rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled. Batteries have gained popularity as they became portable and useful for many purposes. The use of batteries has created many environmental concerns, such as toxic metal pollution. A battery is a device that converts chemical energy directly to electrical energy it consists of one or more voltaic cells. Each
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voltaic cell consists of two half cells connected in series by a conductive electrolyte.

One half-cell is the positive electrode, and the other is the negative electrode. The electrodes do not touch each other but are electrically connected by the electrolyte, which can be either solid or liquid. A battery can be simply modelled as a perfect voltage source which has its own resistance, the resulting voltage across the load depends on the ratio of the battery's internal resistance to the resistance of the load.

When the battery is fresh, its internal resistance is low, so the voltage across the load is almost equal to that of the battery's internal voltage source. As the battery runs down and its internal resistance increases, the voltage drop across its internal resistance increases, so the voltage at its terminals decreases, and the battery's ability to deliver power to the load decreases.

C. DC Water Pump

Pumps work by using mechanical forces to push the material, either by physically lifting, or by the force of compression. Hand-operated, reciprocating, positive displacement, water pump. A positive displacement pump causes a liquid or gas to move by trapping a fixed amount of fluid or gas and then forcing displacing that trapped volume into the discharge pipe. They are relatively inexpensive, and are used extensively for pumping water out of bunds, or pumping low volumes of reactants out of storage drums. Hand operated pumps are considered the most sustainable low cost option for safe water supply in resource settings, A hand pump opens access to deeper groundwater that is often not polluted and also improves the safety of a well by protecting the water source from contaminated buckets. This means that communities are often stuck without spares and cannot use their hand pump anymore and have to go back to traditional and sometimes distant, polluted resources. This is unfortunate, as water projects often have put in a lot of resources to provide that community with a hand pump.

III. WORKING

The system consists of solar panel, charging unit, Battery, Pump and sprayer. The solar panel delivers an output in order of 12 volts and 5 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 fertilized can be stored in tank. When the sun rays are fall 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. There is no maintenance cost and operating cost as it is using solar energy and no pollution its working principal is very easy 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 the house when there is no current supply. And where as in rainy season when the sun rays 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 weight so it is much feasible.

IV. LITERATURE SURVEY

A. R. Joshua, V. Vasu and P. Vincent[1]

1) Abstract

“Energy - demand” is one the major thread for our country. Finding solutions, to meet the “Energy - demand” is the great challenge for Social Scientist, Engineers, Entrepreneurs and Industrialist of our Country. According to them, Applications of Non-conventional energy is the only alternate solution for conventional energy demand. Now-a-days the Concept and Technology employing this Non-conventional energy becomes very popular for all kinds of development activities. One of the major area, which finds number applications are
in Agriculture Sectors. Solar energy plays an important role in drying agriculture products and for irrigation purpose for pumping the well water in remote villages without electricity. This Technology on solar energy can be extended for spraying pesticides, Fungicides and Fertilizers etc., using Solar Sprayers. This paper deals how a ‘Power Sprayer’ which is already in use and works with fossil fuel can be converted into solar sprayers works without any fossil fuel.

B. Ritesh Chavan & Amir Hussain[2]
1) Abstract
Today’s world faces a huge “energy crisis” problem. To meet the future “energy demands”, the use of non-conventional energy as an alternate solution is inescapable. In order to meet the food requirements of growing population, modernization of agriculture has become a necessity. In agriculture, spraying of pesticides is an important task to protect the crops from insects for obtaining high yield. However, farmers have been mainly using traditional conventional techniques like hand operated and fuel operated spray pump system for spraying pesticides. Now-a-days, the concept and technology employing non-conventional energy has become very popular for all the developing activities. With this motivation, we have developed a solar powered agricultural pesticide sprayer prototype. The prototype was design considering parameters like desired spraying efficiency, low weight, low cost, user-friendly nature, high operating time and for faster coverage of area. Thus, the prototype was design to be a value for money product in the agricultural sector. For designing the prototype, the conventional sprayer system was studied to understand the mechanism for spraying process. Mathematical equations were derived after adopting suitable assumptions for calculation of the area covered during spraying, nozzle dimensions, pressure head and power of the motor required for the spraying a known discharge of fluid. The parts required for the system were selected by solving for known inputs value, the derived equations through a java program and considering their availability in market. The prototype was fabricated and arrangements were made on the system to allow the user to carry it on its back while operation. Thus, the system was made portable. The prototype was fabricated according to the design parameters and field tested according to the standard conditions.

C. Sarvesh Kulkarni1, Karan Hasurkar[3]
1) Abstract
There is various non-conventional energy sources from which the power can be generated. Solar energy, Wind energy, Tidal energy, Biogas energy these are various non-conventional energy sources. Solar energy is widely available in nature throughout the year. So it can be utilized in miscellaneous application like spraying, drying and cooking etc. In agricultural areas spraying is one of the essential tasks. This paper gives the information about solar powered pesticide sprayer as in cost effective manner. Solar pesticide sprayer has various advantages over conventional sprayers. It also gives information about various components used in sprayer. As it has various advantages it will become popular in agricultural field.

Abstract—Agriculture has been the backbone of Indian economy. It has to support 17 percent of world population with only 2.3 percent of world’s geographical area, 4.2 percent of world’s water resource, with 2 percent total consumption of world’s total pesticide. To fulfill the need of food modernization of agricultural sector is important. There are many areas in agricultural sector where speed of modernization is quiet slow. One of the main sectors is pesticide spraying machine. By modernization in this sector pesticides can be evenly distributed on farms which will reduce wastage of pesticide and hence prevents wastage of inputs applied on farms which reduces cost of production. Mechanization in pesticide spraying technology will lead to higher productivity with minimum input. Indian farmers are using some traditional spraying mechanisms which lead to wastage of pesticides with some hazardous ill effects on their health. Now day’s some technologies are developed and some inventions are there in this field but they are not much suitable for Indian farming conditions.

E. M. Venkateswarlu & Dr. M. Ashok Kumar[5]
1) Abstract
A Solar Operated Pesticide Sprayer is a pump running on electricity generated by photovoltaic panels or the thermal energy available from collected sunlight as opposed to grid electricity or diesel run water pumps. The operation of solar powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact than pumps powered by an internal combustion engine (ICE). Solar pumps are useful where grid electricity is unavailable and alternative sources (in particular wind) do not provide sufficient energy. The solar panels make up most (up to 80%) of the systems cost. The size of the PV-system is directly dependent on the size of the pump, the amount of water that is required (m³/d) and the solar Irradiance available. The solar sprayer has many advantages. Besides reducing the Cost of spraying, there is a saving on fuel/petrol. Also, the transportation cost for buying petrol is saved. The solar sprayer maintenance is simple. There is less vibration as compared to the petrol sprayer. The farmer can do the spraying operation by himself without engaging labor, thus increasing spraying efficiency.

1) Abstract
In this paper, the design and implementation of multiple power supplied fertilizer sprayer has been presented. The proposed system is the modified model of the two stroke petrol engine powered sprayer which minimizes the difficulties of the existing power sprayer such as operating cost, changing of fuel etc. The two stroke petrol engine has been replaced by a direct current motor and operated by the electrical energy stored in the battery attached to the unit. The battery can be charged by solar panel during the presence of sun. It could also be operated on direct current during rainy and cloudy weather conditions. This system can be used for spraying pesticides, fungicides, fertilizers and paints. The proposed system has been tested and compared with theoretical values of current and charging time. From the results it is found that the time taken to charge the full battery of capacity 12V, 7Ah has required 16.67 hours. The fully charged battery could be used to spray 575 liters pesticides. Which is approximately covers 5-6 acres of land. It is also found that, if we charge the battery for a day, then it covers approximately 200 liters of pesticides which in turn covers 2
to 2.5 acres of land. The developed systems initial cost is little more as compared to conventional sprayer but the running cost of the system is all most zero in other words minimum.

G. Laxmana Rao K & D. Rama Joginaidu

1) Abstract

A Solar Operated Pesticide Sprayer is a pump running on electricity generated by photovoltaic panels or the thermal energy available from collected sunlight as opposed to grid electricity or diesel run water pumps. The operation of solar powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact. GYT6 Solar pumps are useful where grid electricity is unavailable and alternative sources (in particular wind) do not provide sufficient energy

V. CONCLUSION

The trapped solar energy is used to charge the battery for pumping the fertilizers. It is completely simplest design and portable model. It make easy of the spraying operation using solar energy. We use the cheapest method by trapping the solar energy. It is very useful to the farmers for spraying the fertilizers.

REFERENCES


[3] M. Venkateswarlu1, Dr. M. Ashok Kumar2, M. Nagakiran3, K. Saga Kumar4, AGRICULTURAL SOLAR SPRAYER WITH MULTI APPLICATIONS


