



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 Issue: II Month of publication: February 2018

DOI: <http://doi.org/10.22214/ijraset.2018.2101>

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Design & Fabrication of Automatic Operated Solar Agro Sprayer

Puja Pise¹, Ankit Bhende²

¹Asst. Prof. Mechanical Engineer G H Raison College of Engineering Nagpur (MS), India

²VITH SEM, Mechanical Engineering G H Raison College of Engineering Nagpur (MS), India

Abstract: In Today's scenario, due to the development & researches in the field of agriculture sector, we have to create a rapid working, time consuming machine or equipment is to be manufacture on the global demand on agriculture field. Hence, new technic in automation is the necessity with growing completion and need to withstand global demand. In agriculture field, we will be spraying seeds, fertilizers, medicines, etc. in order to have good harvest of particular plant. so in our system we are going to use the cheapest method by using solar plate it collects the energy from the sun directly and convert solar energy into the electricity it used to charge the battery and run the centrifugal pump to suck the spraying liquid is spray throw out of the adjustable nozzle in farm. The sprayer system is economical for farmer also the system indicates the actual storage of pesticides, fertilizers, & water solutions. In the tank with some indicating display indicators and also the buzzer is in- soundly has given information's to human about display indicator's that how does works. Also the charged battery is used for home appliances like glowing of CFL bulbs and charge mobile phones. So ultimately our system works in cheapest method with some advanced automation using of non-renewable energy sources like solar energy in low power consumption. So we decided to develop an automatic operated solar agro sprayer system for agriculture field to overcome disadvantages of manual human efforts and operable by a single person which is ecofriendly & convenient. We are sure this system will be fruitful for farmers.

Keywords: Agriculture field; Automation; Non- renewable energy; solar plate; Sprayer sticks

I. INTRODUCTION

Due to the Development in the field of Science and technology in today's scenario have progressed in every field. Hence rapid working, time consuming machined or equipment are going to be manufacture. Today's world is of the fast and rapid process. Everybody wants to save time and effort by inventing some newer techniques mechanism etc. and implement them in the daily life. This project "Design & Fabrication of Automatic Operated Solar Agro Sprayer System" is based on solar power source of renewable energy. Which is easily available at free of cost. With low initial investment. It is simple in construction and operable by single person. It is working project and having guarantee of success. This solar-powered automatic operated spray pump system uses solar energy as source.

Solar energy is first used to charge a battery. The solar energy stored in the battery is utilized to operate pump which functions as to suck pesticide from tank and forcefully spread with the help of adjustable nozzle. It deals with the constant discharge of pesticide. & for indicating the storage of pesticides in the tank using the display indicators and buzzer is used for alertness of farmer also this charged battery can also be use for home appliances like glowing of CFL bulbs, charging mobile phones .etc...

So, our attempt is to develop a mechanism which is beneficial & convenient to operate by a single person and which is ecofriendly and it will not cause any damage to operator.

II. OBJECTIVE & SERVEY

During the study & more researches we collected detail about pesticide sprayer pump it was found that the farmer are basically used two types of spray pumps which is hand operated spray pump and fuel operated spray pump. In which hand operated spray pump is most popular.

The main drawback of hand operated spray pump is that the user can't use it for more than 5-6 hours continuously as he gets tired after some hours where as fuel operated spray pump requires fuel which is expensive and availability of fuel is not easy at rural places.

At the same time it exhausts carbon dioxide as pollutant which is harmful to our environment.

In such situation we should think to move towards some non-conventional energy. Considering it, solar energy would be one of the solutions. This paper emphasis on the spraying of pesticides using solar power as energy. It can be most often used at various locations such as farms, gardens.

The additional advantage of our system is when battery is charged it can use for home appliances. \

Our attempt is to developed mechanism, or device which is operates on renewable energy. To save other non- renewable source like petrol etc. And also helpful for agriculture sector.

Our objectives are

III. DESIGN & SPECIFICATION

A. Calculation

1) Analytical calculation of current and charging time of the battery.

a) The current produced by the solar panel (I) was calculated by knowing the maximum power (P) of the solar panel and the voltage rating (V) of the battery that is given by. $I = P/V$ There fore, $I = 15/12 = 1.25$ Ampere.

b) Charging time (T) was computed by taking the ratio rating of battery in ampere hour (Ah) to the total current consumed by the solar panel.

$$T = 7/1.25 = 5.6 \text{ hours}$$

c) Power Conversion Efficiency: The Solar cell Power Conversion Efficiency can be calculated by using the relation,

2) Practical measurement of current and charging time of the battery:-

Experimentally the current produced by the solar panel can be measured by connecting an ammeter in series with supply. The charging time of the battery using solar panel has been measured by continuously charging battery and it is found that 6 to 7 hours.

3) Selection of dc pumps on basis power required and voltage, ampere

a) Voltage = 12 volt dc supply

b) Ampere rating = 0.5 to 1.25 Therefore,

c) $P = V * \text{Amp}$

d) $P = 12 * 1$

e) $P = 12 \text{ watt}$.

f)

4) Selection of battery as per rating and requirement: e select 2 batteries as rating,

6 volt 4.5 ampere * 2 = 12 volt 9 ampere

5) Selection of motor as per specification:-

12 volt dc (speed up motor 5000 to 6000rpm)

6. Selection of fertilizer tank capacity

IV. CONSTRUCTION

The design & fabrication of automatic operated solar agro sprayer system in which the mechanisms consist of the frame made up of cast iron.

The system consists of the Solar panel, Battery, Centrifugal Pump, Tank, .Sprayer sticks with nozzle, High speed Dc motor, Impeller, and Automation Unit

A. Component

1) *Solar Panel*: Solar panel is refers either to a photovoltaic module, a solar hot water panel, or to a set of solar photovoltaic modules is assembled in many solar cells which is electrically connected and mounted on a clamping devices like supporting structure. 2. Solar panels can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions. Technical Specifications Peak Power = 10W Peak Volts = 17.8V Peak Current = 0.500Amps Open-circuit Voltage = 21.4V Short-circuit Current = 0.550Amps Max System Voltage = 600V



Fig. Solar Panel

B. Battery

- 1) A rechargeable battery, storage battery, secondary battery or accumulator is a type of electrical battery. It comprises one or more electrochemical, and is a type of energy accumulator used for electrochemical energy storage. It is also known as a secondary cell because its electrochemical reactions are electrically reversible.
- 2) Rechargeable batteries come in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network.
- 3) They store electric energy for use during peak load periods, and for renewable energy uses, such as storing power generated from photovoltaic arrays during the day to be used at night.
- 4) By charging batteries during periods of low demand and returning energy to the grid during periods of high electrical demand, load-leveling helps eliminate the need for expensive peaking power plants and helps amortize the cost of generators over more hours of operation. Specification: - 6 volt 4.5amp x 2 batteries = 12 volt 9amp.



Fig. Battery

C. Water Pump

- 1) Pumps are used to induce flow or raise pressure of a liquid. Its working is simple. At the heart of the system lies impeller. It has a series of curved vanes fitted inside the shroud plates. The impeller is always immersed in the water.
- 2) When the impeller is made to rotate, it makes the fluid surrounding it also rotate. This imparts centrifugal force to the water particles, and water moves radially out. Since the rotational mechanical energy is transferred to the fluid, at the discharge side of the impeller, both the pressure and kinetic energy of the water will rise.
- 3) At the suction side, water is getting displaced, so a negative pressure will be induced at the eye. Such a low pressure helps to suck fresh water stream into the system again, and this process continuously going on. Specification of pump:-Equipment Water Cooling / Coffee Maker Operating Voltage: 6-12V, Current 310mA at 12DV



Fig. Water Pump

D. Pesticide Tank

1. The pesticide tank is made up of plastics, Fiber. It is light in weight and easily carries pesticides for spraying purpose to one place to another. Basically it used to stored pesticide and water mixture solution... & capacity of tank 12 lit.



Fig. Pesticide Tank

E. Sprayer Stick With 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.



Fig. Sprayer Stick with Nozzle

F. High Speed DC Motor

- 1) The high speed 12V DC motor is used to rotate blower impeller. To increase pressure of air and passed through pipe.
Specification of 12 V DC mot
- 2) Voltage current:-12V DC, 2.PoConsumption:-2.4Watt, 3.Current:-0.2Amp, 4.Speed:-6000RPM (No Load), 5.Diameter of motor: - 36mm, length of Shaft: - 16mm



Fig. High Speed 12 V DC Motor

G. Blower Assembly (casing, impeller)

The centrifugal fan has a moving component known as impeller. That consists of a central shaft about which a set of blades, or ribs, are positioned. Centrifugal fans blow air at right angles to the intake of the fan, and spin the air outwards to the outlet (by deflection and centrifugal force). The impeller starts rotating, it causing air to enter the fan near the shaft and move perpendicularly from the shaft to the opening in the scroll-shaped fan casing. A centrifugal fan produces more pressure for a given air volume, and is used in leaf blowers, blow-dryers, air mattress inflators, & various industrial purposes. They are typically noisier than comparable axial fan.

H. Automation Unit

in automation unit it may consist of three display indicators and buzzer which is used for indicating pesticides storage with (A).Green (B). Yellow & (C).Red display indicators .In which storage of pesticides in tank is indicating display indicators (A).Green light indicates the tank in full, (B).Yellow light indicates the tank is medium & (C).Red light indicated tank is empty. & the buzzer has given the tune of the information of three conditions has in different three colors; Red, Yellow& green. .

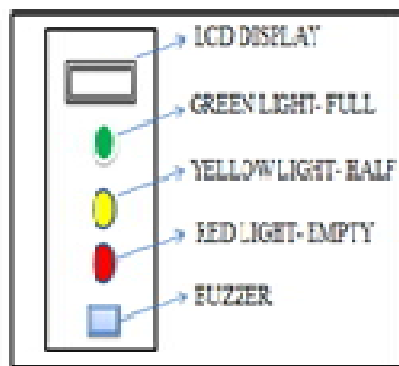


Fig. Automation Unit

V. WORKING

A solar panel is a device that collects the energy from the sun and converts solar energy into electricity or heat & it is using to charge the battery. The solar plate is fixed with upper portion of clamping arrangement & the clamp is fixed to the tank. Also the battery is fixed below in solar plate & the O/P of battery is connected to DC pump. The pump is fixed inside with the sprayer tank at lower portion of the tank. The tank has made of plastics & fiber materials. Also the capacity of tank is 12 Lit. Storage. That it may store pesticides & water mixture solution in the tank The centrifugal pump is connected to sprayer stick with adjustable nozzle & pump is sucked the spraying liquid in the tank and it delivers the sprayer stick to the nozzle with the help of rotating blades of impellers. The spraying liquid is spraying the throw-out of the adjustable nozzle with proper pressure & velocity of spraying liquid. & the nozzle has already connected to the stick. Also the O/P of flow is controlled by the adjustable nozzle.

6. Then Automation unit is connected with the tank surface in which three display indicators & buzzer has fixed. The green color display indicator to show the tank is fully stored of the spraying liquid, the yellow color display indicator is show that the tank is half of stored of the spraying liquid. And also red color display indicator shows tank is empty.

The buzzer in soundly has given information's to human about three display indicator's that how does works.

VI. BLOCK DIAGRAM

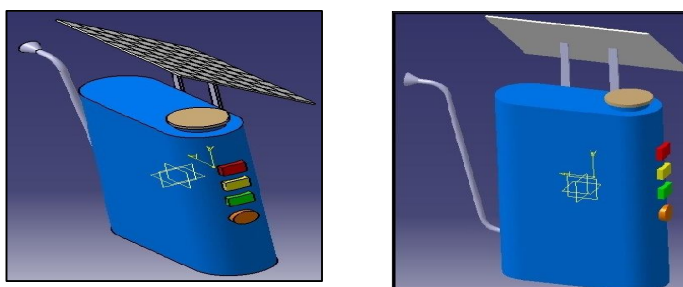
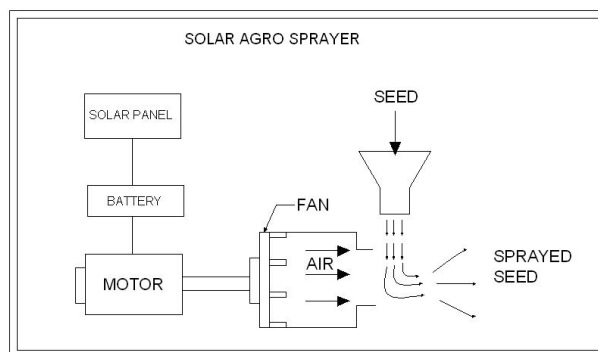


Fig. Block Dia. Of Seed Sprayer

VII. PROPOSED DESIGN OF AUTOMATIC OPERATED SOLAR AGRO SPRAYER



VIII. FUTURE ASPECTS

We developed a mechanism which is convenient, operated by a single person and will not cause any damage to the operator. As its working is the simplest and time consuming it can be used for purpose spraying pesticide, fertilizers as well as different type of seed etc. and it operated by an unskilled person in rural and urban areas. As its working is simple and it does not cause any damage while working and it guarantees the success working it should recommended or adopted in agriculture filed. The models weigh 21Kgs with full pesticide in tank. The weight can be reduced by 3 to 4kgs by using plastic molding for mechanical structure. Further solar energy is saved in battery and which can be used to run air blower which is also sued for spreading different type of seed.

IX. CONCLUSION

It does not compromise the performance of a petrol based pesticide sprayer. In addition, the model is designed to be ecofriendly 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

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