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Design and Fabrication of Automated Solar Insect Trap

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Abstract - *Insect control is the biggest challenge in agriculture. It is a common practice to use a deadly chemical pesticide to protect the crop from pest damage. There are many side effects of using a chemical. Use of more pesticide results in financial burden to the farmers. Moreover, the food becomes contaminated. In organic and integrated farming by using environment friendly automated solar powered insect trap, pest can be brought under control effectively. Solar trap is very simple in construction and use. On the four-legged stand (about five-foot height), the solar lamp strips are mounted powered by battery. A basin is placed below the lamp to collect the insects. The basin can be tilted with the help of motor driven by battery. To refill the basin with the water the solar trap is fitted with a pump. During the evening when the harmful pests hovers the crop fields, the solar lamp will switch on automatically and attracts the insects that may destroy the crops. Attracted insects end up in a water-filled basin. Water can be mixed with soap oil or shampoo to prevent the insects escaping from the basin. Every day, basin full of insects can be trapped. Farmers' job is to switch on the motor that tilt the basin to empty the trapped insects and refill the water to basin with the help of pump every day. One Solar Trap is enough for one-acre farming field. Another specialty of the machine is that it can be shipped anywhere without much difficulty. The Solar Trap can be used in various crops fields such as vegetables, pomegranates, grapes, cucumber, nut, coconut, paddy, sugarcane etc.*

Key Words: Solar Trap, Organic Farming, Insect Trap, Automated Solar Trap, Pest Control, Eco-friendly Insect Trap

1. INTRODUCTION

This project aims at design and fabrication of solar insect light trap at affordable cost using renewable source of energy from the sun (Solar Energy). Agriculture is a principle occupation in our country. Every year farmer faces pest problems which seriously destroy crops. There are many ways one can control the pests, such as:

- Mechanical method
- Physical method
- Biological method
- Chemical method

Chemical method which involves using pesticides is an effective method of controlling the pests. But it has got many disadvantages. Some of the disadvantages are follows:

- Pesticides are potentially harmful pollutants of air, soil and water.
- Pests develop resistance against kind of pesticide over the period which leads to use of more and more pesticides.
- The residues of pesticides are left over the food crops. The chemicals are added upon by these pesticides in the food causing health issues in humans and animals.
- Affects the health of consumer and who comes in contact with the pesticides.

At present, the consumers emphasize is on safe and organic food. By considering this problem of reducing the usage of pesticides. Present research project is mainly based on development and use of solar light insect trap in the field of agriculture which may be well adopted by the farmer due to its several field advantages and low-cost involvement.

1.1 Working Principle of Solar Insect Trap

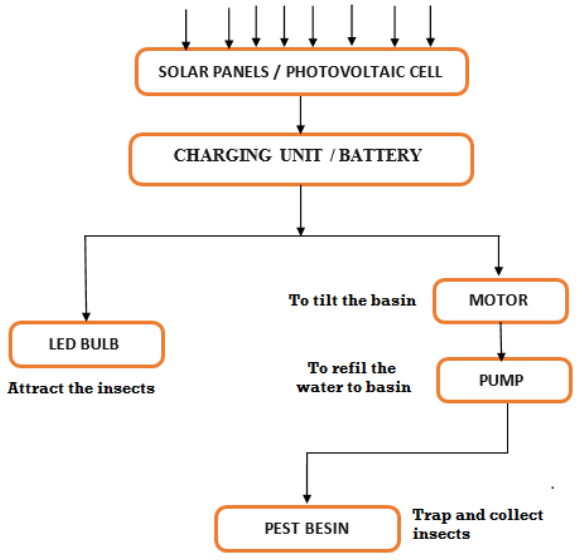

Fig -1: Schematic representation of solar insect trap

Solar trap is a device, which makes use of solar energy to trap the harmful insects in agricultural fields. The Schematic representation of solar trap is as shown in the above figure [Fig-1]. Solar cells are an efficient way to harness the energy of sun, they convert the energy of the sun into electricity, when the sunlight irradiates the surface of solar panels, parts

of the photon are absorbed by silicon and convert into electrical energy.

Then the battery stores the power generated from the sunlight and discharge the power through the controller to the lamps. Then insects get collected in the pest basin, which is filled with water. Once the pest Basin is filled with pest it needs to be cleaned. A Motor is used to tilt the pest basin downwards. The water along with trapped pest will drop down by leaving empty basin. After this pest basin is tilted upwards to its original position. The pump is used to refill the water to pest basin by drawing the water from the water storage tank.

1.2 Methodology

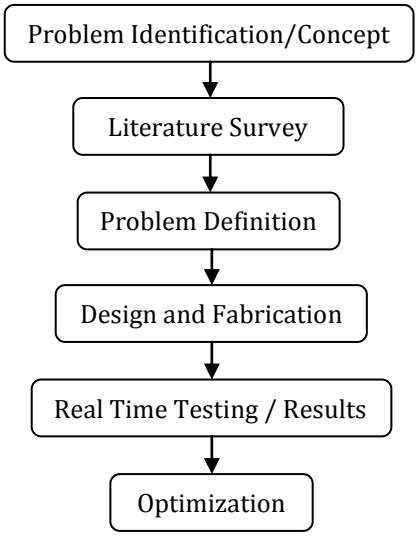

Fig-2: Methodology

Methodology which mainly include few steps which we have come across to develop the prototype of the component. The first main thing is identifying the problem by understanding the current situation. The main problem is use of insecticides and pesticides to avoid insects and pest that are damaging the crops. But by using these we are prone to harmful effects that are faced by human beings as well as environment. These insecticides are expensive and the yield of the crop reduces gradually and causing environmental impact such as air pollution, soil pollution and water pollution.so to eliminate some of these problems and to find an alternative use to avoid these insects and pest the next step is to search and collect information whether there is any substitute are available to control the insect. Based on extensive literature survey of modern methods and equipment's that are used and tested for solar insect trap, automating emptying of the dead insects from the basin and refilling the basin with water has not been studied before. This motivated us to carry the research on solar trap with additional unique features such as emptying the basin using motor and refilling the basin with water.

Once the problem is defined the computed aided design modelling is done according to the dimensions and calculations. After procuring the components of the equipment the fabrication and assembly f the same is completed.

Last and important phase of the work is real time testing and optimizing. Completed and working model is tested by installing in the crop fields and Optimized.

2. DESIGN AND DEVELOPMENT

Table -1: Bill of materials

S/N	Components	Qty.
1	Stand /support table	1
2	Solar panel	1
3	Battery	1
4	Led light	1
5	Pest basin	1
6	Pump	1
7	Motor	1
8	Water storage tank	1
9	Tray	1
10	Wheel	1
11	Driving shaft	1
12	LDR sensor	1

Fig-3: Stand/Support Table

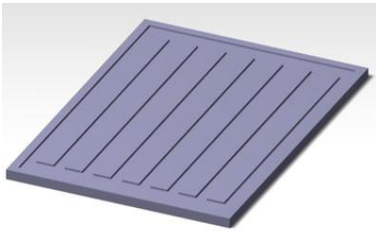

Fig-4: Solar Panel

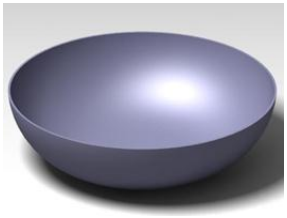

Fig-5: Pest Basin

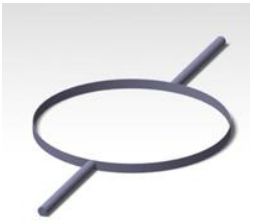

Fig-6: Driving Shaft

Fig-7: Motor

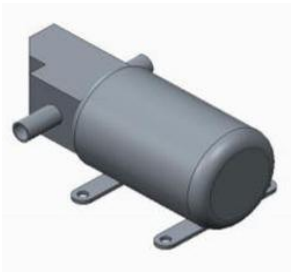

Fig-8: Pump

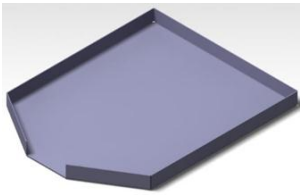

Fig-9: Tray

Fig-10: Storage Tank

2.1 Storage tank

Height of the storage tank = 380 mm
Radius of the storage tank = 130 mm

Volume of the storage tank = $\pi r^2 h = \pi (130)^2 (380)$
$= 20.1 * 10^6 \text{ mm}^3$
= **20.1 Liters**

2.2 Motor

Voltage = 12 Volts, Current = 7Ah

2.3 Battery

A Battery capacity of **12 V** has been used to power the LED bulb, motor to tilt the pest basin and pump to lift water from the storage tank to the pest basin. A ***Lead-acid*** battery is used. The current is 7A. Therefore, the power developed is = Voltage * Current = 12*7 = ***84 Watt***

2.4 Solar Panel Selection

According to battery output power, solar panel is selected.
Power=10 watt.
Dimension=350mm*240mm*22mm
Weight=1kg
Short circuit current= 0.65 A
Operating current=0.59A

Fig-11: 3D Model of Automated Solar Insect Trap [CATIA V5]

3. FABRICATION OF AUTOMATED SOLAR TRAP

Fig-12: Fabricated Model of Automated Solar Insect Trap

Figure-12 shows the fabricated model of the Automated Solar Insect Trap. It consists of solar panel to trap the radiation from the sun and store the energy with the help of the battery. A Solar bulb (LED light strips) to attract the insects, a pump to refill the water into the basin and motor

to rotate and empty the basin. Also, figure shows a container at the bottom to store the water.

The Automated Solar Trap is placed in the fields where the insects are to be controlled otherwise, they might destroy the crop. During the night the solar is switched on that glows the LED light and the insects are attracted towards the light and they end up in the water-basin.

During daytime, once the basin gets filled up, the basin is emptied by tilting the basin using motor. Once the basin is clean and tilted back to itsoriginal position, water gets refilled with the help of the pump that is driven by battery.

4. RESULTS

Fig-13: Automated refilling of water to basin

This section discusses the results of the Automated Solar Insect Trap. Figure-13 shows the testing of Automated Solar Insect Trap in the fields.

1. The basic and important result of the project is harnessing the solar energy using the photovoltaic cell (solar panel) during daytime and store the energy using battery to light up the LED bulb (strips are used here) during night to attract the insects and eventually trap them using water in the basin [Fig-13].

2. The motor powered by battery with basin tilting arrangement is one of the unique features of the *Automated Solar Insect Trap*. This helps to clear off the trapped insects in the basin. This function can be done every morning by the farmer by just switching on the motor [Fig-13].

3. One more unique feature of the trap is refilling of the water to the basin from the container/reservoir automatically with the help of the pump powered by battery. The refilling is done once the trapped insects are cleared. This refilling feature is one of the important results of the project [Fig-13].

4. Figure-14 shows the trapped insects in the basin of the *Automated Solar Insect Trap*. Also, the Figure shows different types of insects can be successfully trapped. The number of insects trapped overnight is also quite high.

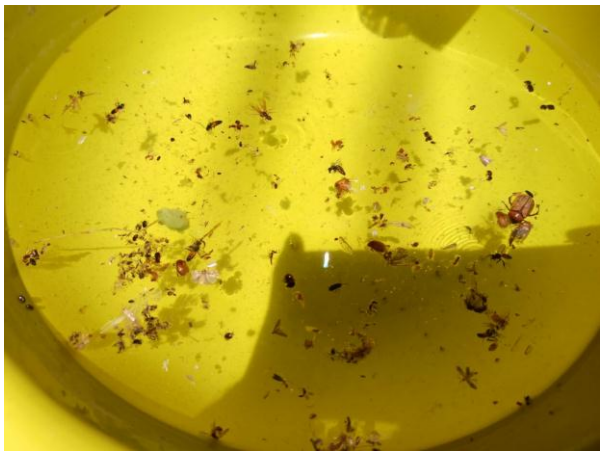

Fig-14: Trapped insects using Automated Solar Trap

5. The Automated Solar Trap is easily movable because of the wheels provided on the trap [Fig-13]
6. It can be used for wide variety of crops to trap the insects.
7. The Automated Solar Insect Trap is ecofriendly since the renewable source of energy i.e., solar power is used to carry out the different functions of the solar trap.

5. CONCLUSIONS

The research aimed at Design, Fabrication and testing of Automated Solar Insect Trap. It is an alternate of chemical insecticides for the farmer which helps in good yield and healthy crop by natural methods.

Important results include: Harnessing the solar energy using solar panel and storing the energy with the help of battery. The stored energy is used to lighting the lamp which attracts the harmful insects and eventually trapped.

Once the insects are trapped in the basin containing the water, the cleaning or emptying of the basin by tilting is carried out with the help of a motor driven by battery.

Once the dead insects are cleared out, the basin is tilted back to its original position and basin is refilled with water using a pump driven by battery.

Design and fabrication of the solar insect trap is done and tested by installing it in the crop fields.

Since it is eco-friendly in nature and low-cost involvement benefits to both the farmers and agricultural experts. The solar insect trap model will be very much effective for the control of different insects which usually causes damage to the growing plants. By this implementation green revolution technology in the crop field for providing necessary safeguard to the nature by providing necessary chemical free nature.

REFERENCES

[1] Nichanant Sermsri and Chonmapat Torasa, "Solar Energy-Based Insect Pest Trap," Procedia - Social and Behavioral Sciences 197 (2015) 2548 – 2553 doi: 10.1016/j.sbspro.2015.07.620
[2] R. Brimapureeswaran, "Development of a New Solar Light Cum Glue Trap Model and Its Utilization in Agriculture", International Journal of Emerging Technology and Innovative Engineering, Volume 2, Issue 2, February 2016
[3] Swapnil A. Meshram, "Design a Solar Light Trap for Control of Field Crop Insects" International research journal of engineering and technology, Volume 05, Issue 12, December 2018
[4] P. K. Bera, "Development of a New Solar Light Trap Model and Its Utilization as IPM Tool in Agriculture", Journal of Emerging Technology and Innovative Research, Volume 2, Issue 3, March 2015.
[5] Juan J Roncha, "Solar Powered Insect Trap" Patent.