| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 9, Issue 6, June 2020||

Design and Implementation of Solar based Natural Insect Trap and Pest Control

Prof. M.S. Jadhav[1],Pranav Aryan[2],Mohit Morankar[3],Dnyaneshwar Bodke[4]

Assistant professor, Dept. of ENTC, Sinhgad Institute of Technology, Lonavala, Maharashtra, India[1]

BE Student [ENTC], Dept. of ENTC, Sinhgad Institute of Technology, Lonavala, Maharashtra, India[234]

ABSTRACT: Agriculture is the main occupation of Indian people. Farmers encounter the problems of various types of insect pests that harm crops and result in loss of productivity each year. Therefore, it is necessary for farmers to use pesticides to prevent crop damage. However, when pesticides are used in large quantity, they cause adverse impacts on people, animals and the environment. Instead of using pesticides, the government must support other ways to prevent insect pests, including the use of biological agents and some insects etc. A previous study has shown that the ultraviolet light of light emitting diode tube could be used to lure “Beetle” (Plesispa reichei Chapuis), a damaging pest of coconut and a range of palm species. This study aimed to develop Solar Energy Based Insect Pests Trap by using ultraviolet light emitting diode tube to lure the insect pests and 12-volt battery as power supply to light emitting diode tube. The battery charging system derives electrical energy from 20 watts of solar cell for use at night. This proposed Solar Energy-Based Insect Pests Trap has an automatic control system to lure insect pests when there is no sunlight and the system will be stop when the sun shines. The results of the system installation test showed that this proposed Solar Energy-Based Insect Pests Trap could lure several types of insect pests in vegetable and coconut plantations including Brotispa, Elephus beetles, and Aphis, etc.

KEYWORDS: Solar Energy-Based; Solar cell; Insect Pests Trap.

I.INTRODUCTION

Agriculture is a principal occupation in Thailand. Every year farmers face pest problems which seriously destroy crops. There are many preventions and exterminations of pest problems, such as mechanical method, physical method, biological method, and chemical method. Using pesticides and chemical method directly affects agriculturists and consumers, for example, pests are chemical resistant which leads farmers using more and more pesticides. This causes plant residue which is dangerous for consumers, and also affects the environment and ecology.

At present, the consumers emphasize on safe and non-chemical food. The producers should be aware of this matter and reduce pesticide to decrease farmers’ and consumer’s health problems by creating non-chemical and pesticide measures. Moreover, agriculturalists have tried to find other ways instead of chemical used such as using lights to tempt pests which is popular way for farmers. However, that way is still lack of electric energy for bulbs because the farm is far away, and trap is also expensive. From this point, the researcher has developed Solar Energy-Based Insect Pest Trap for orchards and vegetable.

II.OBJECTIVES

To develop Solar Energy-Based Insect Pest Trap.

III. BUILDING DESCRIPTION

The Solar Energy-Based Insect Pest Trap research is an experimental research. The purpose is, to produce and invent Solar Energy-Based Insect Pest Trap by using ultraviolet LED bulbs as light source. The ultraviolet is effective wavelength to tempt insects. Solar cells are used to change solar energy to electric energy and change to battery for pest trap. After that, bring the trap to test the effectiveness and results of pest trap in agricultural areas.
The processes are;
1. Design. The concept idea of Solar Energy-Based Insect Pest Trap design is using general stuffs; electronic mosquito trap, acrylic boards. The trap has to easily produce, not complicate for teaching to agriculturalist. The Solar Energy-Based Insect Pest Trap consists of a) 20 watts Solar cell to change solar energy to electric energy for battery charging. b) 12-volt 14 Ah Sealed Lead Acid Calcium battery to save electric charge in daytime and give electric energy to LEDs

at night-time. c) Ultraviolet LED. They have 315-400 nm for wavelength; the most appropriate wavelength for insect tempting (Nichanun, Chanonpat, 2014. d) Light sensor switch circuit, it is on/off switch for LED. If the sensor gets lights from solar energy, it does not work yet. If the sun sets or the sensor cannot get any lights, the switch works by transfer electric energy from battery to LED. The LED bulbs will on at night-time. e) Electronic insect trap is used to shock insect.

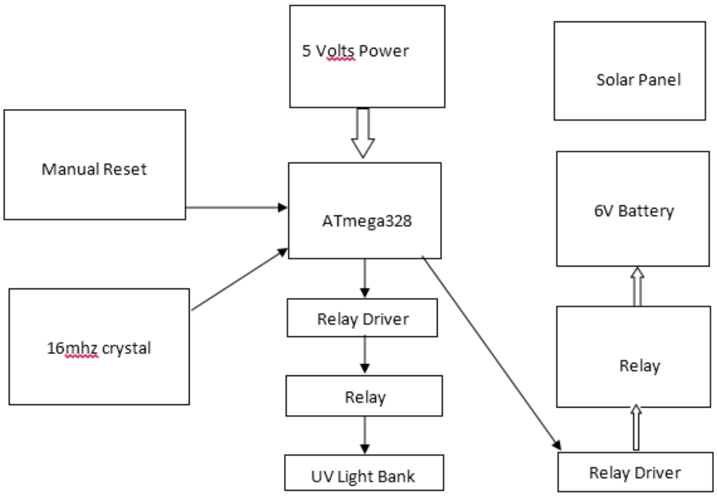

Fig 3.1.1 BLOCK SCHEMATIC

2. Invention. The main structure of Solar Energy-Based Insect Pest Trap is made from steel for durable using in agricultural fields. Its height is 150 centimetres. On the top of Insect Pest Trap, install the 20 watts solar cells panel, size 45x45 cm, 10-15 degrees of elevation angle for solar effective. The base of the trap is steel plates to mount theground. The insects tempt consists of 30x40x15 (width x length x thickness) clear acrylic square box which can let LED light out of the box. There is wire mesh of electronic mosquito trap on one side of the box. There are 150 LED size 7x7 mm; 5 rows of 30 LED bulbs each inside the box.


Fig 3.2.1 Solar Energy-Based Insect Pest Trap

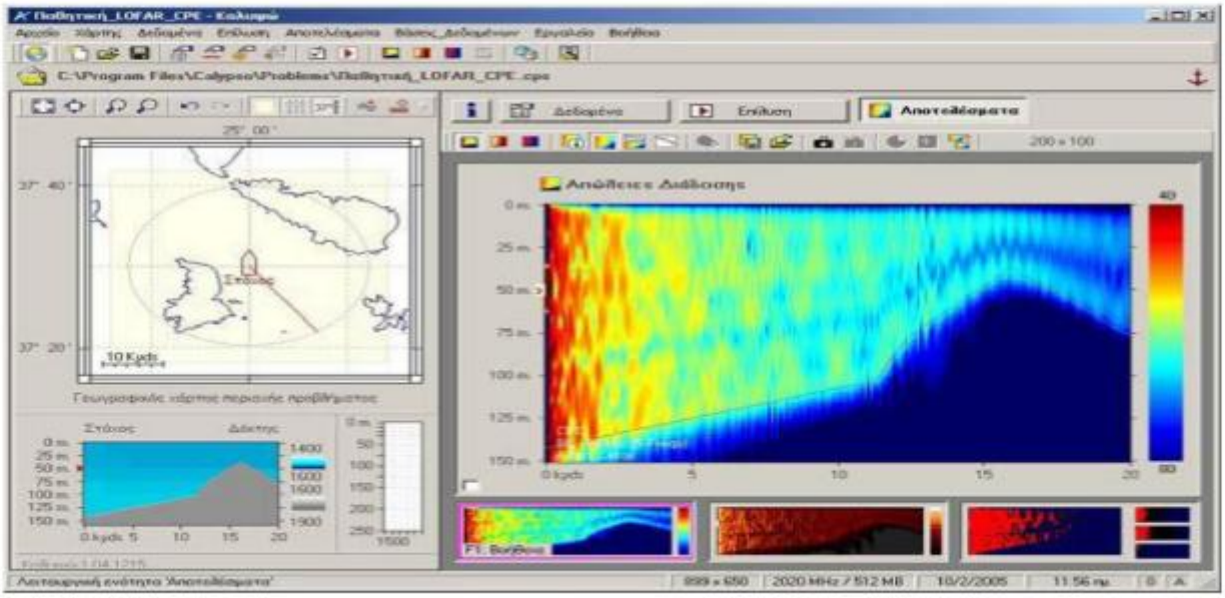

Fig 3.3.1 Integrated computer environment of Underwater acoustic detection system, CALYPSO

3. Detection. In a recent publication by *R.W. Makin* and *J.R. Fisher* (at the Fourth Symposium on Agroacoustics) it has already been presented that sounds generated by insects feeding underground are typically 2-200ms in duration and have significant energy between 0.5-1.5 kHz. The ideal sensor/amplifier system for these applications would be highly sensitive below 1.5 kHz to capture the energy of weak signals, and would enable filtering of signals below ≈0.7 kHz to facilitate signal/noise discrimination. The sensor would be shielded from airborne background noise and, because sound travels only short distances in soil, the waveguide would be easily insertable near where the insects are expected. Acoustic signals were monitored using SP-1 sensor that contained a 20-cm-long, 0.6-cm-diameter stainless steel waveguide attached to a custom-designed, PZT-5 (lead zirconate titanate) piezoelectric crystal sensor system with a 40-dB integrated preamplifier. The sensor housing was shielded to reduce airborne background noise. The spectral range of the sensor-preamplifier system was approximately 1-50 kHz. The waveguide was inserted into the nursery container and the acoustic signals were monitored for 3-min periods using an AED-2000 acoustic detection system. The data obtained is to be processed to find the type of insect pest infecting the crop. Thus, for a different type of a pest, we can identify the kinds of pesticides that would be necessary to be made available to the farmers.

4. Effectiveness test and result. The technical effectiveness of Solar Energy-Based Insect Pest Trap is; LED illumination, the amount of current supply to LED, the amount of current used to charge battery, and duration time of battery used. The measuring instruments are volt meter, amp meter, and luxmeter. The test is produced by set the trap in agricultural fields to find what types of insect and pest can be trapped, as shown in Figure 3.4.1.

Fig 3.4.1 Solar Energy-Based Insect Pest Trap install in agricultural fields

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 9, Issue 6, June 2020||

IV.RESULT

The result on illuminated effectiveness of LED shown that, the 150 LED bulbs produced 160 lux's at 0.5meters and 25 lux's at 2 meters.

The result on the amount of current supply to LED found that, the current supply was 1.1 amps; 13.2 watts, when connected 12 volts battery to 150 LED bulbs.

The result on the amount of current used to charge battery found that, the voltage at 11 am – 1 pm which the solar cells got the most solar energy was 17 volts. When connected solar cells to battery charger, the current 1.2 amps was transferred to battery.

The result on using electric energy from battery since battery was fully charged shown that, LED was light for7-8 hours at 60% of discharge current. That duration was enough to light LED at night-time for insect trapping.

The result of light sensor switch circuit test indicated that, when there was no sunlight on sensor, the sensors worked properly 100%. The sensitivity to light could be changed depends on the area. Moreover, we could set working time for 1-12 hours for the best insect trapped time. When there was sunlight on sensor, the switch also could work properly 100%.

The result of insect and pest trapping found that, Cocinellidae, Cicada leafhopper, Adult cotton leaf worm, and Leaf minor fly were trapped in orchard. The Rhinoceros beetle and Brontispa longissima Gestro were trapped in coconut farm, as shown in Figure 4.1

Fig 4.1 Insect and pest trapped in Solar Energy-Based Insect Pest Trap

.

V. COST CONSIDERATIONS

The statistics show that the losses incurred by the Indian agriculture industry due to pestilence are huge and hence there is a desperate need for the implementation of a system that can work towards reducing this menace to some extent. The system mentioned in this paper proves to be of excellent applicability as the cost of developing such a system is not that large considering the annual losses due to insect pest infection. The reason that one of the systems can be employed over a large region of land, the cost factors would be of minimal consideration. Even if the costs are not recoverable within a year, which is unlikely, but ultimately in the future use the system would ensure that the losses of the industry would be reduced to a great extent.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 9, Issue 6, June 2020||

VI.FUTURE SCOPE

The system can be applied over a large area of field and even in remote areas. For such a consideration, many systems can be used which can communicate with each other and a master system. It would then become the task of the master system of that area to transmit the data of that large area to the controlling station or the satellite, as the case may be i.e. The farmers are relieved of any concerns whatsoever about the system status.

This system can be fully automated whereby the master system controls the subsystems and decides the time of switching on or off and the time of data assimilation. This is of immense utility, as the required personnel would know how to make the system active. Thus, the dependency on the farmers for the acquisition of the data would be eliminated to a great extent. Thus, the work becomes a more reliable venture.

VII.CONCLUSION

This solar energy-based insect pest trap research chose general materials to be adapted for pest trapping such as electronic mosquito trap and clear acrylic board. Then simple design was created for easily teach to farmers.

The Solar Energy-Based Insect Pest Trap can trap many pests such as Cocinellidae, Nephotettix nigropictrs, Adult cotton leaf worm, Leaf minor fly, Rhinoceros beetle, and Brontispa longissima Gestro. They are general pests in farm around Thailand but small number can be destroyed because there was only one side of wire mesh.

LED bulbs with 12 volts were safer to use more than fluorescent bulbs with 220 volts. If the electrical short or leakage current was happened, the users would not get seriously hurt.

This trap did not appropriate for tall and leafy trees because the sunlight could not shine on the trap, the solar cells could not produce electric energy to battery.

The trap should be improved for lighter scattering as 360 degrees from the trap. The ways into LED should be provide more for more insects and effectively trap.

REFERENCES

[1] Mankin, R.W, J.R. Fisher, Current and potential uses of Acoustic Systems for detection of soil insect infestation. [2] Dhaliwal. G. S. and Heinrichs (Eds) 1998. Critical issues in insect pest management, Common wealth Publishers, New Delhi.

[2] http://krishiworld.com/html/insect_pest_crops4.html [6] (www.aedconsulting.com/aed-2000.html). [7] Magical microwaves: the exploitation of the century James, J.R.

[3] Nichanun S., Chanonpat T. (2014). Colour lighting efficiency of light emitting diode tube to lure the adult coconut hispine beetle. International Journal of Biological, Veterinary, Agricultural and Food Engineering Vol:8 No:9, 2014.

[4] Taiwan Agricultural Research Institute. (2014). LED insect trap for effective control of pests in rice barns. Retrieved December 10, 2014, from http://www.tari.gov.tw/english/form/index-1.asp?Parser=20,15,926,81,3264.

[5] Tavatchai R. (2014). Pests and their management. Retrieved December 12, 2014, from http://mis.agri.cmu.ac.th/course/course_lecture_download.

[6] www.iacm.forth.gr.

[7] www.krishiworld.com.