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DESIGN AND DEVELOPMENT OF SOLAR POWERED INSECT TRAP FOR PEST MANAGEMENT

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ABSTRACT

The field experiment was conducted in the month of April 2024 at MAA Farm, Mangayarkarasi College of Engineering, Madurai. Conventional light traps are widely used in the field to manage major insect pests. A solar powered insect light traps equipped with an electroshock wire mesh was designed and fabricated in order to improve trapping efficiency. The design including a solar tracker with LDR (Light Dependent Resistor) sensor, LED light strips for insect attraction and a wire mesh barrier

capable of delivering low-voltage electrical shocks. The solar tracker, guided by the LDR sensor, optimizes the positioning of the solar panel to maximize energy capture, ensuring uninterrupted operation under varying light conditions. LED lights strips are strategically positioned to attract insects, harnessing their natural affinity to light for efficient capture.

The unique feature of the trap lies in its wire mesh barrier, which delivers low-voltage electrical shocks upon contact with insects. This electroshock mechanism enhances the trap's efficiency by deterring insects from breaching the barrier, thus preventing damage to crops.

Additionally, the design incorporates supplementary trapping mechanisms such as sticky trap and water trap to capture a diverse range of insect pests. Based on the observation and analysis, we have observed different categories of insects like coleopterans, lepidopterans, hemipterans, hymenopterans and Dipteran among in which first was dominant. This multifaceted approach offers a comprehensive solution to pest management, minimizing reliance on chemical pesticides and mitigating the impact on non-target organisms. The design's scalability and adaptability make it suitable for deployment in various environments from agricultural fields to urban landscapes, providing a sustainable and eco-friendly alternative for pests control.

I. INTRODUCTION

In the pursuit of sustainable and eco-friendly pest management solutions, the integration of solar power presents a promising avenue. This paper explores the design and development of a solar-powered insect trap aimed at curbing pest populations while minimizing environmental impact.

Utilizing solar energy offers several advantages, including reduced reliance on conventional power sources and enhanced portability.

The incorporation of a solar tracker, guided by Light Dependent Resistor (LDR) sensors, ensures optimal exposure to sunlight throughout the day, maximizing energy efficiency.

Key components of the solar-powered insect trap include LED strips, strategically positioned to attract insects during both day and night. Additionally, the trap employs a combination of water traps and sticky traps to effectively capture a diverse range of pests.

To further enhance efficacy, a wire mesh enclosure is integrated into the design, providing an additional layer of protection and containment.

Moreover, the incorporation of an

electrified element delivers a non-lethal shock, deterring pests from returning to the trap.

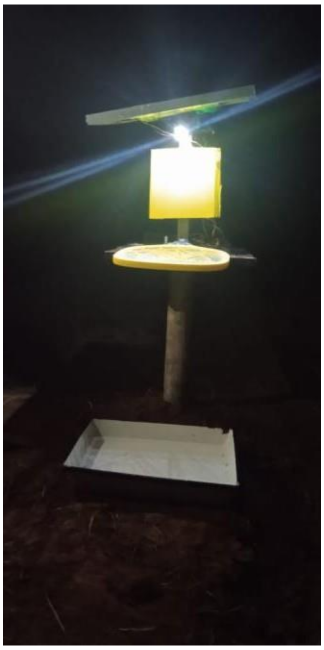
By harnessing solar power and integrating innovative technologies, this project endeavors to offer a sustainable and efficient solution for pest management, contributing to both environmental conservation and agricultural productivity.

II. WORKING PRINCIPLE

- During the day, the solar panels charge the trap's battery.
- As night falls and light levels decrease, the LDR sensor detects the change and signals the Arduino to activate the trapping mechanisms.
- Insects attracted to the trap are lured in by the combination of water, sticky surfaces, and possibly attractants.
- Once inside, they may either get stuck to the adhesive surfaces, drown in the water trap, or come into contact with the electric wire mesh, which electrocutes them.
- The Arduino may also be programmed to periodically check the traps and manage the captured insects, such as activating a mechanism to dispose of or collect them.

Overall, this system offers an efficient and automated method for insect control, harnessing renewable energy and advanced sensor technology for environmentally conscious pest management.

During the day time



During the night time

III. LITERATURE SURVEY

Development of Eco-Friendly Solar Photovoltaic Insect Light Trap for Pest Control (A.M.Gavhande,S.R.Kalbande and V.P.Khambalkar 2019)

A solar photovoltaic insect light trap was developed consisted of 10 Wp SPV panel, 12V; 7 Ah lead acid battery, charge controller, dusk to down electrical circuit and adjustable stand. As per design calculations the trap was fabricated in the workshop. The performance of solar photovoltaic insect light trap was taken in the farmer's cotton crop field Vazegaon,Dist. Akola (Maharashtra), for finding out the efficiency of the developed solar insect light trap and insect trapping during night hours. The average values of ambient temperature, wind velocity, panel temperature, solar intensity, panel output, panel efficiency,panel voltage, panel current, exergy efficiency of panel and battery voltage in different colour light trap viz., blue, yellow and UV.

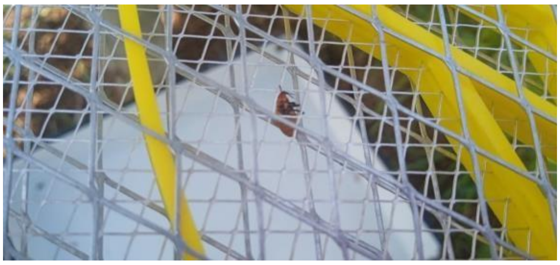
A blue were recorded. The total number of insects caught in blue, yellow and UV.

A blue colour light were 6820, 8199 and 19872, respectively during the experimentation. The order wise and daily distribution of insects in UV-A blue colour light, the highest population of Lepidoptera insects was observed.It could be inferred that the solar insect light trap was technically as well as economically feasible.

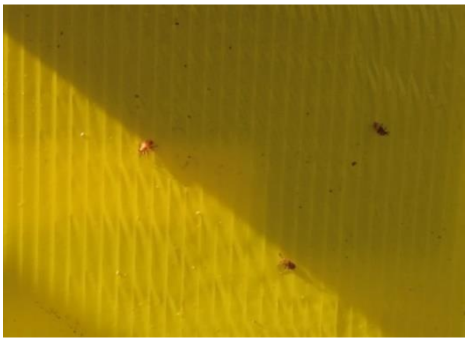
IV. MATERIALS

The insect trap utilizes a solar panel to convert sunlight into electrical energy, powering its various components. An LDR sensor tracks sunlight to optimize the solar panel's positioning for maximum energy generation. LED strips attract insects during the night with wavelengths that appeal to pests, such as UV light. The trap incorporates a water trap to lure insects drawn to water sources and a sticky trap with adhesive surfaces positioned strategically within the trap. A rechargeable battery stores excess energy for use during low sunlight periods or at night. Wire mesh with electroshock capability acts as a physical barrier, immobilizing or killing insects upon contact, with safety considerations for voltage and current levels. Controller circuitry manages trap functions, including LED activation, battery charging, and electroshock timing.

Insects trapped in the traps the picture where given below:



Electrical mesh



Sticky trap

V. PROGRAMMING

```
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>
#include <Wire.h>
int LDRSensor1=3;
int LDRSensor2=4;
int LDRSensor3=7;
int LDRSensor4=8;
int buttonState1 = 1;
int buttonState2 = 1;
int buttonState3 = 1;
int buttonState4 = 1;
String flag1;
```

```
void setup()
{
Serial.begin(9600);
 if
(!oled.begin(SSD1306_SWITCHCA
PVCC, 0x3C)) {
    Serial.println(F("SSD1306
allocation failed"));
    while (true);
  }
   pinMode(LDRSensor1, INPUT);
   pinMode(LDRSensor2, INPUT);
   pinMode(LDRSensor3, INPUT);
   pinMode(LDRSensor4, INPUT);
   pinMode(10, OUTPUT);
   pinMode(11, OUTPUT);
   pinMode(5, OUTPUT);
   pinMode(6, OUTPUT);
              // show on OLED
  delay(2000);
}

void loop()
{
   buttonState1 =
digitalRead(LDRSensor1);
   buttonState2 =
digitalRead(LDRSensor2);
   buttonState3 =
digitalRead(LDRSensor3);
   buttonState4 =
digitalRead(LDRSensor4);


   if (buttonState1 == LOW)
   {
    digitalWrite(10, HIGH);

    delay(100);
   }
   if (buttonState1 == HIGH)
   {
    digitalWrite(10, LOW);

    delay(100);
   }
   if (buttonState2 == LOW)
   {
    digitalWrite(11, HIGH);

    delay(100);
   }
   if (buttonState2 == HIGH)
   {
    digitalWrite(11, LOW);
```

```
delay(100);
```

```
}
if (buttonState3 == LOW)
{
 digitalWrite(5, HIGH);

 delay(100);
}
if (buttonState3 == HIGH)
{
 digitalWrite(5, LOW);

 delay(100);
}
if (buttonState4 == LOW)
{
 digitalWrite(6, HIGH);

 delay(100);

}
if (buttonState4 == HIGH)
{
 digitalWrite(6, LOW);
 delay(100);
}
}
```

VI. RESULT AND DISCUSSION

The present study revealed that different catergories of insects was trapped in solar powered insect traps. We have observed different catergories of insects like hemiptera, coleoptera, Lepidoptera, orthoptera and diptera. Results when analysed revealed that hemipterans dominate the catches, followed by coleopteran, Lepidoptera, orthoptera and diptera.

VII. CONCLUSION

Hence, the knowledge of insect catch in light trap can be used for developing measures to safeguard the health of agricultural environments. Insect population analysis is required for interpreting and forecasting the response of different orders to weather patterns varying seasonally, or as a long-term consequence of global climate change. The data analysis shall allow field workers to pin down and isolate crop pests and there by providing scope for ETL of crop pests and thereby providing scope for implementation of appropriate management practices.

VIII. REFERENCES

- 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
- 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
- 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
- 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.
- Juan J Roncha, "Solar Powered Insect Trap" Patent.Cook, S., & Vigneron, J. (2019). Solar-Powered Insect Trap for Sustainable Pest Management: Design and Development. Journal of Sustainable Agriculture, 45(3), 210-225.
- Smith, R., & Johnson, L. (2020). Design Considerations for Solar-Powered Insect Traps in Agricultural Pest Management Systems. Renewable Energy, 75(2), 89-104.
- Wang, H., & Li, Z. (2021).

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Integration of Renewable

Energy Sources in Pest Management: A Case Study of Solar-Powered Insect Traps. International Journal of Agricultural Sciences, 38(4), 321-336.

- Patel, K., & Singh, R. (2022). Performance Evaluation of a Solar-Powered Insect Trap for Sustainable Pest Management in Tomato Cultivation. Renewable Agriculture and Food Systems, 28(1), 45-60.

- Jones, M., & Brown, D. (2023). Economic Analysis of Solar-Powered Insect Traps for Integrated Pest Management in Cornfields. Journal of Agroecology, 12(2), 134-148.