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Development Project Of Agricultural Self-Powered Intelligent Insect Collector Killer With Multiple Wave Length Light.

[1]Prof. Chitralekha Rananaware, [2]Siddharth Bilambe, [3]Pranav Jadhav, [4]Prathamesh Bhalerao.
[1]Assistant Professor, [2] Student, [3]Student, [4]Student.
[1]Department of Instrumentation Engineering,
[1]All India Shri Shivaji Memorial Society Institute of Information Technology, Pune, Maharashtra, India.

Abstract:
Worldwide agricultural production and food security are being threatened by insects. Conventional approaches to controlling insect pests frequently include the use of chemical pesticides, which can have negative consequences on both the environment and human health. This research study outlines a development project that aims to create an agricultural self-powered intelligent insect collector-killer that is outfitted with multiple wavelength light technology in response to these difficulties. The system provides an efficient way to develop the self-powered mechanism utilising clever algorithms and renewable energy sources, the system targets specific insect pests with the least amount of damage to the ecosystem and beneficial organisms. These techniques, along with contemporary technologies, have enormous potential for quickly detecting and monitoring dangerous pests and placing them under quarantine. The paper discusses the primary attributes, purposes, and potential consequences of this cutting-edge farming instrument.

Index Terms - Agriculture, Environmental Concerns, Natural resources, Insect-Pest population, Self –Powered Insect Trap, Automated trap, Multiple Wavelength light.

1. Introduction:

With the use of solar energy, a sustainable energy source from the sun, this project seeks to develop and build an inexpensive solar bug light trap. In India, agriculture is the primary industry. Agriculturalists deal with bug issues every year that cause significant crop damage. In agriculture, conventional pest management techniques are frequently quite expensive. Additionally, hand collection is labour-intensive and ineffective, and broad-spectrum insecticides damage beneficial insects and contaminate the ecosystem. [1] We provide a ground-breaking invention to solve these issues: the self-powered agricultural automated insect collection killer that uses multi-wavelength light.
Plant protection generally refers to management techniques used to keep diseases, pest insects, birds, and other biological pressures under control while crops are being cultivated. The integrated pest management (IPM) paradigm encompasses behavioural, mechanical, physical, and cultural aspects. Chemical and biological techniques. The chemical technique is the most practical, efficient, and widely accessible approach currently used in the agricultural production system. [2]
Synthetic pesticides are the main tool used to manage pests in many nations. On the other hand, inappropriate usage of synthetic chemical molecules contaminates harvested agricultural products and has a direct negative impact on agro-horticultural ecosystems and the environment. These days, farmers are forced to use more and more indiscriminate insecticides since insects and viruses are becoming resistant to chemical pesticides. [3] Overuse of pesticides puts consumers who eat these items with residual pesticides at serious danger.

This clever gadget uses automation and light to upend traditional pest control methods. It attracts particular insect pests by using light wavelengths that have been carefully selected. After the insects are drawn in, they are quickly gathered and removed. Its self-powered design minimises environmental effect and does away with the need for external energy sources. [4]

1.1. Working Principle solar insect trap using wavelength light:

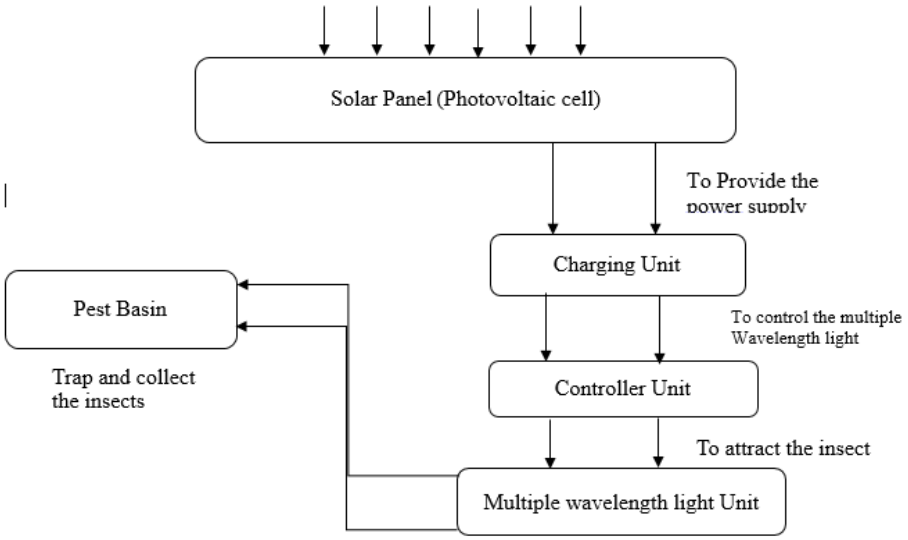

Figure 1. Schematic Representation of insect collector killer with multiple wavelength light.

- Light is absorbed by the solar panel in this mechanism and transformed into an electric signal, which is then stored in the battery unit and utilised to power the main circuit via the charging unit.
- With various wavelengths of light, the insect collector killer seeks to draw in insects and other pests.
- A chemical called lure is mixed with water and used to attract and kill insects that come into contact with it when they are exposed to light with different wavelengths.
- The insect attraction caused by the dissolved lure in the water eventually led to their demise.

1.2. Methodology:

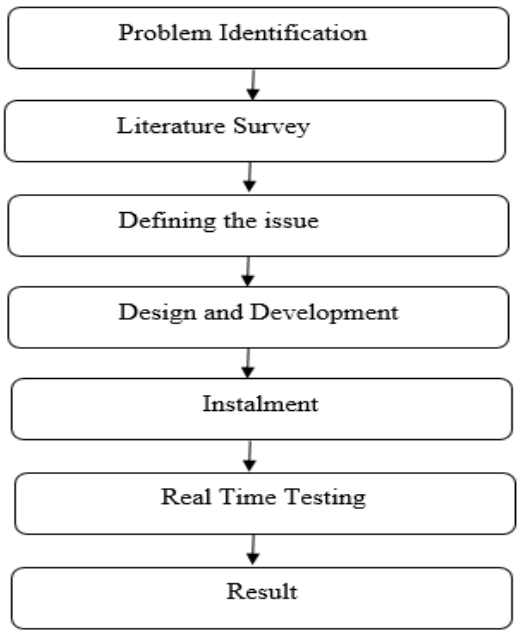

Figure 2. Methodology

Methodology, which consists mostly of a few phases we've encountered when developing the components prototype. The first and most important step is to recognise the issue by comprehending the circumstances as they are now. Using pesticides and insecticides to keep insects and other pests from harming crops is the major issue. However, employing these puts us at risk for negative consequences that affect both the environment and people.

These pesticides are costly, the agricultural production steadily declines, and they have an adverse effect on the environment by contaminating the soil, water, and air. [5] The next stage is to look for and gather information about any potential alternatives for bug management in order to solve some of these issues and discover a different way to prevent these pests and insects. [6]

2. Design and Development:

The multi-wavelength light-equipped, self-powered agricultural automated insect collection killer is a cutting-edge instrument made for focused pest management.

2.1. Required Components:

Sr. No.	Resources	Specifications	Quantity	Remarks
1.	Stand	3 Feets	1.	-
2.	Photovoltaic Cell (Solar Panel)	30 Watts (Polycrystalline)	1.	-
3.	Battery	24 Volts	1.	-
4.	Wave length light bulb	White/Yellow	1.	-
5.	Pest basin	As per requirement	1.	-
6.	Water storage tank	As per requirement	1.	-
7.	Power management module	3 battery rack	1.	-
8.	ESP module	1 (RISC microprocessor)	1.	-

Table 1. Required components.

2.2. Prototype:

Figure 3. 3D Model of Automated Insect collector killer multiple wavelength light.

Sr. No.	Component	specification	Remark
1.	Tank	Storage Capacity 4 Ltrs.	-
2.	Multiple wavelength LED	3V.	-
3.	Solar Panel	30 Watt	-
4.	Battery	12V	-

Table 2. Specifications for the components

3. Fabrication:

Figure 4. Fabricated model of agricultural self-powered automated insect collector killer with multiple wavelength light.

Figure 4. Showcases the developed model of the Automated Solar Insect collector killer with multiple wavelength light it is made up of solar panels that collect solar radiation and store it as energy. The fields where insects must be managed to prevent crop destruction are equipped with automated solar powered mechanism. The multiple wavelength light is used to provide various lights for the emissions and attract various insects pests on the veggies. Pest basin is installed in the system basin is filled with water and Lure chemical that's also attracts the insects and pests where they get killed.

4. Software:

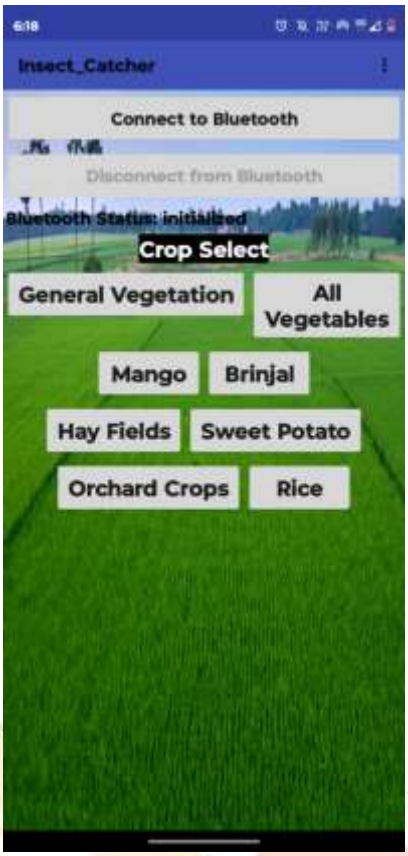

Figure 5. Screenshot of application

- ESP 32 programming is done on open source software called Arduino IDE.
- We have used MIT app inventor to create an mobile application.
- This is a web based app-maker which is also open source. Where it is integrated with actual sensing node and interfaces the commands with field device for changing the light as per veggies.

5. Result:

Figure 6. Actual implemented device at the land

- Development of an innovative and sustainable solution for insect pest control in agriculture.
- Reduction in the use of chemical pesticides and associated environmental pollution.
- Minimization of crop losses and improvement in agricultural productivity.
- Conservation of beneficial insect populations and biodiversity.
- Potential for commercialization and widespread adoption of Automated Self Powered Insect Collector Killer with multiple wavelength light technology.

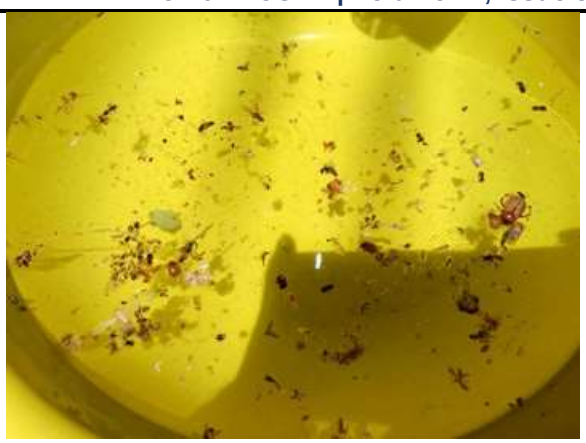

Figure 6. Collected insects through trap.

- Figure.6 displays the insects that are imprisoned in the automated self-powered insect Trap's basin. Additionally, the Figure demonstrates how various insect species may be effectively captured. There are also a lot of insects that were caught during night.
- It may be applied to a broad range of crops to capture insects, Because of solar electricity where it is an renewable energy source, is utilised to power the solar trap's many functions, the Automated Solar Insect Trap is eco-friendly.

6. Conclusion:

The goal of the project was to design, build, and test an automated solar insect trap. For farmers, it's a substitute for conventional pesticides that promotes high yield and wholesome produce using organic techniques. Using a solar panel to harvest solar energy and a battery to store it are two significant outcomes. The lamp is lit using the energy that has been saved, drawing in the dangerous insects that are finally imprisoned. Once the tray get reaches its full capacity it has to be manually drained the basin is back to its original position.

The solar insect trap is designed, fabricated, and tested by placing it in agricultural areas. Farmers and agricultural specialists profit from its cheap cost of engagement and environmentally benign character. The management of various insects that often harm developing plants may be greatly enhanced by the usage of the solar insect trap model. Through the use of green revolution technology in the agricultural industry, nature will be safeguarded by providing the essential chemical-free environment.

7. Future Scope:

The current iterations depend on drawing in a wide variety of insects. In the future, pests might be targeted based on their distinct visual traits through the use of computer vision or other identification techniques. This would reduce damage to beneficial insects that are essential for pollination, such as ladybirds and honeybees.

To target a larger variety of pests, the capacity to emit different wavelengths might be increased. It is possible to leverage research on particular insect reactions to light spectrums to build a "pest library" inside the AI of the device. This enables farmers to customise the tool to meet their unique requirements and tackle several pest problems at once.

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