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Research Article

Insect Killing Using Laser

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ABSTRACT

Insects are closely related to human existence and well-being in both senses. Flying insects are frequently used as vectors for the spread of diseases and cause serious harm to people as well as agricultural productivity over most of the world. In old method insects' detection, counting and killing is performed by sticky traps which are manually done, and these kinds of method are expensive and time consuming. We are working on a low-cost optical sensor that can identify flying insects at a distance using a weak laser beam. Although our concepts might have consequences for tracking beneficial insects, our primary goal is to employ classification methods to deliver precise real-time counts of disease carriers at the species/sex level. Here, we report some initial findings from our study, which involved three different insect species. We talk about how we might scale our methods to classify more species by augmenting the sensor with additional input sources.

Index Terms— LASER Shooting, Insect identification, Insect detection, Raspberry pi Camera.

I.INTRODUCTION

Insects and human health have been closely related throughout human history. For instance, malaria spread by mosquitoes has afflicted humans for tens of thousands of years. However, insects pollinate at least two-thirds of the food consumed worldwide. Flying insects are common vectors for the transfer of infections and cause major harm to humans and agricultural productivity in many regions of the world. The majority of the time, sticky traps are used for manual insect detection, counting, and killing; these procedures are costly and time-consuming. The primary goal of this research is to create a low-cost optical sensor that can detect flying insects at a distance using a low-powered laser beam. Our more pressing goal is to accurately count disease vectors in real time, down to the species and sex level, using classification techniques. Our goal is to construct a wing-beat sensor using low-cost components like a phototransistor and laser pointer. This method requires less time to complete and makes it simple to accomplish classification, detection, counting, and killing.

II. LITERATURE REVIEW

Agricultural pest management can also be accomplished with LASER. Investigations have been done into the effectiveness of using lasers to kill or scare away pests. These experiments demonstrate the use of the thermal impact of the laser to harm or kill insects in laser-based pest management. Heat destroys the nearby exoskeleton and the interior tissue beneath it when the laser's irradiation intensity surpasses the epidermis's level of absorption. Other laser methods are mostly used to treat adult pests, such flies, that cannot move on their own and require long-term irradiation. These pests are stored grain pests and pests that attack stored grains. The laser opening time for the control strategy, however, is only 1.117 s, and it directly effects larvae. With this strategy, crop killing can be accomplished.

The Programming And Software Specifications Are:

Python as the programming language Open CV library Tensor flow platform Jupyter IDE and Pycharm IDEOPENCV: OpenCV is a Python package that enables the execution of image processing and computer vision operations. It offers a variety of capabilities, such as tracking, face recognition, and object detection. In this project, we first use the OpenCV library to identify objects captured in real time by the camera, then we use the Tensor Flow platform to identify the desired object in the frame to create a machine learning/deep learning model. Once we have the necessary object, we need to train the AUR model with the aid of object tracking to direct the laser at the target.

THE HARDWARE SPECIFICATIONS:

We use the Raspberry Pi as an input and output device for our purpose, and we use the 4GB model because it functions like a little computer and is faster and more advanced than any other controller. High resolution video and pictures of the bug on the soil are taken using a camera. The Raspberry Pi receives the films and pictures taken by the camera module for processing and computation. Servo motors, or "servos" as they are also known, are electronic devices and rotary or linear actuators that precisely rotate and push elements of a machine. In order to achieve a certain velocity or acceleration, servos are typically utilized for angular or linear position. A LASER diode is pointed at the bug using a servo motor. A motor controller is used to drive the servo motor precisely and correctly. Close the loop on the system by continuously examining the encoder signal and applying a torque to the motor in order to regulate it is the responsibility of the servo motor controller, also known as the motion controller. Holding a particular position is the most basic variation of this. The entire system we'll be using is battery powered. These alkaline batteries' lifespan is significantly shortened when used in digital cameras or other high-drain gadgets. The battery lasts a lot longer in laser pointers since they use significantly less power.

When using a laser diode to kill insects, focus it on the target and begin. Fiber optic communications, laser pointers, laser printing, laser scanning, and light beam illumination are just a few of the many applications for laser diodes, the most widely used form of lasers. Laser diodes can be utilized as general lighting by using a phosphor like that found in white LEDs.

To identify flying insects at a distance, we are creating a low-cost optical sensor that makes use of a laser beam. Despite the potential benefits of our theories for monitoring beneficial insects, our current focus is on using classification algorithms to offer precise real-time counts of disease vectors. We have developed a laser system automated by machine vision for eliminating and discouraging moving insect pests, which is an improvement over our previous strategy. The inherent dangers of off-target laser exposure are reduced by using the laser more quickly and selectively with machine vision guidance to locate things more precisely. A Jetson Nano single-board computer that uses deep learning techniques (neural networks) for this gadget controls the laser beam using galvanometer mirrors.

CURRENT LIMITATIONS

For these strategies to work well, it is crucial to comprehend the spatiotemporal dynamics of insects. Usually, traps are positioned all over the area that needs to be watched over to find insects. Typically, a sticky material that never dries up is used in traps to catch any insects that walk or land on it. An expert must regularly collect and personally inspect these traps. The primary problem is that this procedure delays the placement of the trap until after it has been inspected and is expensive in terms of labor and materials. Even though there could just be a week's delay, a mature mosquito can survive for longer than that.

III.PURPOSED SOLUTION

In order to identify flying insects at a distance, we are creating a low-cost optical sensor that makes use of a laser beam. Despite the potential benefits of our theories for monitoring beneficial insects, our current focus is on using classification algorithms to offer precise real-time counts of disease vectors. We have developed a laser system automated by machine vision for eliminating and discouraging moving insect pests, which is an improvement over our previous strategy. The inherent dangers of off-target laser exposure are reduced by using the laser more quickly and selectively with machine vision guidance to locate things more precisely. A Jetson Nano single-board computer that uses deep learning techniques (neural networks) for this gadget controls the laser beam using galvanometer mirrors.

IV. CONCLUSION

According to the study, laser irradiation is a physical control approach for insects. The most effective set of operating parameters for enhancing insect control performance was discovered by analyzing the 450 nm laser's controlling effect on insects and investigating the components that influence lasers (laser power, irradiation area, laser opening time, and irradiation location).

Following were the primary findings of the study:
1. The following was the best combination for obtaining the highest comprehensive score: Middle abdomen is the area that will be exposed to the laser's radiation; its size is 6.189 mm2; the laser's opening time is 1.177 s.
2. To confirm the experiment, the best combination determined by the observations was utilized. the antifeedant percentage of insects decreased after 24 hours, according to the results.
3. The experimental settings combined were appropriate for 1st to 5th instar insect life cycles, and the death rate of the 5th instar larvae at 36 hours was also 100%.
The findings demonstrate the effectiveness of laser irradiation as a non-contact, high-efficiency physical control technique for insects. The field evaluation of the control impact of laser irradiation against insects is necessary even though the high antifeedant percentage and mortality rate are excellent indicators of laser field success. We still need to learn more about how to apply this technology in processing facilities or in the field.

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