AUTOMATED PEST DETECTION AND PESTICIDE SPRAYING ROBOT

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Abstract - Economy of the country highly depends on Agricultural productivity. To increase productivity controlling of Pest infestation plays an important role. Many kinds of pests can hurt plants as they grow. According to the Pesticide manufacturers the only solution to control pests is to spray pesticides regularly. Farmers go around the fields and spray pesticides, which can cause adverse effects on their health leading to dreadful diseases such as respiratory disorders, asthma, skin diseases and cancer. Our system proposes an automated approach to identify the pests and spray pesticides based on its count. It also indicates the pesticide level when it reaches below a pre-defined threshold to the farmer who controls it from a far distance. The live feed of the plant is processed by employing Video processing technique. Through Float sensor only required amount of pesticides are sprayed to the plants which is affected by the pests. The effectiveness of this approach is the ability of Robot to successfully navigate itself down the rows of a Farm by using Arduino Uno.

Keywords – agriculture; pest; video processing; counting; pesticide.

I. INTRODUCTION

Agriculture is the backbone of India. Around 215.6 million acres of land is irrigated crop area in our country. The Economic Survey states that farm mechanization in the country has to be enhanced. To increase productivity controlling of Pest infestation plays an important role. The major problems faced by the farmers are controlling pest infestation. Pests are unwanted insects or germs that interfere with human activity and they may bite, destroy food crops or otherwise makes farmers lives more difficult. Early detection and prevention of pests is a key-point in crop management. Effective pest control requires some knowledge about pests and its habitats.

Currently, farmers go around their field and spray pesticides. The major disadvantages with respect to this technique are: While spraying, the pesticide might come in contact with farmer which might cause diseases skin cancer and asthma. Increased spraying of pesticides can affect the health of consumers as it enters the food chain. Also Pesticides are sometimes sprayed on plants that are not affected resulting in wastage of the same.

Thus, in order to overcome the issues mentioned above, we have developed an automated robotic system that can spray pesticides in limited amounts only if pests are found. This not only saves the farmer from life threatening diseases and physical problems but also saves his money due to limited usage of pesticides. Hence it helps in economic development of farmers, in turn the country. Using this type of robots time consumption in spraying the pesticide liquid is reduced and also it will help the farmers to reduce the workload and to do work in any season and conditions.

II. LITERATURE SURVEY

Various researchers have proposed different techniques to identify and detect the pests. Identification of Leaf Disease in Pepper plants is done by Jobin Francis [1] using Soft Computing techniques. In
this method, disease of the leaf is detected using Image Processing technique. Since it detects after the pests have eaten it and gone, this method is not useful in controlling pests.

Detection of Sunn Pests using Sound Signal Processing Methods [2] has been proposed by Bilgi Gorkem Yazgac to detect the pests by sound. For one leaf this method is suitable but for a whole plant detection of pests using this method becomes complicated.

Martin [3] proposed a system for Identification and Counting of Pests using Extended Region Grow Algorithm. In the proposed work, identification and counting of pests to predict the amount of pesticide to be sprayed is done based on the extended region grow algorithm in image processing. This algorithm provides best identification and count of pests but it is slow and takes a lot of time.

To overcome the above mentioned problems, we have proposed Video Processing technique to detect pests such as Whiteflies. Our system is meant for crops up to 3 feet height and we have designed Robotic system to spray pesticides, if pests are found. Also, the farmers will be intimated if the pesticide level in the tank decreases below a threshold level and indicate the refilling of same through the buzzer.

III. METHODOLOGY

ROBOT

![Block Diagram]

As shown in Figure 1, the Web Camera present in robot model scans the plants up to 3 feet height. This live feed of the plant obtained is sent via Bluetooth to the Video processor that processes the video employing Video processing algorithm using MATLAB code. Simulink is used in processing the live video and the Simulink block is as shown in Figure 2. Simulink code is used to get the live video of the plants. Through video processing technique, the algorithm automatically analyses the number of pests on the plant, especially the leafy area.
The flow of the process occurs as shown in Figure 3. The video undergoes pre-processing and segmentation to improve its features by suppressing unwanted distortions and removal of noise, also it is divided into multiple parts to identify the image obtained. Morphological operations are done to process the video based on shapes that helps robot to spray different pesticides based on the type of pests. Noise removal is done in two steps that are Erosion and Dilation. Erosion is done to remove the unwanted pixels that are considered as pests while detection. Dilation is done to recover the pixels of pests in the video. The code present in algorithm specifies the time to spray pesticide based on the pest count.

The above information from the processor is fed through Bluetooth to the Arduino Microcontroller board, which has an ATmega328p chip. The instructions to control the movement of robot are fed through L293D Motor Control board that is used as driver circuit for DC Motor of Robot and Peristaltic Motor. DC Motor is used for the movement of wheels and Peristaltic Motor is used for spraying pesticides. A Float sensor is connected to Arduino Uno Microcontroller board for detecting pesticide level. If the amount of pesticide in the spraying bottle is above the threshold level, spraying of pesticides is done based on the count of pests and if it is below the threshold value, it alerts farmer through a Buzzer. Then the robot is stopped for refilling of the pesticides.
IV. HARDWARE REQUIREMENTS

A. Arduino Uno microcontroller board

Arduino Uno is a microcontroller board that is based on ATmega328P chip. It consists of 14 digital input/output pins, 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It is simply connected to a computer with a USB cable. Arduino Uno is as shown in Figure 4 and its pin diagram is shown in Figure 5.

![Arduino Uno microcontroller board](image-url)
B. L293D Motor Control Board

L293D is a dual H-bridge motor control board IC. It allows two BO motors to be used simultaneously both in forward and reverse directions. It is as shown in Figure 6.

C. DC Motors and Wheels

The wheels and DC motors used is as shown in Figure 7. It is used in robot to reduce the speed and increase the torque.
D. Peristaltic motor

Peristaltic motor is as shown in Figure 8. It is used to spray the pesticides.

![Figure 8: Peristaltic motor](image)

E. Float sensor and Buzzer

Float sensor is used to indicate the pesticide level in the spray bottle and it is shown in Figure 9. Buzzer is used to indicate the pesticide level when it is low to a farmer present in the field. It is shown in Figure 10.

![Figure 9: Float sensor](image)

![Figure 10: Buzzer](image)

V. RESULTS AND OUTCOMES

Our proposal is a prototype model as shown in Figure 11. The count of the pests scanned from the camera is taken into account and the time is configured for spraying pesticides based on that count. Figure 12 shows the identification of pests in white with a black colour background and the count is displayed in the display block. Time is configured so that time required to spray pesticides is directly proportional to the pest count that is when the count of pests is low, the time required to spray is also low and it increases with increase in the number of pests.

Also when the pesticide level in the spraying bottle is above a certain threshold value as in Figure 13, pesticide liquid is sprayed on the plants if the pests are present. Also when the pesticide level reaches below a threshold level as shown in Figure 14 the farmer is alerted through the buzzer.
Figure 11: Robot model

Figure 12: Detection of pests using Simulink block

Figure 13: Pesticide level above a threshold value

Figure 14: Pesticide level below a threshold value
VI. CONCLUSION AND FUTURE SCOPE

In this model, Video processing algorithms are employed in identification of pests. The algorithm gives better results that give the count of pests using Simulink. The proposed System ensures an efficient mechanism for spraying pesticides using Robot based on pest concentration by configuring the spray time. This time configuration depends on the pest concentration. The count of pests is directly proportional to the spray time. When the pesticide level reaches below a threshold level, by Float Sensor it indicates farmer about the decreased level of pesticide by Buzzer and the System is stopped.

In future, Robot can be developed further with hands to spray pesticides. Also the System can be updated to rotate so that pesticides will be sprayed in all directions simultaneously.

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