Pest Detection and Obliteration Based Robotic System

Vandana Shree J S
Student, Department of ECE, East Point College of Engineering and Technology, Bangalore, India, shreedeekshith042@gmail.com

Ayaz Pasha S
Assistant Professor, Department of ECE, East Point College of Engineering and Technology, Bengaluru, India, ayazpash.epcet@eastpoint.ac.in

Dr. Yogesh G S
HOD and Professor, Department of ECE, East Point College of Engineering and Technology, Bengaluru, India, gsyogesh@gmail.com

Anita R
Associate Professor, Department of ECE, East Point College of Engineering and Technology, Bengaluru, India, anitar.ece@eastpoint.ac.in

Abstract: Pest infestation is one of the major challenges by farmers. If these pests are not controlled, they can cause threat to harvest, thus generating a huge loss for the farmers. Thus, pesticides have to be supplied to plants. However, extensive usage of pesticide can cause adverse effects on a human's life when the harvest enters the food chain. Thus in order to curb the extensive usage of pesticides, we propose a pest obliteration system that captures real time video of plants; if pests are found pesticide is sprayed, else the robotic prototype will keep moving until it find the pest on plant.

Keywords: Pest Infestation; Obliteration; Prototype; Gaussian Filtering; Raspberry Pi

I. INTRODUCTION

Agriculture is the major contributor towards India's GDP. Thus, in order to assist growth of farmers, government has provided several schemes and plans for their welfare, such as harvest storage units, fertilizer distribution and irrigation systems. Yet a major problem faced by them is the pest infestation. These pests can directly tamper the harvest of the plants/crops, thus incurring a huge loss for a farmer. Hence, to put a check on this, farmers spray huge amounts of pesticides on their crops. Extensive and continuous exposure of these pesticides can cause asthma and skin cancer.

Thus, in order to save the lives of the farmers and their families, we plan to develop a pest detection algorithm in real time. The outcomes of the algorithm will be communicated to the robot, which shall be responsible for spraying pesticides at pests.

II. LITERATURE SURVEY

Automatic Monitoring of Pest Trap by Mary Monisha Raphael[1] proposed an autonomous monitoring system based on a low cost image sensor that is able to capture and send images of the trap contents to control station. Ultraviolet light is attached to a square shaped yellow board where the insect get attached to it, according to the time scheduled program in software which is inserted to raspberry pi the camera get captured automatically and sends Multimedia message to the scientist through GPRS server. The algorithm worked on identifying the pests captured by the traps and not the plants directly and hence this became the drawback of this methodology.

Dynamic Features Extraction System of Live Pests in Farmland by Qian Jing[2] proposed a method for obtaining the dynamic characteristics of pests in farmland based on machine vision. First, the pests and the background images were segmented by color feature & thresholding methods. Then, the shape features and the number of pests were obtained by Gaussian filtering. Finally, the quantity of pest motion was obtained by frame to frame differencing method. The experimental results showed the accuracy rate of 99% for each experimental sample. The software of system doesn't have real time online processing capacity and how effectively to combine pest movement with pest control is still a problem in this method.

Research on Pest Image Processing Method Based on Android Thermal Infrared Lens by Yuqing Chen[3] in which infrared thermal imaging lens based on Android system was used to obtain yield disease images and open CV technology was used for image processing. Thermal infrared images were influenced by ambient temperatures and even its lens had low resolution. Only last stage of disease was studied and these became the drawbacks of this technique.

A Capacitive Pest Detection Approach Based on STM32 Microcontroller by Feipeng Qiao[4] proposed a capacitive pest detection approach based on single chip microcomputer (STM32). MAT Lab can effectively filter the noise according to data frequency. The simulation results showed that this approach improved the performance of pest recognition both in variety and quantity. Practically this method was not applicable for all grain storages.

Smart Pest Control System in Agriculture by B Vijayalakshmi[5] presented paper in detection of pest attack in the initial stage and intimate the farmer about infection automatically. This process was aided by temperature and humidity sensor which was interfaced with Raspberry pi- 3B to atmosphere. When temperature and humidity exceed the predetermined level, then obtained real time values were compared with the database and alerted the farmer. Here only pest attack was identified and farmer was informed about infection to crops and this became the drawback.

Research on Plant Diseases and Insect Pests Monitoring Technology under the Background of Internet of Things Technology by Linquan Fang[6], he combined the IOT technology, intelligent identification technology and drone technology, the use of computer technology to diagonize plants was realized. Complex graphics were not identified, and the accuracy of diagnosis was needed to be improved.

III. SYSTEM DESIGN

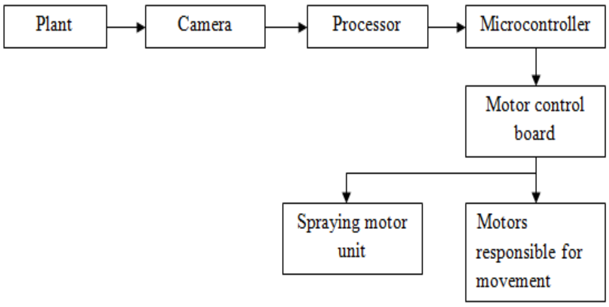

Fig 1. Block Diagram of Designed System

The above Fig. 1 represents the proposed block diagram to overcome the issues specified in literature survey. A camera is installed on the robot that captures the real time videos of the plant and sends it to video processor. The video processor houses the algorithm that can detect pests. White flies, hornets and aphids will be detected using the algorithm. If pests are found, a signal is sent to the robot prototype through a microcontroller that is embedded to prototype to spray the pesticides. Once the pesticide is sprayed the robot must move to capture the live feed of the next plants (it stops only if any pest is found).

IV. METHODOLOGY

The methodology uses MATLAB as a software tool and language embedding this with Arduino and camera as a part of hardware implementation. The hardware setup is as shown in below Fig. 2; it also uses 4WD robot chassis, BO motors to connect the universal and normal wheels, few batteries along with necessary wires.

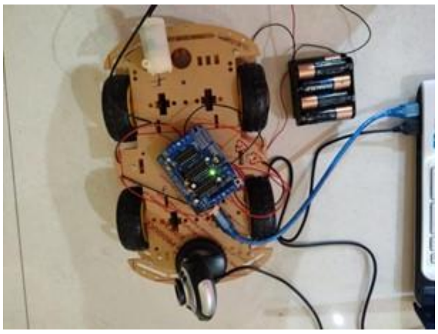

Fig 2. Hardware Setup

The process carried out at software implementation is presented through a flowchart that is shown as a Fig. 3 below.

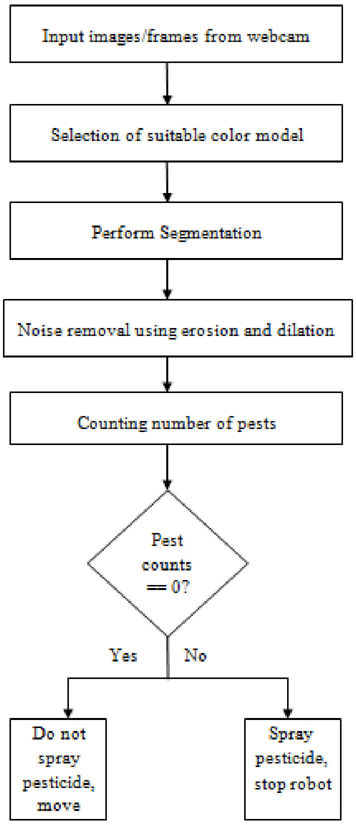

Fig 3. Flowchart of software implementation

For initial analysis the pictures were taken from the internet and the techniques mentioned in flow chart were followed that is: first image is read from source, secondly the color model conversion was done and based on analysis particular color component was considered, later image was enhanced. At third step the image obtained after enhancing is housed for segmentation. Here we use Otsu Automatic Threshold Segmentation which was very much suitable for grayscale image. At fourth step noise removal process is done by performing erosion and dilation. Erosion is the process of reducing white pixels in black area while dilation is the process of enhancing white pixels in the black area according to this work done. Flow chart for erosion and dilation process is shown below in a Fig. 4 and Fig. 5.

After removing noises by performing above morphological operations the counting of pests has to be done. This done by two ways one is by considering area wise if area of pest infection is larger or else normally consider the count if pest infected to crops is less.

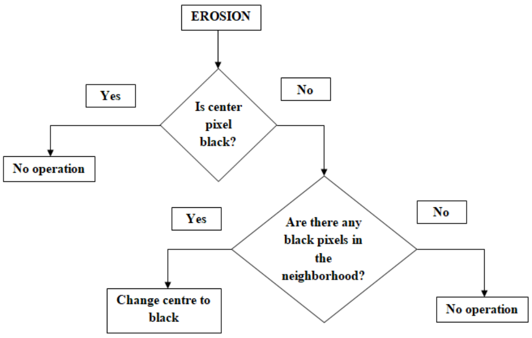

Fig 4. Erosion flowchart.

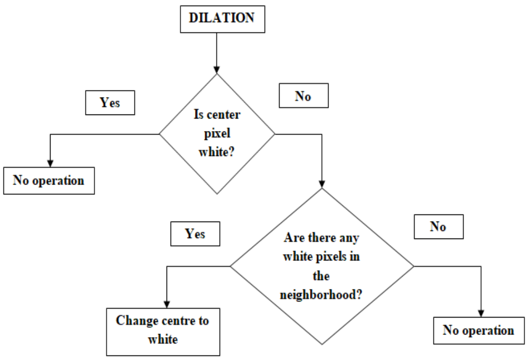

Fig 5. Dilation flowchart.

V. RESULTS

The image shown below in Fig. 6 has the outputs of all the techniques that is mentioned in methodology.

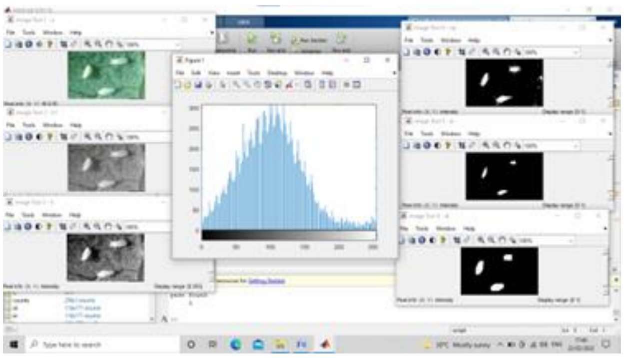

Fig 6. Final result obtained through software implementation.

Along with output images there was a display of count of pests if pest found or displayed would show pest not found. The output of hardware implementation is to run the algorithm developed in real time. Hence done image processing techniques was further done with video processing except for taking images instead web camera recorded the live videos of leaves considered in our case. The snapshot of real time output is as shown in the below Fig. 7.

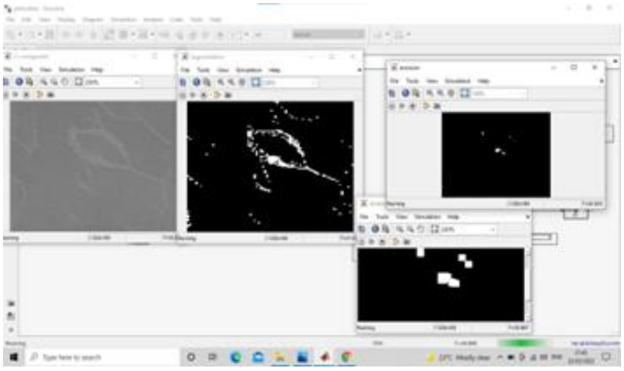

Fig 7. Final result obtained through hardware implementation working for real time.

VI. CONCLUSION

The obtained result was almost 92% accurate. This when implemented in future days will help very much to the farmers in reducing pest problems. To obtain 100% result camera of high resolution can be used to maintain the values of erosion and dilation constant. Path that robot prototype has to move can be coded as future work.

REFERENCES

[1] Mary Monisha Raphael, R Maheshwari- “Automatic Monitoring of Pest Trap”, IJAREEIE, Vol. 5, Issue 4, April 2016.

[2] Qian jing, Nie yu-man, Wang yong-ping, Cao ping-guo, Lei jian-he, Song quan-jun- “Dynamic Features Extraction System of Live Pests in Farmland”, IEEE paper published in 2018 33rd Youth Academic Annual Conference of Chinese Association of Automation (YAC).

[3] Yuqing Chen, Wei Yang Minzan Li, Ziyuan Hao, Peng Zhou, Hong Sun- “Research on Pest Image Processing Method Based on Android Thermal Infrared Lens”, Key Laboratory of Modern Precision Agriculture System Integration Research, Ministry of Education, China Agricultural University, Beijing, CO 100083, China.

[4] Feipeng Qiao, Chunlei Ji, Xiangxu Zeng, Jiyong Zhang- “A Capacitive Pest Detection Approach Based on STM32 Microcontroller”, IEEE paper published in 2019 6th International Conference on Systems and Informatics (ICSAI).

[5] B Vijayalakshmi, S Niveda, C Ramkumar, S Chenthur Pandian- “Smart Pest Control System in Agriculture”, published in 2019 IEEE International Conference on Intelligent Techniques in Control, Optimization and Signal Processing (INCOS).

[6] Linquan Fang- “Research on Plant Diseases and Insect Pests Monitoring Technology under the Background of Internet Of Things Technology”, IEEE paper published in 2020 International Wireless Communications and Mobile Computing (IWCMC).