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Automatic Leaf Disease Detection And Spraying Robot

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Abstract: Precision farming has become a popular method for increasing agricultural productivity while using less resources in recent years. The health and yield of crops are greatly impacted by leaf diseases, which calls for effective techniques of diagnosis and intervention. The proposed model integrates advanced technologies including computer vision, machine learning, and robotics to achieve autonomous operation in agricultural fields. Equipped with high-resolution cameras and deep learning algorithms, the robot efficiently identifies symptoms of leaf diseases such as spots, lesions, and discolorations. Real-time processing enables rapid diagnosis, ensuring timely intervention.

Keywords: Image processing ,Robot, Deep learning and Pesticide.

I. INTRODUCTION

The majority of people in India, which is an agricultural nation, work in the agricultural sector. Selecting the ideal crops for cultivation presents a significant challenge for farmers. Additionally, growing crops spreads disease to the plant, which lowers the amount and quality of things that are farmed. In order to successfully cultivate crops in the agricultural sector, it is crucial to monitor plants and protect them from various diseases. This process is known as the research of plant diseases.

Machine learning is like teaching computers to learn from examples and make decisions on their own. It's super helpful in lots of areas like looking at pictures, understanding languages, and finding useful information in big data. One cool thing happening now is combining machine learning with computer vision, which is like teaching computers to see and understand what's in pictures. Imagine using this to help farmers by looking at pictures of plant leaves and figuring out if they're sick or not.

Computer Vision-Based Disease Detection: Utilizing convolutional neural networks (CNNs), the Autonomous Leaf Disease Detection and Spraying Robot accurately identifies leaf diseases in real-time, enabling proactive management.

Precision Spraying: Employing advanced nozzle control systems, the Autonomous Leaf Disease Detection and Spraying Robot delivers precise doses of treatment only to infected areas, reducing chemical usage and minimizing environmental impact.

II. PROBLEM STATEMENT

Many farmers lose money because they use too much water, struggle with bugs eating their crops, and deal with plant diseases. They also often use too many chemicals, which can be dangerous. Currently, farmers have to spray pesticides themselves, which is hard work and risky because the chemicals can harm their health.

Now a days agriculture, leaf diseases pose a significant threat to crop health and yield. The methods of disease detection and treatment are often hard working, time-consuming, and reliant on chemical-intensive spraying practices, leading to inefficiencies, environmental concerns, and reduced profitability for farmers. Consequently, there is a critical need for innovative solutions to automate the detection and treatment of leaf diseases in agricultural fields.

Therefore, the problem statement revolves around the development of an Automatic Leaf Disease Detection and Spraying Robot. This robotic system should be capable of:

1. Automatically scanning and analyzing plant leaves to detect signs of disease using computer vision and machine learning techniques.
2. Differentiating between healthy and diseased leaves with high accuracy and reliability.
3. Localizing the affected areas on the plant for targeted treatment.
4. Dispensing pesticides or other treatments precisely onto the identified diseased areas, minimizing wastage and environmental impact.
5. Operating autonomously or semi-autonomously in agricultural fields, navigating terrain and obstacles efficiently.

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III. METHODOLOGY

The following steps are given to explain the methodology of the project:

STEP 1
1) A Model which moves around the crop field.
2) Take the images of plants and leafs.

STEP 2
1) With the help of CNN and Machine learning disease will Detect.
2) The initial stage of the algorithms involves distinguishing between healthy and diseased crops, whereas the subsequent task involves determining the type of crop disease.

The steps in image processing:
1) Input Image
2) Image Pre-processing
3) Image segmentation
4) Feature extraction
5) Detection of disease

STEP 3
1) After disease detection, the accurate pesticide will be sprayed on the leaf.
2) The bot will sprays the pesticide on the diseased Plant or that particular leaf too.

IV. LIVE STREAMING

Our special farming robot is helping farmers work faster and more accurately. It uses a small computer called Arduino to control everything. This robot can do a few important jobs: it watches live video, sprays pesticides, and moves around the farm by itself. Live streaming allows farmers or agricultural experts to monitor the disease leaf detection and spraying process in real-time. They can observe the robot's operation remotely, enabling them to intervene or make adjustments if necessary. integrating live streaming capabilities into disease leaf detection and spraying robots enhances efficiency, effectiveness, and accountability in agricultural practices. It facilitates real-time monitoring, troubleshooting, training, and data-driven decision-making, ultimately contributing to improved crop health and productivity.

Here's how it works:
1) Live Video: The robot has a camera that sends live video to the computer. The computer checks the video to see if there are any weeds or sick plants.
2) Pesticide Spraying: If the computer finds any weeds or sick plants, it tells the robot to spray pesticides on them to help them get better.
3) Moving Around: The robot knows where to go because Arduino tells it. It can move by itself and spray pesticides on all the plants that need it.
By using this robot, farmers can do their work more easily and make sure their crops stay healthy. It's like having a helper that takes care of the farm for them.

V. INPUTS FROM CAMERA

ORIGINAL IMAGE :

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LEAF MASK

DISEASE MASK

DESEASE MASK WITH LEAF MASK :

FINAL RESULT OF DESEASE DETECTION :

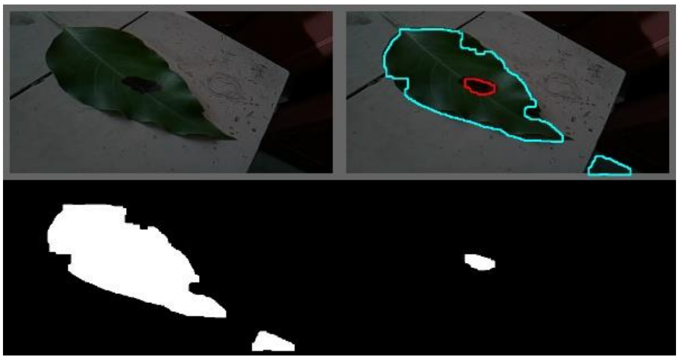

Fig -1: Live streaming block diagram

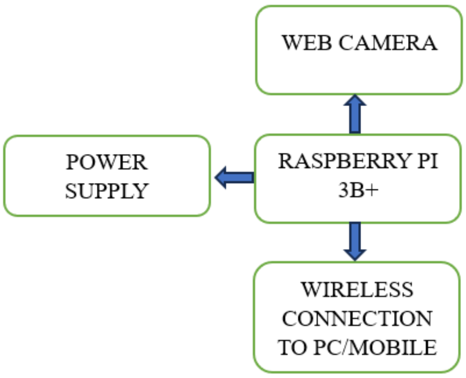

Figure 1 shows the live streaming block diagram. We used a raspberry pi 3B+ and an CAM module for computational processes. Overall, our raspberry pi -controlled agricultural robot represents a significant advancement in precision farming, offering a comprehensive solution to optimize pesticide application and improve crops yield while minimizing labor and environmental impact.

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VI. FLOW CHART OF SYSTEM

This flowchart represents a general overview of the image processing pipeline and may vary depending on the specific application or requirements. Each step in the process plays a crucial role in extracting meaningful information from the input image for various tasks such as object detection, recognition, or analysis. Image processing refers to the manipulation of digital images using algorithms and techniques to enhance, analyze, or extract information from the images. It involves converting an input image into a digital form and performing various operations on it to achieve desired results.

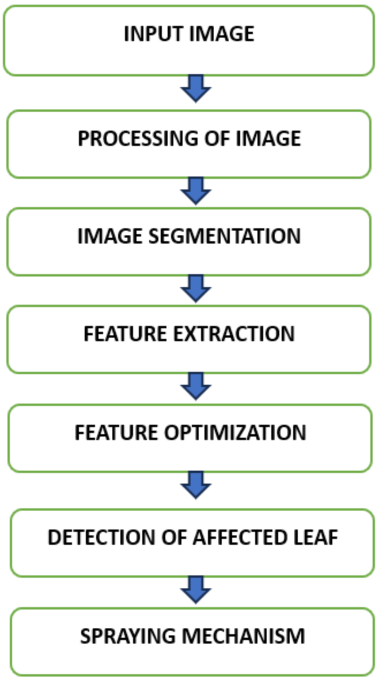
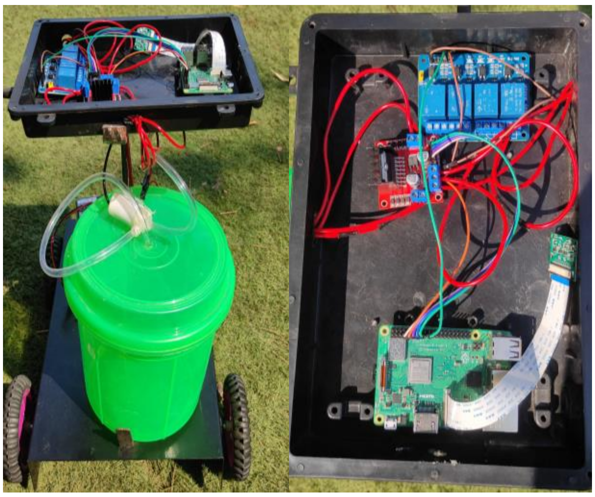


Fig -2: Flow chart of the system.

VII. HARDWARE PHOTOGRAPHS



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VIII. ADVANTAGES

Improved Efficiency: The robot can quickly scan crops for signs of disease, allowing for early detection and intervention.

Labor Savings: Farmers no longer need to manually inspect crops or apply treatments, saving time and labor costs.

Reduced Health Risks: Since the robot handles the spraying of chemicals, farmers are not exposed to potentially harmful substances, reducing health risks associated with traditional pesticide application methods.

Real-time Monitoring: The robot continuously monitors crop health and disease progression, providing farmers with valuable insights in real-time.

IX. CONCLUSIONS

We've made improvements to the robot farmers use, which can now work on controlled by a mobile app. This is important because farmers sometimes use too much fertilizer, and many farmers in India don't use technology much. Our new system focuses on finding weeds early using special technology that understands the types of weeds found in Indian fields. We've also made a special way for the robot to spray pesticides that saves money and is better for the environment. Instead of spraying everywhere, it only sprays where there are weeds, which is safer for farmers and the environment.
Incorporating a feedback loop to enhance disease detection and treatment decision-making, as well as connecting the robot to a cloud-based platform for instantaneous data exchange and examination, are our efforts to equip farmers with enhanced resources and knowledge to safeguard their crops and raise the general effectiveness of farming systems.
This new robot is easy to use, works in different types of fields, and is cheaper to maintain. It helps farmers grow crops better and makes farming safer for everyone.

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