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Agriculture Precision Robot

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Abstarct: Precision agriculture is an innovative technology that is rapidly gaining popularity. By automating farming processes, it saves time and energy typically spent on repetitive tasks, ultimately boosting crop productivity through individualized treatment of each plant. Agribot aims to incorporate robotics technologies into the agricultural industry. The farmers still heavily depend on conventional methods to perform agricultural tasks, resulting in a rise in labor requirements and a decline in the precise end result. This initiative seeks to address agricultural challenges and enhance the accuracy of the final output by creating an agricultural robot capable of automatically performing tasks such as plowing, leveling, seed sowing,and leaf disease detection . First, the robotic system is built using a high-torque DC motor, communication module, relay driver circuit, battery package , and microcontroller.The navigation of the vehicle is based on Zigbee and remote controlled system, to achieve high -level of accuracy and cost effective. Second, Automation in seeding operation provides accuracy in these spatial distance and digging the soil at a crop specific depth, dropping of seeds in the hole, covering it by soil and then pouring water on it . The completion of row is detected by IR sensors. Third, detection of leaf diseases by using the image processing techniques,a Convolution Neural Network (CNN)-based system and Digital cameras which are integrated to capture particular diseases on the plant body surface based on the shape, colour, and spots present on the leaf, and identified information is is processed though the IP unit ,feed to the controller and sends an SMS alert to the centralised cloud for storage and the farmer's smartphone for necessary response.

Keywords:- Precision Agriculture,Convolutional Neural Network (CNN),Leaf Disease Detection,Autonomous Agriculture Robot, Controlled pesticide spray.

1. INTRODUCTION

Agriculture is the process of cultivating plants to create food, fiber, and other items. The principal occupation in India has earned it the label of 'Backbone of India'. Farmers continue to employ old methods, which increases effort and decreases accuracy. The Agribot seeks to address these concerns by creating a robotic solution for agricultural operations such as plowing, sowing, irrigation, disease diagnosis, and pesticide application. Agribot focuses on using robotic technologies in agriculture to automate variety of operations without the need for human interaction. Many countries continue to use laborious and time-consuming conventional methods such as animal-drawn ploughs and human seed scattering. The goal of the project is to change current processes in order to boost efficiency and productivity.

Agribot's goal is to integrate robots technologies into the agricultural industry. Studies have revealed that many farmers still use conventional methods, which can lead to higher labor requirements and lower precision in the end results. In some cases, farmers may struggle to identify leaf diseases due to a lack of expertise. This project is focused on developing an agricultural robot that can handle tasks such as plowing, seed sowing, leveling, and irrigation automatically. These functions can also be controlled manually, providing flexibility to farmers. The ability of the robot to operate both manually and automatically makes it highly beneficial for farmers. In addition to these functions, we are working on integrating a leaf disease detection module into the robot. This module will identify diseases based on the shape, color, and spots present on the leaf and recommend the appropriate pesticide to the farmer.The main goal of this agribot is to reduce the workload of farmers, increase work efficiency, and ultimately boost agricultural yield.

2.LITERATURE SURVEY

1.Renuka Dhawale, Shweta Kalshetty, Bhushan Patil, Prachi Choudhari, and Ajay Pal Singh (July 2021-22) conducted research on agribots used for digging and seed sowing. This project aims to create a system that saves operational costs, reduces digging time, and improves seed sowing performance utilizing agribots. DC motors, moisture sensors, infrared sensors, and ultrasonic sensors are employed in this machine, which is controlled by an Android application operating on a Wi-Fi interface on the robot in the field. This reduces staff dependence. The seed-sowing and digging robot will go through numerous rows of soil, digging, sowing seeds, and covering the soil. This document details the whole installation of agribot, including both hardware and software. This study describes an agricultural robot with advanced feature of soil testing.

2.The goal of the Research Focus on Agricultural Pesticide Spraying Robot project, led by K. Sushma Priya, R. Praneetha Reddy, and Y. Pradeep (July 2022-23), is to develop an intelligent spraying robot that will reduce the use of pesticides and harm to human health, protecting farmers and reducing labor intensity. Complete route planning and navigation systems, driving control, a spraying mechanism, system construction, obstacle avoidance, and the integration of several sensor modules will all be features of the robot. The design of the spray robot will include simulations and analysis for

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sensor integration, obstacle avoidance, and spraying. In order to achieve strong stability and dependability, it is utilized not only to track motion and monitor orientation but also to adjust for path errors. In the meanwhile, the spraying apparatus will be designed, including obstacle avoidance, spraying, and sensor integration simulations and analyses. It is used not only to track motion and monitor orientation, but also to compensate for path errors in order to achieve good stability and reliability. Meanwhile, the spraying system will be improved to eliminate leaks and prevent repeated spraying, with automatic sprays varying according to the target. This project proposes a pesticide spraying system which will help farmers in field of agriculture.

3.R. Gowtham and Dr. R. Jeba Kumar (2022) are conducting research on an IOT-based plant leaf disease detection system that uses machine learning and autospraying. The project's goals are to identify diseases, prevent diseases, reduce the need for insecticides and fungicides, and classify diseases. Along with complete route planning, navigation, and driving control, the robot will also be capable of segmentation and feature extraction through the use of machine learning, SVM algorithms, and convolutional neural networks. In order to achieve strong stability and dependability, it is utilized not only to track motion and monitor orientation but also to adjust for path errors. The pesticide spraying strategy that this study suggests will assist farmers in the agricultural sector.

3. METHODOLOGY

The ARM microcontroller, Wi-Fi module, DC motor relays, camera, and image processing form the foundation of the suggested system. The microprocessor is interfaced with the peripherals to carry out a variety of tasks, including water and pesticide sprinkling, leveling, sowing, and plowing. An Android smartphone equipped with a Zigbee and Wi-Fi module controls the system. The robot can move in four directions: front, back, right, and left thanks to wireless connection. The suggested model's microcontroller responds to commands from a smartphone to enable different field functions. Using the CNN Classifier, an agricultural robot can also detect leaf disease.

Robot Module: DC motors, a communication module, relays and the circuits that drive them, a battery, and a microcontroller are used to construct the robot module. The module is divided into two components: the control section and the robotic section. These sections communicate with one another. The plowing unit, soil-digging drill, seed delivery, and seed storage are all part of the robotic segment. The control section, which houses the motors, microcontroller, and power supply, is in charge of the robotic components. Batteries are used to power the robot module. A 12V battery is included with the robot so it can run the system. Four wheels are attached to four arms to form the base structure, and a DC motor powers the back wheel. A cultivator, designed to dig dirt, is mounted to one end of the frame and is powered by a DC motor. The seeds are dropped through drilled hole on the shaft by the linked mechanism with soil digging. A leveller is used to close the seeds and water pump sprayer is used to spray the water. The robot is guided and controlled by the remote guiding device. When the motors are initiated, the module moves in the programmed columns of ploughed land. It performs the functions of digging the soil and sowing the seeds. The micro controller gives the orders to all the networks, and responds accordingly to the data processed by the programs for the factors collected.

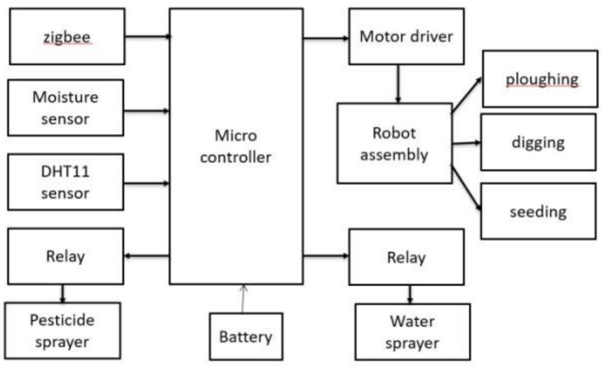
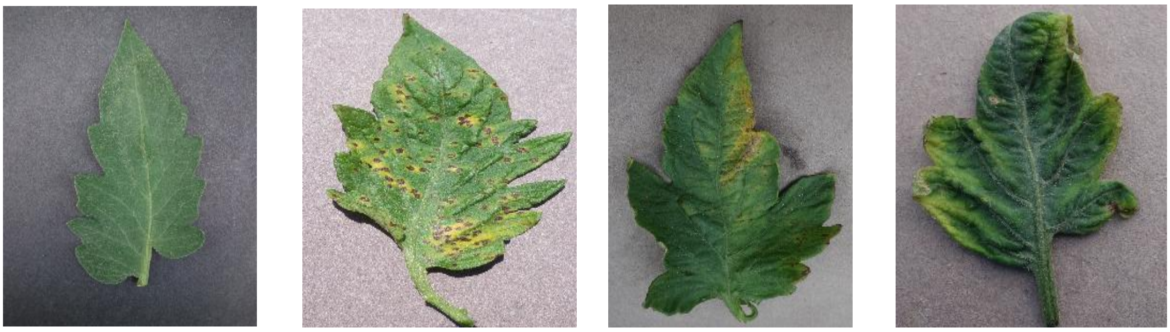


Fig 1: A complete system design

Disease detection module: The field robot is equipped with an integrated digital camera. The field robot traverses the field and takes pictures of the foliage. After being caught, the plants are divided into infected and non-diseased categories. The camera is then used to take a picture of the afflicted area of the sick plants. The recorded images are subjected to pre-processing, modification, and clustering operations. The processed photos are then fed into the processor and contrasted with the original training set of images. If the picture taken shows the portion of the leaf that is afflicted, the automatic pesticide sprayer will apply the pesticide to that specific location. If the image is not of the afflicted portion, the robot will go on and the processor will discard it.After the evaluation of the diseases all the identified data and the suitable actions need to be taken is sent as alert to the centralised cloud for storage and the farmer's smartphone in the form of SMS for necessary response. In order to spray the pesticide to the affected part, an automatic pesticide sprayer is involved. he system consists of a sprayer filled with required pesticide. The spy continuous flow of pesticide. on the affected part of the plant.

Type of leaf diseases in tomato plant leaves



(a) Healthy leaf **(b) Mosaic- virus** **(c) Leafmold spot** **(d) Curl-virus spot**

Image collection: Establishing a reliable database is the initial stage in any image processing project. A database can be created in two different ways: either all of the images can be stored, or all of the photos from various sources can be combined into a single, processable database. In this work, we used the Leaf disease detection picture collection. Prior to image processing, the data was first cleaned and tagged. High-Quy and well-angled images were chosen for image processing in order to attain a high level of algorithmic detection accuracy.

Pre-Processing and model training: After the image has been collected, it undergoes image pre-processing, an important detection step that enhances the quality of the original image by removing unnecessary features such background noise. This step involves carrying out the next picture preparation steps. For testing purposes, all 700 of the photos in the database are appropriate. The database is used to identify the test image and related disease. The training dataset was created using photos of identified illness phases. Classifiers are trained using the generated training dataset. The testing dataset is located in the temporary folder. Enhances the correctness of the anticipated test case results for image processing models by adding feature sets and plotting classifier graphs to the test case file.

Feature Extraction: The robotic module is capable of plow work, seeding, digging, and watering. Sensors assist in the performance of these tasks. The temperature and moisture sensors get information from the environment. The robotic module calculates how much water needs to be sprayed after processing the supplied data. After that, the robot ploughs. The module is loaded with the seeds that need to be sown. Depending on the type of seed being used, pre-designed guidelines specify the depth and placement distance. The DC motors under the software module's control enable the robot to move. The module has a pesticide sprinkler pump fitted. Initially, the module is trained to generate various leaf databases for comparison with the acquired image.The leaf detection module takes the picture, which the Support Vector Machine classifier uses to classify it. After that, the kind of illness discovered in the leaf is identified and shown. The robot applies the appropriate type of pesticide to the diseased leaf by loading the pesticide into the module.

Classification: Image categorization is a fundamental problem in pattern recognition. Labeling the image in accordance with the feature vector is the process of classification. After feature extraction, classification's task is to construct a detention model using a variety of classification algorithms. Deeper networks with more layers are what distinguish healthy and unhealthy Leaf Disease detection. These are identified and categorized using the extracted attributes filters built on top of one another.

4.RESULTS AND DISCUSSION

The robotic module has four functions: plowing, seeding, digging, and watering. These functions rely on sensors. Moisture and temperature sensors collect data from their environment. The robotic module processes the data and calculates the amount of water to be sprinkled. The robot then begins ploughing. The seed to be sowed is loaded into the module. The depth to dig and the distance to place are predetermined based on the type of seed used.

The software module controls the DC motors, which move the robot. The module has a pump for sprinkling pesticides. Initially, the module is trained to generate various leaf databases for comparison with the acquired image. The leaf detection module captures the image, which is then classified using the Support Vector Machine classifier. The type of illness

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discovered in the leaf is then determined and shown. The type of pesticide to be used for the specific disease is placed into the module, and the robot sprays it on the damaged leaf.

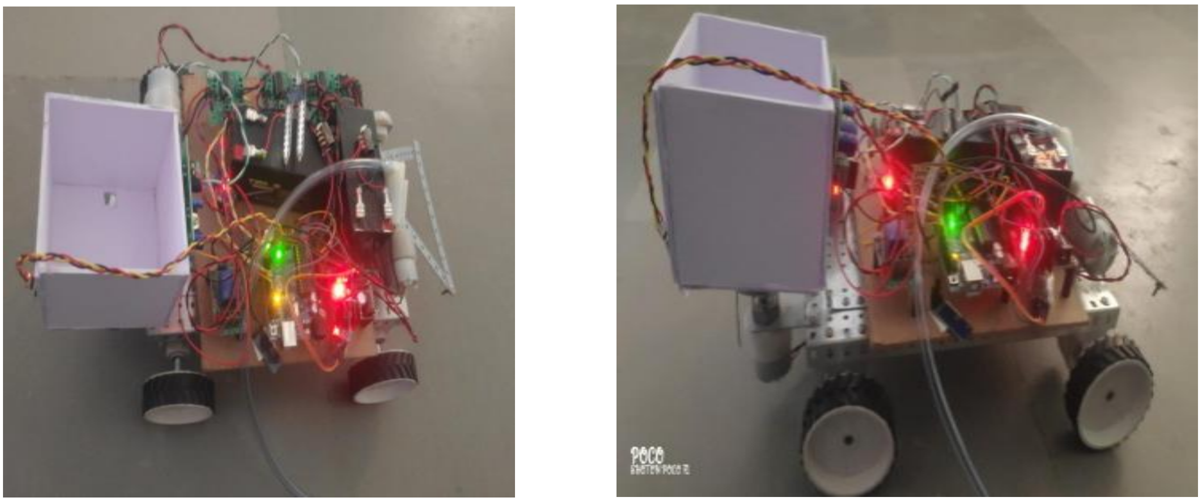

FIG 2. ROBOT MODULE

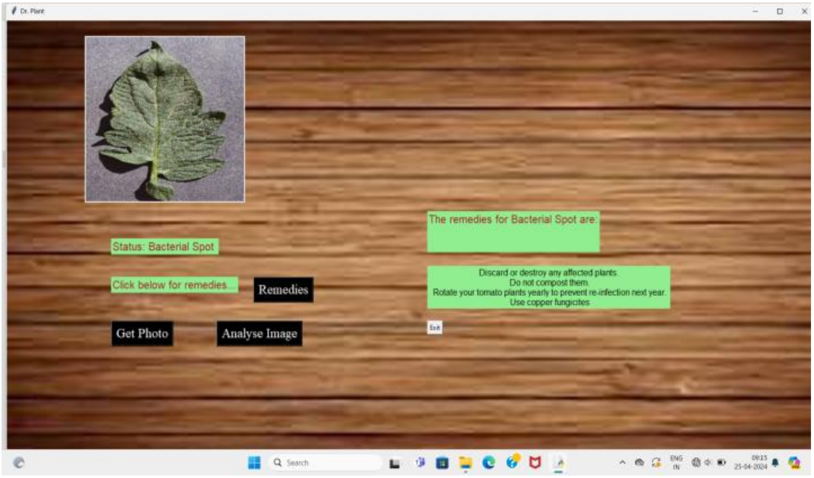

FIG 3. LEAF DISEASE IDENTIFIED OUTPUT

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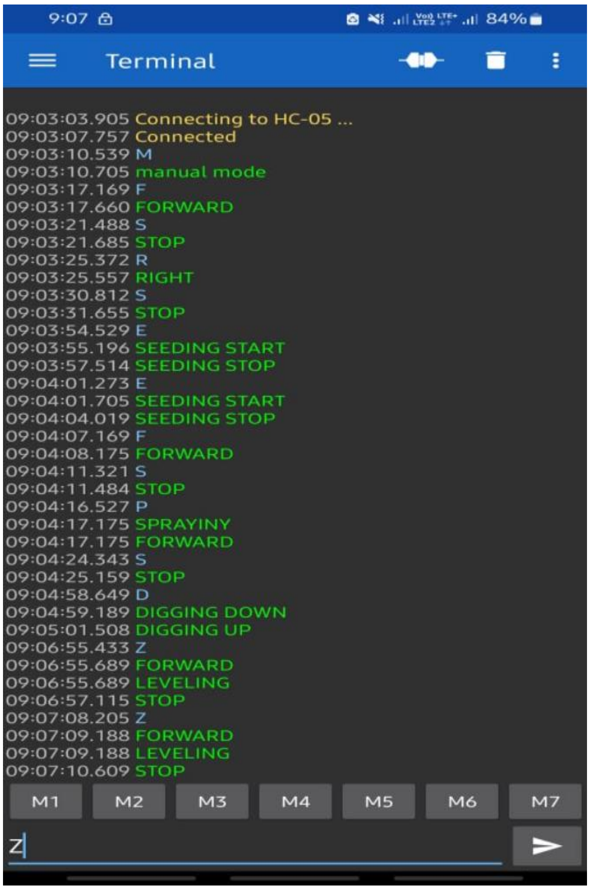

FIG 4. ROBOT CONTROL

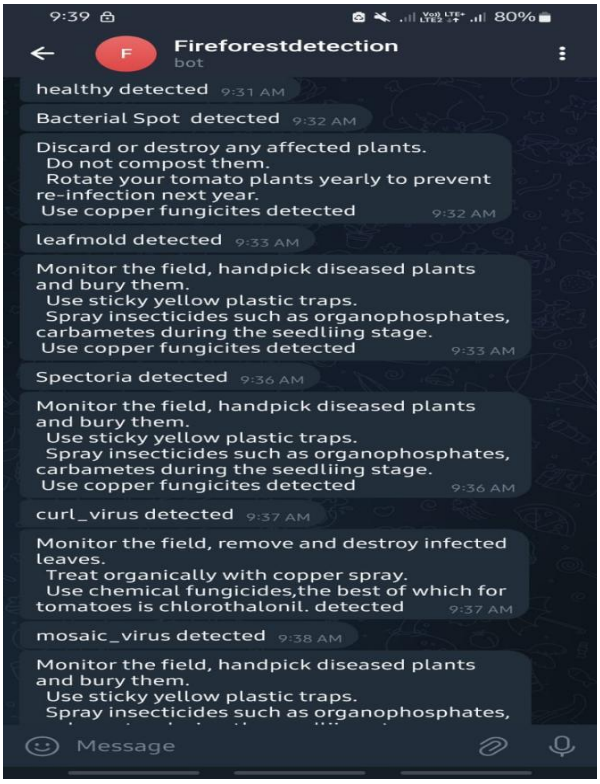

FIG 5. LEAF DISEASE NOTIFICATION

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5. CONCLUSION

The agriculture robot was proposed based on the automation of agriculture. The proposed method helps the farmers to easily perform their agricultural activities and efficient leaf disease detection. The robot reduces the stress and strain suffered by the farmer. Information about the leaf disease was obtained through image processing algorithms. Image processing offers a noninvasive approach to detect disease. It was found that with this algorithm, an efficient detection was obtained. Hence, it reduces the problem of wrong determination of disease.

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