



SMART LEAF DISEASE DETECTION

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Abstract: The main objective of this project is to develop a surveillance robot to perform the act in domestic areas. Nowadays robot plays a vital role in our daily life activities thus reducing human efforts. This robot scouts around the farms which captures images and stored them which diagnose the disease of the plant and thus providing suggestions to the farmer helping them to reduce huge loss in terms of vegetation.

I. INTRODUCTION

Agriculture plays an important role of the planet, without agriculture there cannot be any food products or raw materials which are used for survival of human kind. It is the backbone of the country's economic system. Most of the people's main source of livelihood is farming and it constitute 70% of the total livelihood. Many agricultural practices help the people in meeting the demands of fast growing population. Most of the agriculture products constitute the major items of exports of countries that rely on agriculture. Agriculture being so important there are many factors like water scarcity, climatic conditions and diseases which affect the vegetation in agriculture. Just like various problems to agriculture, there are various solutions to prevent it like checking the moisture level and predicting the climatic changes to ensure that crop is good. But every year nearly most of the farmers lose their vegetation lose vegetation because they are not able to find the disease caused to the crops which make the farmers unsure about what kind of necessary steps to be taken to prevent crops from being damaged due to diseases and due to which farmers face a huge loss since there won't be proper guidance when they cultivate any kind of new crops.

The disease to each crop is not limited to one but has various diseases which affect the crop in different ways, by the time the farmer identifies the disease and take necessary steps it might be too late and almost half of the vegetation might have been destroyed due to the disease which makes a huge loss. Being this as a major concern of all the farmers across the globe, the disease of the crops must be identified at the earliest which will alter the farmer and display the suggestions of what must be done to stop the crop disease which will help yield better, ensuring good and healthy disease free crops.

A device which monitors and alters the farmer if there are any kind of diseases observed in the crops and the farmer can take necessary actions to avoid it. A remote operated surveillance bot embedded with a camera which is controlled using a smart phone is used to move around the field which captures the images of the crops and are stored in the drive of the bot. Those images are collected by the farmer and are used to analyse the crops in lab. The images which are collected in lab are analysed using CNN and Backpropagation algorithms to identify whether the crop is disease free or not, if it's not it also helps in finding what kind of disease the crop is having and suggests the solution to the farmer so he can take necessary steps to make the crop disease free.

II. LITERATURE REVIEW

- Plant Disease Detection Using CNN and GAN
 - Local data set is used for specific crops and the data is used as a training data by using GAN and CNN algorithms.
 - It is deployed as a mobile app where the farmer gets to download it and use it to identify whether the crop is good or not by capturing images and analysing it.
 - The farmer has to move to that specific location to get the image of the crops and even mobile apps can't provide accurate results as mobile device processors aren't effective enough.
- Image Processing for Smart Farming
 - Image Processing is used to monitor the disease on fruits during farming and right time for harvesting.
 - Backpropagation method is used in training database where the images are classified and mapped to their disease category. These implementations are done using MATLAB.
 - The images have to be captured separately and then moved to the respective device where the results have to be observed.
 - Time consuming in capturing the images and then processing it using a device.
- Multi-feature Based Automated Flower Harvesting Technique in DCNN
 - An automated robotic harvester is used to roam around the field and to capture the images of flowers. The image is being processed by the bot and immediately informed to the user if the flowers are bloomed and ready to be harvested.
 - Not only in case of harvesting techniques but they can also be used to find various things like disease.

- Instead of processing all the images in the bot, the data can be sent to a server for better processing speed which reduce the bot power consumption and even such mechanism makes the bot more expensive.
- 4. The Smart Image Recognition Mechanism for Crop Harvesting System in Intelligent Agriculture
 - A harvesting system based on Internet of Things and smart image recognition. The robot analyses the crops and based on the crop maturity identified using the trained neural network model, the crops are harvested using the robotic arm. MobileNet 2 convolution neural network is used as the image extraction model which is combined with a single shot multibox detector model as the posterior layer to form an object detection model.
 - This system has all advancement tools present in the robot which can do everything on its own without waiting for the command from farmer and even its expensive when it comes to the existing models as all components equipped are not available at lower prices.
- 5. Low-Cost Wireless Monitoring and Decision Support for Water Saving in Agriculture
 - A decision support system based on the combination of the wireless sensor and actuation network technology and the fuzzy logic theory is proposed to support the irrigation management in agriculture. The farmers experience and the irrigation best practices are modelled through fuzzy rule sets and the outputs of numerical soil and crop models are used to provide a context-aware and optimized irrigation schedule.
 - Autonomous wireless decision support system is embedded in the network gateway making the system truly smart, water saving by taking various parameters thresholding and an improved exploitation of the irrigated water.

III. DESIGN AND IMPLEMENTATION

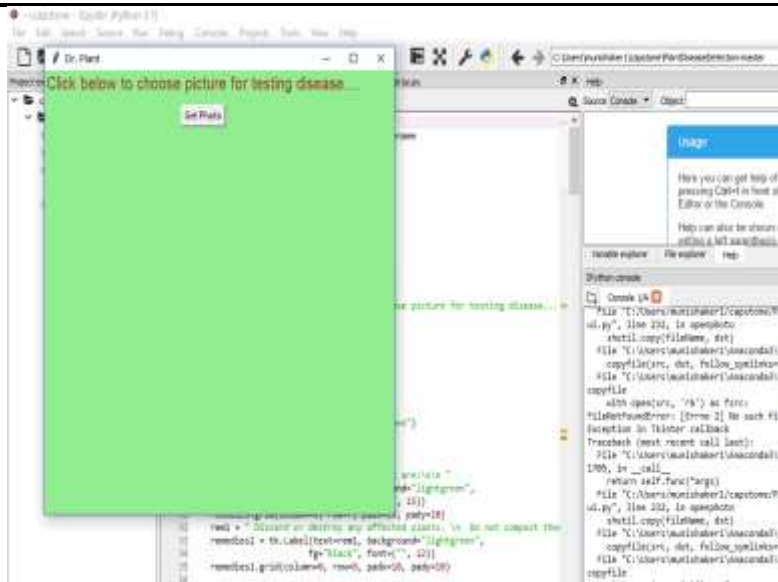
The project aims on analyzing and recognizing crops which have disease to do this, a surveillance robot is used to capture the live images of the leaves using ESP32 Camera Module as opposed to using a dataset. The robot will survey the field everyday which is operated using a smart phone connected via Bluetooth as in Fig 1.1



Fig. 1.1 Surveillance Robot Hardware

And after analysing the images remedies required to prevent such future occurrences is also displayed. The images used to train the Neural Network were that of tomato leaves and the main disease occurring in tomato crops are late blight, bacterial spots and yellow leaf curl virus. These tomato disease datasets are used to train the CNN (Convolution Neural Network) algorithm, it is the neural network which is used in this system. The main reason to use CNN is that it is easier to implement and have the ability to detect the important features of images without human supervision. This is called the learning feature present in it. The CNN is a deep learning algorithm which can take in an input image which assign importance to various other aspects or objects in the image and will be able to differentiate one from the other image. The pre-processing required in a CNN is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered with enough training which have the ability to learn these characteristics. There are three layers of CNN which are convolution layer, pooling layer, activation layer. The primary convolution layer performs a convolutions operation of weight matrix with the input image to produce a stack of filtered images, where the filter is multiplied with patches of the image matrix chosen over a particular stride. The pooling layer which is responsible for reducing the number of parameters in the image stack and in turn reduces the amount of computation required making it easy to process. The most common form of pooling is Max Pooling where from every small pooling window, the maximum value is selected.

With the accuracy the disease is identified and suggestions are given to the farmer to take necessary actions which will in return save the crop from diseases and yield better production.



Now we discuss about components.

IV. COMPONENTS

Arduino UNO



Fig. 3.1 Arduino UNO

Arduino UNO is an open-source microcontroller which is developed for experimental purposes which is based on Atmega328. Open source refers that the boards and software which are available where anyone can modify it and use it for testing on any specific application without the need of starting from scratch

Bluetooth Module (HC-05)

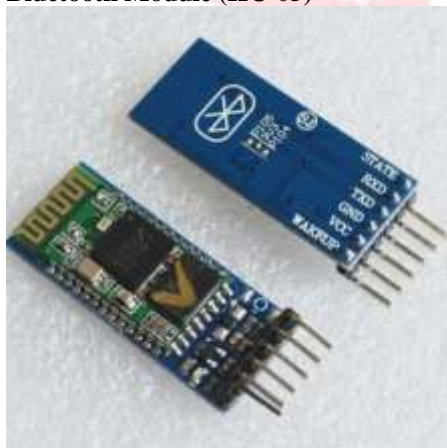


Fig. 3.2 HC-05 Bluetooth Module

The HC-05 Bluetooth Module is used to embed with microcontroller for wireless communication between microcontroller or other devices, it a full duplex wireless functionality. It is easy to interface HC-05 Bluetooth Module with Microcontrollers as it on SPP, as it has only 2 pins (Rx and Tx pins) to be connected to the Tx and Rx pins of the microcontroller. It has two operating modes, one is data mode to send and receive data from other Bluetooth devices and the other is AT command which is used to change the settings of the Bluetooth module.

L298 Motor Driver

L298 Motor Driver is a high voltage and high current motor drive chip which is a dual H-Bridge motor driver. It allows speed and direction control of two DC motors at the same time. The module can drive DC motors easily with peak current up to 2A. A 12V power supply is required to run the motor driver. This is used since microcontrollers cannot directly run motors, thus making it easy for microcontrollers to control the motors which are connected to it.



Fig. 3.3 L298 Motor Driver

ESP32 Camera Module



Fig. 3.4 ESP32 Camera Module

The ESP32 module comes with ESP32-S chip and a small size ov070 camera with a micro SD card slot. The micro SD card slot can be used to store images taken from the camera which is with the module or to store some other required files in it. This module can be widely used in various IoT applications. It can be used as a face detection system in offices, schools and other private areas where wireless monitoring is required.

DC Motors

A DC motor is class of rotatory electric motors that convert electric energy to mechanical energy, with the help of magnetic fields runs on direct current power. A current carrying conductor generates a magnetic field when it is placed in external magnetic field which will encounter a force proportional to the current in the conductor and to strength of the external magnetic field.

V. SOFTWARE SPECIFICATION

Arduino UNO IDE:

Arduino IDE (Integrated Development Environment) is a cross-platform application for any operating system, where the functions and commands are written in C. It is used to write and upload programs to Arduino UNO Microcontroller using USB port.

Anaconda:

Anaconda is a free open – source distribution of Python programming languages for scientific computing like data science, machine learning, deep learning and much more. In Anaconda navigator which is a desktop GUI (Graphical User Interface) includes a lot of applications to manage the conda packages, in which Spyder is used as a navigator.

VI. RESULT AND DISCUSSION

Most of the existing models provide good solutions to it, but they lack in one or the other way, and the ones providing excellent results are more expensive which a farmer can't afford to buy. This project provides better results when compared with existing models which comes with low price working effectively.



VII. CONCLUSION

This is a surveillance robot which scouts around the field which captures images of crops and stores in it. These pictures are helpful in finding whether the crops are affected due to any kind of disease. Convolution Neural Networks concept is used to identify the disease by which the plant has been affected and helps in thus provides suggestions to the farmer to help reduce it. The surveillance robot runs on a rechargeable battery and can last whole day without any interruption. The robot can be controlled using smart phone and can be easily identified whether it's working good or not. The pictures captured from robot are collected and copied to a PC for processing. Main aim of this project was to provide better results at low price. Future work can involve atomising the robot and processing all the results in the robot itself which might be a lot expensive.

VIII. REFERENCES

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