Agricultural Drone for Monitoring and Crop Disease Detection

Prof. M.M Baig[1], Sneha Paherwar[2], Sakshi Mishra[3], Shrishti Paherwar[4], Aman Patil[5], Saurav Anasane[6]
[1]*Dept of CSE-IT, JD College of Engineering & Management, Nagpur, India*
[2,3,4,5,6]*Information Technology JD College of Engineering & Management, Nagpur, India*

Abstract **- This paper propose a new approach of technology in agricultural field i.e. agricultural drone which works on monitoring the plant healthiness. The main approach of the research is to analyze the healthiness of plant and to detect the different diseases by applying neural network tool, image pre-processing method based on color changes, texture pattern, gradient, shape changes. After recognizing the disease, it will provide a medicament for it and analyze the defected region of the plant. This will be beneficial for farmer, which will ultimately meet the robust demand of today's generation. Apart from this, there is an additional features of leaf classification. Some of the factors that can affect the whole field plants are some growth of unwanted plants, the growth of this plant can't be recognized initially but after classifying the leaves in the field majority of the leaves will be of same pattern but the different kind of leaves will be considered as unwanted plants by providing a dataset to the neural network.**

Index Terms **- CNN, Image Processing, Clustering.**

I.INTRODUCTION

Indian economy is based on agriculture over the years it has developed, and the use of new technologies and equipment replaced almost all the traditional methods of farming. Agriculture provides employment to near about 50% of India's population. An agricultural drone is an unmanned aerial vehicle used to help optimize agriculture operations, increase crop production, and monitor crop growth. The productivity of agriculture depends on crop healthiness as the crop diseases are the major issues for lack of productivity in agriculture field. For Indians, agriculture is the most important part of their daily needs. Population is increasing day by day hence, the requirements are also increasing. So to fulfill those robust demands on time UAV is the viable solution. Drones have high accuracy, efficiency, tools and technologies which will help for crop monitoring in precision agriculture. Basically, it's a quad copter. The aerial Quad copter used for agricultural surveillance is an unmanned vehicle used for proper and accurate surveying of the crops and leaves reducing the human effort. The increasing computational efficiency in image data processing, helps to analyze the real-time situation.

[1] In recent years, researchers, companies and also military are developing the light-weight airborne or unmanned aerial vehicles (UAVs) for various application such as disaster monitoring, traffic monitoring, real-time monitoring, mapping, movie production increasingly forestry and so on. To use UAV as a sensor for capturing and detecting environmental phenomena, we mount a modified digital compact camera ("action camera") which can be used as a multispectral sensor to capture aerial images with high resolution quickly. On the other hand, in agronomical research, aerial image analysis is widely used for area monitoring and agricultural analysis. Today, largescale farming or agricultural areas are increasing. In wide scale farming, it is difficult to control the condition and quality of the plantation area. In qualitative method to control agricultural areas the assessment of plant health is often based on condition of plant leaves. Agronomical researchers and companies are searching for new methods and procedures to help farmer to manage and improve the agriculture quality.

[2] Quadcopter is one type of drone that is lifted and propelled by four rotors on fix-wings. It use two set of identical pitches propeller; clockwise (CW) and counter-clockwise (CCW), to control the movement of drone by alter the rotation rate of one rotor disc or more. The advantages of quadcopter compared to others drone are low cost, steady flying, accurate

position to handle works and most importantly the ability to carry various instruments to operate in the air.

Fig.1. Outer structure

II.RELATED WORK

Convolution Neural Network (CNN) algorithm is used for analyzing an image by extracting features such as texture pattern, color, shape.

Then it will detect the disease on the basis of datasets that are provided. Then, CNN algorithm will categorize the crop into 2 categories: Healthy and un-healthy crop.

The crops in the field are numbered from 1 to n. The numbered crops are placed in categories, which will be shown on our system.

Once the disease is detected, system will provide medicament.

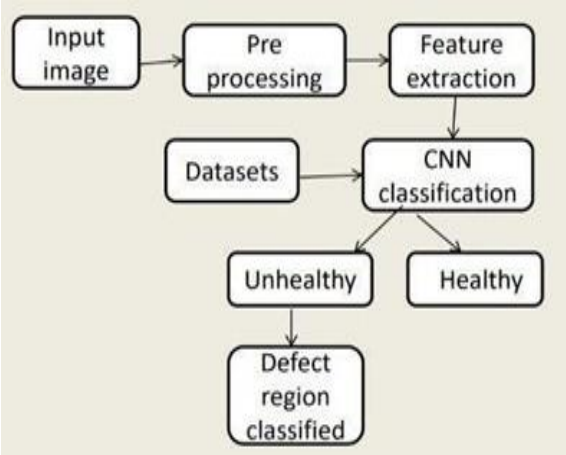


Fig.2. Block Diagram

III.PROPOSED METHODOLOGY

The main components of the system are:

1. GOPRO CAMERA

It is a small camera that takes the best qualities of point-and-shoots and camcorders and packs them into a rugged frame that's smaller, waterproof and virtually indestructible.

2. BRUSHED MOTOR

Brushed DC motors possess a rotating armature that works like a electromagnet having two poles. A rotary switch is connected that helps to reverse current direction for every half cycle so that poles can be pushed or pulled against permanent magnets connected outside motor. It is commonly used as a power tool for drones.

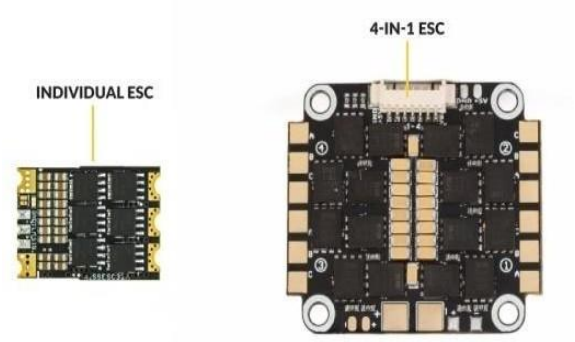
3. LANDING GEAR

Landing Gear is responsible for safe landing of drone such that no damage occurs to drone or camera. Basically, it represents legs of a drone used for landing purpose (We are using 4 legs landing gear).

4. SPEED CONTROLLER

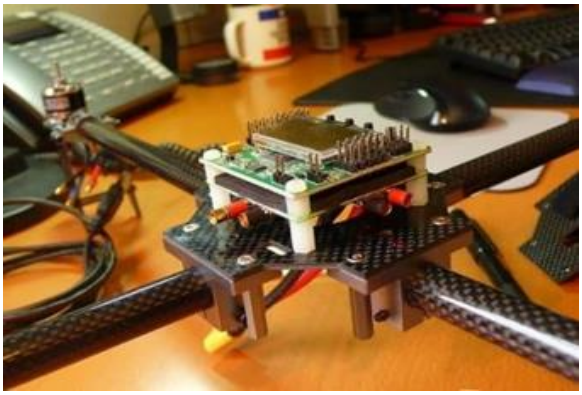
An electronic speed controller (ESC) is an electric circuit whose main responsibility is to monitor and vary the speed of drone during flight. It is also

responsible for the direction of the flight and variations in brakes of the drone.



5. FLIGHT CONTROLLER

The flight controller is the motherboard of the drone. Commands that are issued to the drone are controlled by flight controller. The fight controller is also responsible for the regulation of the motor speed through the ESC.



IV.PROCESS DESCRIPTION

Drone will detect the disease from scanning images of crop field. Drone will take/ click the images of crop from aerial perspective, and send the images to system(Such as mobile, computer, laptop) through internet. A camera is attached to drone through gimbal. Gimbal is used so that camera can be stable and can take clear and efficient images. Image acquisition is the first step in workflow because without an image we cannot detect any type of plant disease. We will retrieve an image through camera which is attached to drone through gimbal. After capturing the image, image processing will be done for enhancement of image so that the results are more suitable for further image analysis. GPS is attached to drone which will provide a path to drone. First, we are importing the necessary files. Then, randomizing the order of training set is done. Then, we are resizing the image for better results.

The drone will move on the given path. The images captured through the camera are send to third party device (laptops/desktop) through internet. In third party device consists of a system that comprises of CNN which is mainly used to detect patterns. The pattern detection property is the motivation behind choosing CNN. The drone will take the image of each plant and send those images to the third-party device, and the system will process the image and will detect the diseases.

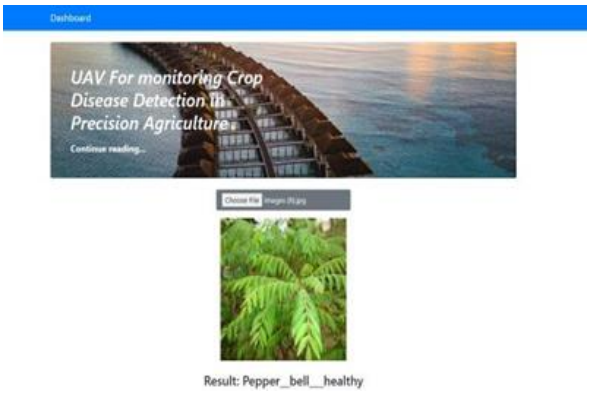
Convolution Neural Network (CNN) algorithm is used for analyzing an image by extracting features such as texture pattern, color, shape. Thus, the features are extracted then it will detect the disease on the basis of datasets that are provided. Then, CNN algorithm will categorize the crop into 2 categories Healthy and un-healthy. The crops in the field are numbered from 1 to n. The numbered crops are placed in categories, which will be shown on our system. Once the disease is detected, system will system will classify it as healthy or non-healthy by datasets that are provided to neural network.

CONVOLUTION NEURAL NETWORK (CNN)

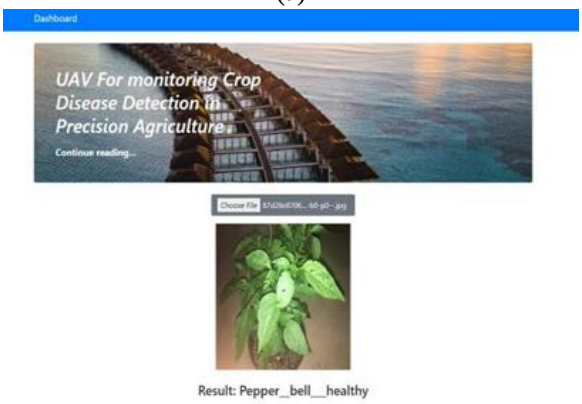
A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

Step -1 Input-Dataset (Un-Healthy, Healthy)
---Training_dataset
----Saved as Pickle
Step-2
Step - 2.1 Model (Seqential*2)
--Conv
--ReLu
--Max-Pooling
Model (Flatten())
--Fullyconnected_layer(relu) OutputLayer -Dense layer(sigmoid) Step-2.2 Optimizing model
--Loss function Step 3-Fit_Model
--Epochs--Batch_Size Step 4- Test_model
--INPUT(Image)
--Convert(gray_scale)
--Prediction

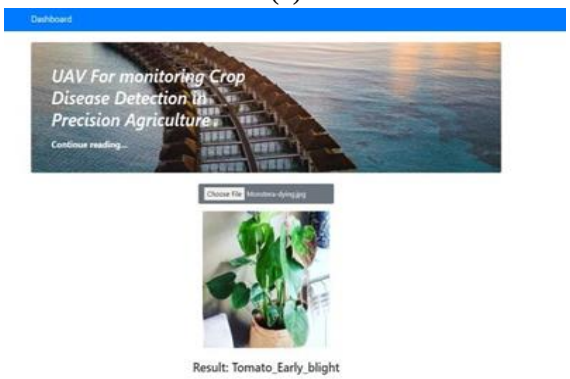
V.RESULTS



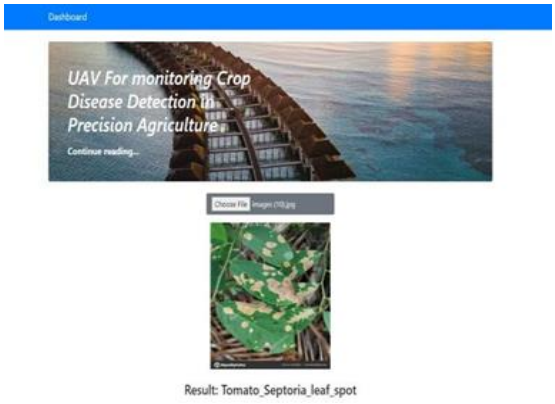
(a)



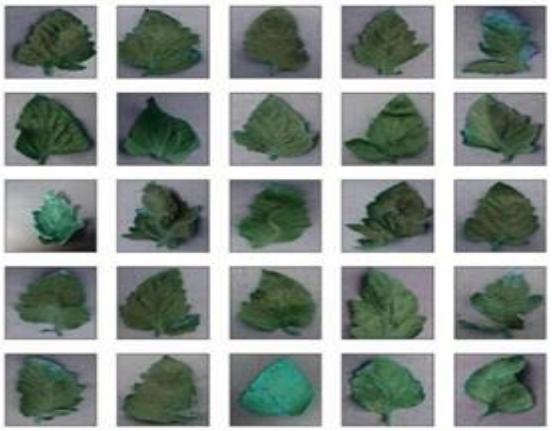
(b)



(c)



(d)



(e)

This are the results of images taken by Unmanned Aerial Vehicle. CNN has made it easy to identify the plant disease by detecting the disease on the basis of color, texture and pattern. The CNN model classifies the disease as per the classes mentioned in the training. In image (a) and (b), the plant is absolutely healthy. While, in image(c) and (d), the plant is unhealthy. CNN model detects the spots on the leaves and classify the plant as unhealthy plant. In image (e), the CNN system is analyzing the unhealthy plant.

Comparison between Existing system and our proposed system

Existing system	Our Proposed System
Less accurate data than our sytem	Multi-spectral sensor provides more accurate data.
Can only detect the plant disease	Providing spraying tools to spray fertilizers, pesticides on plants.

VI.CONCLUSION

This research is based on disease detection from aerial perspective using quad copter done. This project is designed mainly to detect the crop disease. Our agricultural drone does not only provide disease detection but also provide spraying tools for spraying fertilizers/Pesticides and to seed for better cultivation.
[9] M.srinivasan; N.Gandhiraj; K.Dinakaran “Remote sensing for UREA Spraying Agricultural (UAV) system” IEEE 2016

VII.FUTURE SCOPE

In future, the features of agricultural drone can be futyher modified/ enhanced. The feature of controlling drone by remote control can be modified by making the drone autonomous. Drone can also detect the type of disease and also provide necessary information about that disease. After detecting the plant disease, drone can also provide medicament to the plant. The color feature that are extracted using CNN can be further enhanced by providing more datsets as som eplants have spots of different color in their leaves, which are their natural color, but it is detected or shown as un-healthy plant.

REFRENCES

[1] Jinmika Wijitdechakul, Yasushi Kiyoki, Shiori Sasaki, Chawan Koopipat "UAV-based Multispectral Image Analysis System with Semantic Computing for Agricultural Health Conditions Monitoring and Real-time Management" IEEE2016

[2] X. Zhang, X. Li, K. Wang, and Y. Lu, "A Survey of Modelling and Identification of Quadrotor Robot," in Abstract and Applied Analysis, vol. 2014, 2014, pp. 16.

[3] JEONGEUN KIM, SEUNGWON KIM, CHANYOUNG JU, AND HYOUNG IL SON, (Senior Member, IEEE) "Unmanned Aerial Vehicles in Agriculture: A Review of Perspective of Platform, Control, and Applications" IEEE 2019

[4] Jakub Segen; Wojciech Knieć; Ryszard Klempous; Konrad Kluwak "Survey of Drones for Agriculture Automation from Planting to Harvest" IEEE 2018

[5] Jayeeta Saha; RadhikaRay; Sachet Sircar; Subhojit Dutta "IOT-based drone for improvement of crop quality in agricultural field" IEEE 2018

[6] Marthinus Reinecke; Tania Prinsloo "The influence of drone monitoring on crop health and harvest size" IEEE2017

[7] Massimo Satler; Giacomo Dabisias; Emanuele Ruffaldi; Carlo Alberto Avizzano "Towards Smart Farming and Sustainable Agriculture with Drones" IEEE2016

[8] Jeongun kim, Chanyoung Ju, Hyoung II Son 10" IEEE 2019

[9] UM RaoMogili1B B V LDeepak2 "Review on Application of Drone Systems in Precision Agriculture" IEEE 2014

[10] Marthinus Reinecke, Tania Prinslo"The influence of drone monitoring on crop health and harvest size" IEEE 2017

[11] Mr. I.D. Pharne, S. Kanase, S. Patwegar, P. Patil, A. Pore, and Y. Kadam, "AGRICULTURAL DRONE SPRAYER," International Journal of Recent Trends in Engineering and Research, pp. 181– 185, 2018. for Agricultural Applications," International Journal of Latest Engineering and Management