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Farmatron - Pest Detection and Treatment using AI based Drone

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Abstract: In India, where the agriculture sector plays a huge role in the economy and thus protecting the cultivation is crucial. Pest or diseases are complex, crop/region specific, seasonal, epidemic/endemic, which require integrated approaches to manage the loss. Due to the level of complexity, diagnosis for preventive measures are challenging, particularly our inability to (fore)see the pest/disease occurrence and their life cycle, while the level of difficulty raises with the size of land holdings. Due to the poor visibility of pest and disease occurrences, our ability to integrate and use the data for preventive/prescriptive measures has been the challenge leading to continuous productivity loss. The existing Image processing system helps in detecting the infected areas in the field, which can be enhanced to identify the disease of an individual with the use of Machine Learning/Deep Learning algorithm. Hence, we propose a model, which will find the infected areas in the field, detects the disease caused and based on the disease identified pesticides will be sprayed and updates are given to the farmer. The model will be a semi-automated drone with pesticide spraying mechanism and connectivity of cloud, camera, processing unit and android application for an easy and effective system, resulting in convenience to the farmers.
Keywords: Agriculture, Crop protection, Deep learning, drone, plant disease detection

I. INTRODUCTION

India is a country whose economy majorly depends upon agriculture. Today, India ranks second worldwide in farm output. More research and development work are required to make remarkable growth in farming. In order to increase the productivity of agriculture pesticides are sprayed on crops for protection from insects. But its main disadvantage is that it affects the farmer's health while spaying these harmful pesticides. Hence the most effective and efficient way to overcome from this problem is now a necessity. Much more attention is required to reduce the difficulties which are faced by the farmers so that it will be ultimately beneficial for farmers and country development. One of the most important problem is regarding health of the farmers which arises due to coming in direct contact with pesticide while spraying on crops.

The proposed system is an amalgamation of deep learning with drones for predictive/prescriptive model against pest and diseases in crop plants with their respective locations. In addition, such an approach could also open the scope of predictive analysis to execute automated alert to the farmers, potentially improve the crop productivity to more than 20%. Initially, the drone will render or scan the field as per the required analysed height. Now, using deep learning techniques it'll identify the type of disease the plant has like potato early blight, etc. Now, according to the disease it'll identify which type of pesticide to spray in accordance with volume needed for spraying. Thus, it'll spray pesticide on it and send the relevant data to farmer via a cloud service. This enables farmers to access the details of crop condition and act accordingly to conditions. The UI of the whole system will also be user-friendly to comfort farmers.

II. PREVIOUS WORK

K. Yamamoto, et. al. [1] applied a super-resolution method to the low-resolution images of tomato diseases to recover detailed appearances, such as lesions on plant organs. Disease classification was conducted using high-resolution, low-resolution, and super-resolution images to evaluate the effectiveness of super-resolution methods in disease classification. V. Singh, et. al. [2] surveyed the different diseases classification techniques that can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases. P. Moghadam, et. al. [3] proposes the use of hyperspectral imaging (VNIR and SWIR) and machine learning techniques for the detection of the Tomato Spotted Wilt Virus (TSWV) in capsicum plants. Discriminatory features are extracted using the full spectrum, a variety of vegetation indices, and probabilistic topic models. T. Rumpf, et. al. [4] proposes a procedure for the early detection and differentiation of sugar beet diseases based on Support Vector Machines and spectral vegetation indices. Hyperspectral data were recorded from healthy leaves and leaves inoculated with the pathogens Cercospora beticola, Uromyces betae or Erysiphe betae causing Cercospora leaf spot, sugar beet rust and powdery mildew, respectively for a period of 21 days after inoculation.

E. Akemi, et. al. [5] develop a methodology involving aerial surveying using an unmanned aerial system (UAS), processing and analysis of images obtained by a hyperspectral camera, achieving results that enable discrimination and recognition of sugarcane plants infected with mosaic virus. R. Roscher, et. al. [6] analysed the benefit of using topographic dictionaries for a sparse representation (SR) approach for the detection of Cercospora leaf spot disease symptoms on sugar beet plants. Topographic dictionaries are an arranged set of basic elements in which neighboured dictionary elements tend to cause similar activations in the SR approach. P. Gulve, et. al. [7] have developed an efficient diagnosis system that focuses on plant disease identification by processing acquired digital images of leaves of the plant. These images are made to undergo a set of pre-processing methods for image enhancement. S. Kumar, et al. [8] have developed an exponential spider monkey optimization which is employed to fix the significant features from high dimensional set of features generated by SVM.

F. Lin, et. al. [9] surveys the UAV autopilot controller boards. A comparison of existing popular autopilots in market is also presented. Firstly, the basics of multi-rotor UAV as well as the latest key autopilot techniques are introduced. Then, based on the autonomous taxonomy, the representative autopilot products in the market are listed and compared based on their specifications. R. Ilakiya, et. al. [10] proposed a new strategy of quad-rotor model which is used for spraying the urea in the agricultural field. In previous methods, the use of Arduino as a flight controller board did not provide a specialized rotation and was not efficient in rotation of a motor. S. Shetty, et. al. [11] developed a quadcopter type drone using brushless dc motor, Electronic Speed Controller (ESC), Flight Controller, Lithium polymer (Li-Po) battery, Nozzle, Centrifugal motor pump, Storage tank. D. Yallappa, et. al. [12] developed a drone mounted sprayer mainly consisting of BLDC motors, Lithium polymer (Li-Po) batteries, pesticide tank, pump, and supporting frame.

III.PROPOSED METHODOLOGY

The early stage diagnosis of plant disease is an important task and it requires continuous monitoring of experts. Existing Image Processing model can detect the diseases but it is next to impossible to manually find the infected area and detect the disease and is prohibitively expensive and time consuming. Therefore, a fast, less expensive and accurate method to automatically detect the diseases from the symptoms that appear in the field such as automated drone is required.

The objectives are as follows

1) To develop a drone mounted sprayer and evaluate its performance for application of chemicals/pesticides.
2) To work out the economics of operating with a drone mounted sprayer.
3) To make the spraying operation faster and accurate.
4) To have a wireless control mechanism which should require only a smart phone for live streaming and control purposes.

A. *Methodology*

The drone is controlled using flight controller. It helps in the navigation of the drone. GPS in-built module helps in locating the position of drone. Camera module assists in image/video recording. Deep learning method along with camera helps in identifying type of disease. The drone renders or scans the field using hyperspectral imagery. On detecting the infected area, drone will share its GPS coordinates and move towards the area. Moreover, according to the disease it'll identify which type of pesticide to spray in accordance with volume needed for spraying. Thus, it'll spray pesticide on it and send the relevant data to farmer via a cloud service.

Following are the various UML diagrams for the proposed system.

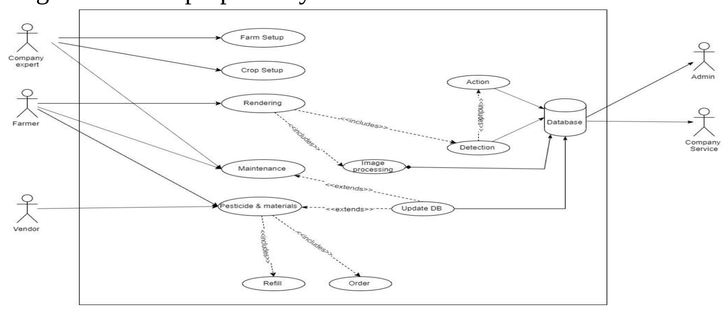


Fig 1 Use Case Diagram

The above Fig. 1 depicts the use case diagram of the system, with all the respective actors and components interacting with each other.

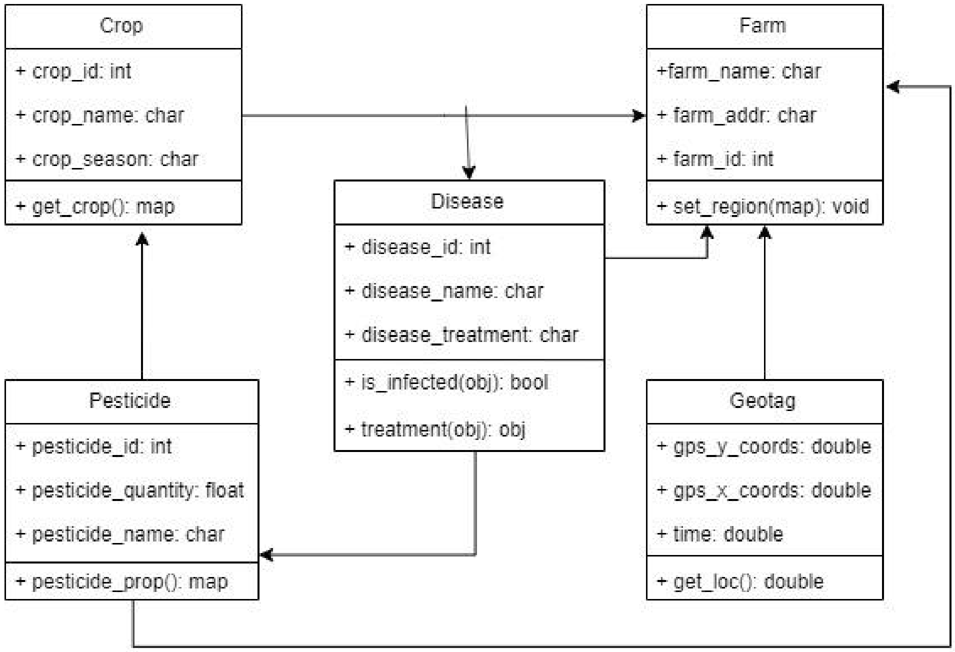


Fig 2 Class Diagram

The above Fig. 2 represents the class diagram of the project, representing all the classes present in the system with each other via their methods.

The proposed main methodology has been described by the below flow diagram which depicts the solution from initial phase to the final phase of the entire architecture.

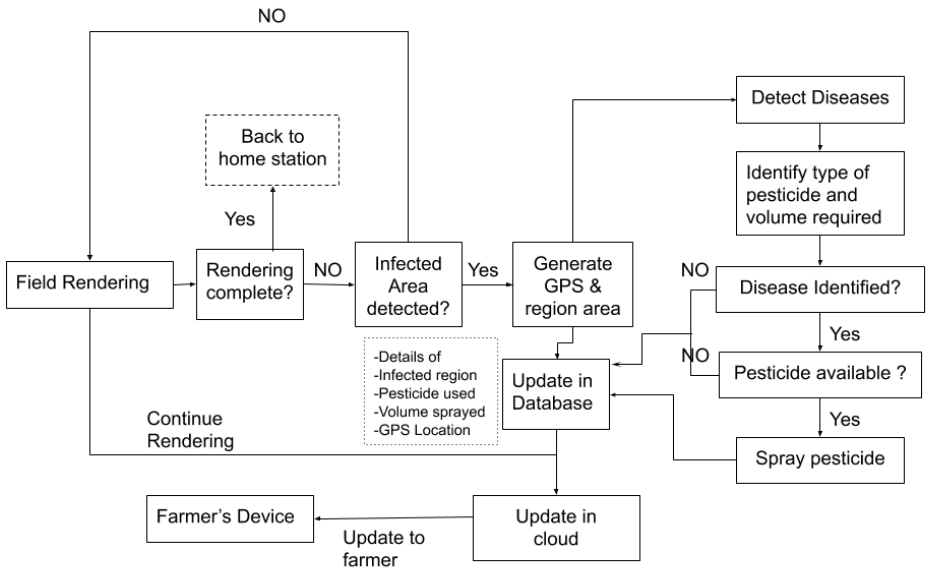
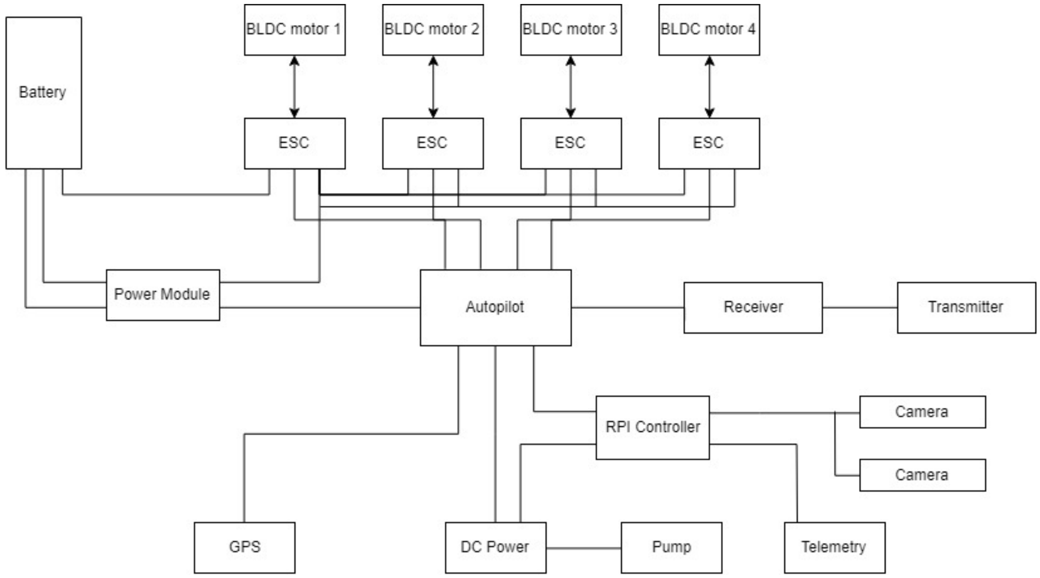


Fig 3 System Flow Diagram

The Fig. 3 represents the System flow diagram of the proposed solution. The system will first render the field for features. Once the rendering is complete, it will detect if a farm area is infected or not. If infected, the GPS coordinates of the location will be stored and updated in the database. At the same time, the farmer will be notified about the infection. The system will identify the disease with which the area is affected. If available, the pesticide will be sprayed over the region.



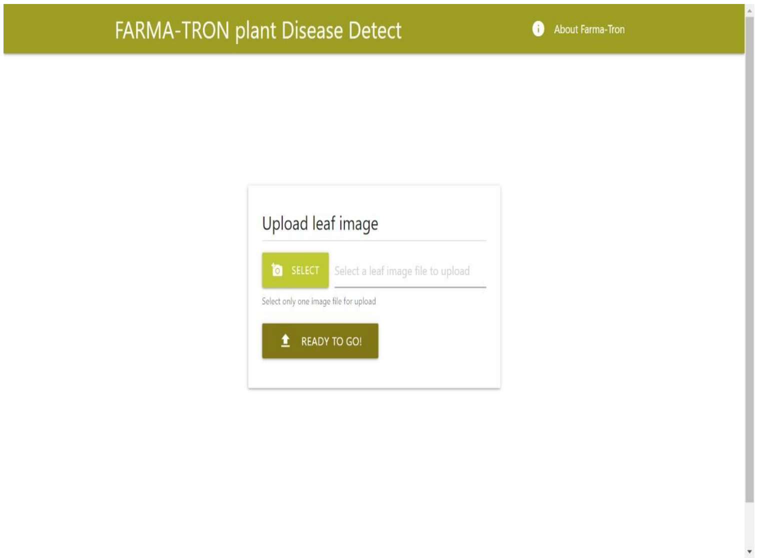
Components and its functions explaining the clear view of above figure: -

1) Battery and power module - To supply and control power to drone.
2) BLDC motors
3) ESC - Speed controller - Controls the speed of motors
4) Autopilot and GPS - Flight controller and GPS location tracker, includes transmitter and receiver for communication.
5) RPI controller - For Image processing and cloud connectivity.
6) DC motors, Tank & Tank - For spraying the pesticides

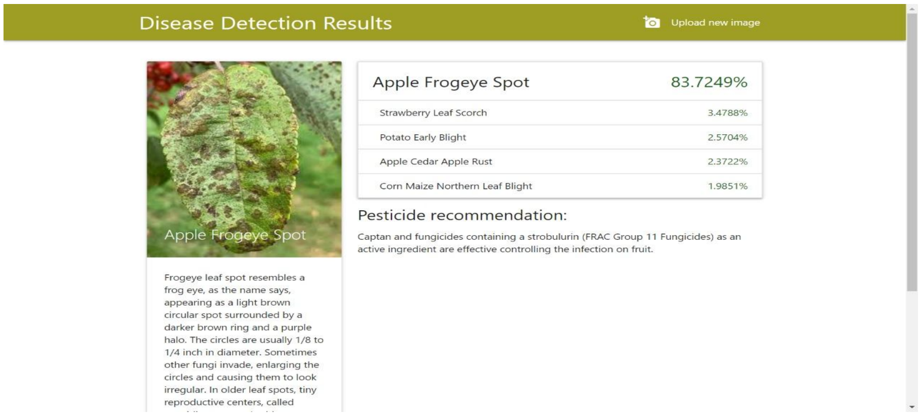
Proposed dimensions and components used were Pixhawk PX4 Autopilot PIX 2.4.8 32-bit controller, Pixhawk 3DR Ublox GPS, RPI 4B+ processor, 2 x 2200mah LIPO batteries weighing 6 kgs (approx) with dimensions standard as 10 inches sized.

B. Results

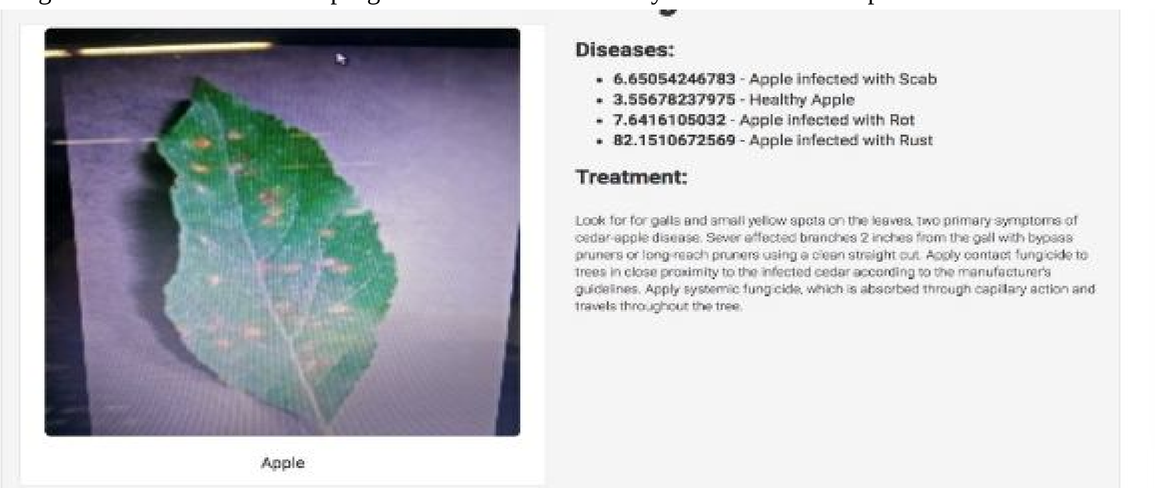
1) Screenshots of Results.



The website is hosted online in the cloud and the drone uploads the images to a server wherein it can be uploaded on the website. The upload UI can also be switched to Hindi, Marathi, etc to suit the farmer's needs.



The disease detection results can be seen after uploading images and it tells what the pest is with respective percentages. While researching, it can be depicted that a certain leaf can have multiple pests not just only one type. So, the results show each of them accordingly. And pesticide recommendation is provided for the pest which has a larger percentage. Further, the disease report can be downloaded using the download button at top right. It can be used for analysis of the entire crop field.



Further, to make the system handier, here are some predicted results on the android app. The phone's camera can be used to click a picture and then predict the type of disease.

Also, we have planned some deliverables and plan to achieve some milestones. Our drone will be useful to all farmers across the globe specially India. If dedicated intelligent UAVs are employed in farms, crop yield can be improved drastically to reduce the burden of farmers and also impact their life some or the other way, and therefore such a research project will put drone farming under a worldwide spotlight. Since, the designed model of drone will detect the type of disease a leaf has, the scope also includes less knowledgeable farmers. This proposed project will be with minimum cost so that it's affordable. We will also ensure that the drone won't be affected by climatic and environmental factors and make it feasible in all types of situations.

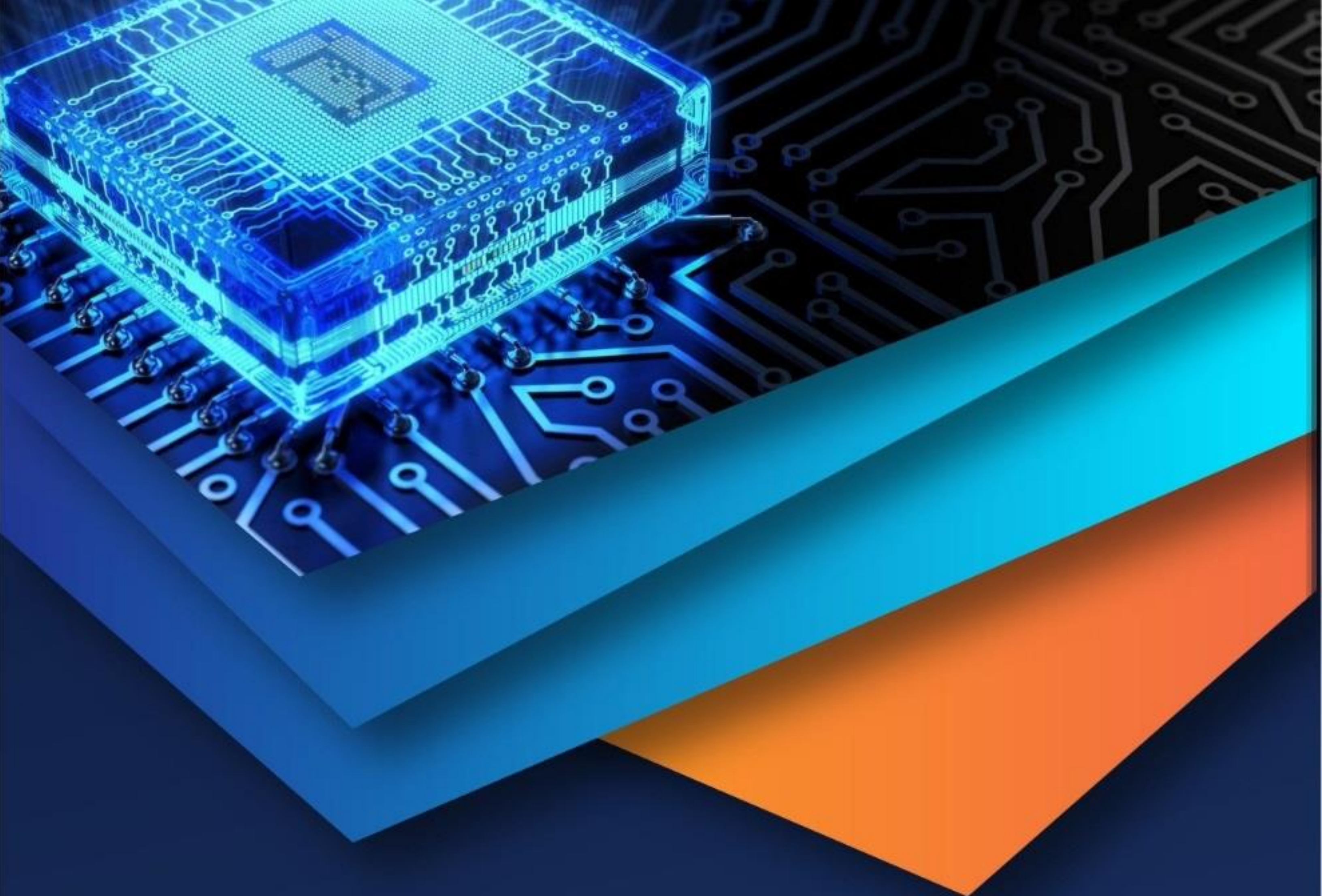
IV. CONCLUSIONS AND FUTURE SCOPE

Thus, the proposed system has partially achieved what was planned and such an approach could also open the scope of predictive analysis to execute automated alerts to the farmers, as well as potentially improve crop productivity. The automated system will provide early disease prediction and will decrease crop loss and will enhance productivity. The presented project here tries to solve a major problem of plants faced by the Farmers. The proposed model enables farmers to access the details of crop conditions and act accordingly to conditions. The UI of the whole system will also be user-friendly to comfort farmers. The entire workflow will effectively reduce the stress of farmers and thus improve the overall yield of agriculture performed.

Here, the accuracy factor can be increased by increasing the training data of the model. It can be optimized using proper fine tuning of hyperparameters. The front interface can be made more interactive and more oriented towards automation. The drone can be enhanced as well but it should be done considering the expense factor. The climatic and various environmental factors affect the working of the entire architecture and thus the system must tend to be more adaptable along with sustainability maintaining efficiency.

REFERENCES

[1] Kyosuke Yamamoto, Takashi Togami, Norio Yamaguchi, "Super-Resolution of Plant Disease Images for the Acceleration of Image-based Phenotyping and Vigor Diagnosis in Agriculture", MDPI, 2017.
[2] Vijai Singh,Varsha, "Detection of unhealthy region of plant leaves using Image Processing and Genetic Algorithm", ICACEA, 2015.
[3] Peyman Moghadam, Daniel Ward, Ethan Goan, "Plant Disease Detection using Hyperspectral Imaging", IEEE, 2017
[4] T. Rumpf, A.K. Mahleinb, U. Steiner, "Early detection and classification of plant diseases with SVM based on hyperspectral reflectance", Computers and Electronics in Agriculture, 2016.
[5] Erika Akemi Saito Moriya, Nilton Nobuhiro Imai, "Mapping Mosaic Virus in Sugarcane Based on Hyperspectral Images", IEEE, 2016.
[6] Ribana Roscher, Jan Behmann, Anne-Katrin Mahlein, "On the benefit of topographic dictionaries for detecting disease symptoms on hyperspectral 3D plant models", IEEE, 2016.
[7] Pranita P. Gulve, Sharayu S. Tambe, "Leaf Disease Detection of Cotton Plant Using Image Processing Techniques", IOSR-JECE, 2015
[8] Sandeep Kumara, Basudev Sharma, "Plant Leaf Disease Identification using Exponential Spider Monkey Optimization", Sustainable Computing: Informatics and Systems, 2018
[9] Feng Lin, Zhaolin Yang, Ben M Chen, "Survey of autopilot for multi-rotor unmanned aerial vehicles", IEEE, 2016.
[10] R. Ilakiya1, M. Prabavathy, K. Sagadevan, "Design of UAV for urea spraying in agricultural field", IRJET, 2018.
[11] Suraj Shetty, Kamal Yadav, Dipesh Jain, Akash Soni, Mainak Bhaumik, "Drone operated chemical fertilizer sprinkler", IJIRSET, 2018.
[12] D. Yallappa, M. Veerangouda, Devanand Maski, Vijaya Kumar Palled, "Development and evaluation of drone mounted sprayer for pesticide applications to crops", IEEE Global Humanitarian Technology Conference (GHTC), 2017.



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