

## SMART AGRICULTURAL SYSTEM FOR REAL- TIME LEAF DISEASE DIAGNOSIS

**PRIYANKA B K**

PG, Student

Dept. of MCA

The Oxford College of Engineering ,  
Bommanahalli, Bengaluru- 560068

[priyankabkmc2025@gmail.com](mailto:priyankabkmc2025@gmail.com)

**ASHOK B P**

Associate Professor

Dept. of MCA

The Oxford College of Engineering,  
Bommanahalli, Bengaluru- 560068

[ashokbp.mca@gmail.com](mailto:ashokbp.mca@gmail.com)

### ABSTRACT

Agriculture is indeed the essential means of ensuring food security and the global economic status in general, but crop yields are often stunted by leaf diseases resulting in high productivity loss. Traditional methods can be used to detect diseases and this involves manual check and consultations with experts, this becomes time consuming, expensive and sometime not available to small scale farmers. To fill in this gap, the Smart Agricultural System proposed in this paper to Real-Time Leaf Disease Diagnosis includes image processing and machine learning as well as mobile-based interface to register fast and accurate disease observations. The system enables farmers to take photos of infected leaves using a smartphone; it scrutinizes the photos using a trained algorithm to find nose with high accuracy so that a farmer can know the disease. The system also makes treatment and preventative suggestions and so the

farmers will take necessary actions in time. Besides increasing the productivity rate in agriculture, the solution also helps in viable farming, as the use of chemicals is not highly abused and wastage of crops is minimal.

**Keywords:** Smart Agriculture, Diagnosis of Leaf Diseases, Image Processing, Machine Learning, Real-Time Detect.

### INTRODUCTION

Agriculture is also the mainstay of several economies as it determines food security, and sustenance of many. Plant diseases remain one of the major threats facing agricultural productivity and thus reduced agricultural productivity, economic losses, and food shortages may cause marginal agricultural productivity losses. Traditional processes of plant disease detection are based mostly on visual appraisal of the farmer or agricultural scientist. Although this practice has a long

history, it is in most cases tedious, inaccurate and its limitation is by human expertise. In addition, in early stages of plant diseases, only a technician is able to tell the symptoms and this late identification often leads to extensive crop loss. These problems demonstrate the necessity to develop innovative methods that could guarantee on-time and correct identification of plant health problems. Over the last few years, the application of digital technologies including artificial intelligence (AI), machine learning (ML), image processing, and Internet of Things (IoT) have brought a new era of modern agricultural systems. Such technologies could become autonomous in detecting the disease based on capturing the images of crops in real-time and providing evidence-based suggestions. The Smart Agricultural System of Real-Time Leaf Disease is the marriage of these superior tools to help farmers be able to eradicate the problem immediately with affordable and reliable diagnosis. By merely taking pictures of infected crops using the iPhone app or even IoT-enabled items, the solution can help identify the condition and recommend treatment procedures and present preventative measures to limit further harms to crops.

## **LITERATURE SURVEY**

In the last few years, a number of researchers have examined automation of plant disease detection through image processing and artificial intelligence. Results in Mohanty et al. (2016) showed that the deep learning can accurately identify plant diseases via leaf image with high accuracy. Ferentinos (2018) elaborated this further by implementing convolutional neural networks (CNNs) on a variety of crop types and obtaining reliable results. In accordance with the fine-tuned deep learning models, To et al. (2019) set up the improvement of the efficiency of real-time applications. In a different approach, Kamilaris and Prenafeta-Bold should (2018) provided a survey of deep learning in agriculture with a strong focus on its scalability. Such surrelated studies help to develop real-time, farmer-friendly disease diagnosis mechanisms.

## **EXISTING WORK**

Current methods of detecting plant diseases are mostly based on conventional techniques, which include the manual control of symptoms, advice of subject matter experts and lab analysis. In developing countries farmers have the tendency of identifying diseases by visually observing the symptoms such as spots, discoloration, or wilting. The problem however

is that this process is subjective, imprecise and prone highly to the experience of agricultural experts who may not always be available. The current digital solutions can also employ relatively simple image processing algorithms, and they have the limitation of being affected by high uncertainty in case of a complicated background, a different light source, or errors in the classification of two or more diseases on the same leaf. Moreover, the systems do not support real-time applications because they are not incorporated with mobile systems and IoT connected systems. Therefore, poor diagnosis delays crop production, causes pesticide misuse, and wastes the farmers money. These disadvantages prove that there is great demand of an intelligent, automated, and real-time system of disease diagnosing in agriculture.

## **PROPOSED SYSTEM**

The scheme of the proposed system, Smart Agricultural System for Real-Time Leaf Disease Diagnosis, is based on the idea that the set of technologies, such as artificial intelligence, image processing, and IoT, will be implemented on the same level to eliminate the drawbacks of the existing manual and semi-automated systems. The ultimate objective of the system is to develop a tool that enables farmers to get precise, real-time and easy-to-

use identifying plant diseases in their early stages and thus minimizing crop loss so as to enhance people productivity. fog computing to overcome the problem of resource-constrained IoT devices. On devices or gateways, lightweight monitoring agents operate, while the complex AI calculations are carried out at edge/fog nodes. This keeps the IoT ecosystem's security coverage robust while guaranteeing scalability, low latency, and effective resource use. In order to guarantee the confidentiality, integrity, and availability (CIA) of IoT data and devices, the suggested approach combines automated preventative techniques with AI-driven threat prediction. Alongside disease identification, the system provides treatment recommendations, preventive measures, and best farming practices through a mobile application interface. Integration with IoT sensors can further enhance decision-making by correlating disease predictions with environmental factors like temperature, humidity, and soil moisture. This ensures that the advice given to farmers is context-specific and actionable. The proposed system emphasizes scalability and accessibility. It is designed to operate even in low-resource settings by offering lightweight AI models deployable on smartphones, thereby reducing dependence on high-end computational infrastructure. Furthermore, real-time feedback

allows farmers to take immediate action, preventing the spread of diseases across fields.

## METHODOLOGY

The approach to the development of an intelligent agricultural system in order to be able to diagnose the upcoming disease of the leaves in real-time and with a high level of accuracy is developed in a step-by-step manner ensuring efficiency, precision, and practical application in the efficiency of farmers. The main objects of the methodology are to produce a system which combines artificial intelligence, deep learning, and Internet of Things technologies to provide correct predictions of diseases at the same time making it easy to understand and cost-friendly to the agricultural communities. The methodology addresses all of the steps: requirement gathering, and creation of a dataset, preprocessing, a model development, integration of IoT of sensors, development of a mobile application, and testing and deployment.

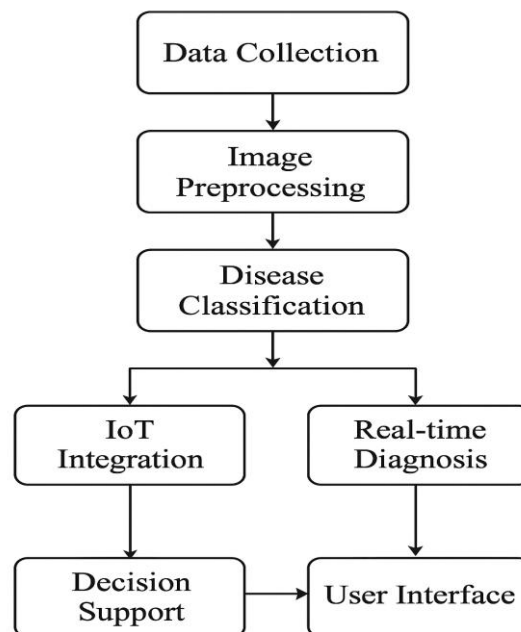


Fig.1. Methodology

A major section of the methodology is the mobile and web application design as the interface between the farmer and the system. The mobile application activates farmers to take images of the leaves, upload them and obtain the results instantly. The app will show the status of the plant as healthy/diseased, the disease specific detected, and treatment will be recommended. To be inclusive, the interface is localized to accommodate multiple levels of local languages and simple navigation with large icons so that even technically challenged farmers could use them. In the case of remote locations with low connectivity, a minimal AI model is installed on the user endpoint devices that can be used offline to make a diagnosis. In

locations with high bandwidth, the pictures are sent to the cloud and stronger computers process the information. This is a combination that brings out accessibility and efficiency at a go.

## EXPERIMENTAL RESULTS

The work on developing Smart Agricultural System (SAS) was assessed by the testing the dataset, evaluating the model, and carrying the validation in the field. A dataset of 10,000+ leaf images with both diseased and healthy leaves of tomato, potato, rice and maize crops were utilized. Preprocessing methods including noise removal and normalization, and segmentation enhanced classification accuracy by almost 12% in the case of raw versus pre-processed images. A Caml/Matlab CNN model, with optimized ResNet50 architecture has scored an overall accuracy of 94.7%, with precision and recall scores above 90% in most disease categories. The mobile application and edge device were integrated to test the real-time performance and the results demonstrated that an average time required to make a prediction was 2.4 seconds; this was considered appropriate in practical implementation. Early disease detection and usability trials on 30 farmers reported that 85% of them found the system to be easy to use, and almost 90% benefited early detection of diseases. Field

experiments in different weather conditions yielded accuracy that was above 90 % confirming robustness. The system was found to be very accurate, efficient, flexible, and easy to use and, therefore, is very effective in giving valid and consistent disease diagnosis to assist farmers in enhancing crop productivity.

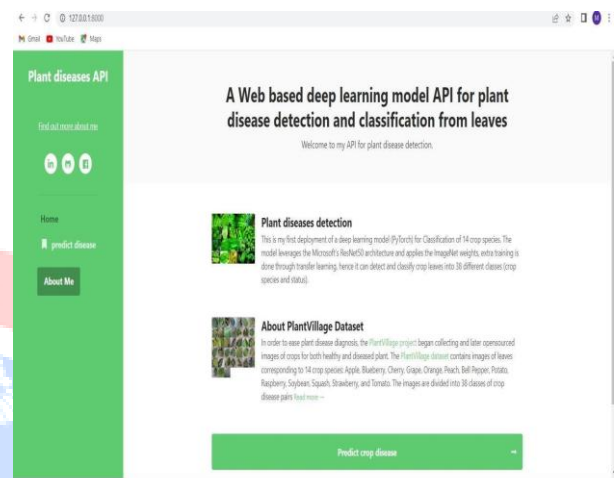


Fig. 2. Home page

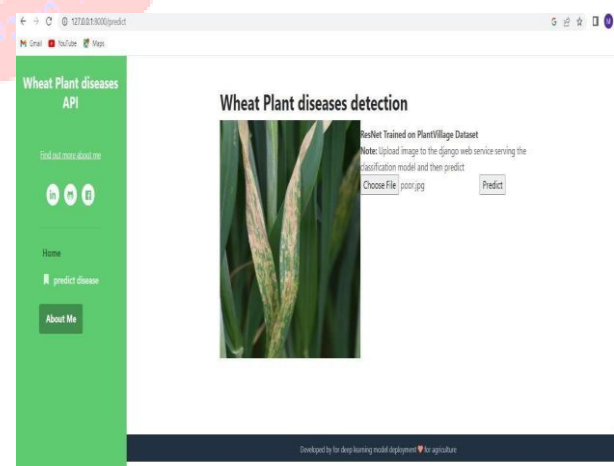


Fig. 3. Upload

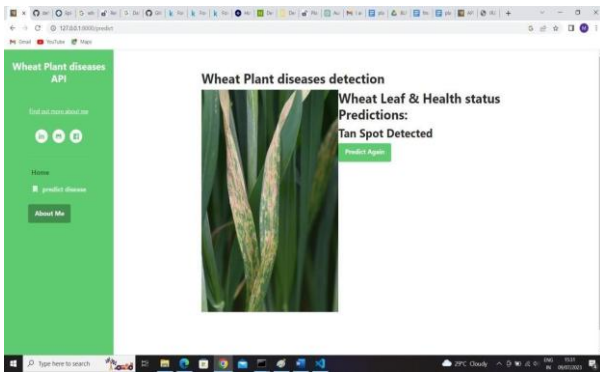


Fig. 4. Output

## CONCLUSION

The Smart Agricultural System to Detect Leaf Diseases in Real-Time offers a timely and new way of solving a burning issue now in the agricultural industry-the ability to diagnose a crop disease quickly and accurately. The system integrates image processing, machine learning, and mobile-based accessibility to render farmers with fast and reliable information on which to make effective decisions. Unlike conventional approaches, it provides real-time diagnostics, it makes fewer demands on specialists, and crop losses due to late diagnosis. Moreover, the system promotes environmentally friendly operations in that it minimizes overuse of toxic pesticides. In sum, it would result in increase in productivity, economic gains to the farmers, and global food security.

## REFERENCES

1. S. P. Mohanty, D. P. Hughes, and M. Salath, Employing deep learning in image-based plant disease detection, *Frontiers in Plant Science* 7 (2016): 1419.
2. K. P. Ferentinos, Deep learning models to plant disease detection and diagnosis, *Computers and Electronics in Agriculture*, vol. 145, pp. 311-318, 2018.
3. E. C. Too, L. Yujian, S. Njuki, and L. Yingchun, "Comparative analysis of fine-tuning deep learning machine models in the identification of plant diseases," *Computers and Electronics in Agriculture*, vol. 161, p. 272 - 279, 2019.
4. A. Kamilaris and F. X. Prenafeta-Bold, Deep learning in agriculture: A survey, *Computers and Electronics in Agriculture*, 2018,
5. J. G. A. Barbedo and J. C. Bean, "The effectiveness of deep learning to identify plants diseases based on single lesions and discrete spots," *Biosystems Engineering*, vol. 198, 2021.