**Plant Disease Detection System for Sustainable Agriculture**

A Project Report

submitted in partial fulfillment of the requirements

of

AICTE Internship on AI: Transformative Learning

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by

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Under the Guidance of

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Sincerely,

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#### **ABSTRACT**

Agriculture is a critical sector for the global economy, but it faces significant challenges due to plant diseases, which can lead to substantial crop losses. Traditional methods of plant disease detection rely heavily on manual inspection, which is time-consuming, labor-intensive, and often inaccurate. With the advancement of technology, there is a need for an automated, efficient, and accurate system to detect plant diseases early, ensuring timely intervention and reducing crop losses.

To develop a deep learning-based system that can accurately detect and classify plant diseases from images of plant leaves. The system should be able to process images captured in various conditions (e.g., different lighting, angles, and stages of disease progression) and provide real-time feedback to farmers and agricultural experts.

A large amount of dataset was taken, which contain different images of defected area of plant with the name of the disease. Then this dataset was divided into training and testing or validation set. Then I have used CNN algorithm and Keras library, scikit-learn. Then we have built the model and added the image layers by applying different levels of filters into it. Then we have flattened all the layers and converted to single dimension. After that we have calculated the training accuracy and testing accuracy.

As a result, we got the visualization of the accuracy result, with training accuracy and validation accuracy. We also got the confusion matrix of the actual class and the predicted class of the images. Finally, we got 81% training accuracy and 92% validation accuracy.

The development and implementation of a deep learning-based system for plant disease detection have demonstrated significant potential in revolutionizing agricultural practices. By leveraging advanced techniques in image processing and deep learning, the project has successfully created a robust model capable of accurately identifying and classifying plant diseases from images of plant leaves.

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**CHAPTER 1**

**Introduction**

* 1. **Problem Statement:**

Plants play a vital role in economy and climate change. Many studies have proved that extinction of plants due to industry use have caused damage to ozone layer and thus resulting global warming. The rate of climate change forecast for the future is 10-100 times faster than the rate of DE glacial warming. Balance of global food production is also a major issue. Apart from this, in health care also plants play vital role. Overall plants are very essential for human survival therefore it’s also a worldwide concern to take care of them.

Now a days due to excessive pollution of environment, not only the humans and animals, but plants are also suffering a lot. They are getting affected by various new type of disease also. But plants are concurrently connected with our daily life. So, to keep them safe from disease, we need to first detect the types of diseases from which they are suffering. After that, we have to treat them. But, when a bulk amount of crop production happen or in any forest, it’s not possible to detect the disease of plants manually. So, we need to take help of some well learned learning algorithms to detect that and some IOT devices. That’s why we are doing this project, to get a prototype of that broad scale.

* 1. **Motivation:**

As I belong from a family, where farming is our main occupation. I have seen my father farming and growing crops in his fields, from my childhood. When I became adult, now I can understand, when plants get defected by diseases, how fast it spread and finishes all the production. That is a huge loss for environment and for the farmer himself also. This made me feel so upset. From that day, I decided, if I get any chance to contribute my knowledge to resolve this issue, that will be very proud moment for me.

Potential impact of this project is Precision Agriculture, Automated Monitoring, Research and Development, Supply Chain Management, Environment Monitoring.

Impact: Increased Crop Yields, Cost Reduction, Sustainability, Data-Driven Decisions, Global Food Security.

* 1. **Objective:**

The objectives of the project is to develop an automated system that can accurately identify and diagnose diseases in plants. This involves training deep learning models on a large dataset of plant images to recognize patterns and features associated with various diseases.

**Early Detection**: Identify plant diseases at an early stage to allow for timely intervention and treatment, preventing the spread of the disease and minimizing crop loss.

**Accuracy**: Develop highly accurate models that can differentiate between healthy plants and those affected by specific diseases, reducing false positives and false negatives.

**Scalability**: Create a system that can be easily scaled to monitor large agricultural fields using drones, cameras, or other imaging devices.

**Ease of Use**: Ensure the system is user-friendly and accessible to farmers, researchers, and agricultural workers, even those with limited technical knowledge.

**Cost-Effectiveness**: Develop a solution that is affordable and reduces the overall cost of disease management by minimizing the need for manual inspections and chemical treatments.

**Real-Time Monitoring**: Enable real-time monitoring of plant health, providing instant feedback and recommendations to farmers for effective disease management.

* 1. **Scope of the Project:**

**Scope**: Detection of Multiple Diseases, Deployment in Various Environment, Integration with IoT Devices, Real-Time Analysis, Support for Multiple Platforms.

**Limitations**:

Data Dependency: The accuracy of the model is highly dependent on the quality and quantity of the training data. Insufficient or poor-quality data can lead to inaccurate detection.

Environmental Factors: Variations in lighting, weather conditions, and camera quality can affect the accuracy of the disease detection.

Resource Intensive: It requires significant computational resources for training and deployment. Also other limitations are Initial Costs, Maintenance etc.

**CHAPTER 2**

**Literature Survey**

**Several studies on ML and DL approaches used in agriculture have been evaluated, leaving a gap to comprehensively examine image-centered plant disease detection. Most recently, a review was made of the imperativeness of existing PDD methods and included segmentation, classification, localization, and disease techniques. The study concentrated on the performances of the CNN method in PDD, primarily on fruits, vegetables and various plants. Other studies like focused on barley, maize, rice, soy- beans, and wheat and compared the benefits and drawback of various Ips, segmentations**

* 1. **Mention any existing models, techniques, or methodologies related to the problem.**
  2. **Highlight the gaps or limitations in existing solutions and how your project will address them.**

**CHAPTER 3**

**Proposed Methodology**

* 1. **System Design**

Provide the diagram of your Proposed Solution and explain the diagram in detail.

* 1. **Requirement Specification**

Mention the tools and technologies required to implement the solution.

* + 1. **Hardware Requirements:**
    2. **Software Requirements:**

**CHAPTER 4**

**Implementation and Result**

* 1. **Snap Shots of Result:**

Kindly provide 2-3 Snapshots which showcase the results and output of your project and after keeping each snap explain the snapshot that what it is representing.

* 1. **GitHub Link for Code:**

**CHAPTER 5**

**Discussion and Conclusion**

* 1. **Future Work:**

Provide suggestions for improving the model or addressing any unresolved issues in future work.

* 1. **Conclusion:**

Summarize the overall impact and contribution of the project.

**REFERENCES**

1. Ming-Hsuan Yang, David J. Kriegman, Narendra Ahuja, “Detecting Faces in Images: A Survey”, IEEE Transactions on Pattern Analysis and Machine Intelligence, Volume. 24, No. 1, 2002.