A Major Project Synopsis on

**PLANT DISEASE DETECTION**

Submitted to Manipal University, Jaipur

Towards the partial fulfilment for the Award of the Degree of

**MASTER OF COMPUTER APPLICATIONS**

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by

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1. **Introduction:**

Global agriculture is seriously threatened by the rising incidence of plant diseases, which lowers food yields and causes financial loss. For plant diseases to be effectively managed and mitigated, early detection is essential. This research investigates automating the identification and categorisation of plant diseases from photos using machine learning, more especially Convolutional Neural Networks (CNNs). This technology can assist farmers, researchers, and agricultural specialists in precisely and swiftly identifying illnesses by utilising picture data, allowing for prompt interventions.

1. **Objectives:**

* **Early Detection:** Develop a machine learning model that can automatically detect plant diseases at an early stage using images of plant leaves.
* **Accuracy & Efficiency:** Build a model capable of identifying various diseases in plants, distinguishing between healthy and infected plants with high accuracy.
* **Automation:** Automate the disease detection process to assist farmers in monitoring crops with minimal manual intervention.

1. **Target Users**

* Farmers
* Agricultural experts
* Home gardeners
* Agronomists
* Agricultural institutions

1. **Approach**

**Data Collection:**

• A dataset of plant photos, comprising both healthy and sick plants, is used in the study. Numerous plant species and their corresponding illnesses are depicted in the pictures.

• Public sources like the PlantVillage dataset, which has thousands of annotated photos arranged by plant species and disease type, are used to gather data.

**Preprocessing:**

* **Image Augmentation:** Techniques such as rotation, flipping, and zooming are used to augment the dataset and prevent overfitting.
* **Normalization:** Image pixel values are normalized to a [0, 1] scale to improve model training efficiency.

1. **Model Architecture:**

• To categorise photos as either healthy or unhealthy, a Convolutional Neural Network (CNN) is used. CNNs are selected for image classification problems because of their capacity to automatically extract spatial characteristics from images.

• The model is made up of many convolutional layers, dense layers for classification, and pooling layers to lower dimensionality.

1. **Model Training:**

* The CNN is trained using labelled images with a **binary classification** approach (healthy vs. diseased).
* A training-validation split is used to evaluate the model’s performance on unseen data during training. The model is trained using **binary cross-entropy loss** and optimized using the **Adam optimizer**.

1. **Evaluation:**

* The performance of the model is evaluated using metrics such as **accuracy**, **precision**, **recall**, and **F1-score**.
* Plots for training and validation accuracy/loss are generated to visualize the model’s learning progress.

1. **Deployment:**

* Once trained, the model can be deployed on mobile devices, drones, or cloud-based systems for real-time disease detection in agricultural fields.
* The system can alert farmers when a disease is detected, enabling timely treatment and minimizing crop loss.

1. **Expected Outcomes:**

• **High-Accuracy Disease Detection:** It is anticipated that the model will correctly identify and categorise a range of plant illnesses, enhancing the general effectiveness of agricultural disease control.   
• **Real-Time Assistance:** Farmers will be able to remotely monitor crops and get immediate input on plant health once this system is deployed in the field.  
• **Scalability:** Over time, other plant species and illnesses can be added to the model, and this method can be used to different agricultural contexts.

1. **Challenges & Limitations:**

• **Data Quality:** The accuracy of the model may be impacted by variations in lighting, plant angles, and backgrounds.  
• **Unbalanced Data:** Some illnesses could not be well-represented, necessitating sophisticated methods like artificial data fabrication or oversampling.  
• **Generalisation:** Variations not included in the training data or novel, undiscovered diseases may cause the model to falter.   
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1. **Future Scope:**

• **Transfer Learning:** Applying pre-trained models, like VGGNet or ResNet, to take advantage of their strong generalisation from sizable datasets, particularly when there are few plant disease datasets.   
• **Multi-Class Classification:** extending the approach to categorise more than just healthy versus ill plants.  
• **Real-Time IoT Detection:** Using IoT devices, such as drones or cameras, can record real-time data and feed it into a model for immediate disease prediction in vast agricultural areas.   
• This method of detecting plant diseases has the potential to completely change how we monitor and manage plant health, decreasing the need for chemical treatments and boosting crop sustainability in addition to improving agricultural practices.

1. **Technology Used:**

 **Frontend**: React Native (for mobile) / React.js (for web)

 **Backend**: Node.js with Express

 **Database**: Firebase / PostgreSQL

 **AI Model**: TensorFlow / PyTorch-based deep learning model

 **Cloud Services**: AWS / Google Cloud for model deployment

1. **Bibliography**