Project Synopsis

Name	**Pranali Pawar**
USN	**23VMTHR0838**
Elective	**Machine Learning**
Date of Submission	**05-03-2025**

Plant Disease Detection Using Machine Learning.

- **Problem Statement**

  - Agriculture is one of the primary sources of livelihood in India, contributing significantly to the economy. However, plant diseases have been a persistent issue, leading to substantial losses in crop yield. Traditionally, farmers manually inspect crops for diseases, which is time-consuming, prone to human error, and inefficient.

  - With technological advancements, there is a need for an automated system that can detect plant diseases accurately and efficiently. The existing methods lack real-time monitoring, and rural farmers often have limited access to modern agricultural technologies. Misdiagnosis of plant diseases leads to improper use of pesticides, resulting in economic losses and adverse environmental effects.

  - The proposed system leverages deep learning techniques, such as Convolutional Neural Networks (CNN), to automatically detect plant diseases using images captured via smartphones. By integrating image recognition software and data analytics, the system can classify plant diseases effectively, ensuring timely intervention and better crop management. This project aims to develop a robust and accurate plant disease detection model that will aid farmers in identifying diseases early, ultimately improving agricultural productivity and sustainability.

- **Objectives of the Project**

  - To develop an automated plant disease detection system using deep learning techniques to improve agricultural productivity.
  - To implement image recognition software that can classify plant diseases with high accuracy and provide real-time monitoring.
  - To contribute to precision agriculture by integrating technology-driven solutions for early disease detection and better decision-making.

- **Project Methodology**

  - This project is an application-based research initiative that employs deep learning algorithms to detect plant diseases using image recognition techniques. The methodology involves the following steps:

  - Data Collection: The dataset is obtained from the Kaggle repository, specifically the Plant Village dataset, which contains labeled images of various plant diseases such as rust, powdery mildew, and healthy crops.

  - Preprocessing: Image preprocessing techniques such as resizing, noise reduction, and contrast enhancement using Keras are applied to improve model accuracy.

  - Model Selection: A Convolutional Neural Network (CNN) architecture is used for feature extraction and classification of plant diseases.

  - Training and Testing: The dataset is split into training and testing sets, with the model being trained using TensorFlow and Keras frameworks.

  - Evaluation: The model is evaluated based on accuracy, precision, recall, and F1-score. The best-performing model is selected for deployment.

  - Implementation: A mobile-friendly web application is developed where farmers can upload plant images, and the system will classify diseases and suggest remedies.

  - Deployment: The final model is integrated into a user-friendly interface that allows farmers to easily access disease predictions and recommendations for treatment.

- **Limitation**

- Despite its advantages, the proposed system has some limitations. The model relies heavily on image quality; poor lighting conditions or unclear images may lead to incorrect classifications. Additionally, the dataset used for training may not include all possible plant diseases, limiting the model's generalizability.

- The model also requires a stable internet connection for cloud-based processing, which may be a challenge in rural areas. Furthermore, real-time disease prediction may face latency issues depending on server capabilities and image processing speed. While deep learning techniques provide high accuracy, computational resources required for training can be expensive and may not be accessible to all users.

- Another limitation is the dependency on labeled datasets. If new plant diseases emerge that are not included in the training data, the model may fail to detect them accurately. Future enhancements could include the integration of local farmer feedback and continuous learning models to improve performance over time.

- **Work Plan (Week 1 to Week 8)**

Week No.	Activities Completed
Week 1	a) Literature survey and research on existing systems b) Data collection from Kaggle Plant Village dataset c) Understanding deep learning models for image classification
Week 2	a) Data preprocessing (image resizing, noise reduction) b) Exploring different CNN architectures c) Setting up the development environment with TensorFlow and Keras
Week 3	a) Model selection and initial training b) Hyper-parameter tuning for better accuracy c) Evaluating model performance on validation data
Week 4	a) Testing the model on unseen datasets b) Performance analysis and improvements c) Exploring mobile application integration
Week 5	a) Developing the web-based interface for image upload b) Connecting the trained model to the web interface c) Implementing real-time predictions
Week 6	a) Testing the application for accuracy and usability b) Debugging and optimizing performance c) Documenting system features and limitations
Week 7	a) Conducting final evaluations and user testing b) Preparing the final report and documentation c) Gathering feedback for future improvements
Week 8	a) Finalizing the project b) Preparing the presentation c) Submitting the project synopsis