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"Agrifutura" - Plant Disease Detection with Fertilizer Recommendation using Deep Learning (CNN)

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Abstract: *Agrifutura is an AI-based plant disease detection system that uses Deep Learning and Convolutional Neural Networks (CNN) to identify plant diseases from leaf images. The system helps farmers detect diseases at an early stage and provides disease information, preventive measures, and suitable fertilizer and treatment recommendations. It is developed using Python and Flask with a user-friendly web interface. The main aim of this project is to reduce crop losses, improve plant health, and support smart and sustainable agriculture.*

Keywords: Agrifutura, Plant Disease Detection, Deep Learning, Convolutional Neural Network (CNN), Artificial Intelligence (AI), Computer Vision, Fertilizer Recommendation, Image Processing, Flask, Smart Agriculture, Crop Protection, Sustainable Farming

I. INTRODUCTION

Agriculture is one of the most important sectors, but plant diseases affect crop growth and reduce agricultural production. Identifying plant diseases manually is time-consuming and requires expert knowledge.

Agrifutura is an AI-based project that uses Deep Learning and Convolutional Neural Networks (CNN) to detect plant diseases from leaf images. Users can upload plant leaf images, and the system automatically identifies the disease and displays the results.

It also provides disease information, preventive measures, and suitable fertilizer and treatment recommendations. The system is developed using Python and Flask with a user-friendly web interface.

The main aim of this project is to help farmers detect plant diseases early, reduce crop losses, improve productivity, and promote smart agriculture.

II. OBJECTIVES

The main objectives of the proposed work are:

- To develop an AI-based plant disease detection system using Deep Learning and CNN.
- To identify plant diseases by uploading leaf images.
- To classify plant leaves into healthy and diseased categories.
- To provide disease information, symptoms, and preventive measures.
- To recommend suitable fertilizers and treatments for affected plants.
- To help farmers reduce crop losses and improve agricultural productivity.
- To promote smart and sustainable agriculture.

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III. SCOPE

- The scope of the Agrifutura project is to develop an intelligent plant disease detection system using Deep Learning and Convolutional Neural Networks (CNN). The system helps farmers identify plant diseases by uploading leaf images through a user-friendly web application.
- It supports disease detection for 14 major crops and classifies plant leaves into healthy and diseased categories. After detecting the disease, the system provides disease information, symptoms, preventive measures, and suitable treatment recommendations.
- The project also provides information about agricultural supplements and their purchase links. It uses Python and Flask to provide an easy-to-use platform for farmers.
- The main scope of Agrifutura is to support early disease detection, reduce crop losses, improve plant health, and help farmers make better decisions for crop protection and sustainable agriculture.

IV. SYSTEM DESCRIPTION

Hardware Requirements

The proposed system is built around the following hardware components:

- **Processor:** Intel Core i5 or equivalent.
- **RAM:** Minimum 8 GB.
- **Hard Disk:** Minimum 256 GB.
- **Operating System:** Windows 11.
- **Internet Connection:** Stable internet connection.
- **Input Device:** Keyboard and Mouse.

Software Requirements

- **Programming Language:** Python.
- **Operating System:** Windows 11.
- **Deep Learning Model:** Convolutional Neural Network (CNN).
- **Web Framework:** Flask.
- **Frontend:** HTML5 and CSS3.
- **Database:** SQLite.
- **Data Processing:** Pandas.
- **Technology:** Artificial Intelligence, Deep Learning and Computer Vision.
- **Web Server:** Flask Development Server.

Working Principle

The Agrifutura project works using **Deep Learning and Convolutional Neural Networks (CNN)** to detect plant diseases from leaf images.

Step 1: Image Upload

The user uploads a plant leaf image through the web application.

Step 2: Image Processing

The uploaded image is processed and prepared for disease detection.

Step 3: Disease Detection

The CNN model analyzes the leaf image and identifies the disease based on the trained dataset.

Step 4: Disease Classification

The system classifies the plant into healthy or diseased categories.

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Step 5: Recommendation

Based on the detected disease, the system provides disease information, preventive measures, and suitable fertilizer or treatment recommendations.

Step 6: Display Result

Finally, the result is displayed on the web application using Flask.

V. EXPECTED RESULT

- The expected result of the Agrifutura project is to develop an intelligent plant disease detection system using Deep Learning and Convolutional Neural Networks (CNN). The system identifies plant diseases by analyzing uploaded leaf images and classifies them into healthy or diseased categories.
- After detecting the disease, the system displays the disease name, related information, symptoms, and preventive measures. It also provides suitable treatment and fertilizer recommendations to help farmers protect their crops.
- The system aims to provide quick and reliable disease identification through a user-friendly web application developed using Python and Flask. Overall, Agrifutura helps farmers detect plant diseases at an early stage, reduce crop losses, improve plant health, and increase agricultural productivity.

VI. CONCLUSION

- The Agrifutura project provides an intelligent solution for plant disease detection using Deep Learning and Convolutional Neural Networks (CNN). It identifies plant diseases by analyzing leaf images and provides disease information, symptoms, and preventive measures.
- The system also helps farmers by providing suitable fertilizer and treatment recommendations to protect their crops. Using Python and Flask, the project offers a simple and user-friendly web application for quick disease identification.
- Overall, Agrifutura aims to reduce crop losses, improve plant health, increase agricultural productivity, and support farmers in adopting smart and sustainable agricultural practices.

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VII. ACKNOWLEDGMENT

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