A Minor Project report on

"Rice Disease Detection System"

A Minor Project Report
Submitted in partial fulfilment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

IN

INFORMATION TECHNOLOGY

BY

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APPROVAL OF THE GUIDE

Recommended that the Project Report entitled **"Rice Disease Detection System"** presented by Ayush Jha (BTECH/15051/21) under my supervision and guidance be accepted as fulfilling the partial requirements for the award of Degree of **Bachelor of Technology in Information Technology**. To the best of my knowledge, the content of this report did not form a basis for the award of any previous degree to anyone else.

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Motivation:

In India, agriculture remains the backbone of the economy, with millions of farmers depending on crop yields for their livelihoods. Rice, one of the most widely cultivated crops, is especially crucial for both sustenance and economic stability. However, Indian farmers face numerous challenges in growing rice, including unpredictable weather conditions, pest infestations, and, most notably, plant diseases. Identifying and managing diseases such as bacterial leaf blight, leaf smut, and brown smut in rice fields can be difficult for farmers who lack access to timely agricultural support or modern diagnostic tools.

For many small-scale farmers in rural India, traditional methods of detecting and managing rice diseases involve manual observation, which can be inaccurate, delayed, and costly. Limited financial resources, inadequate access to advanced farming technologies, and the high cost of disease outbreaks further exacerbate the struggles of Indian farmers. A technology-driven, accessible solution can significantly reduce the hardships of rice farming, improving crop health, yield, and farmers' livelihoods.

Objective:

The objective of this project is to develop an automated **hybrid rice disease detection system** that leverages both image-based analysis and environmental sensor data to accurately identify common rice diseases in their early stages. By using a combination of computer vision (to analyse leaf images) and IoT-based environmental monitoring (to track factors like temperature, humidity, and soil pH), the system aims to provide real-time disease diagnosis to help Indian farmers take quick and informed decisions to protect their crops.

Problem Statement:

Rice farmers in India face significant challenges in detecting diseases early enough to prevent large-scale crop damage. Manual identification methods are often error-prone, and there is a lack of easily accessible, cost-effective tools that can integrate both visual symptoms (seen on leaves) and environmental factors affecting plant health. This project seeks to develop a machine learning-based system that combines image processing with environmental sensor data to accurately predict rice diseases, helping farmers address the issue in real-time and thereby reduce crop losses.

Introduction:

Rice is a staple food crop for more than half of the world's population, and ensuring its health is vital for food security. Diseases such as bacterial leaf blight, leaf smut, and brown smut have detrimental effects on rice yields. Traditional methods of disease detection are slow, manual, and prone to error. This project addresses these challenges by implementing a hybrid machine learning model that can predict diseases based on environmental conditions and plant imagery. Leveraging IoT sensors, we gather real-time data such as temperature, humidity, and soil moisture, which are key indicators of plant health. Additionally, we incorporate image analysis to detect visual symptoms of rice plant diseases, providing a comprehensive and automated detection system.

Methodology:

1. **Data Collection**:
    - **Image Data**: Images of rice leaves affected by bacterial leaf blight, leaf smut, and brown smut are collected and organized into labelled datasets.

- **Tabular Data**: Environmental sensor data such as temperature, humidity, soil pH, and precipitation is collected and stored in a CSV file.

2. **Preprocessing**:

- **Images**: Images are resized and normalized for input into a Convolutional Neural Network (CNN).
- **Tabular Data**: Environmental data is cleaned and normalized for input into a Dense Neural Network (DNN).

3. **Hybrid Model**:

- A **CNN (Convolution Neural Network)** is used to extract features from the rice disease images.
- Scikit-Learn processes tabular data (temperature, humidity, etc.) to learn patterns relevant to rice health.

4. **Model Training**:

- The combined model is trained on the processed image and tabular datasets. The system is validated using a test set to ensure accuracy in real-world scenarios.

5. **Deployment**:

- The trained model can be deployed on a cloud platform, providing farmers with a mobile or web interface to upload data and get real-time predictions.

Tools and Technology:

Hardware:

- **IoT Sensors**: DHT11 for temperature and humidity, soil moisture sensors.

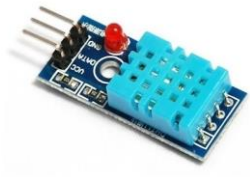

Fig: DHT11 Sensor

Fig: Soil Moisture sensor

- **Arduino/Node-MCU**: Microcontroller for sensor data collection.

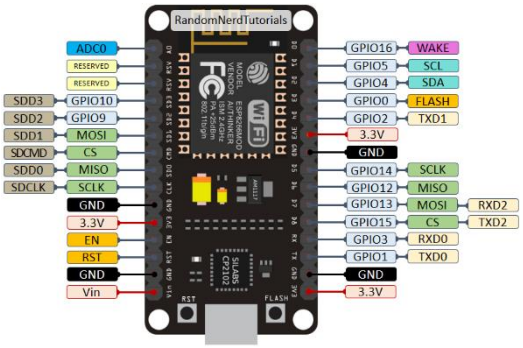

Fig: NodeMCU ESP8266

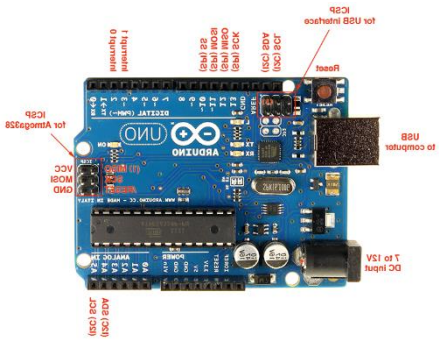

Fig: Arduino UNO

Software:

- **TensorFlow/Keras**: TensorFlow is an open-source machine learning framework developed by Google, used for building and deploying deep learning models. It provides a flexible platform for numerical computation and automatic differentiation, especially suited for large-scale machine learning tasks like neural networks. Here in this project it is for building the machine learning model trained on images of Diseased rice plant using Convolution Neural Networks (CNN).

Fig: TensorFlow Logo

- **Scikit-Learn:** Scikit-learn is a popular open-source Python library for machine learning. It provides simple and efficient tools for data analysis and modelling, offering various algorithms for tasks such as classification, regression, clustering, and dimensionality reduction. . Here in this project it is for building the machine learning model trained on Tabular data of Research paper of Rutuja Rajendra Patil and Sumit Kumar named : Predicting rice diseases across diverse agro-meteorological conditions

Fig: Scikit Learn Logo

using an artificial intelligence approach published on National Library of Medicine (USA).

- **Python**: **Python** is used in my rice disease detection project because it simplifies the integration of all the core components. Python offers powerful libraries like **TensorFlow** for building my machine learning models and **Scikit-learn** for analysing the environmental data from the IoT sensors. Its compatibility with IoT devices makes it easy for me to gather real-time data, while using **FastAPI** will streamline the backend development to connect my machine learning models with the React frontend. Python's flexibility and extensive support make it the perfect choice to manage everything smoothly in one language.

Fig: Python Logo

- **Pandas**: Pandas is an open-source Python library used for data manipulation and analysis. It provides data structures like Data Frames and Series, which make it easy to handle and analyse structured data, perform operations such as filtering, aggregation, and transformation, and manage time series data. It is used for handling and processing the CSV tabular data.

Fig: Pandas Logo

- **Firebase**: Firebase is a platform developed by Google that provides a suite of tools and services for building web and mobile applications. It offers features like real-time databases, authentication, cloud storage, and hosting, allowing developers to quickly develop and scale applications without managing server infrastructure. It will used for storing environmental data collected via IoT sensors.

Fig: Firebase Logo

- **ReactJS & FastAPI**: For building a web-based frontend and backend for user interaction and data submission.

Fig: React JS Logo

Fig: FastAPI Logo

Conclusion:

This project presents an innovative hybrid approach that leverages both image-based disease identification and environmental sensor data for rice disease detection. By combining deep learning (CNN for images) and dense neural networks (for tabular sensor data), the system provides an efficient and scalable solution to agricultural disease management. This technology will help farmers make informed decisions, mitigate crop losses, and improve agricultural productivity. The integration of IoT and machine learning in agriculture offers a promising step towards smart farming and precision agriculture.