KISAN SAHAYAK

PROJECT SYNOPSIS

OF MAJOR PROJECT

BACHELOR OF TECHNOLOGY
CSE

SUBMITTED BY – PCSE25-02

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Project Guide

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Table of contents

Introduction

We're developing an innovative IoT and AI-driven smart farming solution designed to empower farmers by offering disease detection for their crops and treatment provided by experts/scientists linked to the app.

Our application will provide support for multiple regional languages is a significant advantage. Ensuring that the app caters to the local needs and preferences of farmers, including crop varieties, climate, and farming practices.

Farmers will be able use real-time crop detection to identify diseases in their crops as soon as they appear. This shall allow for swift intervention and the application of appropriate treatments to prevent the spread of diseases and minimize crop loss.

Based on the identified disease, the app offers treatment recommendations, including the use of suitable pesticides, fungicides, or other measures to control and manage the disease these are provided by experts/scientists linked to the app.

Following is the tech stack to be used in the project.

- Flutter for app development.
- Firebase for Backend.
- TensorFlow for ML and AI.
- Google cloud AutoML Vision

Rationale

Smart farming solution is much needed because of the following reasons.

- Precision Agriculture can be achieved by AI-driven solutions enable precision agriculture, allowing farmers to target specific issues in real time. This minimizes the use of resources such as pesticides, reducing environmental impact and operational costs.

- Timely Intervention can help in predicting diseases that can spread rapidly and devastate entire crops if not detected early. AI can identify diseases at an early stage, enabling farmers to take prompt action to contain the outbreak and protect their yields.

Objectives

- Early Disease Detection
- Treatment Recommendations
- Remote Monitoring
- Multilingual Accessibility
- Offline Disease Detection

Literature Review

1. **"Machine Learning in Agriculture: A Review"** (A. J. Gongal, et al., 2019)
    - This comprehensive review discusses the role of machine learning in agriculture, including crop disease detection. It emphasizes the importance of machine learning techniques in analyzing various data sources to enhance disease identification and management.
2. **"A Survey on Deep Learning in Agriculture"** (V. Singh, et al., 2021)
    - This survey covers the application of deep learning in agriculture and highlights the significant role of convolutional neural networks in crop disease detection. The review discusses the potential of these technologies for accurate and rapid disease diagnosis.
3. **"Internet of Things-Based Crop Disease Detection Using Machine Learning"** (H. Choudhary, et al., 2018)
    - This study focuses on the integration of Internet of Things (IoT) with machine learning to detect crop diseases. The authors discuss how IoT sensor data can provide real-time information for accurate disease prediction and timely intervention.
4. **"Review of IoT Applications in Agriculture"** (A. Gungula, et al., 2020)
    - This review explores the broader applications of IoT in agriculture, including disease detection and monitoring. It highlights the potential of IoT devices in collecting data related to crop health and the use of machine learning for analysis.
5. **"Computer Vision-Based Tomato Plant Diseases Detection: A Review"** (S. Zhang, et al., 2020)
    - Focusing specifically on tomato plants, this review discusses the use of computer vision and image processing techniques for disease detection. It highlights the importance of high-resolution images and image analysis in accurate disease identification.

Feasibility study

The feasibility, need, and significance of an AI-based crop disease detection solution in modern agriculture are indisputable. With the rapid advancements in AI and machine learning, it is highly feasible to develop accurate and efficient systems for identifying crop diseases through image analysis. The need for such technology is driven by the critical challenges farmers face in safeguarding their yields from diseases that can devastate entire crops. Timely and precise disease detection is paramount to prevent economic losses, reduce environmental impacts from the overuse of pesticides, and ensure food security for a growing global population. Furthermore, the significance of this technology lies in its ability to empower farmers with data-driven insights, enabling them to make informed decisions, optimize resource allocation, and adopt sustainable farming practices. By leveraging AI for crop disease detection, we can not only increase agricultural productivity but also contribute to a more sustainable and resilient future for the agriculture industry.

Methodology/ Planning of work

The methodology for constructing a crop disease detection application involves a systematic and multifaceted approach. To begin, a clear problem statement is defined, specifying the crops of interest and the diseases to be identified. Subsequently, a diverse dataset of images, encompassing both healthy and diseased crops, is collected and preprocessed to ensure data quality.

A suitable machine learning model, typically a Convolutional Neural Network (CNN), is selected and trained using this dataset to classify images accurately. The training dataset is a subset of Plant dataset from Mendeley Data. In this dataset, 39 different classes of plant leaf and background images are available. The dataset containing 61,486 images. We used six different augmentation techniques for increasing the data-set size. The techniques are image flipping, Gamma correction, noise injection, PCA color augmentation, rotation, and Scaling. The model's performance is evaluated, leading to optimization through fine-tuning. Simultaneously, an intuitive and user-friendly interface is designed, tailored to the platform (e.g., mobile app or web application).

Backend development is crucial for managing user interactions, database storage, and communication with the disease detection model. If real-time data from IoT sensors or other sources is part of the solution, this integration is executed seamlessly. Rigorous testing and validation are conducted, including field testing to gauge real-world effectiveness.

Deployment, scaling, user training, and support are integral aspects, ensuring that farmers can utilize the application with ease. Continuous feedback from users informs iterative updates, including retraining the machine learning

models. Robust data security and privacy measures are in place to safeguard user information.

Facilities required for proposed work.

On the software front, you will need a robust development environment with an integrated development environment (IDE) tailored to your chosen platform, such as Android Studio or Xcode for mobile app development or web development environments like Visual Studio Code. The programming language is a crucial choice, with Java, Kotlin, Swift, and Objective-C commonly used for mobile applications, and JavaScript for web applications. Machine learning and AI frameworks, like TensorFlow or PyTorch, are indispensable for crafting and training the disease detection model, while image processing tasks can be handled with OpenCV. The application's data may necessitate a database system like Firebase Realtime Database or SQLite for mobile apps, or MySQL/PostgreSQL for web apps. Employing a version control system, such as Git, helps track changes. For the user interface, you'll need frameworks like Flutter, React Native, or HTML, CSS, and JavaScript libraries. Additionally, deployment and hosting solutions like AWS, Google Cloud, or Firebase Hosting will be required. On the hardware front, a capable development machine is imperative, especially for model training. Physical smartphones and devices for testing are essential, as well as high-quality camera equipment for clear image capture. IoT devices might be necessary for real-time data integration, depending on your application. Adequate data storage, a GPU for faster model training (if feasible), and a stable internet connection for updates and data synchronization round out the hardware requirements. Careful consideration of these software and hardware components is fundamental to the successful creation of an offline disease detection application.

Expected Outcome

An innovative IoT and AI-driven smart farming solution designed to empower farmers by offering disease detection for their crops and treatment provided by experts/scientists linked to the app.