AI Driven Cauliflower Disease Detection

(Final Year Project Proposal)

Project By

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1. **Introduction**

This project revolves around the identification of diseases in cauliflower plants**,** a significant innovation within the field of agricultural technology. The introduction emphasizes the critical role plants play not just ecologically but economically, particularly in agrarian countries like Pakistan, where agriculture underpins the national economy. A major challenge faced by farmers in such regions is the early recognition of plant diseases**,** which is often hindered by low literacy levels and lack of technical knowledge. Diseases in plants generally present themselves through visible symptoms on leaves, stems, and florets**,** but identifying these signs accurately and timely is difficult without proper tools and training. This delay leads to major crop losses**,** affecting both food supply and farmers' income.

The proposed solution is a real-time disease identification system for cauliflower, using modern image processing and machine learning techniques. The system is designed to differentiate among various parts of the plant such as the leaf, stem, or floret and identify three specific diseases, namely downy mildew, black rot and bacterial spot rot, with high accuracy. The integration of smart detection capabilities allows for automatic classification based on visual cues. One of the standout features of this project is its ability to not only detect the presence of disease but also recommend suitable supplements or treatments. This feature brings actionable insight to farmers, helping them manage their crops more effectively.

Traditionally, plant disease detection has relied on manual methods, including visual inspection by experts or chemical analysis. These conventional methods are labor-intensive, costly, and often impractical for large-scale farming operations. They require a continuous presence of trained personnel and significant physical effort, making them less feasible for under-resourced areas. In contrast, the automated system proposed in this project simplifies the entire process**.** By capturing a plant image and analyzing it using trained models, the system provides instant feedback. This not only saves time and cost but also makes modern agricultural practices accessible to local farmers. It empowers them with tools to make better decisions, protect their crops, and enhance yield all without requiring deep technical knowledge.

Ultimately, this system brings innovation to the field of smart agriculture and offers a scalable solution to a widespread problem.

1.1. Objectives

- To **develop** an image-based disease detection system for cauliflower plants.
- To **design** a user-friendly web interface for farmers to upload plant images.
- To **implement** a CNN-based classification model that detects diseases in plant leaves, stems, or floret.
- To **recommend** appropriate remedies and supplements for the detected diseases.
- To **evaluate** the model's accuracy on a real-world dataset and optimize performance.

1.2. Problem Statement

With the global population rising, the demand for food is increasing, placing pressure on farmers to boost crop yields while minimizing losses. Plant diseases remain a major threat to agricultural productivity, yet traditional detection methods like visual inspection are labor-intensive, slow, and often inaccurate, especially in large fields. Small-scale farmers often lack expert support and modern tools, leading to delayed responses, overuse of pesticides, lower yields, and reduced profits. Timely and accurate disease detection is crucial for improving food security and minimizing economic losses.

1.3. Proposed Solution

To address these challenges, this project aims to develop an automated, scalable solution, **A cauliflower Disease Detection app using AI model**. This solution uses cameras to capture high-resolution images and videos of crops, which are then processed through advanced computer vision and machine learning models. By analyzing these images in real time, the system can accurately detect and classify plant diseases, providing farmers and agronomists with timely, actionable insights.

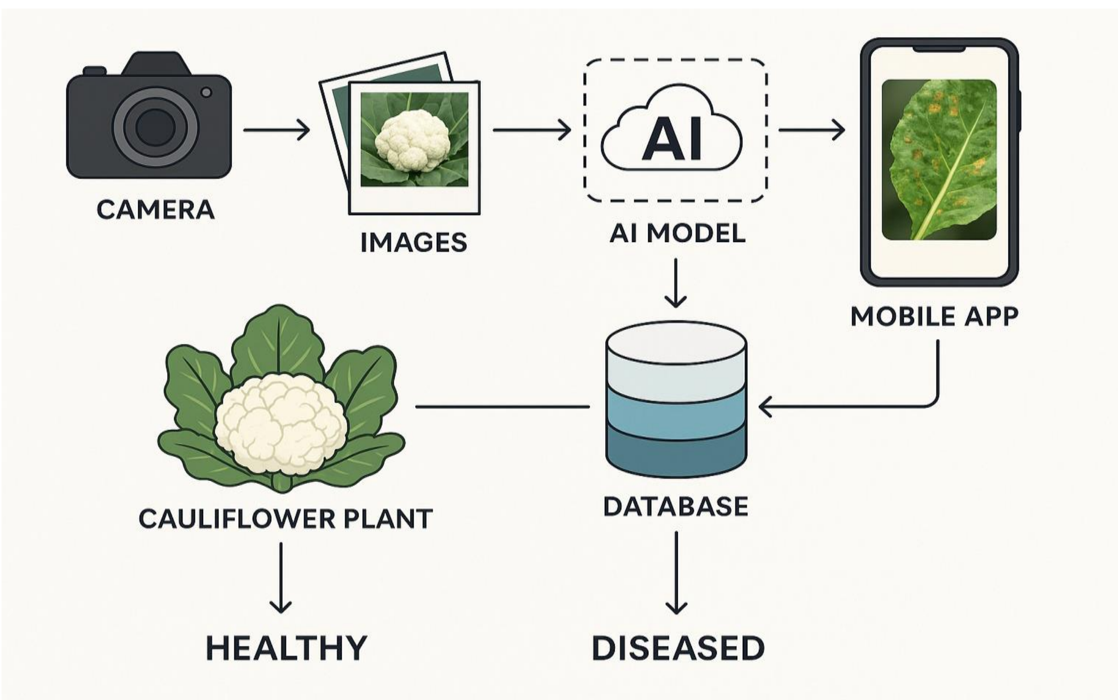
With these insights, farmers can focus on treating only the affected areas rather than entire fields, reducing costs and optimizing resource use. This solution not only enhances disease detection precision and speed but also makes monitoring accessible through mobile devices, empowering even small-scale farmers and home gardeners to safeguard their plants effectively. In the long run, this system supports proactive disease management, contributing to increased agricultural efficiency, minimized economic losses, and improved food security.

Key Features:

- Image classification using a Convolutional Neural Network (CNN).
- Support for different plant parts (leaf, floret, stem).
- Disease diagnosis with an accuracy above 90%.
- Recommendations for chemical or organic treatment based on disease type.

Benefits:

- Fast, accessible, and accurate disease identification.
- Reduced reliance on manual labor.
- Enhanced crop health monitoring.



2. Project Scope

Functionalities:

- Upload plant image
- Disease detection with output label
- Recommendations for treatment
- Admin panel for updating disease records

Limitations:

- Trained only on cauliflower diseases initially.
- Requires internet for prediction.

Users:

- Farmers, agricultural officers, plant pathologists.

3. Feasibility Study

- **Technical Feasibility:**

  Availability of tools and skills.

- **Economic Feasibility:**

  Cost-effective using open-source libraries.

- **Operational Feasibility:**

  Easy-to-use UI for low-tech users (farmers).

- **Legal & Ethical Feasibility:**

  Will comply with data privacy and local agricultural regulations.

- **Schedule Feasibility:**

  Completed in 16 weeks.

4. Solution Application Area

- Agricultural farms
- Agri-tech companies
- Government extension services
- Smart agriculture monitoring systems
- Research in crop disease prediction

5. Functional Requirements

Admin panel:

ID	Requirement	Description
1	Admin Login	Admin can login the system after the sign in.
2	Update Profile	Admin can update the profile.
3	Manage Registration (Approve, Reject)	Admin can manage the registration like approve or reject details of registration.
4	Manage (Doctor,User)	Admin can view, delete and update user and doctor.
5	Manage Events	Admin can view, delete and add events.
6	Admin Logout	Admin can logout the system.

User panel:

ID	Requirement	Description
1	Sign Up	User can sign up firstly.
2	Login	User can login account after the sign up.
3	Update Profile	User can update the profile.
4	Manage image upload	User can manage the images like upload the images.
5	Detect Disease	User can detect the cauliflower disease.
6	Detect Remedies	User can detect remedies or cure.
7	Take Suggestions	User can take suggestions about plant.
8	View Events	User can view the events.
9	Logout	User can logout the account.

Doctor Panel:

ID	Requirement	Description
1	Sign Up	Doctor can sign up the system.
2	Login	Doctor can login the system.
3	Update Profile	Doctor can update the profile.
4	View Events	Doctor can view Events.
5	Give Suggestions	Doctor can give the suggestions.
6	Logout	Doctor can logout the system.

6. Non-Functional Requirements

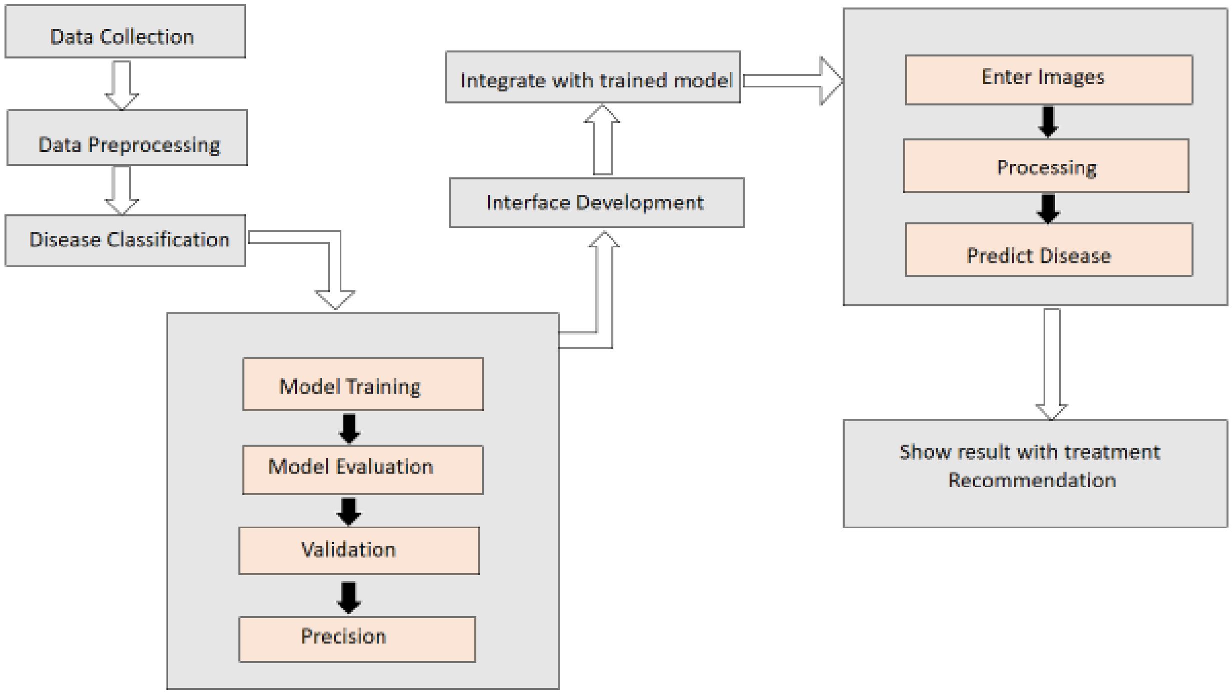
Category	Requirement Description
Performance	Should classify within 3 seconds per image**.**
Security	Image and user data encryption to ensure privacy and protection.
Usability	Provide an intuitive UI/UX suitable for farmers with minimal training.
Reliability	Ensure 99% uptime for uninterrupted access.
Scalability	System should be extendable to other crops and diseases**.**
Maintainability	Use a modular codebase to support easy updates and bug fixes.
Compliance	Follows data protection laws (e.g., GDPR if international users).

7. Methodology

Development Approach: **Agile Model**

1. **Requirement Gathering & Dataset Collection**
   - Collect and clean image datasets of cauliflower plant diseases.
2. **Model Training & Testing**
   - Train CNN on labeled images. Validate performance using accuracy, precision, recall.
3. **Frontend and Backend Development**
   - User interface, image upload, and result visualization.

Flowchart:



Languages & Tools:

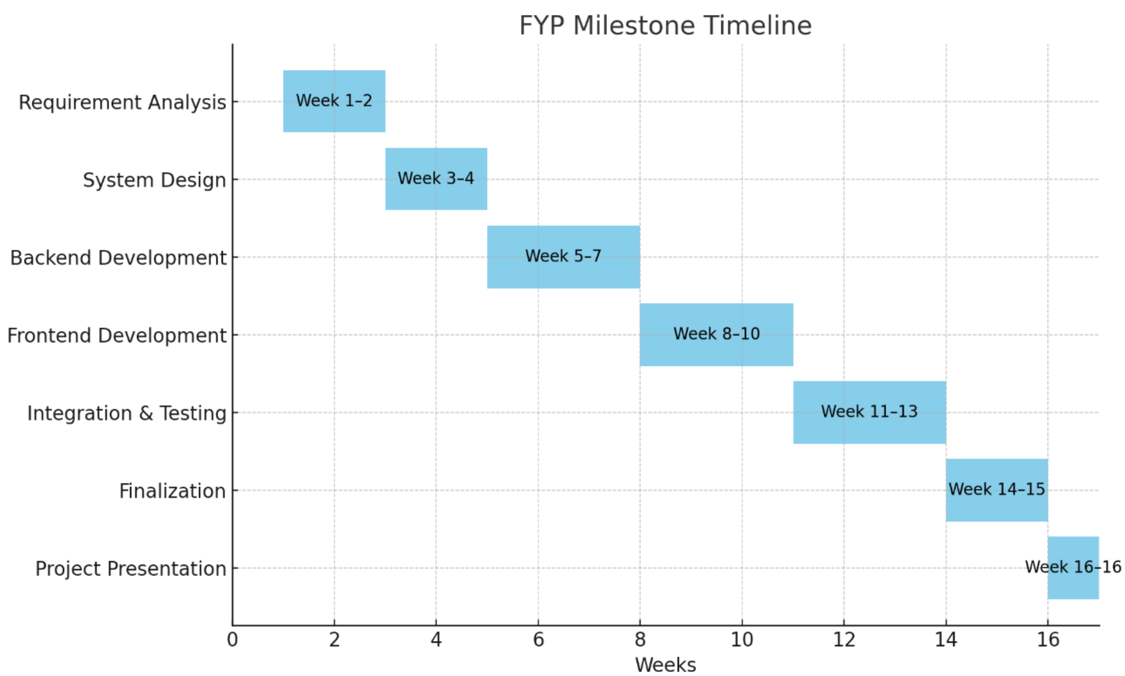
- Python, HTML, CSS, JS, Bootstrap/Tailwind CSS
- Jupyter Notebook, Google Colab GitHub.
- **Databases Management system**: SQLite
- **Testing Tools**: Postman, PyTest

Technologies:

- CNN model for image processing and classification.
- A web frontend built using HTML, CSS, Bootstrap, JS, Tailwind CSS.
- Backend powered by Django.

8. <u>Project Milestones</u>

Milestone	**Expected Completion Date**
Requirement Analysis	Week 1–2
System Design	Week 3–4
Backend Development	Week 5–7
Frontend Development	Week 8–10
Integration & Testing	Week 11–13
Finalization	Week 14–15
Project Presentation	Week 16



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