

PLANT DISEASE DIAGNOSIS AND E-COMMERCE PLATFORM

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Abstract

Many farmers and cultivators face difficulties when it comes to identifying one plant disease from another. Even if they know the disease, they may not know how to prevent its spread or which fertilizers or pesticides would work effectively in that particular case.

This web application allows farmers to easily identify plant diseases and come up with a plan of action as soon as possible. All they have to do is upload an image of the affected area. The Convolutional Neural Network (CNN) model, built using TensorFlow, will classify the disease and provide the disease name for the particular plant. Along with this, a detailed description of the disease, its causes, remedies, and prevention techniques will be compiled and given to the user in the form of a report. Using the location of the farmer's field, the soil type, and climate conditions like temperature and humidity, the application will suggest the best fertilizers and pesticides to treat and prevent the disease from spreading. A list of local suppliers of fertilizers and pesticides will be provided along with the estimated cost. Farmers can post their order to the supplier of their choice and make payment. The supplier will get the order delivered to the customer using the local area parcel service.

A commission will be charged on each order from the supplier. Also, a premium version of the application will be available for better prices and faster delivery options to the customer. These two features will contribute to the overall profit generated from the web application.

1.0 PROBLEM STATEMENT

Agricultural productivity is often hindered by various plant diseases. Timely and accurate diagnosis of these diseases can help farmers take preventive measures and reduce crop loss. The goal of this project is to develop a web application that can identify plant diseases through image classification using machine learning techniques.

2.0 MARKET/ CUSTOMER/ BUSINESS NEED ASSESSMENT

2.1 MARKET NEED ASSESSMENT

2.1.1 Market Size Growth

The market for agricultural technology solutions is growing rapidly. The global market for smart agriculture is projected to reach USD 23.14 billion by 2027, with a compound annual growth rate (CAGR) of 9.7% from 2020 to 2027. The adoption of technology in agriculture, including plant disease detection, is increasing due to the need for higher productivity and sustainability.

2.1.2 Competitive Landscape

Several competitors are offering solutions in the agricultural technology space. Notable competitors include Plantix and Agrobase, which provide plant disease detection and management solutions. However, the proposed web application aims to offer a more comprehensive solution by integrating disease detection with localized treatment recommendations and an e-commerce platform for purchasing necessary products.

2.2 CUSTOMER NEED ASSESSMENT

2.2.1 Primary Needs

- Accurate and timely identification of plant diseases.
- Recommendations for effective treatment and prevention of diseases.
- Access to local suppliers for purchasing fertilizers and pesticides.

2.2.2 Secondary Needs

- Affordable and accessible technology for farmers.
- User-friendly interface for ease of use.
- Integration of payment and delivery services.

2.3 BUSINESS NEED ASSESSMENT

2.3.1 Revenue

Revenue will be generated through commissions on orders placed by farmers with suppliers. Additionally, a premium subscription model will offer advanced features and faster delivery options.

2.3.2 Operational Requirements

- Development and maintenance of the web application.
- Partnerships with local suppliers for fertilizers and pesticides.
- Integration with payment gateways and local parcel services.

2.3.3 Scalability and Growth

The application can be scaled to include more plant diseases, expand to different regions, and integrate more suppliers and delivery services. Continuous updates and improvements will ensure long-term growth and sustainability.

3.0 TARGET SPECIFICATIONS

3.1 USER INTERFACE

The user interface should be intuitive and easy to navigate. Key features include:

3.1.1 User Profile Management: Farmers can create and manage their profiles, including personal information, farm details, and preferences.

3.1.2 Image upload Functionality: Users can upload images of affected plant areas for disease diagnosis.

3.1.3 Disease Diagnosis Results: The application will display the diagnosed disease along with relevant information.

3.1.4 Treatment Recommendations: Detailed suggestions for treatment and prevention of the disease will be provided.

3.1.5 E-Commerce Integration: Farmers can order recommended fertilizers and pesticides directly from the app.

3.1.6 Order Tracking and Transaction History: Users can track their orders and view past transactions.

3.1.7 Customer Support Chatbot: A chatbot will provide instant assistance and answer common queries.

3.2 CORE FUNCTIONALITY

3.2.1 Image Classification using CNN: The application will use a Convolutional Neural Network to classify plant diseases from uploaded images.

3.2.2 Report Generation: Based on the disease diagnosis, a report containing the disease name, causes, remedies, and prevention techniques will be generated.

3.2.3 Localized Treatment Option: The application will use the farmer's location, soil type, and climate conditions to suggest the best fertilizers and pesticides.

3.2.4 E-Commerce Platform Farmers can place orders for the recommended products and make payments through the app.

3.3 Technical Specification

3.3.1 Frontend: HTML, CSS, JavaScript, React

3.3.2 Backend: Python, Django, Flask

3.3.3 Machine Learning: TensorFlow, Keras

3.3.4 Database: MySQL, MongoDB

3.3.5 Hosting: AWS, Azure

3.4 DELIVERY AND LOGISTICS

3.4.1 Integration with Local Parcel Services: Orders will be delivered through local parcel services.

3.4.2 Real-Time order Tracking: Users can track their orders in real-time.

3.4.3 Supplier Partnership: Collaborations with local suppliers will ensure timely delivery of products.

3.5 CUSTOMER ENGAGEMENT AND SUPPORT

3.5.1 Customer Support Chatbot: Provides instant assistance and resolves common issues.

3.5.2 FAQ Section and User Guide: Comprehensive guides and frequently asked questions to help users navigate the app.

3.5.3 Feedback and Review System: Users can provide feedback and reviews on products and services.

3.6 MARKETING AND GROWTH

3.6.1 Digital Marketing Campaigns: Targeted campaigns to reach farmers and agricultural communities.

3.6.2 Partnerships: Collaborations with agricultural organizations and local suppliers.

3.6.3 Referral Programs: Incentives for users who refer others to the app.

3.7 MANAGEMENT TOOLS

3.7.1 Admin Dashboard: Manage users, orders, and suppliers.

3.7.2 Analytics Tools: Monitor application performance and user engagement.

3.7.3 CRM Tools: Manage customer relationships and support.

4.0 EXTERNAL SEARCH

4.1 Crop, Fertilizer, and Pesticides Recommendation Model Using Soil, Image, and Nutrients Data

Authors: Saloni Bhawar, Sanjana Sharma, Pallavi Makode, Pranjal Gangwal, Prof. Atul Barve

This research explores a model for recommending crops, fertilizers, and pesticides based on soil, image, and nutrient data. The model uses various data points to provide accurate recommendations, which can be integrated into the proposed web application.

5.0 BENCHMARKING ALTERNATIVE PRODUCTS

5.1 PLANTIX

Plantix is a mobile app that helps farmers identify plant diseases, pests, and nutrient deficiencies through image recognition. It provides recommendations for treatment and prevention.

5.2 AGROBASE

Agrobase is an agricultural platform that offers a database of plant diseases, pests, and weeds. It provides information on symptoms, causes, and treatment options.

6.0 APPLICABLE REGULATIONS

6.1 Government Regulations

6.1.1 Information Technology (IT) Act, 2000

- **Data Protection and Privacy:** Ensure compliance with provisions related to data protection, privacy, and cybersecurity under the IT Act. This includes securing user data, implementing strong encryption, and protecting against data breaches.
- **Intermediary Guidelines:** Adhere to the guidelines for intermediaries regarding content management and user data handling.

6.1.2 Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021

- **User Data Management:** Comply with guidelines on user data storage, protection, and handling. This includes obtaining user consent for data collection and implementing mechanisms for user data access and correction.
- **Content Moderation:** Implement measures to manage and moderate content shared by users on the app, ensuring it does not violate any legal provisions.

6.1.3 Consumer Protection Act, 2019

- **Consumer Rights:** Ensure the app protects consumer rights, including transparency in pricing, clear terms of service, and mechanisms for addressing consumer complaints.
- **Grievance Redressal:** Establish a system for addressing consumer grievances, including the appointment of a grievance officer.

6.1.4 Payment and Settlement Systems Act, 2006

- **Payment Gateways:** Ensure that the app's payment gateway integration complies with regulations governing electronic payments and settlements.
- **Secure Transactions:** Implement secure payment processes and protect user financial data.

6.1.5 Goods and Services Tax (GST)

- **Tax Compliance:** Register for GST if the annual turnover exceeds the threshold limit and ensure compliance with tax filing requirements.
- **Invoicing:** Issue GST-compliant invoices for subscription fees, delivery charges, and any other payments received through the app.

7.0 APPLICABLE CONSTRAINTS

7.1 SPACE

Minimal physical space is required as it is a digital product.

7.2 BUDGET

Initial investment for development and ongoing costs for cloud services.

7.3 EXPERTISE

Need for a team with expertise in machine learning, web development, and agriculture.

8.0 BUSINESS MODEL

8.1 FREEMIUM MODEL

8.1.1 Basic Features: Available for free to all users.

8.1.2 Premium Features: Advanced features and faster delivery options available for a paid subscription.

8.2 CONSULTATION SERVICES

8.2.1 Expert Advice: Offering expert agricultural advice for a fee.

8.3 DATA SERVICES

8.3.1 Selling Data: Aggregated and anonymized data can be sold to agricultural research institutions.

9.0 CONCEPT GENERATION

9.1 Problem Identification

Identified the problem of crop losses due to plant diseases.

9.2 Solution Brainstorming

Brainstormed potential tech-based solutions.

9.3 Feasibility and Market Demand

Evaluated the feasibility and market demand for a web application using machine learning for disease detection.

10.0 CONCEPT DEVELOPMENT

10.1 WEB APPLICATION DEVELOPMENT

10.1.1 Machine Learning Model: Development of a web application that uses machine learning to identify plant diseases from images uploaded by users.

10.1.2 Diagnostic Results The application will provide diagnostic results and recommendations for treatment.

10.2 WORKFLOW

10.2.1 Image Upload: Farmer uploads the image on the application.

10.2.2 Classification Model: The application feeds the image to the classification model and the model identifies the disease.

10.2.3 Report Generation: Using the disease name, climatic condition of the area, and the soil type, the application generates a report that contains the disease name, cause, remedy, and the estimated cost. The report also provides the address and contact info of the nearest pesticide and fertilizer supplier to the farmer.

10.3 REVENUE GENERATION

10.3.1 Supplier Commission: Profit is generated by charging the suppliers for every farmer/customer it suggests the store to.

11.0 FINAL PRODUCT PROTOTYPE

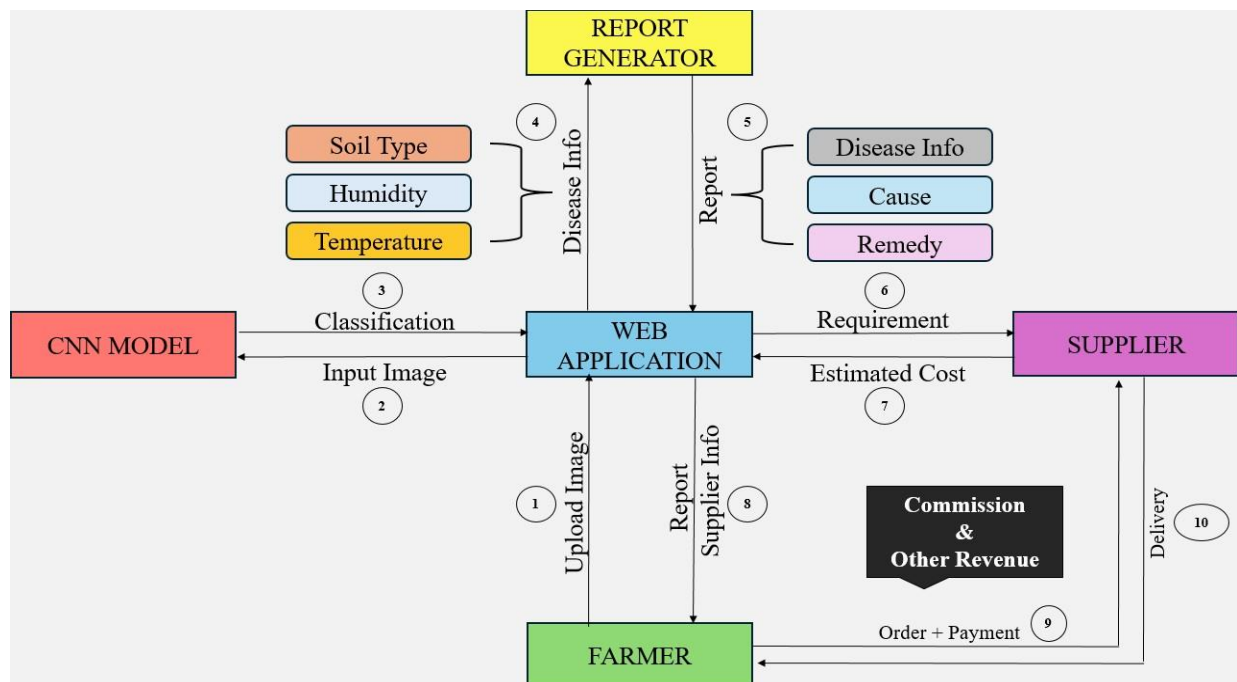


Fig: Abstract Business Model

11.1 Abstract Business Model

Step 1: A customer makes his profile on the web application and uploads the image of the affected plant part.

Step 2: The image is fed to the CNN model which classifies the disease.

Step 3: The soil type and climate conditions are evaluated along with the disease and a report is generated containing the cause, prevention and remedy (fertilizers or pesticides) of the disease.

Step 4: The nearest suppliers contact info, along with the estimated cost is attached with this report.

Step 5: The customer can order these items from the supplier.

Step 6: With the help of the local parcel service providers the package will be delivered as soon as possible upon successful payment.

Step 7: Feedback and customer support services will be available on the platform.

Step 8: A commission on each order will be extracted from the supplier.

Step 9: A premium version will be advertised for both supplier and the customer to get better offers.

Step 10: The uploaded images will be labeled and uses as a dataset for enhancing the model or be sold for revenue.

12.0 PRODUCT DETAILS

12.1 DATA SOURCES

12.1.1 Images of Plant Leaves: Collected from various online repositories and user submissions.

Example: Plant Village Dataset from Kaggle.

12.2 ALGORITHMS, FRAMEWORKS, SOFTWARES

12.2.1 Convolutional Neural Networks (CNN): For image classification.

12.2.2 TensorFlow, Keras, Python: For developing the machine learning model.

12.3 TEAM REQUIRED

12.3.1 Data Scientists: For developing and maintaining the machine learning model.

12.3.2 Web Developers: For building and maintaining the web application.

12.3.3 Agriculture Experts: For providing domain knowledge and validating recommendations.

12.4 COST

12.4.1 Development Costs: Initial development and setup.

12.4.2 Cloud Storage and Processing Costs: Ongoing costs for storing and processing data.

12.4.3 Maintenance and Updates: Continuous improvements and updates to the application.

13.0 CODE IMPLEMENTATION ON SMALL SCALE

13.1 BASIC VISUALIZATION

13.1.1 Data Representation: Visual representation of the data distribution and sample images.

13.2 SIMPLE EDA

13.2.1 Exploratory Data Analysis: Understanding the dataset through EDA techniques.

13.3 ML Modeling

13.3.1 CNN Model: Implementation of a Convolutional Neural Network model for image classification.

13.4 GitHub Link

13.4.1 Repository: <https://github.com/ar-aman/Potato-Disease-Classification>

14.0 CONCLUSION

The proposed web application aims to provide an accessible, accurate, and affordable solution for plant disease diagnosis, helping farmers and agricultural professionals reduce crop losses and improve productivity through timely intervention.