AgriGuru: AI-Powered Plant Disease Identification and Prevention

Mini Project Report -Web Technologies Lab

Department of Data Science & Computer Applications

B. Tech Data Science

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Submitted By

Shreyas Srivastava	210968094
Bhavna Aggarwal	210968060
Ishaan Sachdeva	210968086
Arnav Choudhary	210968088

Mentored By

Tojo Thomas

Assistant Professor-Senior Scale

DSCA, MIT

Date:

CERTIFICATE

This is to certify that Ishaan Sachdeva (210968086), Arnav Choudhary(210968088), Shreyas Srivastava(210968094) and, Bhavna Aggarwal(210968060) have successfully executed a mini project titled "AgriGuru" rightly brining fore the competencies and skill sets they have gained during the course- Web Technologies Lab (DSE 2262 & DSE), thereby resulting in the culmination of this project.

Tojo Thomas
Assistant Professor-Senior Scale
DSCA, MIT

ABSTRACT

In the rapidly advancing digital age, the agricultural sector stands to benefit immensely from technological innovations. AgriGuru addresses a critical issue faced by farmers worldwide – the timely detection and prevention of plant diseases. The project uses Convolutional Neural Networks (CNNs), to revolutionize plant disease diagnosis.

AgriGuru employs a user-friendly web interface where farmers can upload images of affected plants. Through sophisticated algorithms, AgriGuru accurately identifies the specific diseases afflicting the plants. This real-time analysis is pivotal in enabling farmers to make informed decisions swiftly, thereby preventing the spread of diseases and ensuring healthier crop yields.Apart from disease identification, AgriGuru provides information on preventive measures and cures which are environmentally friendly.

AgriGuru not only contributes significantly to the agricultural sector but also aligns with global sustainability goals. Furthermore, the platform fosters a sense of community among farmers, encouraging knowledge sharing and collaborative problem-solving.This project showcases the potential of web technologies, artificial intelligence, and community engagement in addressing real-world challenges.

MOTIVATION

The motivation behind creating “AgriGuru” web application is to address the challenges farmers face in managing their daily agricultural activities. Traditional methods are often cumbersome and lack flexibility. By offering a user-centric digital solution, we aim to empower farmers with the ability to identify the disease in their crops with a mere click of a photograph from their smartphone . The goal is to expand “AgriGuru” to be a one-stop solution for farmers, linking all the technologies and improve their day-to-day lifestyle.

INTRODUCTION

To address the challenge farmers undergo in managing their crops and help in their daily agricultural activities, we introduce the "AgriGuru AI powered plant disease identification and prevention" web application.

This innovative web application is designed to provide farmers with a streamlined solution for identifying the plant diseases, which wasn't possible so easily till now. By offering functionalities such as an interactive chatbot, state-of-the-art image recognition facility using Convolutional Neural Networks, and leveraging Open AI's APIs for the chatbot.

Through this project, we will be exploring full stack development which includes the usage of HTML, CSS, and AngularJs for building the framework and UI of the web application as well as backend development for handling behind-the-scenes operations, managing data, and ensuring the overall functionality and security of the application.

ROLES

Frontend Development(UI/UX): Shreyas Srivastava, Arnav Choudhary

Backend Development (ML/DL Models & Chatbot) : Bhavna Aggarwal, Ishaan Sachdeva

Synopsis

METHODOLOGY

The system enables farmers to identify diseases and problems in their crops by uploading images to help them maintain and manage their daily activities. It also gives them the opportunity to put up their concerns and queries and get solutions throught a trained and prompt chatbot helping them to resolve any issues they have.

OBJECTIVES

Our main aim is to help farmers to manage their daily agricultural activities, this webpage will help:

- To allow farmers identify the diseases in a plant by just uploading a picture.
- To provide a platform for the users to try and answer any questions regarding the care and diseases of platform using a chatbot.

SOFTWARES

Frontend(UI/UX): HTML, CSS, Angular-Ionic Frameworks

Analysis: Python

Backend: Flask

MODULES

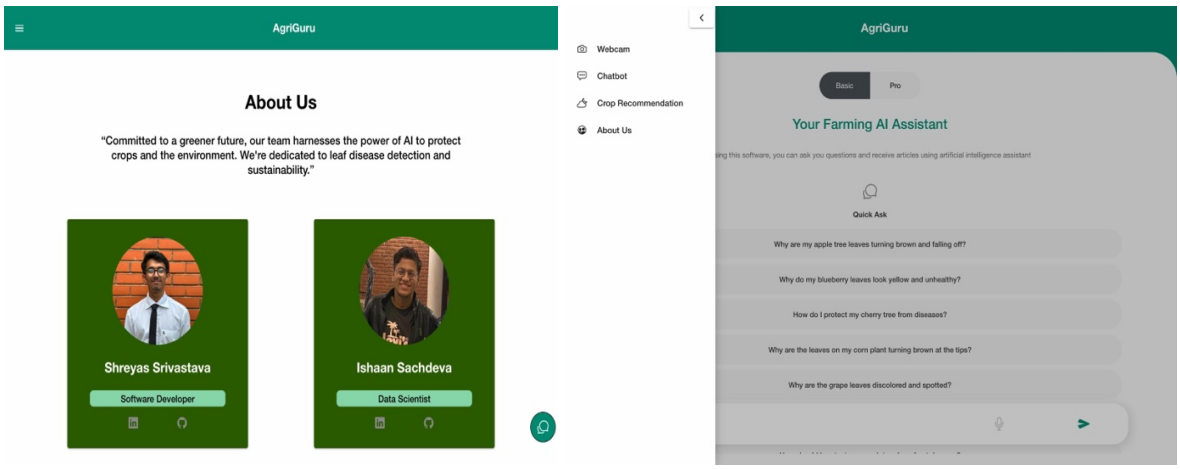
In this section, we will outline the various modules of our project, which enable the functionality of the website. These modules are designed to work in synergy, allowing users to upload or capture images of plant

leaves and receive accurate predictions regarding the plant species and any potential diseases present.

1. User Interface (UI) Module

The User Interface module is responsible for providing a user-friendly interface that allows users to interact with the application. Key components of this module include:

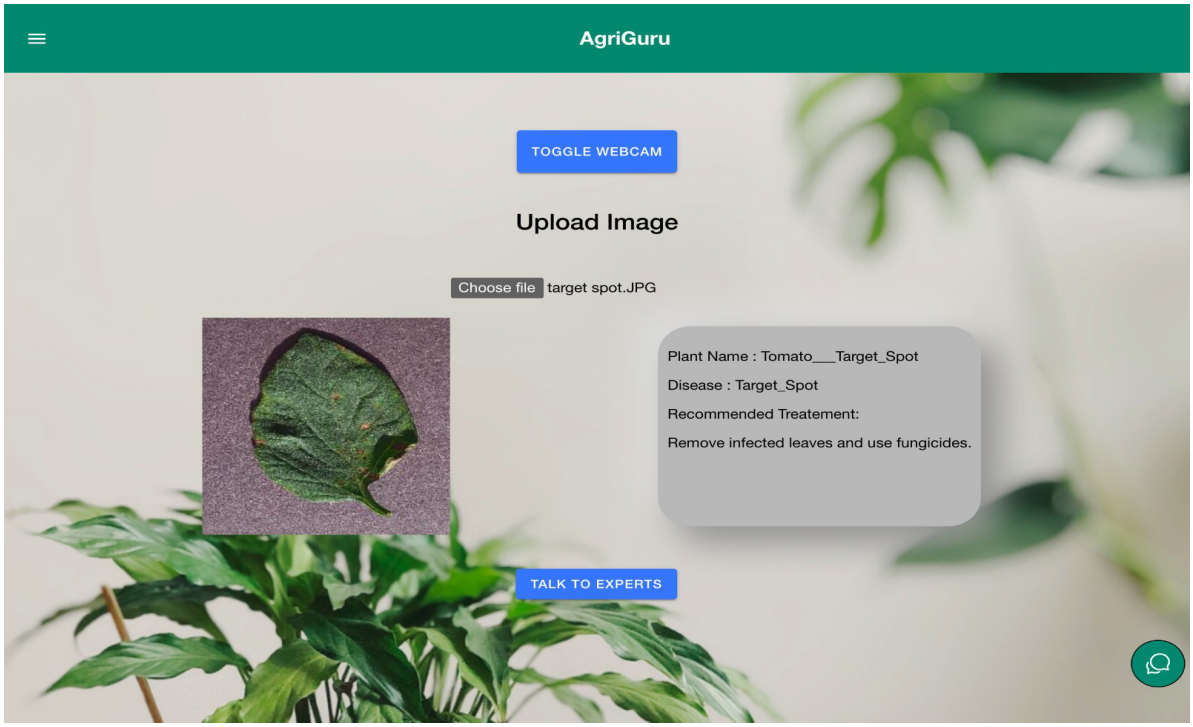
-Image Upload: This feature allows users to upload images of plant leaves from their local devices.
- Camera Integration: For users who prefer to capture images in real-time, the UI integrates with the device's camera to enable image capture within the web application.
- Feedback Indicator: A feedback system is implemented to keep users informed about the image analysis and to display the results.
-About Us Page: Provides the information about the creators of the Project.



2. Plant Disease Classification Module

The core of the project is the deep learning model, which carries out the plant and disease classification task. This module consists of the following components:

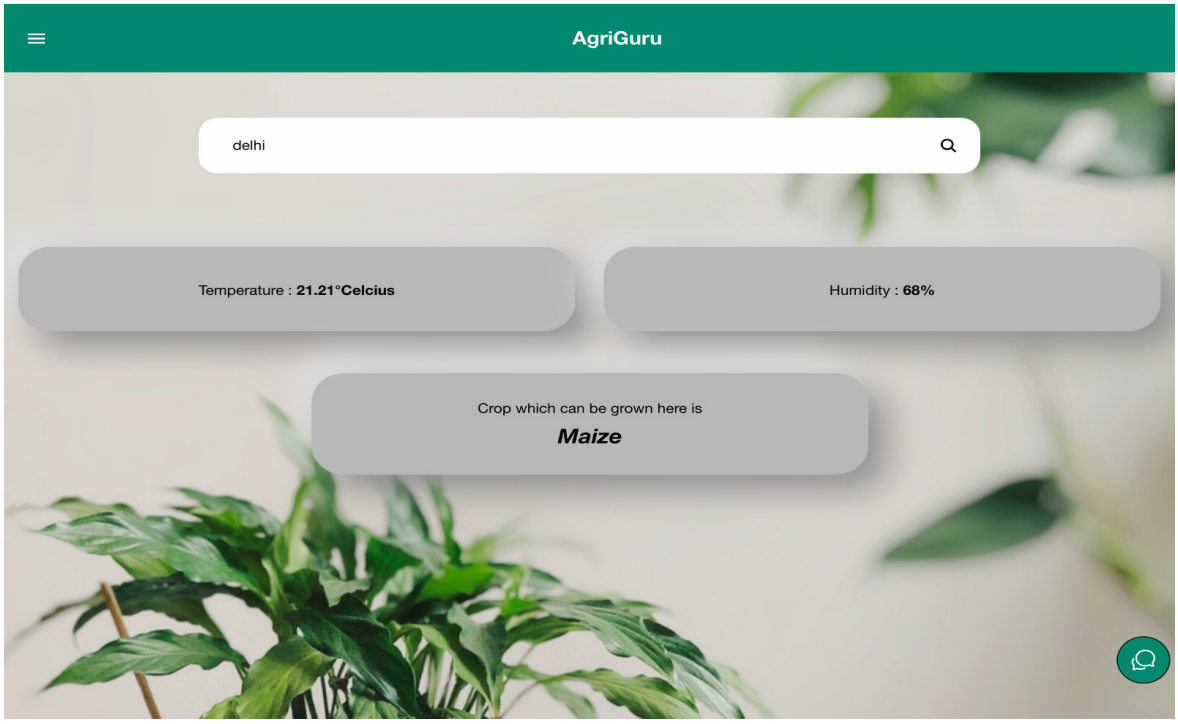
- Model Architecture: The choice of deep learning model architecture, such as Convolutional Neural Networks (CNNs), architectures like **ResNet-9**/**AlexNet** , with the design of custom layers.
- Training: Training the model on a comprehensive dataset of around 87,000 plant leaf images, including healthy and diseased plants consisting of total 38 classes of plant leaves(including healthy and disease affected).
- Inference: Performing inference on user-provided images, providing predictions on the plant species and any associated diseases.



3. Crop Recommendation Module

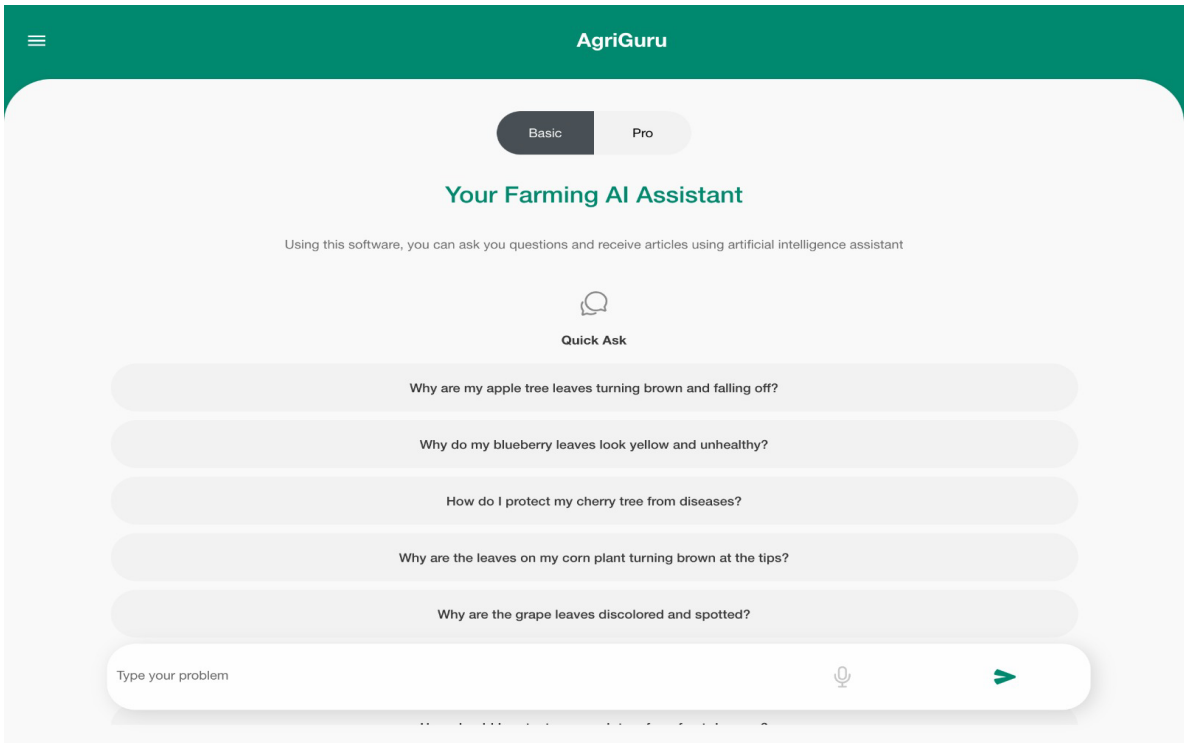
Another key part of this project, providing the farmers with a robust way to get a recommendation on the crops which they should grow, from the input of the location which they are based out of ,leveraging the power of Random Forest Classifier(Machine Learning Model).

- Model Architecture: RandomForest Classifier was chosen after the analysis of multiple classification models, out of which it gave the best accuracy of 92% on the test data.
- Training: The above model was trained on a rich dataset which consisted of 20 classes of crops, which predicts the best crop on the basis of features like temperature, humidity and rainfall(in mm) fetched by the usage of OpenWeatherMap API and GoogleSearch API.



4. Chatbot for Farmers Module

This part of the project was to streamline the experience of farmers and to provide an end-to-end solution for all their crop related needs, giving them the option to convert text-to-speech, or vice-versa, or talk to experts, if they are not satisfied by the results of the chatbot.



LEARNING CURVE

In the development of the project, the team encountered various learning phases. Here is a breakdown of the learning curve for each technology and module used:

Phase 1: Frontend Development (HTML, CSS, Angular-Ionic Frameworks)

HTML:

- Basic HTML Structure: Learning the fundamentals of HTML tags, elements, and document structure.

- Forms: Understanding how to create user input forms for image uploads and capturing.
- HTML5 Features: Exploring HTML5 features like local storage, data attributes, and drag-and-drop functionality.

CSS:

- CSS Styling: Learning CSS for layout, styling, and responsiveness.
- Flexbox and Grid: Understanding layout design using flexbox and grid systems.
- CSS Frameworks: Exploring popular CSS frameworks like Bootstrap and customizing styles.

Angular-Ionic Frameworks:

- Angular Basics: Learning the basics of Angular, including components, templates, and data binding.
- Ionic Framework: Understanding the Ionic framework for building mobile and web applications.
- Routing: Implementing routing for different app views and components.
- User Interface Design: Applying principles of UI/UX design to create an attractive and user-friendly interface.
- Form Handling: Integrating form handling for image uploads and camera integration.
- HTTP Requests: Learning how to make HTTP requests to the backend for data exchange.

Phase 2: Backend Development (Flask)

Python:

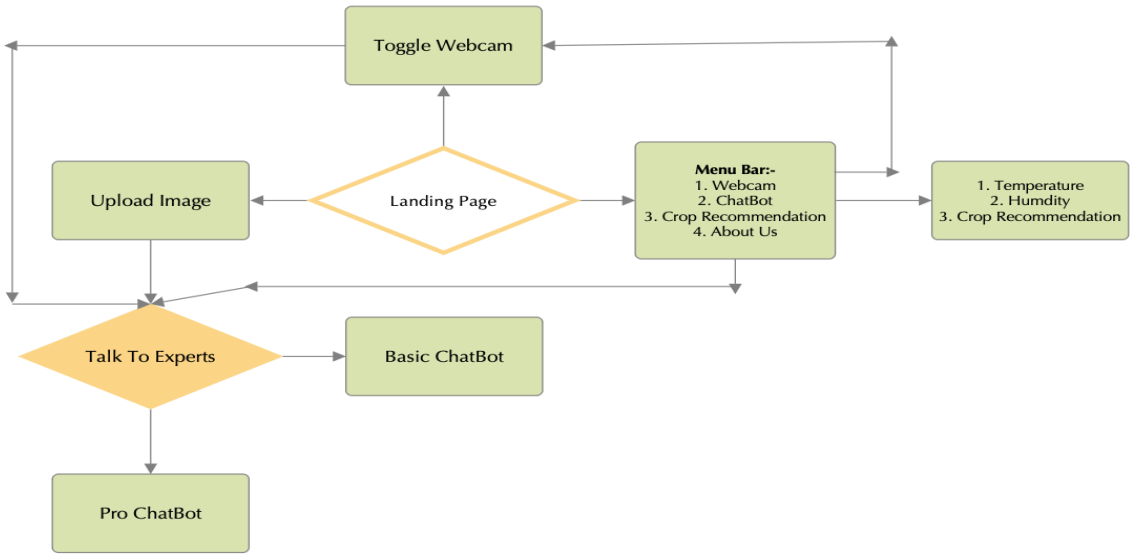
- Python Fundamentals: Learning Python programming language basics, including data types, control structures, and functions.
- Data Processing: Exploring libraries like NumPy and Pandas for data manipulation.
- Image Preprocessing: Implementing image resizing, normalization, and augmentation using libraries like OpenCV and Pillow.
- Deep Learning Concepts: Gaining an understanding of deep learning, convolutional neural networks (CNNs), and transfer learning.
- Flask Fundamentals: Learning Flask, including routes, request handling, and RESTful API design.
- Model Integration: Incorporating the deep learning model into the Flask application for inference.
- Error Handling: Implementing error handling mechanisms for robust backend operations.

Phase 3: Integration and Testing

- Frontend-Backend Integration: Learning how to connect the frontend and backend systems via RESTful APIs.
- Testing: Conducting unit testing and integration testing to ensure system functionality and data flow.

The learning curve for this project involves acquiring a wide range of skills, from web development and design to deep learning and backend development.

PROCESS MODEL



CONCLUSION

The development of our mini-project was a valuable learning experience. We successfully built a user-friendly frontend with HTML, CSS, and Angular-Ionic Frameworks. In the backend, Flask was employed, requiring us to gain proficiency in Python, data processing, and deep learning concepts. Throughout the project, we focused on continuous improvement.

This mini-project exemplifies our adaptability and commitment to learning. As we continue, we'll stay updated with the latest technologies to ensure our application provides valuable insights to users in the field of agriculture and botany.

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