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AeroPlanner

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Abstract: *Aero-Planner is web based tool which is designed to simplify gardening by combining four key features such as plant disease detection where users need just upload image of a plant leaves, this tool will detect the plant disease and suggests treatments. AI chatbot where users can ask queries about plants and it gives real time answers to queries. This tool also offers another feature which is drag and drop layout planner where users can drag and drop plants and personalize their space virtually. Task manager which helps users to set reminders to ensure consistent plant care through watering and fertilizing consistently. Overall this web based platform is designed to make gardening more smarter, easier and organized*

Keywords*:* Plant disease detection, AI chatbot, Drag and drop layout planner, Task manager

I. INTRODUCTION

Home gardening these days have become more popular because of increasing pollution and people look for green space where they can relax and enjoy fresh air. But they may face a lot of challenges like limited space, limited plant care due to busy routines and they have trouble in spotting early signs of disease in plants. Due to these challenges the home gardening has become difficult. There are also many digital gardening tools where each tool will only focus on one function, Like we have CNN web tool which will only detect plant disease, we have another tool which is plant-bot which will only answer to user queries. So the tools which are present will only focus on one feature, the users will face problems in operating many tools. To fill this gap we have introduced Aero-Planner which is a web based tool that combines all the four key features which are essential for home gardening, like plant disease detection which is going to detect plant disease using CNN and suggests treatments. Drag and drop layout planner where users can drag and drop plants and customize their space virtually. Task manager where users can set reminders for watering, fertilizing and other maintenance tasks. AI chatbot where users can ask queries about plants and get instant answers to queries. Aero-Planner provides all these features in one dashboard. This web based tool aims to simplify home gardening , making it more accessible and enjoyable platform which will improve plant health and manage plants more efficiently.

II. LITERATURE SURVEY

This section gives us the highlights of the existing research related to the project.

Panchal et al. pioneer the application of deep learning methodologies for the detection of plant diseases via leaf image analysis. Their research not only achieves superior accuracy in multiclass disease classification but also addresses challenges related to image variability and environmental noise, thereby establishing a high benchmark for automated agricultural diagnostics [1].

Ajra et al. propose an innovative framework that combines classical image processing techniques with convolutional neural networks to detect plant diseases. Beyond mere detec- tion, the study introduces preventive measures, reflecting a comprehensive approach toward practical disease management solutions [2].

Chen et al. demonstrate the efficacy of deep transfer learning by fine-tuning pretrained convolutional networks for plant disease identification. Their work successfully overcomes limitations caused by scarce labeled datasets, highlighting transfer learning as a transformative technique for resource- constrained agricultural environments [3].

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Feroza et al. introduce an advanced web-based platform that deploys convolutional neural networks specifically for Pakcoy pest and disease identification. Their system excels in providing real-time, accessible, and user-friendly plant health monitoring through seamless cloud-based integration [4].

Tembhurne et al. design a robust deep-learning-enabled mo- bile application that performs real-time plant disease detection directly on handheld smart devices. Their contribution effectively bridges the gap between high-performance laboratory AI models and real-world agricultural operations [5].

Pillai et al. address optimization challenges fundamental to dynamic industrial plant layout problems by presenting a robust framework that manages variability in routing and demand, significantly enhancing manufacturing efficiency and adaptability [6].

Gujjar and Kumar develop a domain-specific agricultural conversational AI chatbot that enables natural language interaction for farmers. The system integrates open-source tools with agronomic expertise to deliver instant, context-aware responses, signaling strong potential in intelligent digital ad- visory systems [7].

Abhijit et al. further leverage deep learning to automate plant disease diagnostics through a mobile application that emphasizes both user experience and classification performance, transforming smartphones into practical tools for precision agriculture [8].

Farhangian investigates the adaptation of large language models for industrial plant assistant chatbots, focusing on do- main customization, safety, and interoperability with existing smart plant infrastructures. This work pioneers the integration of general AI with industrial environments [9].

Liu and Zhou explore intelligent garden space planning by integrating deep learning-based predictive modeling with lay- out optimization. Their research achieves an effective balance between aesthetic and functional constraints, contributing no- table advancements in AI-driven landscape management [10].

III. METHODOLOGY

A. Plant Disease Detection

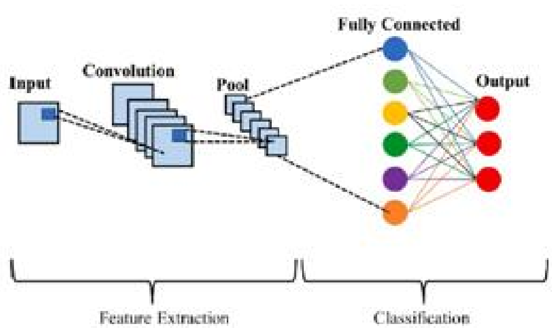

Fig. 1. CNN Architecture

This figure illustrates the overall convolutional neural network (CNN) pipeline used in the proposed plant leaf disease detection system, where the network first learns discriminative visual patterns and then performs classification into disease categories.

In the feature extraction stage, successive convolution and pooling layers operate on the input leaf image to automatically learn hierarchical features such as edges, textures, and lesion shapes that characterize healthy and diseased tissue, eliminating the need for manual feature engineering.

In the classification stage, the high-level feature maps are flattened and passed to one or more fully connected layers, which combine the learned features and feed them to the output layer to predict the most probable disease class (or healthy class) for the given leaf image.

In each convolutional layer, feature maps are computed by sliding a learnable filter over the input and adding a bias term:

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$$y_{i,j}^{(k)} = \sum_m \sum_n x_{i+m,\, j+n}\, w_{m,n}^{(k)} + b^{(k)}. \qquad (1)$$

Here, x is the input feature map, w(k) is the k-th filter, b(k) is the bias, and y(k) is the resulting activation map.
For the final classification layer, the network converts logits z_i into class probabilities using the softmax function:

$$p_i = \frac{\exp(z_i)}{\sum_{j=1}^{C} \exp(z_j)}, \qquad (2)$$

where pi is the predicted probability of class i among C disease and healthy classes.
The CNN is trained by minimizing the categorical cross- entropy loss over a mini-batch of N samples:

$$L = -\frac{1}{N} \sum_{n=1}^{N} \sum_{c=1}^{C} y_{n,c} \log\left(p_{n,c}\right), \qquad (3)$$

where yn,c is the one-hot ground-truth label for sample n and class c, and pn,c is the corresponding predicted probability.
The CNN-based disease detection module operates on color images of tomato leaves acquired in typical home gardening environments. Fig. 2 depicts two tomato leaves affected by Septoria leaf spot, a common fungal infection. Characteristic symptoms visible on these leaves include numerous small, nearly circular lesions which possess dark centers and are surrounded by yellow halos. Sections of the leaf lamina further exhibit general chlorosis and localized tissue breakdown.
Prior to classification, each image is resized to the input dimension required by the CNN, converted to RGB format, and normalized so that convolutional filters can consistently analyze important symptom patterns. In mathematical terms, the network processes each image patch using

$$y_{i,j}^{(k)} = \sum_m \sum_n x_{i+m,\, j+n}\, w_{m,n}^{(k)} + b^{(k)},$$

where x represents the normalized image data, $w^{(k)}$ the k-th filter, and y(k) the extracted feature map. These processed im- ages enable the CNN to differentiate fine-grained texture, color variation, and spot morphology, supporting accurate mapping from raw leaf photographs to disease class predictions.
The CNN produces, for each input leaf image, a probability distribution over all disease and healthy classes. The class with the highest probability is selected as the diagnosis and is displayed to the user as the predicted disease label. For every diagnosis, AeroPlanner also retrieves a structured care profile that summarizes likely causes, recommended control mea- sures, and preventive practices, including guidance on pruning, fungicide use, and monitoring frequency. These diagnosis and treatment suggestions are shown alongside the prediction in the web interface and are made available to the chatbot so that users can request further clarification or step-by-step care instructions.

Fig. 2. Sample diseased tomato leaf images used as input.

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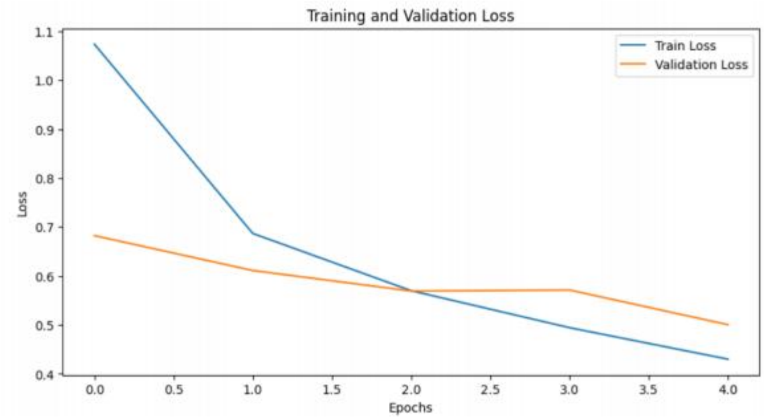

Fig. 3. Training and Validation Loss Graph

B. Plant Care Chatbot

The chatbot was built by using the transformer based language models. These transformer based language models were fine tuned on conversational dataset. The original dataset will be gone through preprocessing steps. The preprocessing steps include tokenization, normalization and removing of unecessary or irrelevant data. These steps are done so that the data fed into the model to be clean, consistent and high quality. This high quality cleaned data will make the training of the model more efficient. Augmentation techniques were also used to increase the strength of the model and ability of the model to handle new inputs. A specific model called T5 was used which created the paraphrased versions from the existing queries. This augmentation technique, it did not just increased the dataset size but also removed the overfitting and it also helped the model to perform better with the unknown inputs. The experimental results showed about 4 percent increase in classification accuracy across models. Adam optimization algorithm was used to train the the model for over two epochs. During training the batch size and learning rate will be adjusted according to experimentation to achieve the best speed of convergence and to get high accuracy. After the model is trained the performance of the model is checked on hold out validation set which the model had not seen before, the unseen data. During the evaluation the model used the standard classification metrics, accuracy, precision, recall and F1 score so it correctly interprets and classifies the user inputs. All the training and evaluation took place on GPU hardware which will ensure efficient processing of transformer architectures. In conclusion, the overall findings show the blend of all the processes such as data preprocessing, augmentation techniques, careful hyperparameter tuning and by combining multiple learning models that precisely improves the chatbot's ability to understand and correctly respond to user queries. This methodology will create a solid foundation for integrating chatbots into real world applications that demand natural language understanding.

C. Garden Layout Planner

Users can arrange various plants and garden items in small or not having usual or expected form areas like balcony, inside rooms, terrace and other areas with its drag and drop interface. it is helpful for city peoples having limited space and those who needs both visual and functional look of the gardens. This system has some of the suggestions for plants which is based on its particular conditions of users garden, and their preferences and border of the spaces. by taking some of the factors like availability of sunlight, climate and size, tools help users to pick up the plants that will flourish in their unique environments. This supports good gardening practices and it boots the chances of faster plant growth. users can also upload their own gardening plant areas. and it is for fully personalized layouts that represents their real environment. aesthetic customization is not only for the improvement of garden design but also it makes more practical and easy to use. the garden layout planner promotes users to consider some of the important elements like sunlight visibility, correct air flow and sufficient places for the plants in gardening. These helps in avoiding overcrowd, less competition for resources, for good growth conditions. By telling users for placing plants where they are more liking to

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place, tools which reduces errors and other garden faces. additionally, planner tells users to save their modified garden designs within the given aero- planner platform. it makes simple to revisit and modify some of the layouts as users will change some of the conditions for the gardening. and it is fully interacts with aero-planner tools, the garden layout planner creates smooth and interacting experiences that connects to the garden design directly for the caring of plants and its maintainence. finally users can save their own created template layouts.

D. Task Manager

The Task Manager module works well with the Garden Layout Planner by providing a complete system for organizing and scheduling important plant care tasks. It allows users to set up personalized reminders for various gardening activities, such as watering, fertilizing, pruning, pest control, and repotting. This flexibility lets users customize care routines based on the specific needs of each plant or garden area, addressing the different requirements of plant species and personal preferences.A key feature of the Task Manager is its automatic notification system. This system sends timely alerts to users based on their set schedules. These reminders are important for ensuring that essential gardening tasks are done consistently and on time. This helps reduce the chances of neglecting plants and supports their overall health. The notification system can deliver alerts through multiple channels, which boosts user engagement and responsiveness to plant care needs.By bringing all care activities into one easy-to-use dashboard, the Task Manager makes managing many plants much simpler. This is particularly helpful for inexperienced gardeners or those tending to large collections since it lessens the mental load of keeping track of different maintenance schedules. The unified interface makes garden management workflows smoother, helping users stay organized and maintain a healthy growing environment. In summary, the Task Manager improves the AeroPlanner platform by offering a structured, user-friendly way to manage plant care. It assists gardeners in building consistent routines, boosting plant health, and creating a satisfying gardening experience through effective task scheduling and timely reminders.

III. CONCLUSION AND FUTURE WORK

Aeroplanner is web based platform that combines all fea- tures like plant disease detection, drag and drop layout planner, AI chatbot and task manager all in one place. It is designed to make gardening more easier especially for beginners. This combination of all key features in one dashboard reduces the confusion and uncertainity in the beginners forming a easy to use web platform.

Plant disease detection uses the Convolutional neural net- work(CNN) which accurately predicts the disease and suggests treatments, so that the users can easily grow healthier plants without the fear of any disease affecting the plants. An integrated AI chatbot which will answer the users queries effectively ensuring better care of the plants. Drag and drop layout planner in which users can drag and drop plants virtually ensuring good use of their space and can make their customizations based on their needs. An automated task manager where users can set reminders for tasks like watering, fertilizing and so on. This reminder will help users to take care of their plants even in busy schedules they will get reminders and they can take care of their plants effectively.

These features not only makes the Aeroplanner not just a gardening tool but a smart assistant that listens to users and does the job perfectly. This tool will help users to maintain a healthy and well organized gardens.

In future, the research will include expanding the person- alizations where the tool could support more variety of plant species and detect diseases. Smarter recommendations where it includes integrating real-time data like weather forecasts and seasonal recommendations for more accurate results. Per- sonalized scheduling which includes implementing adaptive scheduling that learns from the users habits and environmental conditions. Adding interactive features like augmented real- ity(AR) to help users to visualize thier gardens, voice control capabilities and also integration with Internet of things(IoT) devices like sensors for smart water management systems. Ultimately by integrating all these features will make the Aero planner more powerful, efficient and enjoyable platform for gardeners.

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