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Agribot-An Intelligent Chatbot for Farmers

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Abtract: AgriBot is an artificial intelligence based chatbot to solve major issues faced in the agriculture such as selection of crops, plant diseases, unfavorable conditions, irrigation, etc. Using machine learning and real-time data, it makes tailored crop recommendations based on soil health, previous yields and prevailing weather conditions. With the help of advanced image-based algorithms, AgriBot is able to detect plant diseases in early stages and suggest treatments to prevent a crop loss and timely action. Along with crop and disease management, AgriBot also analyzes real-time meteorological data and provides accurate weather forecasts, allowing farmers to plan planting and harvesting more effectively.

Keywords: *AI-Driven Chatbot, Crop Recommendation, Disease Diagnosis, Weather Forecasting, Irrigation Optimization, Multilingual Interface, Smart Agriculture.*

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I. INTRODUCTION

Agriculture today requires more than conventional wisdom. With the changing climate trends and unstable market needs, farmers need to make prompt and prudent decisions to ensure productivity as well as profitability. But most small and marginal farmers are hampered by the absence of access to expert guidance and basic resources, which prevents them from meeting these changing challenges.

In order to bridge this gap, there is a growing need for digital technology that provides hands-on and low-cost assistance. Such technology needs to move beyond generic advice and provide customized advice based on the particular circumstances of individual farmers. A solution that is both modern technology and simple in nature has the potential to enable farmers to make improved decisions regarding their crops and lives.

soil, conditions around the neighborhood, and previous AgriBot steps in to address these difficulties with a well-rounded platform that integrates artificial intelligence and real-time inputs. It weighs important determinants like the quality of the harvests in terms of yields in order to give well-informed suggestions.

This method ensures farmers receive place-based advice instead of general propositions.

One of the most distinctive aspects of AgriBot is its chatbot interface, which accommodates the native languages of users for communication. The natural interaction facilitates the ease of access to basic agricultural information for farmers, without the requirement of technical expertise. Through the conversion of traditional agriculture into a data-intensive and sustainability- focused process, AgriBot provides farmers with the skills necessary to thrive in today's agricultural world.

II. LITERATURE SURVEY

Past studies have proven extensive potential for technology to supplement farming activities. For example, machine learning models have been used to identify crops based on different parameters of soil. One such notable study by Singh et al. (2020) utilized decision trees and support vector machines to recommend suitable crops. While the models worked to some extent, they did not have the capability to adapt to shifting weather patterns in real- time.

In the detection of disease, deep learning, especially convolutional neural networks (CNNs), has been very accurate in diagnosing plant diseases from leaf images. Sharma and Patel (2019) came up with a CNN-based model that is good at distinguishing various plant diseases, thus offering a faster and more consistent approach compared to the conventional manual inspections.

Chatbot technology has increasingly been tasked with offering assistance in agriculture. Such technology is rule-based in its inference and of narrow scope, with a high probability of responding to a limited set of user questions. Additionally, it does not incorporate dynamic environmental information or create links with external sources like weather APIs, limiting its potential for real-world, real-life scenarios.

AgriBot successfully addresses these limitations by combining different functionalities in an intelligent and comprehensive platform. It integrates crop suggestion based on soil and weather data, disease identification enabled through image-based recognition, weather- driven irrigation optimization, and natural language interface for ease of

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operation.

III. CASE STUDY

We gathered a group of 30 farmers who used the AgriBot mobile app throughout an entire growing season. The app was set up in their local language, and we provided them with some basic training to get started.

Throughout the trial, farmers relied on AgriBot for crop recommendations tailored to their soil reports. Many of them decided to switch to more suitable crops, leading to better yields. They particularly valued the disease detection feature, which helped them spot issues like leaf spot and mildew early on, allowing for quick treatment with suggested organic solutions. Plus, the irrigation advisory system helped them cut down water usage by about 20% by fine-tuning their watering schedules based on rainfall forecasts.

The feedback from the farmers was incredibly positive, emphasizing how the chatbot made complex decisions much simpler. This case study clearly showed that smart agricultural systems can be successfully implemented, even in areas where technology isn't widely used.

IV. METHODOLOGY

AgriBot is designed as a modular and integrated platform, with each component targeting a specific challenge in agriculture. The architecture ensures flexibility, scalability, and ease of maintenance while addressing core agricultural needs through data-driven solutions. The modular nature also facilitates independent updates and improvements without affecting the overall functionality of the system.

The Crop Recommendation module is powered by a Random Forest classifier, which takes into account critical agronomic parameters such as soil nutrient levels (Nitrogen, Phosphorus, and Potassium), soil pH, temperature, humidity, and rainfall. These inputs are collected either manually or through sensors and are then processed to predict the most suitable crop for the given conditions. The model has been trained on a curated agricultural dataset to ensure high accuracy and adaptability to diverse climatic zones and soil types.

The Disease Diagnosis module leverages computer vision and deep learning to identify plant diseases. Users can capture and upload images of infected leaves through the app. A Convolutional Neural Network (CNN), trained on thousands of labelled images from the Plant Village dataset, analyses the visual features and accurately classifies the disease. The system then suggests targeted treatment strategies, which include both organic and chemical solutions, enabling timely and effective intervention.

For Irrigation Guidance, AgriBot integrates real-time weather data using the OpenWeatherMap API. The module evaluates forecasted rainfall, humidity, and average evapotranspiration rates to determine optimal irrigation schedules. By recommending whether to irrigate or delay watering, this feature helps conserve water resources and promotes sustainable irrigation practices, particularly important in regions facing water scarcity.

The Weather Forecasting module enhances farm planning by providing a seven-day outlook, including temperature, rainfall, humidity levels, and alerts for extreme conditions such as storms or heatwaves. This forward-looking data assists farmers in making informed decisions about sowing, fertilizing, pesticide application, and harvesting, thereby reducing losses and improving yields.

The Chatbot Interface, built using Gemini AI, enables seamless interaction through natural language processing. Farmers can ask questions such as “Which fertilizer is suitable for tomatoes?”, “Why are my leaves turning yellow?”, or “Will it rain tomorrow?”, and receive contextually relevant, actionable responses. This conversational interface makes advanced agricultural knowledge accessible to users with varying levels of literacy and technical expertise.

Finally, the User Interface is developed using the Kivy framework, ensuring that the mobile application remains lightweight and efficient even on low-end Android devices. The app supports multiple languages to accommodate regional diversity and includes offline capabilities for certain features, making it suitable for rural areas with limited internet connectivity. This user-centric design enhances accessibility and encourages widespread adoption among smallholder farmers.

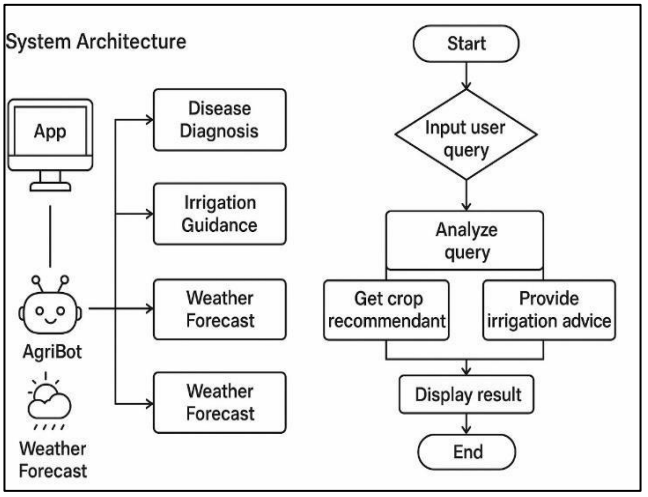

Fig 1 System Architrcture

V. RESULT AND DISCUSSION

AgriBot is an integrated and modular AI-platform that is aimed at solving key agricultural issues using intelligent data-driven solutions. Its architecture guarantees flexibility, scalability, and maintenance simplicity so that individual modules can be updated or enhanced separately without affecting the overall performance. The modular nature of the platform makes it easy for AgriBot to counteract an extensive variety of farmer requirements, including crop choice, disease control, and monitoring environmental conditions.

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➢ *Crop Recommendation:*

This module uses a Random Forest classifier to recommend the most appropriate crops based on major agronomic inputs like soil nutrient status (Nitrogen, Phosphorus, Potassium), soil pH, temperature, humidity, and rainfall. These inputs can be manually gathered or from soil and weather sensors. The model, having been trained using a well-curated dataset of heterogeneous agro-climatic zones, offers precise recommendations for specific soil and climate conditions, thus improving productivity while minimizing risk.

Fig 2 Enter Soil Date

➢ *Disease Diagnosis:*

Early identification of plant diseases is made possible by the system, which includes a Convolutional Neural Network (CNN) that is trained on the popular Plant Village dataset. The farmers can upload infected plant leaf images through the mobile app. The CNN analyses these images to accurately classify the disease and recommend the proper treatment techniques, both organic and chemical. It enables farmers to respond in time, and hence, reduce crop loss and damage.

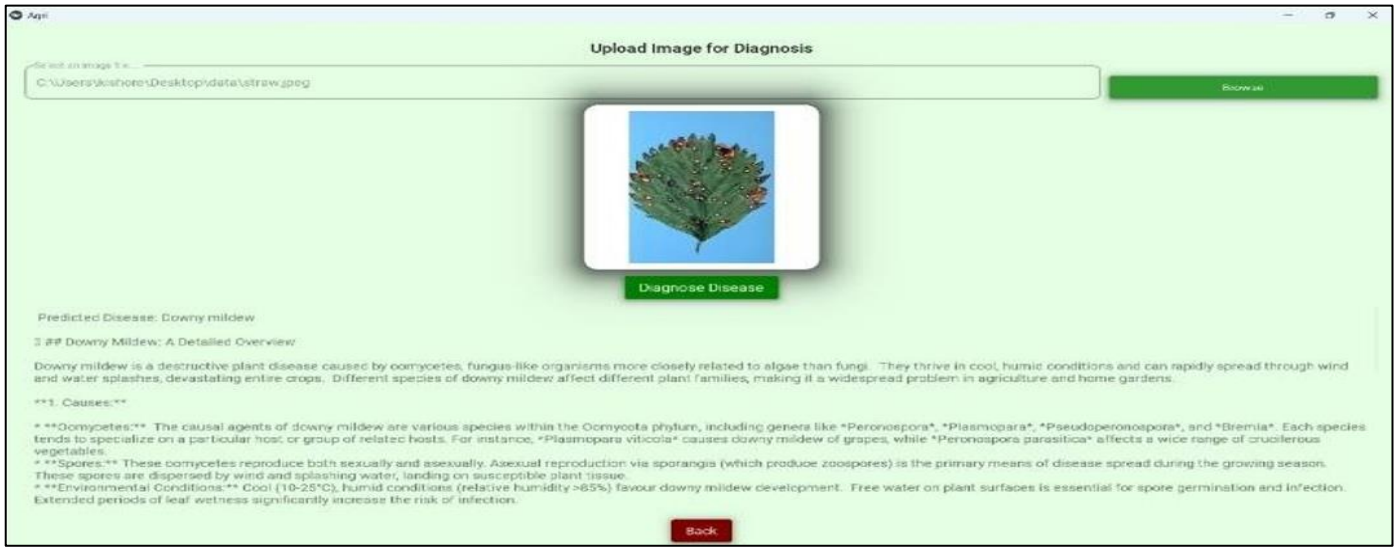

Fig 3 Upload Image for Diagnosis

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➢ *Irrigation Control:*

AgriBot optimizes irrigation methods utilizing live weather feeds from the OpenWeatherMap API. The system compares forecast rainfall, humidity levels, and daily average evapotranspiration levels before suggesting when or if irrigation should be implemented. This tactic maximizes efficient use of water, particularly valuable in areas plagued by water deficiency, and minimizes unsustainable planning in irrigation systems.

Fig 4 Irrigation Control

➢ *Weather Forecasting:*

In addition to helping with farm activities, AgriBot provides an in-depth seven-day weather forecast with parameters such as temperature, humidity, precipitation, and warnings for extreme weather such as storms or heatwaves.

This predictive module enables farmers to make the right choices about planting, fertilization, pesticide application, and harvesting, ultimately enhancing the yield of crops and minimizing environmental exposure.

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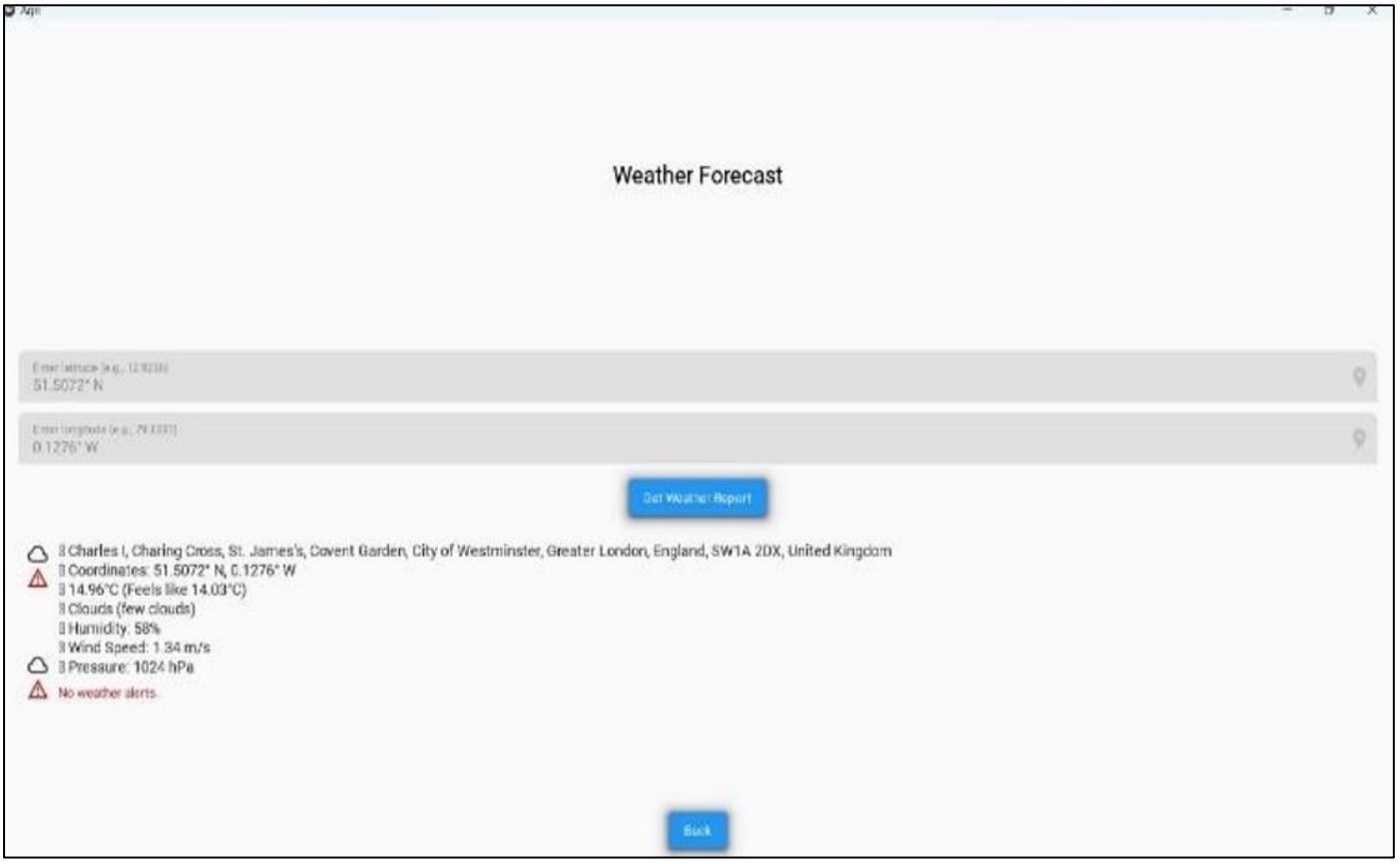

Fig 5 Weather Forecast

➢ *Chatbot Interface:*

Driven by Gemini AI, the chatbot facilitates effortless two-way natural language communication. Farmers can pose context- specific questions like "What fertilizer do I apply to wheat?" or "Will there be rain tomorrow?", and get actionable answers. The chatbot is programmed to recognize local dialects and local agricultural vocabulary, so expert information is available to farmers with different levels of literacy and technical awareness.

Fig 6 Chat with Agribot

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- *User Interface:*

The AgriBot mobile app is coded on the Kivy framework, which guarantees a light yet responsive build that can work smoothly on low-end Android phones. It has support for regional languages and offline modes for most functions. The intuitive design makes even small-town farmers with poor internet connectivity take advantage of the app, bettering usability, and promoting high adoption rates.

VI. CONCLUSION

AgriBot shows the revolutionizing power of AI in farming. Through a centralized, smart, and interactive platform, it gives farmers the power to make sound decisions. Its modularity enables it to change and grow according to user specifications and geographical needs.

The combination of machine learning with weather forecasting, disease detection, and smart irrigation planning not only enhances productivity but also encourages sustainable farming practices. The accessibility of the chatbot on mobile platforms means that even technologically disadvantaged regions can gain. With ongoing improvement, AgriBot may have a significant role to play in the development of precision agriculture and food system security.

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