Agribot: An AI-Powered Farmer's Companion

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Abstract— **Agriculture has been a challenging industry as it still faces many issues in the form of climacteric variation, agricultural soil degradation, agricultural diseases, etc., besides the unavailability of timely access to expert information services in this field. This paper aims to present an intelligent agricultural decision-support tool in the context of Artificial Intelligence technology in the context of an "Agribot," an Artificial Intelligence solution aiming to improve the agriculture sector through intelligent agricultural decision-support services for this challenging industry in a more accurate manner.**

The intelligent agricultural decision-support tool aims at employing machine intelligence in agricultural disease detection, fertilization, natural language processing, as well as real-time weather information services through public external API services to enhance the accuracy of agricultural analysis services for the challenging agriculture industry. Moreover, this tool has been implemented through Python, TensorFlow, Scikit-Learn, along with Open Weather API to enhance precision in agriculture as well as to promote sustainable agriculture in this challenging industry.

Index Terms— Artificial Intelligence, Precision Agriculture, Crop Disease Prediction, NLP, Decision Support Systems.

I. INTRODUCTION

Agriculture is really important for a countrys economy. The fact that we have development means people can make a living and the economy can grow. We also have food to feed everyone, which is great because people always need to eat. However starting an agriculture business is not easy. There are problems that can affect how well the crops do.

For example the weather is not always good. The soil is not as healthy as it used to be. These are challenges, for agriculture. Agriculture has to deal with these problems all the time. The weather can be very unpredictable. The soil quality is getting worse. This makes it hard for agriculture to be successful. Crops can get sick. They can also have bugs and other pests. We really need to talk to an expert who can help us with this problem. The expert consultation services are very important, for our crops.

Agricultural practices usually depend on people watching things and making decisions based on what they see.. This way of doing things is not very good at giving accurate results. It is also not very reliable because the environment is always changing.

The agricultural practices that rely on what people can see may not be good enough. This is because people watching things cannot handle the complex problems that come up in agriculture today. Agricultural practices need to be able to deal with these problems. Relying on observations of beings, for agricultural practices is just not enough to address the complex agricultural dynamics we see today in agricultural practices. The recent developments and advancements in artificial intelligence are contributing towards ensuring adequate development of smart agricultural practices with effective utilization of learning features in order to perform analysis of large quantities of data concerning health conditions of plants, soil properties, and other aspects and drawing upon these aspects as concepts for forming Agribot as a promising concept.

II. LITERATURE SURVEY

Intelligence and machine learning have really changed the way we develop smart farming systems. People who study this stuff want to know how they can use machine learning to help crops grow better use resources wisely and make good decisions about farming. Some studies have shown that artificial intelligence models can look at how healthy cropsre what the soil is, like and what the weather is doing, which helps farmers take care of their farms in a better way. Artificial intelligence and machine learning are

important here because they can really help farmers with their work.

Disease detection in crops has traditionally been one of the most recurrent research areas within smart agriculture. Most of the previous works applied image processing and deep learning-based techniques to analyze the images of crop leaves in order to detect diseases at an early stage. Most plant disease detection studies have utilized CNNs, among other classification algorithms, to achieve high accuracy for the timely treatment that prevents further crop loss. Similarly, machine learning models applied the yield prediction analyzing historical crop data, soil parameters, and climatic conditions.

Apart from finding diseases and predicting them people have also been looking at weather-based services when it comes to farming. These services use weather information that they get from places using special computer programs to help farmers plan what they need to do like watering their crops dealing with pests and picking their crops at the right time. People have seen that getting the weather right is really important to reduce the problems that come with weather that's not always the same. Weather predictions are a deal for farmers because they help them get ready for what is going to happen with the weather and this is a key part of farming and taking care of crops and weather-based advisory services are really helpful, for this.

Moreover, Natural Language Processing (NLP) in agricultural systems has also been accomplished through the implementation of chatbots in order to provide farmers with immediate exposure to agricultural knowledge, expert advice, and best farming practices through a single platform. It facilitates farmers in accessing agricultural knowledge through more accessible and efficient methods, replacing physical consultations.

People have found out that using Artificial Intelligence in farming can be really helpful.. The Artificial Intelligence plans that people have come up with so far for farming mostly focus on a few specific things like finding diseases guessing the weather and giving advice. Not many people have tried to make Artificial Intelligence models that do lots of things like look at crops suggest fertilizers give updates on the weather and the time of year and let people talk to them all in one place. This is what is missing from the Artificial Intelligence models for farming that we have now. Artificial Intelligence, in farming is still an idea but we need to make it better by adding more features to it. Therefore, the main proposal for an integrated AI-supported system for agriculture comes in the form of Agribot.

III. SYSTEM DESIGN AND METHODOLOGY

SYSTEM DESIGN:

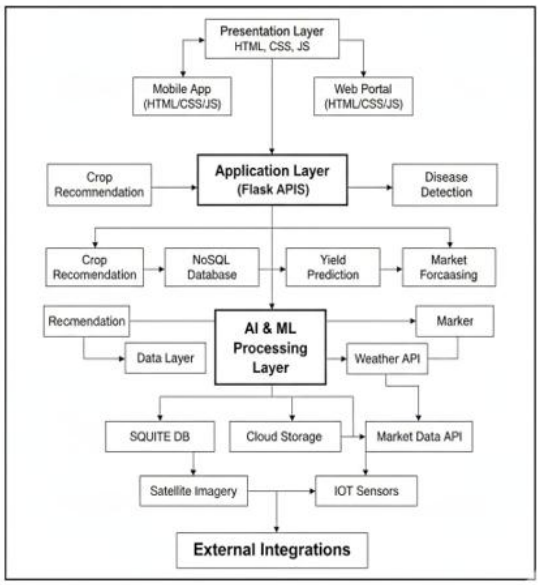

Fig. 1. System Architecture of Agribot

This Agribot System is going to work with a software plan that has layers. These layers make sure the Agribot System is efficient and works well. The Agribot System also has a lot of computing power. With the Agribot System Architecture it will be easy for users to talk to the parts of the Agribot System and to get information, from many different places. The Agribot System will make it simple for people to use.

The Presentation Layer is basically the user interface service. It is made up of a website and a mobile app that were built using HTML, CSS and JavaScript. This Presentation Layer gives users a service that lets them do things like add pictures of their crops add information about the soil and describe any problems they see on their farms. Then the user gets an answer from the system with suggestions.

The Application Layer is, like a controller service. It is based on Flask and REST APIs. This service mainly controls user requests and integrates appropriately

with other system components through smooth communication and data flow.

IV.METHODOLOGY

The way AgriBot is designed to work is very methodical. It starts by collecting information. To collect information AgriBot needs things like pictures of the crops details about the soil and questions from the user. It also needs to know what the weather is like now which it gets from the user and other places. AgriBot uses all this information to make suggestions for agriculture. The system design of AgriBot is very good, at using all the information it collects to help with farming. AgriBot collects data from sources to make sure the agricultural recommendations are intelligent.

Here we get the collected data ready for use. We clean the data make sure it is consistent and check that it is correct. This is important for the data to be good and reliable. We also use machine learning to do some work like figuring out what diseases might happen what crops are best to plant and how much of a crop we will get. The machine learning helps us with things, like disease prediction. Suggesting the right crops to plant and estimating how many crops we will have. During all this, the chatbot is built based on various NLP techniques to facilitate interaction between the farmer and the system for easier use and usability from the user end, and lastly, to communicate to the user the recommendations and information provided to them through a system built using a web interface, to ensure an effective and accurate decision-making process in agriculture.

V. IMPLEMENTATION

The Agribot system uses Python to code the software. This is because Python has a lot of tools that're good for dealing with data and machine learning. People like to use Python to make farming apps because it is easy to work with and can handle big jobs. The Agribot system likes Python for these reasons.

The system uses the Flask web framework for the back-end services. This is what handles the user requests and the things the system does. It uses an API to talk to the end and the back end of the system. The API helps the front end and the back end of the system communicate with each other in a way. The Flask web framework is important, for the back-end services of the system.

We use machine learning models to detect crop diseases and recommend crops and predict yields and do trend analysis of crops and products when it comes to marketing.

We use TensorFlow and Scikit-learn libraries to train machine learning models and evaluate machine learning models.

Machine learning models also use the Open Weather API to get information, from the internet so we can give alerts and advisories to farmers about the weather and climatic conditions.

Agricultural data such as user inputs and prediction results is stored through NoSQL database and cloud storage. SQLite is used to manage structured data if necessary. This helps to store data with greater reliability and helps to scale up the Agribot system.

VI. RESULTS AND DISCUSSION

RESULTS:

The Agribot system was tested by using sample agricultural information, images, soil details, and weather information. The efficiency of the proposed system was tested in terms of accuracy, efficiency, and user-friendly aspects. The results of this study show the efficiency of the proposed system in supporting agricultural-related issues through artificial intelligence.

A. Crop Disease Detection Performance

In this research, crop disease detection is done through a module that was tested on various images of crop leaves. Table 1 shows metrics related to this.

Metric	Value
Accuracy	89%
Precision	87%
Recall	86%
F1-Score	86.5%

The findings show that the model can accurately identify commonly occurring diseases in the farm crops using the machine learning approach.

B. Fertilizer Recommendation Accuracy

A case study was conducted on the system known as the fertilizer recommendation system by comparing the results obtained from the system with the ones obtained from the manual method through the use as suggested in Table 2.

Method	Accuracy
Traditional Manual Method	72%
Agribot ML-Based Recommendation	90%

As can be understood from the results, it has been seen that more accurate advice can be given by Agribot regarding fertilizers.

C. Overall System Performance

Overall performance evaluation in relation to 'response time,' 'usability,' as well as 'system reliability' is performed in the case of the Agribot system. Table 3.

Parameter	Observed Result
Average Response Time	5–8 seconds
Weather Alert Accuracy	High
User Friendliness	High
System Stability	High

System performance provided reliability with quick response times; thus, the system can provide applicability in real life.

DISCUSSION

It can clearly be seen that the tested results have sufficiently demonstrated the efficiency and efficacy associated with the Agribot system as a facilitator in agricultural decision-making activities through the integration and inclusion of machine learning concepts, weather forecasts, and interaction through platforms, reducing the need to search manually while providing precise and exact results and solutions to the end users.

VI. CONCLUSION

This paper is about creating an agricultural assistant. The intelligent agricultural assistant is supposed to help farmers make decisions about farming. It does this by giving them advice based on information and telling them what to do at the right time. The intelligent agricultural assistant uses intelligence to look at things like how crops are doing and what the weather is, like. This helps the agricultural assistant figure out what is going on and give good advice to farmers about their crops and soil.

The new agricultural assistant is going to help farmers with their work. It will make sure they use their resources in a way so they do not lose as many crops. This will help farmers get a harvest.

The agricultural assistant will help farmers choose the crops to plant. It will also help them find out if their crops are sick on so they can do something about it. The assistant will tell farmers how fertilizer to use and how to deal with changes, in the weather.

The agricultural assistant will also encourage farmers to use methods that're better for the environment. It will give them advice so they do not have to do everything by hand. The agricultural assistant will help farmers make decisions and use sustainable farming techniques. Based on this approach, the paper intends to identify the role of AI-driven agricultural assistants in remodeling agriculture and enhancing farming results in the long run.

ACKNOWLEDGMENT

The authors acknowledge with thanks the Department of Computer Science and Engineering (Artificial Intelligence), St. John's College of Engineering and Technology, for providing the necessary guidance and infrastructure. They also thank their project guide for his invaluable mentorship and continued support in building this piece of work.

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