KrishiMitra: An AI-Based Smart Crop Advisory System for Indian Farmers

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***Abstract*—The agriculture plays a vital role in the Indian economy; yet, farmers still have to face such problems as unpredictable weather condition, insufficient access to professional consultations and insufficient access to innovative farming information. The present paper presents KrishiMitra, an intelligent based on AI. A crop advisory system assists Indian to farmers in making informed decisions regarding farming. It provides an interactive web-based chatbot that educates users on farming interface, real-time advice on how to pick crops, maintain soil healthy, use fertilizer, and so forth.**

The processing of KrishiMitra provides farmers with agricultural tasks by means of AI and natural language. The system addresses issues in a well laid out and simple to understand manner. The proposed solution seeks to bind the conventional farming practices with recent technology which increases the productivity of crops, the system increases the sustainability of the system and quick decision making. The system is also easy to operate, expand and able to work in future. The innovations such as location and multilingual support suggestions are improved.

***Index Terms*—Smart Agriculture, Artificial Intelligence, Crop Advisory System, Machine Learning, Indian Farmers, Chatbot, Precision Farming**

I. INTRODUCTION

Agriculture is a very Significant aspect of India's economy. It makes a lot of money for the country and gives jobs to more than half of the population [1], [20].

Technology is becoming better all the time in other areas, but Indian farming still has a lot of challenges. These include changingweather, less fertile soil, pest infestations, not enough water, and not enough access to scientific agricultural knowledge [1, 12, 19].

These challenges are especially serious For small and marginal farmers, who make up majority of the farming community and usually make Decisions based on traditional methods or informal counsel [5, 19].

As the population grow quickly and the need for food grow, it is even more vital to employ farming practices that are good for the environment and work well [1, 12, 20]. Farmers often pick incorrect crop, use the wrong fertilizer, and waste resources when they don't obtain timely and accurate Guidance on how to cultivate crops. And this decreases productivity and loses them money [6, 18, 19]. Traditional agricultural extension services don't satisfy farmer's needs in real time because they are limited by geography, don't have enough experts, and don't provide information quickly enough [5, 12, 19].

Recent advancements in Artificial Intelligence (AI) and Machine Learning (ML) have shown great promise in addressing these challenges by enabling data-driven decision-making in agriculture [2], [3], [21]. AI-based solutions can provide you personalized and precise advise by taking into the consideration things like the weather, the demands of your crop, and other aspects [6], [14], [18]. These smart systems are highly crucial for precision agricultural, which aims to get the most out of farm inputs while also making sure the farm stays the productive and sustainable [8] [13].

In this KrishiMitra, is recommended as an AI-based smart crop advising system that was built specifically for Indian farmers [7], [14].

Utilizing an interactive web-based chatbot interface, the system aids farmers by providing them the guidance on topics like picking crops, taking care of the land, utilizing fertilizer, and fundamental

agricultural skills [7], [11], [16].
KrishiMitra aspires to combine ancient farming knowledge with modern technology by making a platform that is easy to use And can grow with the business, and is simple to use [10, 11, 17]. The recommended method assists Indian farmers by offering them quick and precise information, which in turn increases agricultural production, sustainability, and rural life [1, 8, 12, 20].

II. LITERATURE REVIEW

In recent years, interest in the use of digital technologies in the practice of farming has been growing. This is due, in part, to the growing need to produce food sustainably, as well as the need to manage resources more efficiently. Researchers have focused on the intersection of Artificial Intelligence (AI) and Machine Learning (ML) in achieving greater productivity in farming and the improvement of data driven decision support systems. These technologies assist in the analysis of large data sets in farming and aid farmers in making informed decisions on what crops to grow, how to manage their soils, and how to maximize their yields.

The use of advanced analytics and sensing technologies in the practice of precision farming have been the sole focus of many studies. In their work, Kamilaris et al. showed some of the first instances of success in the analysis of agricultural datasets using ml algorithms to predict crop yield and, therefore, increase efficiency of resource inputs. In the same way, Liakos et al. drew attention to the use of AI in the agricultural field, particularly the practice of crop monitoring, disease detection, and yield forecasting. all of these studies showed the ability of these technologies to improve productivity; however, the large need for specialized resources and trained personnel to use them severely limited, in many instances, their use by subsistence farmers.

Research has been conducted on analysis systems for soil and recommendations for fertilizers. Jain et al. created a system for classification of soil using machine learning to help optimize the application of fertilizers. Patel et al. created decision-support systems for the management of nutrients, based on soil health indicators. These systems manage the inputs of agriculture better, but they tend to be stand-alone applications and do not provide end users with any real time responses.

Ever since smart agriculture has begun, the systems of automated advisories based on weather has been important to research. Mishra et al. documented the impact of the decision support systems based on the varied climate on the unplanned forecasted changes and how that results in the loss of crops. Agricultural advisories integrated with forecasts of weather in order to improve the resilience of the farms is supported by the fao. There is a benefit in the above systems, but the systems are always complex and not easy to use for a farmer with a low level of technological variability.

In the last couple of years, there has been great interest in the use of chatbots and conversational AI to provide agricultural information. Using chatbots in the provision of agricultural extension services was demonstrated by Patel et al. as enabling farmers to obtain real time advice through text-based conversations. Smith et al. highlighted the unique characteristics of knowledge, conversational systems, and in particular, the ability and the potential to operate 24 hours, 7 days a week. However, most of the available chatbot-based solutions suffer from the absence of sufficient understanding of contextual problem domains and therefore, fail to address, in totality, the guidance that may be available in the agricultural sector.

Most ai based solutions focused on the agriculture sector address their problems in a disintegrated manner, for instance, yield prediction, disease identification, detection, and recommendation of fertilizers, etc. Literature has identified the absence of comprehensive, seamless, and integrated systems conversational interface, crop advisory services, and holistic tailored solutions for Indian farmers. This research gap is being addressed by the KrishiMitra system which provides a unique combination of AI powered conversational assistance integrated with agricultural framework knowledge.

Author(s)	Primary Focus	Key Technologie s/Methods	Main Findings/Cont ributions
Senthil Kumar et al.	Leveraging AI to enhance crop recommen d ation, disease prediction, weed detection	ResNet152V 2 (pre- trained Keras model) for image classification (weed detection)	Accurate weed identification with ResNet152V2, Crop recommendati on system based on nutrient and climate data
Cheruku et al.	Examining the role of digital agriculture technologi e s in promoting sustainable agriculture in India.	Analysis of digital and precision agriculture tools	Highlights the potential of digital technologies in improving productivity and sustainability
Barbedo	Analyzing the effectivene s s and challenges of using deep learning, particularly CNNs, for plant disease classificati o n.	Convolution a l Neural Networks (CNNs) - Transfer learning techniques	Highlights the growing success of deep learning in plant disease detection since 2015 - Analyzes performanceaffectin g factors through CNN experiments

III. PROBLEM STATEMENT

Agriculture plays a major role in India's economy and food supply, but in a reality, many farmers continue to struggle in their day-to- day work in our life. In several rural regions, farming methods have a remained almost the same for a years. One main reason for this is a farmers do not always have proper access to modern tools of reliable expert guidance. Small and marginal farmers are especially affected, as they act to often rely on local advice or informal sources of information, which are not always accurate or regularly updated.

Another issue that cannot be ignored is the lack of timely crop- related guidance. In a many cases, the farmers are forced to depend on past experience instead of scientific recommendations. This applies to important decisions such as crop selection, fertilizer usage, soil care, and pest control. When such a decisions turn out to be incorrect, the impact is visible in the form of reduced yields, increased expenses, and long-term harm to the farmland. More, unpredictable weather conditions and changing climate patterns have made farming increasingly uncertain, adding pressure and risk to farmers' livelihoods.

Even though government companies and agricultural extension services strive to assist farmers with training programs and advisory centers, their effectiveness is hindered by geographical limitations, a lack of experts, verious problems and slow information sharing. Farmers in rural and remote areas often struggle to access these services and when they need them most work. Many more current digital use the agricultural platforms frequently feature complicated interfaces, language use , and limited customization, In which diminishes their usability for farmers who may not be very tech-savvy.

In a lot of different technological solutions have been proposed to address these challenges, to do there work easy such as mobile apps, the decision support systems, and prediction models that utilize machine learning. However, many of these solutions concentrate on particular areas like predicting crop yields or detecting diseases, and they fail to offer a complete advisory system that meets the varied information needs of farmers. Additionally, the absence of engaging and conversational interfaces

renders these systems less user-friendly for those who use them.

There is a clear need for a smart, easy-to-use agricultural advisory system that provides farmers with accurate and timely information in a straightforward way. A system like this should be able to understand farmers' questions in everyday language and offer relevant advice about crops, soil, fertilizers, and farming methods. Tackling this issue is crucial for boosting agricultural productivity, minimizing risks linked to misinformation, and encouraging sustainable farming methods in India.

IV. PROPOSED SYSTEM

A smart crop advisory platform based on AI called KrishiMitra. It is an AI-based smart crop advisory tool that will help Indian farmers with their farming in real time and with smart advice through a conversational interface. The primary objective of the system is to bridge the gap between traditional farming practices and modern agricultural technologies by delivering accurate, timely, and easy- to-understand recommendation. KrishiMitra works as a virtual farming assistant that farmers can reach at any time through a website in this way they decided the crop. The three main parts of the system architecture are the user interface, the AI-based processing module, and the advisory knowledge base. The system architecture is meant to be flexible and scalable. The user interface provides a simple and responsive web application that allows farmers to interact with the system by entering their agricultural queries in natural language. In this design, that is based on contract, one touches the bare minimum of technical terms so that people who use it don't drop out in rural areas.

The proposed system's main function is in an artificial intelligence- based processing module, which uses Natural Language Processing (NLP) techniques to understand and interpret user's words, soon replying with an answer. The system takes in farmers' input about which crops to grow, soil fertility,, servicing and general farming practices It generates responses tailored to the current situation, which are made using pre-set agricultural prompts as well domain- specific knowledge. By drawing on language models driven by AI.

KrishiMitra ensures that the responses are relevant, consistent, and aligned with standard agricultural guidelines.
The advisory database integrase pieces of information from reliable agricultural sources such as government portals, research papers, and suggestions from experts. KrishiMitra is designed to include only authentic sources of information for farmers, including government websites, research publications and advice from experts.

This ensures that the advice the system gives you is dependable, and it is scientifically proven. The system can be updated with new knowledge of agriculture, to stay relevant as farming practices and ecology evolve. When a user submits a question, he will rapidly receive a tailored welcome email which appears in his mailbox.

KrishiMitra is based on Cloud Infrastructure so that it is highly available, scalable, and easy to maintain. Rewording software is a type of software that helps you find new ways to say the same thing. This technique can help you come up with fresh, creative, and unique sentences and phrases. However the rewording software counts the number of what it calls useable words in your sentence or paragraph and divides that number (minus 3) by the total to get an average score. As an illustration the snail as a result occupies an average of
2.8 useable words per sentence. The output here is how a rewording software measures the useable words in sentences and paragraphs. Although this technique can produce a new version of old information it does not guarantee that you have found every relevant instance and meaning. We need your help finding these misplaced sentences! Cloud deployment design will enable the system to handle a larger and larger number of users without compromising performance of the system. In addition, the structurelia 2 allows for future developments such as bilingual support, location-based recommendations, weather integration and image-based crop disease detection.
Overall, the proposed system offers Indian farmers a comprehensive and easy-to-use package that brings together three quite different things: artificial

intelligence, conversational interfaces and agricultural expertise.

V. METHODOLOGY

KrishiMitra, is a AI-based smart crop they device system, it was built using an organized and methodical process to make sure it is fast, accurate, easy to use, and can grow. In this methodology they will broken up into many steps, such as gathering data, designing the system, processing AI, putting it into action, and rolling it out.
This systematic method makes sure that the system meets the agricultural advisory needs of Indian farmers.

5.1 Overall System Workflow

The workflow of KrishiMitra begins with user interaction and ends with the delivery of an AI-generated advisory response. Farmers submit queries related to crops, soil, fertilizers, or farming practices through a web-based interface.

5.2 Data Collection and Knowledge Base Development

The advisory knowledge base is created by collecting agricultural information from reliable and authoritative sources such as government agricultural portals, research publications, and expert recommendations. This data includes crop-specific guidelines, soil management practices, fertilizer recommendations, and general agricultural best practices. Using validated sources ensures that the system provides scientifically accurate and trustworthy advice.

5.3 System Architecture and Design

KrishiMitra follows a modular architecture consisting of a frontend interface, an AI-based processing module, and a backend advisory engine. The frontend is developed using modern web technologies to ensure responsiveness and ease of use. The backend integrates AI-driven NLP models to interpret queries and generate responses based on contextual understanding.

5.4 AI Processing and Response Generation

It is very important for us to know Natural Language Processing in order to get the real meanings of users who ask questions in the language of ordinary people. The input is processed by this AI module recognizing the keywords, intention and the context of agricultural matter(s). From the processed input, the system manufactures context-corresponding answers from agricultural domain knowledge. This technique allows for personalized communications with users' needs fully taken into account rather than requiring them to be an expert in his own right.

5.5 Deployment and Testing

The system is deployed using cloud infrastructure to ensure high availability, scalability, and easy maintenance. Cloud deployment allows the system to support multiple concurrent users and enables seamless updates to the knowledge base. Functional testing is performed to validate system responsiveness, accuracy of responses, and overall user experience.

5.6 Methodology Advantages

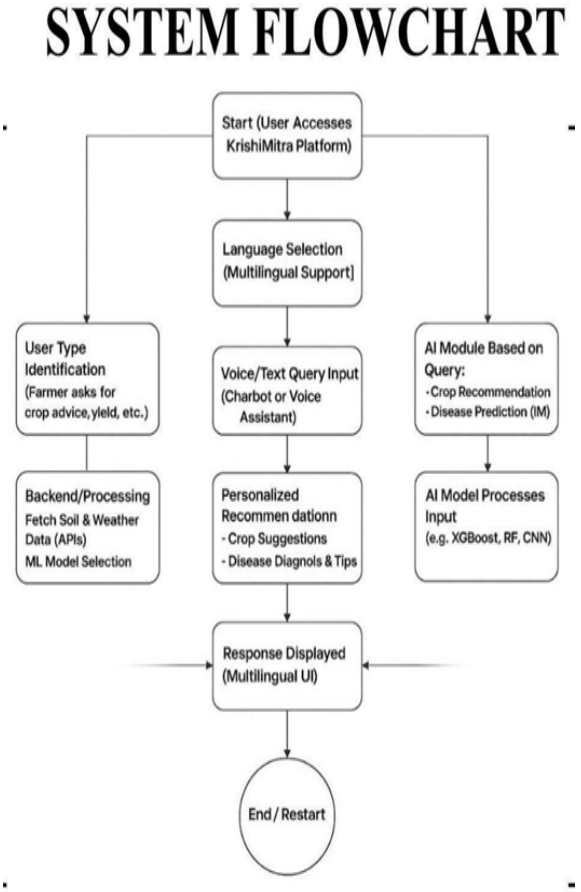
The proposed methodology ensures:

- 5.6.1 Reliable and scientifically validated agricultural guidance
- 5.6.2 User-friendly interaction through conversational AI

VI. EXPECTED OUTCOMES

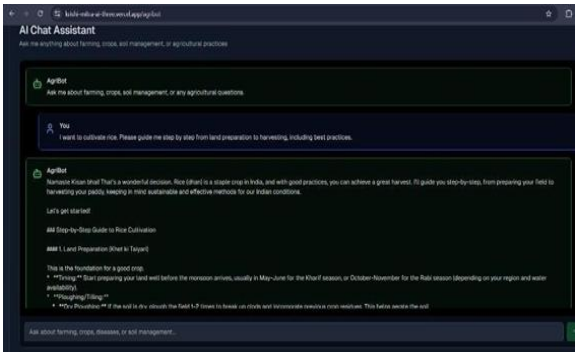
There is one idea that does stand out and that is better tools change the way that farmers work. When advice is imparted by means of smart conversations, old barriers begin to fade. Instead of re merely using neighbors(or just plain old guesswork) help arrives in clear steps. Hiding behind every question is an opportunity to grow more wisely. The same for small farms as large farms when answers are easy to reach. Knowledge - is faster now, one message at a time Small scale growers generally are have the problem with location- based challenges. Boost on how much crops produce really stand out as a key become a result of the use of this system. Out in fields help comes round of a quiet - advice on what crops suits best, how soil reacts, what research says about feeding plots right. The more moves as we see visibly as we see what, works. This way, we are able to get a yield and better grade. We make choices on purpose of just guessing. We process the equipment in such a way

and not waste supplies. We do this every year. When we pay attention to the things that the soil get better slowly. This is because we farm in a That way's good, and the soil, and that would be for a long time. The way of We utilize farming that is made to last

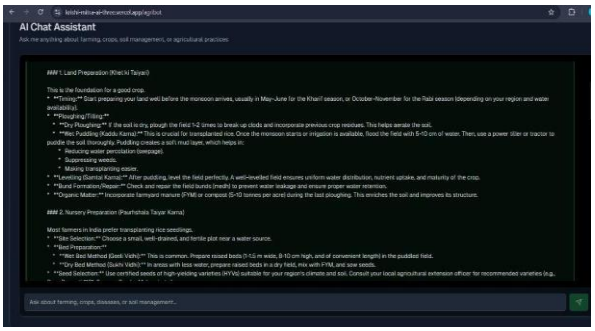


When we have crops lost we get more stable harvests. If farmers get advice quickly they make fewer mistakes like using the wrong fertilizers or picking the wrong seeds. If the guidance is based on what the weather's, like farmers can change the way they plant their crops. The farmers make mistakes when they think about the local conditions. This makes things more stable even when the seasons are not behaving like they usually do. It is really important to reduce the risks especially when the weather is weird.

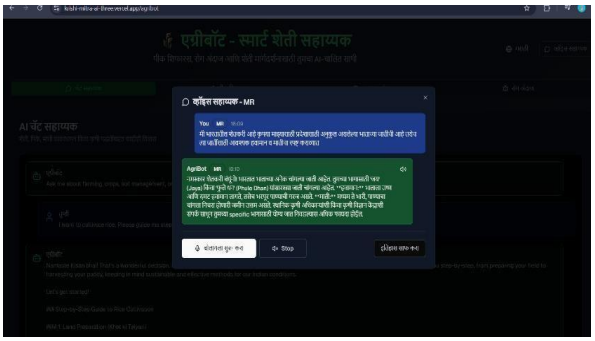
Farmers might pick up new ideas just by messages with KrishiMitra over time. Each talk could slowly sharpen their grasp of science- based growing methods instead of old habits. Because it feels like a conversation, people may return often without even noticing they are learning. This steady back-and-forth helps strengthen skills across entire village networks where farming runs deep.



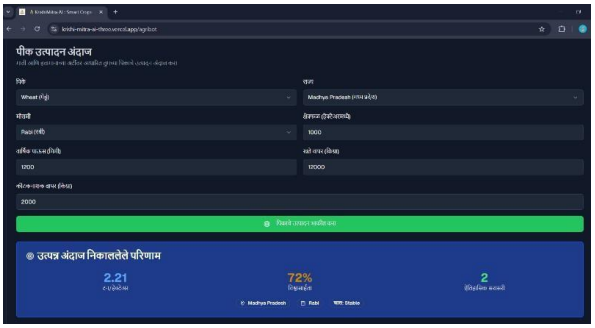
Output 1: KrishiMitra AI chatbot interface for rice cultivation guidance



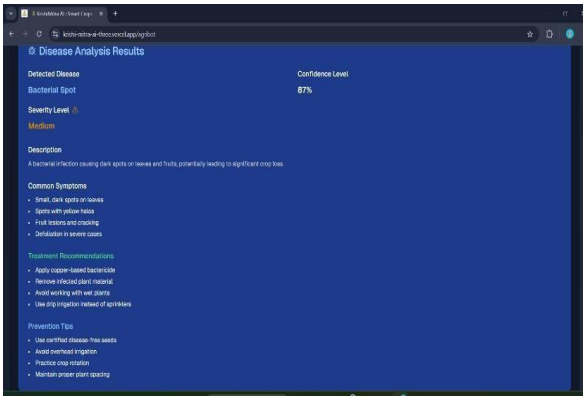
Output 2: KrishiMitra AI chatbot interface for rice cultivation guidance



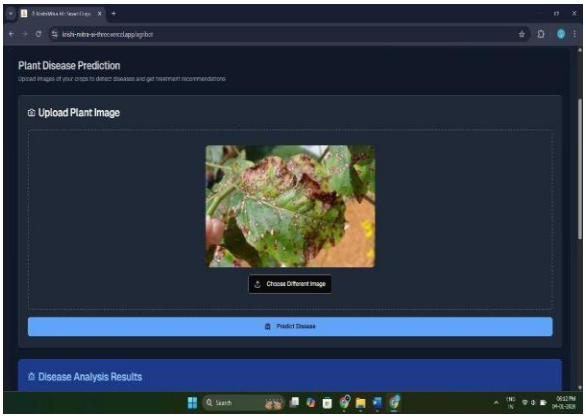
Output 3: Voice-based Marathi interaction with the KrishiMitra AI chatbot for crop advisory



Output 4: AI-powered crop yield estimation interface of KrishiMitra



Output 5: AI-powered crop yield estimation interface of KrishiMitra



Output 6: AI-based plant disease detection module of KrishiMitra

VII. CONCLUSION

A new era has arrived due to digital technology, which has great potential for solving some of the enduring problems in farming and in particular developing countries like India. KrishiMitra, an AI-based smart crop advisory system was unveiled by the researchers, designed to offer comprehensive guidance on farming as you require it in real time.In order to make agriculture better suited for the early 21st century, such a system was needed.

The study highlights the importance of integrating Artificial Intelligence (AI) and Natural Language Processing (NLP) into agricultural advisory services to overcome limitations associated with conventional extension system. Farmers once relied heavily on spotty advice from local hubs or word of mouth. Now KrishiMitra gives them a smooth digital space to explore answers. Instead of waiting around for help, they tap into steady guidance online. Information flows clearer through this tool than it ever did before. Physical visits fade when screens offer quicker clarity.

One thing becomes clear - KrishiMitra is pushing farm tech forward in India, using smart tools powered by artificial intelligence to help growers make better choices every day. Right now, it works through websites, though that might shift. Down the line, efforts will stretch its reach to more rural areas while sharpening how well the system learns and responds.

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