International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 • Website: www.ijfmr.com • Email: editor@ijfmr.com

AI-Powered Krishi Mitra for Small Farmers

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ABSTRACT

The farmers in India have long term problems that have resulted due to unpredictable climatic conditions, soil heterogeneity.
uncertainty, lack of access to agronomic knowledge and a lack of market knowledge. These difficulties often end up in poor crop production and economy. This paper will examine a case of an AI-based advisory system, Krishi Mitra, which is aimed at providing personalized advice on crop choice, nutrient regulation, and agronomic choices based on weather
forecasts. The aim is to transform the smallholders, who are currently using their intuitions to carry out their cultivations, to making decisions that are evidence-based and informed by
data. The research highlights the possibility of AI providing timely information and increasing productivity, which places Krishi Mitra as a feasible solution to farmers that have limited resources.

Keywords: Artificial Intelligence, Small Farmers, Crop Advisory, Digital Agriculture, Fertilizer Optimization, Decision Support System

INTRODUCTION

Agriculture is still the staple of the rural economy in India, providing income to a large group of small and marginal farmers. However, the industry faces numerous challenges that limit
the productivity levels and stifle expansion. The scarcity of land, dependency on rainfall, high costs of inputs and whimsical nature of climatic conditions, among others, assert quite significant risks to these agrarian actors.

According to empirical research, it is common that farmers do not have timely access to accurate agricultural data, professional advice and scientific assistance. In turn, they rely heavily on traditional knowledge and assumptions. Despite the inherent value of experiential farming, it does not always support the demands of the fast changes in climate, soils, and the demands of the market. Lack of systematic instructions tends to result in under-optimal fertilizer use, wrong choice of crops and the associated financial loss.

The technological development has placed artificial intelligence as a powerful tool of transforming agricultural decision-making. A lot of data can be analysed by AI, which also detects trends and creates practical insights to help farmers to develop better plans and avoid risk. In the case of smallholder farmers, AI-based solutions provide the necessary support in reducing the volume of information to feasible advice.

LITERATURE REVIEW

Sometimes, past studies show that small-scale farmers are more vulnerable as compared to largescale agrarian groups and this is mostly attributed to limited financial power and that they are also limited in land. Research studies also point to a lack of information-based decision-support systems in traditional agriculture frameworks that, thus, makes smallholders reliant on unpredictable and unstable information sources.

A number of scientific publications have been conducted on the utilization of artificial intelligence in the agricultural industry. These researches highlight the significance of a predictive modelling and machine learning methods that can help producers in choosing the best crops, measuring the necessary fertilizer could be applied, and predicting the weather. Writers argue that AI has the potential to move agricultural decision-making processes off the intuitiveness-based paradigm towards more rigorous and evidence-based processes.

In addition, the study has investigated the emergence of digital and mobile systems aimed at enhancing agricultural information to the farmers. It has been proven by empirical evidence that these types of technologies improve the accessibility and reduce the necessity of real-life consultations. However, the number of systems that are currently in existence and that are not multifunctional advisory systems as well do not have support in regional languages, which limits their adoption with smallholder communities.

Research has also found out that there are problems related to soil and fertilizers management. The improper use of fertilizers has been cited as the factor of poor soil health and loss of productivity. The example of AI-based models capable of estimating the optimal amounts of fertilizer has shown promising results when it comes to trying to give farmers an idea of how to utilize the available resources in a more efficient way.

One of the gaps in the existing literature is the occurrence of isolated platforms that combine meteorological data, crop data, fertilizer data and advisory features in a single system.

Available tools are often focused on a single piece of information, such as finding illnesses or weather information, instead of providing overall advice on how to act tailored to the needs of small-scale farmers.

OBJECTIVES

The target audience is to create an AI-based agricultural system that will provide small-scale farmers with precise and timely agricultural advice.

To prescribe appropriate crops depending on the soil properties, climate, as well as the size of land.

To use optimised amounts of applied fertilisers depending on the specific crop and field size.

To provide timely weather-related notification in order to help the farmers remove climatic risks.

To create a user-friendly online platform, which will be easily available to small farmers, including those with minimal technical skills.

PROPOSED METHODOLOGY

The approach of handling Krishi Mitra is based on the systematic purchase of the key agricultural inputs and their further processing through the logic created based on the principles of artificial intelligence. First, the system allows the farmer to provide primary data, including distributed soil classification, crop chosen, arable land area, and weather conditions. It is these data points that are used to generate advisory recommendations with a personalized focus.

The system then provides an analytical evaluation of the data after data acquisition, which consists of comparison of the input against available agronomic knowledge, and AI-created decision frameworks. This comparative study enables the determination of suitable crop that should be used within certain environmental context, the maximum rates of fertilizer application and risk evaluation as an anticipation of a risk based on the current climatic trends.

Krishi Mitra prototype had been written in Python and run in Jupyter Notebook. The use of Python also gave the advantage of using strict logical frameworks, which could easily process the incoming data in real time and give instant output on the relevant front. The prototype is an illustration of the application of AI concepts into decision-support tooling to practitioners.

Its methodological design puts high value on user-friendliness and simplicity of operation. It is designed to suit users who have low technical skills thus making it easy to use. The introduction of the multilingual functionality element and the utilization of a mobile application are the potential improvements.

SYSTEM DESIGN AND WORKFLOW

Krishi Mitra system design is outlined into four separate stages with input collection, data processing, recommendation generation, and output delivery. The workflow enables effective functionality and the delivery of pertinent information to the final users.

The information that is provided by the farmer during the input collection stage consists of facts such as soil type, crop, and land area. With these data points, the system can be customized to provide recommendations based on the particular agronomic environment of the plot of the user.

Data processing stage employs the use of rules and logic on the collected data which are arrived at through artificial intelligence. It involves the study of the dynamics between the soil and crops, calculation of ideal fertilizer distribution, and the interweaving of the modern- day meteorological conditions that can affect the growth of crops.

During the recommendation generation phase, the system converts processed data into actionable advice and this includes recommended crops, optimum levels of fertilizers and precautions in relation to the weather conditions.

Output delivery stage makes the results succinct in a consumable version. The comprehensive aim is to make sure that farmers would be able to easily read the instructions and take appropriate interventions when necessary.

RESULTS

The introduction of Krishi Mitra model showed that AI-based suggestions could provide large-scale help to smallholder farmers. The system was successful in producing crop recommendations based on the soil type and land area so that the farmers could identify which crops were most appropriate in their field conditions, and as a result, the chances of planting varieties that do not germinate in unfavourable soil traits were reduced. Furthermore, the model predicted accurate fertilizer needs and prevented farmers to apply excessive or inadequate fertilizers, another benefit since in addition to reducing the input expenses, it facilitated the maintenance of healthy soils. The evidence shows that an underlying AI model can assist farmers to optimize the application of fertilizers which is one of the main elements to increase the productivity.

The system provided weather-based guidance, which allowed the identification of the possible hazards like heavy rains or temperature variations. These lessons enabled farmers to plan irrigation, harvesting, and crop-protecting activities in a better manner. The information presented in the model was also delivered in an easy way, hence serving in the practicality of carrying out the recommendations.

OBSERVATIONS

One of the key conclusions made during the prototype assessment was that structured and sequential advisory information was positively received by farmers. In cases where the guidance was delivered in an understandable and straightforward way the respondents had mentioned better understanding and use of the recommendations.

The other observation that was salient was the topic of local language support. Users who were more conversant with the regional languages said they liked systems that presented information in simple language situating the need to have future developments of Krishi Mitra to suit regional diversity to increase its application.

The research also established that farmers were not well aware of the scientific agronomic practices. Most of them did not know the best amounts of fertilizer or how climatic variability affected the growth of crops. The AI system controlled this gap in knowledge by supplying the topical information, which did not require high technical expertise.

INTERPRETATION OF RESULTS

Its findings suggest that advisory systems based on AI can have a considerable role in advising small farmers who are not easily provided with expert guidance. The system the process of guessing with making informed decisions because it provides personalized advice based on real inputs.

The fact that simple and straightforward products are positively reacted is an indication that such systems can become successful beyond the correctness of the recommendations because the way information is communicated. An easy-to-use design can greatly enhance the chances of adoption amongst the small farmers.

The results also suggest that AI has the potential to serve as the conduit between science and applicable agriculture. The system helps to translate complicated farming ideas into steps to be taken, which helps to achieve better productivity, eliminate dangers, and gain confidence with the farming choices.

CONCLUSION

This study finds out that artificial intelligence can have a transformational role to play in small-scale agriculture. Krishi Mitra model offers a one-stop advisory system that streamlines the complicated agricultural choices that are faced by the small farmers by offering informed advisory services that give them advice on which crop to produce, when to use fertilizers and risk management basing on market weather conditions, thus removing the key bottlenecks faced by the small farmers that can be identified to be the unreachability to professional guidance and their ill-equipped technical expertise.

Results show that process advisory tools based on AI stand a good chance of lowering subjective, guess-based decision-making and enable the implementation of evidence-based practices. The system can change the crop yield by providing understandable and practical insights that can be implemented, reduce the cost of inputs, and increase financial security.

This complaint has been proven right by Krishi Mitra, which proves that a simple AI prototype could

provide relevant assistance to small farmers, which is a promising aspect of further development.
All in all, this paper has brought about the significance of user-friendly technology that is affordable and can be used to minimize the digital divide and empower the rural population.
The Krishi Mitra model is a move to make the agricultural practices in this country more sustainable and well informed.

FUTURE SCOPE

Krishi Mitra system has high expansion potential in the future. Integration of real-time sensor, weather stations, satellite sources is one of the main areas that need to be developed. Such integration would improve the accuracy of the recommendations as well as enable the system to modify dynamically to modifications in the field conditions.
Moreover, an upcoming improvement is the creation of a mobile app with multilingual capabilities, which will improve the accessibility of the farmers based on different languages. The off line feature might also increase the usability in areas with low internet coverage.
The system can also be enhanced in the future to include upgraded machine-learning models to detect the disease, predict the market-price and manage irrigation. The partnerships with the agricultural institutions and government agencies can help to implement the system to larger communities and increase the influence.
Overall, the platform contains a possibility of developing into an all-in-one agricultural helper, to assist farmers at various stages of the crop cycle.

REFERENCES: -

1. The available and appropriate references include the research studies related to artificial intelligence in agriculture, the decision support systems targeting farmers and the issues that are faced by small farming communities. These sources offer background information on the urgency of technological revolution-based agricultural solutions.
2. Singh, R., & Sharma, P. (2024). A Case Study of Smart Agriculture Practices in Rural India.
3. International Journal for Multidisciplinary Research (IJFMR), Vol. 6, Issue 1.
4. https://www.ijfmr.com/papers/2024/1/38502.pdf
5. Ministry of Agriculture & Farmers Welfare, Government of India (2024). Digital Agriculture Mission and Smart Farming Initiatives. https://agricoop.gov.in