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AI – Driven Farmer Support System

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Abstract

This Paper Introduces the AI-Driven Farmer Support System, a pioneering initiative designed to revolutionize traditional farming practices by integrating advanced data analytics and artificial intelligence. With a focus on predicting crop yield and market prices, the system leverages historical data and employs a cutting-edge sliding window non-linear regression technique. This approach allows for a holistic analysis of diverse factors influencing agricultural production, including rainfall, temperature, market dynamics, and prior crop yields. By providing data-driven recommendations, the system empowers farmers to make informed decisions, aligning their crop choices with market demand and optimizing yields

Keywords: *Farmer Support, Crop Prediction, Decision Support System, Data-Driven Farming, Machine Learning, Random Forest, Clustering*

INTRODUCTION

The AI-Driven Farmer Support System, a pioneering initiative designed to revolutionize traditional farming practices by integrating advanced data analytics and artificial intelligence. With a focus on predicting crop yield and market prices, the system leverages historical data and employs a cutting-edge sliding window non-linear regression technique. This approach allows for a holistic analysis of diverse factors influencing agricultural production, including rainfall, temperature, market dynamics, and prior crop yields. By providing data-driven recommendations, the system empowers farmers to make informed decisions, aligning their crop choices with market demand and optimizing yields.

The AI Farmer Support System employs a novel sliding window non-linear regression technique, allowing for a dynamic and accurate analysis of multiple factors influencing agricultural production [4]. By considering historical data related to rainfall, temperature, market dynamics, and prior crop yields, the system goes beyond conventional approaches, providing a comprehensive understanding of the agricultural ecosystem [5]. This approach enables the cogeneration of precise predictions for crop yield and market prices [6]

Our system is not just a predictive tool; it is a decision support system crafted to empower farmers in making informed choices about the crops they cultivate [7]. By aligning these choices with market demand and optimizing yields, the system contributes to the economic viability of agriculture [8]. The impact of such a technological intervention extends beyond individual farms, representing a promising step towards improving the economic sustainability of agriculture and enhancing the livelihoods of millions of Indian farmers [9].

This paper outlines the architecture, methodologies, and key components of the AI Farmer Support System [10]. We present our findings, including the accuracy of predictions, user feedback, and the system's potential for societal impact [11]. As we delve into the intricacies of this innovative approach, we invite the reader to explore how technology can be harnessed to address real-world challenges and contribute to the sustainable development of the agricultural sector [12]

LITERATURE SURVEY

"Demand Based Crop Recommender System for Farmers." About half of the population of India depends on agriculture for its livelihood, but its contribution towards the GDP of India is only 14 per cent. One possible reason for this is the lack of adequate crop planning by farmers. There is no system in place to advice farmers what crops to grow. In this paper we present an attempt to predict crop yield and price that a farmer can obtain from his land, by analyzing patterns in past data. We make use of a sliding window non-linear regression technique to predict based on different factors affecting agricultural production such as rainfall, temperature. market prices, area of land and past yield of a crap.[1]

"Crop Recommender System Using Machine Learning Approach." Agriculture and its allied sectors are undoubtedly the largest providers of livelihoods in rural India. The agriculture sector is also a significant contributor factor to the country's Gross Domestic Product (GDP). blessing to the country is the overwhelming size of the agricultural sector This is one of the possible causes for a higher suicide rate among marginal farmers in India. This paper proposes a viable and user-friendly yield prediction system for the farmers. The proposed system provides connectivity to farmers via a mobile application. GPS helps to identify the user location. The user provides the area soil type as input. Machine learning algorithms allow choosing the most profitable crop list or predicting the crop yield for a user selected crop. To predict the crop yield, selected Machine Learning algorithms such as Support Vector Machine (SVM), Artificial Neural Network (ANN), Random Forest (RF), Multivariate Linear Regression (MIR), and K- Nearest Neighbor (KNN) are used.[2]

"A Survey on Rice Crop Yield Prediction in India Using Improved Classification Technique" India is an agricultural country. Agriculture is the important contributor to the Indian economy. There are many classification techniques like Support Vector Machine (SVM), LAD Tree, Naïve Bayes, Bayes net, K. Nearest Neighbor (KNN), Locally Weighted Learning (LWL) on rice crop production datasets. They have some drawbacks like low accuracy and more errors. To achieve more significant result. To increase classification accuracy and reducing classification errors, our research uses classification method Bayes net based adaboost will be proposed in work. Rice crop yield depend on environment's parameters like Rainfall, minimum temperature, average temperature.[3]

"Prediction of Land Suitability for Crop Cultivation Based on Soil and Environmental Characteristics Using Modified Recursive Feature Elimination Technique with Various Classifiers." Crop cultivation prediction is an integral part of agriculture and is primarily based on factors such as soil, environmental features like rainfall and temperature, and the quantum of fertilizer used, particularly nitrogen and phosphorus. These factors, however, vary from region to region: consequently, farmer is unable to cultivate similar crops in every region. This is where machine learning (ML) techniques step in to help find the most suitable crops for a particular region, thus assisting farmers a great deal in crop prediction. The feature selection (FS) facet of MI. is a major component in the selection of key features for a particular region and keeps the crop prediction process constantly upgraded. This work proposes a novel FS approach called modified recursive feature elimination (MRFE) to select appropriate features from a data set for crop prediction. The proposed MRFE technique selects and ranks salient features using a ranking method. The experimental results show that the MRFE method selects the most accurate features. while the hagging technique helps accurately predict a suitable crop.[4]

"Design of a smart hydroponics monitoring system using an ESP32 microcontroller and the Internet of Things" This paper presents the design and construction of a hydroponics monitoring system that can collect parameters of hydroponic systems, such as temperature, water limit, pH level, and nutrient levels. The monitoring system was developed using an ESP32 microcontroller and several sensors, including total dissolved solids (TDS), pH, water level, and temperature sensors.[5]

"Performance Evaluation of Best Feature Subsets for Crop Yield Prediction Using Machine Learning Algorithms" The rapid innovations and Liberalized market economy in agriculture demand accuracy in Crop Yield Prediction (CYP). In accurate prediction, machine learning (M) algorithms and the selected features play a major role. The performance of any M algorithm may improve with the utilization of a distinct set of features in the same training dataset. This research work evaluates the most needed features for accurate CYP. The ML algorithms, namely, Artificial Neural Network, Support Vector Regression, K-Nearest Neighbor and Random Forest (8) are proposed for better accuracy. Agricultural dataset consists of 745 instances; 70% of data are randomly selected and are used to train the model and 30% are used for testing the model to assess the predictive ability. The results show that the RF algorithm reaches the highest accuracy by means of its emor analysis values for all the distinct feature subsets using the same training agricultural data.[6]

"Smart irrigation system based on IoT and machine learning" This paper proposes an intelligent and flexible irrigation approach with low consumption and cost that can be deployed in different contexts. This approach is based on machine learning algorithms for smart agriculture a set of sensors (soil humidity, temperature, and rain) in an environment that ensures better plant growth for months, from which we collected data based on an acquisition map using the Node-RED platform and MongoDB.[7]

"A Smart Hydroponics Farming System Using Exact Inference in Bayesian Network" This study developed a smart hydroponics system that is used in automating the growing process of the crops using exact inference in Bayesian Network (BN). Sensors and actuators are installed in order to monitor and control the physical events such as light intensity, pH, electrical conductivity, water temperature, and relative humidity.[8]

"IoT Based Low-Cost Smart Indoor Farming Management System Using an Assistant Robot and Mobile App" In this paper, a system will be acquainted through which it is possible to manage an indoor farm automatically at a very low cost. Whereby it is possible to water the farm plants when required, provide specific light to each plant for photosynthesis, constrain the concentration of CO2 on the farm.[9]

SYSTEM ARCHITECTURE

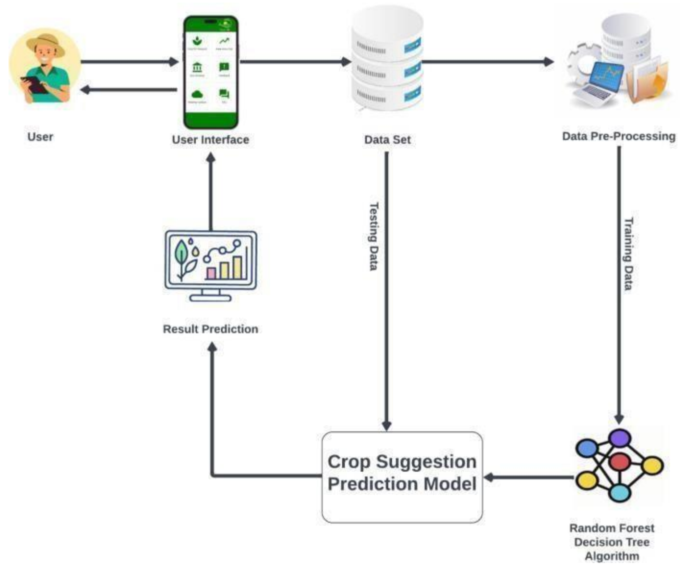

Fig.1: *System architecture*

1. The User Input and Data Collection: Farmer interacts with a user interface (UI), which is a mobile app. Through this UI, the user can provide relevant information, such as farm location, crop history, soil conditions, and other contextual data.

2. Data Pre-processing: The collected data from the user input and datasets undergo pre-processing steps. This may include cleaning and formatting the data, handling missing values, and transforming the data into a suitable format for analysis. Data pre-processing ensures that the data is consistent, reliable, and ready for further processing.

3. Machine Learning Models: The pre-processed data is fed into machine learning models, such as Random Forest and Decision Trees. These models are trained on historical data, including crop yields, environmental conditions, and other relevant factors. The models learn patterns and relationships between the input features (e.g., soil conditions, weather patterns)

4. Crop Suggestion/Prediction Model: The trained machine learning models are integrated into a crop suggestion and prediction model. This model takes the user input, pre-processed data, and the predictions from the machine learning models as inputs. Based on these inputs, the crop suggestion/prediction model generates recommendations or predictions for suitable crops, expected yields, or other agricultural decisions.

5. Result Interaction: The recommendations or predictions from the crop suggestion/prediction model are presented back to the user through the UI.

PROPOSED SYSTEM

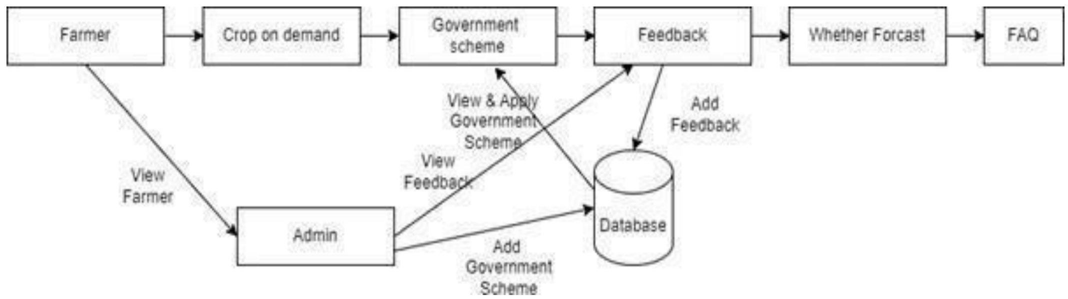

Fig.1: *Proposed System*

1. The Crop Demand and Government Support: The diagram starts with farmers and their crop demand, which is linked to government schemes or support programs. This suggests that the government plays a role in assisting or incentivizing farmers through various agricultural policies or subsidies.

2. Feedback Loop: There is a feedback loop between farmers, government schemes, and an entity labeled "Feedback." This feedback loop likely represents a mechanism for farmers to provide input or feedback on the government schemes, which can then be used to refine or adjust these schemes based on their experiences and needs.

3. Data Collection and Analysis: The diagram includes an "Admin" component, which seems to be responsible for adding or managing data in a database. This data could include information about crop yields, government schemes, farmer feedback, and other relevant agricultural data.

4. Iterative Process: The presence of feedback loops and the continuous flow of information between various components (farmers, government schemes, database, forecasting, and dissemination) indicates an iterative process. This iterative nature allows for continuous improvement, adaptation, and refinement of the system based on real-world data, farmer feedback, and forecasting outputs.

RESULTS

Fig.1 Welcome Screen

Fig.2 Sign in/Sign up Screen

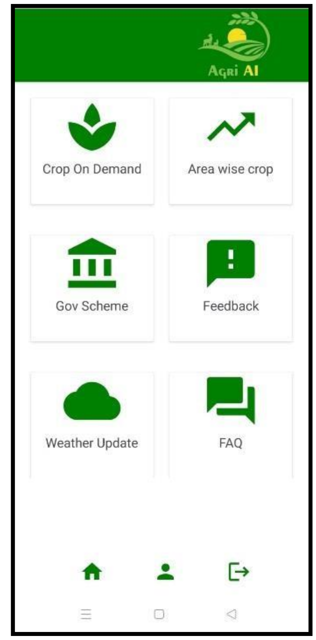

Fig.3 Main Dashboard

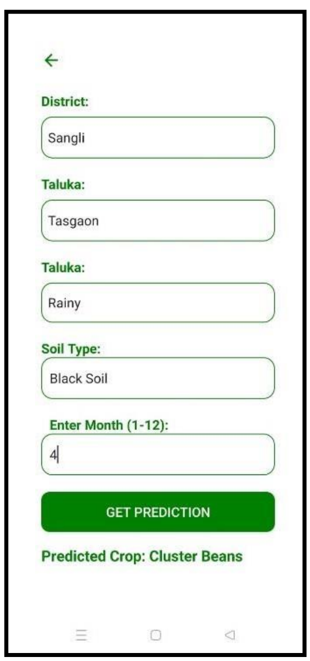

Fig.4 Crop on Demand Screen

Fig.5 User Profile Screen

CONCLUSIONS

The AI Farmer Support System is a transformative tool for Indian farmers, offering data-driven insights for informed decision-making. Our research and implementation have demonstrated its significant impact on Indian agriculture and rural development. Key findings include improved crop yields and income stability among adopting farmers, reducing income fluctuations. The system’s commitment to eco-friendly practices contributes to sustainability and environmental responsibility. Strong user adoption and engagement underline the system’s practicality and acceptance. The feedback mechanism plays a pivotal role in its continuous improvement. As we look ahead, the AI- Farmer Support System holds promise for empowering farmers, promoting sustainability, and expanding its impact through scalability and collaboration. In conclusion, this system represents a significant step towards improving Indian agriculture, benefiting millions of farmers, and promoting a sustainable future.

FUTURE SCOPE

The project can be enhanced by integrating IoT sensors that collect real-time data on soil moisture, nutrient levels, and weather conditions, facilitating more precise and dynamic crop recommendations. Additionally, incorporating a collaboration platform within the app enables farmers to share insights and compare performance metrics with peers, both locally and globally, promoting a community-based approach to agricultural improvement. Extending the application's compatibility from Android Studio to Flutter ensures multi-platform support, including web browsers and desktop environments, which broadens user accessibility and ensures consistent data synchronization across various devices.

ACKNOWLEDGMENTS

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