International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 04 | Apr 2024 www.irjet.net p-ISSN: 2395-0072

Cloud Enabled Crop Recommendation System To Prevent Inflation using machine learning

Gauri Raut[1], Prof. N.M. Yawale[2], Pragati Bhagat[3], Hrishikesh Landge[4], Sanket Kamdi[5]

[1]Student, Dept. of CSE Engineering, PRMIT&R college, Maharashtra, India
[2]Assistant Professor, Dept. of CSE Engineering, PRMIT&R college, Maharashtra, India
[3]Student, Dept. of CSE Engineering, PRMIT&R college, Maharashtra, India
[4] Student, Dept. of CSE Engineering, PRMIT&R college, Maharashtra, India
[5] Student, Dept. of CSE Engineering, PRMIT&R college, Maharashtra, India

---***---

Abstract - *The Agricultural Management System (AMS) is an extensive online platform designed to boost agricultural efficiency and productivity for farmers. This system integrates various features covering different aspects of crop management, purchase tracking, and predictive analysis to empower farmers with valuable insights and tools for informed decision-making. The AMS offers farmers a user-friendly interface to input and manage crop-related information such as crop names, estimated production quantities, and plantation dates. By consolidating this data, farmers can easily monitor and track the progress of their crops, facilitating better planning and management throughout the cultivation process. Moreover, the purchase tracking feature enables farmers to maintain a detailed record of their transactions, including information about sellers, purchased quantities, and transaction dates. This functionality aids in better inventory management and financial tracking, ensuring that farmers can efficiently manage their resources and expenditures. One notable aspect of the AMS is its predictive analysis capabilities. By analyzing market trends, demand-supply dynamics, and crop requirements, the system provides farmers with actionable insights into the most favorable crops for cultivation. Through predictive modeling, the AMS identifies crops that align with market demands and agricultural conditions, helping farmers make strategic decisions to maximize yields and profitability.*

Key Words: Demand and Supply, Inflation reduction, K-Mean Algorithm, Cost-efficient, Yield Productivity, Supply chain.

1.INTRODUCTION

Agriculture has long been recognized as a cornerstone of human civilization, shaping societies from ancient times to the present day. The cultivation of crops and the husbandry of livestock have been essential for sustaining life and driving economic progress. However, the agricultural sector is continually evolving due to factors such as technological advancements, demographic shifts, and environmental changes, presenting new challenges that demand innovative solutions.

Introducing the Agricultural Management System (AMS), a groundbreaking approach to agricultural management developed to meet the evolving needs of farmers. By harnessing state-of-the-art technology and data analytics, the AMS aims to optimize agricultural operations, enhance productivity, and promote sustainability. Equipped with a comprehensive suite of tools and features, the AMS empowers farmers to make informed decisions and achieve greater success in their farming endeavors.

At its core, the AMS serves as a centralized platform for managing all aspects of crop cultivation and management, spanning from planning and planting to harvesting and marketing. Farmers can utilize the AMS to input and track crucial crop-related data, including crop varieties, planting schedules, anticipated yields, and cultivation techniques. This enables meticulous record-keeping and provides valuable insights into performance metrics, facilitating data-driven decisions to optimize productivity and mitigate risks.

A notable feature of the AMS is its capability to facilitate seamless purchasing and inventory management. Through an integrated purchasing module, farmers can easily log and monitor transactions with suppliers and buyers, track inventory levels, and analyze purchasing patterns. This heightened visibility into the supply chain empowers farmers to make well-informed decisions regarding procurement strategies, pricing structures, and resource allocations, ultimately improving financial management and profitability.

In addition to streamlining day-to-day operations, the AMS offers sophisticated analytics capabilities to support strategic decision-making. Leveraging historical data, market trends, and predictive modeling methodologies, the system can forecast crop yields, identify market opportunities, and optimize planting schedules. By providing actionable insights on market demands, climatic patterns, and resource availability, the AMS enables farmers to proactively navigate their operations towards profitability while mitigating potential risks.

2.LITERATURE REVIEW

Prof. Rakesh Shirsath and other co-author in paper [1] proposed a system which helps the users to make decisions regarding the crop to be planted. The system used is a subscription based system which would have personalized information of every farmer registered. The system includes a module which maintains the information of the previous crops planted collected from various sources and shows a matching crop that can be planted. The whole process is done with the help of artificial neutral networks. At the end a feedback system is provided so that the developer can make changes required if the farmer finds some difficulty while using the system.

RSF as mentioned in paper [2] is a recommendation system for famers which considers a location detection module, data analysis and storage module, crop growing database, physiographic database. The similar location detection module identifies the locations which are similar to the user's locations and checks the similar crops that are planted in those locations. Accordingly, using similarity matrix, the recommendations for the user is generated. Location detection module uses the Google API services to get the current location of the user to identify the similar locations. But the system does not get user feedback to improve the process.

Paper [3] is a review paper for studying various algorithms and their accuracy in the agricultural field proposed by Yogesh Gandge and Sandhya. It was observed that Multiple Linear Regression gave an accuracy of 90-95% for rice yield. Decision tree using ID3 algorithm was considered for soybean crop and the recommendations were generated. The third algorithm was SVM which was used on all the crops and the accuracy was good with computationally less requirements. Neural network was used on corn data to achieve 95% of accuracy. Other algorithms were also used which are KNN, C4.5, K-means, J48, LAD Tree and Naïve Bayes. The conclusion was that still improvement is needed for the algorithms to achieve better accuracy.

In this literature review of this project, the team sought out and studied various patents, research papers, documents, and newspapers and magazine articles from various scenes. The paper [4] states requirements and why they tend to move into precision agriculture [5] which is due to globalization are discussed. Precision agriculture is site-specific farming. Though Precision agriculture has shown an improvement with time, there exist some issues. As mentioned above site specific methods of such systems are needed to be supervised to get an improved result. Only a few of the outcomes are provided a particular result. Nevertheless, the situation is farming is indispensable since if any default or a mistake occurs, it might lead to serious damage to resources and as well as the plants.

Crop recommendation system based on demand and supply using a deep learning approach by K. P. Sujatha and M. Krishnamoorthy (2020). This paper presents a crop recommendation system based on demand and supply using a deep learning approach. The system uses a convolutional neural network (CNN) algorithm to predict the future demand for different crops. The recommendations are then generated based on the farmer's location, the type of soil, and the availability of water.

The study conducted by Aditya Shastry, H. A. Sanjay, and E. Bhanusree in 2017 highlights the efficacy of regression techniques in predicting crop yields, specifically for wheat, maize, and cotton in India. The research demonstrates that regression models can offer satisfactory outcomes in forecasting crop production within specific geographical regions. Given India's significance in agricultural production within Asia and the diversity of crops cultivated across different regions of the country, such predictive models hold considerable value.

3.METHODOLOGY

Requirements Analysis:

I. Stakeholder Engagement: This phase entails active involvement with diverse stakeholders, such as farmers, agricultural experts, governmental bodies, and end-users. By conducting interviews, surveys, and workshops, the development team gathers insights into the distinct needs, challenges, and objectives of each stakeholder group.
II. Identifying Key Requirements: The aim of the requirements analysis phase is to pinpoint crucial features and functionalities that cater to the agricultural community's requirements. This encompasses aspects like crop management, inventory tracking, purchasing, analytics, forecasting, and sustainable practices.
III. Prioritization and Validation: Following the identification of requirements, they undergo prioritization based on significance and feasibility. Stakeholders then validate these requirements to ensure alignment with their goals and expectations.

System Design:

I. Architectural Design: The system's architecture is crafted to accommodate the identified requirements while ensuring scalability, flexibility, and maintainability. Architectural components, such as client-server architecture, microservices, or cloud-based solutions, are chosen in accordance with project goals and constraints.
II. User Interface Design: User interface (UI) design concentrates on crafting intuitive and user-friendly interfaces for farmers and other end-users.

Wireframes, prototypes, and usability testing aid in refining the UI design to enhance user experience and accessibility.

III. Database Design: A robust database schema is devised to efficiently store and manage agricultural data. Considerations such as data normalization, indexing strategies, and data integrity constraints are integrated to optimize database performance and ensure data consistency.

Implementation:

I. Front-end Development: Front-end components, including web interfaces, mobile apps, and dashboards, are developed using suitable technologies such as HTML, CSS, JavaScript, and modern frameworks like React or Angular. The UI is designed to offer a responsive and engaging experience across various devices and screen sizes.

II. Back-end Development: Back-end components, encompassing server-side logic, APIs, and database interactions, are implemented using programming languages like Python, Java, or Node.js. Data processing, authentication, authorization and integration with external systems are incorporated to support the system's functionality.

III. Integration and Testing: Integration testing verifies the seamless interaction of all system components. Automated testing frameworks, unit tests, and integration tests are utilized to detect and rectify defects early in the development process.

Testing:

I. Unit Testing: Individual components and modules undergo testing in isolation to ensure their correct functioning.

II. Integration Testing: Testing is conducted to validate the correct interaction of different system modules with each other.

III. User Acceptance Testing (UAT): End-users participate in UAT to verify whether the system aligns with their requirements and expectations.

IV. Performance Testing: Load testing and stress testing are carried out to evaluate the system's performance under varied conditions and ensure scalability.

Deployment:

I. Environment Setup: Production environments are established with the requisite infrastructure, including servers, databases, and networking configurations.

II. Deployment Automation: Deployment scripts and automation tools streamline the deployment process, ensuring consistency across environments.

III. Continuous Integration/Continuous Deployment (CI/CD): CI/CD pipelines automate the build, testing, and deployment process, enabling swift and frequent releases with minimal manual intervention.

4. PROPOSED SYSTEM

Designing a crop recommendation system based on demand and supply dynamics entails integrating various data sources and implementing algorithms to analyze and predict market trends. Here's a proposed system outline:

1.Data Collection:

- Historical Data: Gather historical data on crop production, demand, prices, supply, yielded crops, and other relevant factors.
- Real-Time Data: Utilize APIs or scraping techniques to collect real-time data on market prices, weather forecasts, and any other pertinent information.

2.Data Preprocessing:

- Cleanse and preprocess the collected data to remove outliers, handle missing values, and ensure consistency.
- Normalize or standardize numerical features to bring them to a similar scale.

3.Feature Engineering:

- Extract relevant features from the data that could influence crop recommendation, such as soil type, historical prices, demand-supply ratios, etc.
- Utilize domain knowledge to create new features or combinations of existing ones that might better capture relationships in the data.

4.Demand and Supply Analysis:

- Analyze historical demand and supply trends for different crops.
- Utilize statistical techniques and machine learning algorithms to forecast future demand and supply dynamics.
- Incorporate external factors like population growth, economic indicators, and government policies affecting agriculture.

5.Machine Learning Models:

- Develop predictive models such as regression, time series forecasting, or machine learning algorithms like decision trees or neural networks.
- Train the models using historical data on crop production, demand, and other relevant factors.
- Validate the models using cross-validation techniques to ensure their reliability and generalization capabilities.

6.Recommendation Engine:

- Based on the predictions from the machine learning models, recommend crops that are likely to have high demand and favourable supply conditions in the future.

- Take into account factors like crop rotation, Demand, and Supply conditions to provide personalized recommendations to maximize profit and minimize loss due to surplus supply.

7.User Interface:

- Develop a user-friendly interface where users can input their preferences, such as crop type, estimated Production, and farming practices.
- Display recommended crops along with relevant information such as expected profitability, risk factors, and suggested cultivation practices.

8.Deployment and Integration:

- Deploy the system on a scalable and robust infrastructure, considering factors like data storage, processing power, and security.
- Integrate the system with existing agricultural platforms or marketplaces to provide seamless access to farmers and stakeholders.

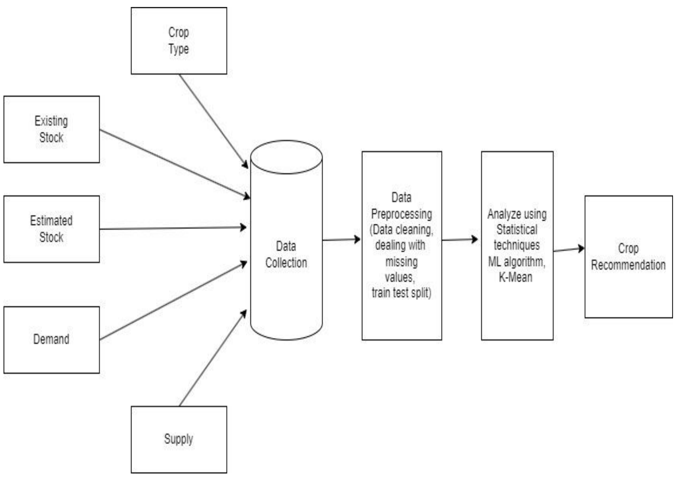

Fig 1: Proposed System

5. DATA FLOW DIAGRAM

The system operates through an administrative panel where farmers input details about their crop selections and estimated production yields. Upon submission, the server cross-references this data with existing stock levels of the specified crops as reported by Agricultural Produce Market Committees (APMCs). By amalgamating both sets of information, the system computes the anticipated supply of each crop.

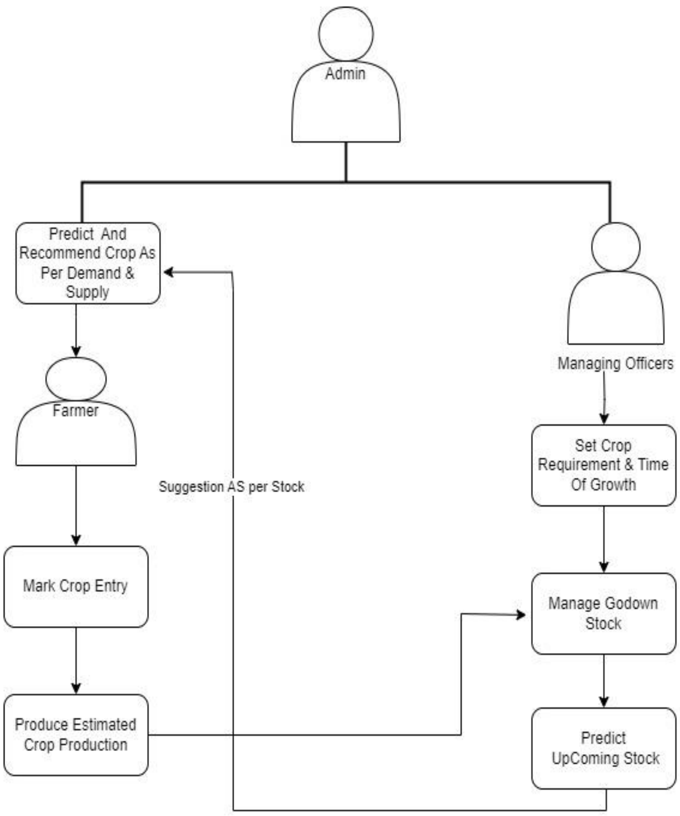

Fig 2: Data Flow Diagram

One of the primary objectives of the system is to mitigate farmer losses resulting from excessive production of a single crop. In the agricultural industry, inflation often stems from a lack of comprehensive insight into the demand and supply dynamics of crops. Moreover, environmental variables such as soil conditions, weather patterns, rainfall, and humidity significantly influence crop yields. This pertinent data can be sourced from the respective APMCs of each region.

The APMCs furnish crucial information regarding the demand for each registered crop, which the system duly incorporates. Upon analyzing the calculated supply against the prevailing demand, if the projected supply falls short of meeting demand, the system employs machine learning algorithms to recommend that farmers proceed with their selected crop. Conversely, if the supply either equals or exceeds demand, the system advises farmers to consider an alternative crop that aligns better with market demand and prevailing environmental conditions.

6. RESULT

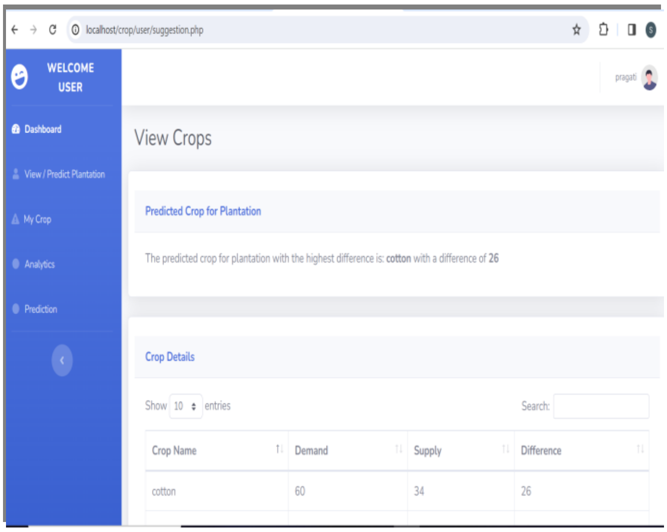

Fig 3: Predicted Crop

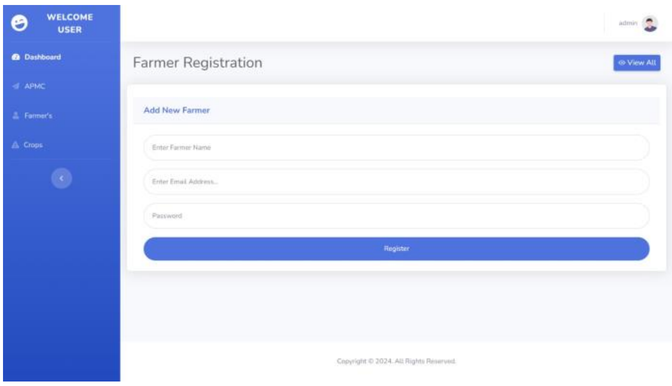

Fig 4: Registration Page

Explanation: From the above window overview, it's evident that the system plays a crucial role in predicting the most suitable crop for farmers, thereby ensuring profitable income generation. By analyzing real-time data on crop demand and supply, including predicted and existing stock levels, the system offers recommendations on the most profitable crop options. This predictive capability allows farmers to make informed decisions, maximizing their earnings while aligning with market dynamics.

7. CONCLUSIONS

Crop recommendation systems based on demand and supply hold promise as a beneficial tool for farmers. However, it's crucial to acknowledge certain potential drawbacks before their implementation. One critical aspect is the reliance on data quality for system accuracy. Inaccurate or incomplete data can compromise the reliability of recommendations.

Another limitation lies in the system's inability to account for all factors influencing crop yields. For instance, it may overlook the impact of upcoming crop stock on demand. Additionally, the system may not sufficiently address the unique circumstances of individual farmers, such as their access to water or land.

Moreover, the system's applicability may be limited by the availability of historical data in certain countries. Despite these challenges, crop recommendation systems have the potential to empower farmers to make more informed decisions, leading to increased profits and a more stable food supply.

Moving forward, research in this area should focus on enhancing system accuracy through improved data and advanced algorithms. Furthermore, incorporating additional factors affecting crop yields, such as weather events and pests, is essential. Tailoring recommendations to individual farmers' circumstances and improving user-friendliness through intuitive interfaces are also key areas for future development.

Here are some of the future directions for research in this area:

- Improving the accuracy of the system. This can be done by using better data and by developing more sophisticated algorithms.
- Considering more factors that affect crop yields. This can be done by incorporating data on weather events, pests, and other factors into the system.
- Considering the specific circumstances of individual farmers. This can be done by collecting data on the farmer's access to water, land, and other resources.
- Making the system more user-friendly. This can be done by developing a user interface that is easy to understand and use.

REFERENCES

[1] Prof. Rakesh Shirsath; Neha Khadke; Divya More," Agriculture decision support system using data mining", International Conference on I2C2 2017.

[2] Miftahul Jannat Mokarrama; Mohammad Shamsul Arefin "RSF: A Recommendation System for Farmers", IEEE Region 10 Humanitarian Technology Conference, 2017.

[3] Yogesh Gandge, Sandhya, "A Study on Various Data Mining Techniques for Crop Yield Prediction", International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT) 2017.

[4] Lakshmi. N, Priya. M, Sahana Shetty, and Manjunath C. R, Crop Recommendation System for Precision Agriculture, vol. 6 Reading, IND: International Journal for Research in Applied Science & Engineering Technology, 2018. [Online] Available: www.ijraset.com.Ding, W. and Marchionini, G. 1997 A Study on Video Browsing Strategies. Technical Report. University of Maryland at College Park.

[5] Remi Schmaltz, "What is Precision Agriculture", April 2017. [Online]. Available: https://agfundernews.com/what-is-precisionagriculture.html [Accessed Feb.23, 2020].

[6] A. Kumar, N. Kumar and V. Vats, "Efficient crop yield prediction using machine learning algorithms," International Research Journal of Engineering and Technology (IRJET), vol. 5, no. 6, June 2018.

[7] S. S. Dahikar and S. V. Rode, "Agricultural crop yield prediction using artificial neural network approach", International Journal Of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, vol. 2, no. 2, Jan.2014.

[8] S. Pudumalar*, E. Ramanujam*, R. Harine Rajashreeń, C. Kavyań, T. Kiruthikań, J.Nishań. "Crop Recommendation System for Precision Agriculture", IEEE Eighth International Conference on Advanced Computing (ICoAC) 2016,

[9] Yogesh Gandge, Sandhya "A Study on Various Data Mining Techniques for Crop Yield Prediction", International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT),2017.

[10] Shruti Mishra, Priyanka Paygude, Snehal Chaudhary, "Use of Data Mining in Crop Yield Prediction", Sonali Idate Proceedings of the Second International Conference on Inventive Systems and Control (ICISC 2018).

[11] Rakesh Kumar, M.P. Singh, Prabhat Kumar and J.P. Singh "Crop Selection Method to Maximize Crop Yield Rate using Machine Learning Technique", International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, T.N., India. 6- 8 May 2015. pp.138-145 2015.

[12] IEEE Sponsored 9th International Conference on Intelligent Systems and Control (ISCO) 2015, "XCYPF: A Flexible and Extensible Framework for Agricultural Crop Yield Prediction", Aakunuri Manjula, Dr. G . Narsimha.

[13] Lakshmi. N, Priya. M, Sahana Shetty, and Manjunath C. R, Crop Recommendation System for Precision Agriculture, vol. 6 Reading, IND: International Journal for Research in Applied Science & Engineering Technology, 2018. [Online] Available: www.ijraset.com.Ding, W. and Marchionini, G. 1997 A Study on Video Browsing Strategies. Technical Report. University of Maryland at College Park.

[14] Remi Schmaltz, "What is Precision Agriculture", April 2017. [Online]. Available: https://agfundernews.com/what-is-precisionagriculture.html [Accessed Feb.23, 2020].

[15] M. Roser, "Employment in Agriculture", Our World in Data, 2020. [Online]. Available: https://ourworldindata.org/employment-in-agriculture.

[16] Shastry, A., Sanjay, H. A., & Bhanushree, E. (2017). Prediction of crop yield using Regression Technique. International Journal of Computing, 12(2),96-102.