INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)

e-ISSN : 2583-1062

Impact Factor: 5.725

www.ijprems.com
editor@ijprems.com

Vol. 04, Issue 04, April 2024, pp: 981-986

AGRO'CART: MULTILINGUAL VOICE-ASSISTED MACHINE LEARNING BASED REAL-TIME PRICE PREDICTION TO ENHANCE AGRICULTURAL INCOME

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DOI: https://www.doi.org/10.58257/IJPREMS33373

ABSTRACT

The objective of this work is to propose the use of AgrO'Cart, a cutting-edge online marketing platform, as an effective solution to modernize conventional agricultural trading practices by facilitating an electronic exchange that links farmers, retailers, and consumers. The platform provides an option to directly sell or buy agricultural products without the involvement of any middlemen, thus allowing farmers to benefit from their crop production by generating 15-20% returns and reducing the debt ratio among farmers and their suicide rate. This proposed solution, AgrO'Cart, integrates a range of innovative features designed like a multilingual voice assistant, powered by advanced ALAN AI (Actionable Artificial Intelligence) technology, enabling farmers to interact with the platform in their native language and revolutionize traditional agricultural trading practices. Farmers can put their queries or ask for assistance by simply speaking out in their native languages. The platform is also accessible in 130+ languages through the integration of the Google Translate API (Application Programming Interface), ensuring a truly global reach. These features make the proposed solution more usable for the farmer community who may not be able to understand international languages or English in general. The Bcrypt's hashing algorithm was leveraged to provide enhanced security for user data and passwords and the incorporation of salted hashing and a variable cost factor adds robustness to thwart brute-force attacks and password-cracking attempts. By employing these cryptographic techniques, the platform ensures effective protection of sensitive information. The , AgrO'Cart also offers a community platform for farmers to connect and collaborate with Agri-experts & fellow farmers to improve productivity and profitability.

Keywords— ALAN AI (Actionable Artificial Intelligence), Agritech, Bcrypt, Community platform, Decision tree, Farmer, Flask, Google Translate API (Application Programming Interface), Hashing, Logistic Regression, Middleman, Multilingual, Voice Assistant.

1. INTRODUCTION

In India, where 57.8% of rural households are involved in agriculture, it dominates the Indian economy (Situation Assessment Survey of Agricultural Households, NSO, 2020- 21). Agriculture marketing plays an important role because it incorporates monetary considerations and returns to farmers. According to the National Crime Records Bureau, there were 10,281 farmer suicides in 2019, highlighting the alarming rates of exploitation faced by farmers in India. Agriculture.

contributes around 16% to the Indian GDP, making it an integral part of the country's economy. However, the State's agriculture marketing regulations, which divide the State into separate market sectors like the Agricultural Produce Marketing Committee (APMC) [1] mandis that oversee managing agriculture marketing, enforces its own market regulations which often leads to farmers, receiving only a small fraction of the final price paid by consumers, which worsens their financial condition. Farmers are forced to sell their produce at lower prices to middlemen, as they lack market information [2]. They expect better returns as they work hard day and night in their fields but doesn't get. Agricultural marketing should be planned and well prepared [3]. The lack of transparency in the supply chain results in price instability leading to further exploitation of farmers. To address this issue, the proposed system utilizes machine learning techniques, including Logistic Regression, Decision Trees, and Clustering to analyse data patterns and generate accurate predictions for crop prices. By leveraging these advanced algorithms, the system aims to provide farmers with valuable insights into crop price trends enabling them to make informed decisions. The prediction of crop yield is very useful for cost estimation of the crop and for the marketing strategies [4]. Additionally, AgrO'Cart integrates the Google Translate API, enabling farmers to access the platform in over 130+ regional

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languages. Also, AgrO'Cart incorporates an advanced voice-based assistant system powered by ALAN AI (Actionable Artificial Intelligence) which enables farmers to interact with the platform through voice communication eliminating the need for text-based input.

Besides this for data & network security, AgrO'Cart leverages Bcrypt's hashing algorithm [5]. By incorporating salted hashing and a variable cost factor, the platform enhances security and protects user data. Moreover, AgrO'Cart provides a community platform that connects farmers with agricultural experts and fellow farmers. This collaborative space allows farmers to share knowledge, discuss best practices, and learn from each other, ultimately improving productivity and profitability. By fostering this community, the platform enables farmers to access valuable insights and expertise, enhancing their agricultural practices.

The proposed platform, AgrO'Cart, has the potential to transform the agriculture sector by providing a fair, efficient, and transparent market for farmers. It will enhance farmers' income and help in reducing the rate of farmer suicides in India, ultimately contributing to the overall development of the country's economy.

The paper is organized into Literature review followed by methodology used to predict the real time crop prices and different tools used to enhance usability of the platform including multilingual feature and voice assistance etc. The next section is for results and discussion followed by conclusion and future scope.

2. LITERATURE REVIEW

The existing mandi system in India has several issues and drawbacks, resulting in the exploitation of farmers, inadequate price realizations, and adverse consequences such as high suicide rates and mounting debt burdens. This review systematically examines these drawbacks, highlighting the need for reform and improvement in the agricultural marketing system. The mandi system's drawbacks include a lengthy chain of middlemen, cartelization at physical marketplaces, and inefficient bookkeeping, manual bidding, and reporting systems. These factors contribute to farmers receiving only a small fraction of the final price, as intermediaries and handling charges diminish their profits. Additionally, farmers often lack awareness of deductions for commission fees and market cess, further exacerbating the exploitation they face. In this century, it is not enough to have a passion for agriculture to be a farmer. Farmers need expert knowledge in agriculture, law, economics, accounting, and data analysis to achieve sustainable agriculture [6].

Furthermore, the current system is limited by laws governing direct marketing, numerous taxes and licenses, and inadequate logistics and infrastructure. Farmers encounter challenges in accessing prompt and accurate information, reports, and analysis necessary for making informed decisions. Recent data, including a 2021 report by the National Sample Survey Office (NSSO), reveal that farmers in India receive an average of only 64% of the final retail price, with the rest being claimed by middlemen and other intermediaries. Therefore, there is a lack of awareness among farmer’s [7]. A 2020 survey by the National Bank for Agriculture and Rural Development (NABARD) also highlights that only 10% of farmers are aware of the deductions made for commission fees and market cess.

The limitations of the mandi system have been further exposed during the COVID-19 pandemic, with disruptions in logistics and inadequate infrastructure amplifying the challenges faced by farmers in selling their produce. Therefore, the existing mandi system in India suffers from significant drawbacks that negatively impact farmers' economic stability and well-being. The exploitation of farmers, inadequate price realizations, and limited access to information underscore the urgency for reformation in the agricultural marketing system.

The adoption of e-commerce platforms in the agricultural sector has the potential to benefit smallholder farmers by providing them by means of access to latest markets, developing their bargaining power, and increasing their income [8]. AgrO'Cart aims to address these gaps by providing a

transparent, equitable, and user-friendly online marketing platform that connects farmers directly with retailers and consumers. By eliminating intermediaries, incorporating advanced technologies, and ensuring multilingual accessibility, AgrO'Cart seeks to empower farmers, reduce exploitation, and contribute to a fair and efficient agricultural trading ecosystem.

The various models for predicting real time prices using Machine learning is available in the literature which includes Linear regression, Support vector regressor, Decision tree regressor etc [9,10,11,12]. The parameters that can be used to evaluate the model performance is accuracy and precision. [13,14,15]. Decision tree regressor is used in this work for real time price prediction.

Therefore, this tech can help

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3. METHODOLOGY

After reading several literature studies, it is necessary to construct a real-time system that will be used to create a reliable platform for farmers and consumers. The major goal of the suggested method is to create a platform that will assist farmers in receiving a fair price for their labour-intensive produce. Also, on-demand access to current information about the product will be available on the platform. The approach offers farmers the option to decide when and where to sell their products separately and brings the advantages of transparency across the pan-India market to farmers and consumers alike.

This research aims to create an efficient marketing system with high levels of transparency which will encourage healthy competition, the active participation of genuine stakeholders, higher returns to the farming community, and a fair deal to consumers.

3.1 Methodology for Real-Time Crop Price Prediction:

3.1.1 Data Collection: Real-time price prediction is a critical feature of this proposed methodology. By leveraging machine learning algorithms and real-time data feeds, the system accurately predicted the prices. The dataset used for this project is from the period 2001-2019 and is taken from Kaggle. The parameters used in crop prediction model included weather variables (temperature, rainfall, wind speed), soil properties (pH, moisture), crop attributes (planting date, growth stage, genetic traits), season (kharif and rabi season). Additionally, some external factors like market trends, supply-demand dynamics, crop growth, vegetation indices and historical crop yield data were also considered. The algorithm's performance was optimized by carefully selecting and tuning these parameters based on the specific requirements of the crop prediction task.

3.1.2 Pre-processing of data: The collected data was cleaned by handling missing values, outliers, and inconsistencies. The data was normalized or scale to ensure compatibility across variables. This was achieved using the Pandas library in Python. The data was then visualized and analyzed to identify trends and patterns.

3.1.3 Train-Test Split: Split the pre-processed dataset into training and testing sets. The model is trained using 70% of the sample data for training and 30% is used for testing the model's performance.

3.1.4 Model Selection: After testing six different algorithms, the Decision Tree Regressor algorithm demonstrated superior performance compared to the others. Its root mean squared value of 3.7, indicates a relatively low prediction error, suggesting that it captures the underlying patterns in the crop price data more effectively. Therefore, the decision Tree Regressor algorithm was chosen since it outperformed the others.

3.1.5 Model Training: Trained the Decision Tree Regressor algorithm using the training dataset. The algorithm learned the underlying patterns and relationships between the input features and crop prices.

3.1.6 Real-Time Price Prediction: Integrated the trained model with real-time data feeds to enable real-time crop price prediction. Continuously collected the required input features, including weather variables, soil properties, crop attributes, and external factors. Feeded this data into the trained model to obtain real-time crop price predictions.

3.1.7 Model Optimization: Fine-tuned the model's parameters and hyperparameters to improve its performance. This was done through techniques like grid search or random search by finding the best combination of parameters that minimized the prediction error

3.1.8 Deployment and Integration: Deployed the trained model into a production environment where it was accessed and used to provide real-time crop price predictions. Integrated the model with a user interface or API to make it easily accessible for stakeholders/ users.

3..2 Web-based Dashboard: A web-based dashboard was developed using the Flask framework that provides users' friendly UI (User interaction) with access to real-time crop price predictions. The dashboard is user-friendly and intuitive, allowing users to easily view and compare prices for different crops and regions.

3.3 Multilingual Voice Assistant Bot: The multilingual voice assistant system was developed which is a cutting-edge feature, providing farmers with the ability to use the platform in their native language. This technology has been developed using the latest advancements in AI and natural language processing, making it possible for farmers to easily communicate their queries or problems simply by speaking in their own language. By leveraging the power of ALAN (Actionable) AI, the system can accurately and efficiently process the farmer's requests and provide them with the necessary assistance. This feature sets the platform apart from other similar products, as it allows farmers to communicate seamlessly and effectively, breaking down language barriers and providing access to critical information and support.

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3.6 Multilingual Accessibility: The platform's multilingual capability, incorporated by the Google Translate API, has been a game-changer for non-native speakers who previously faced linguistic barriers while interacting with the platform and has enhanced multilingual accessibility for farmers and users. The seamless translation of pages into over 130+ native languages has made navigation and utilization of the platform much simpler and more accessible. By leveraging the Google Translate API, the language gap was bridged successfully, delivering an all-inclusive experience to farmers and users globally. This multilingual feature has redefined the way users interact with the platform, making critical information and resources readily available in their native language.

3.7 Community Platform: This work is further extended to form a community of stakeholders where they can talk, discuss, participate, learn and collaborate with each other. It enables individuals to create their own communities and connect with fellow farmers or retailers in their own native language. Farmers and retailers can clear their doubts, share their experiences and insights, and collaborate with others in a way that was not possible before. This platform is a game-changer for local communities, empowering them with the tools and resources they need to thrive in today's digital age. The figure 1 depicts the various communities present in the community platforms more communitiescan also be created by stakeholders as and when required.

Fig.1 AgrO' Cart Community Platform

4. SYSTEM WORKFLOW

Figure 2 depicts the workflow diagram of the AgrO'Cart platform. Where both the farmer and retailer can use multilingual voice assistance, Farmer can register and login, upload and edit products. Retailers can also view the products, add products to the cart, can confirm the order and make payment.

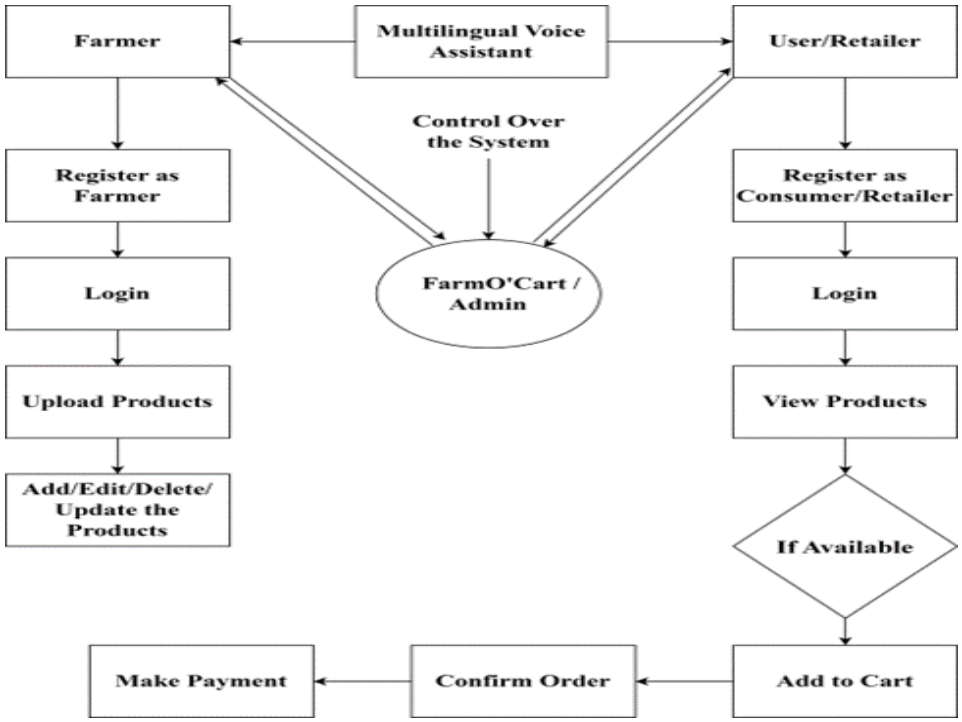

Fig.2 Workflow diagram

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4. The proposed system has three different stakeholders:

4.1 Farmer: Welcome to the farmer portal!

Farmers can connect with retailers and exporters directly to sell their goods and products without the need for middlemen. The real- time price prediction technology ensures that farmers get the best possible price for their products. Farmers can join AgrO'Cart and take their farming business to new heights!

4.2 Retailer: Welcome to the retailer portal!

Connect directly with farmers and exporters to purchase high-quality goods at a lower cost compared to the market, without the interference of middlemen. The platform eliminates the risk of exploitation and ensures fair prices for all parties. Retailers can join AgrO'Cart and revolutionize their retail business.

4.3 Consumer: Welcome to the consumer portal!

Connect directly with farmers, exporters, and retailers to purchase high-quality goods at a lower cost compared to the market, without the interference of middlemen. The platform ensures complete transparency, allowing them to know exactly where end consumers' products are coming from. Consumers can enjoy fresh produce delivered straight to their doorstep while supporting local farmers. Consumers can join AgrO'Cart and start revolutionizing the way they shop!

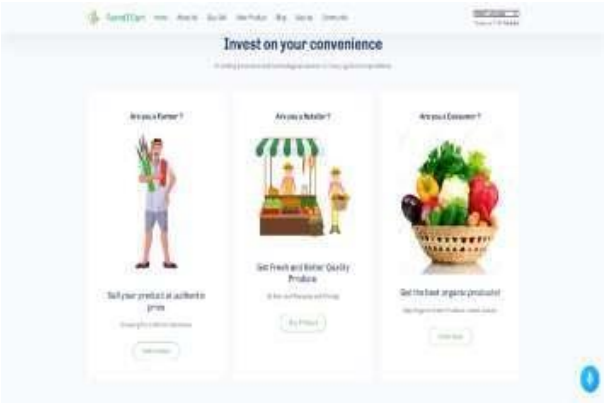

Fig.3 Stakeholders- Farmers, Retailers and Consumers

- ▪ Frontend: HTML5, CSS3, JavaScript, Bootstrap4
- ▪ Backend: Node.js, Express.js, Flask
- ▪ Database: MongoDB
- ▪ Encryption & Security: Bcrypt
- ▪ Machine Learning Model: Logistic Regression, Decision Trees, Neural Networking, and Clustering

The components of the system are as follows:

5. RESULT & DISCUSSION

AgrO'Cart proposes an innovative solution to modernize traditional agricultural trading practices by creating a more transparent and equitable marketplace for farmers, retailers, and consumers. To address the language barrier, AgrO'Cart incorporates a multilingual voice assistant and makes the platform accessible in over 130+ languages. Additionally, a real-time machine learning-based priceprediction system with an accuracy of 87% provides farmers with valuable insights into market demand, leading to higher returns and more efficient operations. The platform also allows farmers to sell their products directly to retailers and consumers, eliminating intermediaries and increasing their income. The community platform provides farmers with a space to share experiences, ask questions,and receive support from other members of the farming community. Overall, AgrO'Cart offers a promising solution for modernizing traditional agricultural trading practices, promoting transparency in the marketplace, and contributing to ongoing efforts to transform agricultural trading practices in India and other countries.

6. CONCLUSIONS AND FUTURE SCOPE

In conclusion, AgrO'Cart offers a cutting-edge solution to modernize conventional agricultural trading practices by providing an online marketing platform that directly connects farmers, retailers, and consumers. The integration of advanced technologies such as ALAN AI and multilingual voice assistance improves usability and accessibility for farmers worldwide. Through data analysis techniques like Logistic Regression and Clustering, the platform empowers farmers with valuable insights into crop prices, facilitating informed decision-making. The platform's direct selling

option and community platform promote transparency and collaboration, reducing exploitation and improving farmers' income, reducing the suicide rate, and increasing their social status.

For future development, AgrO'Cart will focus on expanding its global reach, enhancing the price prediction system by regularly monitoring the model's performance and updating it as new data becomes available. This will ensure that the model remains accurate and up-to-date in predicting crop prices in real-time.Beside this the feedback will be collected from users and stakeholders to identify any areas for improvement and making necessary adjustments to enhance the accuracy and reliability of the crop price predictions. Collaboration with government agencies, NGO's and organizations can facilitate supportive policies and subsidies. Continuous refinement and innovation will solidify AgrO'Cart's position as a sustainable solution, uplifting farmers and fostering socio-economic development in the agricultural sector.

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