International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048
Volume 7, Issue 10, pp 523-531, October-2023
https://doi.org/10.47001/IRJIET/2023.710069

SMART AGRO - Digitalization of Agricultural Production, Distribution, and Marketing Management System to Forecast and Promote Sri Lankan Agricultural Products

[1]Thathsarani D.M.T., [2]Chamathka Sumanasiri M.G.D., [3]Adikaram V.I., [4]Thennakoon T.M.P.B., [5]Kanishka Yapa, [6]J.M.Dulani Maheshika Jayasinghe

[1,2,3,4,5,6]Department of Information Technology, Faculty of Computing, Sri Lanka Institute of Information Technology , Malabe, Sri Lanka

Authors E-mail: [1]thamodadisanayaka@gmail.com, [2]dilmichamathkasumanasiri@gmail.com, [3]vindyaadikaram@gmail.com, [4]pathumthennakoon6@gmail.com, [5]kanishka.y@sliit.lk, [6]dulani.m@sliit.lk

Abstract **- SMART AGRO is a web-based platform developed to revolutionize agricultural production, distribution, and marketing management in Sri Lanka, with a primary focus on paddy production. This platform utilizes various DL and ML technologies, such as RNN, AI, CNN, ANN, and LSTM to provide advanced functionalities. One of the key features of SMART AGRO is its paddy demand forecasting module. This module leverages historical harvest data from previous years to predict future demand. By analysing trends and patterns in the data, the platform can provide accurate forecasts, aiding farmers and stakeholders in making informed decisions regarding production and distribution. Another important aspect of SMART AGRO is its cost estimation functionality. This feature utilizes past costing data to estimate the expenses associated with paddy production. By considering factors as labor, equipment, fertilizers, and other inputs, the platform can provide farmers with a comprehensive cost estimate for their production activities. To enhance security and user access control, SMART AGRO implements multifactor authentication with face recognition. This ensures that only authorized users can access the paddy demand forecasting and cost estimation functions of the platform. Additionally, SMART AGRO includes a communication platform that facilitates knowledge sharing among users. This platform utilizes AI chat capabilities to enable users to interact with the system and seek information or assistance. Moreover, an email server is employed for knowledge-sharing purposes, allowing users to exchange information, documents, and best practices related to agricultural practices. By combining advanced technologies like DL and ML with features such as demand forecasting, cost estimation, and knowledge sharing, SMART AGRO aims to optimize agricultural practices, improve decision-making processes, and enhance productivity within the Sri Lankan paddy farming industry.**

Keywords: Machine Learning, Deep Learning, RNN, AI, CNN, LSTM, ANN.

I. INTRODUCTION

SMART AGRO is an innovative web-based platform that has been created to transform the way agricultural production, distribution, and marketing are managed in Sri Lanka, focusing specifically on paddy production. To achieve this, the platform harnesses the power of deep learning and machine learning technologies, including RNN, AI, CNN, ANN, and LSTM.

The issue of farmers receiving inadequate prices for their agricultural products is a complex problem. A successful solution is developed within the cost estimation and employs a fixed pricing mechanism for paddy products offered to paddy traders. The special feature that allows users to request higher prices for their paddy by entering production cost-related data based on predefined parameters has been incorporated. This option provides farmers with the opportunity to seek fairer compensation. To determine the feasibility of granting higher prices, the system employs a trained price prediction model. This model is trained using historical data on production costs and their corresponding prices. By considering past production cost information, the model can make accurate price predictions. When users submit their production cost related data to the system, it compares the provided information with the trained model's predictions and determines if offering a higher price is possible. By addressing factors including limited market access, inadequate infrastructure, and power imbalances in supply chains, the solution aims to create a

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 10, pp 523-531, October-2023

https://doi.org/10.47001/IRJIET/2023.710069

more equitable and sustainable agricultural environment for farmers.

The research component focuses on predicting the demand for paddy in Sri Lanka based on past harvest data. It utilizes a user-friendly interface where users can input the desired district to obtain forecasting results. To achieve accurate predictions, the component utilizes TensorFlow and Recurrent Neural Networks (RNN) to analyze time series data and generate predictions. Its main objective is to provide accurate demand and harvest forecasts for each district to assist stakeholders in decision-making. The results are presented through a clustered column bar chart, allowing users to visualize and compare the demand and harvest trends across different districts and enhancing understanding and pattern identification. The data source is the Department of Census and Statistics, which provides paddy production data sets spanning from 2005 to 2022. TensorFlow and RNN are used to train the model on the collected past year's data sets, the model learns the historical patterns and utilizes them to forecast future demand and harvest values.

This research's Facial recognition technology has become increasingly popular in recent years [9]. This system uses facial recognition technology to improve agricultural processes, including workforce management, farm security, and customer interaction. Advanced algorithms and machine learning enable the identification, authentication, and analysis of an individual's facial features. Facial recognition technology enhances SMART AGRO's farm security by preventing unauthorized access and ensuring the security of agricultural devices, valuable crops, and agricultural assets. It also helps identify potential threats and suspicious individuals, enabling timely intervention and mitigation of security risks. Using facial recognition technology in Smart Agro system to enhance forecasting and marketing management. Analyzing facial data and customer preferences generates personalized recommendations, enhancing demand forecasting accuracy and optimizing marketing strategies. This enables farmers and stakeholders to make informed decisions, promote products, and increase market competitiveness.

This research's AI chat system is designed specifically for paddy farmers, allowing them to ask questions and receive timely responses related to paddy cultivation. By utilizing AI algorithms, data analysis, and natural language processing, the system offers personalized information to address commonly asked questions. The objective is to empower farmers with accurate agricultural knowledge, enhancing their decision-making and productivity. The paper highlights the integration of AI in agriculture while ensuring academic integrity through appropriate citations and references [16].

This research paper presents a monthly updated magazine subscription service for paddy farmers, offering valuable information on disasters, new inventions, fertilizers, and related topics. By delivering curated content to registered users' emails on a fixed date each month, the service enhances farmers' access to knowledge and decision-making support. The paper emphasizes the importance of providing timely and relevant information while maintaining academic integrity through proper citations and references [17].

In this research paper, section II delves into an extensive review of pertinent research papers encompassing cost estimation, demand forecasting, facial recognition, and chat system domains. In Section III, an exhaustive examination of the methodologies and materials employed in the implementation of each component is conducted, with the overarching goal of accomplishing the primary research objectives. Section IV is dedicated to the presentation and discussion of research outcomes. This section scrutinizes the outputs of the research project and meticulously evaluates the precision of the models employed for each component, juxtaposed against alternative methodologies that could be employed to attain similar objectives. Finally, Section V encapsulates the research endeavor with a succinct conclusion and outlines avenues for future work.

II. LITERATURE REVIEW

In a research paper by Bhardwaj et al., proposes a method for estimating production costs and predicting the prices of potato and tomato crops. The approach combines Graph Neural Networks (GNN) and Convolutional Neural Networks (CNN) to exploit geospatial dependencies in price data. A notable advantage of this approach is its ability to handle noisy legacy data effectively, as the deep learning techniques filter out noise and focus on relevant information. Showcasing the effectiveness of the proposed approach. The model achieves impressive results by accurately predicting prices up to 30 days in advance [11].

Dr. T. Nalini et al. propose a unique approach to corn crop price prediction using a neuro-evolutionary algorithm by considering environmental factors like soil conditions, rainfall, temperature, and crop yield. The algorithm combines neural networks and genetic algorithms to optimize the prediction model. By analyzing historical data, the model learns patterns and correlations, enabling accurate predictions. The neuro-evolutionary algorithm offers adaptability and captures complex interactions. This research presents a solution for improving decision-making in agriculture, maximizing profitability, and managing risks effectively [12].

M. R. Bendre, R. C. Thool, and V. R. Thool examine the use of big data analytics and weather forecasting in precision

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 10, pp 523-531, October-2023

https://doi.org/10.47001/IRJIET/2023.710069

agriculture. It highlights the importance of weather forecasts for making informed decisions in crop management of irrigation, fertilization, and pest control discusses various weather forecasting methods, and proposes leveraging big data from weather stations and satellite imagery. The authors also present examples of big data applications in agriculture and address the challenges of analyzing such data, advocating for further research to improve agricultural weather forecasting models [1].

V. Amaratunga, L. Wickramasinghe, A. Perera, J. Jayasinghe, and U. Rathnayake explore the use of ANNs to forecast paddy yield based on climatic data. They propose a model that combines various climatic variables discusses the advantages of ANNs in handling complex relationships and trains an ANN on historical data, evaluates the accuracy of their predictions using performance metrics, and finds a strong correlation between predicted and actual yields. The study has limitations of small sample sizes and reliance solely on climatic data as input variables [2].

One of the research conducted by, G. Guo and N. Zhang (2019) [6] proposed a facial recognition system for authentication based on deep learning. The system uses a recurrent neural network (RNN) for sequence learning and a convolutional neural network (CNN) to extract face features. The experimental results demonstrated high accuracy and a low false acceptance rate, indicating that it is a promising approach for implementing facial recognition in websites.

In another study, J. Liang, H. Zhao, X.Li, and H. Zhao (2017) [7] proposed deep residual network-based facial recognition tasks with high accuracy. Users could upload images for image recognition using the proposed system, which was integrated into a web-based platform. The ease of implementation and user-friendliness of this method make it useful for integrating a facial recognition system into a website.

The literature review explores previous research on the implementation of AI chat systems for addressing farmers' queries in the context of paddy farming. The findings suggest that these systems effectively provide accurate and timely information to farmers, improving their agricultural knowledge and decision-making. The studies highlight the potential of AI chat systems in enhancing farming practices and productivity. Further research is needed to optimize and tailor these systems specifically for the needs of paddy farmers, emphasizing their positive impact on the agricultural sector's resilience and productivity [18].

The literature review investigates previous research on the delivery of monthly magazines via email to registered farmers, with a specific focus on paddy cultivation. The findings suggest that these magazines have a significant positive impact on farmers by improving their knowledge and decision-making processes. Topics covered include disaster management, new inventions, and fertilizer usage. The studies highlight the importance of timely and relevant information in enhancing farming practices, productivity, and risk management. Further research is required to optimize content customization and delivery methods, as well as to assess the magazines' effectiveness on farmers' outcomes and adoption of recommended practices [19].

III. METHODOLOGY

The proposed system utilizes various ML and AI techniques including RNN, LSTM, CNN, and SMTP for dataset prediction, training, and visualization.

A) An Artificial Neural Network (ANN) is a computational model inspired by the brain's neural networks. It consists of interconnected artificial neurons and is used for tasks like pattern recognition and prediction. ANNs have applications in image recognition, natural language processing, and autonomous vehicles, playing a crucial role in modern AI research [14]. Figure 1 indicates the artificial neural network.

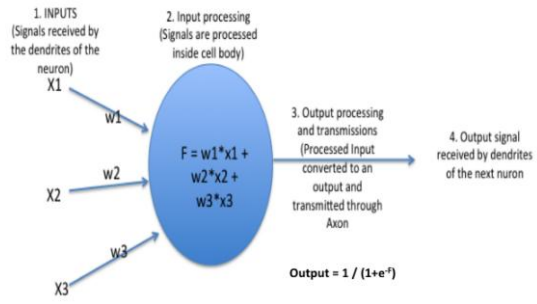

Figure 1: Artificial Neural Network Downloaded from https://towardsdatascience.com/introduction-to-neural-networks-advantages-and-applications-96851bd1a207

B) Recurrent Neural Networks (RNNs) are specialized neural networks designed for sequential data, utilizing recurrent connections to maintain memory states and capture temporal dependencies. Their unique structure enables them to process variable-length sequences and capture long-term relationships [5]. RNNs find applications in speech recognition, language translation, and handwriting recognition, where context from previous inputs is essential for current input processing. [4]. Figure 2 indicates the RNN architecture diagram.

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 10, pp 523-531, October-2023

https://doi.org/10.47001/IRJIET/2023.710069

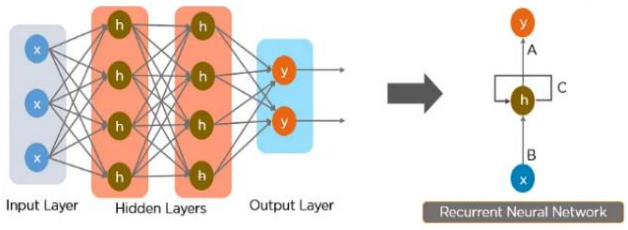

Figure 2: RNN Architecture Diagram Image Downloaded from https://www.analyticsvidhya.com/blog/2022/03/a-brief-overview-of-recurrent-neural-networks-rnn

C) LSTM (Long Short-Term Memory) networks are recurrent neural networks known for effectively learning long-term dependencies in sequence prediction tasks. They address the vanishing gradient problem [13] [15].

The input gate (i) adds the relevant candidate cell state to the cell state (c), while the forget gate (f) retains necessary information from the previous cell state (c[t-1]). The output gate (o) regulates the transfer of information from the cell state (c) to the hidden state (h) [14]. Figure 3 indicates the LSTM Diagram.

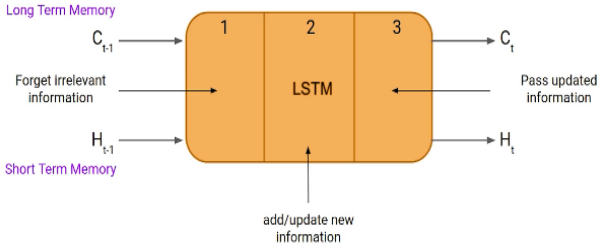

Figure 3: LSTM Diagram Image Downloaded from https://www.analyticsvidhya.com/blog/2021/03/introduction-to-long-short-term-memory-lstm/#LSTM_Architecture

Forget Gate: $\mathbf{f_t = \sigma (X_t * U_f + H_{t-1} W_f)}$

Input Gate: $\mathbf{i_t = \sigma (X_t * U_i + H_{t-1} W_i)}$

New Information: $\mathbf{N_t = tanh (X_t * U_c + H_{t-1} W_c)}$

N_t won't be added directly to the cell state, the following equation is used

$$\mathbf{C_t = f_t * C_{t-1} + i_t * N_t}$$

Output Gate: $\mathbf{O_t = \sigma (X_t * U_o + H_{t-1} W_o)}$

$$\mathbf{H_t = o_t * tanh (C_t)}$$

Output = Softmax(H_t)

D) CNN: Convolutional neural networks (CNNs) are commonly used in image processing and recognition. They use a mathematical operation called convolution to analyze patterns in images. By applying a filter to the image, CNNs scan and identify patterns. This process is represented by the equation,

$$y = f (w * x + b)$$

Where y is the output, w is the weights, x is the input, b is the bias, and f is the activation function. CNNs have shown excellent performance in various image recognition tasks, such as detecting objects, recognizing faces, and classifying images. They are also used in speech recognition and natural language processing, demonstrating their versatility and effectiveness in different fields.

E) SMTP: A monthly magazine subscription service for paddy farmers involves content curation, organization, and integration with an Email Service Provider (ESP) using the Simple Mail Transfer Protocol (SMTP) for email delivery. A fixed monthly schedule is established for timely and consistent delivery to registered users' emails. Personalization techniques are employed to tailor the magazine content to individual farmers' preferences. Regular evaluation and feedback collection drive continuous improvement. The goal is to provide relevant and valuable information to farmers through an effective and personalized magazine subscription service supporting their paddy cultivation practices [20].

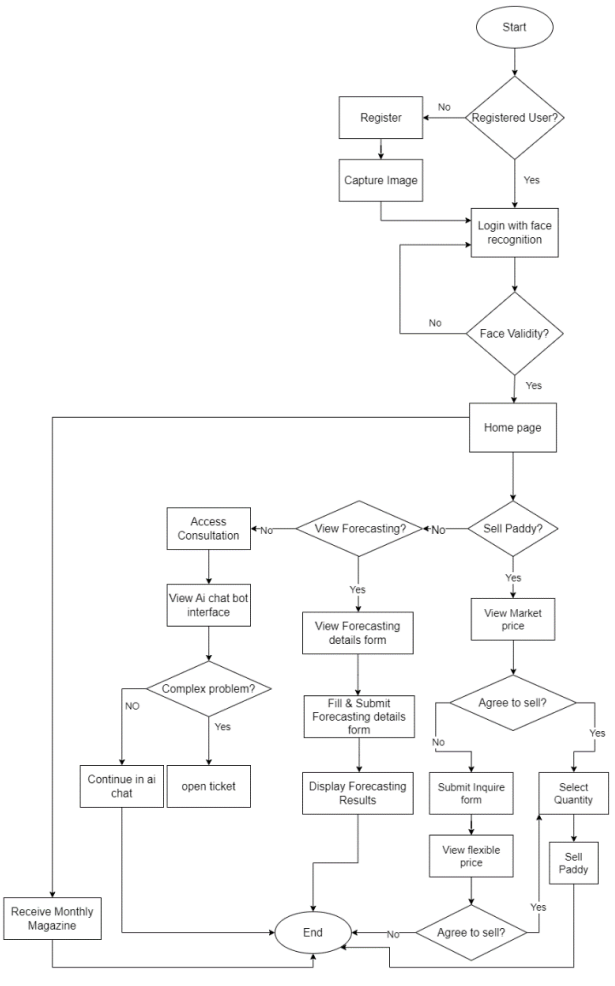

Figure 4: Flow of the SMART AGRO System

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 10, pp 523-531, October-2023

https://doi.org/10.47001/IRJIET/2023.710069

Figure 4 – Flow of the SMART AGRO System elucidates the operational flow of the SMART AGRO System, elucidating the seamless interplay of each component and elucidating their individual functionalities.

A) Cost Estimation

Used Dataset: This dataset originates from the "Cost of Cultivation of Agricultural Crops" Journal, published by the Socio-Economics and Planning Center, Department of Agriculture, Peradeniya. It provides paddy cultivation data, spanning over 10 years. The unit price of paddy is calculated based on the cost for general land preparation, first-second third plow, plastering bunds, leveling broadcasting, fertilizer application, weed control with weed side, pest disease control, water management, harvesting drawing with combine harvester, additional drying and transport produce to store.

The system is designed to estimate the price for one kilogram of paddy (Paddy unit price) based on more than 20 parameters. These parameters are used as input to the Artificial Neural Network model, in order to predict the unit price of paddy without relying on complex calculations.

Upon logging into the system, users will be presented with a main menu. The main menu includes an option to view the market price of a unit of paddy. When the user selects this option, they will be directed to a page where they can see the market price, which is entered by the accounting department through the backend portal. In addition to the market price display, the page will include fields for users to enter the quantity of paddy they wish to sell. There will be a submit button to confirm the quantity, as well as a link to access the inquiry form. If the user agrees to sell their paddy at the given market price, they can enter the quantity they are willing to sell and click the submit button. The order details, along with the user's ID, will be updated in an Excel sheet. If the user does not agree to sell their paddy at the market price, they can click on the inquiry form.

The inquiry form will contain a set of fields where the user can enter costs corresponding to the parameters used for predicting the unit price. After entering the costs for each field, the user can click the submit button. Upon submission, the system will pass the entered costs to the backend unit price estimation model in JSON format. The model will then predict the unit price based on the user's entered cost information. The user will be able to view the flexible price on another page, along with accept and reject buttons. If the user accepts the predicted price, the order details will be recorded in the Excel sheet, including the user's ID. On the other hand, if the user rejects the predicted price, they will be navigated back to the main menu.

B) Facial Recognition

Used Dataset: Collect facial images of buyers and sellers individually from the “Kaggle” website.

In this system, users can get access to the website through Facial Recognition. First, a new user can fill out the form providing their name, email address, and password, and upload a user’s image, and other identifying information. After that, the user must go through authentication, which can include using biometric authentication and entering by giving login credentials. Once authenticated, the user is prompted to capture or upload a face image. Next, the system extracts facial features from the user and compares them to identities that have been stored in the system's database using a trained facial recognition model, which is typically based on neural networks (CNN). Then compare and verify the captured image with the registered identities. The system then shows the user the results of identification or authentication, allowing access if the match is successful or if it isn’t unsuccessful, the interface displays an error message. After that, if the monitor displays an error notification while logging through facial recognition user will navigate back to the first step.

C) Demand Forecasting

Used Dataset: Under this Demand Forecasting, demand is mainly forecasting through the paddy harvest. For that, used a dataset of “Paddy Statistics” published by “The Department of Census and Statistics of Sri Lanka” [3] and “AgStat” books referred by an external supervisor from the Agricultural Department of Sri Lanka. It includes time series data from 2005 to 2022 for each district for each “Yala” and “Maha” seasons. This time series dataset has “Total Production in Metric Tons”, “Approximate Total Area Sown (Hectares)” and “Density Per Hectares” parameters.

The system is designed to forecast demand through the harvest for the upcoming season (Yala/Maha) of paddy based on 3 parameters; such as “Total Production in Metric Tons”, “Approximate Total Area Sown (Hectares)” and “Density Per Hectares”. For this forecasting a time series data set from 2005 to 2022 these data are district-wise and season-wise. In demand forecasting, use the time series model, especially the LSTM (Long-Short Term Memory) model and RNN (Recurrent Neural Network). In RNN, when input 3(the number of input data doesn’t matter, can input any amount of data per time) sequential data after it will generate the expected output as a label. That expected output is the forecasting value. This process of RNN works using the “Time Series Generator Function”. After training the neural network with back propagation, the neural network is used to input the amount of data and automatically behavior to give

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 10, pp 523-531, October-2023

https://doi.org/10.47001/IRJIET/2023.710069

the next output as the label value. This is the process of the backend side according to demand forecasting.

When considering the user-end side, once the user logs into the system, users can interact with the main menu. It may contain an option to "predict production" and once click on that users navigate to the predict production details form. It may include to input the expected location district-wise, and forecasting duration (Yala /Maha season). Finally, the system will display the total production of that season and the approximate total area sown (Hectares) or/and density per hectare in the bar chart.

D) Chat System

Used Dataset: An AI chat system to address farmers' questions about paddy cultivation involves several key steps. It begins with data collection, preprocessing, and annotation of a comprehensive dataset. For that, we create a JSON data set for this and create questions and answers for every question.

The AI chat system involves collecting conversational data, preprocessing it, selecting, and training an RNN model, evaluating its performance, comparing it with baseline models, considering ethical implications, conducting statistical analysis, acknowledging limitations, and discussing future work. The objective is to develop an AI chat system capable of engaging in human-like conversations. The collected data is preprocessed, and an RNN model (e.g., LSTM or GRU) is trained with optimized hyperparameters. Evaluation metrics and human feedback are used to assess the system's performance, and ethical considerations are addressed. The study acknowledges limitations and suggests potential future work, aiming to contribute to the field of AI and human-computer interaction.

IV. RESULT & DISCUSSION

A) Cost estimation

The research paper focuses on developing a price prediction model for agricultural crops using an Artificial Neural Network (ANN). The dataset used is obtained from the Cost of Cultivation of Agricultural Crops and undergoes analysis and preprocessing. The choice of ANN is justified by its capability to handle large datasets, resulting in a high accuracy rate of 96% when trained with costing data. Figure 5 - Cost Estimation ANN Model Accuracy.

Compared to other models, such as Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM), the ANN outperforms in terms of accuracy. The accuracy achieved using CNN for training this model was 62%, while the accuracy with LSTM was 74%. These findings support the decision to employ the ANN model for price prediction, as it demonstrates superior accuracy in handling the agricultural dataset, thereby enhancing the reliability of the predictions.

The cost estimation component aims to determine the optimal price for paddy cultivation, considering registered farmers' expenses, and promoting its adoption. Through the platform's interface, farmers input their actual costs. The system then utilizes a trained model to predict a precise and fair price for the cultivated paddy, based on historical cost data. This objective ensures that farmers receive equitable compensation for their efforts, encouraging and promoting paddy cultivation among the farming community.

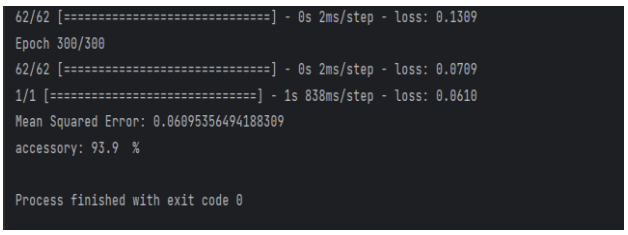

Figure 4: Cost Estimation ANN Model Accuracy

B) Demand Forecasting

The system uses a historical time series dataset and gives results using RNN and time series generator function also that data train neural network with backpropagation. The paddy demand forecasting is based on the "paddy harvest" variable. The historical dataset set since 2005 contains "Total Production in Metric Tons", "Approximate Total Area Sown (Hectares)" and "Density Per Hectare" these parameters. Use the LSTM blocks which is a specialized variation of RNN to handle large datasets and train and get higher accuracy paddy prediction results. In this data set, there is a 0.0204 loss, which means there is nearly 98% accuracy. Figure 6 - Demand Forecasting LSTM Model Accuracy

The main objective of this demand forecasting is to give paddy prediction results for upcoming years by analyzing past harvest data. By analyzing historical datasets, the system predicts the production for upcoming years, providing valuable insights to users on how to maximize their production. Users can input their location and the desired prediction period to receive forecasting results. The output of the prediction result is presented in the form of a bar chart according to the 3 parameters of "Total Production in Metric Tons", "Approximate Total Area Sown (Hectares)" and "Density Per Hectare".

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 10, pp 523-531, October-2023

https://doi.org/10.47001/IRJIET/2023.710069

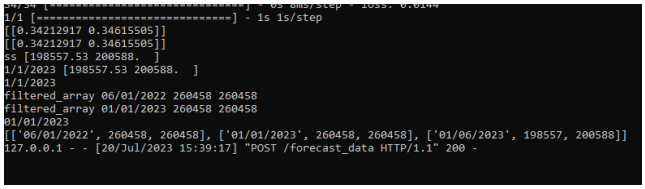

Figure 5: Demand Forecasting LSTM Model Accuracy

C) Facial Recognition

As a result of this component, the access system utilizes Facial Recognition technology to provide a secure and convenient method for users to log in. Users provide personal details and upload their images for identification. The authentication process begins through login credentials. Once authenticated, users are prompted to capture or upload a face image, which undergoes preprocessing for standardization. A trained facial recognition model, often based on CNNs, extracts facial features and compares them to stored identities in the database.

After verifying the captured image, the system displays identification or authentication results, granting access or providing notifications for successful attempts. If an error occurs during the login process, users can return to the first step. This system enhances user experience by leveraging facial recognition technology for convenient and reliable website access.

D) Chat System

An AI chat system for farmers to inquire about paddy cultivation. The system effectively addressed a diverse range of questions on topics such as pest management, irrigation, and fertilizers, providing accurate and relevant responses. Evaluation results indicated high precision and recall rates, ensuring reliable answers. User feedback reflected satisfaction with the system's responsiveness and quality of information, positively impacting farmers' decision-making. The AI chat system demonstrated scalability and efficient handling of concurrent queries. Overall, the research highlights the system's significance in improving agricultural practices, fostering sustainable farming, and empowering paddy farmers with timely and trustworthy knowledge [21].

V. CONCLUSION & FUTURE WORK

A) Conclusion

This research paper introduces SMART AGRO, a web-based platform that leverages deep learning and machine learning technologies to transform agricultural production, distribution, and marketing in Sri Lanka, with a focus on paddy production. The paper presents several innovative components of the platform, including cost estimation, face recognition, demand forecasting, and an AI chat system. The cost estimation component utilizes a trained ANN model to predict the unit price of paddy based on production cost parameters, providing farmers with the opportunity to seek fair compensation. The facial recognition technology enhances farmers' security and enables personalized recommendations for demand forecasting and marketing management. The demand forecasting component utilizes LSTM and RNN models to accurately predict paddy demand and harvest based on historical data. The AI chat system provides timely and accurate responses to farmers' inquiries, empowering them with valuable agricultural knowledge. The research paper highlights the significance of these components in improving agricultural practices, supporting decision-making, and fostering sustainable farming in Sri Lanka.

B) Future Work

Future plans for the agricultural platform involve expanding the range of exported products. Alongside paddy, the platform aims to include Tea, Rubber, Coconut, and Sri Lankan Spices in cultivation and production activities. This expansion will tap into diverse agricultural markets and cater to the growing demand for these commodities. To enhance demand forecasting capabilities, a broader range of parameters will be incorporated, beyond paddy harvest alone. Factors like weather conditions, soil quality, and water levels will be considered to provide more accurate predictions. By considering these variables, production planning can be optimized, ensuring a consistent supply of agricultural products to meet market demands effectively. Additionally, the platform intends to automate the process of market price prediction for the products. By analyzing historical market prices, algorithms and models will be developed to forecast future prices. This automated system will empower users to make informed decisions on pricing, sales, and marketing strategies. By understanding market trends and price fluctuations, farmers and exporters can adjust their strategies accordingly, maximizing profitability and competitiveness in the market.

REFERENCES

[1] M. R. Bendre, R. C. Thool and V. R. Thool, "Big data in precision agriculture: Weather forecasting for future farming," 2015 1st International Conference on Next Generation Computing Technologies (NGCT), Dehradun, India, 2015, pp. 744-750, doi: 10.1109/NGCT.2015.7375220.

[2] V. Amaratunga, L. Wickramasinghe, A. Perera, J. Jayasinghe, and U. Rathnayake, “Artificial Neural Network to Estimate the Paddy Yield Prediction Using Climatic Data,” Mathematical Problems in

ISSN (online): 2581-3048
Volume 7, Issue 10, pp 523-531, October-2023
https://doi.org/10.47001/IRJIET/2023.710069

Engineering, vol. 2020, pp. 1–11, Jul. 2020, doi: https://doi.org/10.1155/2020/8627824.

[3] (Paddy Statistics, n.d.)

[4] Kalita, D. (2022) A brief overview of recurrent neural networks (RNN), Analytics Vidhya. Available at: https://www.analyticsvidhya.com/blog/2022/03/a-brief-overview-of-recurrent-neural-networks-rnn/#:~:text=A%20Deep%20Learning%20approach%20for,by%20a%20deep%20feedforward%20model. (Accessed: 26 June 2023).

[5] M. Rebortera and A. Fajardo, "Forecasting Banana Harvest Yields using Deep Learning," 2019 IEEE 9th International Conference on System Engineering and Technology (ICSET), Shah Alam, Malaysia, 2019, pp. 380-384, doi: 10.1109/ICSEngT.2019.8906427.

[6] G. Guo and N. Zhang, "A survey on deep learning based face recognition," Computer Vision and Image Understanding, p. 102805, Aug. 2019.

[7] J. Liang, H. Zhao, X. Li, and H. Zhao, Research Gate.net, Jan. 2017.

[8] T. ALKHAN, A. Jamil, and A. Hameed, "Deep Learning for Face Detection and Recognition," Research Gate.net, Sep. 2021.

[9] M. Khan, S. Chakraborty, R. Astya, and S. Khepra, "Face Detection and Recognition Using OpenCV," 2019 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS), Oct. 2019.

[10] P. Pannala, J. Charles, and L. Lekamge, "ICT Adoption in the Agriculture Sector: A Case Study in Sri Lanka," 2020. Accessed: May 05, 2023. [Online]. Available: https://fct.kln.ac.lk/media/pdf/proceedings/ICACT-2020/D-4.pdf

[11] T. Nalini, "The Empirical Analysis For Effective Prediction of Crop Price Using Neuro Evolutionary Algorithm based on Machine Learning Approach.", Journal of Physics, Conf. Ser. 2251, 2022.

[12] M. R. Bhardwaj, J. Pawar, A. Bhat, Deepanshu, I Enaganti, K. Sagar, Y. Narahari, " An Innovative Deep Learning Based Approach For Accurate Agricultural Crop Price Prediction," arXiv preprint arXiv:2304.09761, 2023.

[13] G. V. Houdt, C. Mosquera, G. Napoles " A Review on the Long Short-Term Memory Model.", Journal of Physics, Artificial Intelligence Review, 53, pp.5929-5955., 2020.

[14] "Analytics Vidhya," [Online]. Available: https://www.analyticsvidhya.com/blog/2021/03/introduction-to-long-short-term-memory-lstm/#LSTM_Architecture. [Accessed 20 April 2023].

[15] B. Lindemann, T. Müller, H. Vietz, N. Jazdi, M. Weyrich, " A survey on long short-term memory networks for time series prediction", Journal of Physics, Procedia CIRP, 99, 650-655, 2021.

[16] A.Smith and B. Johnson, "Designing an AI Chat System for Paddy Farmers: Empowering Farmers with Timely Information," in Proceedings of the International Conference on Agricultural Informatics (ICAI), Year.

[17] C. Brown and D. Wilson, "Monthly Updated Magazine Subscription Service for Paddy Farmers: Enhancing Access to Knowledge and Decision-Making Support," Journal of Agricultural Technology.

[18] D. Sharma and E. Patel, "Implementation of AI Chat Systems for Paddy Farmers: A Literature Review," in Proceedings of the International Conference on Agricultural Informatics and Communication (ICAIC).

[19] F. Chen and G. Li, "Delivery of Monthly Magazines via Email to Paddy Farmers: A Literature Review," Journal of Agricultural Information Science.

[20] G. Wang and H. Liu, "Email Delivery of Monthly Magazines for Paddy Farmers: Leveraging SMTP and Personalization Techniques," in Proceedings of the International Conference on Agricultural Information Systems (ICAIS).

[21] J. Zhang, H. Chen, and L. Wang, "An AI Chat System for Paddy Cultivation: Improving Agricultural Practices and Empowering Farmers," Journal of Agricultural Technology and Innovation.

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 10, pp 523-531, October-2023

https://doi.org/10.47001/IRJIET/2023.710069

Citation of this Article:

Thathsarani D.M.T., Chamathka Sumanasiri M.G.D., Adikaram V.I., Thennakoon T.M.P.B., Kanishka Yapa, J.M.Dulani Maheshika Jayasinghe, "SMART AGRO - Digitalization of Agricultural Production, Distribution, and Marketing Management System to Forecast and Promote Sri Lankan Agricultural Products" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 7, Issue 10, pp 523-531, October 2023. Article DOI https://doi.org/10.47001/IRJIET/2023.710069

****

