e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

ENHANCING AGRICULTURE THROUGH INTELLIGENT TECHNOLOGY

Dr. A.R. Mune*1, Harsh Pawar*2, Abhishek Pawar*3, Abhishek Jumnake*4, Yash Sinhe*5

*1Assistant Professor, Dept. Of CSE, PRMIT & R, Amravati, Maharashtra, India.

*2,3,4,5Student, Dept. Of CSE, PRMIT& R, Amravati, Maharashtra, India.

DOI : https://www.doi.org/10.56726/IRJMETS53003

ABSTRACT

The Agricultural Portal serves as an innovative and user-friendly platform aimed at enhancing crop production through the provision of essential agricultural information, resources, and tools to farmers. It encompasses a wide array of features such as weather forecasts, tips for pest and disease management, soil health assessment, crop planning tools, and market prices, all of which are geared towards improving farming practices and increasing productivity. This technical paper delves into the development and deployment of the Agricultural Portal, shedding light on its various features and functionalities that are tailored to meet the needs of farmers. It also delves into the advantages that the portal offers to farmers, including heightened productivity, better decision-making capabilities, and increased profitability, thereby underlining its significance in the agricultural sector. The Agricultural Portal is underpinned by a robust technology platform that is not only scalable but also adaptable to cater to the diverse requirements of farmers across different scales and regions. It has the potential to revolutionize farming practices and elevate crop production globally, thereby bridging the gap between traditional farming methods and contemporary technological innovations. In essence, the agriculture portal stands as a beacon of progress in the agricultural landscape, heralding a new era of farming practices worldwide.

Keywords: Agricultural Portal, Crop Production, Farmers, User Friendly.

I. INTRODUCTION

Any country's agricultural industry is its backbone and is essential to its development. Agriculture has become the fastest-growing industry globally due to the expanding world population. The agricultural sector employs around 60% of the people in our nation and contributes significantly to employment rates and the GDP. To fulfill the steadily rising demand for food, the sector must improve farming practices' productivity and quality, among other difficulties. The agriculture industry also has to deal with the unpredictability of climate change. Our study intends to use machine learning algorithms to provide farmers with useful insights into future crop output projections and favorable weather conditions to address these issues. By doing so, we aim to empower farmers to sell their produce directly to customers, thereby streamlining the supply chain and ensuring a more efficient agricultural ecosystem.

An agricultural portal is an online platform that gives farmers and other agriculture industry stakeholders access to a range of materials and services. Such a portal's primary goal is to assist farmers in increasing crop productivity and profitability by giving them access to data, resources, and services that enable them to adopt best practices and make educated decisions. The following are some fundamental ideas at the heart of an agricultural portal for increased crop productivity:

Market intelligence: To make well-informed decisions about the timing and price of their crop sales, farmers need accurate and current information. Farmers have access to real-time market data through agricultural portals, which can help them sell their crops at the best rates and maximize their profits.

Weather information: Farmers must organize their planting and harvesting operations according to the forecast. Agricultural platforms offer weather forecasts and updates to farmers so they can properly manage irrigation, pest management, and other agricultural operations.

Best Practices: In the ever-evolving agricultural sector, farmers must stay current on the newest protocols and best practices. This enables them to use resources and technologies to advance their methods.

II. LITERATURE REVIEW

1. T Raghav Kumar, Bhagavatula Aiswarya, Aashish Suresh, Drishti Jain, Natesh Balaji, and Varshini Sankaran in, Machine Learning Algorithm (KNN) calculates the parameter to suggest the crop which is best to grow in the particular field based on the values received at real-time. A standardized dataset containing the minimum requirements for a particular crop is maintained and is used for the prediction of the crop. The sensors are added to the field for which the readings are needed to be calculated. The DHT11, MQ2, Soil Moisture Sensor, and Light Intensity Sensor send the readings in real time to the cloud server.
2. In this paper, the author says, yield prediction was performed by considering farmers' experience on a particular field and crop. Different Data Mining techniques are used and evaluated in agriculture for estimating the future year's crop production. This is achieved by applying association rule mining on agriculture data. This research focuses on the creation of a prediction model which may be used for future prediction of crop yield. This paper presents a brief analysis of crop yield prediction using a data mining technique based on association rules for the selected region.
3. The author describes how the old farming data can be utilized to depict the future expectation of harvests and yield. It likewise proposes to the ranchers what kind of yield can be developed utilizing the climate station data and gives the appropriate data to incline toward the precise season for cultivating. The curse on the harvest yield is broken down by utilizing different ecological elements and Regression Analysis (RA) and Linear Regression (LR) Algorithms utilizing the various data mining strategies how to improve harvest production.
4. This paper uses machine learning algorithms, direct relapse demonstrated from insights, and two enhancement techniques, the Normal condition strategy, and the Gradient plunge technique to anticipate the weather based on a couple of parameters. this work utilizes the ordinary condition model's speculation and contrasts it and the angle plunge model to give a superior thought of the productivity of the models. This paper is about the use of machine learning algorithms, direct relapse demonstrated from the inside, and two enhancement techniques.

An application for farmers can be created that will aid in the reduction of many problems in the agriculture sector. Medar R, Rajpurohit V S, and Shweta S [5] In this application, farmers perform single/multiple testing by providing input such as crop name, season, and location. As soon as one provides the input, the user can choose a method and the outputs. The outputs will show you the crop's yield rate. The findings of the previous year's data are included in the datasets and transformed into a supported format. The machine learning models used are Naïve Bayes and KNN.

5. This paper predicts the yield of almost all kinds of crops that are planted in India. This script is novel because by the usage of simple parameters like State, district, season, area and the user can predict the yield of the crop in which year he or she wants to. The paper uses advanced regression techniques like Kernel Ridge, Lasso, and ENet algorithms to predict the yield and uses the concept of Stacking Regression to enhance the algorithms to give a better prediction.
6. In this paper, we can predict things like rainy, windy, sunny, stormy, floods variations in temperature, etc. Nowadays, the weather is making a bad impact, as society is growing more and more, causing much damage, injury, and loss of life for farmers. Weather forecasting is very important for agriculture and terrace gardening. Weather forecasting will help remote areas for better crop production. In this paper, a low-cost solution for weather forecast prediction is discussed.
7. This paper uses algorithms such as Random Forest, Support Vector Machine, Weather, and K Nearest neighbor, which are used for better performance results for each selected weather parameter. We also use soil and weather parameters such as soil type, soil fertility, maximum temperature, minimum temperature, and rainfall are used to identify suitable crops for specified farms or land. Ethiopia consolidates both remotely detected information (RSD) and agrarian overview information for a considerable beneficiary of specially appointed imported nourishment help.

IRJMETS
e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

III. DESIGN METHODOLOGY AND IMPLEMENTATION

3.1 Steps in methodology:

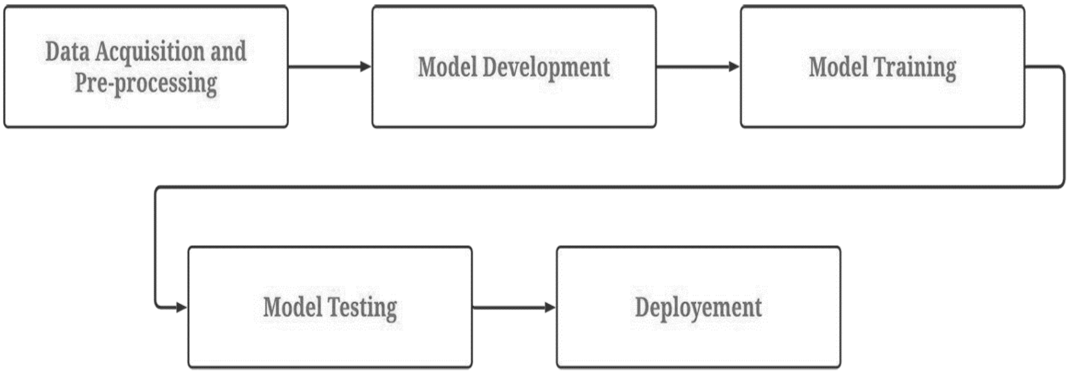

Fig 3.1: Steps in Methodology

The methodology of developing and deploying a machine learning model typically involves the following steps: data acquisition and preprocessing, model development, model training, model testing, and deployment.

1. **Data Acquisition and Preprocessing:**
- Begin by recognizing the problem statement and determining the specific data needed to address it effectively.
- Gather the essential data from diverse sources, including databases, APIs, or web scraping techniques.
- Ensure data cleanliness by eliminating irrelevant or inconsistent entries, addressing missing values, and managing outliers.
- Prepare the data for analysis by carrying out tasks such as normalization, feature scaling, feature engineering, and encoding categorical variables.

2. **Model Development:**
- Select an appropriate machine learning algorithm or a combination of algorithms based on the problem type and the characteristics of the data.
- Divide the preprocessed data into training and validation sets. The training set is utilized to train the model, while the validation set is employed to fine-tune its parameters and assess performance during development.
- Specify the model's architecture or structure, including the number and type of layers (in the case of neural networks) or the configuration of the algorithm.

3. **Model Training:**
- The model's parameters are updated iteratively by feeding the training data into it and utilizing an optimization algorithm like gradient descent.
- Throughout the training process, the model's performance on the validation set is monitored to identify overfitting or underfitting, and hyperparameters are adjusted accordingly.
- Training continues until the model reaches satisfactory performance on the validation set or converges to a stable state.

4. **Model Testing:**
- After completing the training, it is important to assess the performance of the trained model on a different test dataset that has not been seen before.
- Use different evaluation metrics such as accuracy, precision, recall, and F1 score to measure the model's performance and determine its suitability for the given problem.
- Analyze the results of the evaluation to understand the model's performance and make any required adjustments or improvements accordingly.

5. **Deployment:**
- Package the model appropriately for deployment in the selected environment, such as a serialized model file or containerized application.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

- Incorporate the model into the desired system by developing code for input/output, data preprocessing, and communication with other system elements.
- Conduct comprehensive testing on the deployed model to verify its proper operation in the production setting.
- Monitor the model's performance and gather real-world feedback to enhance and update the model as needed.

3.2 Methodology-preprocessing:

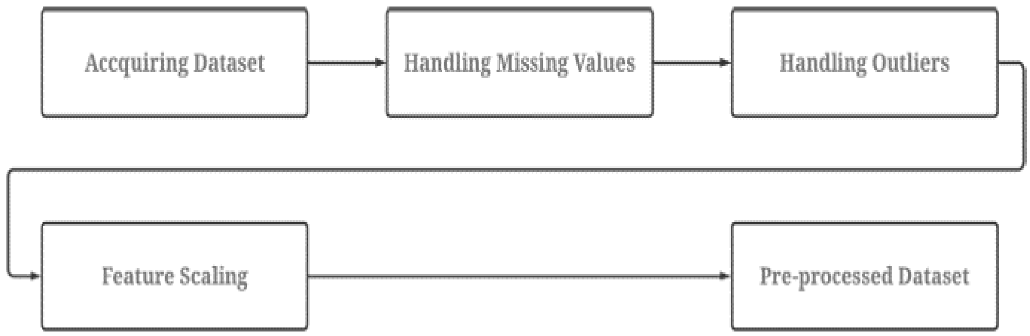

Fig 3.2: Methodology-preprocessing

The preprocessing step in machine learning involves several important tasks to prepare the data for model training. Let's break down each task:

1. Acquiring Dataset:

- Identify the data sources that pertain to your problem statement.
- Collect the necessary data from these sources, which may include databases, APIs, or web scraping.
- Verify that the gathered data is organized in a structured format, such as CSV, JSON, or a database table.

2. Handling Missing Values:

- Identify any missing values in the dataset, represented as NaN (Not a Number) or null values.
- Decide on an appropriate strategy to handle missing values based on the nature of the data and the missing data patterns.
- Some common strategies include:
  - ➢ Eliminating rows or columns containing missing values when they are limited in number and the information loss is deemed tolerable.
  - ➢ Fill in the missing values by replacing them with a statistical metric such as the mean, median, or mode of the specific attribute.
  - ➢ Employing sophisticated imputation methods like regression or machine learning models to forecast and substitute missing values.

3. Handling Outliers:

- Identify and manage anomalies, referring to data points that deviate substantially from the standard range or distribution of the dataset.
- Utilize visualization methods such as box plots or scatter plots to pinpoint potential anomalies within the data.
- Determine a suitable approach according to the characteristics of the data and the particular issue at hand.
  - ➢ To mitigate the influence of outliers on the analysis, it is advisable to eliminate them if they stem from data entry errors or measurement problems.
  - ➢ Employing methods such as log transformation or winsorization can be effective in minimizing the effect of outliers on the data.
  - ➢ Another approach is to utilize robust statistical techniques or algorithms that are less affected by the presence of outliers.

4. Feature Scaling:

- Normalize or scale the features in the dataset to ensure that they are on a similar scale and have comparable ranges.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

- Common techniques for feature scaling include:
  - Z-score normalization involves transforming the data to have a mean of zero and a standard deviation of one.
  - Min-max scaling is a method of scaling the data to fit within a specific range, usually between 0 and 1.
  - Robust scaling is a technique that scales the data using statistical measures that are less affected by outliers.
  - Feature scaling is important to prevent features with larger magnitudes from dominating the learning process and to enable algorithms to converge faster.

5. **Preprocessed Dataset:**

- Once you have finished the aforementioned steps, you will possess a preprocessed dataset that is prepared for model training.
- The dataset must undergo cleaning, with the handling of missing values, management of outliers, and appropriate scaling of features.
- It is recommended to save the preprocessed dataset separately for future reference and to maintain consistency throughout the model development process.

3.3 Modules:

There are 3 modules in our project:

Farmer module, Customer module, Admin module.

1. **Farmer module:**

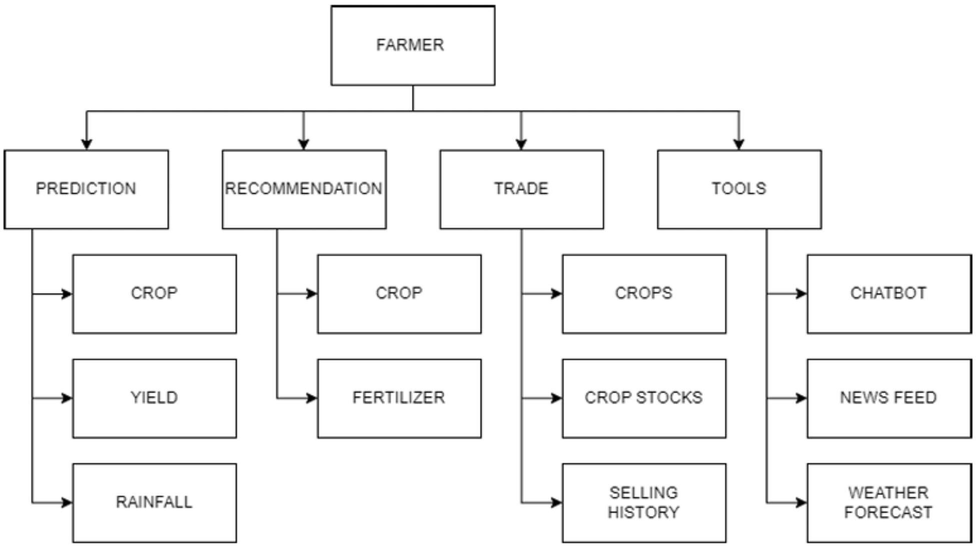

Fig 3.3: Farmer module

The diagram shown above as Figure 3.3 represents the farmer module. Initially, the farmer needs to sign up or log in to the portal. Once logged in, the farmer will be directed to their profile where they can access various options. These options include prediction, recommendation, trade, and tools. Under prediction, the farmer will receive forecasts for crops, yield, and rainfall. In the recommendation section, the farmer will get advice on crops and fertilizers to use. For trade, the farmer can list the crops they want to sell and check crop stocks. They will also have a sales history. In the tools section, the farmer can utilize a chatbot, news feed, and weather forecast. If the farmer has any questions, they can ask the chatbot for clarification. Additionally, the farmer will receive updates on agriculture through the news feed.

2. **Customer module:**

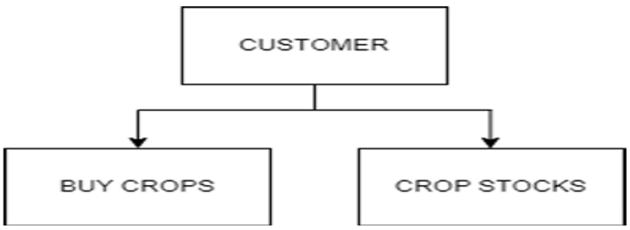

Fig 3.4: Customer module

IRJMETS
e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

The customer module is represented in Figure 3.4. To access the module, customers need to sign up or log in to the portal. Once logged in, customers can explore various options such as buying crops and crop stocks. In the "buy crops" option, customers can add the desired crops to their cart and proceed with payment. After successful payment, customers will receive an invoice. In the "crop stocks" option, customers can view the available crops and make purchases accordingly.

3. Admin module:

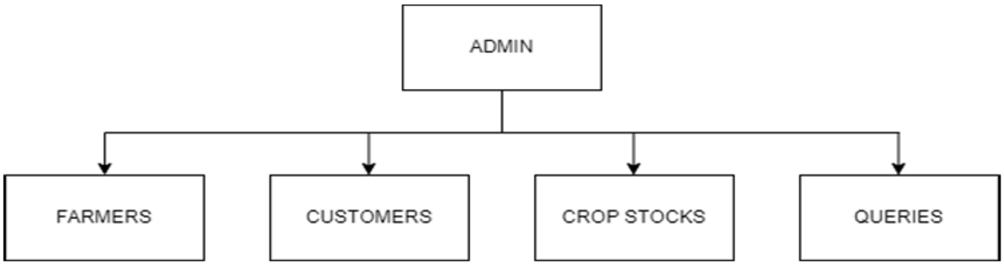

Fig 3.5: Admin module

The admin module is shown in Figure 3.5. To start using it, the admin needs to sign up or log in to the portal. Once logged in, the admin will be taken to their profile. There are several options available for the admin to use after logging in. These options include accessing the list of registered farmers, the list of registered customers, the crop stock, and the queries received through the Contact Us option. The admin can view the list of farmers, the list of customers, the available crops for purchase, and the queries from users of the portal.

IV. RESULT AND ANALYSIS

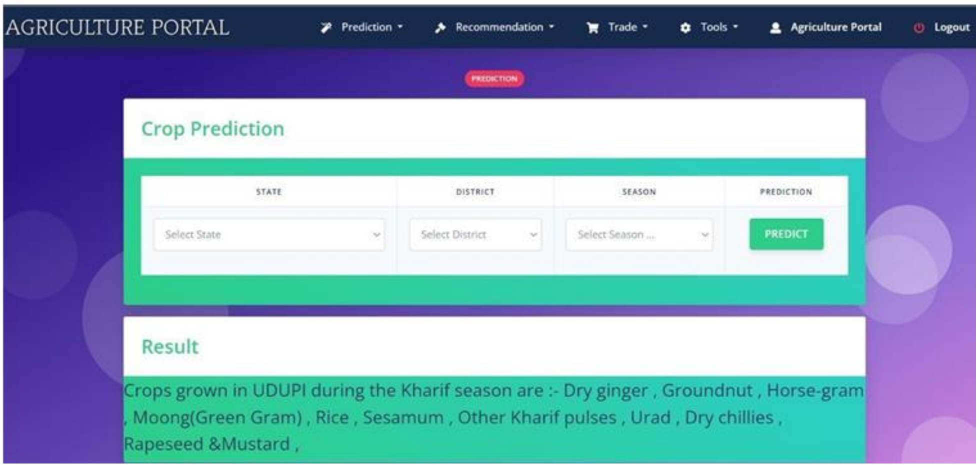

Fig 4.1: Crop prediction

The crop forecasting system will anticipate various types of crops that are ideal for cultivation in the specified region based on the provided input.

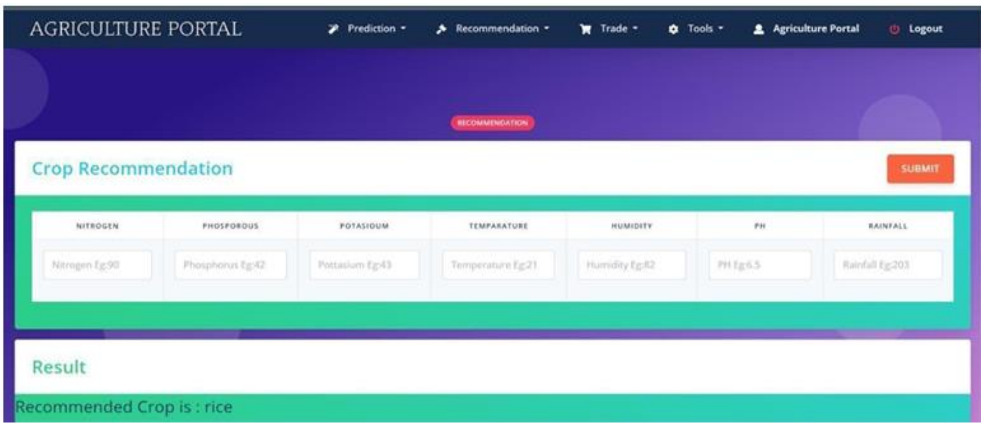

Fig 4.2: Crop recommendation

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

The crop recommendation suggests the specific crop suitable for cultivation in the designated region.

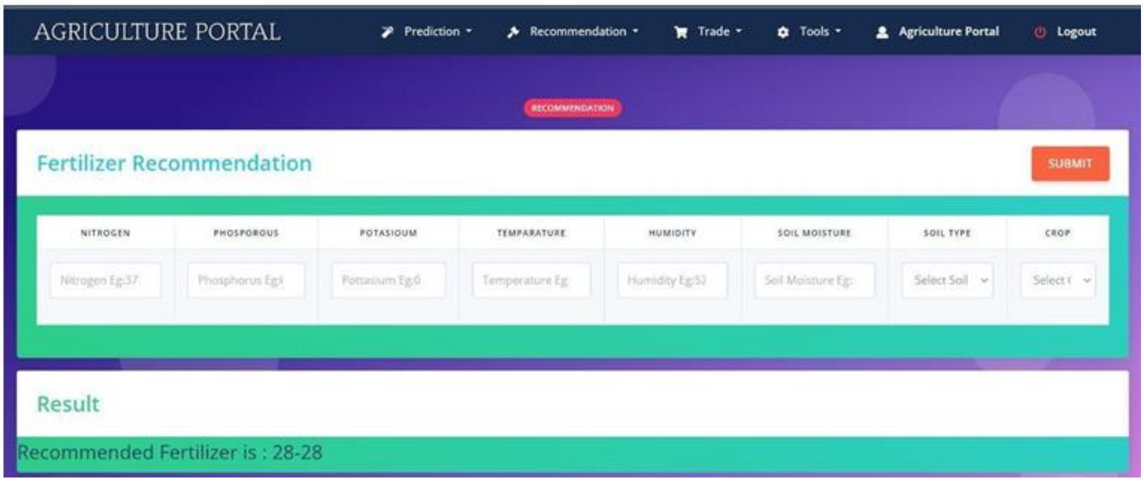

Fig 4.3: Fertilizer prediction

Fertilizer prediction will recommend the particular fertilizer suitable for that area. That fertilizer will be helpful for the crop which is to be grown.

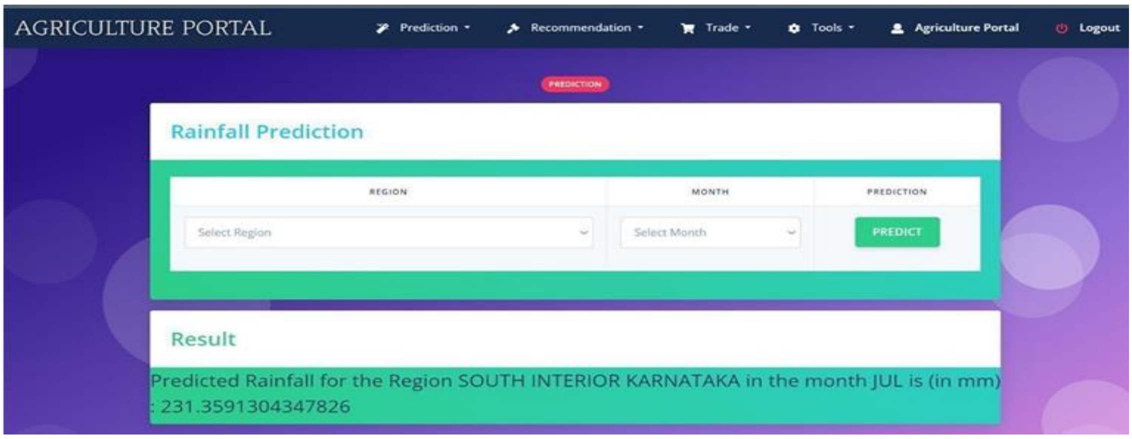

Fig 4.4: Rainfall prediction

Rainfall prediction will predict the rainfall for the particular region which is selected according to the inputs from the list. This will help farmers from incurring losses.

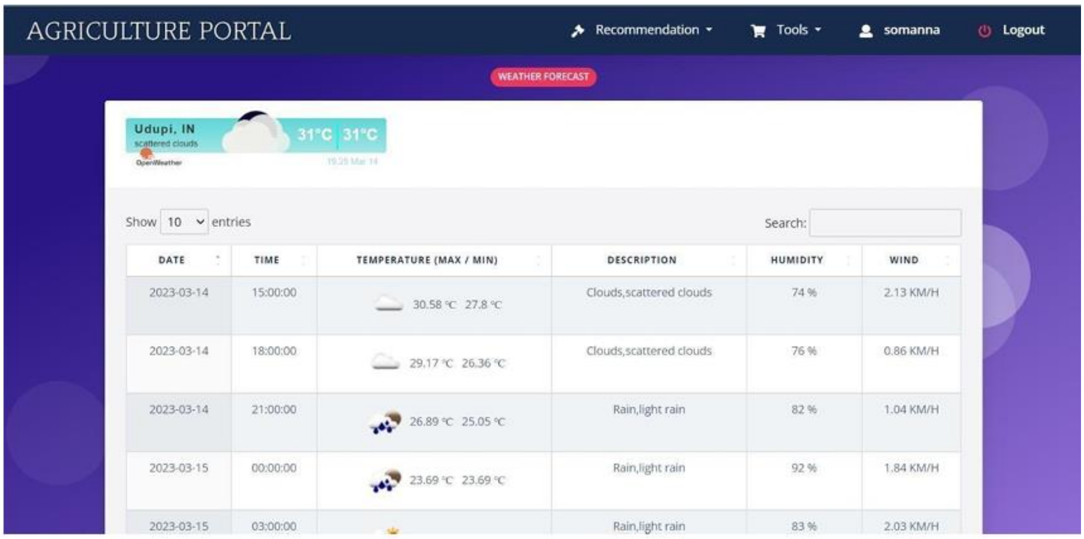

Fig 4.5: Weather forecast

The weather forecast predicts the weather of the coming days, which might be helpful for agricultural purposes.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

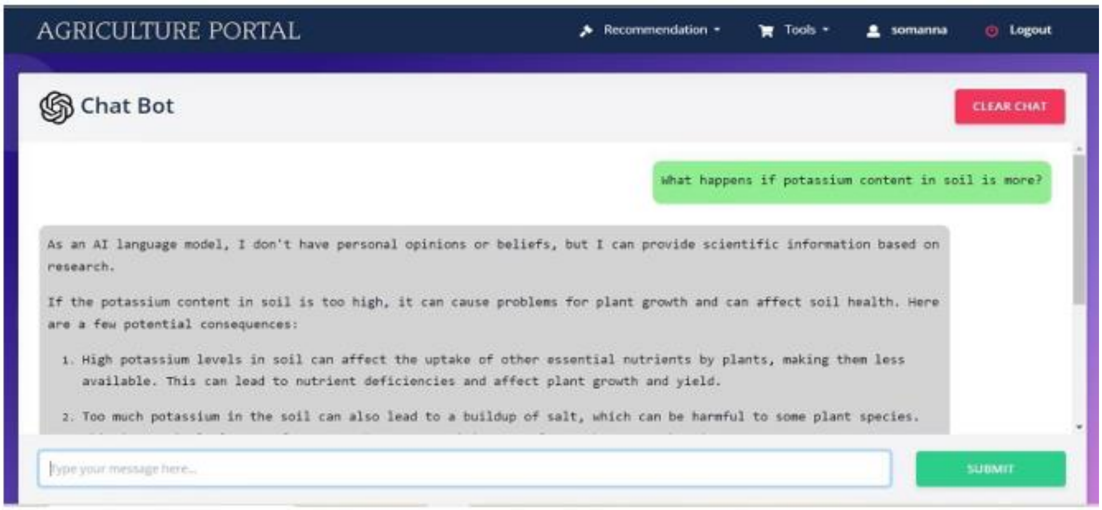

Fig 4.6: Chatbot

V. CONCLUSION

In this paper, we present the different machine learning algorithms that can be used to predict the yield of a crop based on the weather and various other conditions. We are developing a website that can predict crop yield, weather, and fertilizer recommendations with the help of machine learning algorithms. The decision tree can be used to make the most accurate predictions. The prediction system can be used to take input from the user and provide the best and most precise predictive analysis for the crop yield. The website can also provide information about the best crop suitable for the crop and which specific fertilizers are needed for that crop. The Random Forest classifier can be used to provide the highest level of accuracy for weather prediction and fertilizer recommendation. This not only helps farmers maintain the correct crop supply to grow, but it can also help in cost management as well. It will help farmers to make better decisions about crop selection, fertilizer use, and overall cost management. The robustness and reliability of our system have been verified through experiments performed on a reliable dataset.

VI. FUTURE SCOPE

In the future, the web application can be made more user-friendly by catering to a wider audience, provide a link for uploading data in place of manually entering the test value, and including all regional languages in the user interface.

By developing a recommender system for agricultural production and distribution for farmers, this research can be advanced to a higher level. With the help of this method, farmers may decide for themselves which crop to plant in which season to maximise their profits. Databases or organised data sets can be used with this recommender system.

VII. REFERENCES

[1] T Raghav Kumar, Bhagavatula Aiswarya, Aashish Suresh, Drishti Jain, Natesh Balaji, Varshini Sankaran, “Smart Management of Crop Cultivation using IOT and Machine Learning,” International Research Journal of Engineering and Technology (IRJET) Nov 2018, pp. 845- 850.

[2] E. Manjula, S. Djodiltachoumy, “Model for Prediction of Crop Yield”, International Journal of Computational Intelligence and Informatics, Vol. 6: No. 4, March 2017.

[3] Dr. Y. Jeevan Nagendra Kumar, V. Spandana, V.S. Vaishnavi, K. Neha, “Supervised Machine learning Approach for Crop Yield Prediction in Agriculture Sector”, (ICCES 2020) IEEE Xplore ISBN: 978-1-7281-5371-1.

[4] R. B. Saroo Raj, Ankush Rai, Ronit Dharmik, Siddharth Bhattacharjee,” Weather Forecasting System using Machine Learning”, International Journal of Emerging Technologies in Engineering Research (IJETER), Volume 6, Issue 10, October (2018).

[5] Medar R, Rajpurohit V S and Shweta S (2019) Crop yield prediction using machine learning techniques IEEE 5th International Conference for Convergence in Technology (I2CT) pp 1-5 doi: 10. 1109/I2CT45611. 2019. 9033611.

[6] Potnuru Sai Nishant, Pinapa Sai Venkat, Bollu Lakshmi Avinash3, B. Jabber. "Crop Yield Prediction based on Indian Agriculture using Machine Learning", International Conference for Emerging Technology (INCET) Belgaum, India. Jun 5-7, 2020.

[7] Shivani Turamari, Pooja Patil, Mallappa Hallad, Manjunath Bilagi, "Weather Forecast Prediction for Agriculture", (IJERT) ISSN: 2278-0181, Special Issue - 2022.

[8] Pallavi Shankarrao Mahore, Dr. Aashish A. Bardekar, "Crop Yield Prediction using Different Machine Learning Techniques", International Journal of Scientific Research in Computer Science, Engineering and Information Technology ISSN: 2456- 3307, Volume 7, Issue 3, May-June- 2021.