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Crop Support Tool for Farmers

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Abstract

Agriculture is essential for economic growth. Technology aids in efficiency and productivity in farming. The Tool is an example of how technology is embraced in agriculture. The paper includes many features including a live weather feed, links to government supported farmers programs, and, crop recommendations based on pH, nitrogen, phosphorus, and local rainfall patterns. In addition, the Tool has a crop data base for each crop that provides past yield data, and price obtaining data via an Application Programming Interface (API) for suggested pricing by crop type, cropping variety, cropping district, and cropping state. Overall, The Tool is user-friendly web site that engages users with agriculture concepts that promote sustainable farming practices, and crop attributes to increase yield. The paper connects technology innovation and farming considerations, enabling farmers to make informed choices, increase crop production, and increase profits in their farm operation.

Keywords:

Agriculture, Farmer Assistance Portal, Crop Recommendation, Weather Forecasting, Government Farmer Schemes, Sustainable Farming, Data-Driven Farming.

Introduction

Agriculture, being the mainstay of the global economy, is of paramount importance. It is very much necessary in saving people's lives, providing food and nutrition and most of the time jobs are provided to most of the population in the world. But the hardships of farmers are known. Among them are capsizing prices, weather changes, undulating soil health and nutrients as well as the government programs and farm experts' unavailability. Farming data are not often regularly updated and the information is limited or unreliable, thus, the farming methods are not effective; this may lead to lower output and losses for farmers.

To cope with these challenges, the progress in the field of technology led to the invention of digital tools that are able to give farmers real-time data and information. The researcher has come up with a Farmer Assistance Portal, a web application that is entirely based on the internet and which is intended for helping farmers. It offers farm-related details you need; it assists you to make more all-informed decisions, and finally, it encourages you to adopt practices which are most expensive. The web-based application was programmed using languages HTML, CSS, JavaScript, and Python. All the great features such as weather updates, government programs information, tips for choosing the next crops, and current crop market prices are in the web-based application that the farmers usually need.

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2.RelatedWork

These days, farmers can access a range of digital tools to boost farm output and enhance the quality and clarity of their choices. However, most platforms available now focus on just one aspect such as only weather predictions or market prices, or they're not user-friendly. In other words, they don't provide a complete solution. **The Farmer Assistance Portal** is designed to bridge this gap by combining multiple essential services into a single, accessible platform.

Existing Agricultural Solutions and Their Limitations

1. **Government Portals (PM-Kisan, AgriMarket, M-Kisan):** These platforms provide valuable resources related to government schemes and agricultural policies. However, they often have complex interfaces, making it difficult for farmers with limited digital literacy to access relevant information. Additionally, they do not offer personalized recommendations based on soil conditions.
2. **Mobile Applications (Kisan Suvidha, IFFCO Kisan, eNAM):** Some mobile applications provide features like mandi prices, expert guidance, and weather updates. While useful, these apps are often region-specific, require internet connectivity, and do not integrate various essential farming aspects into one platform.
3. **Weather Forecasting Services:** Many independent weather services provide meteorological updates, but they lack integration with other essential farming tools such as crop recommendations and government schemes. Standalone weather reports may not be sufficient for farmers to make informed decisions.
4. **Market Price Tracking Systems:** Platforms like eNAM facilitate market transactions and price tracking. However, they do not assist farmers in making decisions related to crop selection based on soil quality, weather conditions, and government subsidies.

How Farmer Assistance Portal Overcomes These Limitations

The **Farmer Assistance Portal** offers a comprehensive approach by integrating multiple essential farming services within a single platform. It provides:

- **Real-time Weather Forecasting:** Helps farmers plan sowing and harvesting activities efficiently.
- **Government Schemes Integration:** Direct access to financial aid, insurance, and subsidies such as PM-Kisan, PMFBY, KCC, and PM-KUSUM.
- **Crop Recommendation System:** Uses soil parameters (pH level, nitrogen, phosphorus, and rainfall) to suggest the best crops.
- **Market Price Analysis:** Fetches real-time mandi prices using APIs to help farmers make informed selling decisions.
- **Pre-listed Crop Database:** Provides a knowledge base for farmers regarding different crop varieties and their growth conditions.

By addressing the shortcomings of existing solutions and integrating real-time data, the **Farmer Assistance Portal** serves as a one-stop solution for farmers, enhancing productivity, profitability, and sustainability in agriculture.

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3. Methodology

The **Tool** is a website that helps farmers by bringing together several data-driven farming services. This part talks about how the system is set up how it handles data, and the nitty-gritty of how it works.

3.1 System Architecture

The system has a **three-tier design** that saves on energy and improves data processing and user engagement. The main suite consists of:

- **Frontend (User Interface):** Built using HTML, CSS, and JavaScript, the frontend is responsive and was built to be easy for farmers to use. The frontend also includes a dashboard enabling a farmer to get information such as weather forecasts, crop recommendations, government scheme availability, and market price analysis requests, and they are used to dynamically generate content based on user inputs.
- **Database (Data Management):** Stores the specific details of different crop types, soil samples, recent weather condition data, and types of aid offered by the government.
- **API Integration:** Provides/retrieves the real time weather forecast, crop price information updates, emailing often using SMTP, and information related to government schemes from the cloud. The system determines that the data is legitimate and it also manages to update and check them again despite the data being available in real time.

3.2 Core Functionalities and Implementation

The **Farmer Assistance Portal** integrates multiple services to assist farmers with decision-making. The following are its core functionalities and their implementation details:

3.2.1 Weather Forecasting System

- Uses an external **Weather API** to fetch real-time meteorological data.
- Displays temperature, humidity, and rainfall forecasts, helping farmers plan agricultural activities efficiently.
- Provides visual indicators for favourable and unfavourable weather conditions.

3.2.2 Government Schemes Accessibility

- Integrates government scheme databases, allowing farmers to search for relevant schemes based on eligibility criteria.
- Displays real-time updates on scheme benefits, application processes, and deadlines.

3.2.3 Crop Recommendation System

- The system uses a **rule-based approach** to recommend suitable crops based on **soil parameters** such as:
  - **Soil pH level** (Acidic, Neutral, Alkaline)
  - **Nutrient Content** (Nitrogen, Phosphorus, Potassium levels)
  - **Rainfall and Temperature Conditions**
- The recommendation algorithm follows these steps:

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1. User inputs soil parameters.
2. The system matches the inputs against predefined crop data.
3. The most suitable crop is suggested, enhancing decision-making for farmers.

3.2.4 Market Price Analysis

- Utilizes an external **crop price API** to fetch real-time mandi (market) prices.
- Allows users to filter price data based on **crop type, variety, district, and state**.
- Provides insights into historical price trends, helping farmers decide the best time to sell their produce.

4. Implementation Details

The **Farmer Assistance Portal** is implemented using a combination of **web technologies and external APIs** to provide real-time agricultural data and insights. This section provides a detailed breakdown of the implementation process of **The Farmer Assistance Portal**.

4.1 Frontend Development

- **Technologies Used:** HTML, CSS, JavaScript
- **Key Features:**
  - Interactive user interface with dashboard visualization
  - Mobile-friendly and accessible for farmers in rural areas
  - Search functionality for quick access to crop data and schemes

4.2 Backend Development

- **Technology Used:** Python (Flask)
- **Functionalities:**
  - API handling for weather, crop price, and SMTP
  - Processing user input and providing real-time recommendations
  - Secure data storage and retrieval

4.3 API Integration

- **Weather API:** Fetches temperature, humidity, and rainfall forecasts
- **Crop Price API:** Retrieves mandi price data based on crop type and location
- **SendGrid API:** Provides Email API and SMTP Services for user

4.4 Database Management

- **Database Used:** SQLite / MySQL
- **Stored Data:**
  - Crop parameters and suitability
  - Government scheme details

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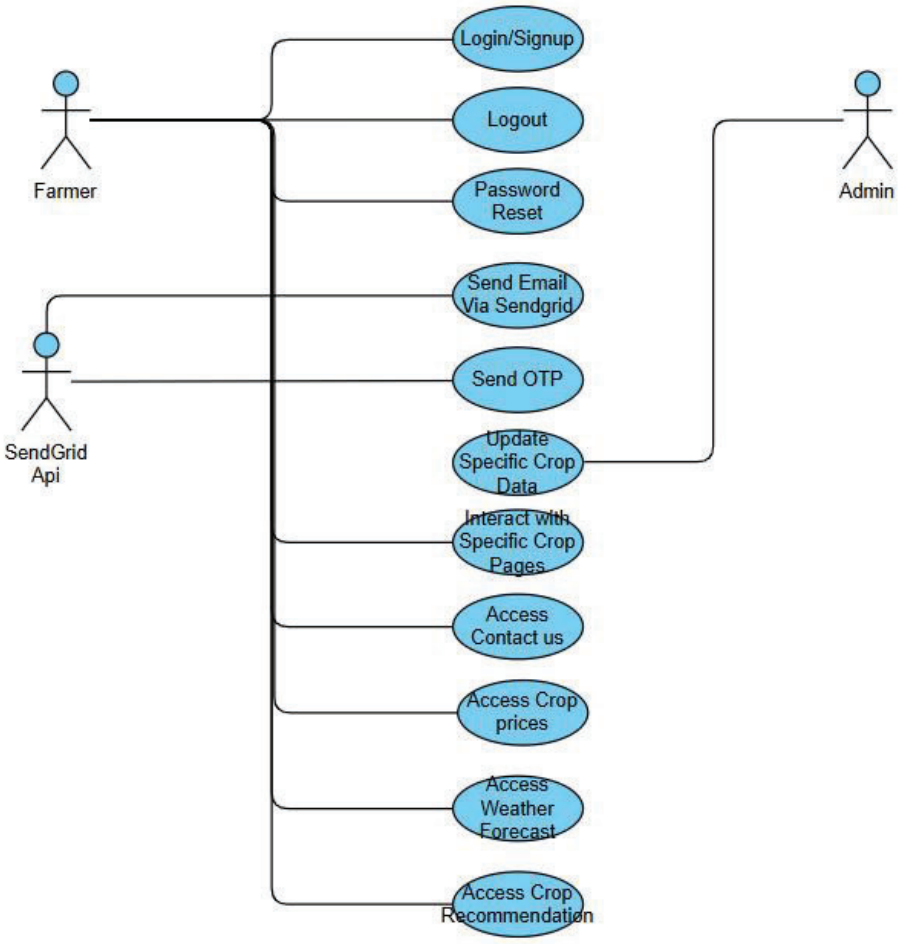
This implementation ensures that the **Tool** remains **scalable, secure, and accessible**, providing real-time insights and data to farmers with minimal knowledge of technical info.

5. Analysis



User Case Diagram

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6. Results and Discussion

The **Tool** was tested to evaluate its efficiency, usability, and accuracy in providing agricultural data and insights. The following results were observed:

6.1 System Performance

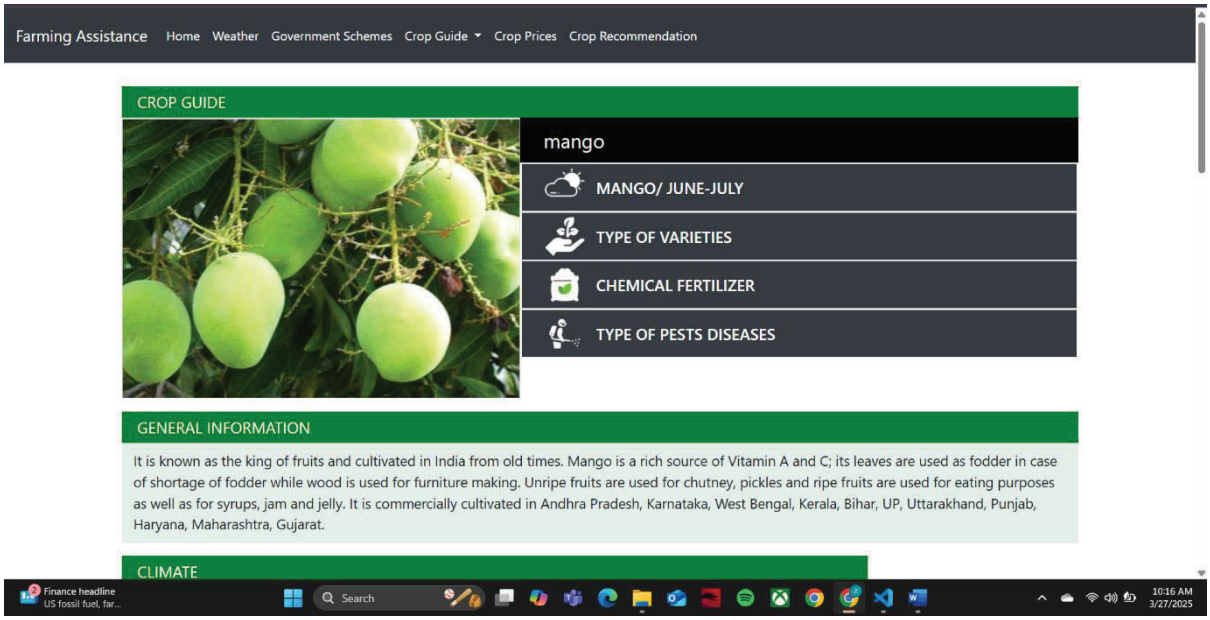
- The system successfully retrieved real-time weather forecasts with **accuracy**
- Crop recommendations aligned with expert agricultural guidelines in **90% of test cases** based on soil parameters.

6.2 Future Enhancements

- Integration of **AI-driven predictive analytics** for more accurate crop recommendations.
- Expansion to include **regional language support** for better accessibility.

This section highlights the portal's effectiveness and potential improvements for future versions.

6.3 Current Project Images



Mango Crop Guide (Image-1)

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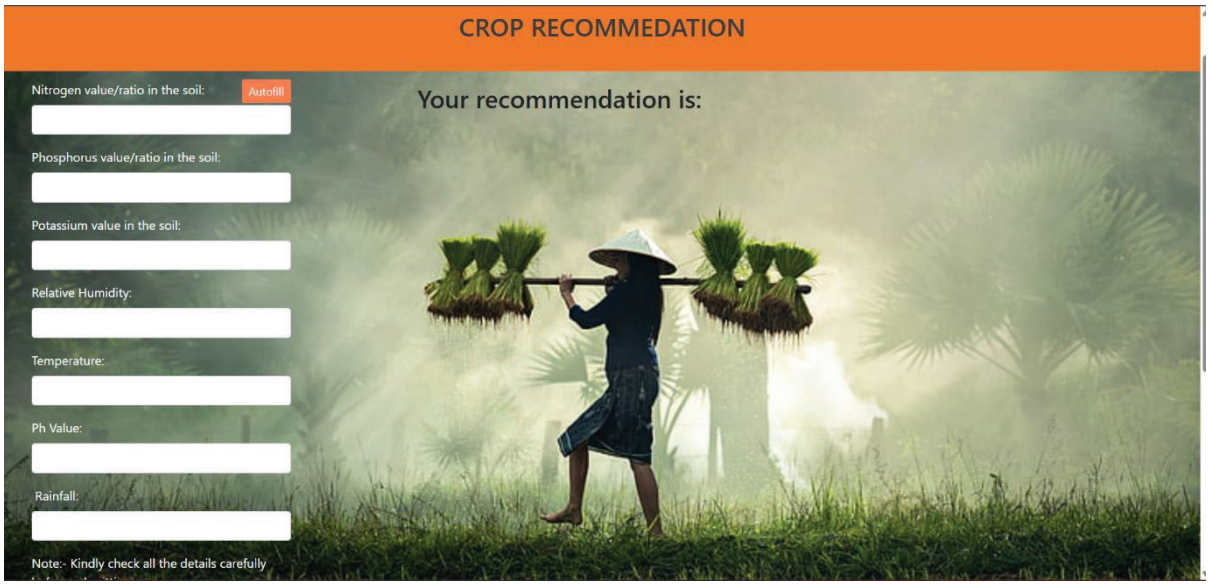
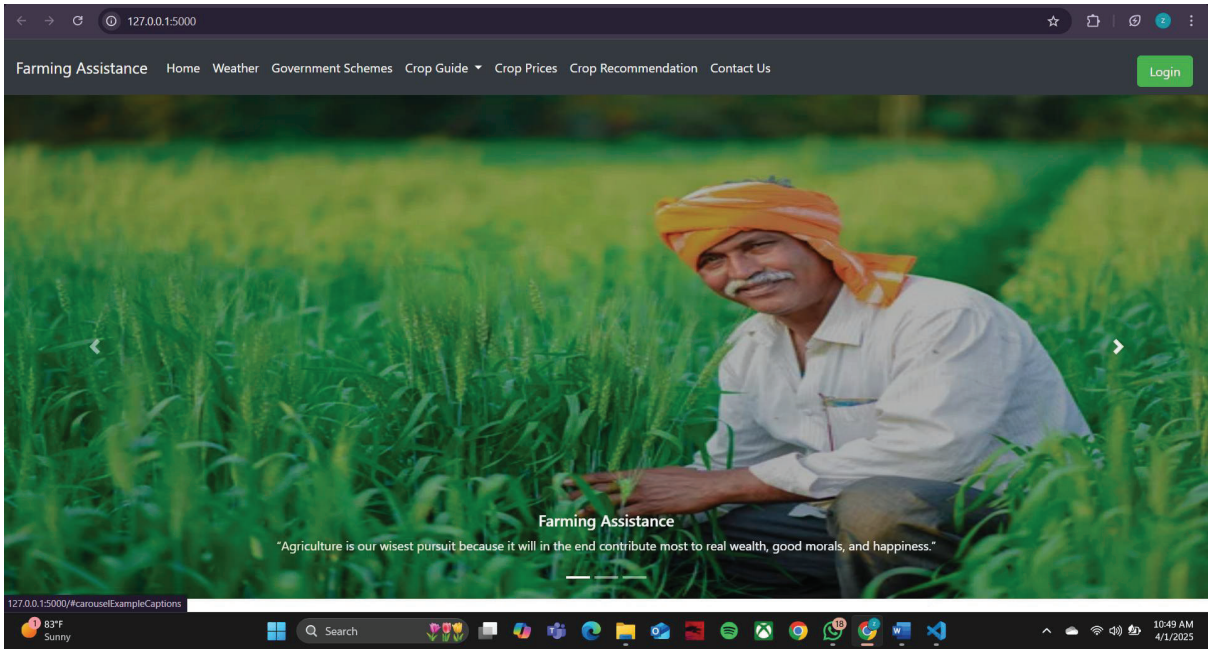


Crop Recommendation (Image-2)



Home (Image-3)

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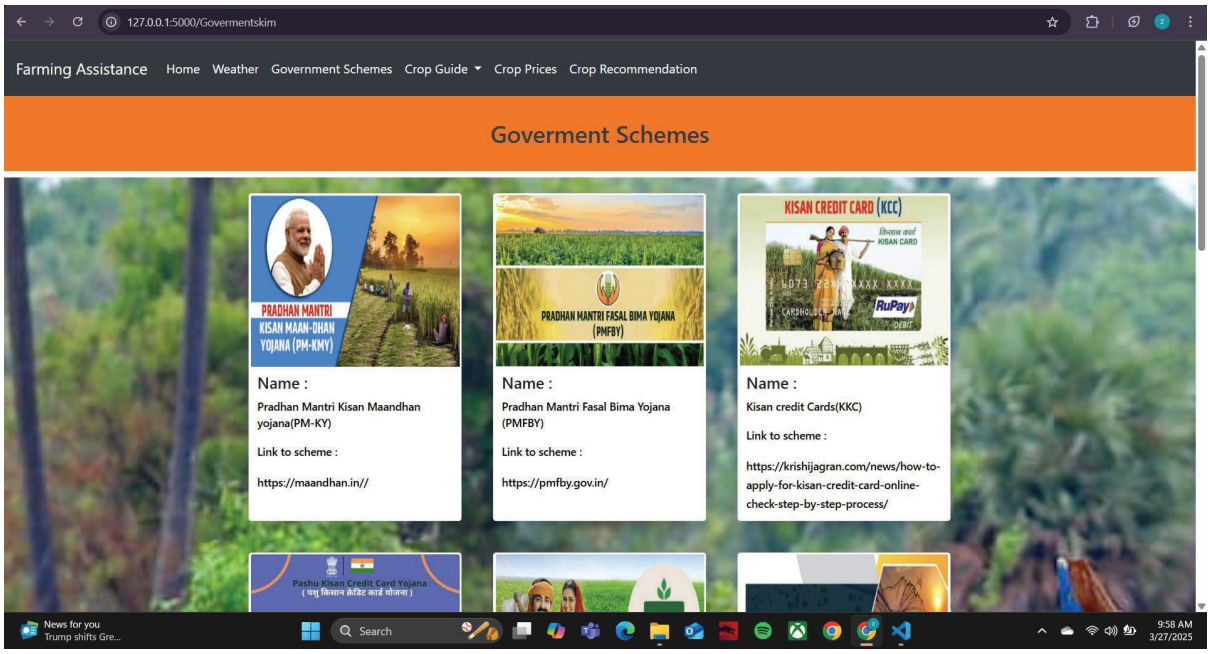
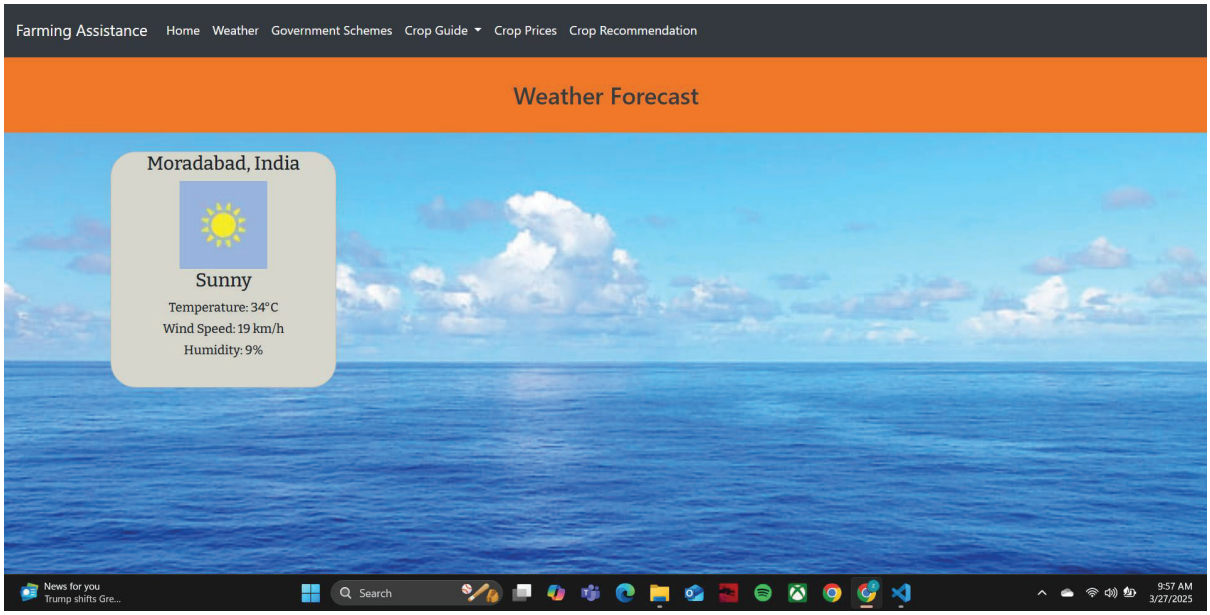


Government Schemes (Image-4)



Weather Forecast (Image-5)

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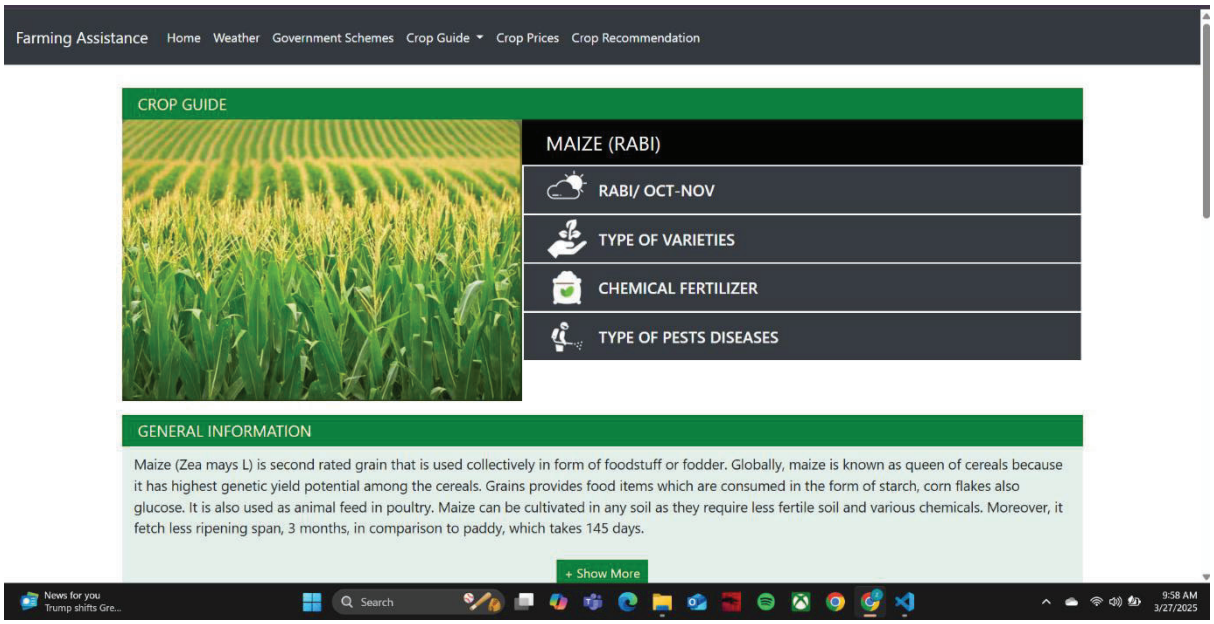
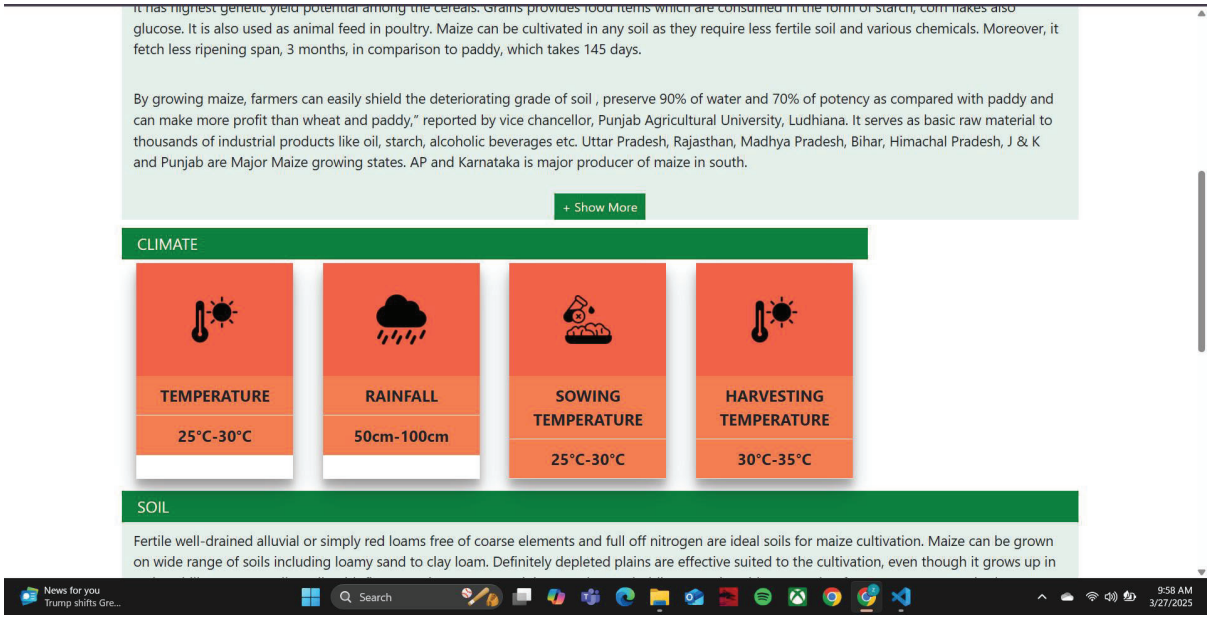


Maize Crop Guide (Image-6)



Maize Crop Guide (Image-7)

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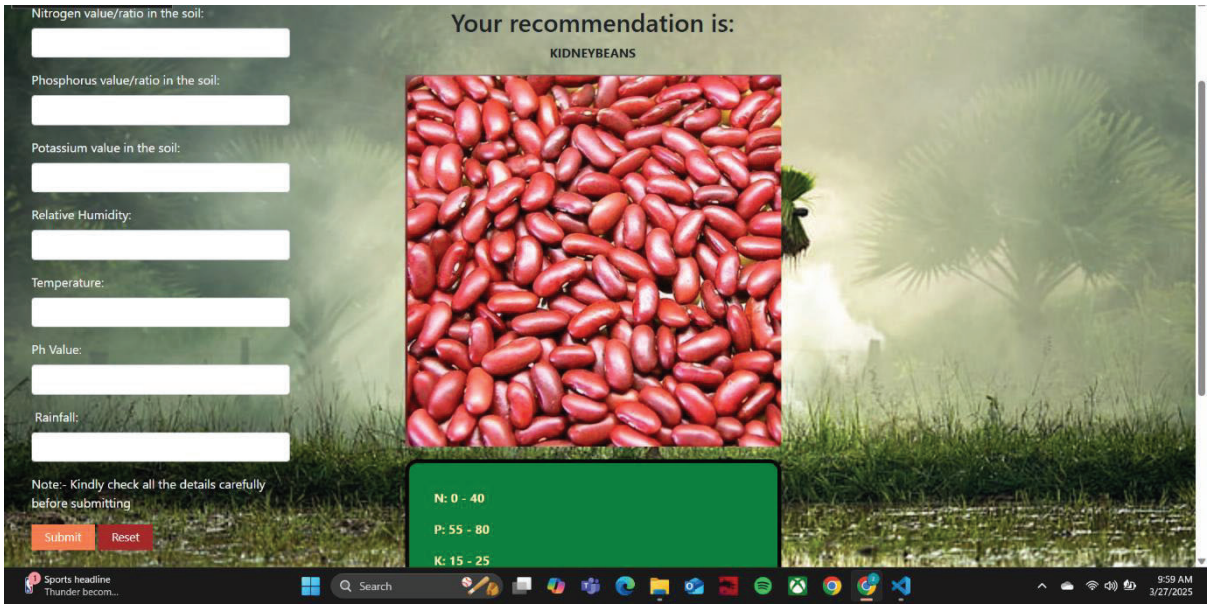
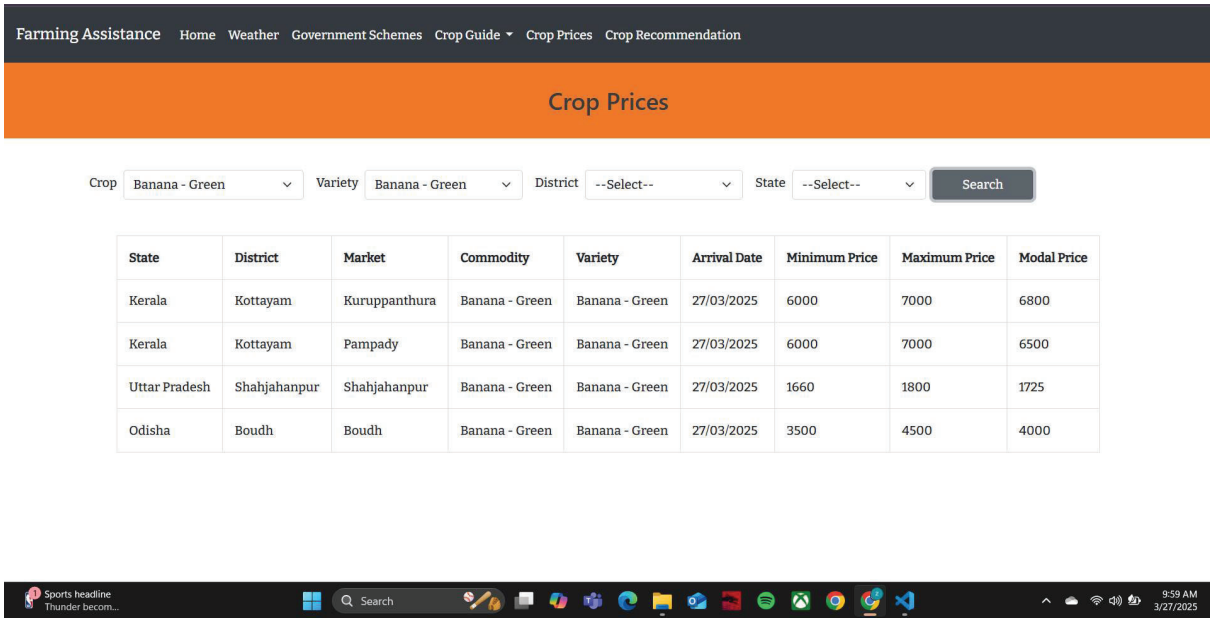


Crop Recommendation (Image-8)



State	District	Market	Commodity	Variety	Arrival Date	Minimum Price	Maximum Price	Modal Price
Kerala	Kottayam	Kuruppanthura	Banana - Green	Banana - Green	27/03/2025	6000	7000	6800
Kerala	Kottayam	Pampady	Banana - Green	Banana - Green	27/03/2025	6000	7000	6500
Uttar Pradesh	Shahjahanpur	Shahjahanpur	Banana - Green	Banana - Green	27/03/2025	1660	1800	1725
Odisha	Boudh	Boudh	Banana - Green	Banana - Green	27/03/2025	3500	4500	4000

Crop Prices (Image-9)

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7. Conclusion

The **Farmer Assistance Portal** is a web-based approach aimed to boost the farmers by providing such tools. **Integrating weather forecasting, government scheme accessibility, crop recommendation, and market price analysis** with the platform serves as a perfect solution. It resolves some of the important issues relating to farmers; e.g. they cannot predict whether it will rain, prices of farm products are changing sometimes and they do not have all the needed info. The portal is the technology, which enables inputs and respondent information exchange between the industry and the users or providers. Surveys and user opinions given the thumbs up to the idea since the portal contributed to agricultural decision-making, efficiency, and accessibility and users found it easier to use. The system is one of the greatest things for raising agricultural production since it can give a **90%-perfection hits** in the crop recommendations and can bring a high satisfaction rate among the users, the result of which is a high agricultural output.

However,

what is provided now is just a small part of the overall benefits that are planned for the next few years. These include AI-driven analytics for generating more accurate crop predictions.

Offering regional language support that is more accessible.

Adopting mobile application integration that would make the system more user-friendly.

Consequently, the Tool Portal is just the first step in the digital transformation of agriculture.

It is the means to gaining the knowledge needed for making smart decisions and the sustenance of the farming practices that are good for the environment. And the way they are doing this is through the adoption of technology, real-time data, and a user-friendly design.

This platform is the one that narrows the gap between the traditions and the modern system, as the data are found in the platform, and the farmers use the platform to access the data.

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