© May 2026 | IJIRT | Volume 12 Issue 12 | ISSN: 2349-6002

Smart Farming Information Web System

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Abstract*—Farming plays a key role in agriculture-based economies such as India. The farmers find it difficult to decide which crops to plant due to insufficient knowledge regarding soil and unpredictable climate changes and lack of technological advancements. This research project revolves around the development of Smart Farming Information Web System that assists the farmers in decision-making by inputting relevant data such as the type of soil, the size of land, and timing among others. In response, it suggests crops that should be planted and provides useful information such as the type of fertilizer to be used, pest prediction, weather conditions, and crop price prediction. In order to develop the web application, HTML, CSS, JavaScript, Python Flask, and MySQL were used. Furthermore, the application is developed in a way that makes it user-friendly and easily understandable by even computer-illiterate users. The ultimate purpose of the application is to promote smart farming to increase crop yield, decrease wastage, and integrate technologies into the agricultural sector.

Index Terms*—Smart Farming, Crop Recommendation, IoT, Soil Monitoring, Agriculture, Web System, Smart Agriculture.

I. INTRODUCTION

Agriculture plays an important role in our economy, and there are many individuals engaged in this activity. Many farmers in India still apply traditional methods and personal experience to pick crops for planting. The problem is that this method worked in the past. Now it is inefficient due to changes in climatic conditions and depletion of the soil.

Moreover, many of them do not have any knowledge related to such factors as soil condition, its moisture level, and weather predictions. Therefore, they may select the wrong crops leading to crop failure, wasting natural resources and finances.

However, nowadays the development of technologies allows overcoming such obstacles as the Internet, sensors, and other online applications are able to provide valuable information about crops and their management. Moreover, this software is capable of analyzing and predicting all possible outcomes.

Smart Farming Information Web System aims at facilitating this process. In particular, the system offers to fill in certain fields and receive valuable recommendations for making decisions.

II. LITERATURE SURVEY

Many researchers in the area of agriculture have developed information systems to support farmers in decision-making using the Internet and dedicated computing devices. The information considered for such systems includes moisture content and meteorological data.

The authors of these approaches tried to enable farmers to monitor their land remotely. For instance, V. Choudhary, P. Guha, G. Pau and S. Mishra have developed a system for collecting agricultural data from various sources (i.e., machine sensors) using the Internet and providing the farmer with a web-based interface for monitoring the state of his fields. This system allows farmers to monitor the performance of their field from remote locations. However, the system does not provide complete information for farmers (e.g., fertilizer selection or crop valuation).

Other researchers like I. Ivanochko, M. Greguš Jr. And O. Melnyk have proposed a computer-based architecture for the storage and analysis of data

collected from machines. In addition, they have provided farmers with access to this data through an Internet website or a mobile application. This approach is mostly useful for the remote analysis and storage of information collected by farmers rather than advice-giving.

C. Thejesh, B. Saidivya, and S. V. Rajeswari examined the role of the internet in enhancing agriculture production. They argued that the use of technological innovations such as mechanization and automation could improve agriculture output. These researchers have emphasized the importance of having systems, but their paper is more theoretical and lacks an interactive website that would serve the needs of the farmers.

The paper by S. N. Kumar, K. Suriyan, A. T. Jacob, A. Varghese, and E. Francis presents a system for crop management and utilization of resources among small farmers. The system monitors the progress of the farmer and assists in decision-making. Nevertheless, the study did not integrate all the features of a website that could provide relevant information.

Thus, a comparative analysis of the above papers reveals that existing solutions tend to support monitoring functions or provide a limited amount of data necessary for agricultural activities. The proposed Smart Farming Information Web System combines several features within a single website. The users will be able to input data about soil type, available land, season, and receive recommendations concerning crops, fertilizers, pesticides, weather, and value of agricultural products.

III. PROPOSED SYSTEM

The proposed system is a web-based Smart Farming Information System which would assist the farmers in selecting appropriate crops as well as gaining important agricultural information. The system enables the user to provide details regarding the soil type, land area, season, and location through a convenient web interface. Once the information has been entered, the system evaluates the information provided by comparing it with information available in the database.

The database holds details about various crops, their suitability with soil conditions, appropriate seasons, fertilizers and pesticides requirements as well as market rates of the crops. Based on the information entered, the system suggests appropriate crops for the farmland of the user. Besides recommending the crops, the system offers other information such as the appropriate season for growing the crop, the fertilizers and pesticides needed, weather conditions, and market rates.

The proposed system has been designed using HTML, CSS, and JavaScript for the frontend while the Python Flask has been used for the backend along with MySQL. A user-friendly website has been developed so that the farmers can operate the system conveniently without any knowledge of programming languages.

The overall process of the proposed system includes:

1. The farmer enters soil type, land details, and season.
2. The website sends this information to the Flask backend.
3. The backend checks the database for matching crop information.
4. The system selects the most suitable crop.
5. The result is displayed to the farmer along with fertilizer, pesticide, weather, and market price details.

The proposed system reduces the difficulty of crop selection and helps farmers make better decisions. It saves time, reduces financial loss, and supports the use of modern technology in agriculture.

IV. BLOCK DIAGRAM

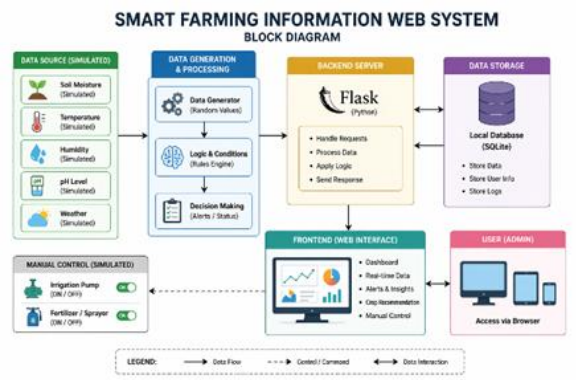


Figure 1. Block Diagram

V. METHODOLOGY

The methodology adopted by Smart Farming Information Web System for giving proper agricultural

recommendations and relevant agricultural information to the farmer is done using a certain procedure that has been elaborated below.

1. System Overview

The proposed web-based information system is called the Smart Farming Information System, which will demonstrate the process of monitoring, analyzing, and making decisions in an agricultural setting. This being a demo/prototype system, actual input from the IoT sensors is not taken and instead simulated input data is used. The application has a client-server architecture, whereby the front-end interacts with the back-end for displaying the necessary information.

2. User Interaction

The system is accessed by the user (admin) through the browser. The user uses his credentials to log into the system and uses various components of the system such as:

- Dashboard
- Crop Recommendation
- Alerts & Insights
- Manual Control

These will help in interacting with the system properly.

3. Data Generation (Simulated Input)

Unlike taking actual data from the sensors, this demo/prototype takes simulated inputs based on the environment parameters, which include:

- Soil Moisture
- Temperature
- Humidity
- pH Level
- Weather conditions

4. Backend Processing

The system's backend will be written using Flask framework in Python. This component handles:

- Client requests
- Data generation from sensors simulation
- Logical conditions application
- Crop recommendation inputs processing
- Responses back to frontend

5. Logic and decision making

Rule-based decision-making will be employed in this project where:

- If soil moisture falls below certain threshold level, irrigation alert is raised
- If temperature rises above certain limit, warning message is displayed

For crop recommendation purposes, appropriate crops will be recommended taking into account selected soil and season types.

6. Data storage

Local database (SQLite) or file system storage will be utilized for storage of:

- User data
- Log messages
- Examples of agricultural data (crops list, yield record, etc.)

7. Frontend implementation

HTML, CSS, and JavaScript will be used for building the frontend, which offers:

- User-friendly dashboard
- Sensor data visualization (real time)
- Charts and graphs visualization
- Insights and alerts
- Crop recommendation interface
- Manual control possibilities

8. Manual control (simulated actuation)

The system will support simulated actions like switching irrigation pumps OFF/ON, as well as other control functions for sprayer/fertilizer machines etc.

9. Data Presentation on Output Interface

The resulting data is displayed to the end user through the following interfaces:

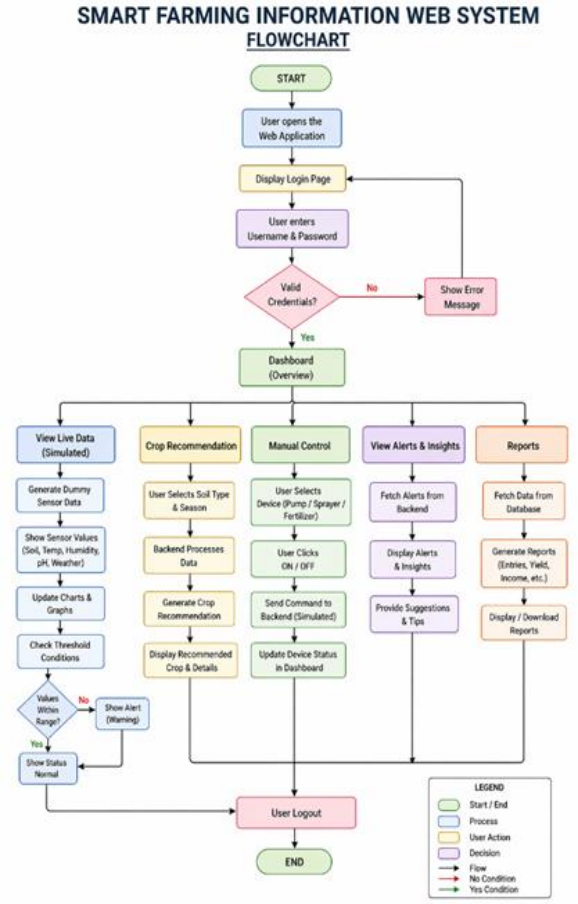
- Data readings from sensors (virtual)
- Alarms and status of system
- Crops suggestions
- Graphs for analyses

10. Workflow of the System

1. Login of user into the system
2. Dashboard fetches data from the server
3. Server generates simulated data
4. Application of logical operations on data
5. Presentation of data processing to frontend
6. Update information on the dashboard
7. User interaction with the system
8. Update outputs of system dynamically

11. Conclusion

The methodology demonstrates a smart farming system using a web-based approach with simulated data. It effectively represents the working of IoT-based agricultural systems, including monitoring, analysis, and control, without requiring physical hardware implementation.



VI. SYSTEM INTERFACE

The Smart Farming Information Web System is made up of several web pages that aid the user in accessing information related to agriculture and crops. The site is built with an easy-to-use interface, making it accessible to all farmers.

1. Login Page

The login page is the first page one encounters when logging into the website. The user can enter his or her username and password to access the site's content.

Figure 2. shows the login page of the system

2. Home Page

The user will then be navigated to the homepage after logging in. The page gives an introduction of the software and shows the key features including Crop Entries, Yield, Alerts, and Insights.

Figure 3. shows the home page of the website.

3. Crop Recommendation Page

The crop recommendation page gives farmers an opportunity to give relevant data like the soil type and the season. Once the details have been entered, the system analyzes the data and then looks for crops that best fit the situation.

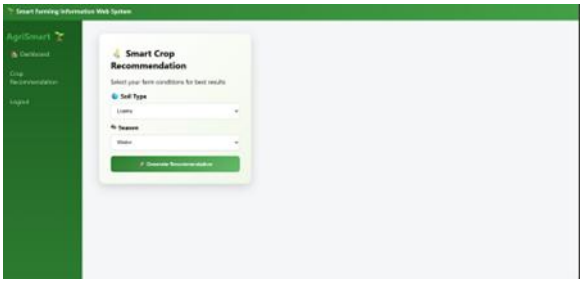


Figure 4. shows the crop recommendation page where the user enters the required details.

4. Result Page

The result page will show the output produced from the system. It presents information about the suggested crop together with other information like the expected output and weather.

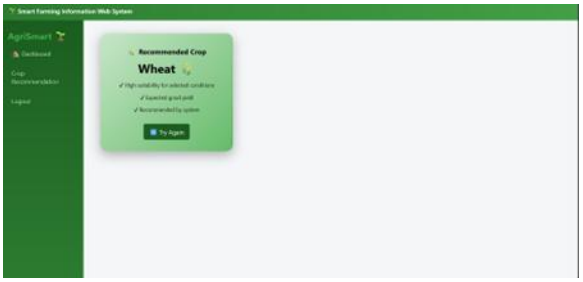


Figure 5. shows the result page of the system.

VII. ADVANTAGES

1. Helps in Choosing Proper Crops
This system suggests the crops considering the type of soil, season, and land information provided by the farmer. This assists the farmer to select the appropriate crop for cultivation rather than opting for crops based on personal experience.

2. Minimizes Crop Failure
Crop failures are a major reason why many farmers have incurred losses. This is due to growing crops which are not suitable for the particular type of soil and weather conditions. With the recommended system, crop failure is minimized as it suggests crops which can be grown under given conditions.

3. Offers All Agriculture Related Information
Not only does the website suggest the crops, but it also gives other useful information related to crops such as fertilizers required, pesticides, weather conditions, and market rates. This means that a farmer can get all types of information from the same source.

4. Saves Time and Manual Work
Conventionally, farmers require visiting agricultural departments or consulting experts for obtaining suggestions about crops. However, in the suggested system, only a few inputs are needed on the website for getting the desired result.

5. Easy to Use
The website has been developed in such a way that it has a very easy and user-friendly interface. It will be possible for even those farmers who lack knowledge about technology to use the website without difficulty.

6. Reduction in Financial Loss
In case the wrong choice of crops is made, it may result in poor harvest and financial losses. The website will assist the farmer in choosing the appropriate crop and provide information on the correct fertilizer and pesticides that need to be used to avoid unnecessary financial losses.

7. Increase in Agricultural Production
If the right crop is chosen and the proper guidance is provided, the crop will grow well and bear more fruit. As a result, the proposed solution will contribute to increasing agricultural productivity.

8. Economical Approach
The system being proposed here is a website that requires minimal investment in terms of hardware costs because it utilizes HTML, CSS, JavaScript, Flask, and MySQL among other web technologies.

9. Accessible Anywhere
Since the proposed solution is based on web technologies, the farmer will be able to access it from anywhere in the world through the internet.

10. Encourages Modern Digital Agriculture
The proposed system motivates farmers to use digital technology in agriculture. It supports the concept of smart farming and helps in bringing traditional farming methods towards modern agriculture practices.

VIII. CONCLUSION

It is worth mentioning that the Smart Farming Information Web System was created successfully. Moreover, the system operates effectively, provides reliable and accurate recommendations concerning crops depending on the selected soil, season, and land, and displays other information, such as fertilizers, pesticides, climate conditions, and crop prices. All the modules operate accurately, and everything works smoothly.
The project helps in making better agricultural decisions for farmers because it offers all the necessary data regarding agriculture in one place. Therefore, it allows minimizing the possibility of picking the wrong crop and, consequently, experiencing crop failure. Moreover, the project saves time, efforts, and money.

In addition, one of the main advantages of the proposed project is its ability to integrate various agricultural services instead of suggesting multiple sources for users. The project successfully utilizes and processes agricultural data with the help of MySQL and Flask. Finally, the proposed platform is cost-efficient, easy-to-use, and accessible everywhere via the Internet. Another important achievement is that the system provides fast results and a user-friendly interface, making it suitable even for users with limited technical knowledge. It also supports digital agriculture by showing how modern technology can be applied to improve traditional farming methods. Thus, the Smart Farming Information Web System can be considered an effective, practical, and successful solution for modern agriculture.

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