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SOIL ANALYSIS AND CROP RECOMMENDATION USING MACHINE LEARNING

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Abstract: The goal of the project "Soil Analysis and Crop Recommendation Using Machine Learning" is to examine several approaches to soil analysis and crop recommendation. This model will forecast the greatest number of crops with a high degree of accuracy. It is essential to the survival and growth of the Indian economy.

Index Terms **– Early Detection, Deep learning, CNN Algorithm, Image Processing.**

I. INDRODUCTION

"Low knowledge about climate change is a problem facing the farming sector." Every crop has a unique significance and unique meteorological characteristics. With the use of precise farming techniques, it may be defeated. Crop productivity is maintained and even increased with precision farming. Traditional methods have their own shortcomings, despite the fact that numerous measures have been taken to reduce crop loss. Precision farming offers solutions for these shortcomings. It is capable of making decisions with the aid of IOT and prediction technologies. The Internet of Things system gathers the data at ground level.

II. OBJECTIVE

This project aims Machine learning models can analyze soil data to provide customized recommendations for crop selection based on the specific characteristics of the soil. This can lead to more optimal and diversified cropping systems.

III.EXISTING SYSTEM

IV. To gain a better understanding, the process of analysis involves disassembling complex elements into simpler bits. The primary function of the analysis is information collection. There is essentially more to the collection procedure than only asking customers about their needs and requirements through surveys. Due to the intricate structure of the applications, each piece of information has an own method.

V. LITERATURE REVIEW

S. Babu and others, [1] The original purpose of precision agriculture (PA) was to overcome crop and soil variability. parameters for industrialized nations' large-scale agriculture. The fundamental ideas of precision agriculture can be modified for use by marginal farmers and farm-based agriculture in developing nations. This method is distinguished by a field-acquired farmer-soil-crop database. crop calendars supplied by agricultural specialists, sensors that gather data in real time on temperature and precipitation, and analytical models that use static, semi-static, and dynamic inputs to simulate crop calendars and generate alerts for crop and farmer support. And this can be given via gadgets like tablets and smartphones, among others.

S. Pudumalar and others [2] The process of looking through data and extracting relevant information is called data mining. There are uses for data mining in a variety of industries, including retail, agriculture, banking, and health. In agriculture, data mining is

utilized to analyze different biotic and abiotic aspects. In India, the economy and job market are significantly influenced by agriculture. One of the main issues facing Indian farmers is that they often select the wrong crop for their soil type. As a result of this issue, their production has taken a significant hit. Precision agriculture provides solutions for the issues that farmers encounter.

Rajak, R. K. et al., [3] India has a big agribusiness sector. It is necessary for the economy to survive and expand. India is a significant producer of a wide range of agricultural goods. Life requires soil, a dynamic, non-renewable natural resource. When it comes to selecting the right crop for the soil's needs, young Indian farmers usually have difficulty. They witness a sharp decline in production as a result. Crops were once farmed by farmers with actual experience. Farmers are no longer able to select the optimal crop based on soil features and qualities. After being processed by the suggested system, the user-supplied soil image is classified as either clay, alluvial, red, or black soil.

G. Narsimha and A. Manjula, [4] A technology-driven strategy for improving agricultural management is called precision farming. Several methodologies were developed by the time this method was finished, including the Normalized Difference Vegetation Index (NDVI), Vegetation Condition Index (VCI), and Temperature Condition Index (TCI). Crop yield forecasting will support agriculturally linked branches and associations in their strategic decision-making.

J.P. Singh and P. Kumar, [5] These days, real-time yield prediction is well-known among farmers, especially since it helps with crop selection. It turns the difficult task of crop prediction into an intriguing one. The article offers a system for crop prediction that makes use of data mining techniques. The crops that will yield are indicated by the projected category.

VI. METHODOLOGY

This methodology serves a graphic depiction of the interactions among the elements of the system. Use cases used to give the expected behavior, and they exact method of making it happen. Use cases, once specified can be denoted both textual and visual representation. The below diagram for the proposed system..

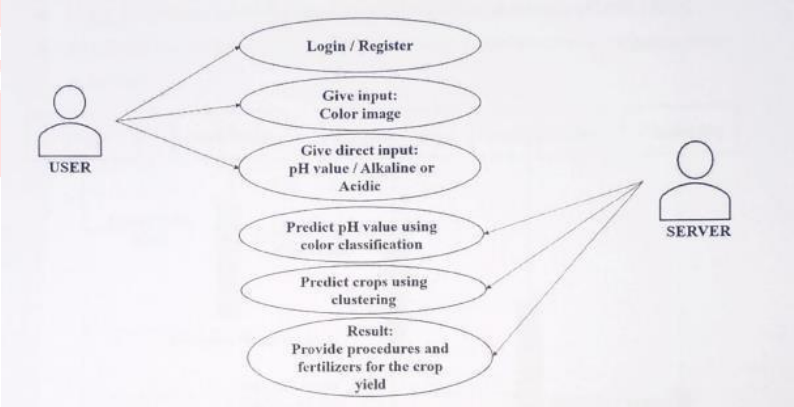

Fig 1: Data flow diagram

Preprocessing:

This application will analyze the soil parameters and nutrients present in soil like NPK which helps to determine fertility level of the soil. Along with soil analysis the system too predicts the crops. The system can predict the list of fertilizers for that crop. Farmers can test the soil multiple number of times during cultivation process and take necessary precaution to get good yield. At the end reports will be generated so farmers can keep record of their fertility.

Modeling:

Selecting suitable algorithms for machine learning: Machine learning can provide suggestions for planting dates, irrigation schedules, and fertilizer management by evaluating soil condition and historical data. Crop yields will rise as a result, and overall farm productivity will rise.

Translation:

To create a sign language dictionary: Soil analysis and crop recommendations based on machine learning enable farm workers to make decisions backed by data. This includes decisions related to crop rotation, soil amendments, and pest control. This can save the farmers time and effort,

System Integration:

Creating a user interface: An interaction diagram such as the Unified Modeling Language can show how and in what order processes can interact with one another. It is a Message Sequence Chart construct. Event diagrams and event scenarios are other names for sequence diagrams. Sequence diagrams are useful for organizing and comprehending the intricate workings of a scenario, either real or imagined. Variations in sign language: A system needs to take into consideration various American Sign Language dialects or types.

Architecture

An overview of the system's roles and functions is provided by the system architecture. It outlines how the system is divided up into different subsystems and the distinct roles that each one plays. The suggested system's system architecture. Improving the health of the soil can be facilitated by ongoing data collection and analysis. Additionally, machine learning will support the trends and patterns that point to modifications in soil properties, enabling farmers to apply techniques that improve soil fertility and structure.

Process Flow:

Gesture Capture: As the hearing-impaired person performs a gesture, the kinetic camera sensor captures the movement and sends the data to the systyem computer.

Gesture Comparison and Translation: The application running at the computer accesses the gesture data, compares it with pre-stored gestures in the database, and identifies the closest match. An algorithm assesses the resemblance among. the performed gesture and the stored sequences to ensure accurate translation.

Output Generation: Once a match is found, the application generates the corresponding text and spoken words are transformed. presented to the normal user. This output helps facilitate communication between the two users. . The classifier models are used here to include Logistic Regression, Navie Bayes and Random Forest, out of them the random forest provides maximum accuracy. The prediction made by machine learning algorithms will help to make decision which crop to grow to induce the most yield by considering factors like temperature, rainfall, area, etc. \

This bridges the gap between technology and agriculture sector.

Processes: The main activities that are happening among the system boundary. The process can be a simple as collecting customer data and storing it in the company database.

External entities: The sources of information coming to or leaving the system.

Data stores: Places where data is held such as files or repositories. Data stores showinformation that is not moving.

Data flows: Illustrate the movements that data have in the external entities, data stores, and theprocesses.

A data flow diagram (DFD) shows how information moves through a system for each process. It displays data inputs, outputs, storage locations, and the paths between each destination using predetermined symbols such as arrows and rectangular or circular forms along with brief text labels. A graphical depiction of the movement of data through an information system is called a data-flow diagram (DFD). Data processing (structured design) visualization is another application for DFDs. Data flows via an internal process on a DFD from an external data source or internal data store to an external data sink or internal data store.

Updating the Database: The normal user can also input new gestures into the system. These gestures are recorded by the kineticcamera, processed to computer, and stored in a web server's database for future reference. Additional Features and Considerations:**Real-time Processing**: The success of a system heavily relies on its ability to process gestures in real-time,

providing immediatetranslation to minimize communication delays.

Accuracy and Learning: Implementing ML algorithms can lead to significant advancements. improve the system's accuracy overtime as it learns from new inputs and user interactions.

User Interface: The application should have a user-friendly interface to accommodate both types of users, allowing easy operationand understanding of the system's functionality.

This architecture not only aids in effective communication but also enriches interactions between hearing-impaired individuals andthose unfamiliar with sign language, promoting inclusivity.

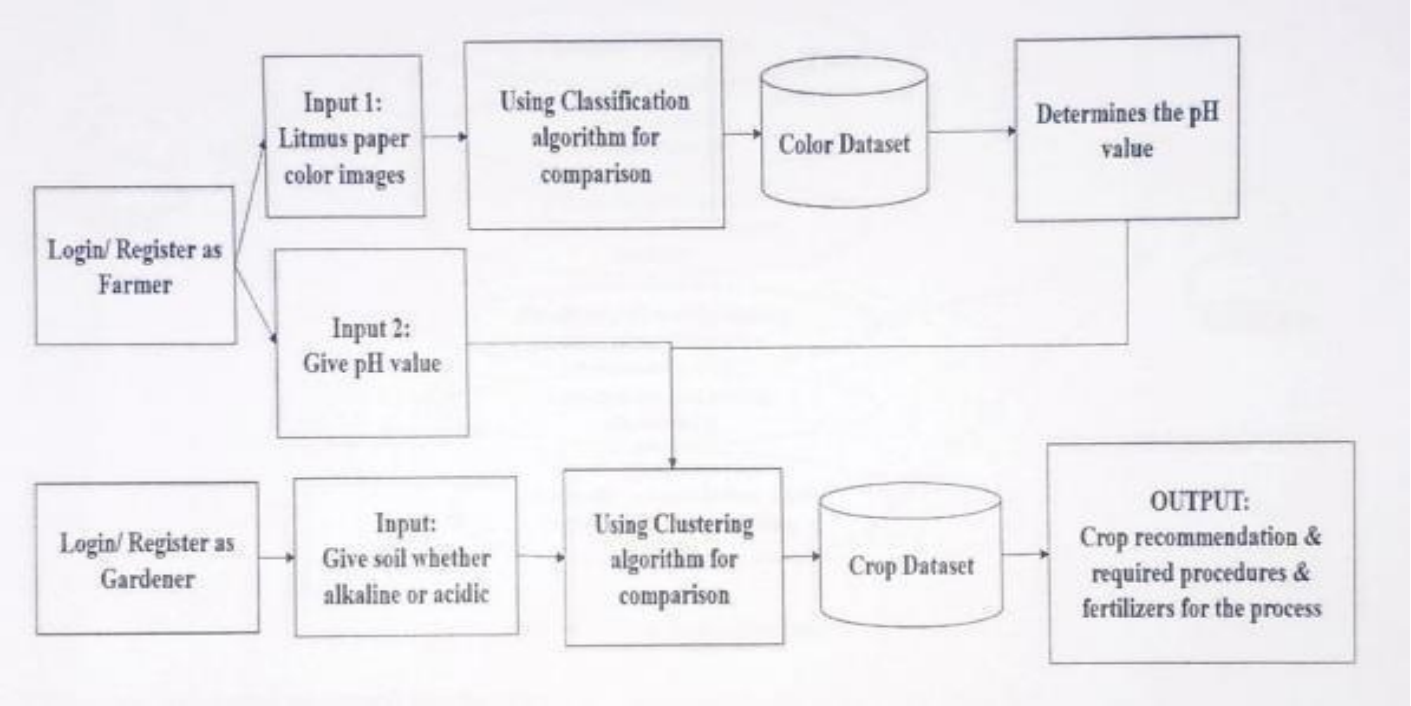

Fig 2: System Architecture

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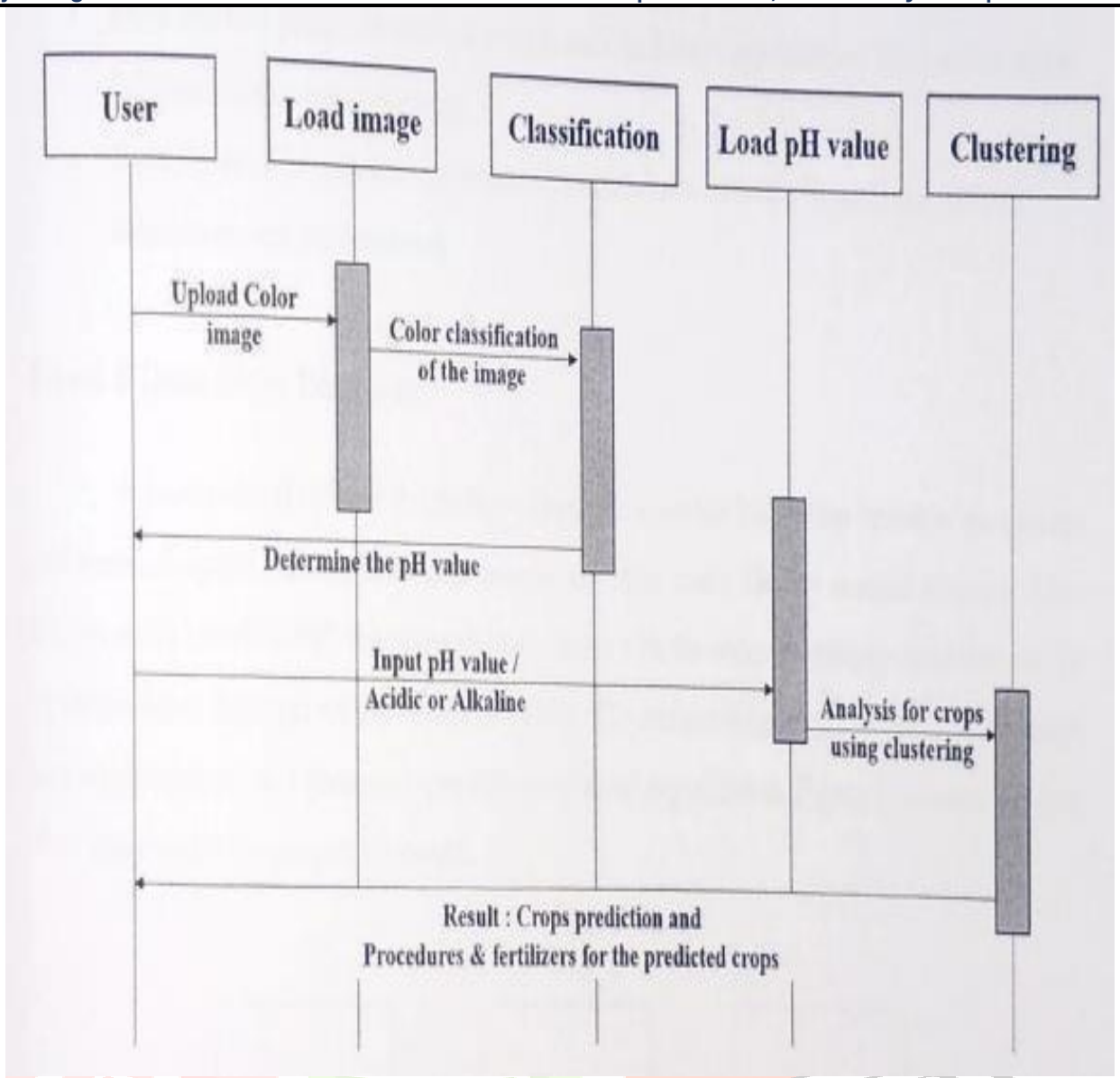

Fig 3: Sequence Diagram

V. RESULTS

The anticipated results for machine learning-based crop advice and soil analysis. By analyzing soil data, machine learning algorithms are able to offer tailored crop selection recommendations that take into account the unique properties of the soil. Cropping systems that are more varied and efficient may result from this. Machine learning provides recommendations for best practices in nutrient management, irrigation schedules, and planting dates by evaluating data and soil conditions.

VII. CONCLUSION

To summarize,Soil Analysis and crop recommendation, potential risks to crops, such as disease outbreaks or nutrient deficiencies. This allows farmers to take some measures to reduce the risks and protect their crops from damage. Soil analysis and crop recommendations based on machine learning enable farmers to make an decisions backed by data. This includes decisions related to crop rotation, soil amendments, and pest control

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