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Intelligence Farming Using Machine Learning

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Abstract: This research paper delves into the revolutionary role of machine learning in contemporary agriculture, a concept termed as "Intelligence Farming." The study encompasses the application of data in farming, including data related to weather conditions, soil quality, and crop health, and how machine learning contributes to efficient resource distribution and crop management. The paper underscores the significance of predictive yield forecasting, precision farming, and early detection of crop diseases, all facilitated by machine learning. Furthermore, it discusses the socio-economic and environmental outcomes of implementing this technology, such as enhanced productivity and sustainability. In conclusion, the paper strongly recommends the incorporation of machine learning in agricultural decision-making processes, underlining its critical role in the current era of data-driven decision-making.

I. INTRODUCTION

Intelligence Farming is a modern approach in agriculture that uses Machine Learning (ML) to increase food production efficiency and sustainability. It involves data analysis, precise farming techniques, and the Internet of Things (IoT) to enhance decision-making in crop management, pest control, and yield prediction.

1) Detailed Explanation: The selected text outlines the concept of Intelligence Farming, which is a response to the critical need for more food due to the growing global population. This innovative method integrates ML with traditional farming to create a more data-driven and precise agricultural process. The key components of Intelligence Farming include:
2) Machine Learning: Utilizing ML algorithms to analyze vast amounts of agricultural data, leading to smarter, more informed decisions about farming practices.
3) Crop Management: Enhancing the way crops are grown and maintained, ensuring optimal growth conditions and efficient use of resources.
4) Pest Control: Predicting and managing pest infestations more effectively to prevent crop damage.
5) Yield Prediction: Accurately forecasting crop yields, which helps in planning and distribution.
6) Crop Health Monitoring: Image detection can be used to analyze images of crops to detect signs of disease or stress. Machine learning algorithms can be trained to recognize patterns or colors associated with certain diseases, enabling early detection and treatment.

II. LITERATURE REVIEW

1) SAMS: Smart Agriculture Management System Using Emerging Technologies.

Writers: Binary Kumar, S. Santhi, Kranthi Kumar

A portion of this study was funded by Lahore 54000's SN Applied Sciences. Publication Date: August 31, 2019

Abstract: Emerging Technologies Like what were mentioned are very often used by many researchers. Automation in many areas would give better results and it aims to improve system work and at the same time it provides good results, in this paper are also when it is suggested Technological Farming it yield good crop, it warns farmer if any bad climate, it informs farmers if any food and other devices theft. Role of AI and IOT In Agriculture:

- Drones: Drones help to monitor crop and to take necessary actions to improve the growth of the crop.
- Weather forecasting or climate Estimation: Most of the farming depends on the weather, monitoring weather reports and giving weather reports results to farmers may give good improvement in the growth of farming.

2) Smart Farming Prediction Using Machine Learning

Writers: S.R.Rajeswari , Parth Khunteta, Subham Kumar,Amrit Raj Singh,Vaibhav Pandey

- Smart Farming: The study addresses the influence of smart farming and precision agriculture, which incorporate sophisticated technology into agricultural techniques to boost production efficiency and quality.
- Machine Learning in Agriculture: It emphasizes the use of machine learning algorithms, such as Support Vector Machine (SVM) and Random Forest, to anticipate agricultural production and expenses, leading to informed decision-making for farmers.

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- Technological Advancements: The book stresses the importance of technologies like Big Data, cloud services, GPS, and IoT systems in agriculture, which help gather field data for accurate crop analysis and automated farming approaches
- Future Prospects: The report predicts that smart farming will greatly affect the agriculture industry by bridging the gap between small and big firms, with an emphasis on both developed and developing nations.
  This review represents the creative techniques and technology that are impacting the future of agriculture, seeking to establish a sustainable and efficient agricultural business.

3) Smart Farming using Machine Learning and Data Analytics

Writers: shardul Pathak , Sagar Majgude , Sagar Maske , Aneesh Sakure , Nirmit Singhal , Yashwant dongre.

- Smart Farming POC: The study proposes a proof of concept targeted at improving agricultural in India. It focuses on proposing the best crops based on soil qualities and environmental conditions, citing soil health cards that comprise 12 minerals and micronutrients[2][2].
- Economic and Yearly Planning: It features a price prediction module for crops and gives farmers with a year-round growing plan to optimize earnings[3][3]. The system also delivers information on government initiatives and soil testing labs[4][4].
- Technical Aspects: The project employs machine learning algorithms and data analytics to assess soil and meteorological data for crop recommendation. It analyzes several algorithms and presents a 'what if' scenario analysis for decision-making.
- Datasets and Models: The study includes developing datasets for soil nutrients, meteorological conditions, market price prediction, and crop selection methodologies. It explores the usage of neural networks, decision trees, and data analytics in the context of agriculture.This paper presents a comprehensive strategy to combine technology with traditional agricultural techniques to boost production and decision-making in agriculture.

4) Smart farming using Machine Learning and Deep Learning techniques

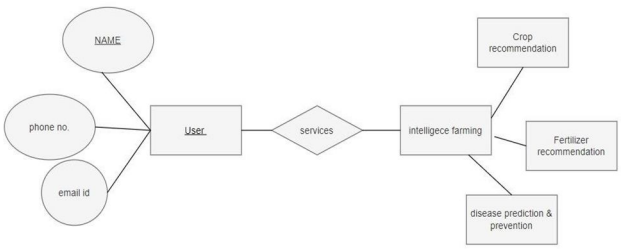
Writers: Senthil Kumar Swami Durai , Mary Divya Shamili b

- Smart Farming Technologies: The paper covers the integration of machine learning and deep learning methods in smart farming, seeking to boost accuracy in agriculture.
- Precision agriculture: it stresses the use of sophisticated technologies like IoT, data mining, and artificial intelligence to enhance decision-making, boost production, and minimize manual labor in farming.
- Issues and solutions: the paper highlights many issues encountered by farmers, such as crop failure and soil infertility, and recommends smart farming as a method to manage crops effectively and estimate cultivation expenses. This part lays the groundwork for understanding how technology might alter conventional agricultural techniques by offering accurate, data-driven insights for improved crop management and cost prediction.

III. METHODOLOGIES

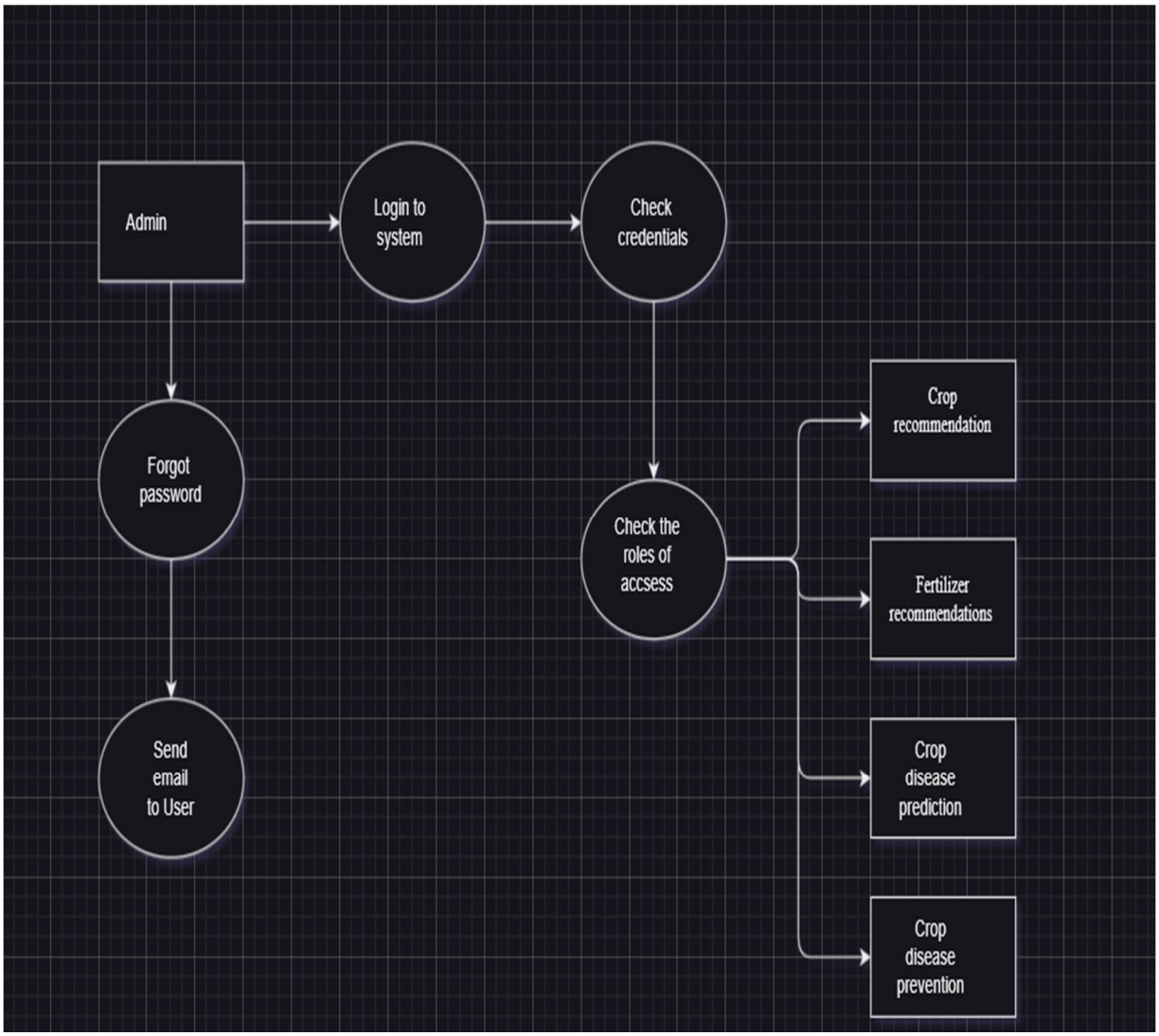
This project uses a methodical approach the methods, procedures, and steps that will be followedto achieve the project's goals. The proposed methodology details how data will be collected, analyzed, and interpreted to address the research problem or project objectives. Below is an overview of the crucial steps:

1) *Collection of Datasets:* Describe the methods and tools that will be used to gather relevant data or information. Detail how data sources will be identified, participants selected (if applicable), and data collected through surveys, interviews, observations, or other means.
2) *Preparing Data:* Preprocessing operations like scaling, normalization, and augmentation are performed on the gathered dataset. Normalization improves convergence during training, augmentation increases dataset diversity, and resizing guarantees uniformity, all of which help the model handle a variety of inputs.

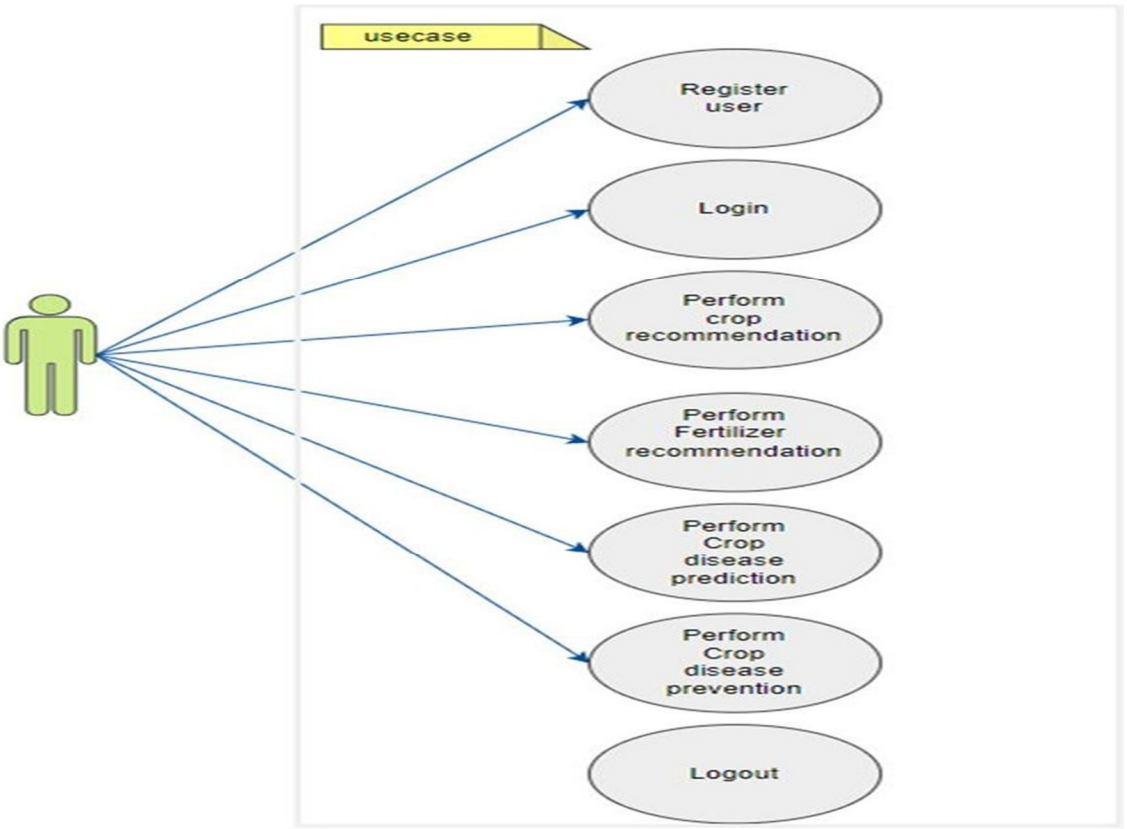


3) *Data Analysis:* Explain the techniques and procedures that will be applied to analyze the collected data. Provide details about statistical methods, qualitative analysis approaches, coding schemes, or any other relevant techniques.
4) *Model Training:* There are training and validation sets inside the dataset. The validation set is used to assess the model's performance after it has been trained using the training set. Forward and backward passes are used in the training phase, and the model's weights are adjusted to minimize the loss function.
5) *Sampling Strategy:* Describe the sampling strategy that will be employed, including the target population, sample size, and any sampling methods (random sampling, stratified sampling) that will be used.
6) *Project Timeline:* Provide a timeline that outlines the planned sequence of activities, milestones, and deadlines for various phases of the project. This timeline helps to track progress and manage the project efficiently.
7) *Data Validation and Reliability:* Explain how data validity and reliability will be ensured through methods such as triangulation, member checking, inter-rater reliability, or other relevant techniques.and numbers in a variety of settings.
8) *Application and Monitoring of Performance:* After validation, this system is put into use for real-world applications. Its real-world performance is tracked by continuous monitoring, allowing for rapid upgrades and enhancements.

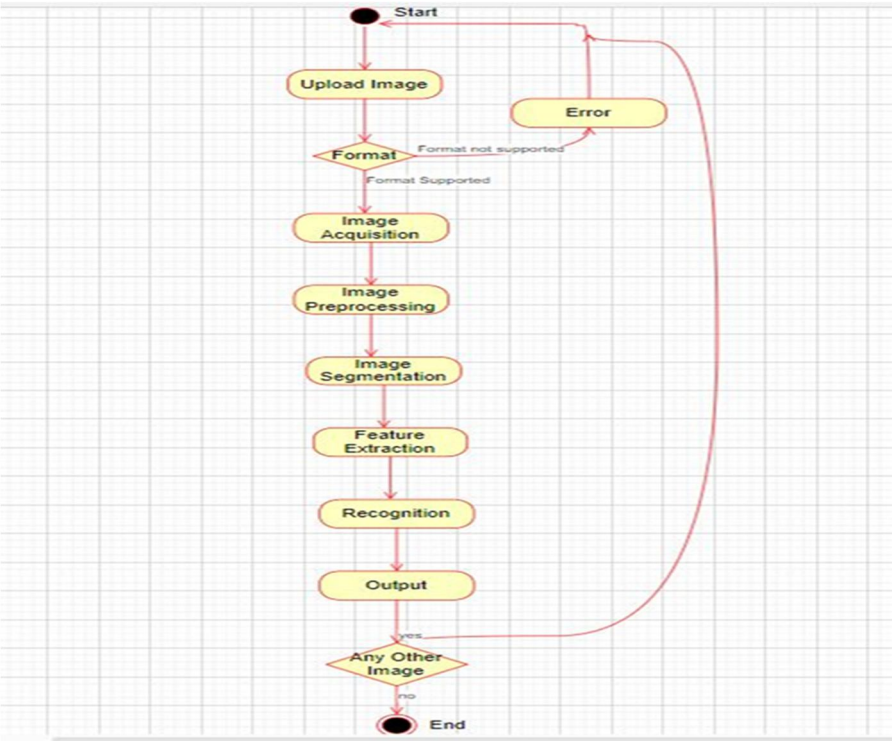
IV. IMPLEMENTATION



DATA FLOW DIAGRAM



USE CASE DIAGRAM



ACTIVITY DIAGRAM

ER DIAGRAM

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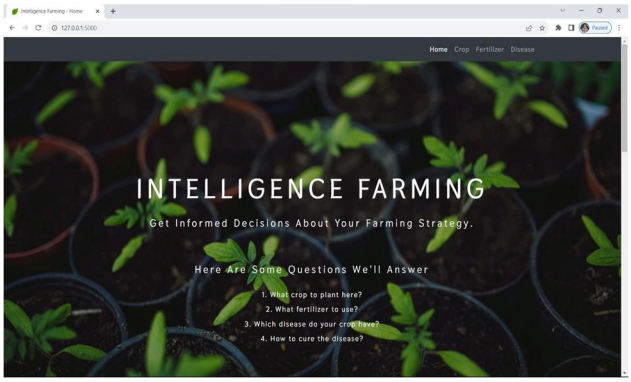
V. PROPOSED SYSTEM

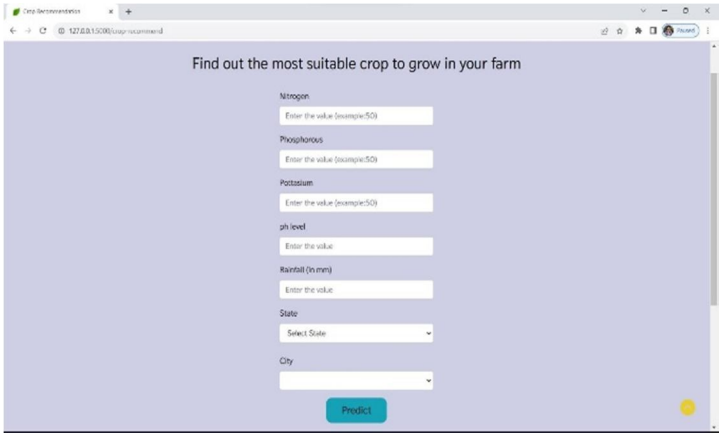
1) User Authentication and Registration

Home Dashboard



2) User Registration:

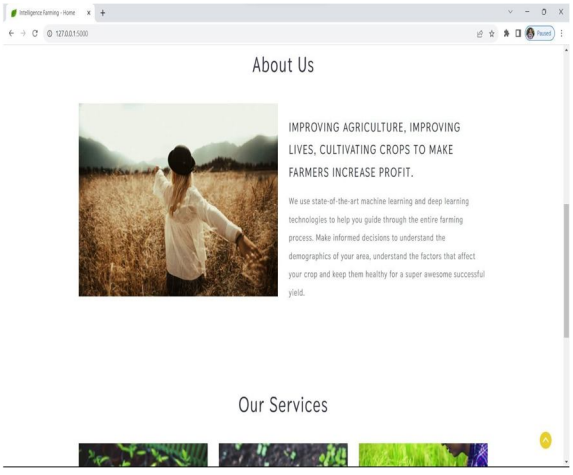
Purpose: Allows new users to create an account in the Veracity system. Description: Users can register by providing their name, email, and password. Upon registration, each user is assigned a unique ID in the format "GJ16000X," where "X" is an incrementing number, making them easily identifiable in the system.



3) User Interfaces:

Python has been used for developing the user layout for the system. Python has been used for creating all the validations and client side scripting functionality, designing the web page of the system. Application:

Client On Internet: Web Browser, Operating System (Any) Language: Python



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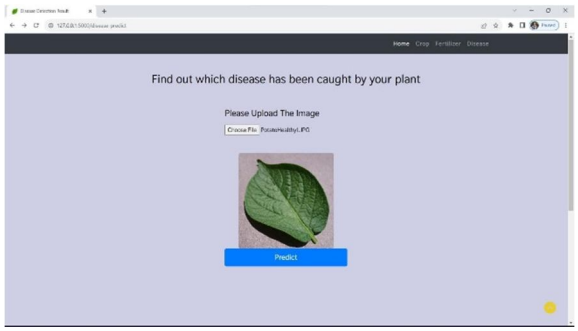
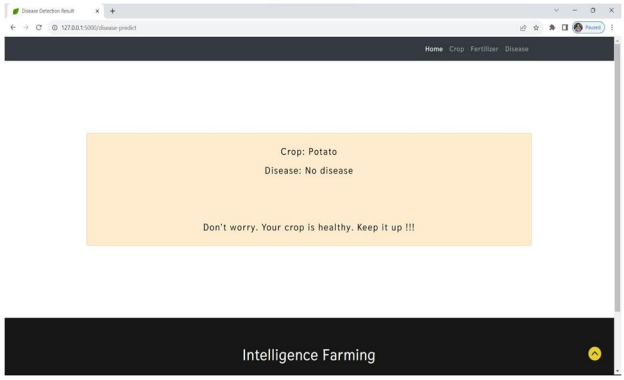
4) Upload Image

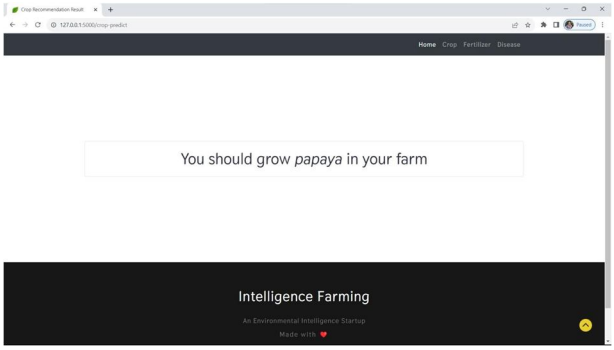
User will upload the Image and Get result regarding the image Detected



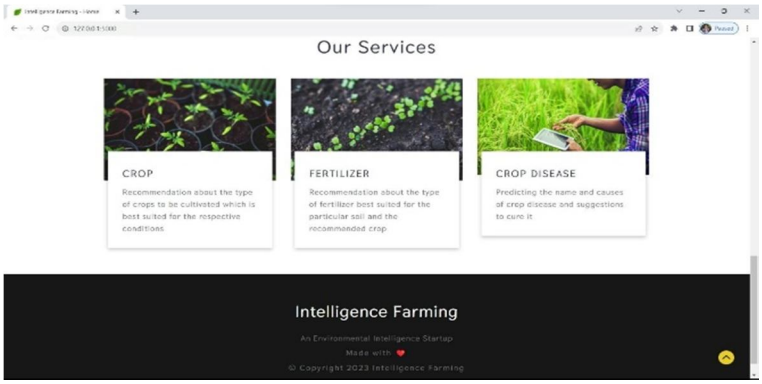
5) Displaying Detected Text



6) What user should Grow in his Farm.



7) Our services



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VI. DATASET

The dataset mentioned on the web page is a comprehensive collection of agricultural data related to India, aimed at supporting the agricultural ecosystem, including farmers, the value chain, and the economy. Here's a detailed overview:

1) Purpose: To provide accurate data for insights into Indian Agriculture, addressing the lack of reliable data for informed decision-making.
2) Content: The dataset includes a wide range of agricultural data such as:
3) Commodity Prices: Daily prices of various commodities from different markets.
4) Weather Data: Historical weather data affecting agriculture.
5) Land Usage: Statistics per crop and acreage for each crop.
6) Crop Yield: Information on crop yield.
7) Agri Inputs: Data on agricultural inputs.
8) Pest and Disease Info: Information on crop pests and diseases.
9) Price Data: Retail and wholesale prices for all agricultural commodities.
10) Influencing Factors: Various factors and sources that affect agriculture and commodity prices.
11) Usability Rating: The dataset has a usability rating of 7.50, indicating its practicality for various applications. License and
12) Update Frequency: These details are unspecified, suggesting users should inquire for the latest information. The dataset is hosted on Kaggle and includes CSV files that can be downloaded or explored through notebooks. It's a valuable resource for learning, research, and application in the agricultural sector. The page also encourages collaboration and sharing of proprietary data to enhance the dataset's utility.

VII. TOOLS & TECHNOLOGY

A. Python

Python is a high-level, interpreted programming language that is commonly utilized in machine learning (ML) applications. It contains a huge array of libraries and frameworks that make it simple to build ML algorithms and models. Python's simplicity, readability, and ease of use make it a perfect option for beginners and professionals alike. Some prominent Python libraries for ML include TensorFlow, Keras, PyTorch, Scikit-learn, and Pandas. These libraries cover a broad variety of features such as data preparation, model training, and assessment. Python's success in the ML field has led to the creation of several open-source programs that are accessible on PyPI.

B. Numpy

NumPy, which stands for Numerical Python, is a fundamental library for scientific computing in Python. It provides support for arrays, matrices, and many mathematical functions to operate on these data structures. Here's how NumPy is used in a Machine Learning (ML) project:

1) Data Representation: ML algorithms require input data to be represented as arrays or matrices. NumPy provides an efficient way to store and manipulate multi-dimensional data, which is essential in ML.
2) Efficient Operations: NumPy arrays are more efficient than Python lists for operations like addition, subtraction, multiplication, and division. This is crucial in ML as large datasets often require heavy computational resources.
3) Integration with Other Libraries: Many other Python libraries used in ML, such as Pandas, Matplotlib, and Scikit-learn, are built on top of NumPy and use its array structure for data manipulation.
4) Mathematical Functions: NumPy provides many mathematical functions like linear algebra operations, Fourier transform and random number generators, which are commonly used in ML algorithms.
5) Handling Missing Values: NumPy also provides support for representing and handling missing values, which is a common issue in ML datasets.

C. Jupyter Notebook

Jupyter Notebook is an open-source online tool that enables users to create and share documents that include live code, equations, visualizations, and narrative prose. It supports approximately 40 programming languages, including Python, R, Julia, and Scala. Jupyter Notebook is managed by the individuals at Project Jupyter and is a spin-off project from the IPython project. The notebook integrates live code, equations, narrative prose, graphics, interactive dashboards, and other media.

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It delivers a straightforward and simplified document-centric experience that is perfect for data science, scientific computing, computational journalism, and machine learning. Jupyter Notebook may be installed using pip.

VIII. CONCLUSION

An ML system Development for agriculture could resolve many real-time issues by increasing the quality and production management which enables the farmers to access huge number of results from the real-time data from the crop field. Three layers in the architecture are connected with cloud where all the data are uploaded, processed and accessed with API libraries and the devices are connected.

Methods for cultivating crops are provided as a process flow explained from the start of seeding to crop yielding. The experimentation is carried out on crops of ground nut and banana and the readings of different sensors are collected and placed in cloud to integrate with ML for the purpose of automation and efficient decision-making process. The system is managing efficiently and effectively. The Architecture proposed in this paper, could provide a base for implementation of smart agriculture system using DS. The layers used in this architecture is intended to store, manage, and monitor the crop growth details and provide the efficient decision making for the process of fertilizers utilization, water supply and plantation of crop basing on the data collected from the sensors connected to the ground of the field. The work proposed has been tested on Live Agriculture Fields obtaining the accuracy rate of up to 98% basing on the data feed. Provide a statement that what is expected, as stated in the "Introduction" chapter can ultimately result in a “Results and Discussion" chapter, so there is compatibility. Moreover, it can also be added the prospect of the development of research results and application prospects of further studies into the next based on result and discussion.

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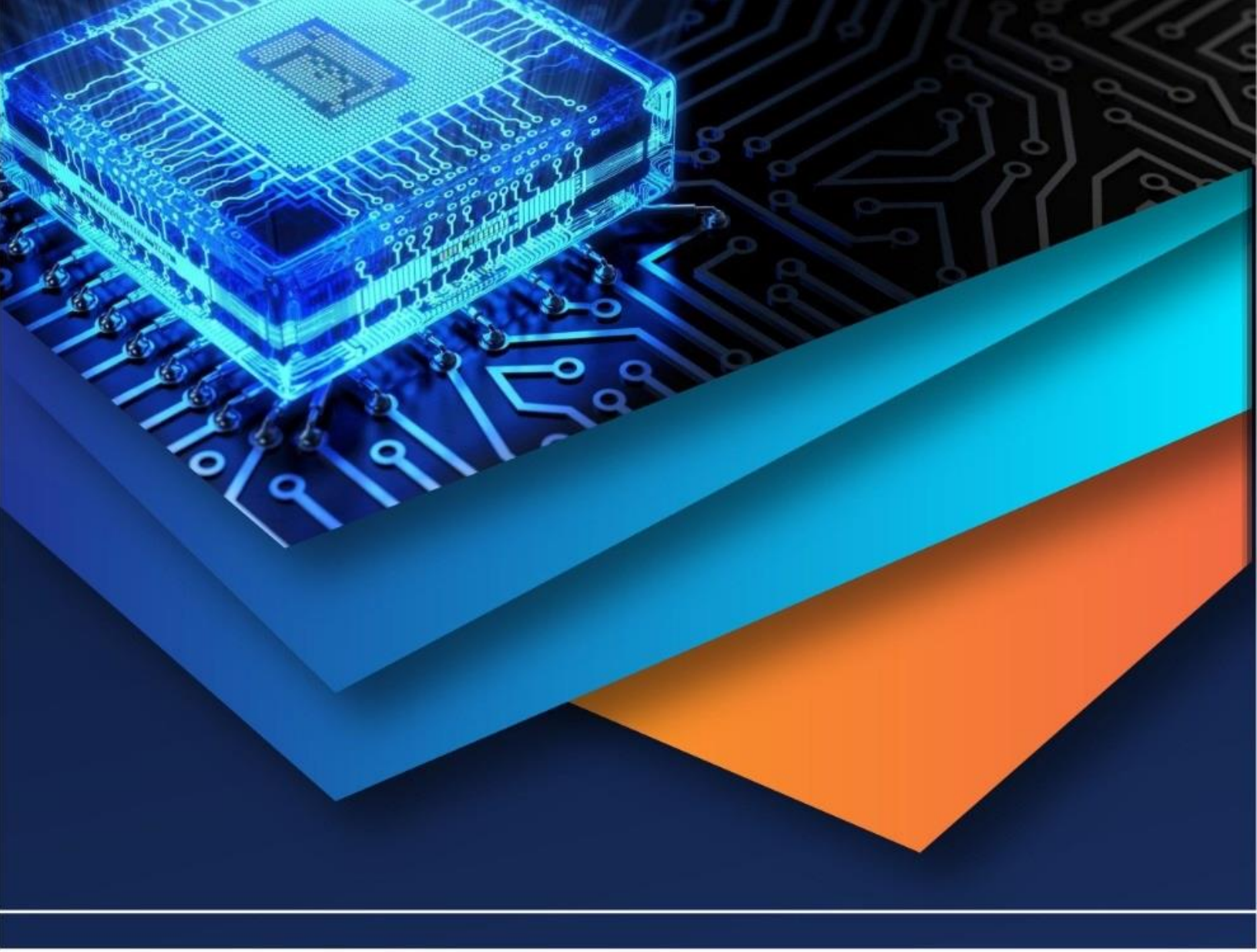
[13] https://www.kaggle.com/code/atharvaingle/plant-disease-classification-resnet-99-2



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