Innovations in Smart Agriculture:

Leveraging IoT, ML, and Big Data for Crop Prediction, Disease Detection, and Sustainable Green Energy Development.

Submitted By

- **Ronak Rathod**
  16010122156
- **Hyder Presswala**
  16010122151
- **Vedant Rathi**
  16010122154

Guide

Kaustubh Kulkarni

Department of Computer Engineering

SOMAIYA VIDYAVIHAR UNIVERSITY

K J Somaiya College of Engineering

Somaiya TRUST

Abstract:

- India's agricultural sector faces unique challenges and opportunities due to its vast landmass, diverse soil types, varying rainfall patterns, and different weather conditions across regions.
- Approximately 60% of India's total land is dedicated to agriculture, highlighting its crucial importance in feeding the population of over a billion people.
- Implementing sustainable practices, leveraging innovative technologies, and prioritizing agricultural research are essential for ensuring food security in India.
- Farmers need to be knowledgeable about the crops suitable for their land, potential diseases affecting crops, and various factors like soil type, temperature, and humidity that influence crop growth.
- Technological advancements in agriculture, such as remote sensing systems and IoT (Internet of Things) devices, are increasingly used in smart farming systems, generating large volumes of data.
- Digital technologies enable constant monitoring of physical surroundings and the generation of massive amounts of data, which can be analyzed to enhance safety, product quality, and production efficiency while reducing downtime.

Introduction:

- The National Crime Records Bureau (NCRB) reports around 10 farmer suicides daily in India due to financial distress from crop failures, low prices, and high debts. Integrating Internet of Things (IoT) and Machine Learning (ML) in agriculture can track real-time conditions, automate irrigation, analyze data for crop diseases, and enhance productivity.
- IoT sensors monitor soil and environmental factors, optimizing resource use. ML algorithms analyze data for trends, crop health, and pest control, enabling data-driven decisions. This technology can mitigate farmer distress and improve agricultural sustainability, though challenges like costs and training exist.

Review:

- Reference Paper [1] employs machine learning algorithms like Back Propagation Network and Kohonen Self Organizing Map to predict crops based on soil quality, classifying soil into organic, inorganic, and real estate types. The system compares different network learning techniques for accuracy improvement.
- Reference Paper [2] utilizes IoT-based smart farming to predict crops by collecting live and historic data on temperature, humidity, soil type, and rainfall. The VAR model forecasts cultivation timing, and various machine learning algorithms like Decision Tree, K-NN, and Support Vector Machine predict the most suitable crop, enhancing accuracy.
- In [3], Modified Support Vector Regression is used with IoT devices like NodeMCU to sample soil properties in real time, determining suitable crops based on soil moisture and pH. The Agri cloud and Agri User Interface aid in data processing and crop suggestions.
- In [4], Image Processing and Classification are employed to detect plant diseases early, using techniques like Support Vector Machine (SVM), Neural Network, Image Enhancement, Feature Extraction, and K-means clustering for disease identification by type and stage.

Scope of future work:

- The development of automated decision support systems is crucial, integrating real-time IoT sensor data with machine learning to provide actionable insights for farmers.
- These systems can recommend precise irrigation schedules, predict trends like crop yields and pest outbreaks, and optimize farming practices based on data analytics. Addressing data security, privacy, and ownership is essential, along with making IoT-based solutions accessible and scalable for smallholder farmers. Big data analytics can enhance supply chain management, improve logistics, reduce wastage, and offer better market opportunities.
- Researchers can focus on developing advanced algorithms to handle large volumes of sensor data and provide accurate insights to farmers.

SOMAIYA VIDYAVIHAR UNIVERSITY
K J Somaiya College of Engineering

Conclusion:

- In this project, we have proposed an innovative approach to smart agriculture using two emerging technologies: the Internet of Things and machine learning. The project focuses on predicting crops and detecting plant diseases using sensor data and advanced algorithms. By training the data with a Random Forest algorithm and selecting features such as temperature, humidity, soil moisture, rainfall, and pH, we achieved high accuracy in crop prediction. Additionally, plant disease detection was accomplished using the SIFT algorithm and image processingtechniques. Feedback on existing crops was provided based on comparisons between trained values and sensor readings. This system significantly enhances productivity and efficiency for farmers. It can further be developed for precision agriculturewithin controlled environments like poly-houses, where sensors can recommend changes based on real-time data.
- The system not only addresses current agricultural challenges but can also adapt to emerging developments in the sector.
- The increasing demand for agricultural production necessitates energy-intensive practices, prompting the adoption of energy-efficient techniques like intelligent farms. Continual monitoring of crops through sensors allows for timely interventions such as fertilization and irrigation adjustments to optimize yields. Estimating yields through biomass measurements using reflectance data adds another layer of precision to farming practices.
- To fully leverage these advancements, a national big data innovation ecosystem is essential. This ecosystem should integrate diverse datasets and analytical tools, enabling smart agriculture solutions to be data-driven and customized to individual farmers' needs. By embracing data science, technology, and integrated agricultural systems, we can achieve digital and smart climate agriculture, paving the way for a more sustainable and productive future in agriculture.

Somaiya TRUST

References:

[1]Dr. Juby Mathew, Albert Joy, Dishna Sasi, Jevin Jiji, Jiya John, “Crop prediction and Plant Disease Detection using IoT and Machine learning.” 2022 6th International Conference on Trends in Electronics and Informatics (ICOEI) 2021 DOI:-10.1109/ICOE 153556.2022.9776852

[2] Rushika Ghadge, Juilee Kulkarni, Pooja More, Sachee Nene, Priya R L, “ Prediction of Crop Yield using Machine Learning,” International Research Journal of Engineering and Technology (IRJET) Feb 2018, pp. 2237-2239

[3] Archana Gupta, Dharmil Nagda, Pratiksha Nikhare, Atharva Sandbhor, “ Smart Crop Prediction using IoT andMachine Learning,“ International Journal of Engineering Research Technology (IJERT) 2021, ISSN: 2278-0181

[4] Radhika, Narendiran, “ Kind of Crops and Small Plants Prediction using IoT with Machine Learning,” International Journal of Computer Mathematical Sciences April 2018, pp. 93-97

[5] B.J. Sowmya, Chetan Shetty, S. Seema, K.G. Srinivasa, “ Utility system for premature plant disease detection using machine learning,” 2020

Thank you