IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

A REVIEW OF DIFFERENT CROP HEALTH MONITORING AND DISEASE DETECTION TECHNIQUES IN AGRICULTURE

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Abstract : The agriculture sector contributes in the GDP of India. In every year, the crop yield reduces due to environmental calamities and improper monitoring of crop health and usage of fertilizers. To enhance the crop yield with the optimal use of resources, there is need of continuously monitoring of crop health. Smart devices are used in agriculture to collect and transmit data from a wide range of sensors that keep track of complex environmental factors vital to guaranteeing optimal plant growth. These elements include, but are not limited to, temperature, soil moisture, and pH of the water. to increase production and plant growth. These environmental variables need to be continuously monitored and managed. Manual disease monitoring is time-consuming and necessitates specific plant pathology knowledge. Internet of Things (IoT) sensors have revolutionized agriculture by providing farmers with real-time data and insights to optimize crop yield, reduce resource consumption, and enhance overall farm efficiency. In this paper, we have reviewed the different techniques of crop health monitoring and disease detection.

IndexTerms **– Wireless Sensor Network, IoT, Breakdown**

I. INTRODUCTION

The agriculture sector contributes in the GDP of India. In every year, the crop yield reduces due to environmental calamities and improper monitoring of crop health and usage of fertilizers. To enhance the crop yield with the optimal use of resources, there is need of continuously monitoring of crop health. In the agricultural context, smart devices are utilized to acquire and transmit data from a diverse range of sensors that monitor intricate environmental parameters crucial to ensuring optimal plant growth. These factors encompass but are not limited to humidity, temperature, soil moisture, and water pH. For maximizing plant growth and yield. There is need of continuous monitoring and control of these environmental aspects. Manual disease monitoring is labor-intensive and requires specialized expertise in plant pathology. Internet of Things (IoT) sensors have revolutionized agriculture by providing farmers with real-time data and insights to optimize crop yield, reduce resource consumption, and enhance overall farm efficiency. The research has been conducted on the different techniques of crop health monitoring and disease detection by using IoT, Machine learning. With help of IoT, they used different types of sensors and other IoT enabling technologies to monitor the crop health and disease detection.

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II. LITERATURE SURVEY

Komal Khuwaja; Aliza Aliza [1], To identify and diagnose plant diseases, they have proposed convolutional neural network models that use deep learning methods. To correctly categorize the health status of plants, the algorithm made use of photos of diseased plant leaves. Healthy plants as well as those plagued by bacterial blight, anthracnose bacteria, and thrips insects were included in the dataset. They have presented an IoT framework that may be used to improve agricultural monitoring dramatically, allowing farmers to manage their crops efficiently and boost productivity with the help of cutting-edge technologies.

Pallabi Saha; Vikas Kumar; Samta Kathuria; Anita Gehlot; Vikrant Pachouri; Angel Swastik Duggal [2], Insights and suggestions for the future are offered to better utilize the benefits of technology in Precision Agriculture. In the agricultural sector, precision agriculture has gained popularity as a method for improving crop yields, lowering costs, and increasing productivity. These farmers can now gather accurate information about environmental factors, crop development and health, soil quality, and nutrient content thanks to the implementation of Internet of Things (IoT) and Wireless Sensor Networks (WSN) technologies. Farmers can decide wisely on irrigation, pest control, fertilizer application, and crop yield optimization thanks to the use of predictive analytics on this data. The essential aspects of WSN in precision agriculture were provided in an overview, including

sensor networks, precise irrigation, crop monitoring, crop protection, soil monitoring, predictive analytics, lower labor costs, and higher efficiency.

Abdelrahman S. Gamal; Hoda K. Mohamed [3] IoT is being employed for a variety of purposes, including advancing agriculture, creating smart cities, and providing healthcare. Furthermore, in order to improve performance, the industry is being pushed to switch from old systems to IoT systems by the development of IoT technologies like LoRaWAN, SIGFOX, ZigBee, and others. The necessity for high energy and water usage to achieve the appropriate crop yield makes smart agriculture one of the most difficult applications in an IoT system. This issue was addressed in a number of related works in various nations in an effort to reduce water usage during irrigation and increase agricultural yield. To forecast the crop production and the necessary parameters, they have applied artificial intelligence and deep learning.

Abhishek Kumar; P Savaridassan , [4] With tools like automated environment parameter monitoring and error rectification, sub-second streaming of telemetry from ground units to cloud servers, and the ability for users to access the status of the plant or system of plants being monitored as a plant health index from anywhere in the world via a mobile application, they have presented an intuitive and affordable approach to monitoring and accelerating plant growth based on hydroponics and IoT. The ultimate goal of this is to comprehend the advantages that come with using a hydroponics-based cultivation system, which include reduced water use, minimal space requirements, increased control over the introduction of nutrients, and significantly more effective protection against pests and diseases when combined with the feature of emphasizing each plant genus.

Prathamesh Dhulam; Prashant Gosavi; Yashraj Oza; Sandesh Darekar; D. S. Jadhav[5], The therapeutic qualities of sandalwood, which is derived from trees of the species Santalum, make it highly prized. Therefore, it is essential to keep an eye on the condition of these trees. This study suggests an Internet of Things (IoT)-based tree monitoring system that can efficiently direct and improve the yield of sandalwood trees dependent on the type of soil. Relative sensors are utilized to communicate the data via IoT to gather information on the four key environmental conditions that influence the growth of sandalwood. Deep learning and other machine learning methods are suggested for detecting crop yield. In this method, a neural network is trained to spot patterns and forecast agricultural yields based on numerous inputs. To do this, information is gathered on a variety of variables that may affect crop productivity, including climate conditions, soil quality, and irrigation. The deep learning model has been trained, it can be easily deployed to monitor crop yields in real-time, providing farmers with valuable insights and helping them to make more informed decisions. Overall, using deep learning to detect crop yields is a promising approach that can help farmers optimize their crop production and ultimately improve their profitability. The collected data is then forwarded to the server for analysis. A QR code can also be used to generate tree data, starting from the date of plantation until the present day. All this information is recorded and systematically organized to create a comprehensive database. Finally, an overall system for data collection, processing, and validation are established from time to time. After implementation, the proposed system could achieve an accuracy of 92%.

C. Vijay Kumar; Kuppala Saritha; M. V. S. Sreekanth Reddy; H. Aditya Pai[6], The Internet of Things (IoT) is a reliable technology that offers organized and sensible answers to the transformation of many domains. IoT technology deployment strategies for agricultural regions have been developed as a result of extensive study and evaluations. IoT may be extremely important for spotting diminishing plant health and taking the necessary steps. It is a crucial step toward intelligent farming. In this work, a method for developing an automated system to recognize crop degradation in its early stages, which are invisible to the human eye, was provided. This approach saved a significant amount of time and work while also assisting in avoiding significant losses. The suggested solution used sensors to create an identification system that took into account temperature, wetness, humidity, and the color of plant leaves.

Gandham Sandhya; Piyush Charan; Heena Farheen Ansari; Mathur Nadarajan Kathiravan; D. Suganthi; Neerav Nishant [7], Chemicals are widely used in farming today to combat pests and illnesses that threaten crops and boost overall yields. Yet, there Chemicals are frequently employed in farming nowadays to fend against pests and diseases that endanger crops and increase yields overall. However, improper use of pesticides and improper disposal of the trash they create pose a serious threat to both human health and the environment. Pesticide exposure has been associated to a wide range of acute and chronic health problems, such as skin irritation, breathing problems, cancer, and reproductive disorders. The increased risk of exposure to dangerous chemicals when proper categorization and safety requirements are not followed also raises concerns regarding the use of drones for pesticide spraying. To sustain a steady supply of food, farming practices must be both ecologically and healthfully beneficial. The goal is to increase agricultural output while reducing pesticide use. This study explores how modern technologies may be implemented into agricultural operations with the goal of increasing crop output while lowering pesticide consumption. The proposed system incorporates predictive analysis, image processing, drones, and IoT for real-time monitoring and identification of damaged locations in the field. Using image processing technology, the damaged area is located and assessed, allowing the proper pesticide to be administered when and where it is needed. By using less pesticides overall, this technique not only works well but also helps farming become more ecologically friendly. Additionally, the system stores the data acquired in the field for subsequent classification and analysis, enabling farmers to use evidence-based crop management techniques. Drones can spray the insecticide over large regions quickly and effectively, promoting quicker growth and higher harvests. In conclusion, this system has offered a comprehensive solution since it promotes sustainable farming while utilizing cutting-edge technology to increase agricultural output. The proposed technology has the potential to significantly revolutionize the agriculture industry by offering a more efficient and environmentally friendly way to cultivate crops.

Vibha Nehra; Megha Sharma; Vaibhav Sharma [8], Agriculture is a huge subject that requires research. We now have advanced agricultural instruments and systems thanks to technological advancement. Agriculture uses over 80% of the surface water in India. To ensure efficient use of water resources and high-quality output, IoT implementation is required. This paper introduces an open-source technology-based smart system to predict irrigation requirements of a field using sensing of ground parameters like soil moisture, environmental conditions like temperature and humidity, and external parameters like obstacle detection or intruder alert using an infrared sensor. This is because optimal irrigation in fields can produce better crops. The algorithm on which the suggested system is built includes sensed data in addition to the previously specified parameters. The complete system was developed and deployed on a trial scale. It wirelessly gathers sensor node data via the cloud using web services, and it provides real-time insights based on sensor analysis through an information visualization and decision support system that is built on both the web and mobile platforms. The investigation demonstrated distinct disparities between the monitored and unmonitored environments and how they impact the long- and short-term health of the plants. The graphs make the

alterations in the environment at certain time periods easier to see. In the future, this technology may be used in conjunction with other technologies to control pH levels, forecast rainfall, and safeguard the enormous volumes of data that sensors generate and store in the cloud. This would increase the system's capacity for sustained use.

Mayur Pillewan; Rahul Agrawal; Nikhil Wyawahare; Laxman Thakare[9] , The use of domestic animals in agriculture is particularly advantageous. Domestic animals like cows, goats, bulls, and chickens are most helpful in agriculture when it comes to producing organic fertilizers for the development of land. Using cow and bull dung as a fertilizer helps organic farming preserve the soil's structure and replenish it with the right nutrients for plants' healthy growth. 1.3 billion farmers depend on cattle globally. The Indian government estimates that 20 million people rely on domestic animal farming and 600 million impoverished farmers depend on livestock for alternate sources of income and the production of raw materials needed in agriculture and industries. In their shed, domestic farm animals deal with a variety of issues, including health issues, assaults by wild animals, and drinking. Domestic animals have been exposed to a number of illnesses, including brucellosis, fever, mouth and sore infections, and more recently, lumpy skin conditions. Small insects like mosquitoes, flies, ticks, and snakes carry all of these illnesses. The major goals were to maintain the temperature, assess the environment's temperature in the animal shed, and improve the atmosphere for domestic animals to relax in. Additionally, count all the animals that enter the animal shed, verify the number of animals that enter it, and transmit the farmer the data. Detect the dangerous animal as it approaches the shed. For this effort, a variety of sensors and IoT technologies are employed.

G. Saranya; N. Dineshkumar; A. S. Hariprasath; G. Jeevanantham [10], India's economy, which is mostly based on the expansion of agricultural products and related market commodities, is an agricultural nation. Agriculture in India is greatly impacted by the extremely unpredictable rain. The growth of agriculture is also influenced by a number of circumstances, including nitrogen, phosphorus, and potassium, as well as plant growth, moisture, surface temperature, and climatic factors like temperature, rain, and other factors. India is now advancing technically quickly. Therefore, innovation will benefit agriculture by increasing plant productivity and giving farmers much larger yields. By advising plants to the agricultural industry that can significantly boost farmers' production, the suggested job offered a service for intelligent farming. IMD (Indian Metrological Division) weather report data, including temperature, precipitation, and other details. The approach presented in this study may be used to create an android-centered application that makes use of information analytics techniques to predict one of the most profitable plants in the current weather-related issues. Incorporating data from the database, the weather division, and the artificial intelligence formula, the proposed system will include: A forecast of several suitable crops is created using a synthetic neural network in accordance with current ecological issues. Everyone is concerned about their health, wellness, and ability to maintain good health. Fruits are one of several food products available that help one become healthy and balanced. Fruit consumption is very crucial since it contains a wealth of vitamins and minerals required for a person to be healthy. Today, these fruits are ripened using artificial ripening agents, which are harmful to our health and wellbeing and can cause a variety of disorders. This study offers a practical method for determining whether climacteric fruits have undergone natural or artificial ripening. To detect whether the fruit is naturally ripened or artificially ripened, deep discovering techniques are used. Additionally, machine learning is used to identify if the fruit is ripening naturally or chemically.

S Vimalnath, K Santhosh Kumar, K Naveen,D Saravana Kumar [11], In recent years, IOT has grown in significance in the industrial sectors, and we have proposed the idea of greenhouse farming based on IOT. It is done out by regularly monitoring greenhouses remotely with mobile and cloud applications, installing sensors, and applying data-sharing methods. The method's objective was to improve the efficiency of smart agricultural farming through the use of edge computing for pest detection, plant health monitoring, and crop quality maintenance. Many diverse crops may be produced utilizing extremely efficient ways, avoiding the reasons why crops fail. Effective smart agriculture depends on crop cultivation and production methods. It works best when crops are cultivated and produced using the concepts of smart agriculture. Using edge computing and IOT together will unquestionably enhance farming methods in agricultural areas (90%–95%). Higher crop quality will follow from increased crop yield.

Ersin Elbasi, Nour Mostafa, Zakwan AlArnaout [12], Artificial intelligence (AI) tools like expert systems, natural language processing, speech recognition, and machine vision have altered both the quantity and quality of work in the agricultural sector as a result of the growing global population, the increasing demand for food, as well as changes in weather and the availability of water. Researchers and scientists are now working to implement new IoT technologies in smart farming to assist farmers in creating better seeds, crop protection, and fertilizers using AI technology. Both the country's general economy and the profitability of farmers will benefit from this. Agricultural robots, predictive analytics, and soil and crop monitoring are the three main areas where AI is starting to show up. In this sense, farmers are utilizing sensors and soil sample more often to collect data that farm management systems may use for more research and analysis. Through an overview of AI applications in the agriculture industry, this paper makes a contribution to the area. It begins with an introduction to AI and a study of all AI techniques used in the agricultural sector, including machine learning, the Internet of Things, expert systems, image processing, and computer vision. The next step is to present a thorough literature analysis that discusses how researchers have successfully used AI applications in data collecting employing sensors, intelligent robots, and monitoring systems for crops and irrigation leaks. Additionally, it is demonstrated that quality, productivity, and sustainability are upheld while using AI technologies. Finally, we examine the advantages and difficulties of AI applications and compare and contrast several AI approaches used in smart farming, including machine learning, expert systems, and image processing.

Manorama Subudhi, Kanhu Charan Bhuyan, Ananya Dastidar [13] Every technology now has a new sense of smartness thanks to IoT. One of the nascent IoT applications that can contribute to the economic development of any nation is smart agriculture. Agriculture depends heavily on irrigation, and automated irrigation makes it possible for farmers to manage their water needs from a distance. The goal of this effort is to create a system that reliably predicts irrigation needs for crops and monitors those needs with the use of machine learning algorithms. This study develops a NodeMCU-based Smart Farming System for an automated irrigation system utilizing Blynk and ThingSpeak cloud. Using the NodeMCU and ThingSpeak Cloud, statistics of several factors, including temperature, rain, air moisture content, soil moisture content, and motion, are gathered. In order to assess the data and accurately estimate irrigation, a variety of Machine Learning (ML) models, including Decision Tree, K-Nearest Neighbor, Random Forest, and Logistic Regression models, have been used. The Logistic Regression Model, out of all the models, provides an accuracy of 99.69%, a precision of 98.95%, and a recall of 100%.

R Thirukkumaran; B Rajalakshmi; Aaradhya Priyedarshni; KV Abhigna; Ashwij Kumar [14], India is second globally in terms of agricultural production, and ninth globally in terms of agricultural exports. A 12% yearly growth rate has been seen in agricultural production. In India, the rate of agriculture has skyrocketed due to the country's growing population and declining labor force. There are more pesticides used as agricultural productivity increases, which causes more crop illnesses. Crops are wasted in large quantities, and the cost of pest control and fertilization is rising. This compares and contrasts Smart Agriculture Systems, which use cutting-edge technology like the Internet of Things (IoT) to address the issues of crop diseases.

Elvaretta Dian Detiana Yucky; Aji Gautama Putrada; Maman Abdurohman [15], The technique for detecting the health of paddy crops using drone cameras is proposed in this study. Every action related to monitoring the health of plants is carried out manually in the agricultural nation of Indonesia, which has a sizable amount of agricultural area. However, incorporating technology advancements into land monitoring operations will cut down on time and boost productivity. In this study, rice fields were photographed from various angles using a drone equipped with a Raspberry Pi camera. Through the processes of picture capture, RGB color extraction, and k-Nearest Neighbor (k-NN) classification, the image data is converted into a digital leaf color chart (LCC). The information has been contrasted with the actual LCC, which refers to the hue of healthy rice plants. 25 days have passed since the paddy fields that would be the subject of the study were planted. According to the outcome, the method's precision is 88.89%, recall is 93.02%, accuracy is 98.22%, and specificity is 98.77%.

III. INTERPRETATION AND ANALYSIS

Many authors have presented the different techniques of crop health monitoring and disease detection using IoT- based sensors, different machine learning algorithms and by using deep learning. By using the IoT-based sensors, the crop health can be monitored accurately but the failure of devices and discontinuity in internet connection are the loopholes. The crop health can also be monitored by using different machine learning algorithms but dataset must the proper data for comparisons. In case of disease prediction, the data of variety of diseases must be included in the data set in order to predict the disease. The different environmental factored must be considered while calculating the crop health and for predicting.

IV. CONCLUSION

Different mechanisms help in monitoring the well-being of crops in real-time. They help detect diseases, pests, nutrient deficiencies, and other stressors early, allowing farmers to take timely corrective actions. These mechanisms provide a range of data that can be integrated into farm management systems, enabling farmers to make informed decisions and implement precise interventions to optimize crop growth and yield while reducing resource usage. There is need of system that can monitor the crop health accurately and detect the crop disease in the initial stage. Also the system can be developed to predict the crop disease in the early stage before spreading of disease.

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