PAPER-3 SUMMARY

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CSC 500, Research Methods

Title: **CROPCARE: An Intelligent Real-Time Sustainable IoT System for Crop Disease Detection Using Mobile Vision**

Summary

In today's world, several critical Crop Care systems are of paramount importance to ensure sustainable agriculture and food security. The cornerstone of pest management is integrated pest management (IPM), which emphasizes ecologically friendly approaches that reduce the usage of pesticides and give priority to natural insect control techniques. Utilizing cutting-edge technologies like GPS, drones, and data analytics, precision agriculture maximizes resource allocation, increasing agricultural output while reducing waste. To conserve water resources and enhance crop health, water management methods are essential. Examples include drip irrigation and soil moisture monitoring. A further aspect of climate-smart agriculture is the incorporation of techniques to lessen the impact of climate change on crop yields while fostering adaptability and resilience in agricultural practices. Collectively, these systems help create a more effective, resilient, and sustainable agricultural landscape in the modern world.

This paper proposes an intelligent real-time sustainable IoT system called CROPCARE for crop disease detection and prevention. The technology combines mobile vision, IoT, and Google Cloud services to offer a long-term fix for problems with agriculture. Through the CROPCARE mobile application, the suggested intelligent system's main purpose is to identify crop illnesses. It creates a decision model that has been trained over a variety of diseases using deep learning models like the super resolution convolution network (SRCNN) and MobileNet-V2 [1]. To preserve sustainability, the mobile app is coupled with Google Cloud services and IoT sensors. The suggested approach also offers suggestions that inform farmers on the current state of the soil, the weather, disease prevention techniques, etc. The farmers would find it convenient since it supports both Hindi and English dictionaries.

The proposed CROPCARE system's design architecture, including the data flow diagram, system architecture, and system components, is thoroughly explained in the article. Data processing, data analysis, data visualization, and data collecting are the system's four core modules. Data is gathered by the data gathering module from a variety of sources, including IoT sensors, mobile phones, and cloud services. The data processing module preprocesses the data and uses deep learning models to extract features. The data analysis module uses machine learning algorithms to evaluate the data and produce insights. The data visualization module uses graphs, tables, and charts to communicate the findings in an approachable manner.

A publicly accessible data collection named PlantVillage was used to verify the proposed system's performance. The acquired findings attest to the proposed system's strong performance. The proposed model is superior to other models while working on a multiclass problem, with an accuracy of 96.72%, according to a comparison of the proposed methodology with the existing published work [1]. The report also gives a thorough explanation of the suggestion module, which offers a few details about the plant disease. The farmer or client could learn about the disease, its etiology, and ways to prevent it thanks to this module.

The suggested CROPCARE system, which can assist farmers in producing high-quality crops and preventing crop loss due to pests, diseases, or natural catastrophes, offers a sustainable approach for crop disease diagnosis and prevention.

Good points

This paper provides a strong argument for tackling the crucial problem of crop disease detection and prevention in agriculture. The proposed study, dubbed CROPCARE, is an innovative mix of cutting-edge technology like mobile vision, the Internet of Things (IoT), and Google Cloud services. Through a user-friendly mobile application, this integration creates a comprehensive system that offers real-time analysis, prediction, and personalized suggestions for farmers. The main goal of CROPCARE is to enable farmers to respond promptly and wisely to prevent potential crop losses, thereby promoting sustainable and successful agricultural methods.

This study discusses about a complex decision model that was painstakingly built utilizing cutting-edge deep learning models across a wide spectrum of crop diseases is the basis of CROPCARE. Notably, two well-known deep learning architectures—the super resolution convolution network (SRCNN) and MobileNet-V2—are used to improve the system's ability to accurately identify diseases. According to the rigorous comparison study carried out in the research, the use of these models demonstrates remarkable effectiveness in addressing the complexities of a multiclass classification problem, providing an impressive accuracy rate [1].

The PlantVillage dataset, a widely used and freely available archive of photos of plant diseases, was used by the authors to validate and evaluate the effectiveness of the suggested approach. The use of this dataset in CROPCARE's evaluation confirms the system's excellent performance and dependability in real-world agricultural contexts. The integration of the dataset and its use in developing and verifying the suggested deep learning models are covered in-depth by the authors [1].

The mobile application's central feature, the CROPCARE recommendation module, is a remarkable aspect. With information on the genesis, symptoms, and practical preventive methods of identified plant diseases, this module provides in-depth and comprehensive knowledge. By utilizing this module, farmers and clients can learn a great deal about the specific diseases that affect their crops, empowering them to take wise decisions and implement effective preventative measures.

In conclusion, the CROPCARE system is an ingenious and painstakingly designed solution that aims to revolutionize contemporary agriculture. A leader in the field of sustainable agriculture, CROPCARE combines cutting-edge technologies and makes use of the potential of data-driven deep learning models. The system provides farmers with the resources and information they need to grow crops of superior quality while successfully reducing the negative effects of pests, illnesses, and natural disasters. CROPCARE represents a positive step in the direction of a more durable and profitable future for the agriculture industry.

Bad points

In this paper, numerous difficult aspects demand attention. First, there may be some uncertainty regarding the precision and dependability of illness detection utilizing mobile vision. Mobile vision technology might not always produce extremely accurate results, which could result in erroneous positive or negative outcomes for diagnosing diseases. The robustness and dependability of the system may be impacted by elements like fluctuating lighting conditions and a variety of crop varieties in actual agricultural settings. The technical difficulties and difficulties involved in smoothly merging mobile vision and IoT technology into a user-friendly and efficient solution may not be effectively addressed by the article. Integration difficulties could include everything from synchronizing various data sources to interoperability problems [2].

Scalability and affordability are essential factors for realistic deployment. The proposed system's scalability may not be fully covered in the study, and there may be substantial expenditures involved. It may be expensive to implement IoT systems on a wide scale across many agricultural contexts, which could burden farmers or stakeholders. Furthermore, given that farmers have various degrees of technology knowledge, the article might not fully address user acceptance and uptake. The successful deployment of CROPCARE may be hampered by farmers' resistance to new technology or their difficulties adjusting to them.

IoT devices must effectively address privacy and security issues when collecting, storing, and analyzing sensitive agricultural data. The report might not offer in-depth explanations of the steps taken to protect against potential breaches and preserve data protection [2]. For the system to be used effectively, users, especially farmers, must also get training and ongoing support. The report might not go into detail about the user manuals, support systems, or training programs needed to maximize CROPCARE's utility for users.

The environmental impact of placing a lot of IoT devices in agricultural settings should also be considered. This covers the management of electronic waste, the life cycle analysis of IoT devices, and the overall carbon footprint connected to the manufacturing and use of these devices. For sustainable farming techniques to be used, these environmental impacts must be thoroughly investigated. To ensure the successful deployment, general acceptance, and long-term viability of the CROPCARE system in agricultural domains, it is crucial to address these issues and problems.

References

[1] G. Garg, S. Gupta, P. Mishra, A Vidyarthi, A. Singh and A. Ali, “CROPCARE: An Intelligent Real-Time Sustainable IoT System for Crop Disease Detection Using Mobile Vision”, in IEEE Internet Of Things Journal, vol. 10, issue:1, pp. 2840-2851, 15 February 2023.

[2] G. Nagasubramanian, R. K. Sakthivel, R. Patan, M. Sankayya, M. Daneshmand and A. H. Gandomi, “Ensemble Classification and IoT-Based Pattern Recognition for Crop Disease Monitoring System”, in IEEE Internet Of Things Journal, vol. 8, issue:16, pp. 12847-12854, 15 August 2021.