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Tomato Planting Environment Monitoring and Pest Warning System Using IOT and Huawei Modelarts

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Abstract - This paper presents an intelligent agricultural monitoring system that integrates Internet of Things (IoT) technology with deep learning using Huawei Model Arts for tomato crop management. The system continuously monitors environmental parameters such as temperature, humidity, soil moisture, and pH using IoT sensors, while a Convolutional Neural Network (CNN) analyses leaf images to detect pest infestations and diseases. A Raspberry Pi serves as the central processing unit, enabling real-time data acquisition, processing, and control of irrigation and pest management systems. Alerts are generated via GSM, LCD display, and buzzer for timely farmer intervention. The proposed system achieves a disease detection accuracy of 91.4% and operates with a low-cost hardware setup. The integration of AI and IoT enhances precision agriculture by reducing manual monitoring, minimizing crop loss, and improving productivity.

Key Words: IoT, CNN, Smart Agriculture, Tomato, Huawei ModelArts.

1.Introduction

Agriculture plays a crucial role in ensuring food security and economic stability. Tomato cultivation, especially in regions like Andhra Pradesh, is highly vulnerable to environmental variations and pest attacks. Traditional farming methods rely on manual monitoring, which is inefficient and error-prone. Advancements in IoT and Artificial Intelligence enable realtime monitoring and automated decision-making. Deep learning techniques, particularly CNNs, have proven effective in detecting plant diseases from images. This paper proposes a smart system combining IoT sensors and AI models deployed using Huawei Model Arts to improve tomato crop management.

2. Body of Paper

Agriculture plays a vital role in ensuring food security and economic stability, particularly in countries like India where a large portion of the population depends on farming, and tomato cultivation is one of the most significant agricultural activities, especially in regions such as Andhra Pradesh; however, tomato crops are highly susceptible to environmental variations, pest infestations, and plant diseases, which can lead to considerable yield losses, while traditional monitoring methods rely heavily on manual inspection that is time consuming, labour-intensive, and prone to human error, making early detection difficult and inefficient; to address these challenges, this paper proposes an intelligent agricultural monitoring system that integrates Internet of Things (IoT) technology with Artificial Intelligence using a Convolutional Neural Network (CNN) deployed through Huawei Model Arts, enabling real-time monitoring and automated pest detection; the system is designed with three main layers including a data acquisition layer consisting of sensors such as soil moisture, temperature, humidity, and pH sensors along with a USB camera for capturing leaf images, a processing layer where a Raspberry Pi acts as the central unit to process sensor data and execute the CNN model for disease detection, and an output layer that provides alerts through an LCD display, GSM-based SMS notifications, buzzer alarms, and relay-controlled irrigation and pest control pumps; the methodology involves continuous monitoring where sensors collect environmental data at regular intervals, images of tomato leaves are captured and pre-processed,

and the CNN model based on MobileNetV2 architecture classifies the images into healthy, aphid-infested, or categories achieving an overall accuracy of 91.4%with efficient inference time of 0.31 seconds, while IoT integration ensures automated irrigation based on soil moisture levels and real-time alerts when abnormal conditions or pest infestations are detected; the implementation utilizes hardware components such as Raspberry Pi, FC-28 soil moisture sensor, pH sensor, temperature and humidity sensors, LCD display, GSM module, relay module, and water pumps, along with software tools including Python, TensorFlow Lite, OpenCV, and Huawei Model Arts for model training and deployment; the results demonstrate high system reliability with 98.6% uptime, sensor update intervals of 30 seconds,

and SMS alert delivery within 12 seconds, indicating efficient real-time performance, while the system offers several advantages such as early pest detection, and the reduced pesticide usage, automated irrigation, cost of the
effectiveness with an approximate cost of ₹4500 per node, and scalability for larger farms; in conclusion, the proposed IoT and AI-based tomato monitoring system significantly enhances precision agriculture by combining environmental monitoring with intelligent pest detection, thereby reducing crop losses, improving productivity, and supporting sustainable farming practices, and future work includes the development of mobile applications, integration with cloud-based analytics, expansion to multiple crops, use of drone-based monitoring, and implementation of advanced predictive models for further optimization.

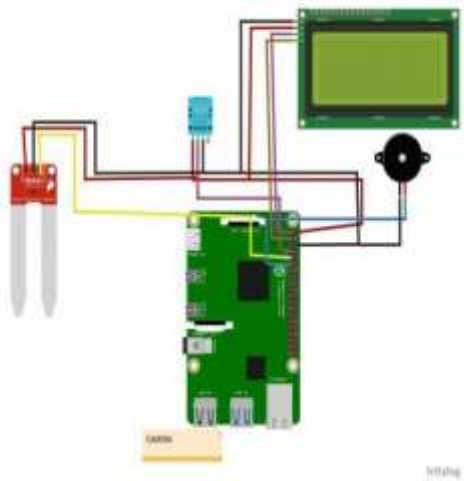

Fig. 1: Schematic Diagram

Fig. 2: Practical Circuit diagram

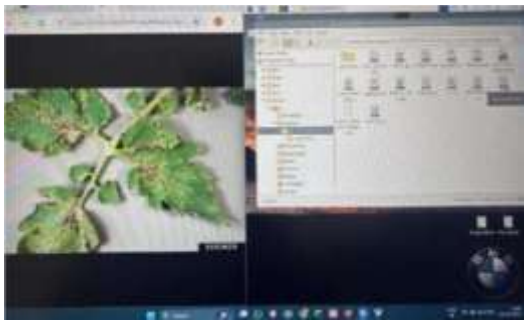

Fig. 3: Practical Image Analysis After Implementation

Fig.3 shows the image analysis in the proposed system is performed using a USB camera connected to a Raspberry Pi, which captures real-time images of tomato plant leaves. These images are pre-processed by resizing and normalizing them before being fed into a Convolutional Neural Network (CNN) based on the MobileNetV2 model.

CNN analyzes features such as colour, texture, and patterns to classify the leaves as healthy or Pest infested. If a disease or pest is detected with high confidence, the system triggers alerts such as buzzer notifications, SMS messages, and activates the pest control mechanism. This approach enables early detection with an accuracy of about 91.4% and supports efficient real-time monitoring.

Table 1: Practical Parameters

Time	Temperature	Humidity	Soil
16:02:52	30.0°C	54 %	Wet
16:02:59	30.0°C	60 %	Wet
16:02:60	50.0°C	0 %	Dry

3. CONCLUSION

The proposed Tomato Planting Environment Monitoring and Pest Warning System successfully integrates IoT and Artificial Intelligence to enhance modern agricultural practices.

By combining real-time environmental monitoring with CNN-based image analysis using Huawei Model Arts, the system enables early detection of pests and diseases, reducing crop losses and improving yield. The use of sensors, Raspberry Pi, and automated alert mechanisms ensures efficient and reliable operation with minimal human intervention. With an accuracy of 91.4% and low implementation cost, the system proves to be a practical and scalable solution for smart farming, especially for small and medium-scale farmers.

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