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Chapter 17

# AI-Assisted Environmental Parameter Monitoring of Plants in Greenhouse Farming

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## Summary

In modern agricultural practices, the controlled environment offered by poly-houses or greenhouses has become indispensable, not only for ensuring optimal plant growth but also for addressing the environmental concerns associated with traditional farming methods. The necessity to prevent the escape of greenhouse gases, coupled with the need for enhancing agricultural productivity, has propelled the adoption of advanced technologies in greenhouse farming. Polyhouses provide a controlled environment that can accommodate fluctuations in weather conditions, ensuring stable and favorable conditions for plant growth throughout the year. To achieve this, novel artificial intelligence (AI) techniques have been integrated into the design of polyhouses. These AI techniques enable the monitoring and regulation of crucial environmental parameters such as temperature, sunlight intensity, carbon dioxide levels, moisture content, soil nutrients, and pest control. The utilization of AI in greenhouse farming enables precise control over environmental variables, thereby optimizing crop productivity. By continuously monitoring and adjusting factors like atmospheric temperature, light exposure, and CO2 availability, AI algorithms can create an ideal growing environment for plants, resulting in healthier and more robust crops. One of the innovative applications of AI in greenhouse farming involves the use of image processing techniques to assess plant health. Night vision cameras installed within polyhouses capture images, allowing for the estimation of chlorophyll content based on the presence of green pixels. These images undergo preprocessing to eliminate noise and extract relevant features such as Intensity Gradient (IG) readings. Additionally, data from soil moisture sensors are incorporated into the analysis to provide a comprehensive understanding of plant health and growth conditions. The extracted features serve as inputs to artificial neural networks employing advanced optimization algorithms like black widow optimization algorithm with mayfly optimization algorithm (BWO-MA) to

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and growth patterns of their crops. These systems enable continuous monitoring and analysis of various environmental and biological factors affecting crop development. By integrating sensors and data collection tools, the AI platforms gather real-time data on soil moisture, temperature, light intensity, and other vital parameters. This data is then processed and analyzed to give farmers a clear and detailed understanding of their crops' conditions, allowing for timely interventions and adjustments in their cultivation practices. Leveraging data analytics and predictive modeling, these AI systems empower farmers to make informed decisions regarding crop management.

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