# Development of an Intelligent Robotic System for Pesticide Application in Agricultural Fields: A Comprehensive Review

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**Abstract:** *The integration of intelligent robotic systems in precision agriculture has revolutionized pesticide application, addressing critical challenges of chemical overuse, environmental contamination, and economic inefficiency. This review examines recent advances in autonomous robotic platforms, computer vision technologies, sensor integration, and intelligent decision-making algorithms for targeted pesticide delivery. We analyze the evolution from conventional broadcast spraying to precision spot-spraying systems, emphasizing the role of artificial intelligence, machine learning, and real-time sensing in optimizing chemical usage. The paper synthesizes current research on mechanical design, navigation systems, detection algorithms, and spraying mechanisms while identifying key challenges in field deployment, including real-time processing, obstacle avoidance, and varying environmental conditions. Future directions highlight the convergence of robotics, IoT, and deep learning for creating fully autonomous, sustainable pest management solutions.*

**Keywords:** Precision agriculture, autonomous robotics, pesticide application, computer vision, machine learning, variable rate technology, precision spraying, agricultural automation, sustainable farming, smart agriculture