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(57) Abstract :
A drone swarm based pollination system, comprising a modular quadcopter drone 101 fleet, with each drone 101 fabricated using biodegradable components, ensuring lightweight strength and eco-friendly disposal, the fleet is supported by an edge computing based hive-mind server 102 communicatively coupled to each drone 101, enabling decentralized decision-making and real-time coordination, a predictive pollination module undertakes epidemic plant analysis, allowing the drone 101 swarm to move beyond visual inspection by predicting a plant's pollination receptivity through subtle environmental stressors, complementing this is a swarm-scale digital twin model with predictive emergence to optimize pollination efficiency, each drone 101 is further equipped with phased-array antennas 103 forming a swarm phased-array energy beamforming module, and a biocompatible pollen dispenser 104 comprising micro-pneumatic nozzles and an electrostatic charge ensuring 99% pollen adhesion to stigmas, silent propellers 105, ultrasonic bee guard emitter 106, and collision-avoidance via ultrasonic sensors safeguard birds and bees.

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