

Research and design of a nutrient mixing and pumping system for application in vegetable care on smart growing racks.

Vi Van Chuan

Abstract: This thesis presents the design and development of an automated nutrient mixing and pumping system for smart vertical farming applications. Addressing the limitations of manual nutrient preparation in soilless cultivation, the proposed system integrates sensors for pH and electrical conductivity (EC) with a microcontroller-based control unit. The system precisely regulates the mixing ratio of concentrated nutrient stock solutions and water, ensuring optimal nutrient concentration and acidity for plant growth. A peristaltic pump mechanism delivers the prepared solution to the crop rows according to a programmable schedule. Experimental results demonstrate that the system maintains nutrient parameters within the ideal range for leafy greens, reducing human error and labor costs. The design offers a scalable, cost-effective solution for automated fertigation, contributing to improved crop yield and resource efficiency in intelligent agricultural systems.

Keywords: Mixing system, nutrient pump, smart growing rack, vegetable care