



**SMART HYDROPONIC GARDENING: AN IOT-BASED MONITORING
AND AUTOMATION SYSTEM FOR URBAN AGRICULTURE**

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Submitted as one of the requirements to obtain

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SMART HYDROPONIC GARDENING: AN IOT -BASED MONITORING
AND AUTOMATION SYSTEM FOR URBAN AGRICULTURE

ABSTRACT

Urban agriculture faces challenges in maintaining efficient, resource-conscious farming within limited spaces. Hydroponics offers a sustainable, soil-less alternative but often requires constant monitoring and technical expertise. This project presents a smart hydroponic gardening system integrating IoT-based sensors and automated controls to simplify system management for small-scale users.

The system employs ESP32 microcontrollers for real-time monitoring of light intensity, humidity, water level, and temperature. Sensor data is transmitted via MQTT to a Node.js backend, which processes the readings, logs them in a MySQL database, and triggers automated responses when thresholds are breached. A React.js-based dashboard enables users to visualize data trends, set automation parameters, and manage maintenance logs.

Testing results confirm that the system operates reliably under various scenarios, with strong usability, responsiveness, and stability. By lowering the technical barrier and offering a user-friendly interface, this system contributes to the broader adoption of precision hydroponics in urban environments.

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