

## Low-Cost Monitoring System for Hydroponic Urban Vertical Farms

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**Abstract :** This paper presents the development of a low-cost monitoring system for a hydroponic urban vertical farm, enabling its automation and a quantitative assessment of the farm performance. Urban farming has seen increasing interest in the last decade thanks to the development of energy efficient and affordable LED lights; however, the optimal configuration of such systems (i.e. amount of nutrients, light-on time, ambient temperature etc.) is mostly based on the farmers' experience and empirical guidelines. Moreover, even if simple, the maintenance of such systems is labor intensive as it requires water to be topped-up periodically, mixing of the nutrients etc. To unlock the full potential of urban farming, a quantitative understanding of the role that each variable plays in the growth of the plants is needed, together with a higher degree of automation. The low-cost monitoring system proposed in this paper is a step toward filling this knowledge and technological gap, as it enables collection of sensor data related to water and air temperature, water level, humidity, pressure, light intensity, pH and electric conductivity without requiring any human intervention. More sensors and actuators can also easily be added thanks to the modular design of the proposed platform. Data can be accessed remotely via a simple web interface. The proposed platform can be used both for quantitatively optimizing the setup of the farms and for automating some of the most labor-intensive maintenance activities. Moreover, such monitoring system can also potentially be used for high-level decision making, once enough data are collected.

**Keywords :** automation, hydroponics, internet of things, monitoring system, urban farming

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