



A Comparative Study of Automated Hydroponics Farming System using Internet of Things and Web Application

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Abstract: Recent advances in Internet of Things (IoT)-enabled hydroponic and aquaponic system research highlight a potentially transformative shift in agricultural paradigms. These cutting-edge solutions tackle a variety of issues, from the need for sustainable farming practices to extreme environmental circumstances. The attainment of increased growth rates and enhanced crop production through careful monitoring and management of environmental conditions is a recurring topic in all the research. Actuators, sensors, and microcontrollers can be integrated to optimize plant development and reduce human dependency by adjusting fertilizer delivery and ambient conditions in real-time. This integration is typically made possible by platforms like NodeMcu and Raspberry Pi. A workable approach for sustainable food production, the studies also highlight the use of these systems in areas where traditional farming faces significant obstacles. It is explored how hydroponics and aquaponics might help with precision agriculture in urban and suburban areas where farmland is scarce, in addition to alleviating the issue of food scarcity. The findings recommend ongoing research in the fields of data science, AI, and UI design in order to improve and enhance these technologically advanced farming methods. The convergence of cutting-edge technologies and environmentally conscious agricultural methods portends a future in which Internet of Things-enabled hydroponic and aquaponic systems are essential to guaranteeing food security worldwide.

Keywords: IoT, Web, WWW, Hydroponics, Framing, NedeMcu.

1. Introduction

The combination of cutting-edge technologies and creative farming methods has led to the development of a new area of study in recent years that focuses on the Internet of Things (IoT) integrated hydroponic and aquaponic systems. This intersection signifies a paradigm shift away from conventional farming toward increased productivity, sustainability, and accuracy. The soil-less growth technique known as hydroponics has become more popular because of its ability to maximize agricultural yields while minimizing environmental impact and resource usage. At the same time, a holistic method known as aquaponics a hybrid of hydroponics and aquaculture has gained popularity. It uses the mutualistic interaction between fish and plants to build a closed-loop, sustainable ecosystem.

Real-time monitoring and control of critical environmental factors is made possible by the integration of IoT technology into these systems, which has emerged as a research focus. Because of this connectedness, remote

management is made easier and crops are given accurate and timely treatments for the best possible growth. Together, the research presented here highlights the many advantages of these intelligent farming systems, from resolving issues in challenging agricultural regions to satisfying the growing demand for food worldwide.

The framework for a thorough examination of current research projects that examine the development, application, and assessment of IoT-enhanced hydroponic and aquaponic systems is provided in this overview. These studies offer insights into the changing landscape of technology-driven sustainable farming methods as agriculture embraces the digital revolution.

2. Literature Review

Dr. Asawari Dudwadkar et al. (2020) conducted an investigation on a hydroponic system that ensures a controlled environment and an accelerated growth rate. To enhance the efficiency of plant and vegetable production, the system employs actuators to systematically monitor