JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SMART HYDROPONIC FARMING

Mr. Gaurav Patkar[1], Mr. Harshal Kadam[2], Mr. Siddhant Kamble[3], Mr. Akash Bharti[4],

Prof. Atul Atalkar[5]

[1234]BE. Student, Department of Electronics and Telecommunication, Shivajirao S. Jondhle College of Engg. &Technology, Asangaon, Maharashtra. India
[5] Dept. of Electronics and Telecommunication, Shivajirao S. Jondhle College of Engg. &Technology, Asangaon, Maharashtra. India

Abstract: As a cornerstone of human civilization, agriculture has experienced significant changes. In the modern world, smart hydroponic farming is at the forefront of sustainable and productive agricultural methods. The need of closely monitoring critical variables, including as temperature, PH, and total dissolved solids (TDS), in hydroponic systems is emphasized in this abstract. To maximize agricultural production while preserving resources, the best growing environments for plants must be maintained. The aim of this research is to investigate how modern data analytics and sensor technologies might be used to improve and simplify these crucial aspects. The goal of this research is to improve hydroponic farming operations' sustainability and efficiency by automating and fine-tuning key variables, opening the door to a more resilient and fruitful farming environment.

Key Words: ***Temperature, PH, TDC.***

1.INTRODUCTION

This paper's main goal is to investigate the use of smart hydroponic farming, with a particular emphasis on temperature management, PH, and TDS monitoring. Our goal is to find out how to maximize crop productivity by utilizing sensor-based technologies, automated control mechanisms, and real-time data collection. By doing this, we hope to support the larger objective of sustainable agriculture, which is to lessen the environmental impact of food production and guarantee food security in a changing global environment.

Smart hydroponic farming is used in this paper. The need for creative and sustainable agricultural methods is more than ever in the modern world due to the growing global population and shrinking amount of arable land. Cutting edge advancements in this area include smart hydroponic farming, which provides an environmentally responsible and resource-efficient crop-growing solution that has the potential to completely transform agricultural practices. The topic of smart hydroponic farming is explored in this research, with a focus on temperature, PH levels, and total dissolved solids (TDS) and how real-time monitoring and control of these parameters might maximize crop yield. The technique of growing plants without soil, known as hydroponics, has become more popular in recent years because it has the potential to solve a number of issues that traditional agriculture faces. By giving plants a well managed nutrition source Hydroponic systems provide the chance to improve crop growth, use less water, and reduce the use of fertilizers that include chemicals. However, controlling important environmental parameters, especially TDS, PH, and temperature, is crucial to the success of hydroponic farming.

2.LITREATURE

[1] The study by Adhikari and Gupta (2021) explores hydroponic farming's potential as a sustainable farming method, highlighting its capacity to solve urgent environmental and agricultural issues. Farmers that use hydroponics may maximize nutrient delivery to plants, cut down on water usage, and do rid of the need for dangerous chemicals like pesticides and herbicides. The writers' analysis is in line with previous research, which highlights the advantages of hydroponics for the environment, technological breakthroughs, economic viability, and creative nutrient management strategies. Adhikari and Gupta's work highlights the revolutionary potential of hydroponic farming in cultivating resilient and sustainable agricultural systems in the long run.

[2] Panda and Malik's (2021) literature study provides a thorough analysis of hydroponic crop production, covering its theoretical underpinnings, historical development, and several advantages. Apart from offering an understanding of the principles of hydroponics, the writers explore the various kinds of hydroponic systems that are accessible, emphasizing their unique benefits and uses. Additionally, the paper explores the complexities of managing plant nutrients in hydroponic settings, discussing methods for maximizing nutrient uptake and preserving plant health. Furthermore, Panda and Malik examine how plant growth regulators function in hydroponic farming and provide insight into the possible effects these regulators may have on plant development and growth. All things considered, this review adds significant knowledge to the subject by providing a thorough analysis of hydroponic crop production and all of its features.

[3] The 2019 book "Hydroponic Crop Production: A Practical Guidebook for the Soilless Grower" by Fox is a classic in the field of hydroponic farming, providing a thorough resource for operators of all stripes. The book is a useful resource that guides readers through the basic ideas of hydroponic systems, offering a strong foundation for beginners and exploring more sophisticated methods for more experienced growers.

Particularly, it provides farmers with the know-how to tackle typical problems arising from hydroponic farming by providing them with useful troubleshooting advice. Fox's guidebook is a valuable resource for anybody interested in hydroponic crop production because of its all-inclusive approach, which meets the needs of both commercial farmers and enthusiasts. We learn about the nuances of hydroponic crop growing from this paper.

[4] Regarding hydroponic agriculture, Resh's (1981) book "Hydroponic food production: a definitive guidebook for the advanced home gardener and the commercial that caters to both home gardeners and commercial farmers. The manual provides extensive coverage, covering everything from the basic construction of hydroponic systems to the finer points of crop selection and marketing tactics. Resh's manual offers a wealth of information to anybody considering hydroponic farming, whether for personal use or as a business venture, by catering to a variety of audience demands. We take key information from this article that is necessary for creating intelligent hydroponic farming systems. This information includes setup tips, crop recommendations, and marketing tactics. These realizations aid in the development and use of effective and long-lasting hydroponic farming techniques, enabling increased output and financial gain in residential and commercial contexts.

3. PROPOSED METHODOLOGY

The smart hydroponics system integrates advanced sensors to meticulously monitor water quality and environmental parameters crucial for plant growth. These sensors provide real-time data, enabling precise control over the hydroponic environment. When sensor readings indicate optimal conditions, the system automatically directs water towards the plants to supply essential nutrients. However, deviations trigger immediate alerts through visual displays and audible signals, prompting users to address any issues promptly.

To ensure consistent temperature levels conducive to plant growth, the system employs an intelligent temperature regulation mechanism. If temperatures stray from the ideal range, an exhaust fan activates to stabilize conditions, safeguarding plant health. Leveraging smart hydroponics technology, users can cultivate a variety of fresh, pesticide-free vegetables and fruits directly in their balconies or indoor spaces. By eliminating the need for pesticides and herbicides, the system promotes the production of safe, nutritious produce for urban dwellers, fostering sustainable urban agriculture practices.

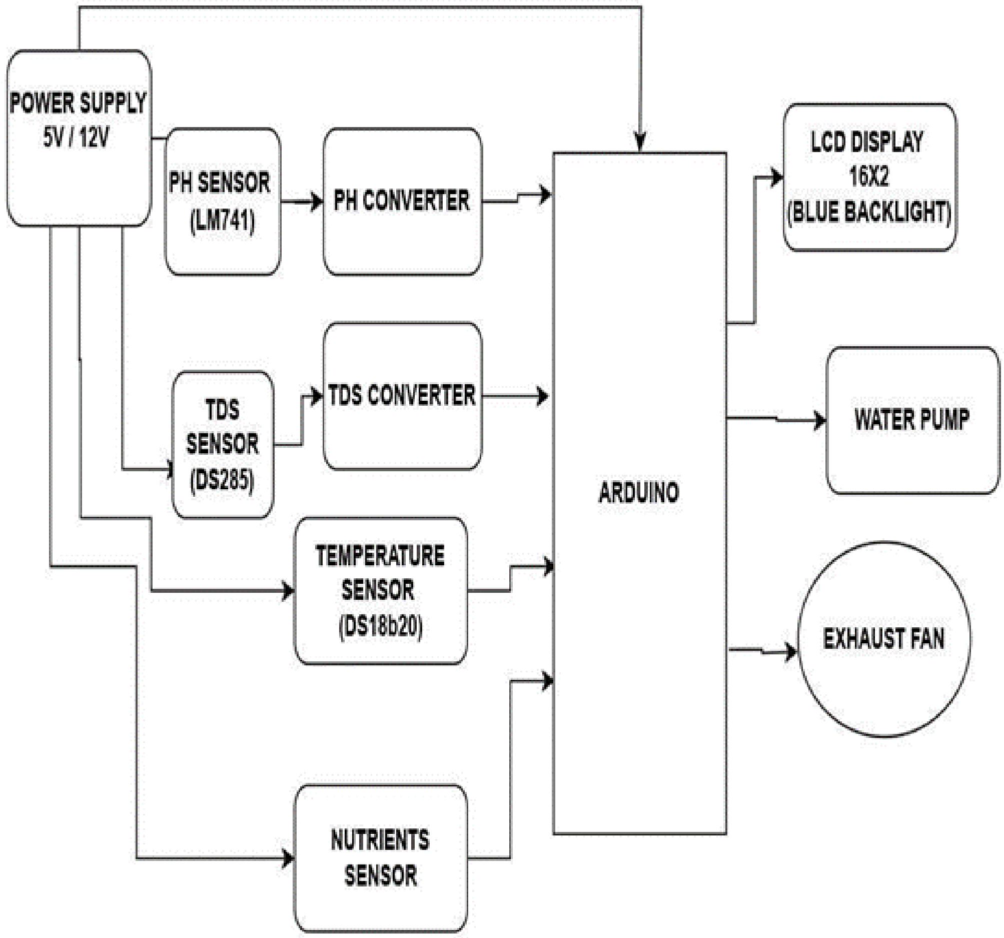

Fig -1: Block Diagram

4.WORKING

Smart hydroponics farming leverages sophisticated automation through control systems and sensors to create and maintain ideal growing conditions for plants. The system is designed with precision, placing temperature, PH, and TDS sensors strategically throughout the hydroponic setup to continuously monitor crucial environmental and water quality parameters. These sensors collect real-time data and transmit it to a central control unit, which is typically a microcontroller or a small computer responsible for overseeing the entire cultivation process. To ensure the plants thrive, specific optimal ranges for PH, TDS levels, and temperature are pre-established based on the requirements of the plant species being cultivated. The control unit continuously compares the incoming sensor data against these predetermined ranges. If all sensor values align within these ideal parameters, indicating that environmental conditions are favorable, the control unit triggers action by activating the water pump.

The water pump's role is vital—it delivers water from the reservoir to the plants, ensuring they receive the necessary hydration for growth and development. This process of automated watering occurs seamlessly when conditions are optimal, contributing to efficient and sustainable plant cultivation. However, the system is not solely focused on action; it is also equipped to detect deviations from the ideal conditions. If any sensor readings fall outside the predefined ranges indicating potential issues such as fluctuations in PH, excessive TDS levels, or unfavorable temperatures the control unit initiates an alert system. The alert system serves as a crucial feedback mechanism, promptly notifying the user of any deviations through visual indicators like LED lights and audible alarms such as beeps. This real-time notification empowers the user to take immediate corrective action, addressing the identified issue to restore optimal growing conditions swiftly.

User intervention plays a vital role in this process. Armed with information from the alert system, the user can promptly intervene by adjusting parameters, replenishing nutrients, or making other necessary modifications to ensure the hydroponic system remains in optimal working order. This proactive approach enhances efficiency and productivity in smart hydroponics farming, ultimately facilitating healthier plant growth and maximizing yields.

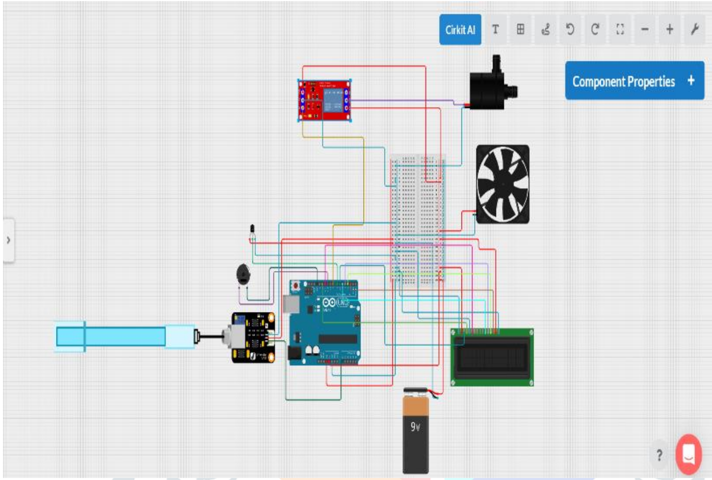

Fig -2: Circuit Diagram

5. RESULT

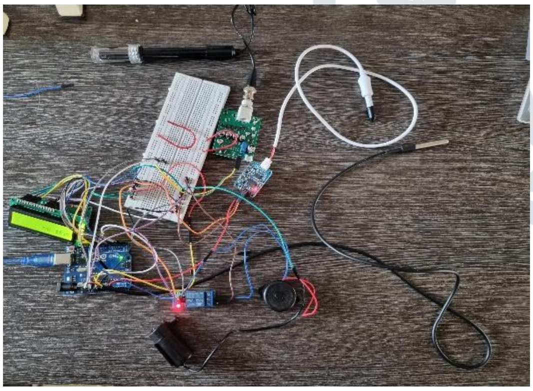

Fig -3: Working model

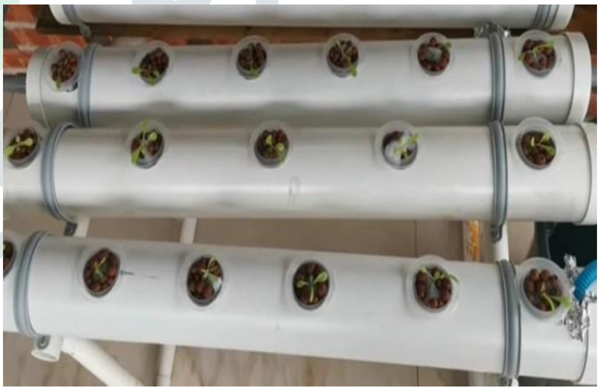

Fig -4: Working model

Fig -5: Plant grow successfully

In the result section, it was observed that the temperature sensor effectively detected ambient temperature variations. When the temperature deviated from the set threshold, the system triggered the exhaust fan to regulate the temperature, ensuring a comfortable environment. Conversely, if the temperature remained within the desired range, the system remained in a standby state, indicating "Okay."

Additionally, the TDS and pH sensors consistently monitored water quality. Upon detecting optimal readings, the water pump efficiently initiated water flow. However, if the readings indicated unsuitable water conditions, a buzzer sounded, alerting the user to take necessary action, thus ensuring the maintenance of ideal water parameters for the intended application.

6. CONCLUSION

To sum up, the intelligent hydroponic farming system is revolutionizing the field of hydroponic farming. It tackles the difficulties associated with conventional water quality monitoring. The apparatus makes use of cutting-edge sensors for true. The system's advantages include higher agricultural yields, less waste of water and nutrients, and better plant health. The system's efficacious execution in multiple case studies underscores its potential for extensive implementation.

REFERENCES

[1] Adhikari and Gupta, 2021- "Hydroponics: a potential technique for sustainable agriculture".
[2] Panda and Malik, 2021 -"A review of hydroponic crop production".
[3] Fox, 2019 "Hydroponic crop production: a practical guidebook for the soilless grower".
[4] Resh, 1981 "Hydroponic food production: a definitive guidebook for the advanced home gardener and the commercial hydroponic grower".

BIOGRAPHIES

Mr. Gaurav Patkar
BE. Student, Department of Electronics and Telecommunication, Shivajirao S. Jondhle College of Engg. &Technology, Asangaon, Maharashtra, India

Mr. Harshal Kadam
BE. Student, Department of Electronics and Telecommunication, Shivajirao S. Jondhle College of Engg. &Technology, Asangaon, Maharashtra, India

Mr. Siddhant Kamble
BE. Student, Department of Electronics and Telecommunication, Shivajirao S. Jondhle College of Engg. &Technology, Asangaon, Maharashtra,India

Mr. Akash Bharti
BE. Student, Department of Electronics and Telecommunication, Shivajirao S. Jondhle College of Engg. &Technology, Asangaon, Maharashtra,India

Prof. Atul Atalkar,
Head of Dept. of Electronics and Telecommunication,
Shivajirao S. Jondhle College of Engg. &Technology, Asangaon,
Maharashtra. India