International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

# Indoor Farming Hydroponic Plant Growth Chamber

***Revanna B R [1] , Akash R M [2] , Karthik R T [3], Mohan B V [4]***

[1] Professor ( B.E, M.Tech,Ph.D), [2]UG Student, [3] UG Student, [4]UG Student,
Department of Electronics and Communication Engineering, Sri Siddharatha Institute of Technology, Tumkur, India
***Corresponding author.** Tel.:7760356765; E-mail address: akashrm929@gmail.com

ABSTRACT

Nowadays, with increasing population and limited farming space in cities, it's becoming hard to grow food in a traditional way. This project aims to create a smart, compact indoor hydroponic system that grows leafy vegetables and herbs without using soil. We used a combination of water, nutrients, sensors, and LED lights to maintain ideal conditions for plant growth. The chamber is designed for use in homes, hostels, and schools. It works in all seasons and is easy to maintain. It also saves water and does not need pesticides. This project helps in understanding how to use technology for sustainable and smart agriculture.

**Keywords:** Hydroponics, Indoor Farming, Controlled Environment Agriculture (CEA), LED Lighting, Sustainable Agriculture and Plant Growth Chamber.

## 1. Introduction

Due to the rapid growth of urban areas, people are facing challenges in growing food. Most houses in cities don't have space for traditional farming. In addition, soil pollution and unpredictable weather conditions are causing problems. To solve this, we developed a hydroponic chamber that works indoors. This system helps in growing plants using nutrient-rich water. It includes sensors to check pH, humidity, and temperature. The LED lights help the plants grow even without sunlight. It is suitable for urban households and educational institutions where space and water are limited.

## 2. Problem Statement

In cities, there is not enough space for farming. Also, water and clean soil are not easily available. People depend on markets for vegetables, which may not always be fresh. Traditional farming methods are also affected by changing climate and pollution. So, we thought of developing a compact hydroponic system that can be kept indoors. It can grow fresh vegetables using only water and nutrients. This solution helps people to grow food easily at home, anytime.

## 3. Proposed System

The system consists of sensors like pH, TDS, turbidity, temperature, and humidity sensors connected to a microcontroller. It uses the ESP8266 Wi-Fi module to send data to the cloud. Based on the sensor data, the system can automatically turn ON/OFF the LED lights, water pumps, and nutrient supply. This smart system is programmed to maintain ideal growing conditions. The data is displayed on an OLED screen and can be monitored using mobile or PC. This makes it convenient for users to check the system from anywhere and take action if needed.

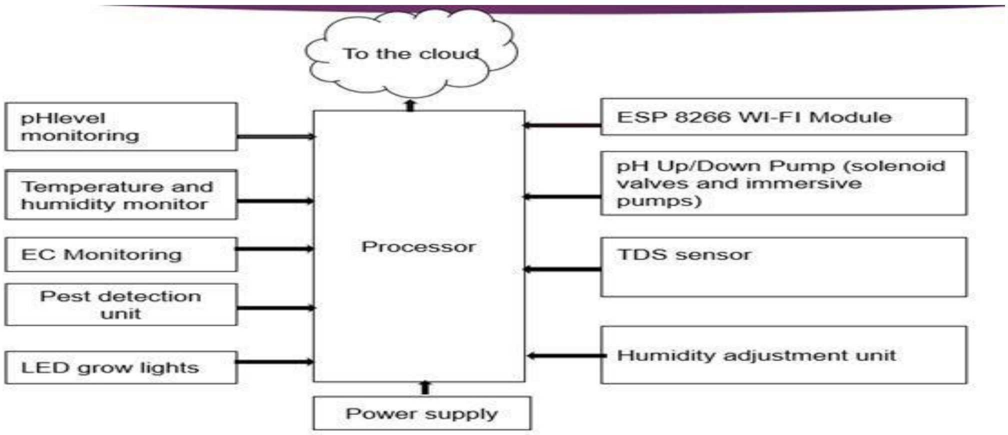


Figure 1: Block Diagram

## 4. System Components

- pH Sensor – Checks if the water is too acidic or basic.
- Turbidity Sensor – Tells us if the water is clean.
- Water Level Sensor – Ensures enough water is available.
- TDS Sensor – Measures the nutrients in water.
- Temp & Humidity Sensor – Measures environmental conditions.
- Soil Moisture Sensor – Used if there's soil added to the system.
- ESP8266 – Sends data to cloud and controls components.
- LED Lights – Helps in photosynthesis when sunlight is not available.
- OLED Display – Shows real-time data.

## 5. Working module

The chamber includes all necessary components to support plant growth in a closed environment. The sensors continuously collect data about temperature, humidity, pH level, water quality, and nutrient levels. This data is processed by the microcontroller which then activates the required component—for example, if the light is low, LED lights are turned on, or if the water is low, the pump starts. All activities are monitored in real-time and data is sent to a cloud platform via Wi-Fi. The system is designed to be both automatic and manual depending on the user's preference. This helps in saving water, time, and ensures proper growth of plants without much human involvement.

## 6. Result

After building the system, we observed that the plants grew faster compared to normal soil farming. The roots were healthy and white, and the leaves were fresh. The sensors provided real-time data which helped in maintaining the best conditions for the plants. The LED lights worked well in place of natural sunlight. Because the system used only required water and recycled it, there was no wastage. This confirmed that hydroponics is an efficient method for urban agriculture.

Figure 2: Sample photo of prototype of the mod

## 7. Observation

• Growth was faster compared to soil-based farming.
• Very little water was used and there was no wastage.
• Clean environment – no pests or weeds.
• Roots were healthy and white.
• LED lights helped in indoor growth.
• After adding nutrients, plant health improved within 2–3 days.
• Stable temperature helped in faster growth.

## 8. Merits

High growth rate of plants.
• Efficient water use.
• No soil – no mess.
• Can work in all seasons.
• Compact and fits in small space.
• Minimal pest issues.
• Automated system with sensor control.
• Useful for city houses, schools, and research labs.

## 9. Conclusion

This project helped us to explore modern farming techniques. We learned that hydroponics can grow healthy plants using water and nutrients without soil. The system is clean, space-saving, and works indoors. With the help of sensors and automation, it becomes easier to manage the growth process. Such projects are helpful in solving food production problems in urban areas. It is a step towards smart agriculture and sustainable living. In the future, this model can be scaled up or even used in vertical farming techniques for larger production.

## References

1. Chowdhury, M.E.; Antonio, S., Jr.; Sorino, C.K.; Benhmed, K. Photo-Voltaic (PV) monitoring system, performance analysis and power prediction models in Doha, Qatar. In Renewable Energy; IntechOpen: London, UK, 2020.
2. CA Mitchell.; Sankaranarayanan, S.; Tom, R.J.; Veeramanikandan, M. IoT based hydroponics system using Deep Neural Networks. Comput. Electron. Agric. 2022.
3. Peter AY Ampim.; Khandakar, A.; Chowdhury, M.E.; Antonio, S., Jr.; Sorino, C.K.; Benhmed, K. Photo-Voltaic (PV) monitoring system, performance analysis and power predictionmodelsinDoha,Qatar.InRenewableEnergy;IntechOpen:London, UK,2022.
4. Gaganjot Kaur.; Reyes, J.M.M.; Breceda, H.F.; Fuentes, H.R.; Contreras, J.A.V.; Maldonado, U.L. Automation and robotics used in hydroponic system. In Hydrocultural and Hydroponics Systems; IntechOpen: London, UK, 2023.
5. MoslemaHoqueOeishee.; Aleixo, D.; Pitarma, R. Enhanced hydroponic agriculture environmental monitoring: An internet of things approach. In Proceedings of the International Conference on Computational Science, Faro, Portugal, 12–14 June 2024.
6. Resh,H.M.HydroponicFoodProduction:ADefinitiveGuidebookfortheAdvancedHome Gardener and the Commercial Hydroponic Grower; 9 August 2012; CRC Press: Boca Raton, FL, USA, 2022.
7. MdShamimAhamed.;Mandikiana,B.W.Towardssustainablefoodproductionsystemsin Qatar: Assessment of the viability of aquaponics. Glob. Food Secur. 2023.
8. Yee Sin Goh.; Lee, J. Beneficial bacteria and fungi in hydroponic systems: Types and characteristics of hydroponic food production methods. Sci. Hortic. 2023.