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Atomized Hydroponic System by Using Modern Digital Tools

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SUMMARY

Hydroponic system requires periodic labour, a systematic approach, repetitive motion and a structured environment. Robotics, Automation, and IoT promote farmers to monitor all the activities in plant, root zone and environmental conditions under hydroponics. This article introduces findings in design with real time operating systems based on microcontrollers pH fuzzy logic control system for nutrient solution in embed and flow hydroponic system , hydroponic system in combination with automated drip irrigation expert system-based automation system automated hydroponics nutrition plants systems hydroponic management and monitoring system for an intelligent hydroponic system using internet of things and web technology neural network-based fault detection in hydroponics additional technologies implemented in hydroponic systems and robotics in hydroponic systems. The above advances will improve the efficiency of hydroponics which helps to increase the quality and quantity of the produce and provide an opportunity for the growth of the hydroponics market in near future.

INTRODUCTION

Considering that human world population will reach about 9 billion by the year 2050 (Tilman *et al*., 2002), it appears clear that food security is one of the pivotal themes of the new millennium and reasonably, the most immediate challenge for the agricultural sector. Hydroponics is a method of growing crops without soil. Plants are grown in rows or on trellises, just like in a traditional garden, but they have their roots in water rather than in dirt. Most of us confuse soil with nutrients. In fact, soil provides structure not the actual food itself, for plant roots. The food comes from other materials mixed in the soil, such as compost, broken-down plant waste or fertilizers. Plants grown hydroponically can actually grow faster and healthier than plants in soil because they don't have to fight soil borne diseases in addition all the food and water they need are given directly to their roots around the clock. Soilless cultivation represents a valid opportunity for the agricultural production sector, especially in areas characterized by severe soil degradation and limited water availability. Furthermore, this agronomic practice embodies a favourable response toward an environment-friendly agriculture and a promising tool in the vision of a general challenge in terms of food security.

Urban Horticulture - Necessity of the Future

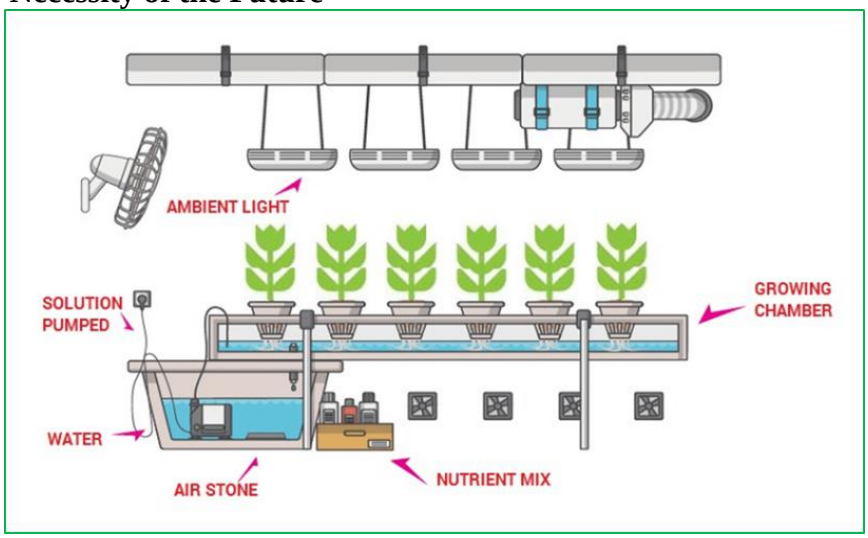
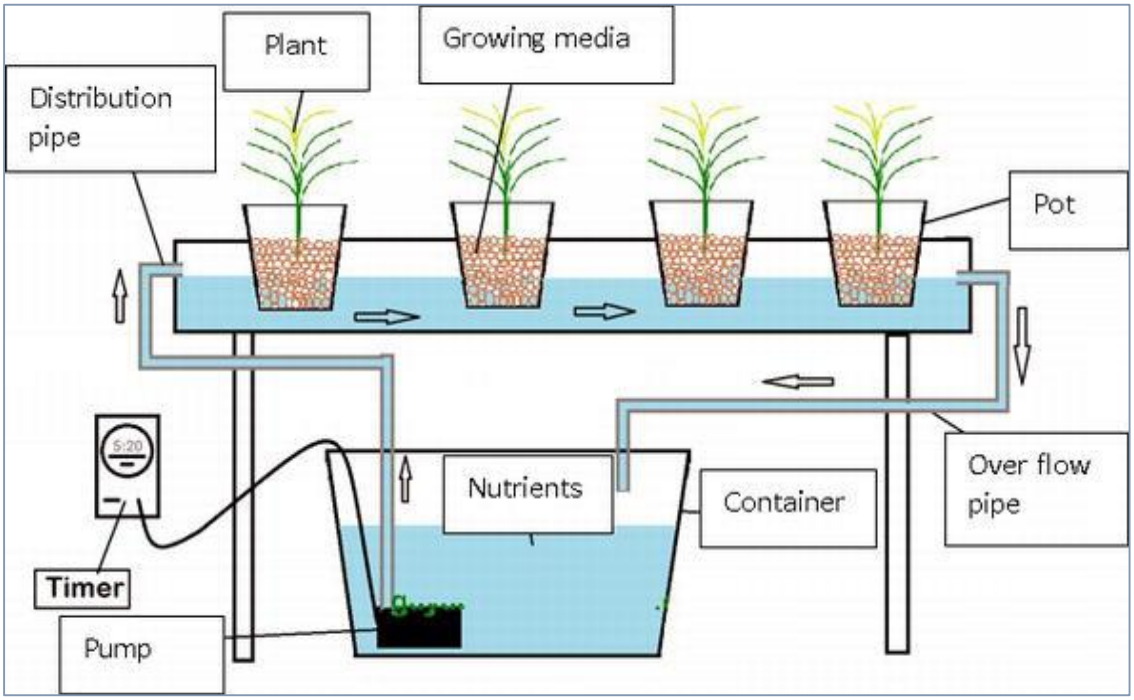
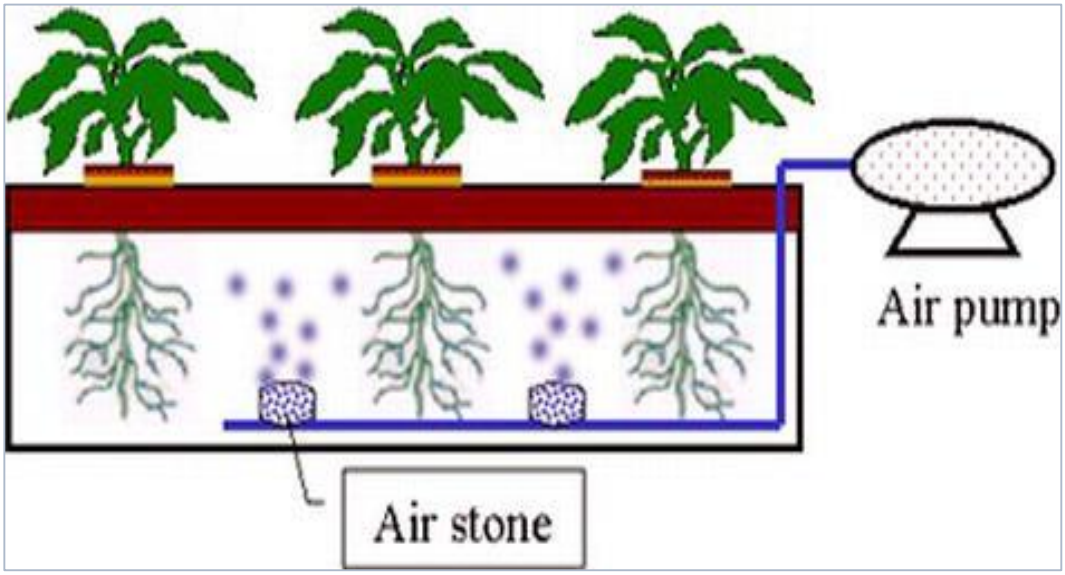


Fig. 01 Hydroponic system Setup.(https://scottline.com/Hydroponics_Using_IoT.html)



(Figure 2a) Nutrient film technique.



(Figure 2b) Deep floating technique

To accomplish with this, hydroponic systems must collect a lot of information, since this allows a better diagnosis of the problems and better understand the development of hydroponic crops. Automatic sensors not only have the ones that can be read at predefined intervals, but also the readings of these sensors are stored so that higher results can be obtained for analysis and diagnosis resulting in higher crop yields and friendlier practices with the environment.

To solve this problems of data collection and manipulation now a days there are different sensors available in the market. The emergence of Internet of Things (IoT) has allowed farmers to automate the hydroponic culture. Monitoring of water level, pH, temperature, flow and light intensity can be regulated using IoT, which allows for

machine to machine interaction, and controlling the hydroponic system autonomously and intelligently employing deep neural networks.

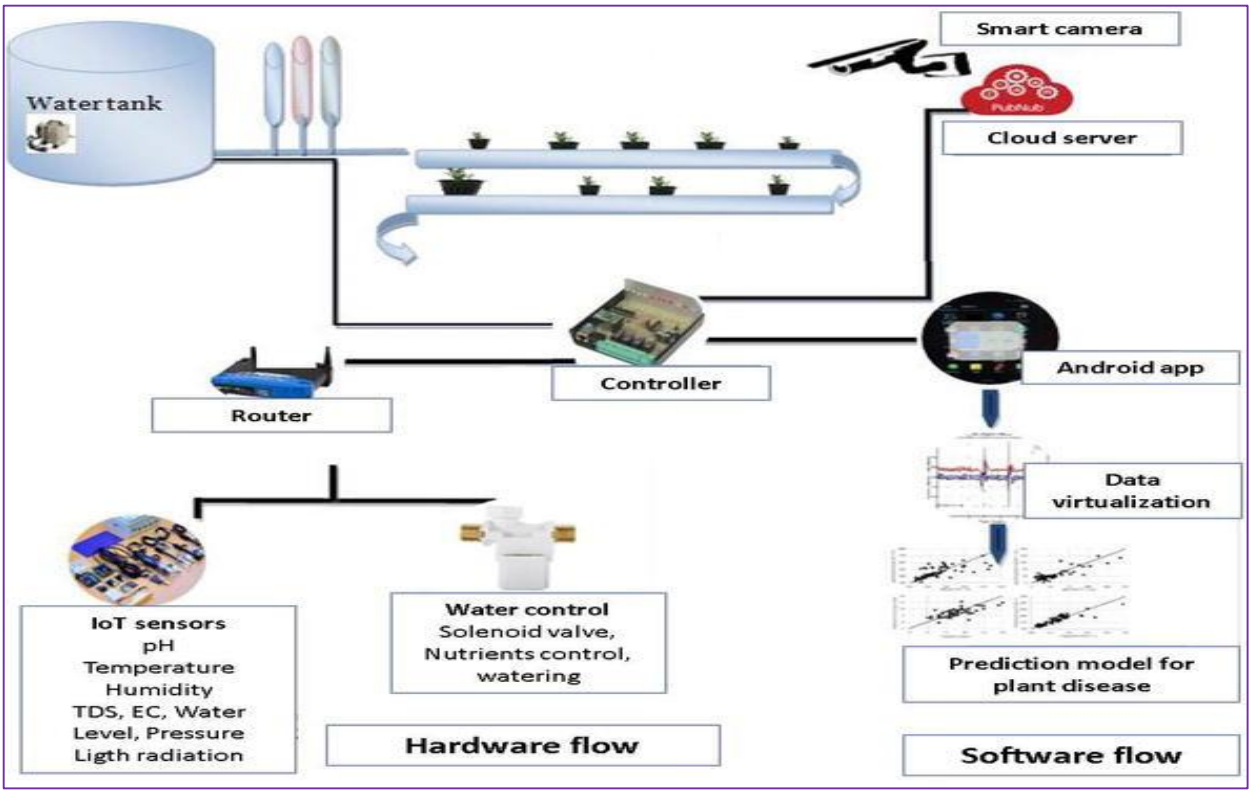


Fig.3 Schematics of internet of hydroponics
(Courtesy National Institute of technology, Trichy, India).

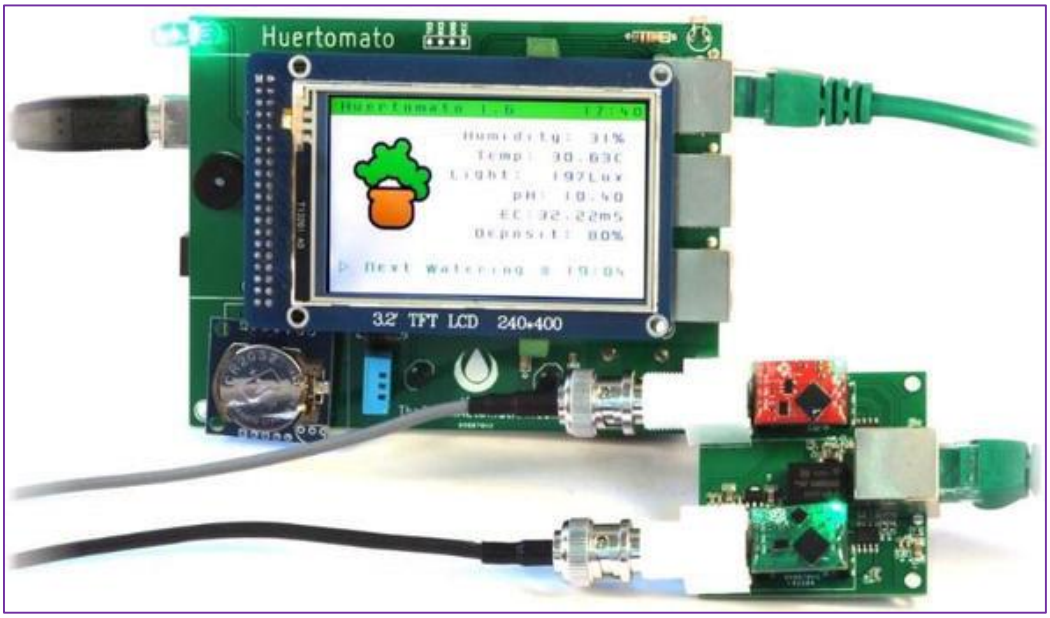


Fig.4 Huertomato microcontroller for measuring of humidity, water and air temperature, light, pH, electrical conductivity (courtesy of Arduino).

Automation in hydroponic systems:

All possible variables in root zone must be monitored for automation of the hydroponic system and sensors of pH, the electrical conductivity (EC), light, the ambient temperature, the temperature of the solution, the humidity and the carbon dioxide, the dissolved oxygen and the oxidation–reduction potential must be considered

as they directly affect the growth of hydroponically grown plants. The system controlled autonomously the desired agronomic conditions for production and fodder flow. The automatic solution comprised: the mechanical structure, the mechanical and hydraulic components, and the control system to automate the hydroponic automatic system.

Hydroponic system design with real time OS based on microcontroller.

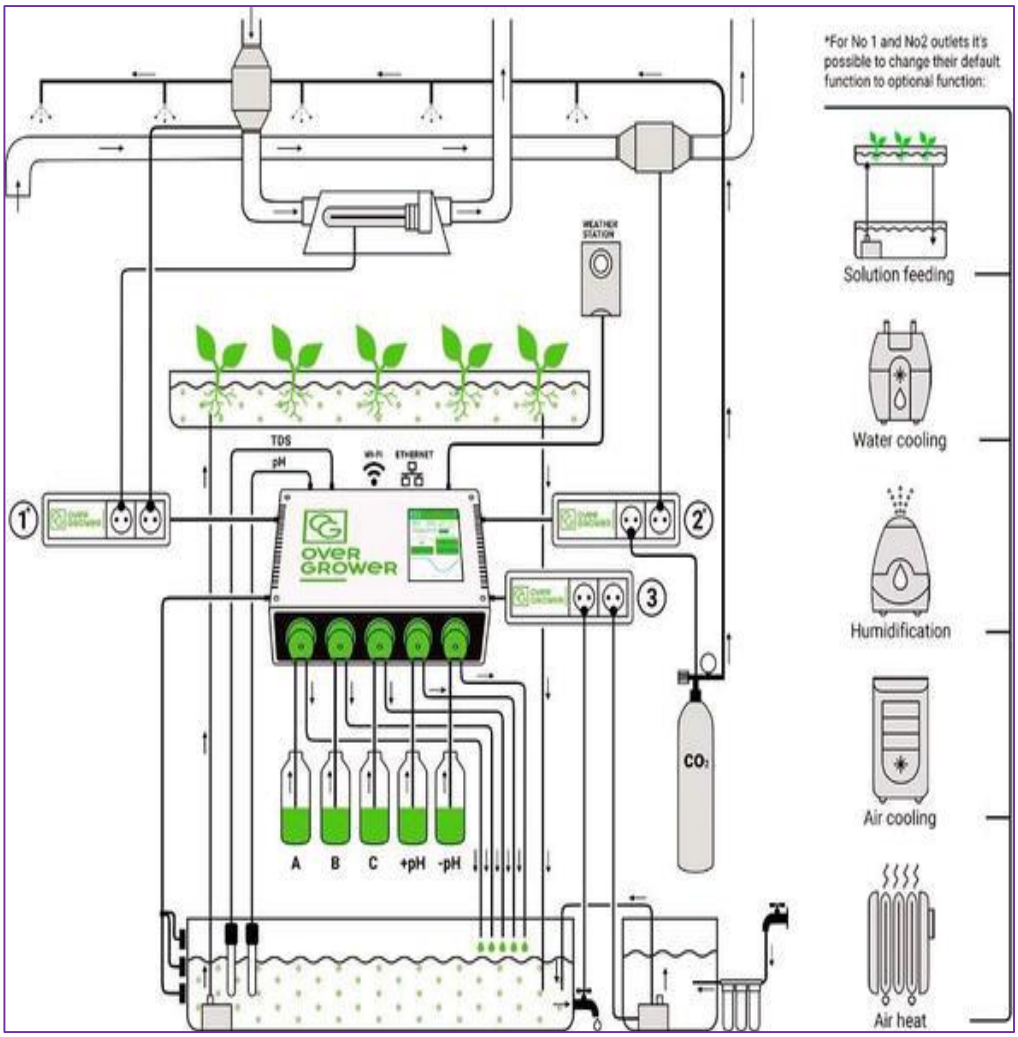
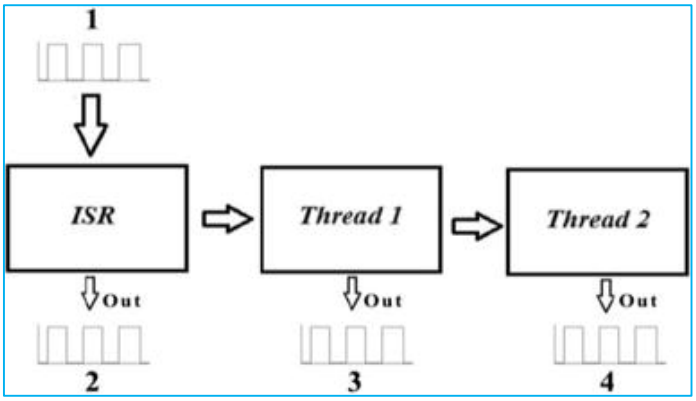


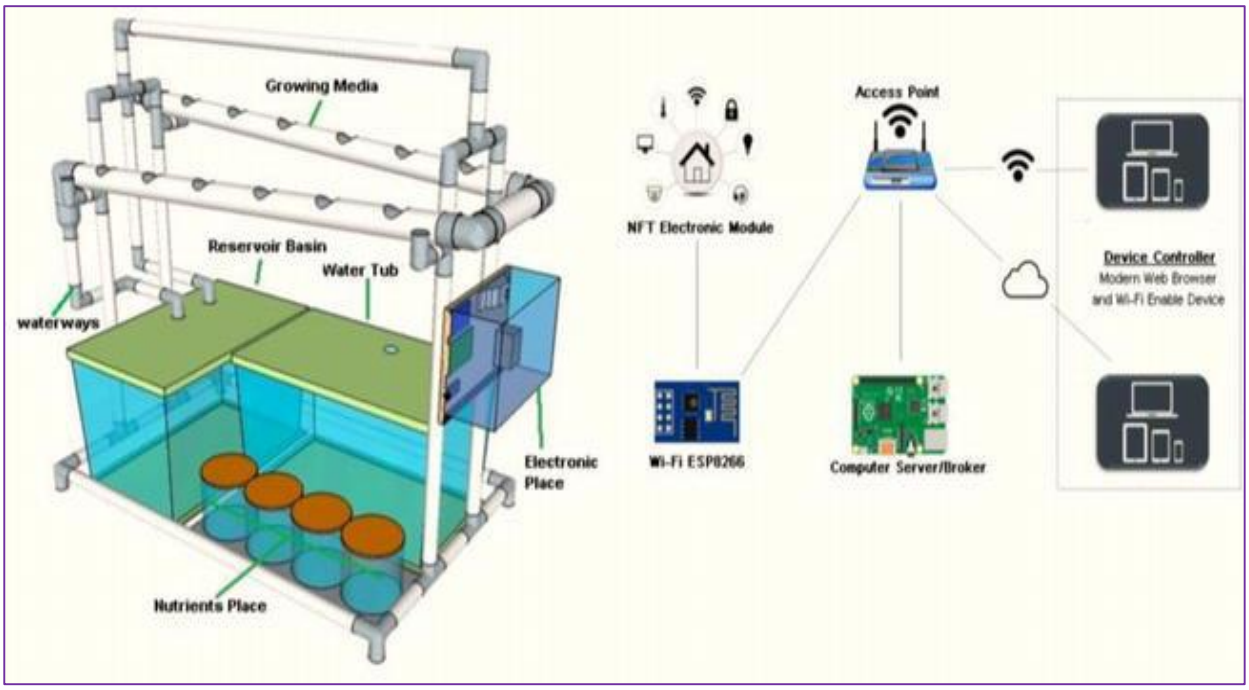
Fig.5 Hydroponics automation system (courtesy of over grower).

pH fuzzy logic control system for nutrient solution in embedded and flow hydroponic culture.



Hydroponic management and monitoring system for an IOT-based NFT farm using web technology (Hommons).

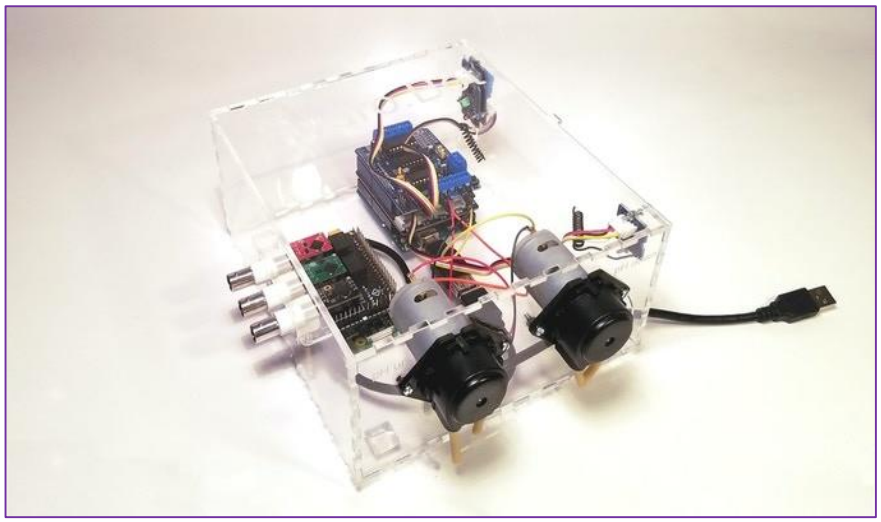
It is Hydroponic farm Management system that could monitor water temperature, water level, higher densities of nutrient solution and the acidity of a nutrient solution using sensors which have to connect to microcontroller via a website.



Robotics in hydroponic systems

HydroBot.

HydroBot is the world's first open source hydroponic automation system. HydroBot allows you to take the guesswork and hassle out of growing plants in water. HydroBot will seamlessly work with any hydroponics, fogponics, or aeroponics system. Simply set it up once and start growing plants faster, that taste better. Monitor your system from anywhere in the world on any phone or computer. HydroBot comes fully assembled in a beautiful custom laser cut acrylic case with specially treated water resistant electronics. It can be connected to appliances such as air conditioners, fans, bubblers, dehumidifiers, or lights within a 200 ft range in just a few seconds without any wires. Combine this with its data logging, detailed reports, environmental sensors, and its ability to be controlled from anywhere in the world and you've got the most powerful hydroponics automation system ever built.



Hydro Bots (courtesy of Kickstarter**)**

How the HydroBot works?

HydroBot is built on top of two powerful mini computers. The RaspBerry Pi Zero and Arduino Lenardo. It runs Linux and controls appliances such as fans or lights wirelessly using dual 433 MHz omnidirectional antennas. It comes with highly sensitive air temperature, humidity, water temperature, pH (water acidity), and EC (water nutrient content) environmental sensors. It can even broadcast its own wireless intranet network for easy initial setup. . On top of that, HydroBot's software can be updated, so it will continually get better over time.

Features of Hydro Bot

- Water Resistant Electronics
- WiFi Connected Smart Device
- Easy Installation and Set Up
- Data Logging (pH, EC, Humidity, Air Temp, Water Temp)
- Easy-to-use web app that can be controlled on any device, anywhere in the world.
- Wireless Outlet Control (Lights, AC, Dehumidifier, Heater etc.)
- Manual and Automated Control
- Timed Controls (Lighting, Fans, Aeration etc.)
- Fits Large and Small Hydroponic Configurations

Advantages of Hydroponics

- Up to 90% more efficient use of water.
- Production increases 3 to 10 times in the same amount of space.
- Many crops can be produced twice as fast in a well-managed hydroponic system.
- Decreasing the time between harvest and consumption increases the nutritional value of the end product.
- Indoor farming in a climate controlled environment means farms can exist in places where weather and soil conditions are not favorable for traditional food production.
- No chemical weed or pest control products are needed when operating a hydroponic system

REFERENCES

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Soilless Culture Book by Md. Asaduzzaman
Commercial Hydroponics by John Mason. Simon & Schuster.