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AUTOMATIC HYDROPONICS SYSTEM USING IOT

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ABSTRTACT:

Hydroponics is a way of growing plants in water with nutrients instead of soil. This methodallows for faster growth and higher yields compared to traditional farming. It's particularly useful in areas with poor soil quality. This study focuses on using the Internet of Things (IoT)to automate monitoring of hydroponic systems. By constantly checking factors like temperature, humidity, and nutrient levels, IoT systems can help reduce workload for farmersand optimize plant growth. These smart systems have been successful in growing fruits, lettuce, cucumbers, and tomatoes. IoT technology involves interconnected devices that can collect andshare data without needing constant human intervention. These devices can connect to the internet, be controlled remotely, and come equipped with various sensors and tools. It reducesthe amount of work they need to do. It helps plants grow better by keeping everything in the perfect balance. It can even be used to grow fruits and bigger plants like lettuce, tomatoes, andcucumbers. So, with the help of technology, farming can be more convenient and productive!

KEYWORDS:

IoT, Hydroponics, sensors, Esp32, GUI, Automation.

INTRODUCTION:

A soilless farming method called hydroponics. In hydroponics, plants grow in nutrient-richwater instead of soil, leading to faster growth and higher yields. This technique is particularlybeneficial in areas with poor soil quality.

The main focus is on using technology to improve hydroponics. The concept revolves around Internet of Things (IoT) systems that constantly monitor factors like temperature, humidity, and nutrients in the water. This automation reduces the workload for farmers and optimizes plant growth, ultimately leading to increased productivity. These smart systems haveproven successful for various crops, including fruits, lettuce, cucumbers, and tomatoes Concludes by explaining IoT technology. It involves interconnected devices that can collect and share data without constant human intervention. These devices can connect to the internet,be controlled remotely, and come equipped with various sensors to gather real-time data.

These devices have identifiers and the ability to communicate information with one another and computers without the need for direct human or computer involvement. They canlink and interact with others through the web, be automatically evaluated and controlled, and are packed with tools, online networks, and other equipment like sensorsing.

MAIN OBJECTIVE:

- **Increased productivity and yield:** Hydroponics allows for faster plant growth and higher yields compared to traditional soil-based farming. This is because plants have easier access to water and nutrients.
- **water conservation:** Hydroponic systems use significantly less water than traditional farming methods. This is because the water is recirculated and reused in the system, minimizing waste.
- **Improved food security:** Hydroponics can be used to grow crops in areas with poor soil quality or limited water resources. This makes it a valuable tool for increasing foodproduction in developing countries.

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 Reduced environmental impact: By using less water and land, hydroponics can helpto reduce the environmental impact of agriculture. Additionally, hydroponic systems can be used to grow crops indoors, which can help to reduce pollution and protect biodiversity.
 Enhanced food safety: Because hydroponic systems are controlled environments, theyare less susceptible to pests and diseases. This can help to produce safer and healthier food.

LITERATURE SURVEY:

 Hydroponics system uses nutrient-rich water as the growing medium for plants. The use of hydroponic systems in agricultural technology has grown significantly. It has the potential to partially replace conventional soil-based growth methods in global food production.
 One benefit of hydroponic growing systems is the ability to control environmental factors to maximize production in vertical gardens to constrained spaces. Other benefits include reducing water waste through recirculation, growing crops in controlled environments (such as monitoring nutrition, plant pests, and other aspects necessary for optimal growth of plants), and the ability to control circumstances to increase the output of vertical gardens in limited spaces.
 Kularbphyttong et al. developed a mechanism for controlling plant growth. This system can regulate essential environmental elements that affect a plant's growth, such as temperature, humidity, and water. The application system automaticallyblends the chosen solution to determine the correct amount, collects data on the quantity of solution mixed during planting, and may be used to assess the cost of producing vegetables and determine the profitability of each produce to help.

ARCHITECTURE:

1. Data Acquisition:

- Sensors: The GUI would display readings from various sensors like temperature, humidity, TDS sensor, and nutrient levels (EC). These would likely be represented by gauges, graphs, or numerical values.

2. System Status:

- Water level indicator: A gauge or indicator showing the current water level in thereservoir.
- Pump status: An icon or text indicating if the water pump is currently running.
- Nutrient dosing status: Information on when the last nutrient addition occurred and thecurrent nutrient concentration.

3. User Controls:

- Setpoints: Users could adjust desired temperature, humidity, and TDS ranges throughsliders or text input fields.
- Alarms: The GUI could display visual or audible alerts when readings fall outsidesetpoints.
- Manual controls: Buttons might allow manual activation of pumps or lighting systemsfor specific needs.

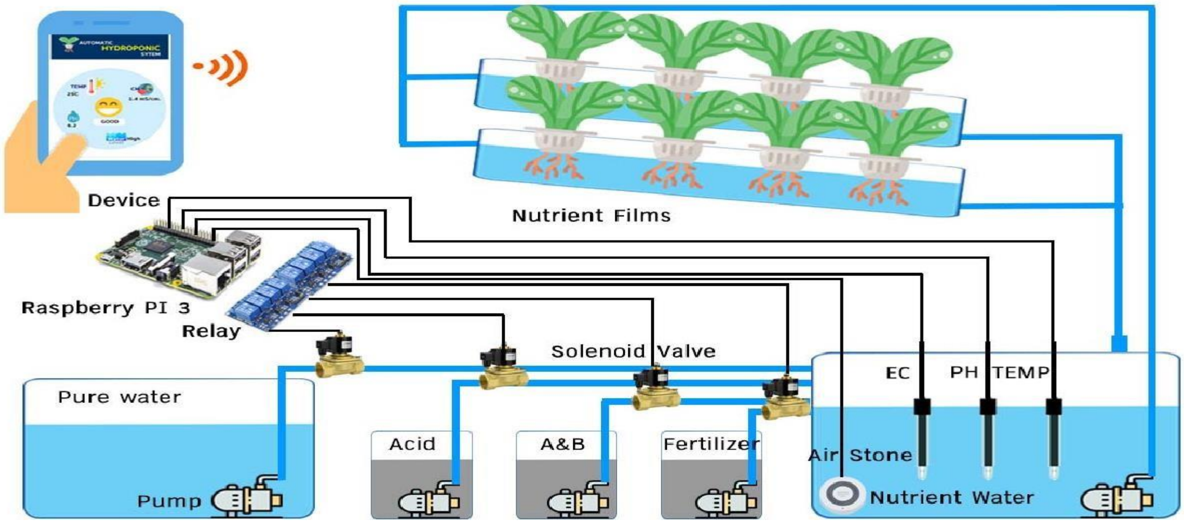
4. Plant Management:

- Plant growth stages: The GUI could display the current growth stage of the plants(seedling, vegetative, flowering) to guide adjustments.
- Crop selection: Users might be able to choose from pre-configured settings optimizedfor specific crops like lettuce or tomatoes.

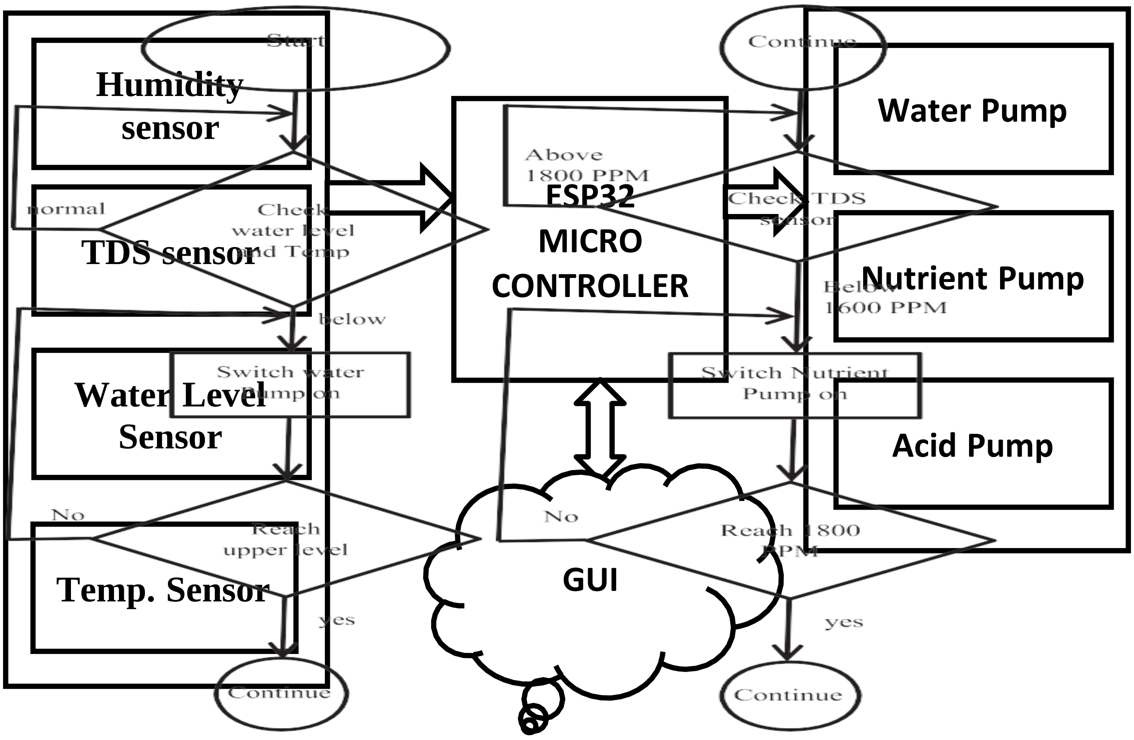
Visualization:

Imagine a main dashboard with sections for each function. Sensor readings would be displayed prominently, with gauges or graphs for easy visualization. User controls and setpoints might be grouped together for easy access. Additional information like plant growthstages and data logs could be accessed through submenus or tabs.

This is a general overview, and the specific design of the GUI would depend on the complexity of the hydroponics system and the needs of the user.



BLOCK DIAGRAM:



FLOW CHART:

RESULT:

Integrating Internet of Things (IoT) technology with hydroponics leads to a powerful combination for optimizing plant growth. IoT sensors continuously monitor crucial environmental factors like temperature, humidity, nutrient levels, and water pH. This real-time data allows for automatic adjustments, ensuring ideal conditions for your plants. Imagine a system that automatically turns on fans if humidity gets too high, or pumps in additional nutrients when levels dip. This automation reduces workload for farmers and ensures consistent, optimal conditions for plant growth.

The result? Increased yields, healthier plants, and less wasted resources – a win-win for both efficiency and productivity.

The result of incorporating IoT (Internet of Things) into a hydroponic system can be significant improvements in monitoring and control. IoT sensors can gather data on factors like temperature, humidity, pH levels, nutrient concentrations, and light levels in real-time. This data can then be analyzed to optimize growing conditions, detect issues early, and automate adjustments to ensure optimal plant growth and yield. Overall, integrating IoT into hydroponicsystems can lead to increased efficiency, productivity, and resource conservation.




STATISTICS:

Day Parameter	Day1	Day2	Day3	Day4	Day 5	Day 6	Day7	Day8	Day9	Day10	Day11

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TDS(ppm)	1780	1778	1781	1778	1779	1777	1782	1778	1778	1782	1777
Temp. (°C)	20.5	20.5	21	21.5	22	21.5	20.4	20.5	20.9	20.8	21.2

CONCLUSION:

Automatic hydroponics systems with a user-friendly GUI offer a powerful solution formaximizing plant growth and streamlining the management process. The combination of hydroponics' efficient resource utilization and IoT's real-time monitoring capabilities creates acontrolled environment ideal for consistent, high-yield production.

The GUI acts as the central hub, providing a clear visual representation of system status, sensorreadings, and user controls. This allows for effortless monitoring, adjustments, and automationof crucial growth factors like temperature, humidity, and nutrient levels. With minimalintervention needed, farmers can focus on other aspects while the system ensures optimal conditions for their plants.

Ultimately, automatic hydroponics systems with a GUI empower users to achieve greater efficiency, productivity, and resource conservation in their cultivation endeavors. This technology holds significant promise for the future of sustainable agriculture, particularly in areas with limited resources or challenging environments.

REFERENCES:

[1] C. J. G. Aliac and E. Maravillas, "IOT Hydroponics Management System," in IEEE 10th International Conference on Humanoid, Nanotechnology, Infromation Technology, Communication and Control,Environment and Management, Philipines, pp. 1-5, 2018.
[2] S. Navulur, et al., "Agricultural management through wireless sensors and internet ofthings," International Journal of Electrical and Computer Engineering (IJECE), vol. 7, no. 6, pp. 3492-3499, 2017.
[3] H. J. Dong, et al., "Interactive on smart classroom system using beacon technology,"International Journal of Electrical and Computer Engineering (IJECE), vol. 9, no. 5, pp. 4250-4257, 2019.
[4] S. Padmadevi and V. Deepigha, "Smart E-Agriculture Monitoring Using Internet ofThings," in Sixth International Conference on Emerging trends in Engineering and Technology (ICETET'16), Levengipuram,pp. 47-50, 2016.
[5] S. Keerthana, et al., "Automating and Analysing Greenhouse Hydroponic Farms using IOT," Interntaional Journal for Research in Applied Science & Engineering Technology, vol. 6, no. 3, pp. 3325-3329,2018.
[6] A. Rajeswari and S. Saipriya, "A survey on Hydroponic methods of smart farming and its effectiveness in reducing pesticide usage," International Journal of Pure and Applied Mathematics, vol. 119, no. 12, pp.1503-1510, 2018.
[7] M. D. Sardare and S. V. Admane, "A Review on Plant without Soil Hydroponics,"International Journal of Research in Engineering and Technology, vol. 2, no. 3, pp. 299-304, 2013.
[8] X. Wang and N. Liu, "The application of Internet of things in agricultural meansof production supply chain management," Journal of Chemical and Pharmaceutical Research, vol. 6, no. 7, pp. 2304-2310,2014.
[9] N. Vijayakumar and R. Ramya, "The real time monitoring of water quality in IoTenvironment,"

in Proceedings of International Conference on Innovations in Information, Embedded and CommunicationSystems, pp. 1-5, 2015.
[10] N. Tanke, et al., “Automation of Hydroponic Installations using a Robot with positionbased visual feedback,” Proceedings of the International Conference of Agricultural Engineering, pp. 1-6, 2012.
[11] I. Mohanraj, et al., “Field Monitoring and Automation using IOT in AgricultureDomain,” Procedia Computer Science, vol. 93, pp. 931-939, 2016.
[12] J. Nuvvula, et al., “Environmental smart agriculture monitoring system using internetof Things,” International Journal of Pure and Applied Mathematics, vol. 115, no. 6, pp. 313-320, 2017.
[13] D. Vyas, et al., “Smart Agriculture Monitoring and Data Acqusition System,”International Research Journal of Engineering and Technology, vol. 3, no. 3, pp. 1823-1826, 2016.
[14] K. Rose, et al., “The Internet of Things and Overview,” The Internet Society (ISOC),2015.
[15] P. Sihombing, et al., “Automated Hydropincs nutrition plants systes using Arduino uno microcontroller based an android,” Journal of Physics: Conference series, vol. 978, pp. 1-6, 2018.