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"Smart Hydroponics System"

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Abstract:- Hydroponic farming is a revolutionary method for cultivating plants in a controlled environment without the use of soil. By eliminating the reliance on traditional soil-based agriculture, hydroponics enables precise control over nutrient delivery, water usage, and other critical growth factors. This allows for optimized plant growth, increased crop yields, and reduced resource consumption. Hydroponic farming offers numerous environmental advantages. The controlled environment reduces the need for pesticides, herbicides, and other chemical inputs, promoting sustainable and eco-friendly farming practices. Additionally, Hydroponics can be implemented in urban areas, bringing agriculture closer to consumers, and reducing the carbon footprint associated with long-distance food transportation. By utilizing vertical farming techniques and maximizing land utilization, hydroponics can achieve higher yields per square foot compared to conventional agriculture. This increased productivity not only supports food security but also offers economic opportunities for farmers and entrepreneurs. While hydroponic farming presents several advantages, there are also challenges to consider, including initial investment costs, technical expertise requirements, and the need for careful management of nutrient solutions. However, ongoing advancements in technology and increased awareness of sustainable food production are driving the adoption and improvement of hydroponic systems.

Introduction/Background:-

Hydroponic farming is a modern agricultural technique that enables the cultivation of plants without soil. It is a method that provides plants with the necessary nutrients and water through a controlled environment, allowing them to grow efficiently. By using a water-based solution enriched with essential minerals, hydroponic systems create an optimal growing environment for plants. By precisely controlling factors such as temperature, humidity, light, and nutrient composition, hydroponic farming allows for optimal plant growth and accelerated development.

Aim and Objectives:-

A smart hydroponic system with IoT aims to revolutionize hydroponic-based agriculture by integrating sensors and connectivity. It enables remote monitoring and control, resource efficiency, data-driven decision-making, automation, and environment sustainability.

Objectives:

- To provide a better temperature for plants to grow.
- To Design such an application that gives the user all information regarding temperature, nutrient composition, and recent crop conditions.

Problem Statement:-

Hydroponic farming is a modern agricultural technique that enables the cultivation of plants without soil. It consumes less water and other resources as compared to traditional soil-based agriculture systems. However, monitoring hydroponics farming is challenging due to the simultaneous supervising of numerous parameters, nutrition suggestions, and plant diagnosis systems.

Existing system:-

In hydroponic farming, plants are cultivated in a nutrient-rich water solution. This technique offers several advantages over soil-based farming, including better control over nutrient levels, more efficient use of water, etc. In Hydroponic farm, all the work including plantation, adding nutrient and changing water is done manually.

System Architecture

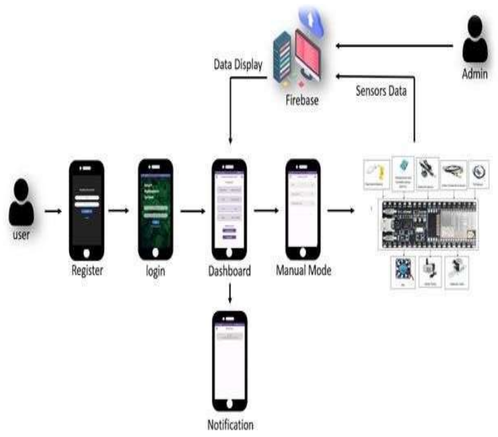

Fig 1: System Architecture of Smart Hydroponic System Using IoT

Circuit Diagram:-

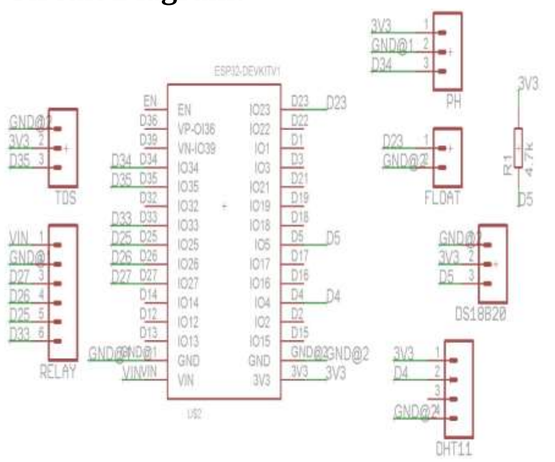

Fig 2: Circuit Diagram of Smart Hydroponic System Using IoT

Methodology:-

- Set up the microcontroller and connect all the sensors and actuators.
- Connect the microcontroller to the internet for IoT capabilities. Establish communication with Firebase for data storage and retrieval.
- Continuously read sensor data at regular intervals.
- If TDS value exceeds the defined range i.e. 1700 ppm trigger the solenoid valve to drain the tank and refill it from the main water source.
- If the temperature surpasses the predefined range i.e. 24ºC activate the fan to regulate the environment.
- Develop a mobile application for users to monitor system readings and manage settings manually or automatically.

System Flowchart:-

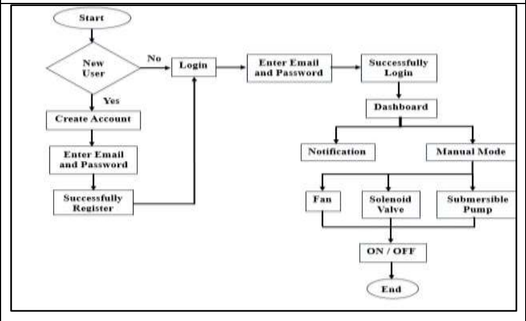

Fig 3: Real Time Data Monitoring Application

Results and Observation:-

Fig 4: Project Setup

References:-

1. Arjun Dutta, Ishita Nag, Shreya Basu, Ditipriya Seal, Rintu Kumar Gayen, "IoT based Indoor Hydroponics System" 2021 IEEE, DOI: 10.1109/IEMENTech53263.2021.9614730.
2. Waluyo, Andre Widura, Febrian Hadiatna, and Delvin Anugerah, "Fuzzy-Based Smart Farming and Consumed Energy Comparison Using the Internet of Things", IEEE 2023 DOI: 10.1109/ACCESS.2023.3291616.

Conclusion:-

- In conclusion, smart hydroponic farming has emerged as a promising solution to address the challenges of traditional agriculture and pave the way for a sustainable and efficient future of food production.
- By harnessing the power of technology and controlled environments, hydroponics offers numerous benefits that extend beyond conventional farming practices.

Future Scope:-

- Automation and Remote Monitoring
- Improved Crop Yield and Quality
- Resource Efficiency
- Enhanced User Experience
- Integration and Connectivity
- Data-Driven Insights