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Department of Electronics and Telecommunication

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Project Group ID - 11

Hydroponics Based Precision Farming using – Approach

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Overview :

1. Introduction
2. Objective
3. Block Diagram
4. Hardware Design
5. Hardware Description
6. Applications

1. Why Agriculture Automation is needed?

- **Rising world population** demands increased agricultural productivity, which can be achieved through automation to meet growing food demands efficiently.

- **Sudden climate change** poses unpredictable challenges for farmers, necessitating automation to adapt quickly and ensure stable crop yields.

- Implementing agricultural automation can **decrease pesticide usage** by employing precision techniques, and promoting sustainable farming practices.

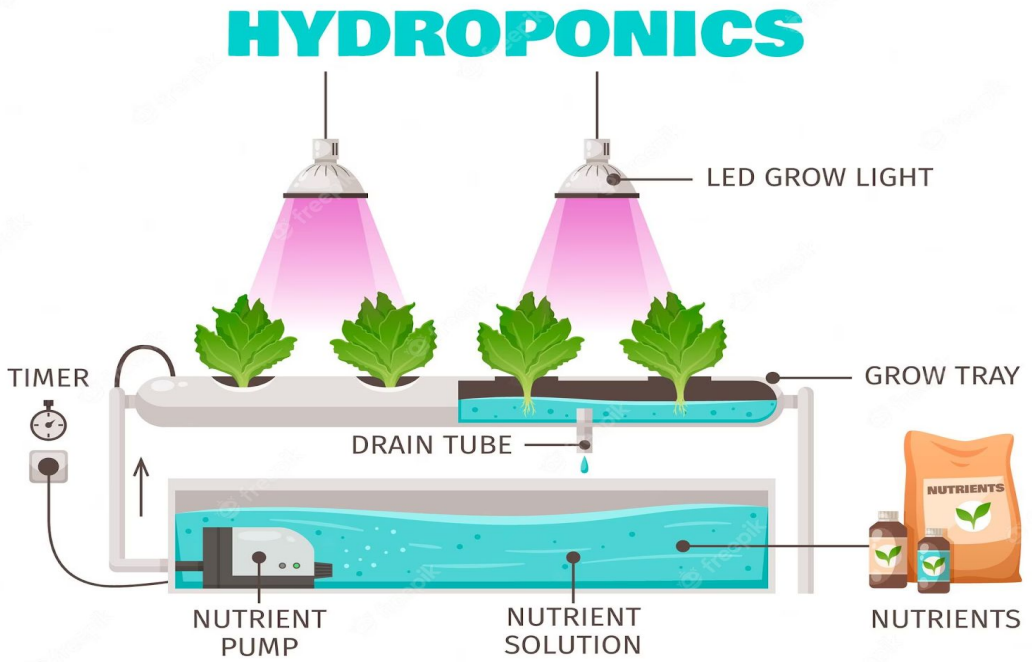
- Automation enables the **creation of optimal growing conditions regardless of time and location,** maximizing crop output and reducing dependence on specific climates.

- By automating tasks, agriculture requires **minimum labor efforts**, freeing up human resources for higher-value activities and improving overall productivity.

2. The latest farming technology: Hydroponics

- Hydroponics is a modern agricultural method that involves **growing plants without soil,** using nutrient-rich water solutions to supply essential minerals directly to the plant roots.

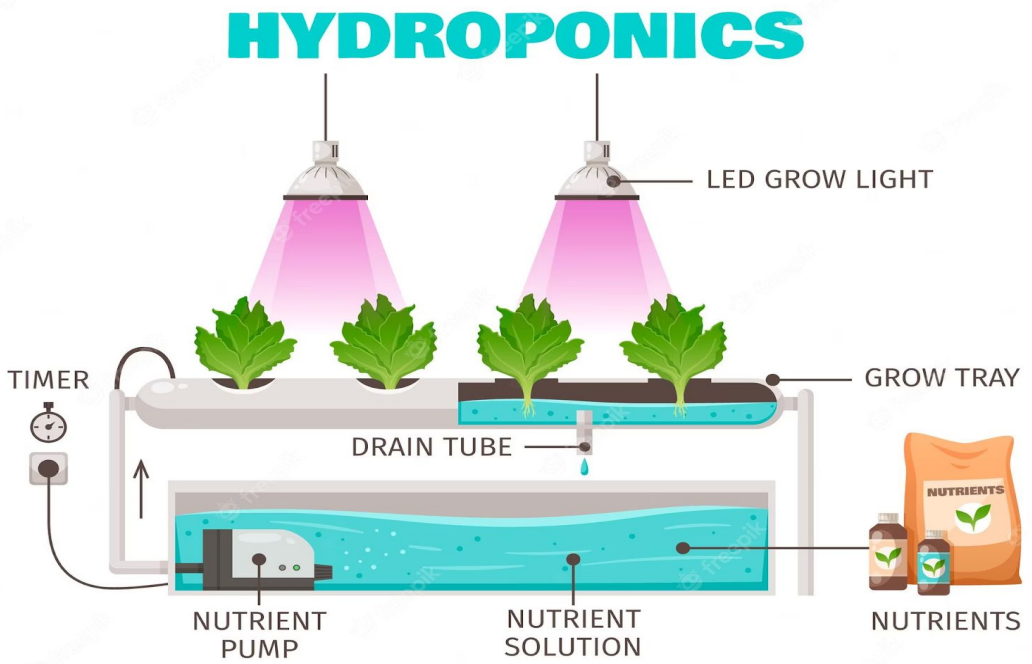
- In hydroponic systems, plants are typically **grown in a controlled environment,** such as greenhouses or indoor setups, where factors like temperature, light, and humidity can be carefully regulated to maximize plant growth and productivity.



2. The latest farming technology: Hydroponics

- Hydroponics allows for **efficient water recycling and requires less water** compared to traditional soil-based farming, promoting sustainable water management in agriculture.

- With hydroponics, growers have **precise control over nutrient supply**, ensuring plants receive the exact nutrients they need, leading to optimized growth and higher yields.



3. Problems with Hydroponics

- The **initial setup cost** of hydroponic systems can be relatively high, including investments in equipment, infrastructure, and technology, making it less accessible for small-scale farmers.

- In hydroponics, precise control over nutrient levels can be challenging, leading to the **risk of overfeeding or underfeeding plants**, potentially impacting their health and productivity.

- **Inadequate monitoring of air supply** in closed hydroponic environments may lead to oxygen deficiencies, affecting root health and ultimately causing plant mortality.

- Hydroponic farming demands a **deeper understanding of nutrient management, and system operation**, requiring farmers to possess specialized knowledge and expertise, which may be a barrier for newcomers to the technique.

4. Objectives achieved in the last term

- Decreased initial setup cost to some extent and achieved a certain yield compared to traditional agriculture methods.
- Reduced water consumption by 10-25% through the DWC hydroponics setup.
- Eliminated pesticide usage and safeguarding plants from insects and pests through a controlled indoor environment.
- Power consumption is optimized to some extent.
- Developed a system that can be run on the scheduled operations of RTC and monitored using an OLED display

Previous Year Demonstration Link

Previous PPT Link

Result

Fig. 7.2 Final assembly on PCB

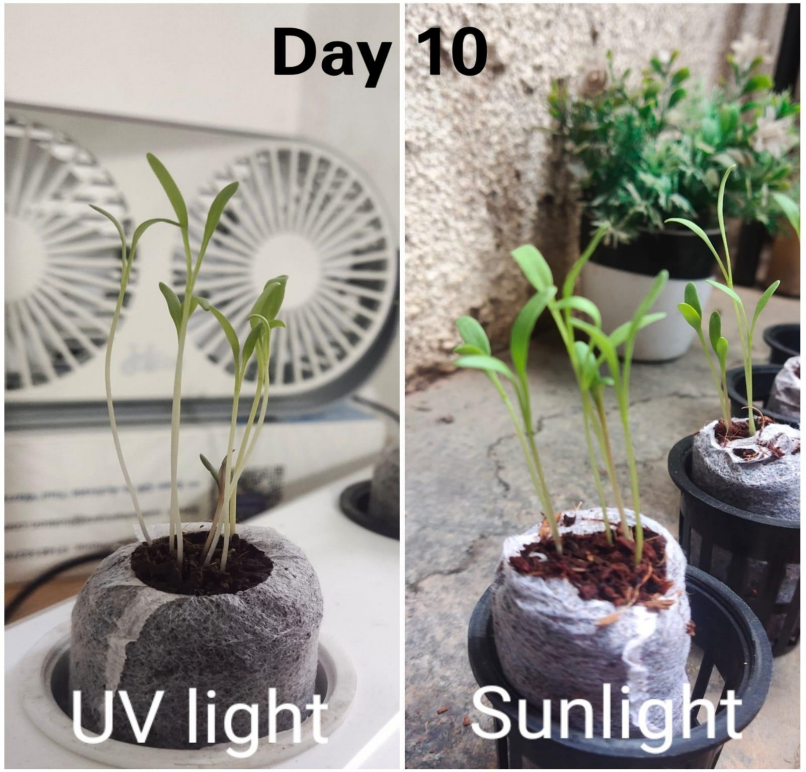


Fig. 7.4 Photo of difference between plants taken after day 10

5. New Objectives

- To create a **AI Based system** that **eliminates the need for manual monitoring and adjustment of TDS and pH levels in the water reservoir.**

- **To further decrease initial setup cost and achieve significant yield** compared to traditional agriculture methods.

- **To reduce water consumption by 70-80%** through the efficient closed-loop water circulation system of the DWC hydroponics setup.

- **Develop a website and mobile application** to provide remote control, monitoring, and alert functionality for the advanced agriculture automation system.

- To incorporate a water tank empty valve to periodically **flush out pathogens or contaminants** from the system.

6. Research aspects

- Nutrient Formulations: Studying **nutrient solution and their concentrations to achieve optimal growth** rates and yields for various plant species in the DWC system.

- Power optimization using time slotting

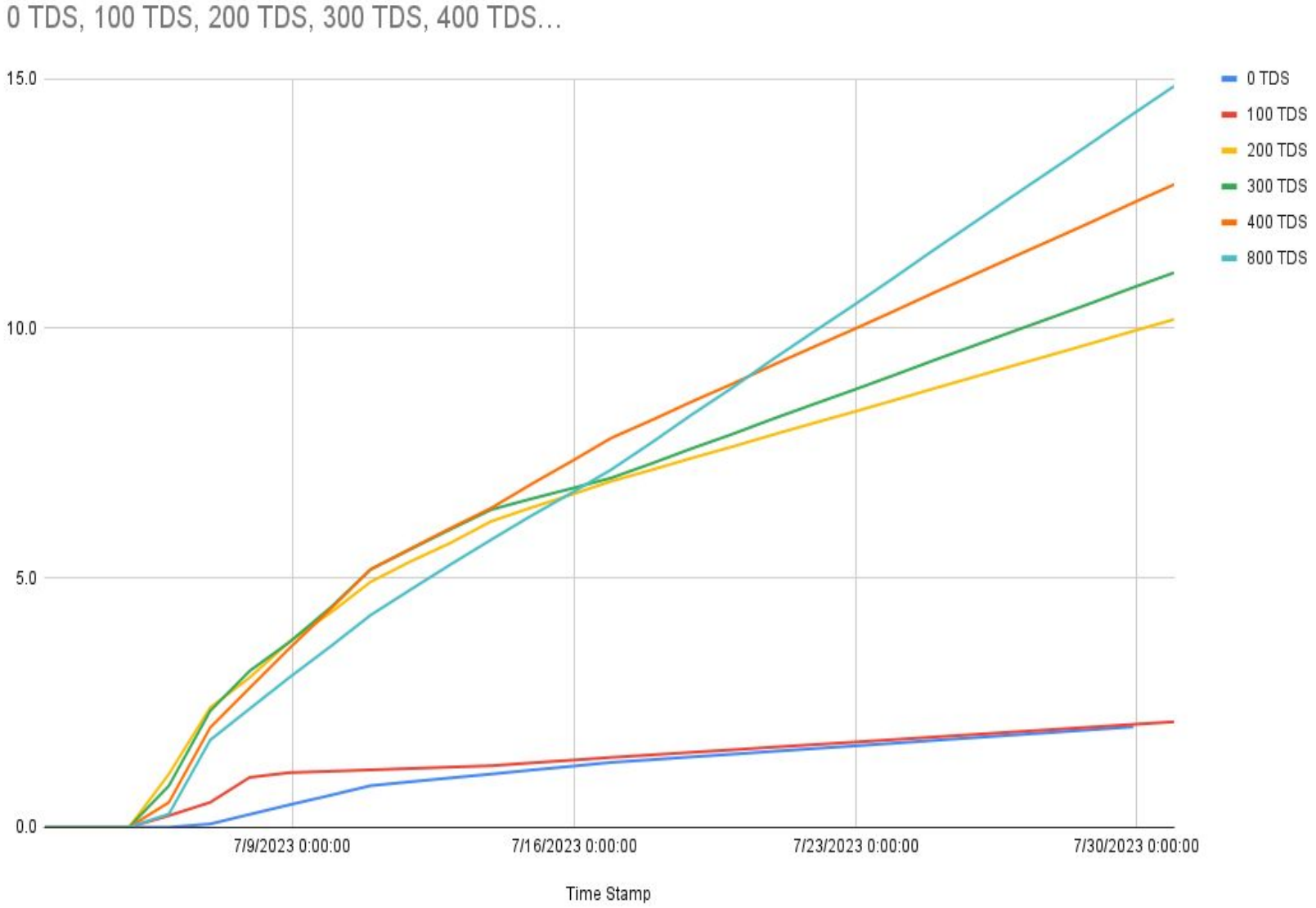
- Oxygenation and Aeration: Investigating **optimal methods and frequencies for oxygenating and aerating** the nutrient solution in DWC systems to improve root health and nutrient uptake.

- UV Light Duration and Plant Development: Study impact of **UV light exposure duration on plants**. Assess potential benefits and risks of UV light exposure.

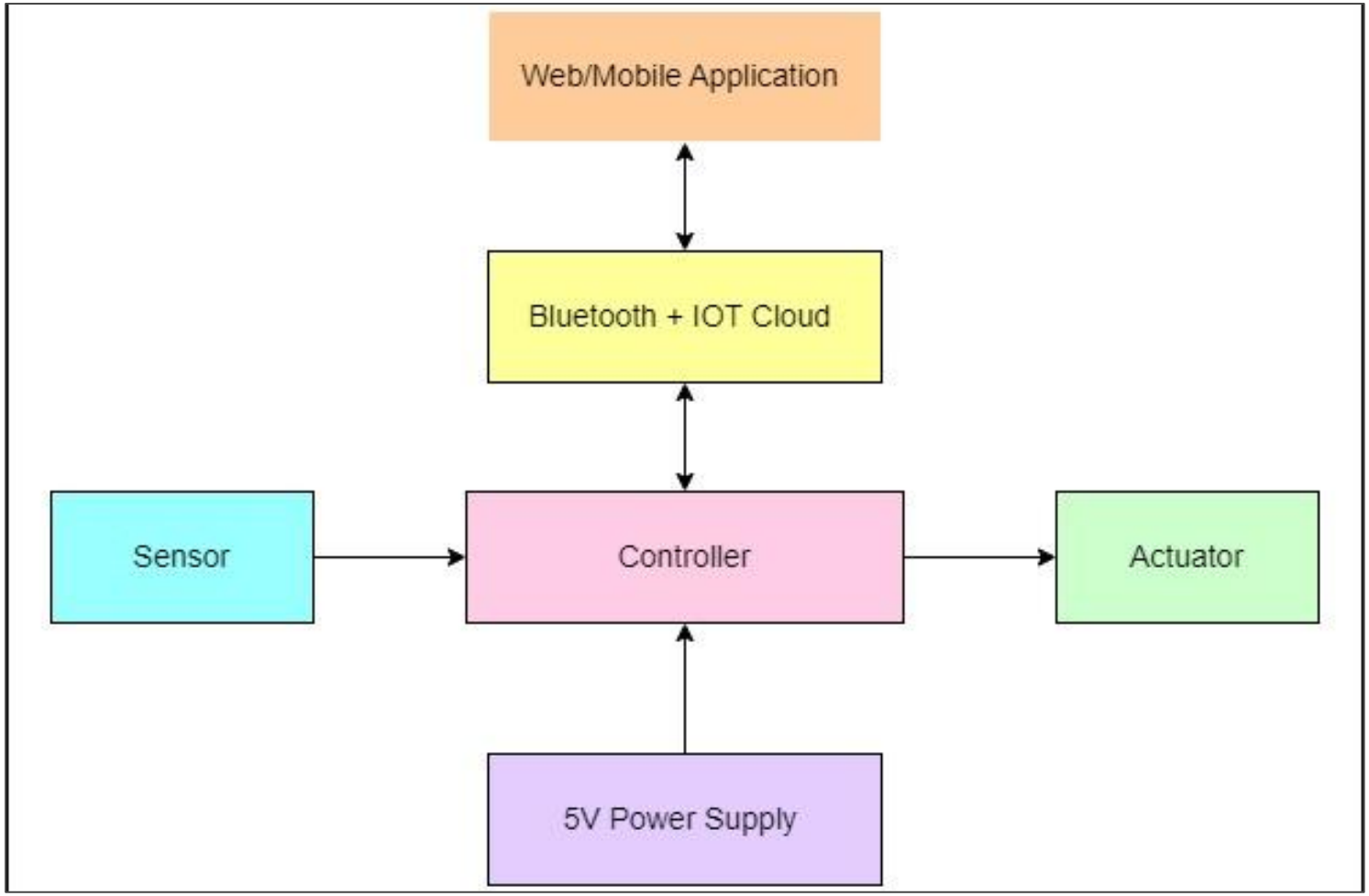
- Predicting Water Tank Refill Time: Develop model using humidity and temperature data. Estimate water tank refill time in different environments. Investigate **correlation between water consumption and environmental conditions.**

Does TDS Really Effect on Plant Growth?

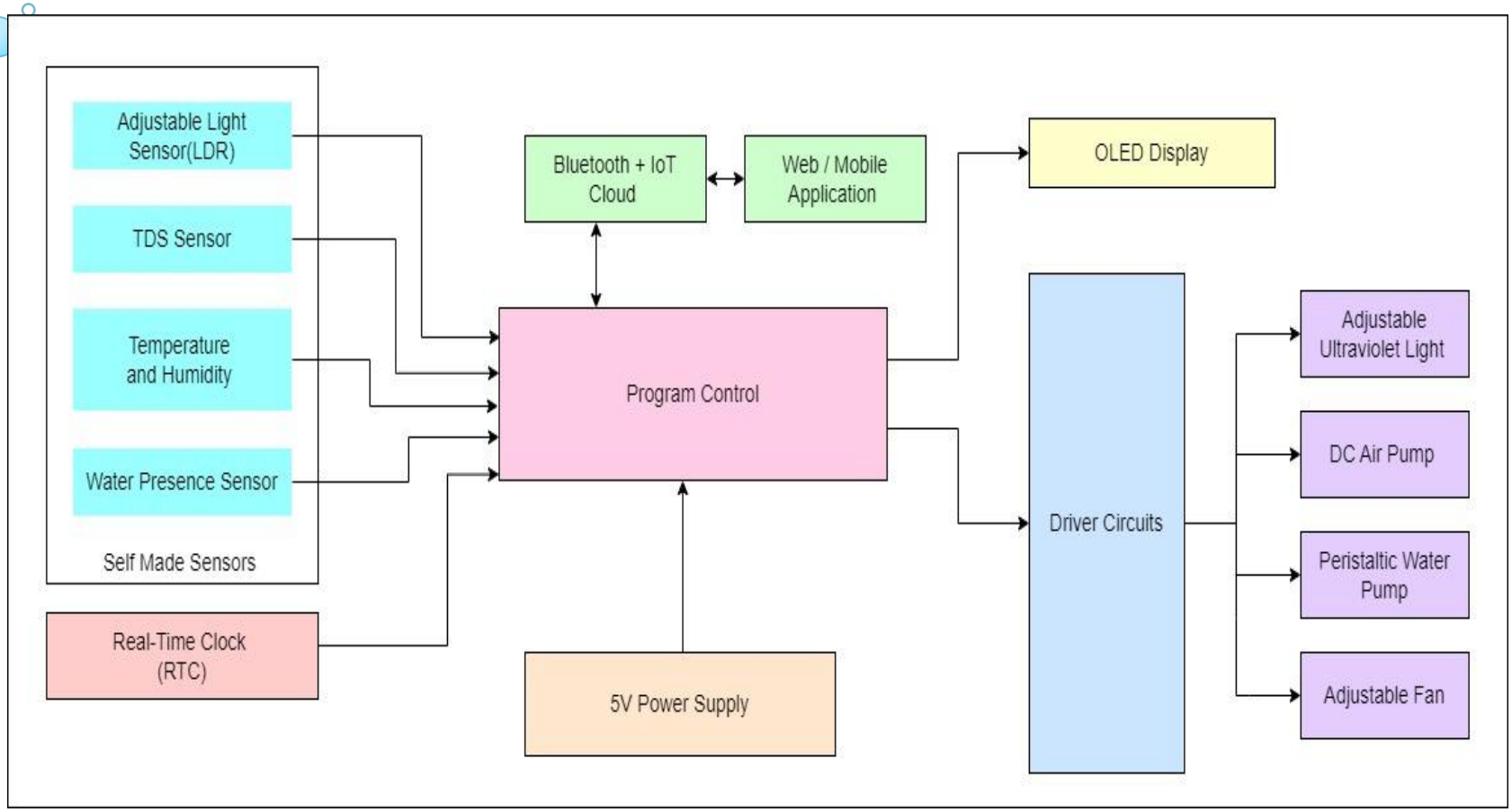
Effect of TDS on Plant Height



7. Block Diagram



8. Hardware Block Diagram



9. Project Details

- **Conduct research** on the effects of TDS on plant growth, air pump duration on plant health, UV light duration on plant development, and predict water tank refill time using humidity and temperature.
- Integrate **adjustable UV lights** to provide partial or full UV light exposure based on plant requirements.
- Design air pump, water pump, fan **driver circuits** for **efficient nutrient solution circulation** and delivery to plants.
- Implement the LDR sensor to ensure **UV lights are functioning as intended**, promoting the optimal growth of plants.
- Employ a TDS sensor **to measure the nutrient concentration** at the top level and automate the watering process if it falls below a predetermined threshold.
- Incorporate **schedule operations,** allowing for continued functionality even after lights shut down.

10. Expected Outcome

- High plant growth effectivity
- Power optimized system
- Remote user control
- Compact design
- Economical product
- Scalable product
- Fault proof

11. Applications

- Aquaponics at household and commercial.
- Hydroponics for both household and commercial purposes.
- Aeroponics for commercial purposes.
- All the latest farming technologies.