Project Group ID - 11

# Hydroponics Based Precision Farming with Feature Optimization Approach

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1.1. What is 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.
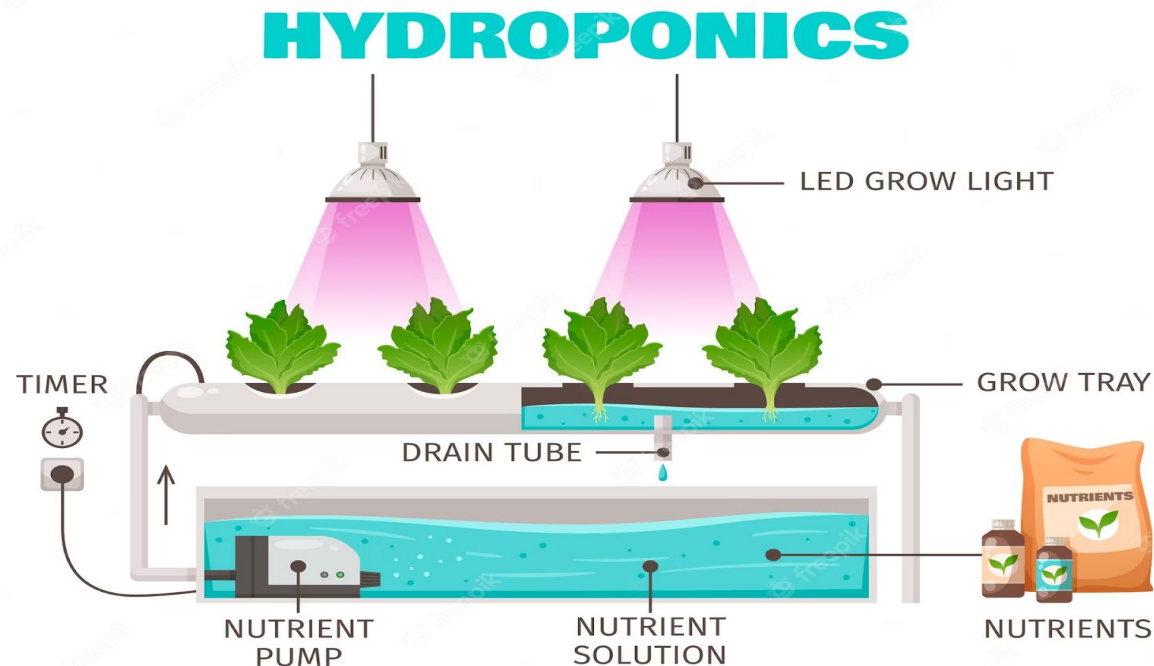
1.2. Advantages of Hydroponics over Soil Farming

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

- **Higher yield:** They produce between three and ten times more food than conventional agriculture in the same space. The plants also grow in half the time.
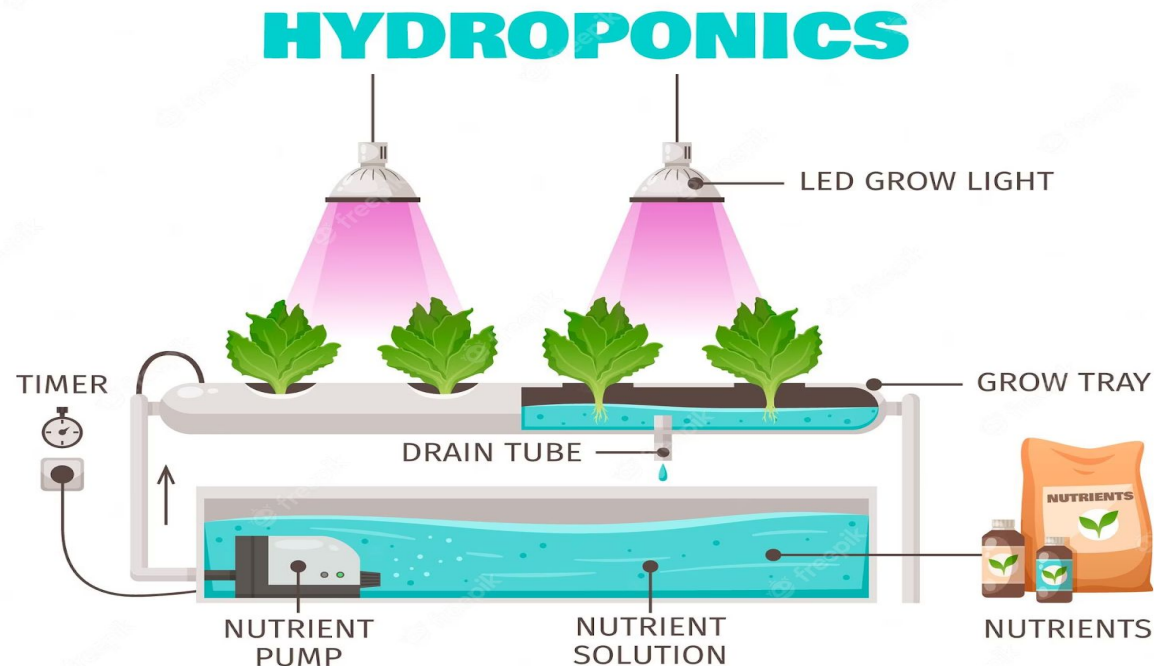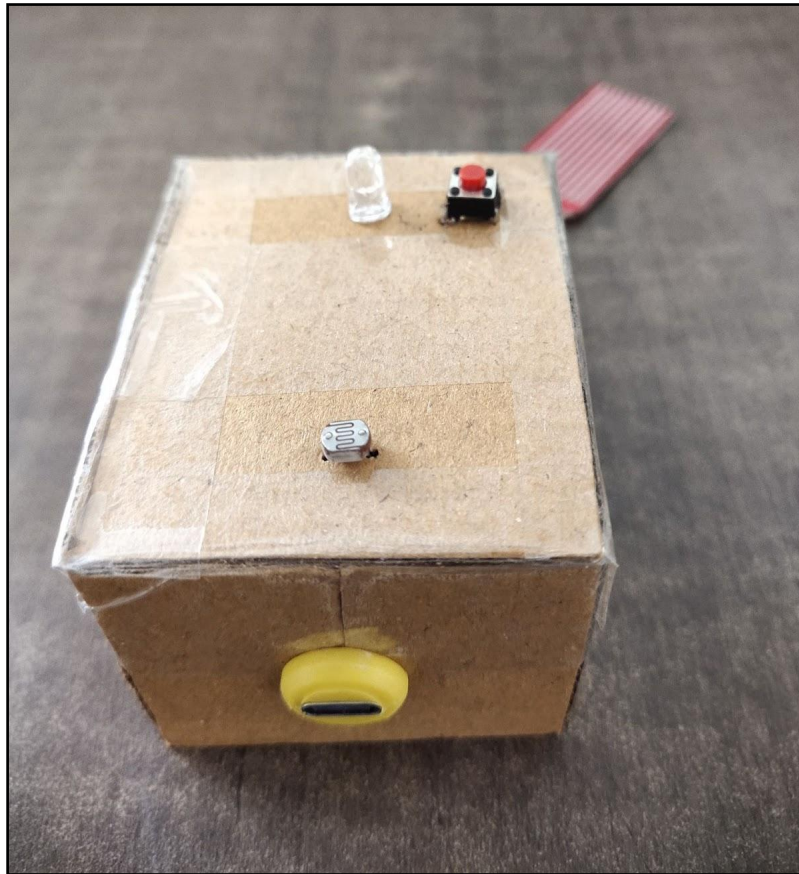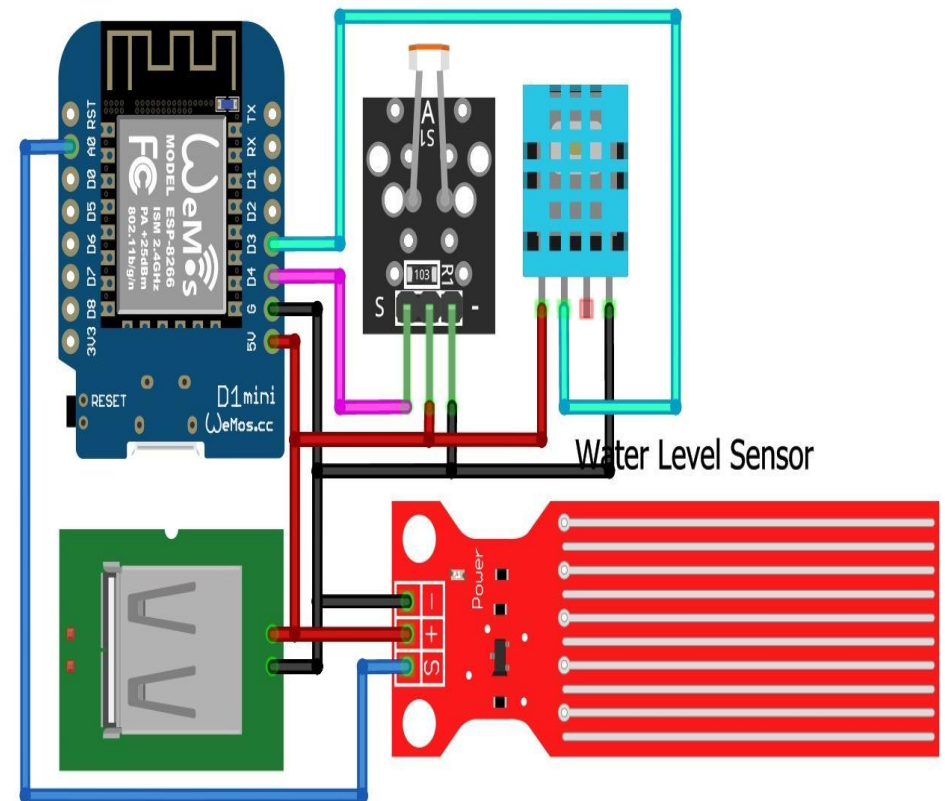
1.3. Current Limitations with Hydroponics

- 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.

- **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.

HYDROPONICS

LED GROW LIGHT

TIMER

GROW TRAY

DRAIN TUBE

NUTRIENT PUMP

NUTRIENT SOLUTION
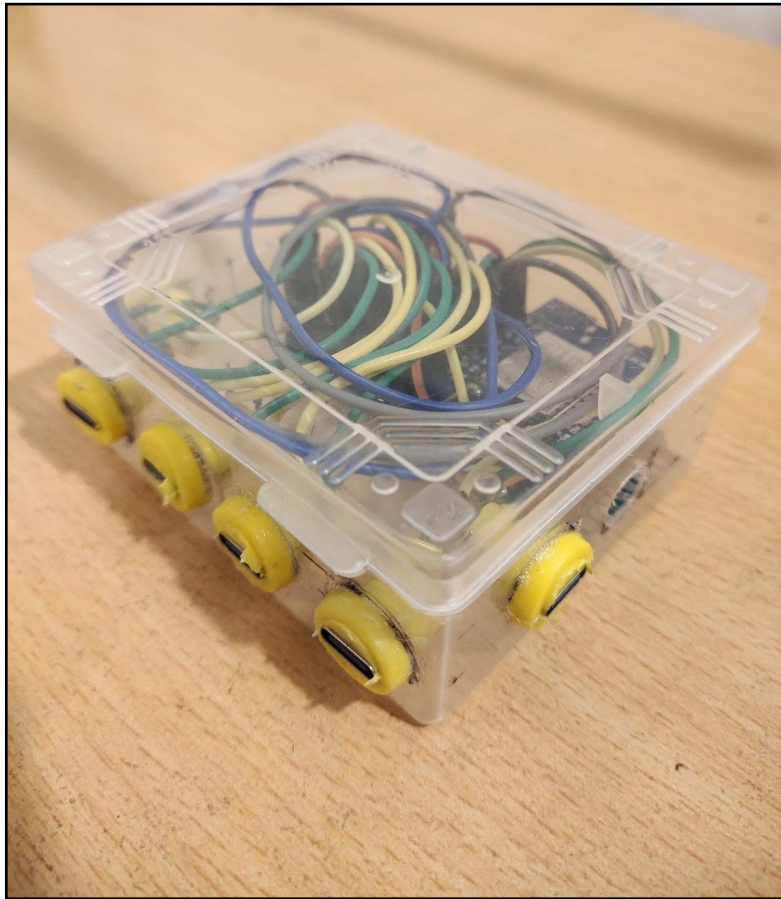
NUTRIENTS
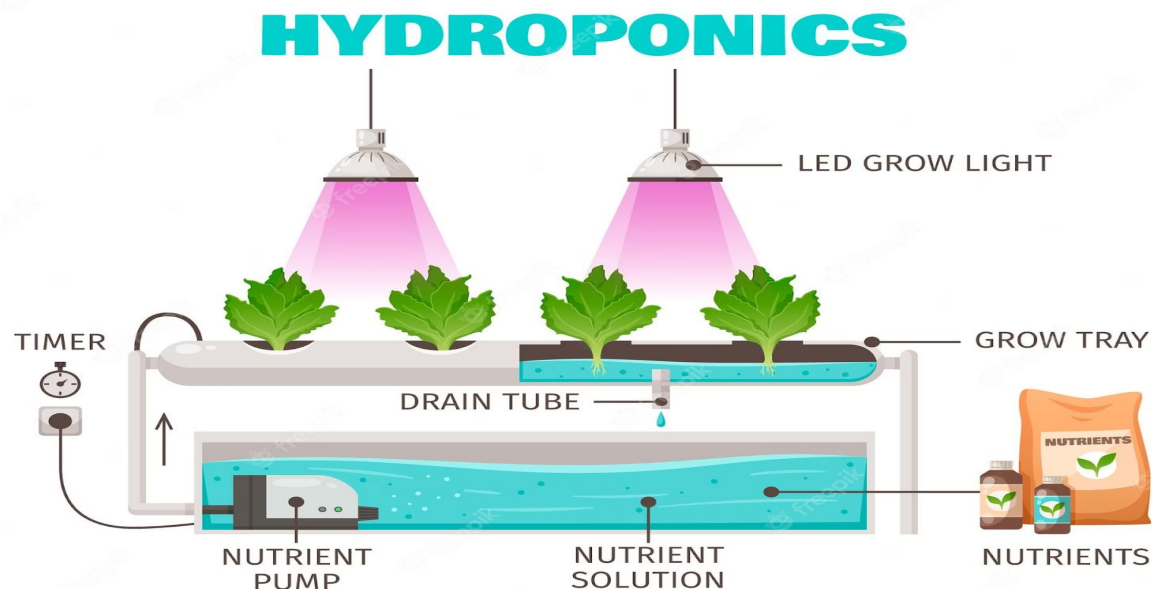
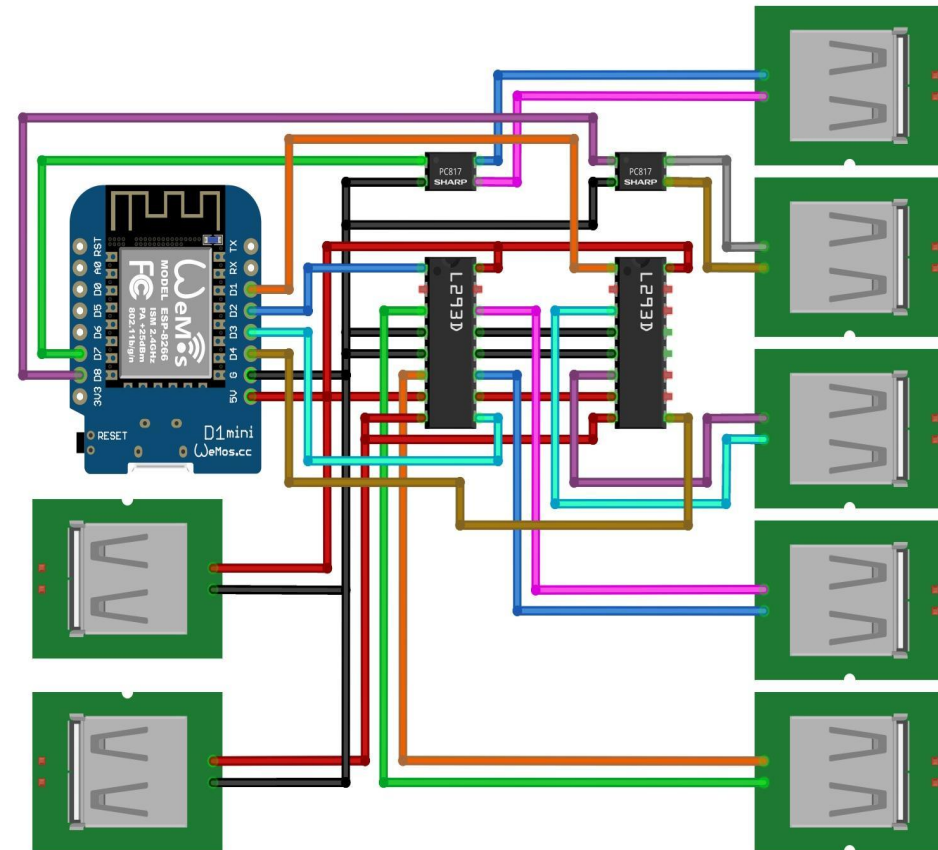# 2. Hardware and Circuit Design

Fig 2.1. Sensor Module

Fig 2.2. Simple Circuit Design of the Sensor Module

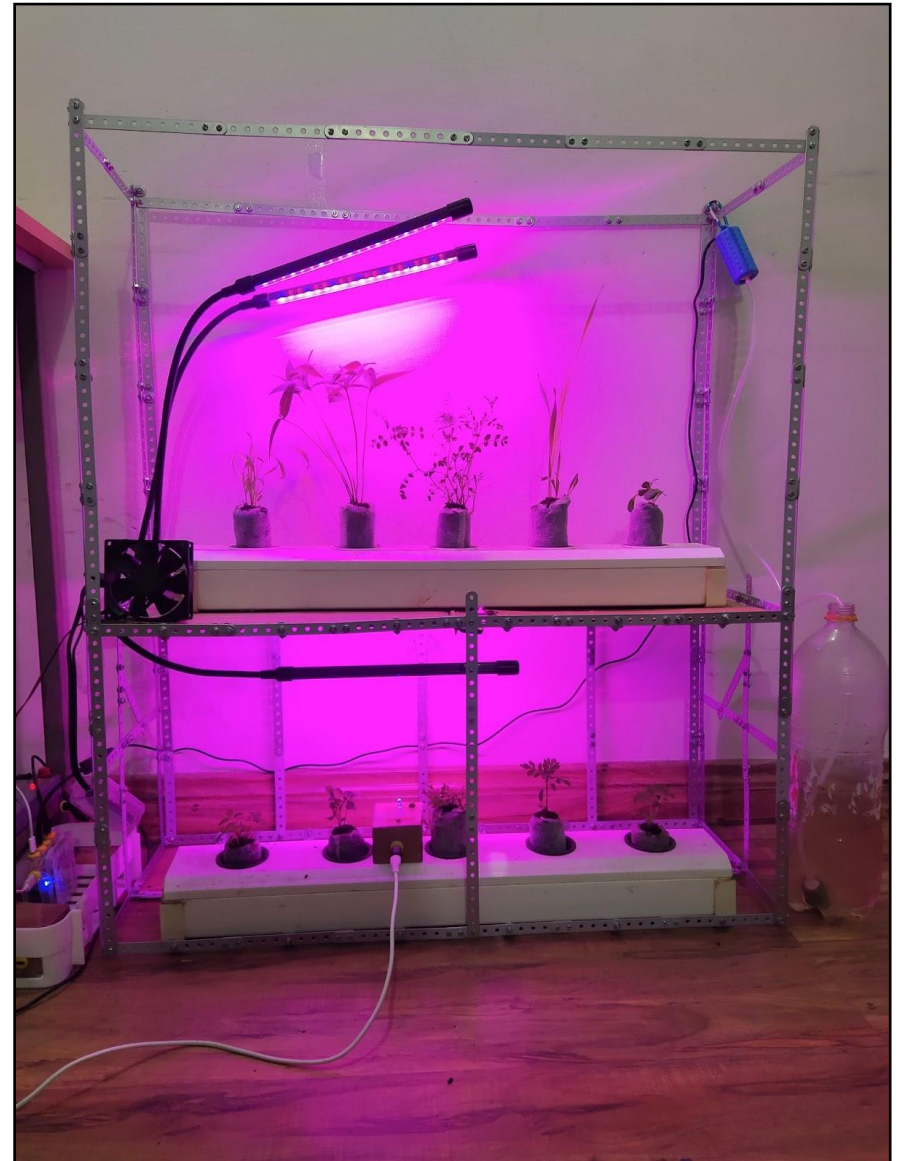# 2. Hardware and Circuit Design

Fig 2.3. Actuator Module

Fig 2.4. Simple Circuit Design of the Actuator Module

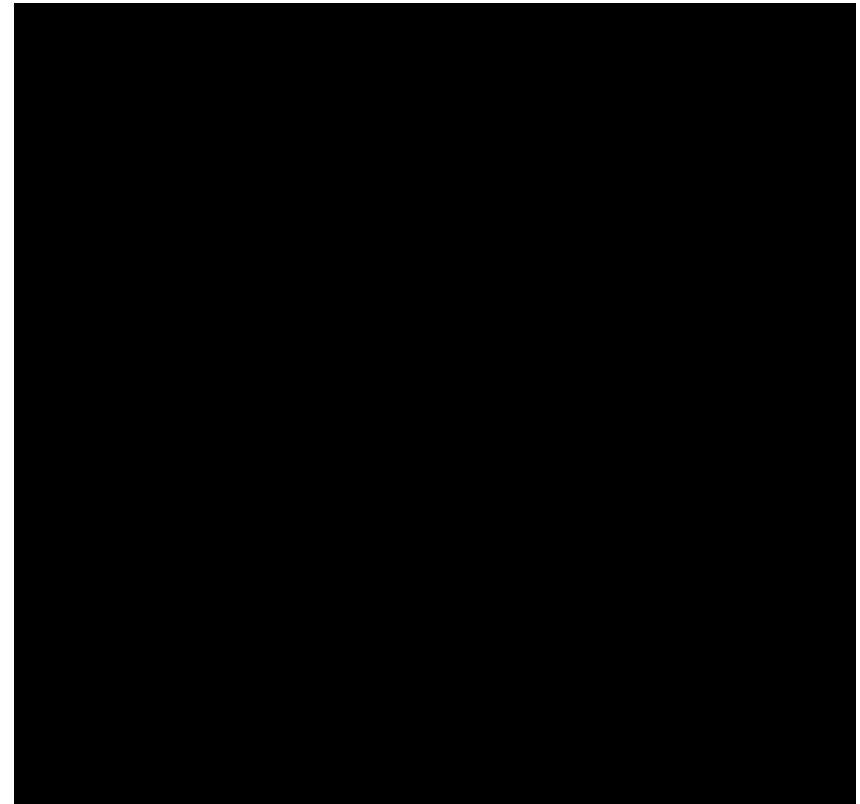# 3.1. Final Setup

Fig 3.1. Final Setup with Lights OFF

Fig 3.2. Final Setup with Lights ON

3.2. Video of Changing UV Light

Video of Adjusting the UV Light

Video of Turning UV Light ON & OFF

3.3. Wi-Fi Credentials Change
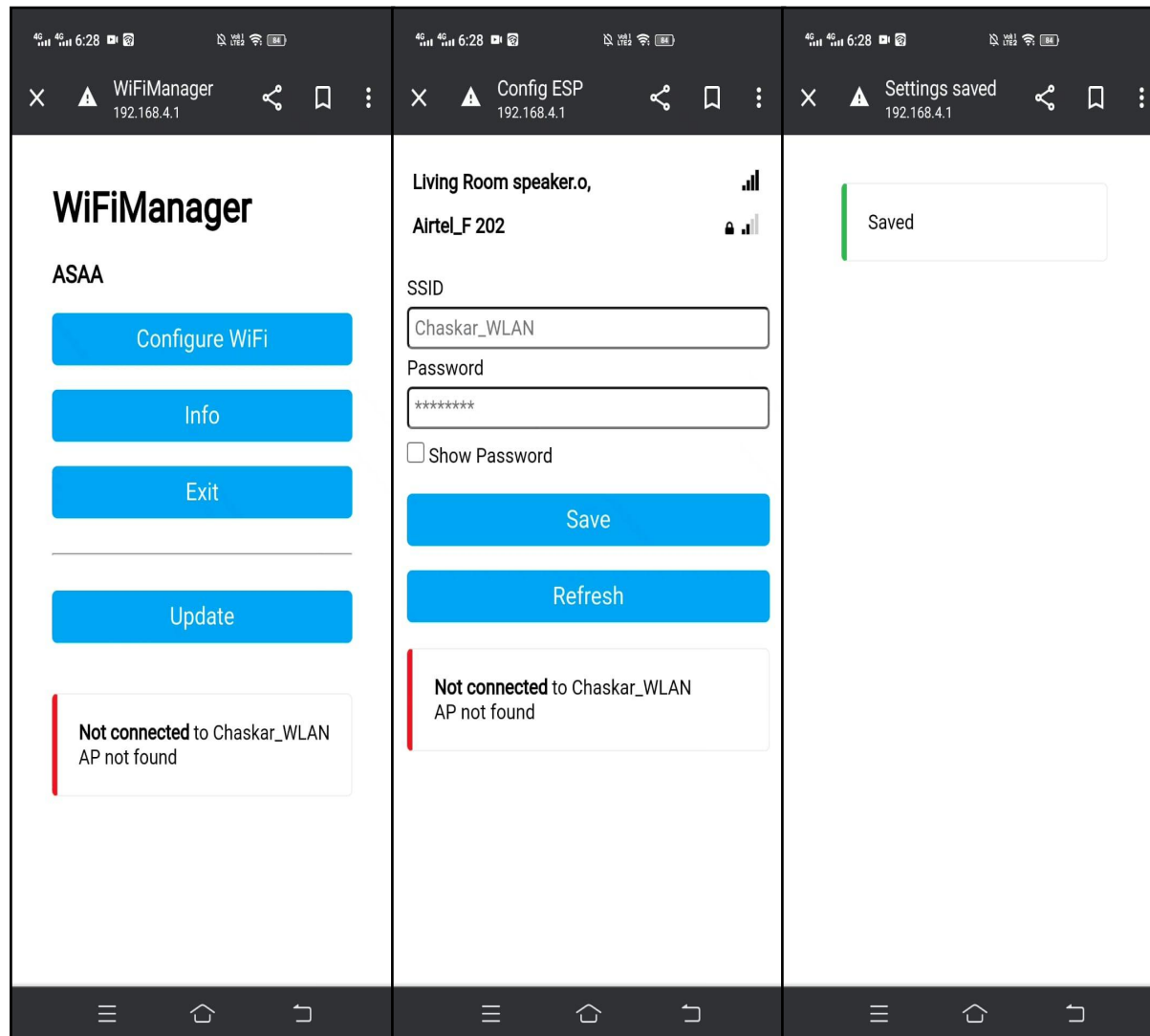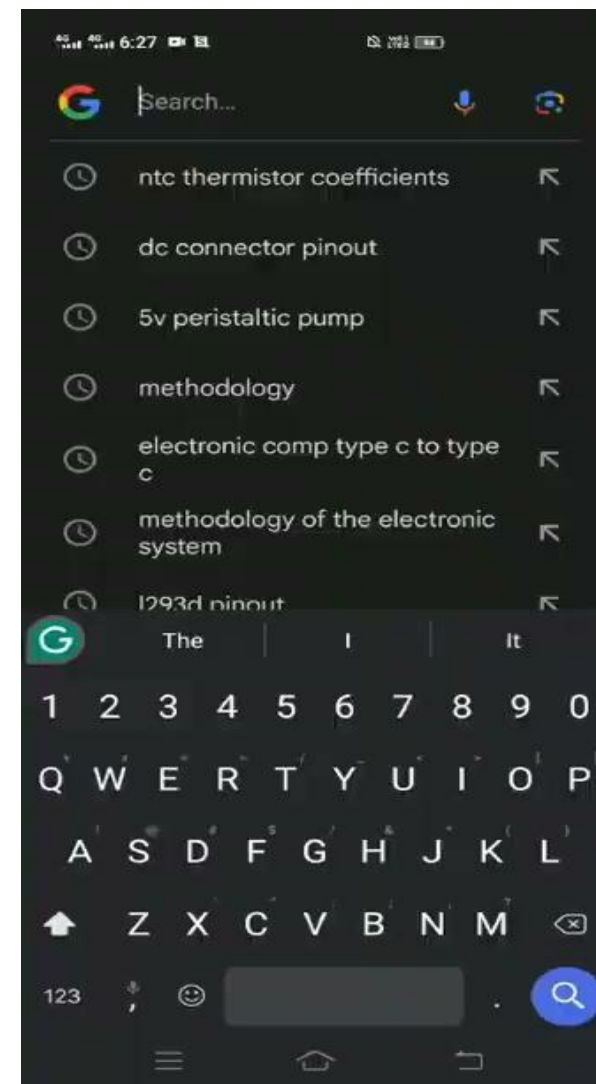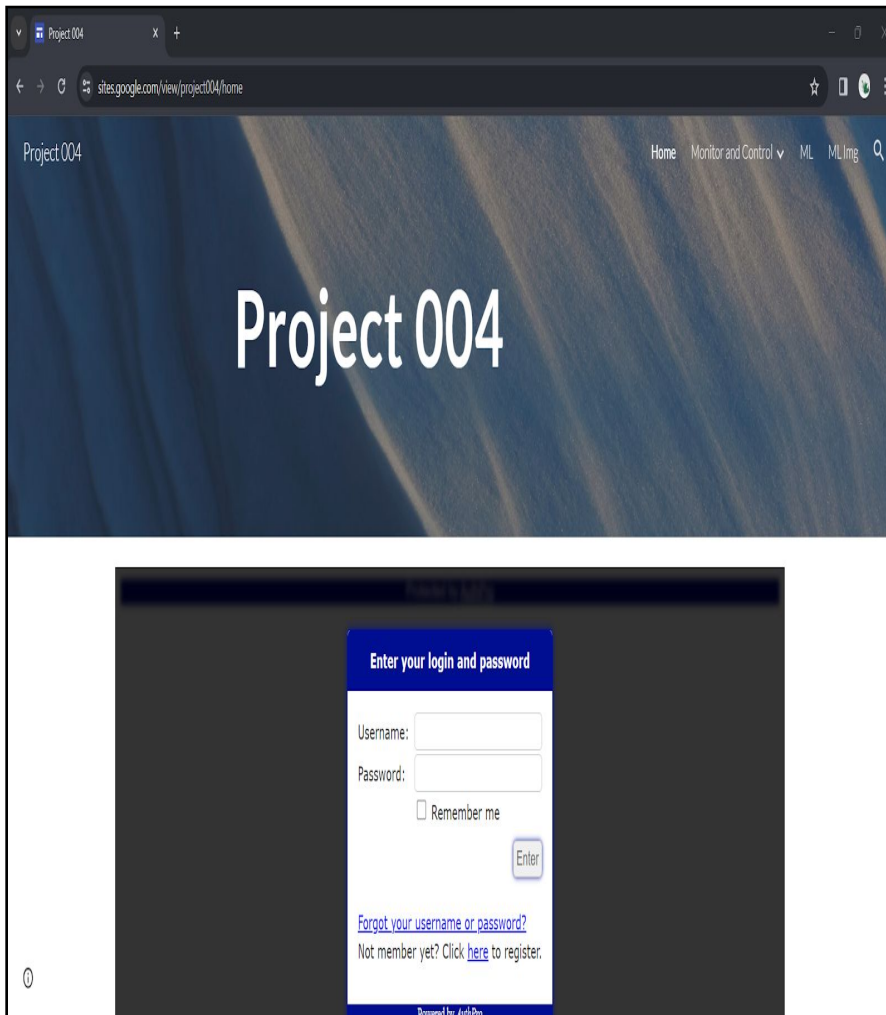

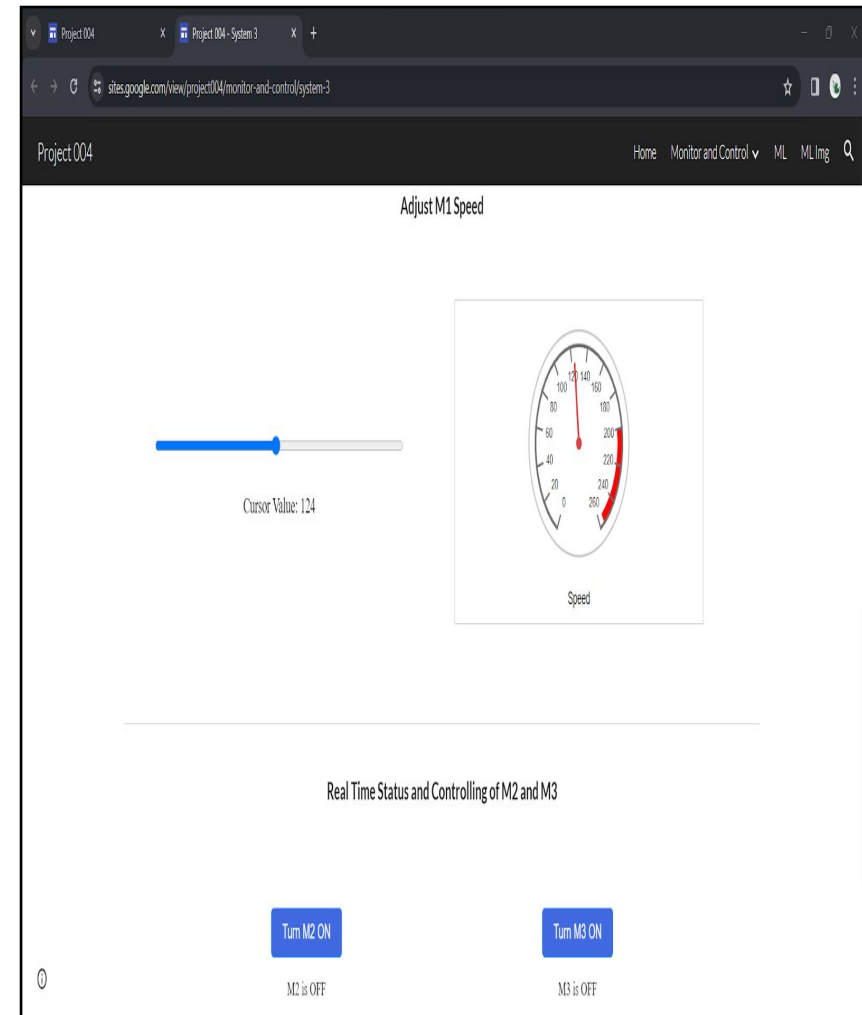**Fig 3.3. Screenshots taken while changing the Wi-Fi credentials**

Video of Changing Wi-Fi Credentials

3.4. Web Interface


Fig 3.4.1. Web Interface with Login and Password

Fig 3.4.2. Web Interface to Control the Actuators

3.5. App interface

- The web and app interface screenshots depict a user-friendly control panel for managing the hydroponic automation system.

- Notably, a key feature ensures that any data modification made through either the web or app interface is promptly updated in the cloud, thereby synchronizing data across all connected devices in real-time.

- It adjusting light intensity, or monitoring environmental conditions, users can efficiently control the system's operations with ease and convenience, fostering optimal plant growth regardless of location.
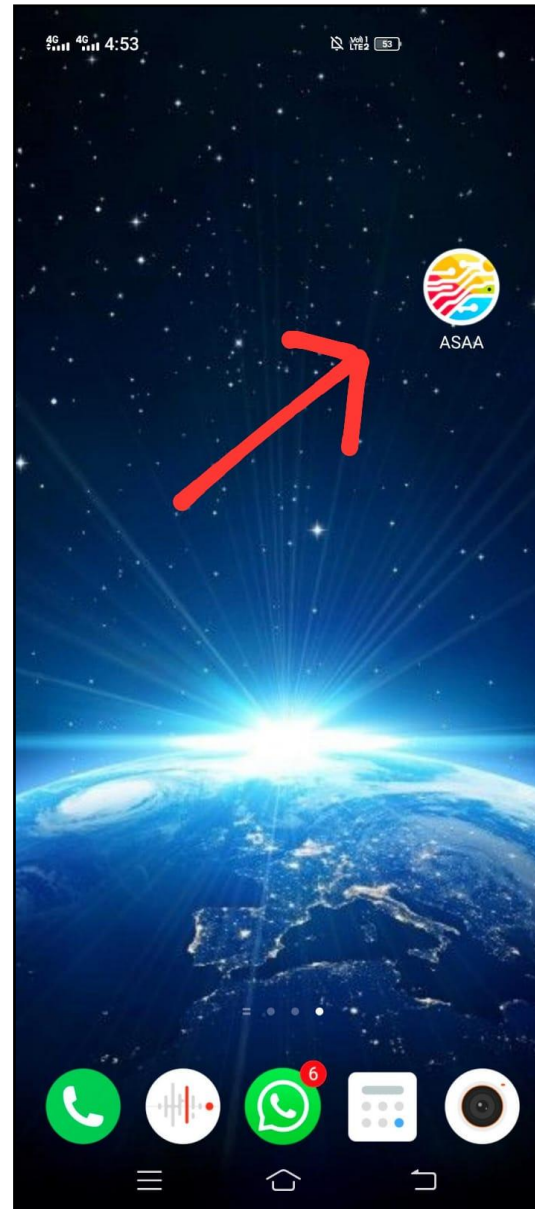
3.5.1. Android App Icon
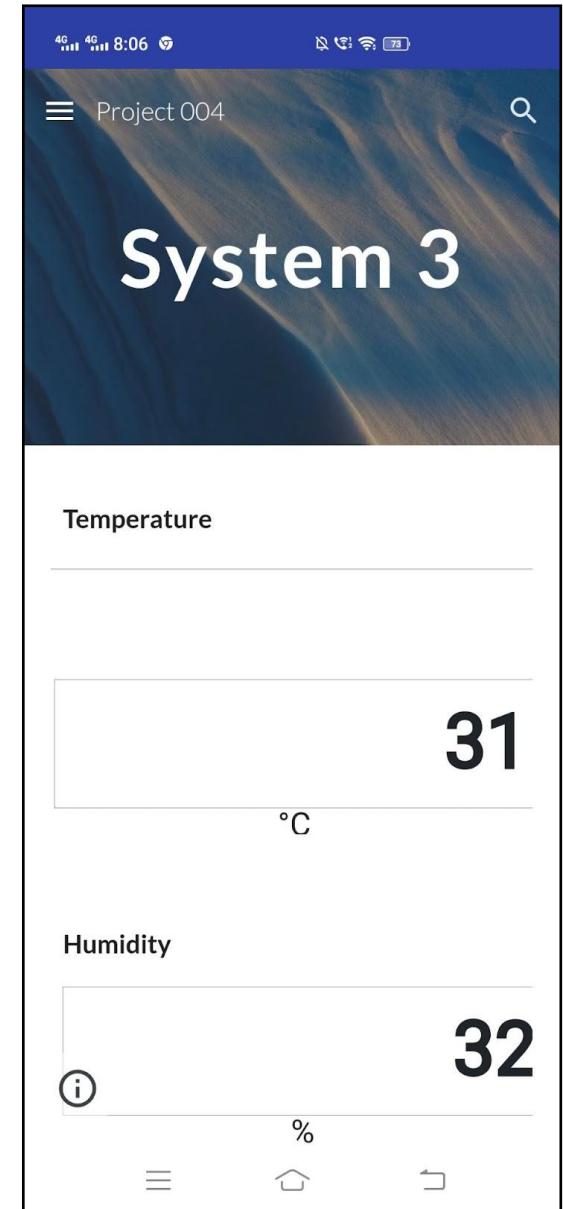
3.5.2. Android App Interface

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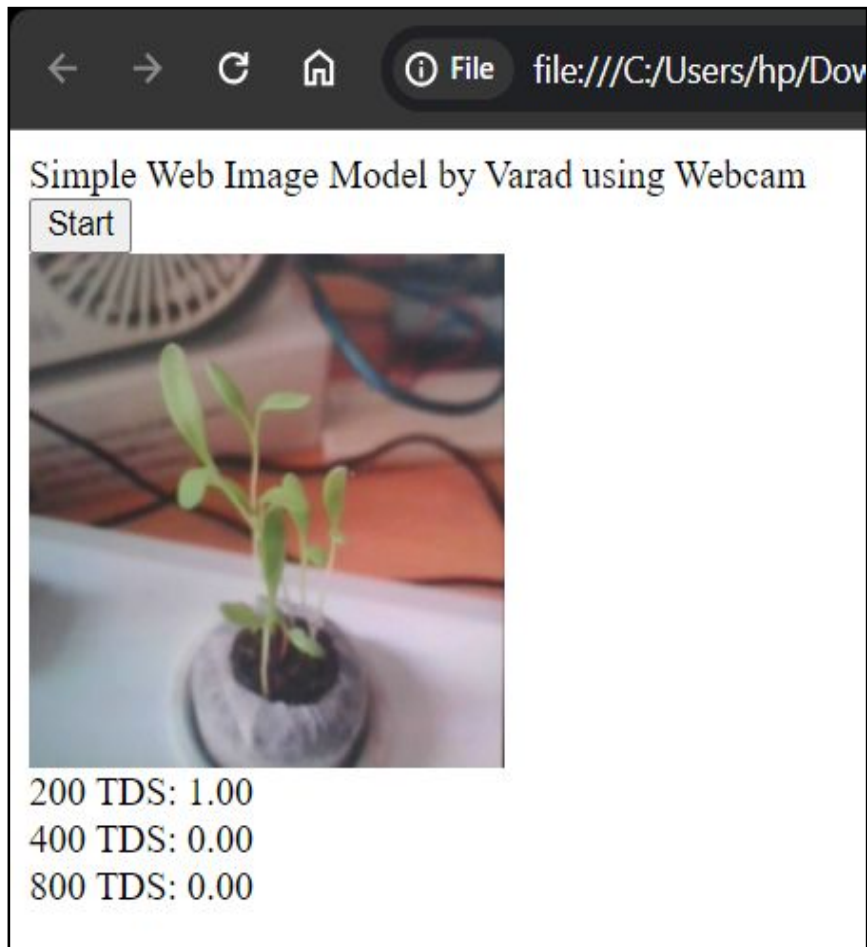# 3.6. TDS Recommendation using Camera

Fig 3.6.1 Image analysis for small plant

Fig 3.6.2. Image analysis for medium plant

3.7. Plants grown using our setup

Fig 3.7.1. Chickpea Plant

Fig 3.7.2. Wheat Plant

Fig 3.7.3. Mung Bean Plant

4. Applications

- [Aquaponics](#) at household and commercial.

- [Hydroponics](#) for both household and commercial purposes.

- [Aeroponics](#) for commercial purposes.

- All the latest farming technologies.