Smart Hydroponic

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Introduction

- One of the modern methods of agriculture is hydroponics which is a method of growing plants that takes advantage of this fact by providing all of the nutrients, in their inorganic form, in a liquid solution with or without solid media. Industrial applications of hydroponics have been developed for crops such as lettuce which used in this project.

- One of the most important benefits of hydroponics is the provision of water and the optimization of the unit area.

- With the worlds water supply shrinking, hydroponics can be a solution to our wasteful resources, especially in Palestine, where we suffer from the Israeli occupation, which confiscates lands and control the water resources, which leads to the limited use of water.

Soilless Culture

- **Soilless Culture: is a technology for growing plants in nutrient solutions that supply all nutrient elements needed for optimum plant growth with or without the use of an inert medium such as gravel, vermiculite, rockwool, peat moss, saw dust, coconut fibre. to provide mechanical support.**

Classification of Soilless Culture

The methods of growing plants without soil fall into two general categories:

1. **Liquid culture (true hydroponics): where the nutrient solution is recirculated after reaeration and adjustment of the pH and nutrient levels.**
2. **Aggregate culture: where the nutrient solution is supplied to plants via an irrigation system through the media, and excess solution is allowed to run to waste or the solution is recirculated.**

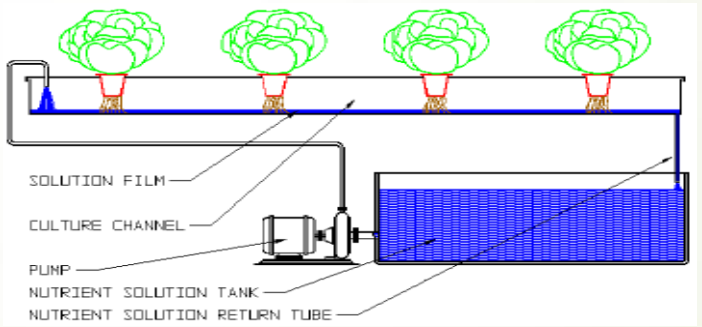
Liquid culture

Classification of Hydroponic :

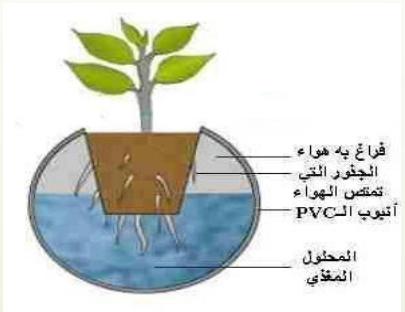
- **Circulating methods: The nutrient solution is pumped through the plant root system and excess solution is collected, replenished and reused in these methods.**

type Circulating methods :

- **Nutrient film technique (NFT).**



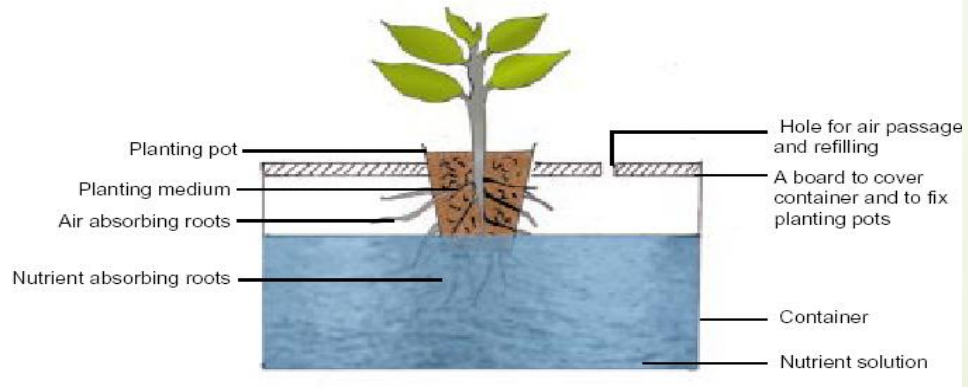
- **Deep flow technique (DFT) – pipe system**



- **Non-circulating methods: The nutrient solution is not circulated but used only once. When its nutrient concentration decreases or pH or Ec changes, it is replaced**

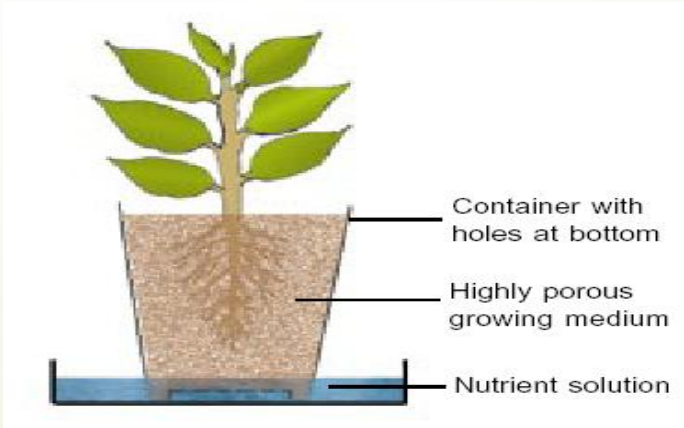
Type of Non-circulating methods:

- **Root dipping technique.**



- **Floating technique.**

- **Capillary Action Technique.**



Hydroponic production has a number of advantages:

- Because hydroponics does not use soil, soil-borne diseases and pests that live in soil cannot damage hydroponic crops.
- Hydroponic systems do not have weed seeds that might germinate and compete with crops for water, nutrients, and light.
- Hydroponic systems allow for every plant's optimal nutrient needs to be addressed.
- Water economy and control
- Reduction of labor requirement
- Multiple crops per year
- Provide the highest yield per area

Hydroponic production has a number of disadvantages:

- High capital cost
- A hydroponic system requires extensive technical knowledge and training in order to operate.
- If a disease appears then all plants in the container will be affected.

Objectives

- Optimal use of space and resources as water and fertilizers .
- Use of hydroponics method at homes and control easily by using mobile application.

Materials and Method

Equipments

In my project I used hydroponic with mobile application to keep me informed of the developments and the status of the system to get better results.

- pH sensor.

- Ec sensor.

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- **Temperature and humidity sensor.**

- **Aluminum pipes.**

- **Glass Structure.**

- **Led light white and orange.**

- Fans .
- Wi-Fi access point.
- Pump.
- Arduino piece which is a microcontroller board.

Methodology

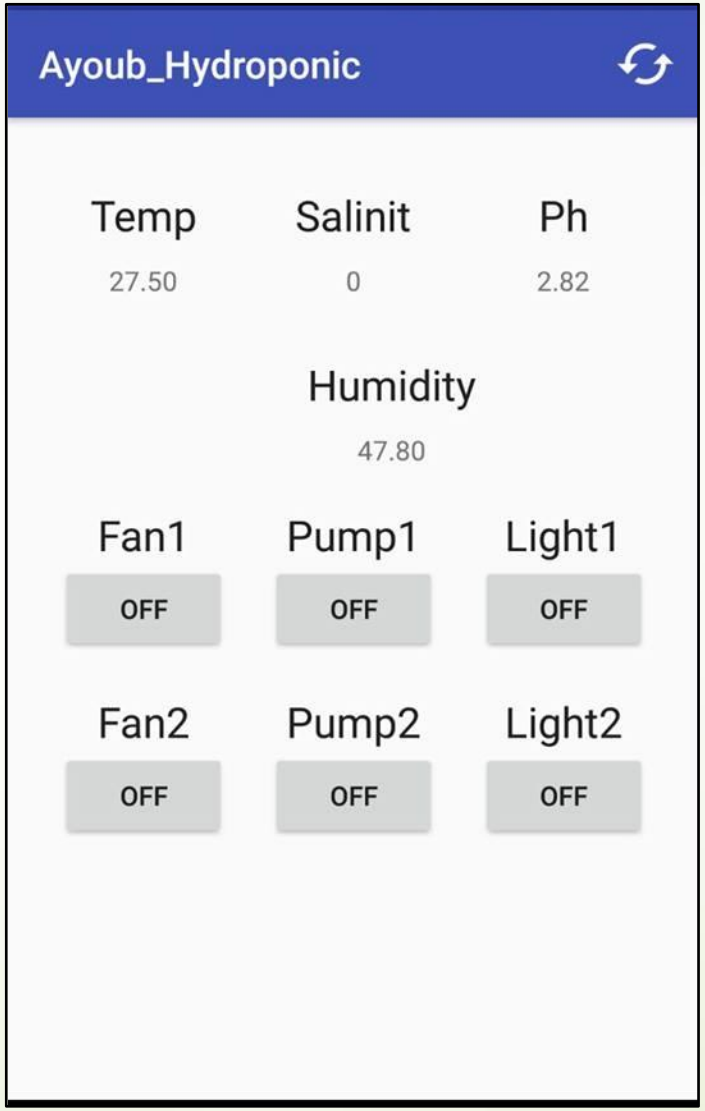
- Designed a glass house with dimension of (1*.55*.45 m). The glass house consists of three shelves.

  In the bottom (1st) shelf has been put the nutrient solution tank, and in the second & thrid shelves put aluminum pipes which contain the plants.

Methodology

- The solution is collected in a tank where the pump re-pumps the solution back into the pipes. The pump operates every 15 minutes and stops for 3 minutes.
- Controlled the system through the application on the phone where it connected the pump, lights, fans and sensors with the Arduino and then connect them to phone through Wi-Fi.
- The phone application provide multiple output includes: prints on-screen sensors reading , turn on/ off fans, determines the duration of the lights (on/ off), and operates the pump for 15 minutes and off for 3 minutes.

This picture shows us the mobile application with the reading of all sensor and controlling the lights, pump &fans.



Results

As the pictures below show us the good growth of lettuce by using hydroponic method , and the water saving that accomplished during the operation of the growth.

Conclusion

- The system provides optimal conditions for the plant by controlling the duration of lighting according to plant need, temperature control.
- Protection from pests and diseases.
- Provide an agricultural system within homes that any family member can use it .
- The project was able to use the optimal space unit.
- The system was able to save water and fertilizer.

THANKS