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# Hydroponics Farming Using IoT

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**Abstract:** Agriculture is the main part of India's economical activity. Our experience demonstrated the relationship between agricultural growth and economic wealth. We need an advance technology which can improve continuously the productivity, profitability, quality of our major farming systems. One solution to improve this agriculture growth is soil less culture.

Hydroponics or soil less culture gives opportunities to provide optimal conditions for plant growth and thus higher yields can be obtained as compared to open field agriculture. Hydroponics gives a means of control over soil-borne diseases and pests. The objective of this venture is to develop a hydroponic framework which will be completely programmed and coordinated for business aptitudes.

**Keywords:** Hydroponics farming, IOT, Soil-less culture.

## I. INTRODUCTION

The word hydroponics came from the two Greek words 'hydro' means water and 'ponos' means labor [6]. The word hydroponics it was first used in 1937 by Dr. William Frederick Gericke. From the 1950s, there were feasible commercial farms in America, Europe, Africa and Asia [26]. Hydroponics farming or soil less culture is an method for growing plants in nutrient solutions that supply all nutrient elements that are needed for optimum plant growth with or without the use of an inert medium such as rock wool, peat moss, sawdust, coir dust, coconut fiber, etc. to provide mechanical support. Hydroponics or soil less culture gives a means of control over soil-borne diseases and pests. Thus the costly and time consuming task of soil sterilization, soil amelioration, etc. can be circumvent with hydroponics system of cultivation. It provides a clean working environment and thus hiring labor is easy.

These system are further categorized into:

- 1) Passive systems
- 2) Active systems

Passive systems uses an wick and growing media has very high capillary action.

### A. Wick System

The wick system is the simplest of all six methods of hydroponic systems. That's because classically it doesn't have any moving parts, thus it doesn't require any pumps or electricity. However some people still like use an optional air pump in the reservoir. Because it dosent need electricity to work, it's also quite useful in situation where electricity cant be uses, or is unreliable [3]. This method of hydroponic system is also used by teachers in classrooms as experiments for kids.

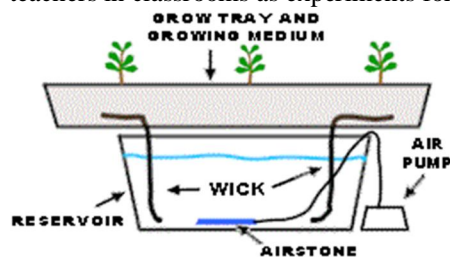


Fig 1.1.1. Wick system

It primarily just wicks up nutrient solution from the reservoir to the plants by the use of the process of capillary action. Means that it absorbs up water to the plants through the wick like a sponge [26]. This suffer water to be drawn to the plant roots. Classically good wick system has at least two or more good size wicks to provide enough water (nutrient solution) to the plant. The bucket with the plant in it primarily sits right on top of the container used for the reservoir. That's why water doesn't need to trek up very far to get to the growing media with plants.

**B. Water Culture System**

The Water Culture System is an easiest of all active hydroponic systems. The plan that grasp the plants is usually made up of Styrofoam also it floats directly to the nutrient solution [1]. The air pump furnish air to the air stone that bubbles the nutrient solution and also provides oxygen to the roots of the plants . It is technically simple, they are still very efficient for growing plants hydroponically [4]. Not only lot of home hydroponic planters really like using water culture systems, but also commercial planters use this type of system on a large scale as well [17]. Mainly because of the water culture systems is a simple and cheap concept. It's is very affordable type of system to build [22].

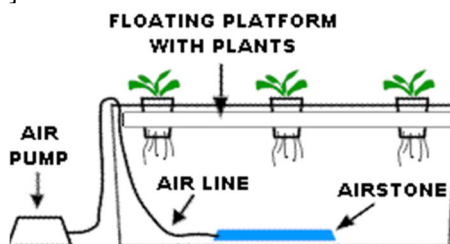


Fig2.1.1. Water Culture systems

The plant is actually hang in baskets right over to the nutrient solution in the reservoir. Usually by styrofoam floating on uppermost, or through holes cut in the lid covering the reservoir. The roots decline down from baskets the plants are in, and decline down directly into the nutrient solution at where they are deluge [1]. The roots remains deluge all the time 24/7. The roots do not stifle because they get the air and oxygen they need from air bubbles rising through the nutrient solution, as well as from dissolved oxygen in water itself. The added air bubbles it should be better for the water culture systems. The bubbles must be outbreak up through, and thus making direct contact with the roots as they jump to the top of the water to be most effective for the plants [22]. There are primarily two ways of providing aeration and dissolved oxygen to the nutrient solution.

**C. Ebb and Flow System**

The Ebb and Flow System operates in the meantime flooding the grow tray with nutrient solution and then exhausting the solution back into the reservoir. This action is basically done with a deluge pump that is connected to a timer.

Ebb and Flow systems are very approved with home hydroponic planters for many reasons [3]. Also they can be construct to fit in any obtainable space you might have. Along with being cheap and easy to construct, plants grow very well in flood and drain systems. The flood and drain system operates basically like it sounds, by simply flooding the plants root system with nutrient solution. Only periodically rather than continuously.

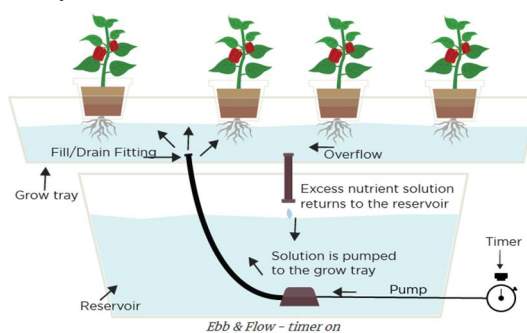


Fig2.2.1. Ebb and Flow System

The important part of the flood and drain system it holds the containers that the plants are growing in. It can be fair one plant, or many plants in sequence. A timer will turns on the pump therefore water (nutrient solution) is pumped through tubing from the reservoir up into the important part of the system utilizing a submersible fountain pump [26]. The nutrient solution stand to fill the system til it extends the height of the preset overflow tube thus it soaks the plants roots. The overflow tube must be set to about 2 inches under the top of the growing media. When the water stuffing the system reaches the overflow tube height, it drains back down to the reservoir where it recirculates rear through the system again. The overflow tube adjust the water level height in the flood and drain system, as well as make sure that the water (nutrient solution) doesn't spill out the top of the system while the pump is on. When the pump close off, the water siphons back down into the reservoir through the pump .



#### D. Drip Systems

Drip Systems are likely the most widely used type of hydroponic system in the world [6]. A timer regulates a submersed pump. The timer makes the pump on and nutrient solution is dropped onto the base of each plant by a small drip line [12]. Both for home planters as well as commercial planters alike. That's why because it's an simple concept and needs not many parts, but yet it's a very multi skilled and effectual type of hydroponic system [13]. Even though it's an easy concept, it won't limit your imagination when building your own systems. The way a drip system operates is just like it sounds, you simply drip nutrient solution on the plants roots to stay them moist.

Hydroponic drip systems can easily be plan in various ways, as well as from small to large systems. But it is mostly useful for larger plants which take a large amount of root space. And because of these you don't need large capacity of water .

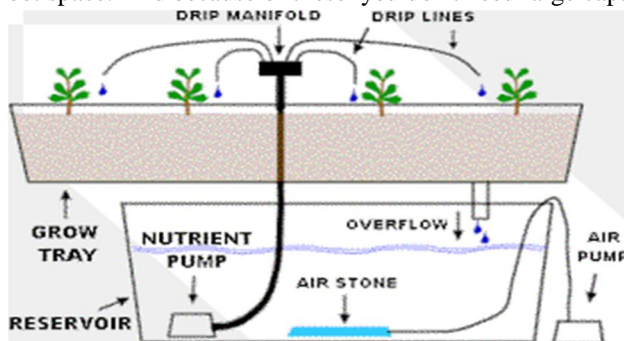


Fig2.3.1. Drip System

Water is drive up from the reservoir between tubing to the head of the fatten media , from there it drips away of the tubing onto the growing media [12]. The nutrient solution evacuate down drenched both the roots and growing media all the way to the base of the container. From there the nutrient solution flows between the opening/s, and gravity allow the nutrient solution to flow decline through tubing all the process back to the reservoir [6]. It's main to recall that the plants growing container requires to be at least 6-8 inches or so overhead the top of the reservoir, so that gravity can drain the surplus water back do the to it [13] .There are basically two types of hydroponic drip systems recirculating drip systems and non recirculating drip systems [21] .

#### E. NFT Systems

NFT Systems have a continual flow of nutrient solution,so timer is not required for the submersible pump.The N.F.T. system (Nutrient Film Technique) is quite popular with home hydroponic planters as well [3]. However N.F.T. systems are more convenient for, and most commonly used for growing little quick growing plants like various types of lettuce [20]. Along with growing lettuce, some commercial planters also grow various types of herbs and baby grass using N.F.T. systems.

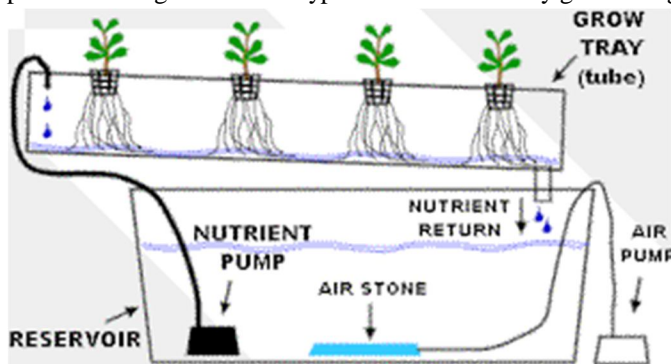


Fig2.4.1. Nutrient Film Technique

Nutrient solution is drive up from the reservoir, usually to a manifold that attach the larger tubing to a number of smaller ones [9]. Every smaller tubes runs nutrient solution to one side of each one of the growing channels along with the plants in it. A narrow layer of the nutrient solution flows through every channel's along with the plants in it to the another side, process by each plant and moisten the roots on the base of the channel as it does.

The nutrient solution passes from one side to the another because the channel is doze slightly so the water flows down elevation. The plants in the growing tubes are commonly sling overhead of the water by planting seedlings started in starter cubes or little one inch box of planting media into little holes in the head of the tube [20]. The roots of the seedlings hang down to the base of the tube/channel where they obtain nutrients from the ford film of nutrient solution flowing by. The extra nutrient solution flowing out of the small end of every one of the channels drains into another channel or tube, and control back to the reservoir where it is recirculated through the system anew. While the nutrient solution passing through the channels is very slight, the whole plants root heap remains wet from the roots being able to wick up moisture on the exterior of the roots, as well as through humidity that's stay within the tube/channel [26].

The roots that are sling between the base of the plant and the water level in the channel not only have wetness to access, but also able to get enough oxygen from the air neighbouring them within the tube/channel as well. Commercial planters basically use specially made channels for N.F.T. systems that have flat base with track running lengthwise along the channel. These tracks allow water to flow underneath the root heap and help keep it from pooling or damming up. Home planters make use of vinyl rain gutter down nozzles for their channels [26]. Home growers also make use of round ADS (Advanced Drainage System) irrigation tubing for N.F.T. systems. The ADS tubing do not have grooves, but with increasing the slope to satisfy, the round tubing operates well also.

#### F. Aeroponic System

The Aeroponic System is likely the most high tech type of hydroponic gardening. A timer command the nutrient pump a lot of like other types of hydroponic systems, except the aeroponic system needs a short cycle timer that runs the pump for a few seconds each couple of minutes [19]. While the concept of the aeroponic system is fairly simple, it's literally the most technical of all 6 types of hydroponic systems [3].

However it's still justly easy to construct your own basic aeroponic system, and a lot of home planters like growing in them as well, and even get really better results using this type of hydroponic system. Some advantages of using an aeroponic systems are they do not require any growing media. The roots get maximal oxygen, and the plants grow more quickly as a result. Aeroponic systems also generally use fewer water than any other type of hydroponic system. Also harvesting is usually simple, mainly for root crops.

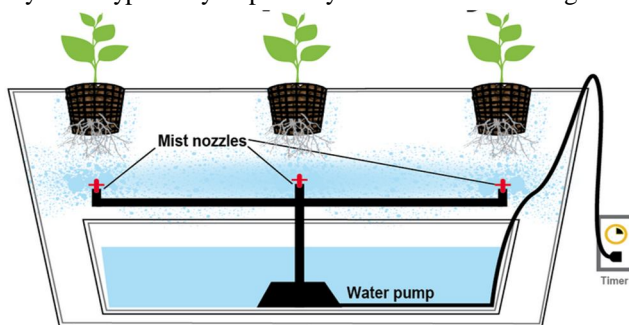


Fig2.5.1. Aeroponic System

First the motive of the roots swing in mid air is so they can acquire the maximal amount of oxygen that they can get. The lofty volume of oxygen the roots get allows the plants to grow rapidly than they would otherwise, and the main convenience to this method of hydroponic system [19].

Second, there is generally very small if any growing media is used, reveal all the plants roots. The plants are slinged either by little container, or shut cell foam plugs that flatten around the plants stem. These containers or foam plugs suitable in small holes at the head of the growing chamber. The roots swing down inside the growing chamber where they get sprinkled with nutrient solution from mister heads at methodical short cycles. The regular watering cycles keep the roots wet and from drying out, as well as supply the nutrients the plants require to grow. The growing chamber the roots should be in light validation, and nearly air compacted. It does need to permit fresh air in therefore the roots can obtain a lot of oxygen, but you dosent want water to cowp out, or pests to obtain in. Also you desire the root chamber to grasp in humidity.

Eventually what you want is the roots to obtain a lot of moisture, fresh oxygen, and nutrients. Lastly, a crucial factor in aeroponic systems is an water droplet size [26]. Roots sprinkle with a fine haze will grow much rapidly, bushier, and with additional surface area to occupy nutrients and oxygen with than roots sprinkle with little streams of water like from small sprinkler heads. That interpret into the plant canopy growing more rapidly as well. There are basically three types of aeroponic systems are low pressure aeroponic Systems, high pressure aeroponic systems, ultrasonic foggers.

## II. CONCLUSION

The wick systems takes benefit of the activity of wicking to provide a water based nutrient solution to the roots of plants. Water culture method of plant production by means of hanging the plant roots in a solution of nutrient rich, oxygenated water. An ebb and flow system is an favoured hydroponic growing system where there's an sporadic water flow in which plants grown in an inert mode. The drip system operates is just like it sounds, you directly drip nutrient solution on the plants roots to remain them moist. Nutrient film technique is a hydroponic method where in a very glib stream of water hold all the dissolved nutrients need for plant growth is re-circulated past the bare roots of plants in a water tight channels. Aeroponic systems feed plants with nothing more than nutrient loaded mist.

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