SMART FLOATING FARMING:-THE FUTURE IS HERE.

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Abstract:-Smart floating farming is a new revolution in the field of agriculture. The development of urbanization is reducing the land region and has also become a major problem for farming. As this new farming technique can completely avoid the land problems like scarcity of nutrients, problem of mixed farming, insufficient land, problem for getting rich nutrient crops etc. In this paper we are going to implement smart floating farming by using the concept of hydroponics with the help of solar energy and internet of things concepts. Smart floating farming is technique where the farming is done completely in ocean or aquatic surfaces in the absence of soil with increased yielding results.

1 INTRODUCTION

The rapid growth of urbanization is causing serious problems in the field of agriculture as this is leading decrease of land region. Today, we are not able to grow the crops according to our needs as we are facing the lot of problems like fertility, insufficient nutrients, irregular rains etc. To overcome this problem we will be using smart floating farming in which farming can be done in water surfaces in complete absence of soil by using the concept called hydroponics. Another factor in farming is the natural environment which is an external factor such as soil, water, light, temperature, water temperature, soil temperature, humidity in the air, relative humidity, alkalinity of soil and water, and essential nutrient required for plant growth. All of them are difficult to control and affect the quality of crops [1]. Internet of Things is a new type of computing system where small electronic devices equipped with sensors are used to detect the operating environment of the system and, together with data from other sources, determine the actions that should be taken on behalf of users to increase values or create new features for the system. Automation is usually one of the goals for deploying Internet of Things either in home or workplace. Smart agriculture or smart farming [2, 3] is the application of Internet of Things to growing crops with the potential of saving labor and resources, more fine-grained control in watering and fertilization, and more accurate gathering of information about planting environment. Hydroponics is a method of growing plant without soil, using instead liquid nutrient solution [4]. One benefits of hydroponics farm is reduced labor cost because the farmer does not have to prepare the soil, and watering and fertilization are usually automatically build into the hydroponics farm. Since hydroponics farm is usually partly automated, it is much easier to integrate Internet of Things to get better and more accurate data and fully automate the farm. In this research, we plan to evaluate the cost-effectiveness of Smart Hydroponic farm using Internet of Things technology when compared to a regular hydroponic farm. Of course, the Smart Farm should produce better crops, but we intend to find out how much better, and whether the improvement merit the usually high cost of installation. This floating farm uses renewable solar energy for working purpose so apart from installation and maintenance there is no real big cost effectiveness. This floating farming can do two farming's at a time we will be implementing aquaculture along with agriculture in our smart floating farm.

Firstly we are going to discuss about hydroponics and its method, Secondly about floating farming technique and finally using of IoT in our smart floating farming technique.

2. Internet of Things

Internet of Things can be viewed as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies [5].

IoT-related systems are based on the essential definition of IoT as "a network of devices that connect directly with each other to capture and share vital data through a secure service layer that connects to a central command and control server in the cloud" [6].

The potential for the convergence of technologies and systems is vast, as can be seen in Figure 1. This development will generate changes in many vertical industries, from health care to manufacturing, from energy to smart buildings and cities [7]. We can see some examples of control of energy systems such as: interactive multimedia systems; methods on physical polluting agents and environment modeling and simulation; computational techniques for trading systems, time series forecasting, stock market modeling, and financial assets modeling.; recent advances in defense system globally. The IoT offer greater promise in the field of health care, where its principles are already being applied to improve access to health care services, increase the quality of health services and reduce the cost of this services [6] .New developments and concepts that lead to innovative smart and portable devices able to identify, locate, sense and connect anytime and anywhere between themselves leading to a new form of communication and network.

Fig1:- internet of things areas

This IoT concept will be used in our hydroponics for the efficient maintenance and supply of nutrition to the clops and to monitor their growth.

3. Hydroponics

Hydroponics is the method of growing plants or vegetables without soil, but using mineral nutrient solutions mixed with water. Since this solution will be used as a food source for plants or vegetables, it is necessary to control or manage many factors in this liquid. There are types in hydroponics.

WICK SYSTEM

Fig2:- wick system

It is a simple system with no moving parts which makes it a passive system, using capillary system a rubber fabric material draws the nutrient solution upward to the growing medium this makes the roots of the plant constantly hydrated, wick system does not use any pumps and timers. This system cannot be used for large commercial growing of crops.

DRIP SYSTEM

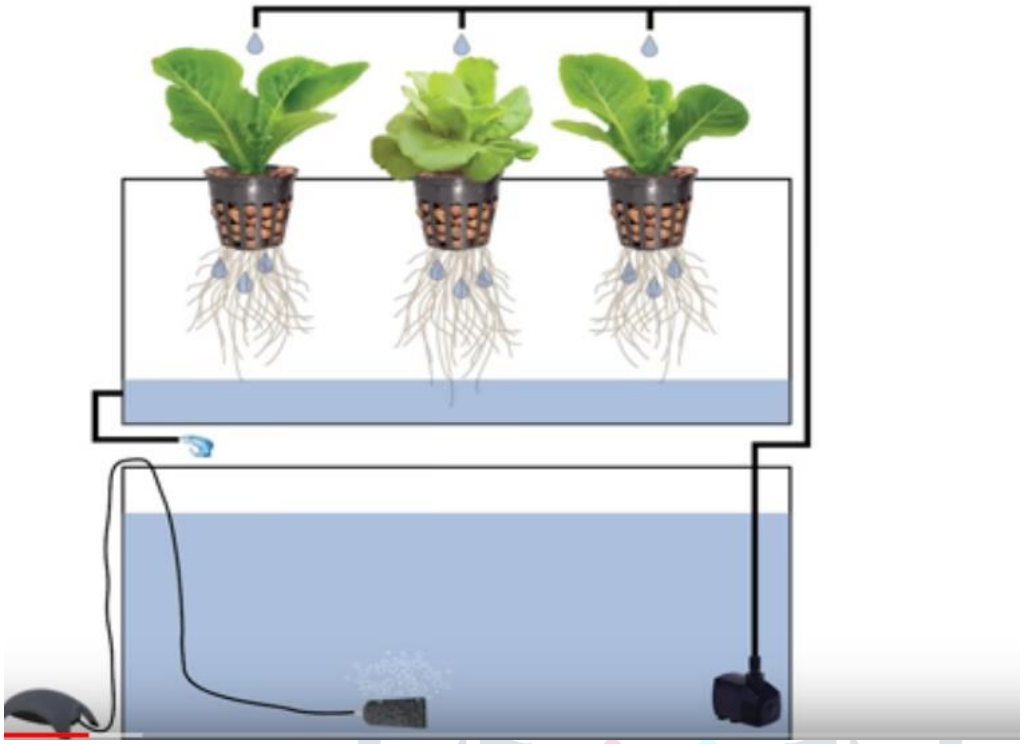
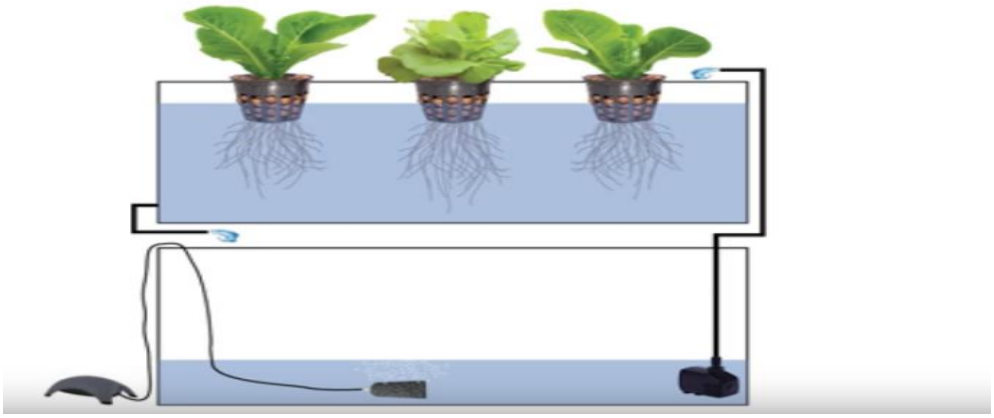


Fig3:- drip system

It is the most popular hydroponics system.in this system slow feed of nutrient solution is dripped into root zone and then recycled back to the reservoir, here the solution is constantly drop by drop is given to the crop to keep it hydrated and the excess nutrient cycle is not recycled.

EBB and FLOW SYSTEM (flood and drain)

In this system we are going to flood the crops firstly then we will allow them to dry and again we will flood the crops this process will continue.



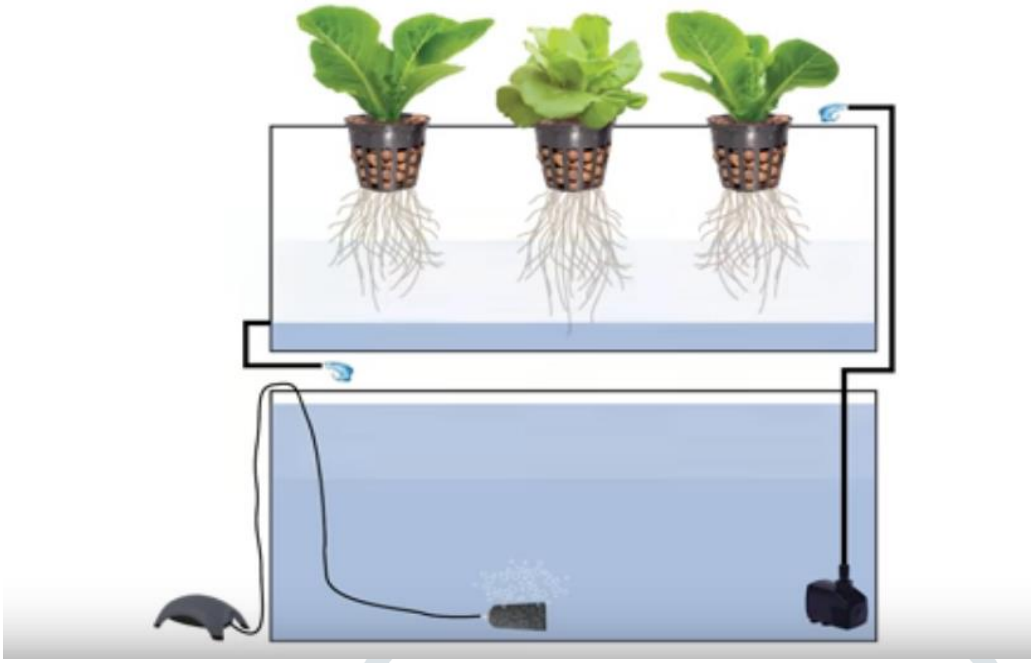


Fig:4 ebb and flow system

In this system the crops are temporarily flooded by nutrient system and then pumped back to the reservoir.it uses the submerged pump system for pumping of nutrients. This cycle repeats numerous times allowing plant to experience both flooding and drying.it is a highly effective and popular technique.

DEEP WATER CULTURE

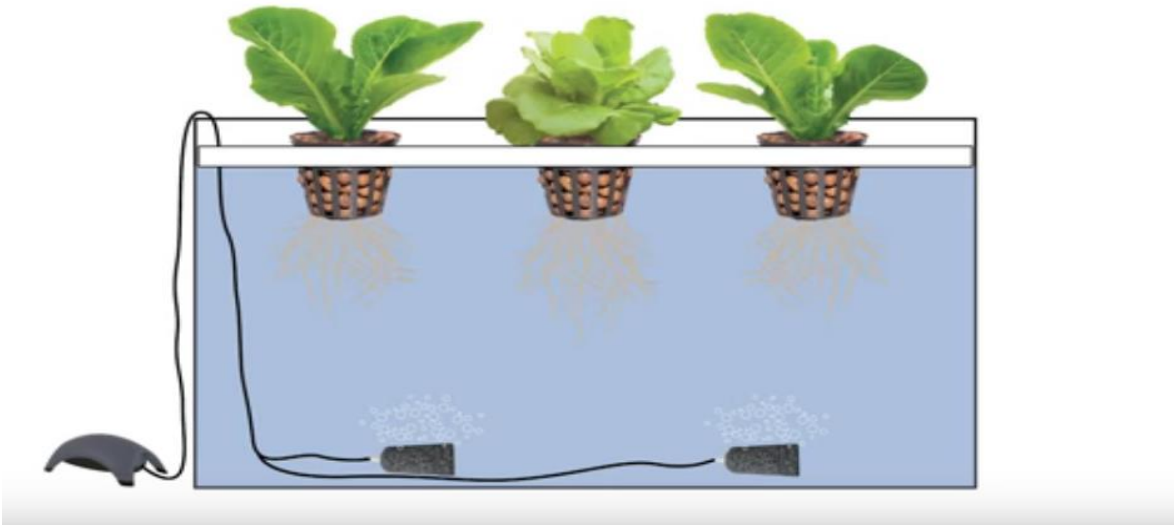


Fig5:-deep water culture

Roots are suspended in oxygenated nutrient solution this technique in fact gives maximum nutrient supply the crops but in few cases it might be in effective.

NUTRIENT FILM TECHNIQUE (NFT)

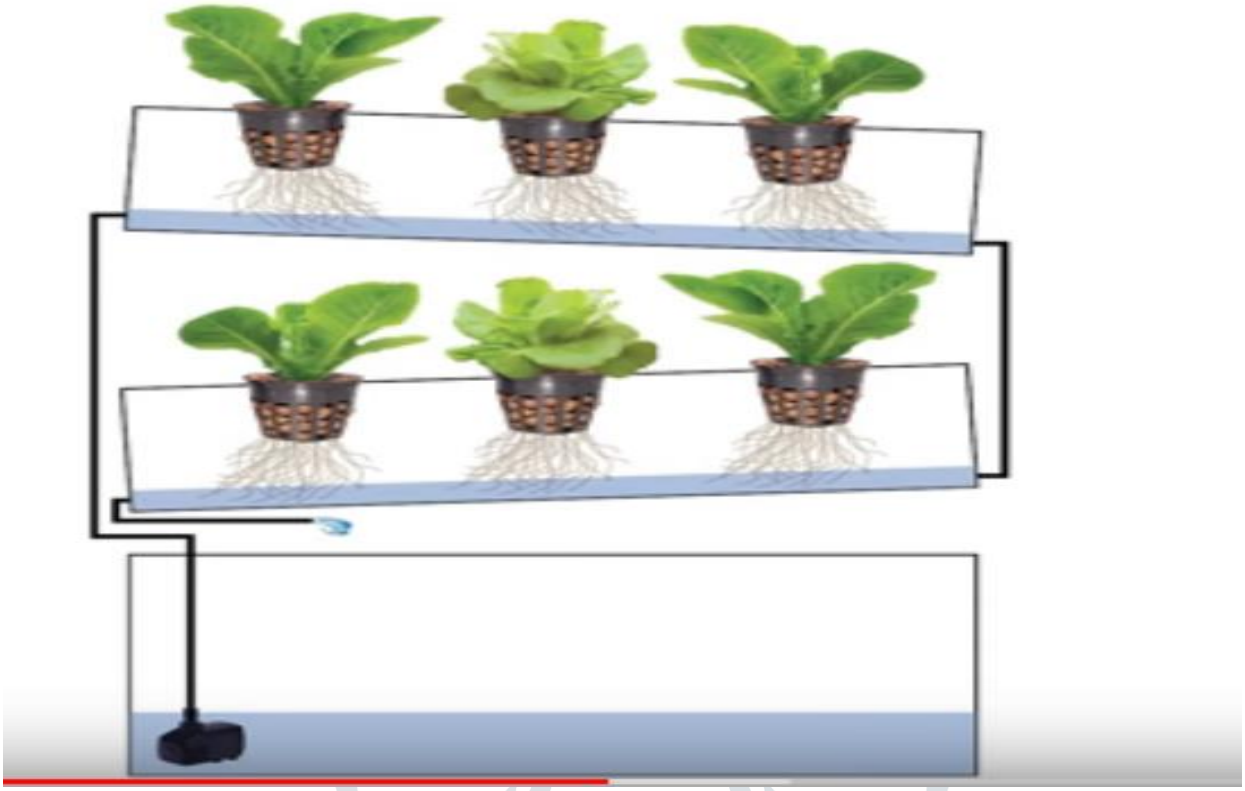


Fig6:-nutrient film technique

Nutrient flows through channels and over bare roots. It allows faster growth in limited space, here only the tip of the roots are touched with nutrients. The drawback is this system cannot be used for large yielding fruits and crops[8].

FLOATING FARMING

No Land? No Problem. New Architecture has its way, farms of the future will operate autonomously as they float on the open sea. Stretching eco-friendly concepts to the limit, the ambitious design firm has come up with the idea of Smart floating farms, large triple-decker agriculture barges that feature fish farms down below, hydroponic gardens up top and solar panels on the roof to keep things running. They don't exist yet, but they certainly provide plenty of thought. This practice helps to mitigate land loss through flooding, by allowing cultivation of these areas to continue. In this way, the total cultivatable area can be increased and communities can become more self-sufficient. In addition to this, the area under floating cultivation is up to 10 times more productive than traditionally farmed land and no additional chemical fertilizers or manure is required. When the crops have been harvested and floating rafts are no longer required, they can be used as organic fertilizers in the fields or incorporated into the following years floating beds as a fertilizer. The practice of floating farming also helps supplement the income of local communities and contributes to eradicate poverty.

Smart floating farms believe in providing humanity with complementary solutions. The purpose of smart floating farm is to help reduce communities/growing cities food risk associated problems, make food production more transparent, using clean energy to produce fresh food closer to home.

The main reason behind the introduction of this system is the urban areas will increase 185% by 2030, therefore the major problem of food and water scarcity will occur along with this pollution will also be increased so this may also affect the growth of crops.

For this reason we propose a productive floating farm system to bring food closer to growing cities and it's a replicable and scalable modular design, this implementation can be done worldwide scale/different locations.

This floating farming consist of 3 layers the top layer will be having solar energy plant which consist of solar cells which converts solar energy into electrical energy and it's a renewable form of resource. The second layer consists of crop production using the concept of hydroponics where the crops are grown without the use of soil and with the help of nutrient solution. Finally, the bottom layer where the process of aquaculture is done which the process of fishing and other hatching activities takes place.

Fig7:-architecture of floating farm

The bottom level would contain fish farms, external perimeter wave barriers and protection, water access points, storage, a slaughterhouse a desalination plant and packaging facility. Upstairs would be a greenhouse with automated hydroponics and microclimate control for crop cultivation. The rooftop level would be having photovoltaic power plant and feature skylights to deliver natural light to the plants, Wind turbines and wave energy converter systems could also play a role, as could biogas power, plants and digesters that would be used to eliminate the biological waste produced throughout the operation.

Fig8:- an overview diagram

The nutrient supply is efficiently managed by measuring the nutrient supply to each and every crop individually. There will be sensor nodes which are used to measure the nutrient supply of each and every individual crop and make sure that the supply does not exceed than the limit may be called as threshold. if the nutrient supply is exceeded than the threshold the nutrient supply to that particular plant will be stopped .

Algorithm for managing nutrient supply to each crop.

1. Get the nutrient supply data with the help of nutrient sensor node .
2. Send data to surface gateway using IoT communication.
3. Pre-processing module of surface gateway filters the required data.
4. IF(Nutrient supply >= threshold)
5. stop supply of nutrient supply.
6. END IF
7. Send the data to database server for future reference.

Conclusion

Combining internet of things with hydroponics and solar energy enables development in the field of agriculture and farming techniques in smart floating farming. The new methods of collecting,tracking assessing and measuring the nutrient data through IoT helps the cultivation to work in an smart and efficient manner.

The utilization of Smart floating form with the help of IoT promotes development in the field of agriculture, farming etc., and also shows the new ways to overcome the problem of land for cultivation with increased efficiency and profits.Smart floting farm could be a revolution in the field of farming.

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