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Automation in Hydroponic System Using PLC

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***Abstract*—** The aim of this project is to develop automation in hydroponic system. Hydroponics is the science of growing plants in water without soil. Hydroponics is a new agricultural production system in which the production takes place in soil less mediums using either an artificial soil medium or water. Nutrients and fertilizers are supplied to the crop or through the water. Hydroponic system requires controlled environment for proper growth plants, less chance of diseases and faster growth. It includes Automated Monitoring and controlling environmental parameters like temperature, humidity, light intensity etc. The parameters like Temperature, Humidity, and Light Intensity are read by the respective sensors. If these values exceed or decrease their corresponding set points, the system starts the controlling action and set back to its normal value.

***Keywords*—** Agriculture; automation; hydroponics; PLC.

I. INTRODUCTION

Hydroponics is a new agricultural production technique of growing plants in water without soil. Hydroponic is the system in which the production takes place in soil less medium using water or an artificial medium. Nutrients and fertilizers are provided to the plant through the water. It is an effective alternative method to soil based agriculture. It gives large production in less area, high productivity and less use of water. Production may takes place either in a greenhouse or indoors. A wide variety of crops such as lettuce, flowers such as roses, gerberas, carnations, and other crops such as tomatoes, capsicum, strawberry, and cucumbers are all grown in hydroponic system.

II. LITERATURE SURVEY

Growth Requirements

There are many factors affecting plant growth and productivity. Whether a plant is grown in soil or a soilless medium all plants need nutrients, water supply, light, and air to grow. A plant growing in soil takes nutrients and water from the soil. In hydroponics, water and nutrients are available regularly, so the plants are never stressed.

Air and sunlight are easily available in an outdoor hydroponic system. But for an indoor system, we must need an adequate light source and good air Circulation. Metal halide lamps, sodium vapour lamps, grow-lights, or fluorescent lights may be used with incandescent light bulbs which provide adequate light.

Using this technique we can grow,

- Tomatoes.
- Cucumbers.
- Bell Peppers.
- Strawberries.
- Lettuce.
- Cut flowers such as roses, gerberas.

Growing Substrates

- *Rockwool*

Widely used. High-water holding capacity. Not recyclable, not reusable.

- *Expanded clay*

Grow Rocks. Can be reused (wash and sterilize). Not good for starting seed.

- *Coconut fiber (Coir)*

Many different sizes. Good water holding capacity.

- *Sawdust*

Sawdust is actually a very common growing media used in hydroponics. It's the main growing media used at the Epcot Centre Hydroponic Greenhouse in Florida, Mainly for their large hydroponically grown plants and trees.

Sawdust is just smaller in size. Because the particle size is smaller moisture doesn't drain out as fast. Sand is also commonly mixed with Vermiculite, Perlite, and or coco coir.

TABLE I. Nutrients deficiency.

Sr. No.	Nutrients Deficiency Symptoms	Deficiency
1	Plant colour is light green; yellow leaves.	Nitrogen
2	Plant colour is bluish-green, leaves are yellow, growth may be stunned.	Phosphorous
3	Dead areas along the edges of the leaves; growth is stunted.	Potassium
4	Lower leaves turn yellow along the tips and margin and between the veins; the lower leaves wilt.	Magnesium
5	Young and new leaves die	Calcium
6	Leaf tissue is lighter in colour; yellowed; papery in appearance.	Zinc
7	Leaf tissue may be yellow in colour, veins are green.	Iron
8	Leaf edges may be dark green or blue in colour; young leaves wilt	Copper
9	Young leaves may change to pale green. Older leaves remain green; plant is stunted.	Sulphur
10	Growth is stunted; lower leaves may have yellow and green coloured pattern.	Manganese

Types of Hydroponic Systems

- *Ebb-Flow (flood and drain) system*

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One of the most common systems using an aggregate media is the flood and drain method. A water-holding container, such as a plastic dish pan, is filled with the aggregate and plants. The container is flooded periodically with the nutrient solution. The solution is drained back into the nutrient reservoir by opening a valve at the bottom of the container. During each cycle, the roots should be submerged in the solution for no more than 20 to 30 minutes.

- *Drip system*
  Drip systems are easy to control moisture.
- *Water culture system*

Water culture systems include the nutrient film technique. The nutrient film technique uses a plastic trough or tube as the container through which a constant, thin film of nutrient solution flows.

III. Hydroponic System

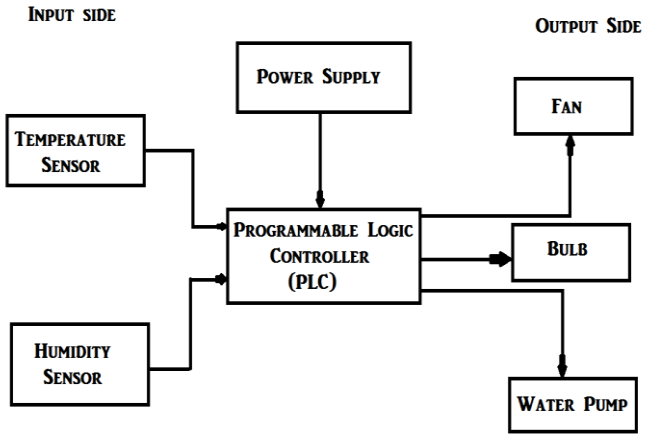

Fig. 1. Block diagram of hydroponic system.

- *Temperature control*

We will use Digital temperature sensor. Temperature is sensed and after that this signal is send to PLC. In PLC a particular set point is given and if it is below or above it take action likewise. If the temperature exceeds the maximum value, the PLC will then turn on the fan. If the temperature drops below the minimum value, the bulb will turn on.

- *Light Intensity control*

In certain areas where natural illumination is absent or very low, illumination for plants may be provided by artificial sources. Incandescent bulbs generate excessive heat and are unsatisfactory in most instances.

- *Humidity control*

The digital humidity sensor coupled to water circulating pump and light bulb to control the humidity of atmosphere. Here we maintain the humidity of atmosphere. Humidity sensor will detect a change in humidity levels and send a signal to the PLC. If the humidity level is not within the required range, the water supply or light bulb will be turned on or off.

IV. Result Analysis

We have designed hydroponic system as per our need and it was found that the system worked successfully as per the design. Now a day's drought is major problem in front of us. In this condition hydroponic system will be more helpful as it uses less amount of water and gives more yield in less time interval. Hydroponic is effective alternative method to soil based agriculture. It gives large production in less area, high productivity and less use of water. Automated Monitoring and controlling environmental parameters like temperature, humidity, light intensity etc. is successfully done by this system. The parameters like Temperature, Humidity, and Light Intensity are read by the respective sensors. If these values exceed or decrease their corresponding set points, the system starts the controlling action and set back to its normal value. The system designed in this project fulfills the primary need of every person's indoor farming need.

V. Future Scope

- To feed the plants the hydroponic system needs all the time expensive nutrients and also on a regular basis a waste disposal issue appears by flushing the systems.
- Aquaponic Systems came as the magical solve for the down sides of both aquaculture and hydroponics in the best way, thinking about re-circulating both systems together we will find that the negative aspects of aquaculture "getting the excess nutrients out of the system" is the best solve for the negative aspect of hydroponics "the hydroponic system is in need all the time for expensive nutrients" and no more waste water cause of the periodic flushing of the systems that means no more lost money.
- By the magical touch of aquaponic, we will have fresh fish, vegetables and fruits all the time in the in the cheapest and cleanest way.

Aquaponic System Design

- *First stage*: We feed the fishes normally and then the fishes extract ammonia into the water
- *Second stage*: The pump is lifting the water from the fish tank up to the grow-bed
- *Third stage*: The water is dripping down through the porous media bed / filter, passing through the roots of the plants before discharging back into the tank
- *Fourth Stage*: The plants roots absorb the water and nutrients that they need to grow, cleaning the water by this way from the nutrients, returning back to the tank fresh and clean water that fish need.

VI. Conclusion

The system designed in this project fulfills the primary need of every person's indoor farming need. As we see, now a day's drought is major problem in front of us. In this condition this system will be more helpful as it uses less amount of water and gives more yield in less time interval. This system also help crops to grow where soil is unsuitable and also Reduces plant disease generated due to soil. If automation is

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introduced in hydroponics, no more attention is required. Thus using this system will be considered wise.

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REFERENCES

[1] J. D. Taylor, *Grow More Nutritious Vegetables without Soil*, Santa Anna, Calif.: Parkside Press Publishing Co., 1983.
[2] L. Jones, *Home Hydroponics.and how to do it!*, New York, N.Y.: Crown Publishers, Inc., 1977.
[3] R. Sorenson and D. Relf, "Home Hydroponics," Horticulture, Virginia Tech, Virginia cooperative extension, publication 426-084
[4] H. Resh, *Hydroponic Food Production*, 4th ed., santa barbara, calif.: woodbridge press, 1989.
[5] A. G. Ramakant, *Op-Amps and Linear Integrated Circuits*, Fourth Edition, 560 1, 2009.
[6] S. T. Sanamdikar, V. G. Suryawanshi, and S. S. Shete, "Automation in polyhouse using PLC," *IJAIR*, Instrumentation & Control Dept. PDEA's, COEM, Pune, India, 2012.

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