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AUTOMATION OF HYDROPONIC SYSTEM

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ABSTRACT

Hydroponics is a soilless agriculture that is a method of growing plants in water based nutrient rich solution. Hydroponics does not use soil; instead the root system is supported using an inert medium such as perlite, rock wool, clay pellets, peat moss, or vermiculite. The basic premise behind hydroponics is to allow the plants roots to come in direct contact with the nutrient solution, while also having oxygen, which is essential for proper growth. There are six main types of hydroponic system. Those are Wick Systems, DWC, NFT, Flood and Drain, Aeroponics and Drip System. In the NFT type of Hydroponics system the nutrient solution is pumped into the growing tray (usually a tube) and flows over the roots of the plants, and then drains back into the reservoir. This type of Hydroponics system is very susceptible to power outages and pump failures. The roots dry out very rapidly when flow of nutrient solution is interrupted. To overcome this issue, we automate and monitor this system by using Infrared sensors and Arduino so that the level of nutrients can be maintained all the time

INTRODUCTION

Hydroponics is a subset of hydro culture, the method of growing plants without soil, using mineral nutrient solutions in a water solvent. Terrestrial plants may be grown with only their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as perlite or gravel.

History

By 1860 the principles of growing plants in solution is well understood, and satisfactory solutions for supplying nutrients were developed. Soil is the natural habitat for plants. It supplies support, nutrients and water. Where an adequate supply of productive soil is available, growing plants without soil is not practical. However, where good soil is not available, where maintenance of favorable soil conditions is too expensive, or where growth of high-value out-of-season crops is contemplated, growing plants without soil may be desirable. With adequate water supply but where soil is not available, very favorable climates are needed to favor growing plants without soil. Growing plants without soil maybe desirable for health reasons and provides an excellent means of physical or occupational theory for people who cannot lead a full, normal life.

Factors limiting soilless method

Two factors have limited soilless methods of production: first economic considerations and second, commercial grower unfamiliarity with the management of growing without soil. Growing plants without soil is costly and needs expert supervision. The initial cost is very high. This is especially true where material and labour costs are very high. Expert supervision is necessary to cope with the technical difficulties often met with in this method of production.

Hydroponic culture method

This Automated Hydroponic systems automatically delivers nutrients into the water for different crops. The mix of Water and nutrient solution is continuously circulates the water with the help of sprinkler. This system uses less water and fertilizer as compared to soil. Also the system becomes more advanced, more accurate and cost effective so that farmers can use this system in large scale which is a challenge that must be addressed in a future. Overall automated hydroponic system using microcontroller provides more flexible and more efficient operation than manually operated hydroponic system. Hydroponics is method of growing plants using mineral Nutrients solutions in Water without soil. Hydroponics technique is best way to grow vegetables, fruits, plants without soil. Hydroponics can be grown outdoors, indoors even in small space. Hydroponic allow for crop to grow in area where Growing traditionally has been problem and the place where soil is poor and where water is minimum and farm land is too expensive. In Hydroponics techniques plants are placed in growing medium and nutrients are delivered directly to roots. Plant may grow with their roots in nutrient solution only or inert medium. Hydroponic technique is Batter, faster way to grow plant than the growing plants in soil. Hydroponic provide better, more nutritional result with the efficient Use of water and fertilizer.

Hydroponics allow farmers to grow more food in less space as compared to traditional Soil gardening. Vegetables, plants and flower can be grown on the roof of houses. Fruits grow in shorter period of Time as compared with soil system. It is also called as “controlled environment agriculture” since raising plants hydroponically requires control of environmental factors such as light intensity and duration temperature, humidity, pH of the solution and mineral nutrients. Hydroponics does not use soil, instead the root system is supported using an inert medium such as perlite, rockwool, clay pellets, peat moss, or vermiculite. The basic premise behind hydroponics is to allow the plants roots to come in direct contact with the nutrient solution, while also having access to oxygen, which is essential for proper growth. India is an Agricultural country but now a days, India is facing many problem in agricultural sectors due to the drought, flood, and insufficient raining. Due to industrialization the land is in trouble and cost required for this is much more. In conventional hydroponic system operator is required to handle the all process such as, to give water to plants at regular intervals. This includes some requirement of manpower, periodic observation and

also it is time consuming process. To overcome these drawbacks we have done automation in our study.

Existing system

Hydroponics is a subset of hydro culture, the method of growing plants without soil, using mineral nutrient solutions in a water solvent. Terrestrial plants may be grown with only their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as perlite or gravel. By 1860 the principles of growing plants in solution is well understood, and satisfactory solutions for supplying nutrients were developed. Soil is the natural habitat for plants. It supplies support, nutrients and water. Where an adequate supply of productive soil is available, growing plants without soil is not practical. However, where good soil is not available, where maintenance of favorable soil conditions is too expensive, or where growth of high-value out-of-season crops is contemplated, growing plants without soil may be desirable. With adequate water supply but where soil is not available, very favorable climates are needed to favor growing plants without soil. Growing plants without soil maybe desirable for health reasons and provides an excellent means of physical or occupational theory for people who cannot lead a full, normal life. Two factors have limited soilless methods of production: first economic considerations and second, commercial grower unfamiliarity with the management of growing without soil. Growing plants without soil is costly and needs expert supervision. The initial cost is very high. This is especially true where material and labor costs are very high. Expert supervision is necessary to cope with the technical difficulties often met with in this method of production.

Proposed system

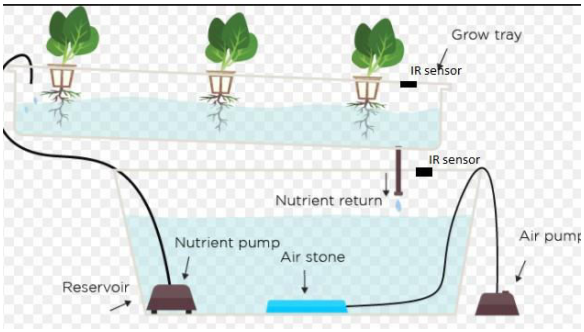
Technically hydroponics system is termed as water culture only. The plants are grown with their roots partially submerged in a solution containing nutrients for plant growth. Plants are held upright on wire or on wooden or metal supports. The solution is contained in tanks which vary in size. The width and length of the tank depend upon the location of its use. Tank must be made of metal, glass, wood, plastic, concrete, or other suitable materials. Glass and translucent plastic containers should be painted to eliminate light to prevent growth of algae in the solution. Solution in tank should supply nutrients necessary for plant growth. The solutions may be made from commercially available fertilizer salts, chemically pure salts, or ready-made mixtures.

Nutrients	Grams/Litre	Milligrams/Litre	Ounces /100gals
Monopotassium phosphate	0.14	140	2.0
Potassium nitrate	0.55	550	8.0
Calcium nitrate	0.88	880	12.0
Magnesium sulphate	0.71	710	10.0

Table 1 Nutrient mixtures

To overcome expert supervision we planned to automate the system in which leaf sensors are used to detect the moisture level of plant which is placed

anywhere on the stem. When leaf sensor detects low moisture content level on the plant, the motor which is placed inside a nutrient solution containing container is made to on and then the nutrient solutions are filled in the plant growing container. This process gets repeated whenever the nutrient solution for the growth of the plants becomes low. As soon as the nutrient solution container gets emptied we can simply fill it manually reducing the fulltime supervision of plants. The simplified diagram is as follows



REQUIREMENTS

Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

Arduino specification

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Power of Arduino components

Microcontroller ATmega328

○Operating Voltage 5V

○Input Voltage (recommended) 7-12V

○Input Voltage (limits) 6-20V

○Digital I/O Pins 14 (of which 6 provide PWM output)

○Analog Input Pins 6

DC Current per I/O Pin 40 mA

oDC Current for 3.3V Pin 50 mA

oFlash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader

oSRAM 2 KB (ATmega328)

oEEPROM 1 KB (ATmega328)

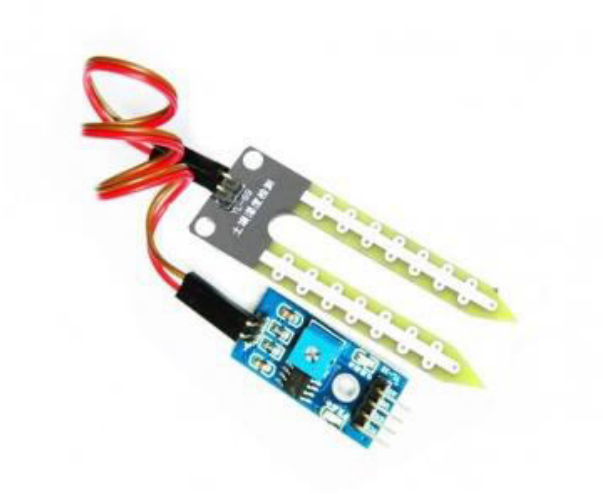
oClock Speed 16 MHz

Moisture Sensor

A moisture sensor can read the amount of moisture present in the soil surrounding it. It's a low technology sensor, but ideal for monitoring an urban garden, or your pet plant's water level. This is a must have tool for a connected garden! This sensor uses the two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance).

It will be helpful to remind you to water your indoor plants or to monitor the soil moisture in your garden. The IO Expansion Shield is the perfect shield to connect this sensor to Arduino.

Moisture sensor uses Immersion Gold which protects the nickel from oxidation. Electroless nickel immersion gold (ENIG) has several advantages over more conventional (and cheaper) surface platings such as HASL (solder), including excellent surface planarity (particularly helpful for PCB's with large BGA packages), good oxidation resistance, and usability for untreated contact surfaces such as membrane switches and contact points.



Ultrasonic sensor

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work are Using IO trigger for at least 10us high level signal and the module automatically sends eight 40 kHz and detect whether there is a pulse signal back. if the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2,

LCD

A **liquid crystal display** is a flat panel display, electronic visual display, or video display that uses the light modulating properties of

liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content which can be displayed or hidden, such as set words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as DVD players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in nearly all applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.

The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolete for most purposes

- LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.
- A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

1) CONCLUSION

As a result, implementing the above system will reduce the complete supervision on hydroponic system. It gives the expert much time to concentrate on other duties without any deviation. Even if the cost gets increased on developing this, it gives the grower a satisfaction and relaxation as the complete supervision is reduced.

REFERENCE

1. Douglas, James S., Hydroponics, 5th ed. Bombay: Oxford UP, 1975.
2. J. Benton, Jones (2004).Hydroponics: A Practical Guide for the Soilless Grower(2nd ed.). Newyork: Taylor & Francis.
3. Kumar, Ramasamy Rajesh; Cho, Jae Young(2014)."Reuse of hydroponic waste solution". Environmental Science and Pollution Research.
4. Schaefer, Karen."Canadian greenhouse industry seeks methodsto reduce pollution into Lake Erie". Marketplace.org. Marketplace.org. Retrieved 17 January 2017.

5. Barbosa, Guilherme (16 June 2015)."Comparison of Land, Water, and Energy Requirements of LettuceGrown Using Hydroponic vs. Conventional Agricultural Methods". International Journal of Environmental Research and Public Health. Retrieved 5 December 2017.
6. Adams P, Graves CJ, Winsor GW (1989) some responses of cucumber, grown in beds of peat, to micronutrients and pH. J Hortic Sci 64:293-299
7. Adamson RM, Maas EF (1971) Sawdust and other soil substitutes and amendments in greenhouse tomato production. Hortic Sci 6(4):397-399
8. Berry WL, Wallace A, Lunt OR (1977) Recycling municipal wastewater for hydroponic culture. Hortic Sci 12:186
9. Bently M (1959) Commercial Hydroponics (2nd edn). Benton Jones J (1983) A guide for the hydroponic and soilless culture grower. Timber Press, Portland, 124 pp, Johannesburg, 750 pp
10. Adamson RM, Maas EF (1976) Amount and kind of growth media in soilless greenhouse tomato production. Hortic Sci 11(3):212-213