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Application of Unsupervised Algorithm for DWC using IOT

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Abstract
Computing and Mechanical advancements today make the science as a part of our life, inducing technology into Agriculture will result in an efficient Agro-product. Our paper intends in designing a sway system for the progression of supplements of hydroponic plants, consequently utilizing Arduino microcontroller and constrained by a System. With the next support of an Arduino UNO R3 microcontroller to naturally control the progression of supplement arrangement with rationale. The sensors like MQ135 gas sensor, DHT22 temperature and humidity sensor, PH and EC sensors are related to Arduino UNO R3 board, is connected with the system. The generated values that are recorded should be stored into the database employing a process called "Data Acquisition". A comparative report is finished with generated and standard values of plant germination for the improved development of the hydroponic plant.

Keywords**:** *DWC(deep water culture), DFC(deep flow culture), NFT(nutrient film technique), pH(potential of hydrogen), EC(electric conductivity), PWM(pulse width modulation), USB(universal serial bus), ICSP(in circuit serial programming), LED(light emitting diode), DATA ACQUISITION, RB(rice husk biochar), PL(alone or in combination with pertile).*

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1. Introduction

A water culture system is another amazingly straight forward system to setup. In this system, the plants are put into a Styrofoam stage that sits directly over the store holding the arrangement of water and supplements. A bubbler pneumatic machine is added to the store to convey oxygen to the plant roots. This system is for water-hungry plants, however isn't so appropriate for all the more extensive plants, for example, tomatoes. The deep-water culture system is an other age approach which delivers high return crops and where we can get an examination on its development rate time-to-time.

With the advancement of software engineering, particularly on microcontroller, the Deep watering system for plant hydroponics is truly conceivable to do. The Arduino UNO as the cerebrum of the instrument will screen the hydroponics plants, helped by the sensors like MQ135 gas sensor, DHT22 temperature and humidity sensor, PH and EC sensor are associated with the system. These sensors get the data, which are the main elements for development of a specific plant. Various plants have various estimations of temperature, PH, EC, humidity level, which are to be maintained for healthy growth and good yield. All of the data will be sent to the Arduino Serial Monitor and send to excel sheet by Arduino Data Logging.

2. Related Work

In some writing, Hydroponics is perhaps the best option for plants on tight land. There have been a few papers publicized in a few journals in a hydroponics system lately; they recommend how hydroponic plant system work. Hydroponics refers to the technique of growing plants without soil and instead placing the roots in a nutrient solution [1].Hydroponics, strictly defined, allows for no substrate or rooting media and includes techniques such as raft culture, including Deep Water Culture (DWC) and deep flow culture (DFC), nutrient film technique (NFT), and several variations of each [2]. In an article appearing in Science in 1937 Gericke coined the

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term hydroponics by combining the Greek words hydro and ponos meaning "water" and "to work", respectively [3]. This system also can achieve higher productivity per growing area which also translates to better land utilization [4]. A deep-water culture system is another viable system of soilless agriculture system that maintains the plants in a very controlled root-zoned atmosphere [5]. Another paper discusses the event of an automatic microcontroller system utilized in deep water culture this paper provides a basic idea of hydroponic water culture. This paper discusses the techniques used to measure pH values from the sensors and maintaining the water and nutrient levels in the hydroponic reservoirs [6]. To run this project, the program module has been embedded into this hydroponic system [7]. Many studies of large-scale hydroponic, aeroponics and aquaponics production showed the potential pragmatic role for those new technologies within the sustainable food security [8]. Red lettuce plants developed in RB substrate were diminished by 49% on normal contrasted with those plants developed in PL substrate [9]. The results also indicated that use of PL + RB hydroponic substrate may be another and effective technology for the higher management of unwanted algal growth in nutrient solutions and high production of leafy vegetables [10].This examination planned to give a knowledge into yield, mineral take-up, and nature of basil, Swiss chard, and rocket microgreens developed in a hydroponic system [11]. The major disadvantages are the troubles of giving an air supply (oxygen) for the plant roots and appropriate support and root harbor for the plants [12]. In some cases, particles found in water plant supplements, for example, SO4. Ca, Mg and B. Concentration of these plant supplements ought not to surpass the concentration referenced in the standard nutrient solutions of supplement 6. In a shut framework focus in crude water should be lower than in an open system [13]. The productivity of the proposed instrumentation was assessed by concurrent a similar sort of lettuce (Vanda) in two unique ways, hydroponics in nursery controlled with the created gadgets, and developed ordinarily in soil, received as referential [14]. Plants developed in the spring season displayed a lower yield, development (all-out dry biomass and leaf territory file), leaf mineral substance (N, K, and Mg), absolute carotenoids and water use effectiveness than those developed in the mid-year season yet were affected decidedly by some quality parameters (the higher substance of glucose and fructose and lower nitrate content) [15].

3. Hydroponics Nutrition Plants Systems and prototype

In Deep Water culture system, the seeds of the plant are taken in Buoyant pads in the plastic tope which is loaded up with supplement arrangement and associated with water dissemination siphon and an air pipe which sends oxygen to the roots. The sensors like MQ135 gas sensor, DHT22 temperature and humidity sensor, PH and EC sensor are associated with the Arduino UNO board. These sensors give the data, which are the main components for development of a specific plant. Various plants have various estimations of temperature, PH, EC, humidity level, which are to be kept up for a solid development and great yield. These sensors are associated with Arduino Uno board, that is associated with the PC. The values which are getting recorded will be imported to excel sheet.

A. Architecture of the system

From the below figure-3.1,The modules that aided in building the engineering of the system are clarified. The Arduino UNO has 14 programmed input and output pins during which they're 6 analog inputs, a16MHz oscillator, 6 input/output pins are frequently utilized as PWM outputs, a USB connection, an influence jack, an ICSP header, it countenances the Atmega328p microcontroller programmed as a USB to serial converter. The DHT22 is a minimal effort advanced temperature and humidity sensor with a solitary wire computerized interface. It uses a humidity sensor to quantify the encasing air and spits out a computerized signal on the data pin. LEDs are frequently controlled and tweaked to any ideal shading temperature for sustaining the plants that are developed practicing hydroponics. Environmental ambiance can be replicated by the use of an LED grow light system. When the greenhouse that the plant is placed in is too dark, the LED lights get switched on automatically aspert her equirement of the plant. This enables the plant to grow faster and better. The control of pH is extremely important, not only in hydroponics but in soil further. Plants lose the potential to soak up different nutrients when the pH differs. Different plants have a specific pH that's optimal for them, generally, though most plants prefer a slightly acid growing environment. a perfect pH level is between 5.5 and 7. Changing the pH level too quickly isn't an honest idea as this can stress the plant out an excessive amount of. A pump is employed here to regulate the speed of the flow of the water through the roots of the plant. The water pump will be programmed to show on and off in step with the wants of the plant so it grows faster and more effectively, this is done employing a relay switch. just in case the plant moisture content is a smaller amount, the pump will be switched on so water is circulated and also the moisture content increases. Electrical conductivity is useful in hydroponics for the reason that the conductivity of a mixed solution is directly in proportion to the number of salts (in this case, the salts are our nutrients) dissolved in it, so, if a solution has more salts dissolved, it has a higher conductivity.

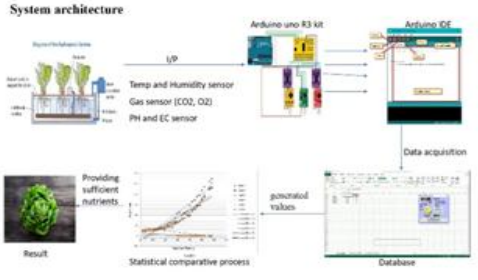

Figure 3.1: Architecture of the System

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B. Program Module

The program module to support this project has been embedded in Arduino UNO microcontroller is presented in the below figure-3.2

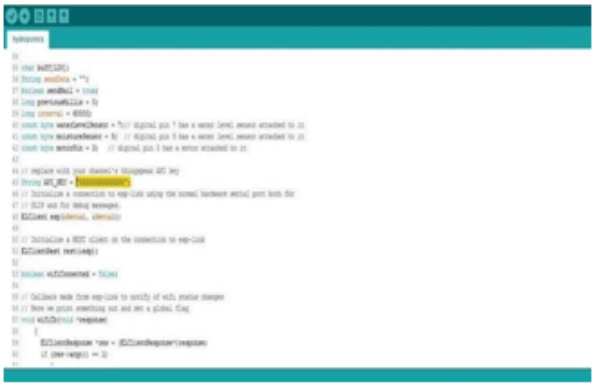
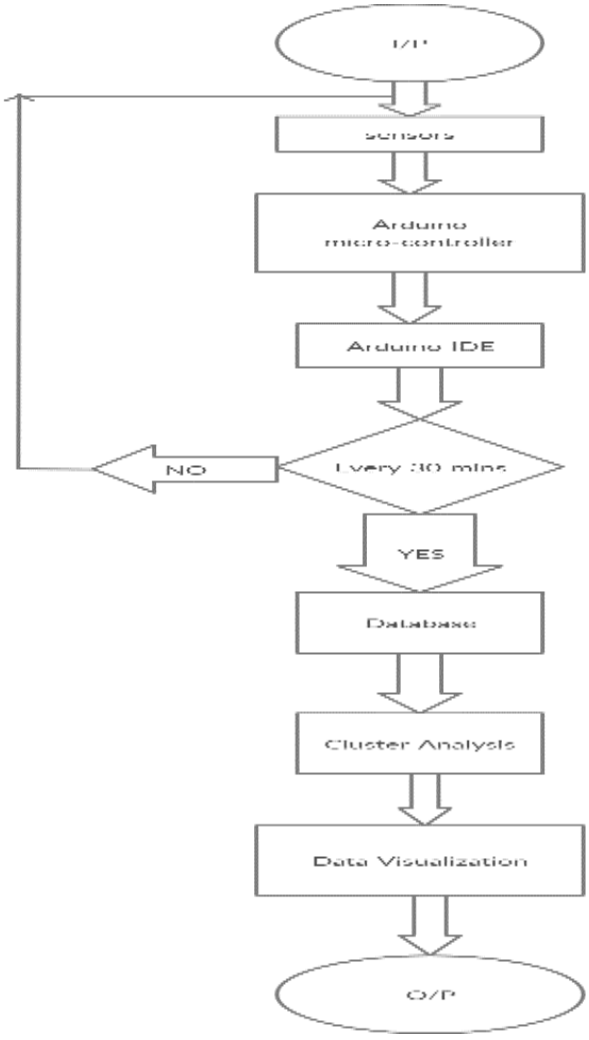


Figure 3.2: Program Module

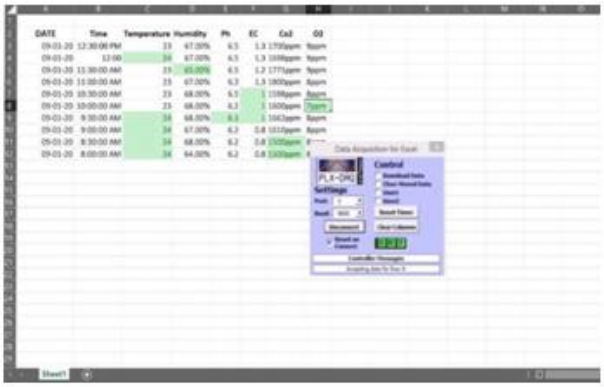
C. Flowchart



Flow chart of s/w implementation

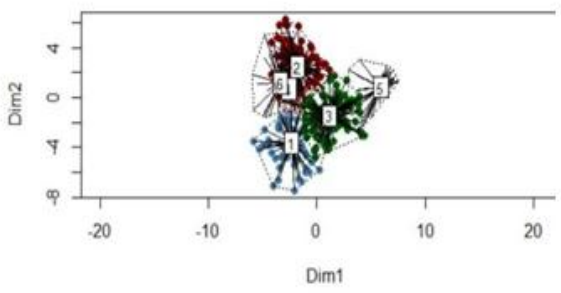
4. The Experimental Analysis

In Deep Water culture system, the seeds of the plant are taken in Buoyant pads in the plastic tope which is filled with nutrient solution and connected with a water circulation pump and an air pipe that sends oxygen to roots. The sensors like the MQ135 gas sensor, DHT22 temperature and humidity sensor, PH and EC sensor are connected to the system. These sensors give the information, which are the deciding factors for the growth of a particular plant. Different plants have different values of temperature, PH, EC, humidity level, which are to be maintained for healthy growth and good yield. These sensors are connected to the Arduino Uno board, which is connected to pc. The values which are getting recorded should be imported to an excel sheet which is done by a method called "Data Acquisition", This acquisition is done by Arduino Data Logging.



Cluster analysis of DWC lettuce data

After data logging, Here we are performing Cluster analysis or clustering, which is an Unsupervised Learning Technique that consists in grouping a set of experiments (observations) in such a way those elements having a place with the indistinguishable gathering are progressively comparative (in some mathematical sense) to each beside those inside different gatherings. The most common centroid based clustering algorithm is the so-called K-means.



Timeline series graph

As we can see all the 6 variables are closely packed in 6-Dimensional Space is represented in 2-Dimensional

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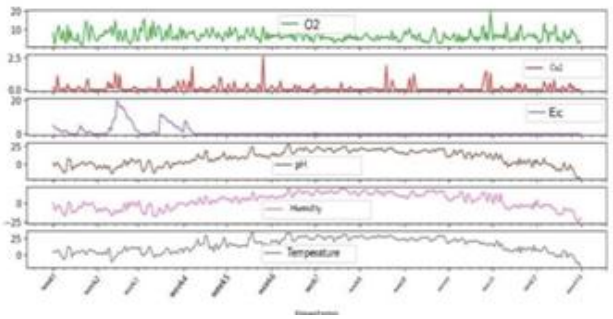
space, we can further visualize the entire data in time series for every variable below.



Timeline series graph

By visualizing the above data, we can observe each variable data is following a Linear trend with some noise. This noise is the fluctuations in variable data [i.e., a sudden jump in temperature or in PH or EC, etc.]. And with this we can say that, by maintaining a perfect Linear Trend in graph i.e., to maintain the variable parameter values for better growth of the plant. Hence, by Deep Water Culture [DWC] system we can produce high yield crops faster than the crops which grow in soil.

Graph of growth rate versus time

5. Future Enhancements

Diagnosis the plant fettle using AI/Deep learning. where now a days we use our mobile phones to look at several things and therefore the Artificial Intelligence will play a key role within the process. SO, this helps us to develop an application on the premise of deep learning to check the plants health condition.

6. Conclusions

A system for hydroponic plant water system utilizing Arduino UNO Microcontroller is exhibited during this paper. The sensor results are sent to the Arduino UNO microcontroller and to excel sheet. Similarly, the temperature setting has been effectively progressed nicely. the area temperature will be resolved. In our examinations, it had been indicated that the blend of water and supplements was naturally moved to plant established in hydroponic plastic tope. For future research, it's normal that future designers can identify corrosiveness levels of pH arrangement, oxygen, and different aspects. As this venture is no scale, so it's relied upon to be created to create it on a more extensive scale. So, it's normal that in innovative examine make the device and therefore the system able to make data board with the opposite working system that may be utilized as a regular system.

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