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Hydroponic Framing Monitoring System

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Abstract: ***As we see population is increasing in cities due to which requirement of fresh food to ensure a healthy population. So, to get this fresh food has to travel a long way to reach the urban area population. To reach the urban areas we lose two thing first quality and nutrition and second is fossil fuel cost for transportation and storage. So, we are purpose system which are vertical hydroponic farming (VHF) also known as modern agriculture. The main objective of this system is that the plants can grow by using efficient water and land. So, by this people in urban areas can grow plants in there balconies or on roofs etc.***
Keywords: Arduino UNO, pH Sensor (also known as pH Kit), DHT22 (also known as Temperature + Humidity Sensor), Node-MCU, Water level Sensor.

I. INTRODUCTION

In daily changing advancing world people need to adapt to new reliable techniques for framing, one of which is Hydroponic Framing. Hydroponics is a type of horticulture and subset of hydroculture that involves growing plants without soil using mineral nutrient solutions in aqueous solvents.

Many of us don't know that soil is not providing the required nutrients to the plants rather it provides roots with a structure to the plants up-right. Plants basically require three things: Water (Oxygen), Air(Carbon), Food(Nutrient Solutions). The hydroponics system makes it easy to grow plants faster and healthier without any diseases caused by soil.

As we know real-time monitoring places a key role in day-to-day life, especially in industries and the agricultural sector. Earlier traditional agriculture was dependent upon mechanical instruments (Tractors, Harvesters, etc) and laborers. Hence, the hydroponic system is the ultimate technique of growing plants for framers as well as home gardeners who are seeking high yield in time and small cultivating space.

We are trying to make things easier using modern techniques by using devices such as Arduino UNO, Node-MCU, and various sensors like pH Sensor, Water level sensor, Temperature, and Humidity Sensor, Turbidity Sensor, Flow Sensor, and Buzzer is begin provided to indicate the requirement of nutrient solution.

In this context, we are interfacing all the sensors with the microcontroller (Arduino UNO) which will take the required input for a sensor that will be displayed on the LCD screen and by interfacing the microcontroller, with Node-MCU we will be getting real-time data on IoT Cloud (Application Software).

II. LITERATURE SURVEY

The earliest published work on growing terrestrial plants without soil was the 1627 book Sylva Sylvarum by Francis Bacon, printed a year after his death. Water culture became a popular research technique after that. In 1699, John Woodward published his water culture experiments with spearmint. He found that plants in less-pure water sources grew better than plants in distilled water. By 1842, a list of nine elements believed to be essential for plant growth had been compiled, and the discoveries of German botanists Julius von Sachs and Wilhelm Knop, in the years 1859-1875, resulted in development of technique of soilless cultivation. Growth of terrestrial plants without soil in mineral nutrients solutions are called solution culture. It quickly became a standard research and teaching technique and is still widely used. Solution culture is now considered a type of hydroponics where there is no inert medium. Growth of terrestrial plants without soil in mineral nutrients solutions are called solution culture. It quickly became a standard research and teaching technique and is still widely used. Solution culture is now considered a type of hydroponics where there is no inert medium. Plants which are not traditionally grown in a climate would be possible to grow using a controlled environment system like hydroponics. NASA has also looked to utilize hydroponics in the space program. Ray Wheeler, a plant physiologist at Kennedy Space Center's Space Life Science Lab, believes that hydroponics will create advances within space travel. He terms this as a bioregenerative life support system.

Summary Of Literature Survey: From the above literature survey, it can be summarized that it is possible for

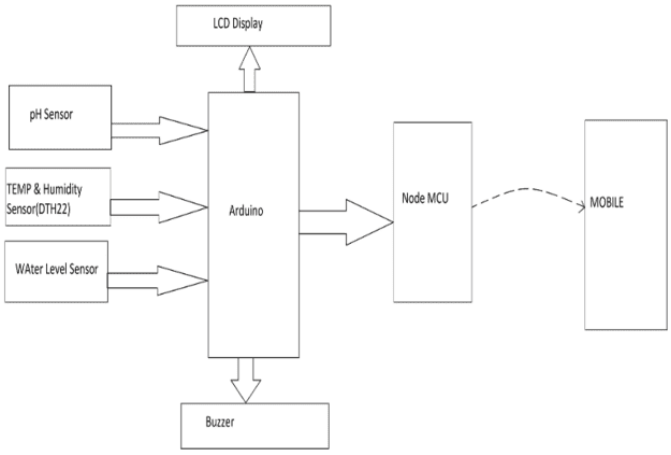
The plan is to reduce the use of water, increase the productivity and to supply ideal nutritional environment to the plant using smart monitoring system.

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III. METHODOLOGY

A. *Block Diagram*



B. *Components Used*

1) *ESP8266 Wi-Fi module:* Node MCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. The ESP-12E module on the Node MCU ESP8266 development board contains an ESP8266 chip with a Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor runs on a configurable clock frequency of 80MHz to 160MHz and supports RTOS. To store data and programs, the Node MCU contains 128 KB of RAM and 4MB of Flash memory. It is perfect for IoT projects due to its high processing power, built-in Wi-Fi / Bluetooth, and many such capabilities. A Micro USB jack and VIN pin can be used to power Node MCU (External Supply Pin). Here we use ESP8266 Wi-Fi Module as our primary microcontroller where the Temperature Sensor, Rain Sensor and the Pressure sensor is interfaced with the Wi-Fi Module.[9]



Fig1: ESP8266 Wi-Fi Module

2) *Dht22 Temperature Sensor:* The DHT22 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins are needed). It's fairly simple to use but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old. Simply connect the first pin on the left to 3-5V power, the second pin to your data input pin, and the rightmost pin to the ground. Although it uses a single wire to send data it is not Dallas One Wire compatible! If you want multiple sensors, each one must have its own data pin.[10]

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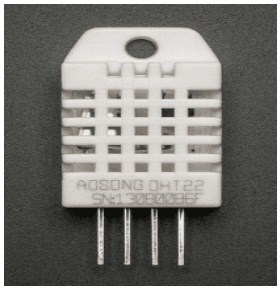


Fig 2: DHT22 Sensor

3) *PH Sensor:* Here, we have an Industrial Grade Analog PH Sensor Kit. This probe can be used with this pH sensor module. The Analog pH Sensor Kit is specially designed for Arduino controllers and has a built-in simple, convenient, and practical connection and features. It has an LED that works as the Power Indicator, a BNC connector, and a PH2.0 sensor interface. To use it, just connect the pH sensor with the BND connector, and plug the PH2.0 interface into the analog input port of any Arduino controller. If pre-programmed, you will get the pH value easily. Comes in a compact plastic box with foams for better mobile storage.

a) Applications

- Water quality testing
- Aquaculture

b) Specifications

Input Supply voltage (VDC)	5
Module Size (mm)	50 x 47 x 16
Measuring Range	0 14 PH
Measuring Temperature	0 50
Accuracy	0.01 pH
Response Time	1min
Cable Length (cm)	75
pH sensor size (mm)	150, 12

c) Packageincludes

- 1 x pH probe with cable and BNC connector.
- 1 x pH sensor circuit board.[11]

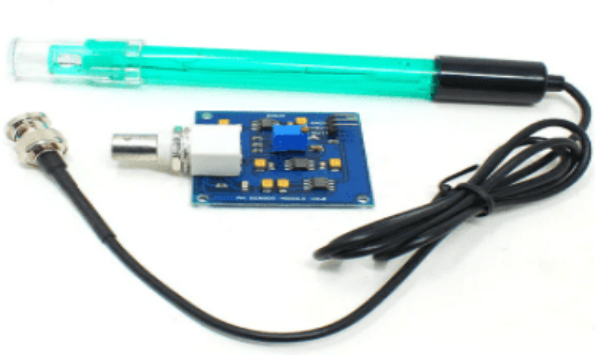


Fig 3: pH Sensor

4) *Water Level sensor:* The sensor has a series of ten exposed copper traces, five of which are power traces and five are sense traces. These traces are interlaced so that there is one sense trace between every two power traces. Usually, these traces are not connected but are bridged by water when submerged. There's a Power LED on the board which will light up when the board is powered. The working of the water level sensor is pretty straightforward. The series of exposed parallel conductors, together acts as a variable resistor (just like a potentiometer) whose resistance varies according to the water level. The change in resistance corresponds to the distance from the top of the sensor to the surface of the water.The resistance is inversely proportional to the height of the water: The more water the sensor is immersed in, results in better conductivity and will result in a lower resistance. The less water the sensor is immersed in, results in poor conductivity and will result in a higher resistance. The sensor produces an output voltage according to the resistance, which by measuring we can determine the water level.
Water Level Sensor Pinout
The water level sensor is super easy to use and only has 3 pins to connect.

a) S (Signal) pin is an analog output that will be connected to one of the analog inputs on your Arduino.

b) + (VCC) pin supplies power for the sensor. It is recommended to power the sensor with between 3.3V – 5V. Please note that the analog output will vary depending on what voltage is provided for the sensor.

c) – (GND) is a ground connection.[12]

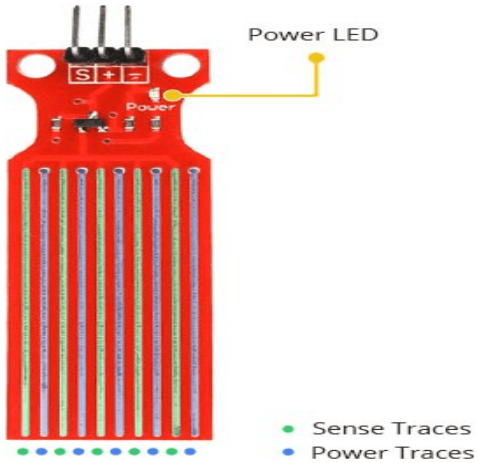


Fig 4: Water Level Sensor

5) *LCD:* LCD is used to display the final output of the system. We are using a 16x2 LCD Display in our system which is interfaced with the Node MCU.

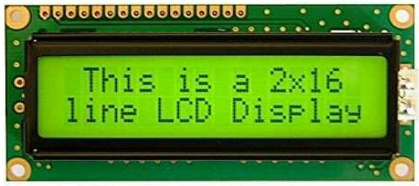


Fig 4: LCD 16x2 Display

6) *Arduino:* Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC BY-SA license, while software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially from the official website or through authorized distributors.Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal_Serial_Bus (USB) on some models, which are also used for loading programs.

The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the Arduino language, inspired by the Processing language and used with a modified version of the Processing IDE. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command line tool developed in Go. The Arduino project began in 2005 as a tool for students at the Interaction Design Institute Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.

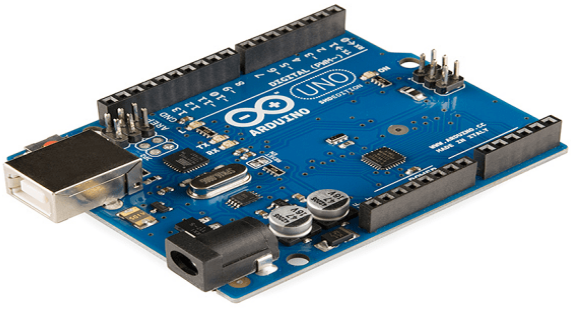


Fig. 5: Arduino

IV. WORKING

In our proposed system, we are measuring the current weather conditions in Temperature, Humidity, Pressure and Rain Probability. Temperature Sensor detects the Temperature and Humidity and sends the Temperature data to the Microcontroller. Similarly, the Pressure Sensor and Rain Sensor will send the current Pressure conditions and Rain Probability to the microcontroller. The programming is done using the Arduino IDE. The final results can be viewed through the serial monitor on Arduino. This is done to verify whether the results on the web server are true or not. All the sensors are interfaced with the Node MCU with the sensors. Node MCU is a Wi-Fi Module which helps all the output to be displayed on a Web Server. This web server can be accessed by a unique IP Address on any web browser application where all the relevant information will be displayed. All this data is also displayed on a LCD Display so that if one cannot access the web server via the Internet, they can view the current weather conditions through the LCD.

V. RESULTS

In the result part we the out from the sensors which are humidity, temperature, and pH values. As we have grown the chill plant so we have to give all the necessary conditions required for that plant to grow. Firstly we grow the plants in soil for 5-7 days so that they get roots and require some height for them to pore in the model.

After that, we have pore these plants into the model and give the nutrient solutions to grow and all check the reading on the LCD. The reading is a little bit fluctuating. After all these the reading which we get is sent on the Think Speak by using the Node MCU. On Think Speak we get the graphs of the data which we have sent.

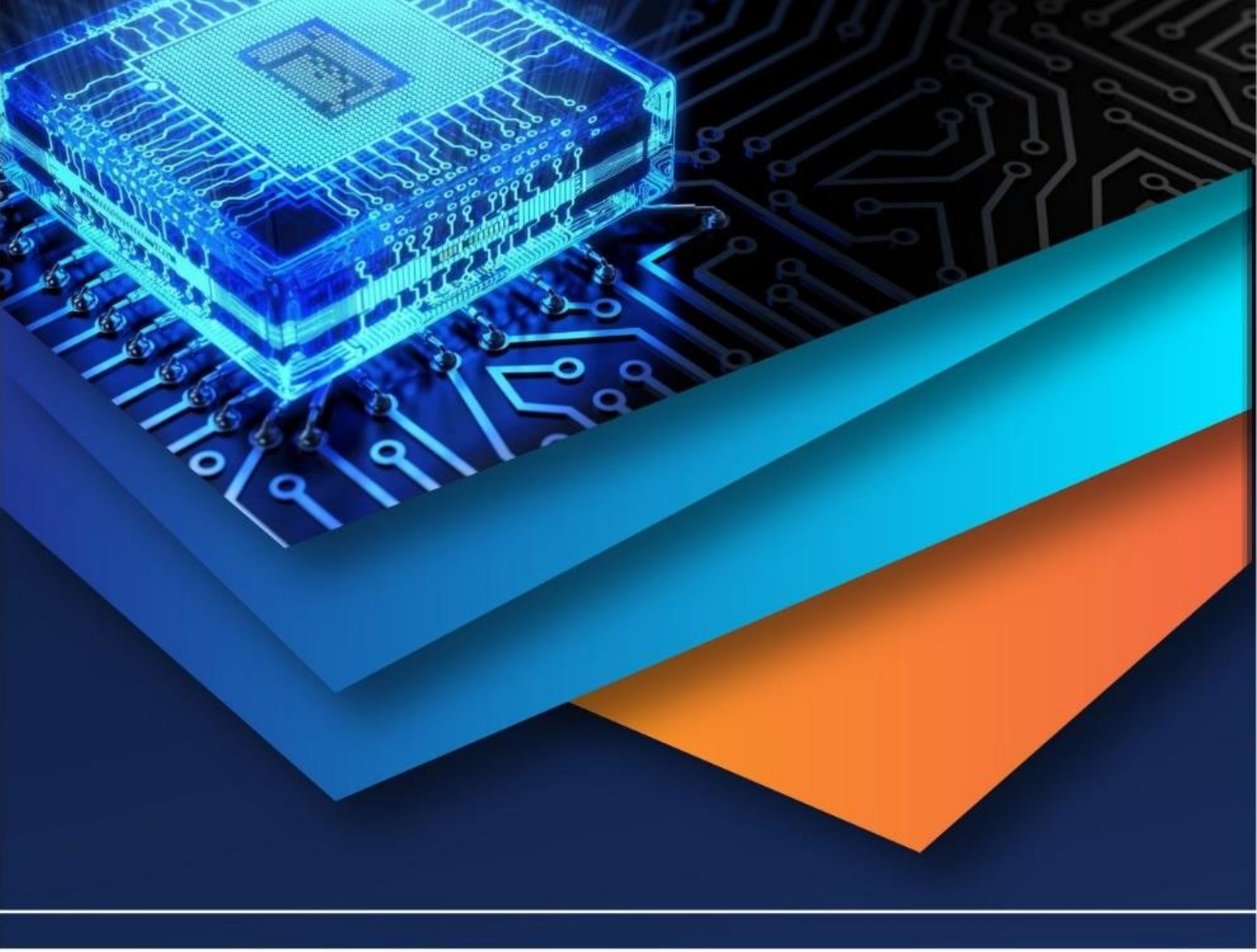


VI. CONCLUSION

As the population increases day by day so the requirement for food also increases. So we have started using this type of framing so that in the future we don't have to face the issues of food scary. Because of the evolution in the technologies. we can use these technologies. This is one of the simplest models anyone can make in the cheapest way. As we get the output on LCD as well as on the mobile by Think Speak app. With this type of agriculture, we can actually control the growth of plants and make them healthier too. As many countries started using this type of framing because they have scarce plants, water, and other nutrients also which requires for agriculture. Also, India has started this type of agriculture and hopes we will grow future in these field and make sure there will not be any shortage of food.

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