

Automation In Hydroponic Farming Eco-System: A Review

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Abstract –Smart Farming or agriculture is a basic requirement of any nation. Scientific and technological interventions are required to bring more produce in a healthier way to every household. From last ten years, few existing systems are working for reducing the agriculture water use. So, modern technology is necessary to resolve this problem and to support better crop-watering method. Hydroponics is an interesting new format that uses less area than other methods. Although hydroponics uses less space than conventional planting, it can provide many products to the farmer. The hydroponics farming ecosystem is made to support non-professional farmers, city people who have limited knowledge in farming and people who are interested in doing vertical planting in very small areas in the city such as building tops, balconies of small rooms in apartments, and in small office spaces. In this paper we will propose a Hydroponic Farming Ecosystem (HFE) that uses IoT devices to monitor humidity, nutrient solution temperature, air temperature, PH and Electrical Conductivity.

Keywords-Smart Farming, Hydroponics, IoT.

I- INTRODUCTION

If the traditional method of farming is replaced by advanced methods like hydroponics in which water is the main medium which will carry the essential nutrients to the crops, the produce can definitely be improved. Also since soil is not being used almost 80% of the total pest attacks possible can be eliminated. 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. We have to control are the PH value or concentration and Electrical Conductivity (EC) of the nutrient solution. However, use of technology in the field of agriculture plays an important role in increasing the production as well as in reducing the man power.

II- EXISTING SYSTEM

It consists of multiple sensors, an Arduino UNO board, a Wi-Fi Shield, a Relay, an MQTT Broker, a Server, a Database and mobile user. The Arduino UNO is the main microcontroller of the system which receives data from the sensors then passes the data to other parts [1].

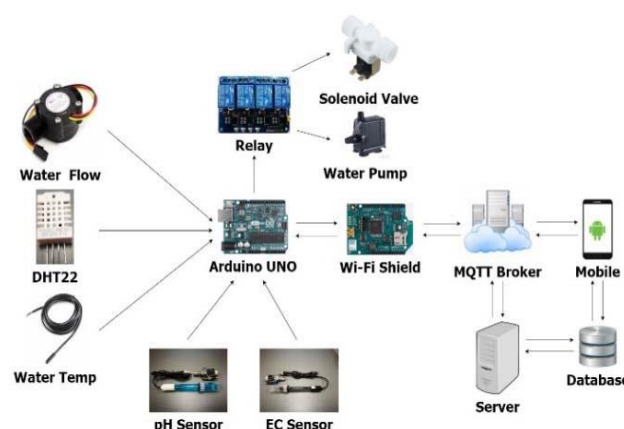


Fig.1. The system's architecture

Figure 1 shows the architecture of the HFE which The Data from sensors will be combined to one string then converted to JSON. After that, the microcontroller will send that string to the server through the MQTT Broker

(A connectivity protocol for the IoT). Although the Arduino Wi-Fi board has a Wi-Fi module, it couldn't be used because the connection was too unstable and unreliable. Therefore, a dedicated Wi-Fi module had to be added, so a Wi-Fi Shield was used. The MQTT Broker is an intermediary that sends and receives data [2,4,5]. It has 3 functions. First, the MQTT broker sends data directly to the mobile application. Second, the MQTT Broker will send information to the server. Third, it will receive commands from the mobile app or server then send them back to the sensors. The server is used for processing and saving all values in the database.

The authors mentioned that [3], now days even when the farmers are gaining more profits by producing the quality product, effects of the global warming creates uncontrolled environment. Ultimately the outcome is unmatched with customers' requirement. Therefore planting in a greenhouse is easy to maintain and to control important factors such as light, temperature, and humidity. Using of sensors coming in a greenhouse as Wireless Sensor Networks System are one efficiency of technology used in agricultural development by sending data to the cloud and controlling values such as temperature, light, etc. The results of this study will be useful for the farmer and related organizations applying in the farm. Various challenges in agricultural domain are identified. The architecture of the challenges is mentioned, knowledge based structure have various details about agriculture, flow, various input such as market availability, geospatial information and weather prediction. Monitoring system contains modules like remainder, monitoring plant growth in various stages, irrigation planner, and the water need of a plant per day with devised algorithm's help.

Aquaponics is a system [4] which is a junction of aquaculture and hydroponics, in which the waste produced by the aquatic creatures are passed as nutrients to grow plants hydroponically, which in turn purifies the water. This system can be made use of to produce organic food to match the ever-growing demand for food in the world. Since, the system continuously recycles the water used; the quality of water must be constantly monitored at regular intervals. Manually doing this task can be very tiring. Hence, Internet of Things (IoT), considerably reduce the human intervention in the system and also improve the efficiency of the system. The latest technologies such as Internet of Things can help in implementing this system in urban areas like smart cities where traditional farming is not feasible and produce locally grown organic food. The information collected by the sensors is accessed remotely by using the Internet of things. Authors developed a compact hydroponic planter and are conducting cultivation

experiments to realize an agricultural service industry that uses vacant spaces in urban areas. In order to provide a full-fledged cultivation method for fruit and vegetables to beginners in agriculture, a low-cost sensor module and a planter with an integrated remote-control system have been developed. MQTT, a lightweight protocol for IoT is used to monitor sensor data and to control a pump. Data is securely encrypted using TLS/SSL. In addition to monitoring sensor data, a USB-connected camera-based still-image photography function with motion detection is included. We are also enhancing the interfaces to support AI speakers as well as smartphones and PCs.

Authors [5] developed a sensor module for a hydroponic cultivation system to expand a new type of enjoyable agriculture into urban areas as a service industry. In order to reduce costs of the system, general purpose microcomputer boards, Arduino and Raspberry Pi, are used as an MQTT client and server, and a remote management system was built using open source libraries and low-bandwidth communication services. They are also developing various service businesses for urban smart agriculture, and expect to report on them in near future.

In [6], authors have mentioned that, it is important that modern farmers need to be equipped with precise management and monitoring of the crop system with access to the scientific data about the field environment to execute intelligent and informed decisions in time. They have developed a smart hydroponic system with LED lighting technology enabled by IoT system. Plants were hydroponically cultured under various treatments and morphological parameters were measured and characterized. The plants treated with blue supplementary LED light resulted in greater accumulation of biomass, leaf density, leaf area and pigment content. IoT devices and software applications were incorporated to transmit and display of system information online. The system was successful in archiving data real time for end user access. In smart urban farming, crop monitoring and yield are of paramount importance. This technology proved suitable and beneficial in urban setting for year round crop production with precise plant management.

III- PROBLEM STATEMENT

The previously used system consists of Arduino UNO board. The Arduino Wi-Fi board has a Wi-Fi module, it couldn't be used because the connection was too unstable and unreliable. Therefore, a dedicated Wi-Fi module had to be added, so a Wi-Fi Shield was used and system becomes bulky. Arduino runs only one program again and again, Also Arduino requires external hardware

to connect to the internet and this hardware is addressed using code. Arduino only uses C/C++ and Arduino.

PROPOSED SYSTEM

Our system is using raspberry pi. The proposed work deals with integrating the growing environment for individual crops on to a single system. Appropriate nutrient solution is supplied to the crops, mixing them with the required quantity of water. Various sensors are utilized for monitoring the pH level of the nutrient solution and the water level. The input obtained from these sensors will enable the controller to regulate the water and nutrient flow in correct proportion. The controller is programmed with an efficient algorithm which will systematically regulate the flow.

IV- METHODOLOGY

a. System architecture

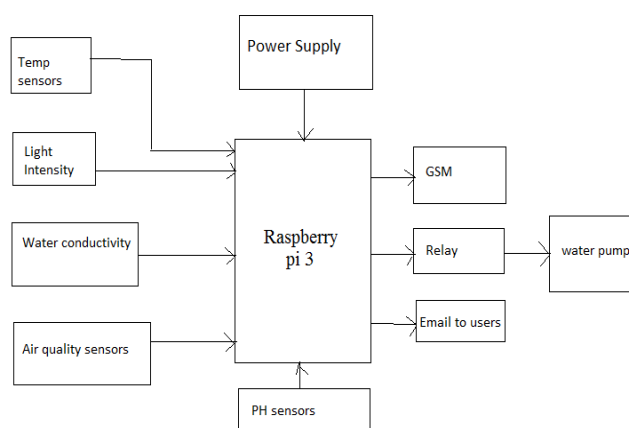


Fig. 2. BLOCK DIAGRAM OF PROPOSED SYSTEM.

4.1 PURPOSE OF USING RASPBERRY PI

In our system we have to perform multitask. The main difference between them is Arduino is microcontroller board while raspberry pi is a mini computer, so it can run multiple programs at a time. Thus Arduino is just a part of raspberry pi. Raspberry pi can be easily connected to the internet using Ethernet port and Wi-Fi dongles.

4.2 WHY PYTHON

Python is an interpreted high-level programming language for general-purpose programming. This gives the ability to program at a faster rate than a low level language. Python has a syntax that allows programmers to express concepts in fewer lines of code.

4.3 ALGORITHM STEPS

1. The sensors are connected to raspberry pi and power supply is given.
2. The raspberry pi reads the values from Sensors and sends the information to the cloud server.
3. If the values are less than the already set threshold values, then the relay gets ON, and the relay switches ON the motor.
4. The motor stays in ON condition till the factor that is less than the threshold value reaches the threshold value
5. When the threshold value is reached, the relay automatically switches off the motor.

V- CONCLUSION

We are trying here too develop a hydroponic farm that help in managing the time in planting of crop using wireless sensor network which will be deployed at various points and senses various environmental parameters, gather data to the center node by using wireless protocol through IoT. Still it has been observed that to monitor the environmental factors is not the total solution to increase the yield of cropping, hence automation in agriculture can only avoid the other factors and problems that reduces the productivity.

We are expecting that our proposed system can effectively control the PH value or concentration and electrical conductivity in nutrition liquid. Plant performance may be optimized by controlling the climate and lighting. There will be lesser requirements in cost and also easy to maintain which controls the important factors such as light, water level temperature and humidity throughout the year is needed.

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