*Impact Factor Value 4.046* **e-ISSN: 2456-3463**
*International Journal of Innovations in Engineering and Science, Vol 4, No.9,2019*
*www.ijies.net*

# Automation In Hydroponic Farming Eco-System: A Review

**JagrutiKishor Wagh[1], Rajendra V.Patil[2], H.T.Ingale[3], Vijay D. Chaudhari[4]**

*[1]M.Tech.(VLSI & Embedded System Design) scholar [2]Asso.Prof. [3,4]Asstt. Prof.*
*[1,2,3,4]E&TC Engg.dept, GF's Godavari College of Engg., Jalgaon-425003, Maharashtra, India.*
*Jagrutiwagh999@gmail.com[1]*

***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. Inthis 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 thetraditionalmethod 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 beingused almost 80% of the total pest attacks possible can be eliminated. Hydroponics is the method of growing plants or vegetableswithout 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-FiShield, a Relay, an MQTT Broker, a Server, a Database and mobile user. The ArduinoUNO is the main microcontroller ofthe system which receives data from the sensors then passesthe data to other parts [1].

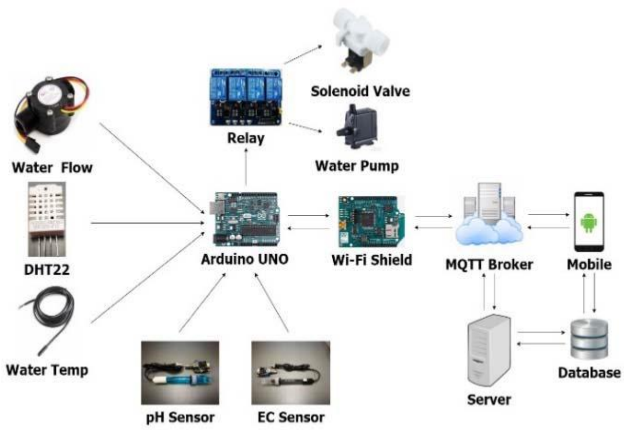


Fig.1. The system's architecture

Figure 1 shows the architecture of the HFE whichThe Data from sensors will becombined to one string then converted to JSON. After that, themicrocontroller 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, itcouldn't be used because the connection was too unstable andunreliable. Therefore, a dedicated Wi-Fi module had to beadded, so a Wi-Fi Shield was used. The MQTT Broker is anintermediary that sends and receives data [2,4,5]. It has 3 functions.First, the MQTT broker sends data directly to the mobileapplication. Second, the MQTT Broker will send informationto the server. Third, it will receive commands from the mobile app or server then send them back to the sensors. The serveris 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 byproducing the quality product, effects of the global warming creates uncontrolled environment. Ultimately the outcomeis unmatchedwith customers' requirement. Therefore planting in a greenhouse is easy to maintain and to controlimportant factors such as light, temperature, and humidity. Usingof sensors coming in a greenhouse as Wireless Sensor NetworksSystem are one efficiency of technology used in agriculturaldevelopment by sending data to the cloud and controlling valuessuch as temperature, light, etc. The results of this study will beuseful for the farmer and related organizations applying in thefarm.Various challenges in agricultural domain are identified. Thearchitecture of the challenges is mentioned, knowledgebasedstructure have various details about agriculture, flow,various input such as market availability, geospatialinformation and weather prediction. Monitoring systemcontains modules like remainder, monitoring plant growth invarious stages, irrigation planner, and the water need of a plantper day with devised algorithm's help.

Aquaponics is a system [4] which is ajunction of aquaculture and hydroponics, in which thewaste produced by the aquatic creatures are passed asnutrients to grow plants hydroponically, which in turnpurifies the water. This system can be made use of toproduce organic food to match the ever-growing demandfor food in the world.Since, the systemcontinuouslyrecycles the water used; the quality of watermust be constantly monitored at regular intervals.Manuallydoing this task can be very tiring. Hence,Internet of Things(IoT),considerably reducesthe human intervention in the system and also improve theefficiency of the system.The latest technologies such asInternet of Things can help in implementing this system inurban areas like smart cities where traditional farming isnot feasible and produce locally grown organic food. The information collected by the sensorsis accessed remotely by using the Internet of things.Authors developed a compact hydroponic planterand are conducting cultivation experiments to realize anagricultural service industry that uses vacant spaces in urbanareas. In order to provide a full-fledged cultivation method forfruit and vegetables to beginners in agriculture, a low-cost sensormodule and a planter with an integrated remote-control systemhave been developed. MQTT, a lightweight protocol for IoT is usedto monitor sensor data and to control a pump. Data is securelyencrypted using TLS/SSL. In addition to monitoring sensor data,a USB-connected camera-based still-image photography functionwith motion detection is included. We are also enhancing theinterfaces to support AI speakers as well as smartphones and PCs.

Authors [5] developed a sensor module for a hydroponic cultivationsystem to expand a new type of enjoyable agriculture into urbanareas as a service industry. In order to reduce costs of the system,general purpose microcomputer boards, Arduino and RaspberryPi, are used as an MQTT client and server, and a remotemanagement system was built using open source libraries andlow-bandwidth communication services. They are also developing various service businesses for urban smartagriculture, 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 withprecise management and monitoring of the crop system withaccess to the scientific data about the field environment to executeintelligent and informed decisions in time. They have developed a smart hydroponic system with LED lightingtechnology enabled by IoT system. Plants were hydroponicallycultured under various treatments and morphological parameterswere measured and characterized. The plants treated with bluesupplementary LED light resulted in greater accumulation ofbiomass, leaf density, leaf area and pigment content. IoT devicesand software applications were incorporated to transmit anddisplay of system information online. The system was successful inarchiving data real time for end user access.In smart urban farming, crop monitoring and yield are ofparamount importance. This technology provedsuitable and beneficial in urban setting for year round cropproduction with precise plant management.

## III- PROBLEM STATEMENT

The previously used system consists of Arduino UNO board. The ArduinoWi-Fi board has a Wi-Fi module, itcouldn't be used because the connection was toounstable andunreliable. Therefore, a dedicated Wi-Fi module had to beadded, 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 obtainedfrom 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- METHOLOGY

**a. System architecture**

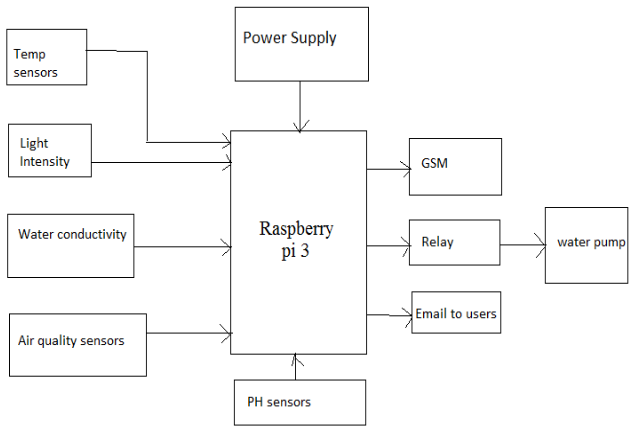


Fig. 2.BLOCK DIAGRAM OF PROPOSED SYSTEM.

### 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.ThusArduino 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.

## REFERENCES

[1] SomchokeRuengittinun, SitthidechPhongsamsuan, PhasawutSureeratanakorn, "Applied Internet of Thing for Smart HydroponicFarming Ecosystem (HFE)", *10th International Conference on Ubi-media Computing and Workshops* (Ubi-Media). 2017.

[2] U. Meenakshi, Dr..M.. Lakshmaiah, B. Bilvika,"Design And Implementation Of Raspberry Pi 3 Based Embedded System For Analysis Of Soil Parameters:, *Int. Journal of Engineering Research and Application (IJERA)*, ISSN : 2248-9622, Vol. 7, Issue 11, ( Part -5) November 2017, pp.34-39.

[3] Jumras Pitakphongmetha, Nathaphon Boonnam, Siriwan Wongkoon, Teerayut Horanont, Deeprom

Somkiadcharoen, Jiranuwat Prapakornpilai, "Internet of Things for Planting in Smart FarmHydroponics Style".*IEEE*, 2016, DOI: 10.1109/ICSEC.2016.7859872.

[4] Manju M., Hariharan S. et. Al., "Real Time Monitoring of the Environmentalparameters of an Aquaponic System Based onInternet of Things, *Third International Conference on Science Technology Engineering & Management (ICONSTEM), IEEE,* 2017, pp. 943-948.

[5] Akashi Satoh, "A Hydroponic Planter System to enablean Urban Agriculture Service Industry", *7th Global Conference on Consumer Electronics (GCCE 2018), IEEE,* 2018. pp. 281-284.

[6] T. Namgyel1, S. Siyang et. Al., "IoT based hydroponic system with supplementary LED light for smart home farming of lettuce", *15th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology, IEEE*, 2018, pp. 221-224.