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IoT BASED FERTIGATION SYSTEM

Sathiya Girija H[a]*, Manoj D[b], Saran Prabhu S S[c], Boopathi T[d].

[a]Assistant Professor, Dr.Mahalingam College of Engineering and Technlogy, Pollachi – 642003, India
[c,d]UG Scholar, , Dr.Mahalingam College of Engineering and Technlogy, Pollachi – 642003, India
E-mail address: sathya11.sece@gmail.com

A B S T R A C T

Nowadays, agricultural technologies is gaining a thrust and with the help of these updates, plantation of annual and bi-annual crops has been made very easy for the farmers. Even though science has bought many new ideas, the worst climatic change prevailing in most of the countries have made it impossible to get the predicted outcome. To reduce such efforts of farmers in plantation, here a prototype has been designed wherein a number of sensors like temperature sensor, soil moisture sensor, pH sensor, humidity sensor etc., has been adopted and are blended together with a controller to achieve the desired output and this complete setup can be monitored using IoT. This in turn reduces the cost and time spent by the labors. These sort of automated systems are in large demand to satisfy the increasing population in food production.

Keywords *- Automated Fertigation System, Sensor technology, IoT,*

1. INTRODUCTION

In developing nation like India, people are multitasking in nature and to perform all the tasks in an efficient manner, these sort of automated systems are very helpful for plantation and crop cultivation. We know that agriculture is the major source of income in this nation. Also, Food production plays a major role when considering with the Indian population. Crop cultivation is the first step in food production. With the best yield in crops, food production rate can be improved. To reach a very good yield, plants must be monitored periodically. Manual error is very common that can affect the yield. Also, overwatering of plants results in rotting of roots and insufficient fertilizers leads to crop retardation.

To overcome this sort of problem, automated monitoring systems can be adopted. This system initially gathers up the data from different nodes, processes it, and helps in scrutinizing the information in a well-organized method. In total this prototype facilitates the farmers to analyze different measures based on the sensor data. This type of monitoring systems can be adopted in different domains like security, industrial safety, and healthcare and even in agriculture sectors and this seems to be already a part of the daily lifestyle [1].

As a companion to monitoring systems, an IoT network has been used. IoT can be simply defined as a communication network between any two things that are entrenched with all sorts of electronic gadgets, software, connectivity among objects, sensors, transducers and actuators [2]. As of now we couldn't find out any of such field that performs without IoT. This depicts the rapid growth of IoT in every sector. Here, in this prototype, NodeMCU is used as primary controller that monitors the temperature, water level in the tank, humidity, and Soil moisture and pH level of the soil. Since, this controller is an inbuilt Wi-Fi module too; it is used to transmit the status to the farmer [2].

2. LITERATURE SURVEY

Sujaritha M and Sanjana R [3] proposed a system that provides the field with organic liquid fertilizers like Panchagavya and Jeevamrutham to the root node of the crops. They have adopted flow sensor, temperature sensor and water pH sensor connected to Arduino controller, and according to the current values, several corrective measures can be taken using motor and solenoid valve. Also, these sensor data's and actions (motor ON & OFF and Valve OPEN & CLOSE) are periodically uploaded to thingspeak cloud using Wi-Fi module.

Santosh Deshpande and Smita R. Lokare [4] designed a prototype using MSP 430 launchpad that gets the data from temperature, soil pH and moisture sensor and the complete data is processed and transmitted via Zigbee unit to the cloud storage. Based on these data some preventive actions have been taken.

Kushal M. Ghadge, Harsha K. Ghadge and Vidhya Seeman [5] deliberated a crop monitoring system that maintains proper soil moisture and soil pH level using MSP 430 launchpad.

Boopathy S et al., [6] considered horticulture parameters that observes basic parameters like soil characteristics, moisture, pH, water flow etc., and feeds the necessary nutrients for sustainable environment.

Muhammad Zulhilmi Md Zailani, Siti Amely Jumaat [7] suggested a simple agricultural monitoring system that enables farmers to monitor soil pH, moisture, humidity levels to avoid such undesirable consequences.

3. PROPOSED SYSTEM

The proposed prototype model is made of;

3.1. Hardware

The major hardware components include controller, sensors and valves. Here, the controller used is Arduino. This controller is preferred more because it is more compatible with various types and various ranges of sensors. Sensors include temperature sensor, humidity sensor, soil moisture sensor and pH sensor. These sensors are used to measure the corresponding parameters like atmospheric temperature, atmospheric humidity, moisture level of the soil and nutrient content available in the soil. The block diagram of the implemented prototype is shown in figure 1.

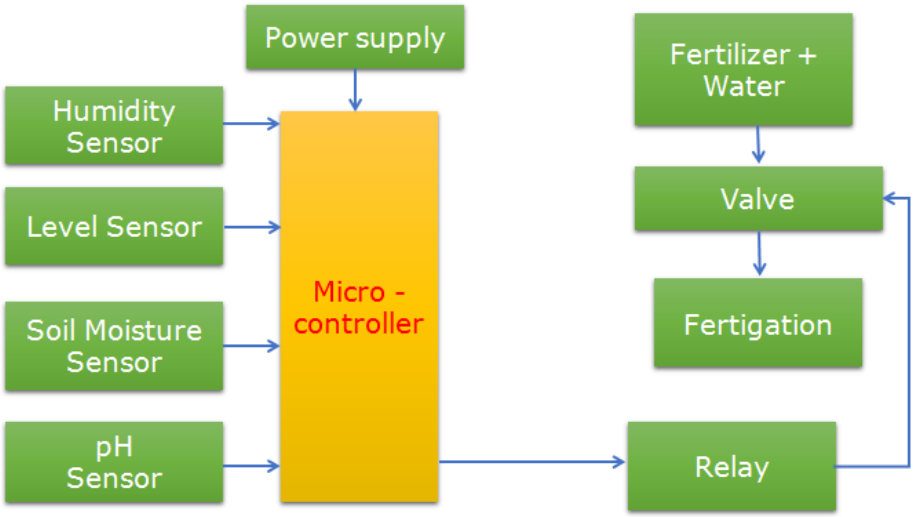

Figure 1 – System Block Diagram

3.2. Sensors

3.2.1 Soil Moisture Sensor

Generally, this sensor is adopted to measure the moisture content available in the soil. This is very cost efficient and hence preferred more. Output of the sensor is the volumetric analysis of H2O in the land. It consists of probes (also denoted as electrodes) that are used to analyze the water content and this quantity is processed to the controller using the sensor module.

3.2.2 pH Sensor

Hydrogen ion concentration plays a major role in determining the pH level. By using this concept the presence of various nutrients can be analyzed, and this process is done using pH sensor. The concept behind the concentration identification is given in figure 2.

Soil Ph measurement

State	Soil Acidity	Nitrogen	Phosphate	Potash	Fertilizer Wasted
STATE-1	Extremely Acid	4.5 pH	30%	23%	33%	71.34%
STATE-2	Very Strong Acid	5.0 pH	53%	34%	52%	53.67%
STATE-3	Strongly Acid	5.5 pH	77%	48%	77%	32.69%
STATE-4	Medium Acid	6.0 pH	89%	52%	100%	19.67%
STATE-5	Neutral	7.0 pH	100%	100%	100%	00.0%
STATE-6	Alkaline	7.5	iron availability problem, adding lime			

Figure 2 – pH Chart for analyzing various nutrients present

3.3. Software

The basic software requirement is Arduino ide that helps us in interfacing the sensors with controller board. The output from the sensors are fed into data pins of the controller and here the data is processed and the corrective action is done, like opening of valves for watering and supplying fertilizers to the soil.

4. RESULTS AND DISCUSSION

As stataed, here the sensors are connected to the controller as shown in figure 3. Solenoid valves are turned ON and OFF using the relay module. Once the moisture level from the sensor is dropped then the corresponding valve opens up he water tank, on the other case according to the pH value the correspomding fertilizer valve gets opened up to serve the fertilizer storage tank. For monitoring purpose the complete procedure can be viewedby using OLED display unit.

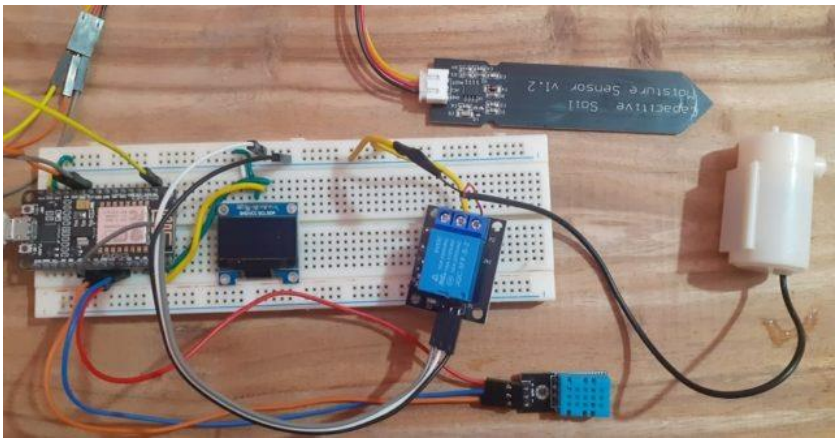

Figure 3 – Hardware setup of the proposed system

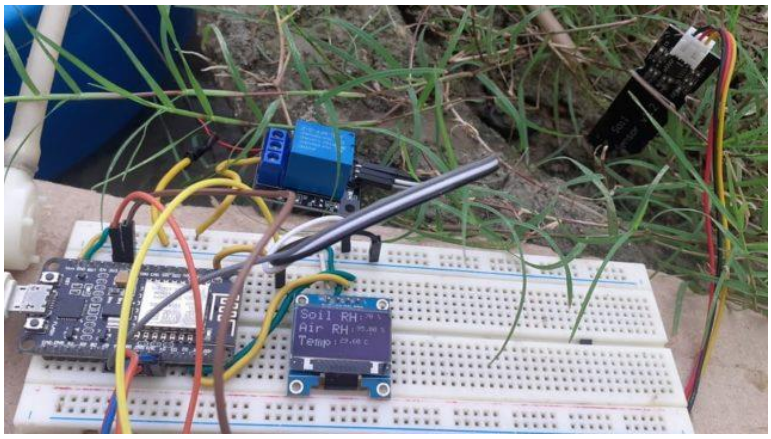

Figure 4 – Implementation and Testing of the Hardware setup

Testing of the complete hardware components was done and the result analysis is shown in figure 4.

5. CONCLUSION

This system was implemented in a small garden area, and the results are thus verified as discussed. As said, the moisture sensor updates the soil moisture level, the pH sensor updates the soil nutient level into the controller. According to these values, the particular valve gets opened up and either the water or fertilizer is drained into the field. Thereby, plant growth or crop yield can be automated without human interference. This could be extended by introducing IoT into the network, therby the complete process can be monitored even frome remote locations. This enables our farmers to concentrate on multiple options.

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