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Site Specific Farming Using Arduino Module

Annie Isabella L[a] Abhishek S[b],Advaid P Anoop[c],Arun Kumar D[d] , Manimudi A[e] and T.Jabamani[f]

[a*] Asst.Professor [b,c,d,e]B.E Final year Students [f]Senior Engineer
Electrical and Electronics Engineering Department , R.M.K. Engineering College RSM Nagar, Kavarapettai, Gummidipoondi Taluk, Tamil Nadu 601206.
Engineering Business Service Center,Vestas Wind Technology India Private LTD.

Abstract

Farming was the first occupation of human beings. A country's growth is only defined by its prosperity. Food still remains the basic necessity for every human being. Still there is a lag between the necessity and the production. This is mainly due to less number of farmers. The crop which we cultivate requires adequate supply of water and nutrients for its growth. The resources requirement for the crop yield needs to be satisfied by the farmer for better production. The project's objective is to minimise the man power by automating the process. In our system we monitor the soil moisture content and soil pH content using soil moisture sensor and soil pH sensor. The correctness of our suggested system highly depends on how well the system can maintain the required moisture content and pH content. To reduce the erroneousness we are placing more sensors of similar type and getting their average values. To increase the efficiency we switch-off the sensors for a particular interval of time..

Keywords: soil moisture sensor, soil pH sensor, irrigation, fertigation, Zigbee module.

1. Introduction

All living beings have always had and will always have a need for food. Humans have evolved the art of farming as a civilised species. Our forefathers ate edible substances from the forest, they did not consider cultivating. They were obliged to practise agriculture as the human population grew. They observed leftover seeds sprouting new vegetation. They started farming. Today thanks to great minds the technology has grown but still food remains our primary need.

While many people sit in their air-conditioned offices farmers who feed us are working in the field under drastic weather conditions. Through our project we are aiming to provide an automated farm management system which reduces the efforts of farmers by automating irrigation and fertigation. Since we are maintaining the optimum level of moisture and fertilizer content of the soil we can avoid wastage of resources. Here we are using a pH sensor to maintain the pH. Fertigation is a process in which fertilizers are supplied along with water that is in soluble state which has high nitrogen, Phosphorus and potassium content.

The necessary for automating the irrigation system in the farming process is to know the moisture content of the soil. Generally the soil moisture content is measured in terms of Volumetric Water Content(VWC) and it is expressed in percentage[3].

We can monitor the moisture content using different sensors and it will be cost effective and by that we can create a low cost system.[2].

The wireless technology is much better because it reduces the maintenance cost and transferring data from ranges in the field and also it reduces the product capital costs[8],[10].

Sensors measure the soil parameters using the technique by measuring the electrical resistance[5].

The Zigbee wireless network system is cost effective and it is flexible in the automatic farming process[4],[9].

To minimize the utilization of natural resources like water, drip irrigation is best for crops like tomatoes[7].

The soil fertility is necessary for the yield[14]

The process of automatic fertigation is used to reduce the manpower and to increase the crop yield[6],[12].

The fertilizer with respect to the crop yield must be known[1],[11][16].

The process of automating the farming is done maximum by automating the irrigation and fertigation[13],[15].

2.Proposed System

The system aims at developing a flawless irrigation and fertigation system. The pH level and soil moisture content is monitored at certain intervals of time. The time interval is essential while the absorption of nutrients takes time and real time monitoring may lead to overuse of resources and also oversupply of nutrients.

The device supplies water through a drip irrigation system. The fertilizer is mixed with water and supplied to the field. The fertilizer is nothing but a soluble liquid type fertilizer.

3.Algorithm

Step 1 : Switch ON the power supply(230V) in order to provide supply to the DC motor.

Step 2 : Soil pH sensor measures the pH value.

Step 3 : If pH value falls below 6 or it goes above 8 the module works corresponding to the step 4 or else with step 6.

Step 4 : The module turns on both the motors correspondence with water and fertilizers and goes to step 2.

Step 5 : Soil moisture sensor measures the soil moisture level, if it falls below threshold the module works corresponding to step 6 or else it goes to step 2.

Step 6 : The motor corresponding to the water turns on and pumps the water to the field and goes to step 2.

4.Flow Chart

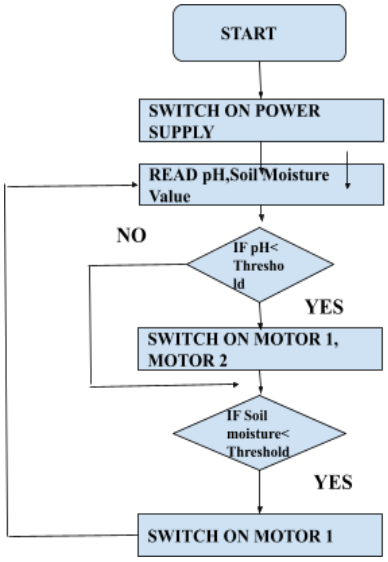


Fig 1.0 Flowchart for Algorithm

The above mentioned steps are the steps in which our system works. Once the supply is on it keeps on repeating these steps and the efficiency which we get from this will be very high.

5.Block Diagram

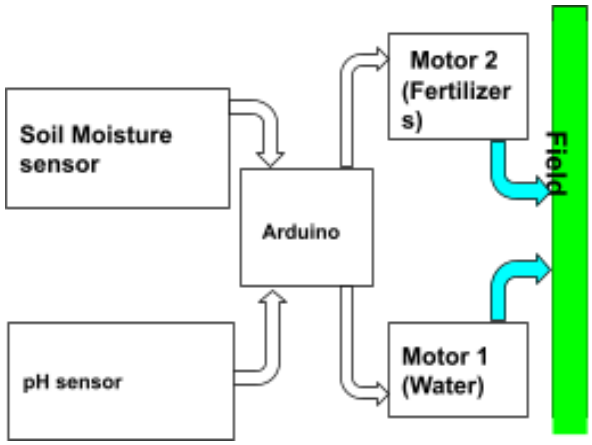


Fig 1.1 Schematic Diagram of Proposed System

Here we are using an **Arduino UNO** which is powered by a 12V DC supply. The sensors measure the **soil moisture** level and **pH level** of the soil. The clock pulse from the rtc is given to the microcontroller, and the motor pumps the water/fertilizer to the field in response to the clock pulse. The **ZigBee** module is linked to the microcontroller by connecting the TX and RX pins of the microcontroller to the Zigbee module. It is used to get date from the sensors via wireless.

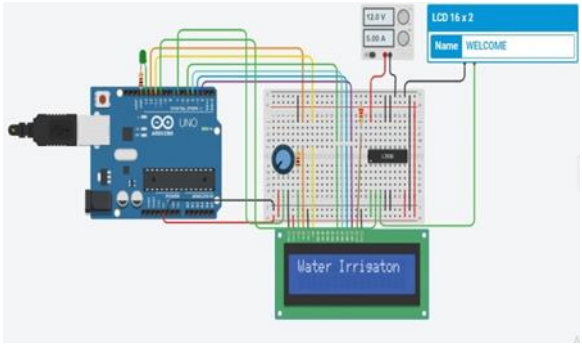


Fig 1.2 Irrigation system

6. Circuit Simulation

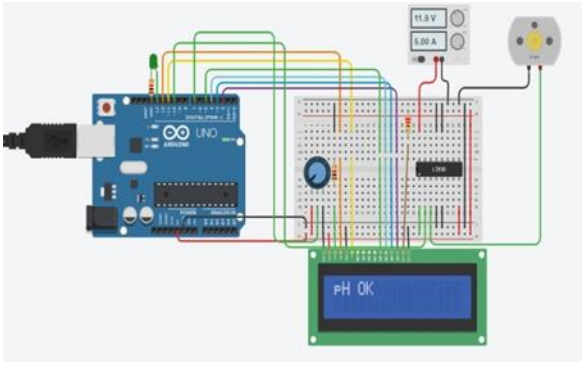
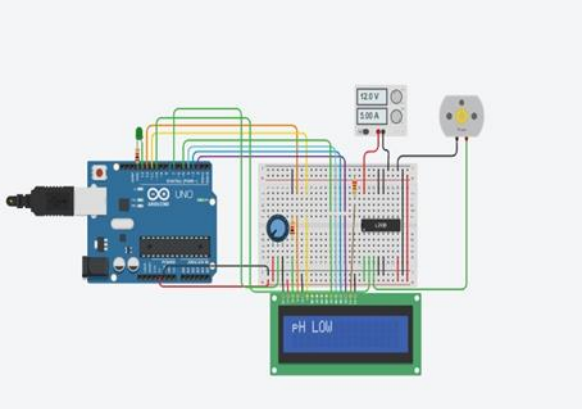


Fig 1.3 pH Monitoring(pH low)



Tinkercad is an online simulation software.To illustrate our working idea we performed a simulation model for both irrigating and pH maintaining systems

7.. Tabular Column

SI.No.	Time	VWC(in percenta ge)	pH value	System Status
1.	06.00	80.2	6.1	Motor Off pH OK
2.	09.00	79.7.7	6.1	Motor Off pH OK
3.	12.00	69.1	6.1	Motor On pH OK
4.	15.00	75.3	6.0	Motor Off pH OK
5.	18.00	74.2	6.0	Motor Off pH OK
6.	21.00	73.9	6.1	Motor Off pH OK
7.	00.00	73.0	6.0	Motor Off pH OK
8.	03.00	72.6	6.0	Motor Off pH OK
9.	06.00	69.8	6.0	Motor On pH Ok
10.	09.00	71.7	6.0	Motor Off pH Ok

Tab.1 Data Analysis of Hardware results

Data is sent to the arduino and processed by it. The device works in a particular interval of time. In LCD the data is shown frequently. The device keeps on working throughout the full day. The water and fertilizer is fed to the land whenever it requires. When the supply reaches the threshold the motor associated with irrigation and fertigation stops automatically.

8.Results

8.1.Simulation Results

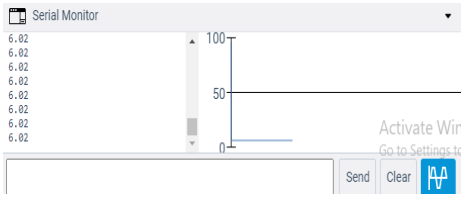


Fig 1.5 Variation of pH over Time

From the graph it is understood that pH did not vary steadily with time. But as time passes pH may vary under earthly conditions.

9.Comparison

9.1.Existing Method

Here irrigation is done manually. In some rare cases farmers use a drip irrigation system or sprinkler irrigation system.Normally irrigation/watering is done at a particular time or when they notice a blight on crops.Practically this process may seem effective but for better yield a moisture level should be maintained properly. Generally farmers do soil pH test once in a year or once in every 6 months.It is scientifically proven that for better absorption rate of nutrients from soil or those we supply by fertilizing a slightly acidic pH should be maintained.When it comes to fertigation it must be done at a regular interval.This process can be tedious for

farmers who cultivate on an industrial scale.Here watering and fertilizing consumes more than necessary amount of resources.

9.2.Our Proposed Method

Here by the usage of microcontrollers, irrigation is done automatically.We can use both drip irrigation or sprinkler systems for our method.It is based on the area that we are using and the type of crop that we are cultivating.This process is activated whenever the soil moisture sensor placed on the field reads an average value lower than the ideal moisture content value in VWC percentage.

For mai**n**taining perfect pH, we made use of a soil pH sensor which senses and stores soil pH values at certain intervals of time. When soil pH becomes more or less acidic or basic we supply water soluble solutions to adjust the pH. Also nutrients like Nitrogen Potassium and Phosphorus are supplied at regular intervals for better yield from the crop.

Here a method known as fertigation is used where we supply the essential nutrients through water making it easy for farmers.Here less resources are used since only maintenance of the ideal condition happens.

10.Conclusion

This system was designed to maintain the water level and nutrient content in the soil thereby increasing the productivity by minimal use of resources.Soil moisture and soil pH which are the essential factors of plant growth are measured.A method known as fertigation is implemented here to supply the essential factors like fertilizers . Farmers can get benefited since minimal resources are used .This is achieved because essential substances are provided as per the requirement.

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