REVOLUATIONARY TECHNIQUES FOR TRADITIONAL FARMING TO CLOUD FARMING USING RASPBERRY PI

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Abstract: Revolutionary techniques make use of wireless sensor nodes to monitor the agricultural environment. Arduino, Zigbee and Raspberry pi based agriculture monitoring system serves as a reliable and efficient method for monitoring agricultural parameters. Monitoring of field not only allows user to reduce the human power, but it also allows user to see accurate changes in it. This paper aims to describe about smart agriculture using IOT technologies.

***Index Terms*– Arduino, IOT, Solenoid valve, Raspberry Pi, Composite sensor pH and Moisture and Zigbee**

I. INTRODUCTION

Agriculture sector is the backbone for our country. The growing of population puts a more pressure and challenges on agricultural sector. To keep up the growing demands, latest technology achievements such as IOT, smart farming, cloud services. There are different kinds of sensors will detect the changes in the soil and crop conditions will do automatically, these available sensors are to determine when the plants may need water. Automation involves improving the speed of production, reduction of the cost, effective use of resources. [1]

II.EXISTING SYSTEM

In the present agriculture system, the farmers are facing a lot of problems like, not availability of water, sometimes wasting the water and continuous monitoring needed to check the soil type and proper watering to the crop and more number of man power.

III. PROPOSED SYSTEM:

Wireless sensor network is widely used in agricultural domain for efficient farming management. The application of the networking system for agricultural environment monitoring was successfully developed in this research. In this project, we are designing wireless sensor node using Arduino and zigbee wireless technology. The composite sensor we are using will identify the soil pH level and moisture level. Based on the pH level we will identify the soil nutrient content and the same information will update to the control panel with zigbee communication. The control unit will receive the information consisting of pH and soil moisture level from all different nodes and the data will be updated in the cloud. The Raspberry pi has inbuilt WIFI module. By using this WIFI, Raspberry pi will connect to the internet and update the data base frequently in the cloud (Website). Then according to the information from the cloud, water pump will be turned on or off. When the pump is ON the directions of the water flow will be controlled by the cloud data using solenoid valves. The entire system will work under IoT (Internet of Things).

3.1 BLOCK DIAGRAM:

3.1.1 WIRELESS NODES:

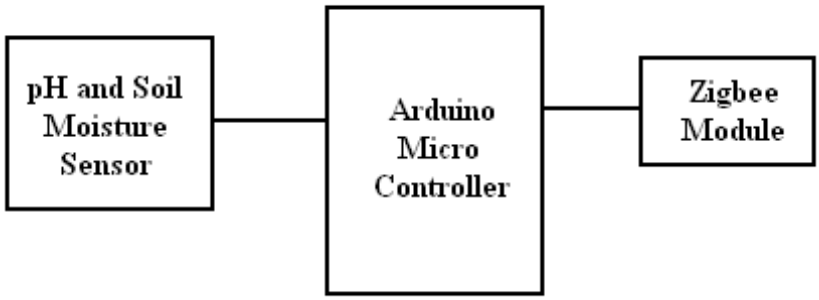


Fig 3.1.1: Block Diagram of Wireless Nodes

3.1.2 CONTROL UNIT:

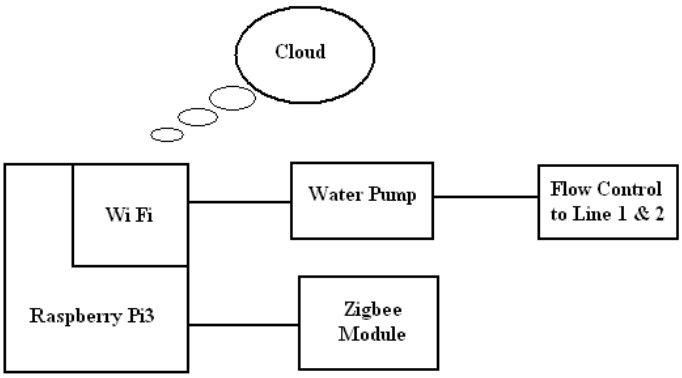


Fig 3.1.2: Block Diagram of Control Unit

IV. DESIGN METHODOLOGY

4.1. pH SENSOR

The pH (always written little p, big H) of a substance of how many hydrogen ions in a certain volume of water. 'pH' stands for potential of hydrogen. The definition pH is minus the logarithm of hydrogen ion activity in the solution. pH is gram equivalent per liter of hydrogen ion concentration in a solution. pH has a property of multifunctional in nature, it can test light, pH and soil. It varies between 0 to 14. It is the logarithmic measurement of moles of hydrogen ion concentration per liter of solution. The solutions having pH value between 0 to 7 are acidic solutions, with large hydrogen concentration. Whereas the solution having pH value between 8 to 14 are basic solutions, with small hydrogen concentration. Solutions having pH value of 7 are neutral solutions. Measuring the pH gives the alkalinity or acidity of a solution. This sensor is essential to monitor pH level of soil for optimal growth of crops according to the requirements.

Fig 4.1: pH Sensor

The below figure 4.1.1 shows the pH level is out 14 which display the strength of acidity and alkalinity of solution.

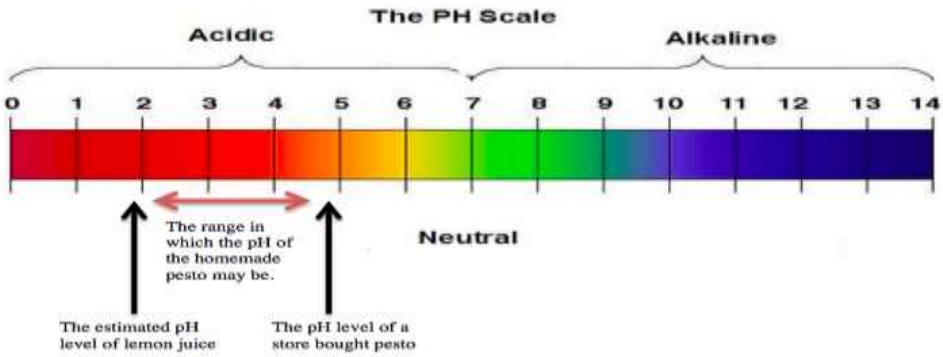


Fig 4.1.1:Levels pH Sensor

4.2. ZIGBEE MODULE

HC-12 wireless serial port communication module is multichannel wireless data transmission module. Its working frequency band is 433.4-473.0MHz; there are totally 100 channels in this module. The maximum transmitting power of module is 100mW (20dBm), the receiving sensitivity is -117dBm at the baud rate of 5000bps in the air, and the communication distance is 1000m in open area. HC-12 module has a microcontroller which actually doesn't have to program by the user. For configuring the module we simply use AT commands, which can be sent from Arduino, PC or any other microcontroller using serial communication port.

Fig 4.2: Zigbee Module(HC-12)

4.3.ARDUINO UNO

The Arduino Uno is microcontroller based board on the ATmega328P. It consists of 2KB of SRAM and 1KB of EEROM. It has totally 14 digital input and output pins, in which 6 output pins functions as PWM outputs, 6 input pins as analog inputs, 16 MHz quartz crystal oscillator, a universal serial bus connection, a power jacket, an in-circuit serial programming (ICSP) header and a reset button as shown in the below figure. It contains everything required to maintain the microcontroller. It simply connects to the computer with a USB cable or power it with an AC-to-DC adapter or battery to get started [2].

Fig 4.3: Arduino Uno

4.4. RASPBERRY PI

The Raspberry Pi is a small size computer. It is used do small computing and networking operations. It is a Broadcom BCM2837 64-bit ARMv7 quad core processor powered single board computer running at 1.2 MHz. It is the main element in the field of internet of things. Raspberry Pi is a available in various versions. It has quad core ARM cortex-A53 CPU of 900 MHz, and RAM of 1 GB, it also has: 40 extended GPIO pins, full size HDMI port,4x USB 2 ports, Ethernet port, 3.5mm audio jack, video camera interface (CSI), the display interface , and micro SD card slot.[3]

Fig 4.4: Raspberry Pi

4.6. RELAY

Relay is an electromechanical switching device. Relay allows the flowing of current in an opening and closing contacts in another circuit. The below figure shows relay, when the relay contact is in normally open (NO), there is open contact. When the relay is in normally closed (NC), there is closed contact. In either case, applying electrical current to the contacts will change their states. Relays contain a sensing unit, the electric coil, which is powered by AC or DC current. When the applied current or voltage exceeds a threshold value, the coil activates the armature, which operates either to close the open contacts or to open the closed contacts. When a power is supplied to the coil, it generates a magnetic force that actuates the switch mechanism. Relays are used in various applications throughout industry, such as in telephone exchange, digital computers and automation systems.

Fig 4.6: Relay

4.7. AC WATER PUMP

The below figure shows the AC water pump. It is used to provide water from reservoir. Here the microcontroller is used for controlling of water pump. As with the use of relay we can able to turn on and off water pump.

Fig 4.7: AC Water Pump

4.8. SOLENOID VALVE

A solenoid valve is electromechanical controlled valve. The solenoid valves help to control the flow of liquids in a positive, fully-closed or fully open mode. There are different types of solenoid valves available, these are used depending upon the applications and requirements. For example has 2 ports ; if the valve open the 2 ports are connected and fluid may also may flow between the ports are isolated; if the valve is closed, then ports are isolated. If the valve is open when the solenoid is not energized, then the valve is termed normally open. Similarly, if the valve is closed when the solenoid is not energized, then the valve is termed normally closed. There is also 3-way and more complicated designs. A 3-way valve has 3 ports; it connects one port to either of the two other ports typically a supply port and an exhaust. [3]

Fig 4.8: Solenoid Valve

V. FLOWCHART

The above flowchart shows for controlling of solenoid valves. Firstly initializing the serial communication in the raspberry pi. Then after raspberry pi will send '@' value through zigbee module. Then raspberry pi will take the 4-digit data from the Arduino-1 using zigbee module. Again raspberry pi will send '#' value through the zigbee module. Then raspberry pi will take 4-digit value from Arduino-2 using zigbee module. From these two nodes raspberry pi will receive the moisture level in the soil and pH values and these received values are uploaded to cloud using ubidots website. In the cloud we have designed 3 switches for controlling of motor and two solenoid valves. If any one of the solenoid valve is ON, at that time the motor will be ON otherwise the motor will be OFF.

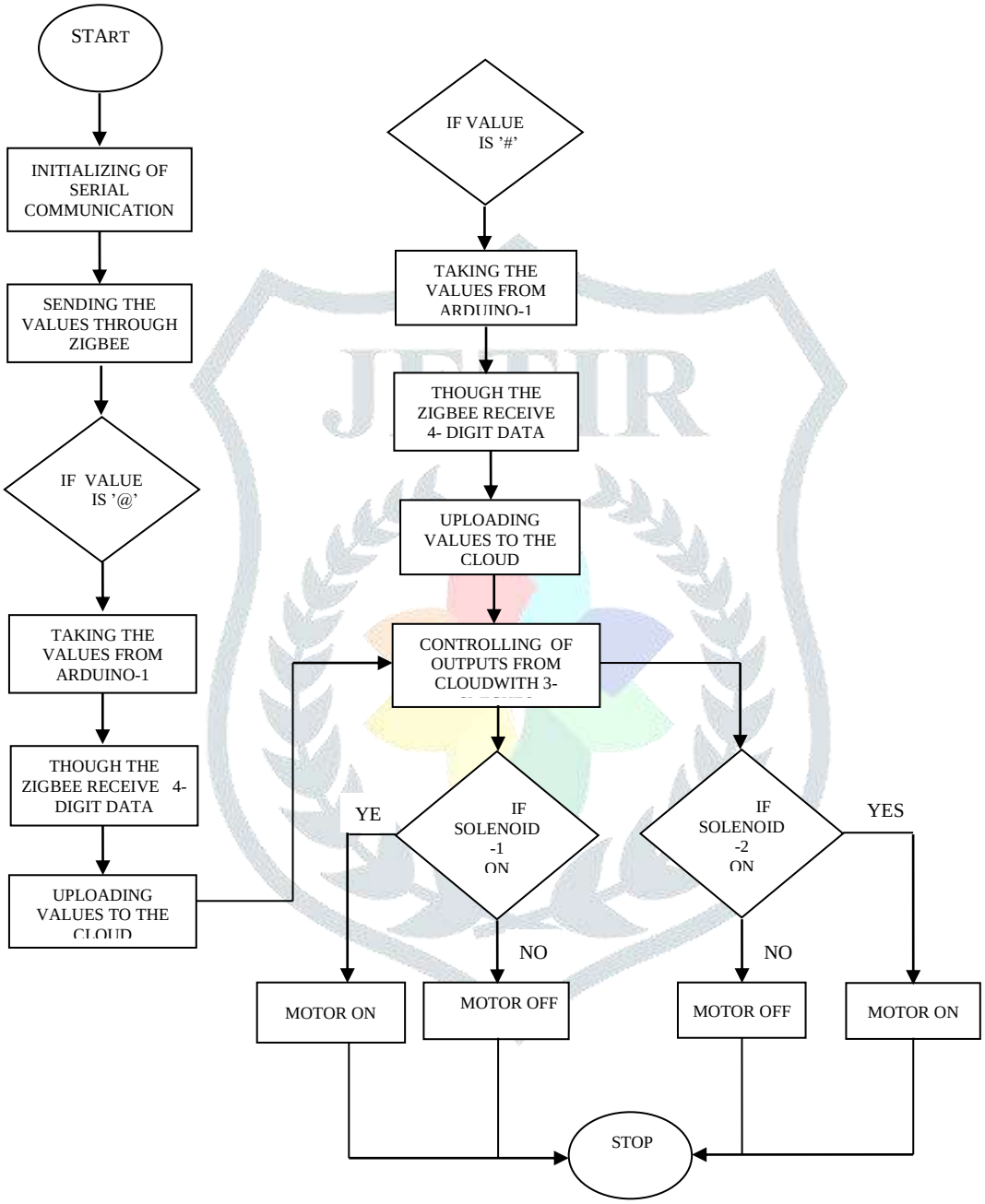


Fig5: Flowchart of Irrigation System

VI. RESULTS

The below figure shows hardware implementation and output results

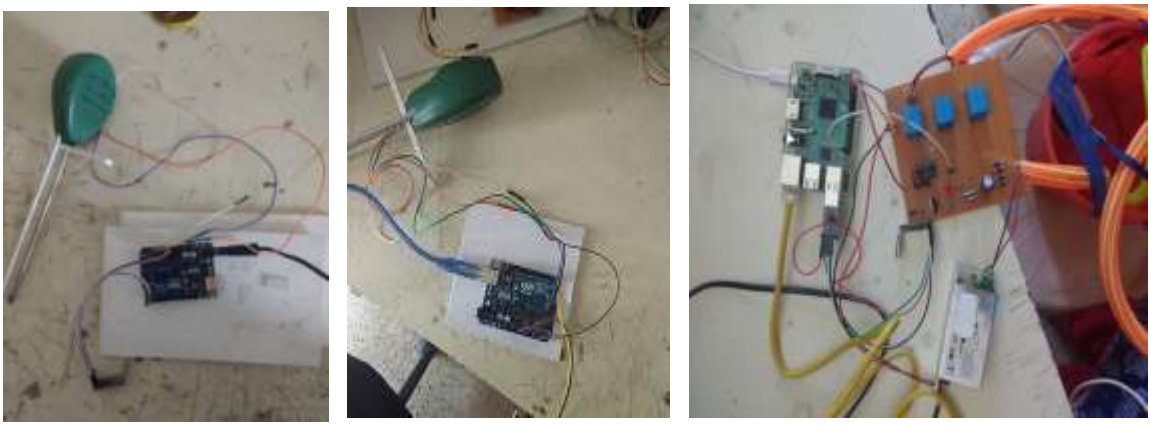
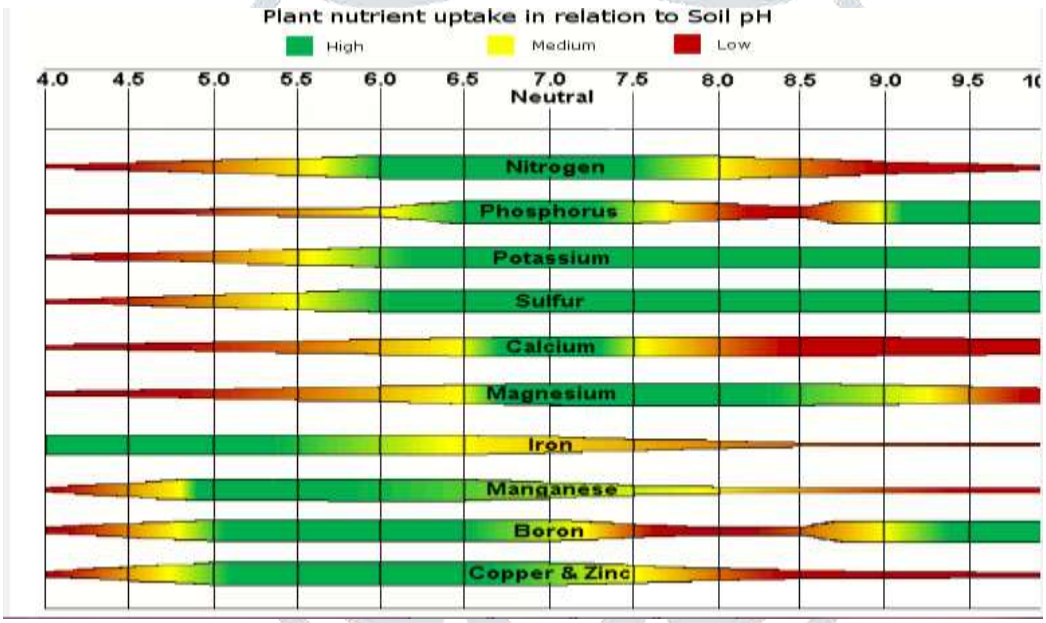


Fig 6.1: Hardware Implementation of Irrigation System



(a)

(b)

(c)

(d)

(e)

Fig 6.2 (a) Nutrient level of soil pH , (b) pH1soil level, (c) pH2 soil level, (d) Moisture Levels, (e) Motor Controlling Switches

VII. CONCLUSION

The paper presents the techniques for traditional farming to cloud farming using Arduino, Raspberry Pi controllers and 3 in 1 pH sensor. The function of pH sensor is to identify the amount of water is required for the irrigation. Raspberry pi then controls water pump through a relay, based on solenoid valves and moisture content in soil. If the pH value is lower or greater than the optimum pH value then supply of fertilizer for plant growth will be stopped. By this water management, we will reduce the over watering of plants and over sprinkling of fertilizer. This will improve the crop quality than traditional method.

REFERENCES

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[3] K. Jyostsna Vanaja, Aala Suresh, S. Srilatha, K. Vijay Kumar, M. Bharath5 IOT based Agriculture System Using NodeMCU