National Conference on Information, Communication, VLSI Design and Embedded system (ICVE 2K17)
(9 - 10 March 2017)
International Journal of Engineering Research & Science (IJOER)
ISSN: [2395-6992] [Vol-3, Issue-3 March- 2017]

Smart Irrigation System using Iot Approach

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Abstract— *The project is about automatic irrigation system using the Arduino microcontroller with moisture sensor and water flow management. The humidity sensor unit consists of an Arduino board, Wi-Fi unit, Humidity sensor and water flow control mechanism. The data taken from Humidity sensor will be sending to data monitoring system by arduino boards over a wireless network using WiFi. At Monitoring system, the humidity levels are monitored and any decrease in humidity level below a limit will be reported as requirement for water and signal is raised to the entire humidity sensor unit to open the water flow management. Also, Humidity level in agricultural field can be checked any time through the web portal.*

Keywords— Irrigation, Arduino microcontroller, Soil moisture sensor, Temperature sensor.

I. INTRODUCTION

India is mainly an agricultural country. Agriculture is the most important occupation for most of the Indian families. In India, agriculture contributes about sixteen percent (16%) of total GDP and ten percent (10%) of total exports. Over 60 % of India's land area is arable making it the second largest country in terms of total arable land. Water helps in the transpiration, which is very essential for maintaining the absorption of nutrient from the soil. Water regulates the temperature and cools the plant. So, water is applied externally, if availability seems limited through soil, not sufficient to meet the requirement due to drought or excess losses. We call the external application of water to the soil to supplement the requirement as `Irrigation'. In India most of the irrigation system are operated manually. These technique are replaced with semi-automated and automated techniques. The available techniques are like ditch irrigation, terraced irrigation, drip irrigation and sprinkler system. The global irrigation scenario is categorized by increased demand for higher agricultural productivity, poor performance and decreased availability of water for agriculture. These problems can be appropriately rectified if we use automated irrigation.

Need of Automatic Irrigation:

- Automated irrigation system uses valves to turn motor ON and OFF. Motors can be automated easily by using controllers and no need of labor to turn motor ON and OFF.
- Saving energy and resources, so that it can be utilized in proper way and amount.
- Farmers would be able to smear the right amount of water at the right time by automating farm or nursery irrigation.
- It is time saving, the human error elimination in adjusting available soil moisture.

II. LITERATURE REVIEW

[1] In Sensor based Automated Irrigation System with IOT mentioned about using sensor based irrigation in which the irrigation will take place whenever there is a change in temperature and humidity of the surroundings. The flow of water is managed by solenoid valve. The opening and closing of valve is done when a signal is send through microcontroller. The water to the root of plant is done drop by drop using rain gun and when the moisture level again become normal then sensor senses it and send a signal to microcontroller and the value is then closed. The two mobile are connected using GSM. The GSM and microcontroller are connected using MAX232. When moisture of the soil become low moisture sensor sense it and send signal to microcontroller, then the microcontroller gives the signal to mobile and it activate the buzzer. This buzzer indicates that valve needs to be opened by pressing the button in the called function signals are sent back to microcontroller. Microcontroller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extra ordinary features.

[2] In Automated Irrigation System Using a Wireless Sensor Network and GPRS Module mentioned about using automatic irrigation system in which irrigation will take place by wireless sensor units (WSUs) and a wireless information unit (WIU), linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology. It takes a measure of temperature and moisture using sensor and controlled by microcontroller. The WIU has also a GPRS module to transmit the data to a web server via the public mobile network. The information can be remotely monitored online through a graphical application through Internet access devices. This irrigation system allows cultivation in places with water scarcity thereby improving sustainability and it is feasible system. But due to Zigbee protocol this system becomes more costly.

[3] In Wireless Sensor Network based Remote Irrigation Control System and Automation using DTMF code mentioned about using automated irrigation system for proper yield and handled remotely for farmer safety. Wireless sensor network and Embedded based technique of DTMF (Dual Tone Multiple Frequency) signaling to control water flow for sectored, sprinkler or drip section irrigation. Circuit switching instead of packet switching used by SMS controlled devices available currently in the market. The farmer can use his cell phone or landline phone for the purpose of starting and controlling the irrigation and the pesticide spraying, just by dialing and sending the DTMF commands over the GSM network. This system will be very economical in terms of the hardware cost, power consumption and call charges. Farmers have to control (on/off) the valves time to time (even at night) which increases the running cost because every time we have to make a call to on or off the valves and it is also very inconvenient. Farmers are unable to know the status of power supply at the field.

[4] In Wireless Sensor Network Based Automated Irrigation and Crop Field Monitoring System mentioned about using wireless sensor network based automated irrigation system for optimize water use for agricultural purpose. The system consists of distributed wireless sensor network of soil moisture, and temperature sensors placed in the crop field. To handle the sensor information Zig bee protocol used and control the water quantity programming using an algorithm with threshold values of the sensors to a microcontroller for irrigation system. The system continuously displays the abnormal condition of the land (soil moisture, temperature level). Using a GSM modem with GPRS facility feature provides the information to fanners and interface with PIC 18F77 A microcontroller. The Irrigation system is automatic and manual mode. This system increase the crop fields, improve the crop quality, increase the energy and reduce the non-point source pollution.Due to PIC microcontroller the length of the program will be big because of using RISC (35 instructions).

[5] In Smart drip irrigation system for sustainable agriculture mentioned about using fully automated drip irrigation system which is controlled and monitored by using ARM9 processor.PH content and the nitrogen content of the soil are frequently monitored. For the purpose of monitoring and controlling, GSM module is implemented. The system is used to turn the valves ON or OFF automatically as per the water requirement of the plants. The system informs user about any abnormal conditions like less moisture content and temperature rise, even concentration of CO2 via SMS through the GSM module. The moisture sensor output will help to determine whether to irrigate the land or not depending upon the moisture content. Along with moisture sensor the temperature sensor output can also be taken into consideration while irrigating the land. If the moisture content of soil is very low and the temperature is very high then there is need of irrigation for plants, but the time for which irrigation will be provided is different for different temperature range. Small amount of water is lost through deep percolation if the proper amount is applied.ARM processor is that it is not binary compatible with x86. This means you not going to be running windows any time soon. There are several Unixoperating systems that can run on ARM however, such as Linux and BSD.

III. SYSTEM DESIGN

The project is designed to develop an automatic irrigation system which switches the pump motor ON/OFF on sensing the moisture content of the soil. In the field of agriculture, use of proper method of irrigation is important. The advantage of using this method is to reduce human intervention and still ensure proper irrigation.

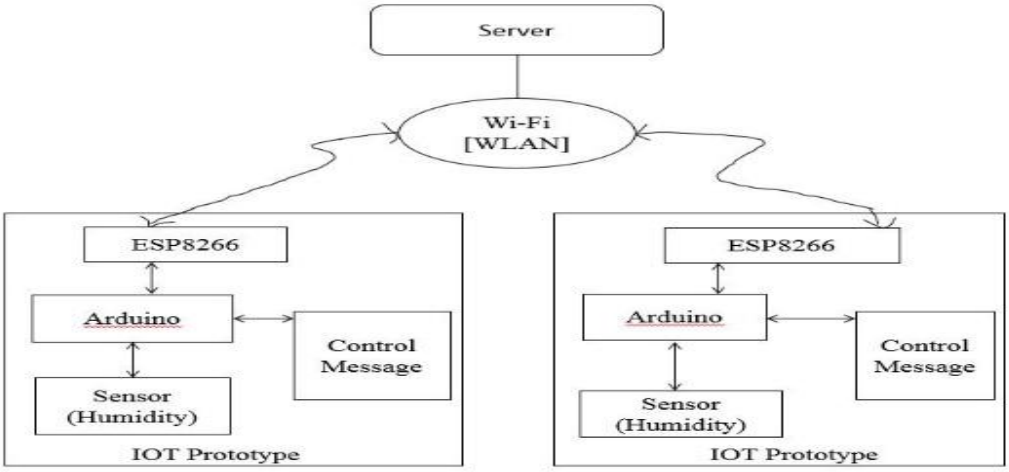

FIGURE 1 SYSTEM DESIGN

The project uses an arduino microcontroller which is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement The sensor data are stored in database. The web application is designed in such a way to analyze the data received and to check with the threshold values of moisture, humidity and temperature. The decision making is done at server to automate irrigation. If soil moisture is less than the threshold value the motor is switched ON and if the soil moisture exceeds the threshold value the motor is switched off.

3.1 Sensors Data acquisition

There sensors used are already discussed. Let discuss about data acquisition from sensors one by one.

The sensor is interfaced with Arduino microcontroller and programmed. The moisture sensor can read the amount of moisture present in the soil surrounding it. The soil moisture sensor has two probes which is inserted into the soil. This sensor uses the two probes to pass current through the soil. The moisture soil has less resistance and hence passes more current through the soil whereas the dry soils has high resistance and pass less current through the soil. The resistance value help detecting the soil moisture.

FIG. 2.SHOWS SOIL MOISTURE SENSOR

The DHT11 temperature and Humidity sensor is used. The total amount of water vapor in air is defined as a measure of humidity. Relative humidity is calculated because when there is a change in temperature, relative humidity also changed. The temperature and humidity changes occur before and after irrigation. The amount of water droplets in air is increased after irrigation. This causes decrease in temperature which in turn increases the relative humidity of the surroundings. The temperature and humidity reading are often notified to the user so that the user can be able to know the field conditions from anywhere. The temperature and humidity sensor can also be used in green houses.DHT11 temperature and humidity sensor is shown in Fig. 3.

International Journal of Engineering Research & Science (IJOER)
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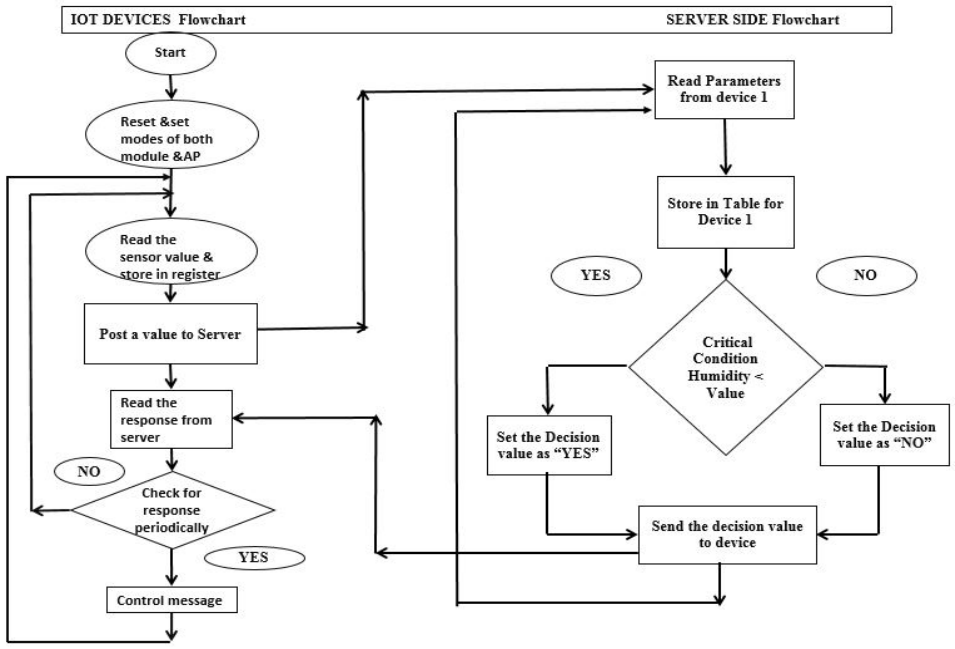
FIG 3 .SHOWS DHT 11A

FIG 4 SHOWS ARDUINO MICROCONTROLLER

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. Arduino programming language is based on Wiring and the Arduino Software (IDE), based on Processing Arduino microcontroller is shown in fig 4

IV. METHODS

Automation of the irrigation system is gaining importance as there is need to use water resources efficiently and also to increase the field productivity. The system is used to turn the valves ON or OFF automatically as per the water requirement of the plants. The system is used for sensing, monitoring, controlling and for communication purpose. Different sensors are used to detect the different parameters of the soil like moisture, temperature, humidity, pH of soil and nitrogen content of the soil. Depending upon the sensors output the ARM9 processor will take the necessary action. The moisture sensor output will help to determine whether to irrigate the land or not depending upon the moisture content. Along with moisture sensor the temperature sensor output can also be taken into consideration while irrigating the land. If the moisture content of soil is very low and the temperature is very high then there is need of irrigation for plants, but the time for which irrigation will be provided is different for different temperature range. Because if the temperature is very high then the evaporation rate is also very high and hence we have to provide water for more time in order to attain the proper moisture level in the soil. Hence for different temperature range and moisture content level in the soil the land will be irrigated for different time interval. Flow chart of entire process is shown in figure 5.



V. ALGORITHM

1. Configure the WIFI module.
    a. Reset the module.
    b. Set the mode of the module.
    c. Attach the module to one AP.
    d. Read the IP address of module.
2. Reading Sensor Values.
    a. Start the modules to ready mode.
    b. Read the sensor value.
    c. Store it in the register.
3. Posting the value to sensor.
    a. Get connected to server.
    b. Instruct the Wi-Fi module for sending data.
    c. Post a sensor value to the server.
    d. Store a value in server database.
    e. Taking action based on server response.
4. Take action based on server response.
    a. YES- Taking action & continue the reading.
    b. NO -Continue reading next sensor values.

VI. CONCLUSION

The automated irrigation system has been designed and implemented in this paper. The system developed is beneficial and works in cost effective manner. It reduces the water consumption to a greater extent. It needs minimal maintenance .The power consumption has been reduced very much. The system can be used in green houses. The System is very useful in areas where water scarcity is major problem .The crop productivity increases and the wastage of crops is very much reduced using this irrigation system. The developed system is more helpful and gives more feasible results.

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