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Smart Irrigation System Using WiFi Module and IOT

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ABSTRACT: The project is designed to develop an automatic irrigation system that switches a pump motor ON/OFF by sensing the moisture content of the soil using wireless technology effectively for agriculture applications through Wi-Fi module used in an SMS on the status. 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 to ensure proper irrigation. The project uses ESP8266 MOD which is programmed to receive the input signal of varying moisture condition of the soil through sensing arrangement. Once the module receives this signal, it generates an output that drives a relay for operating the water pump. This concept in future can be enhanced by integrating XBEE/Bluetooth technology, such that whenever the water pump switches ON/OFF, the information is sent to a smart mobile phone or XBEE transceiver module regarding the status of the pump.

KEYWORDS: Energy consumes, Humidity sensor, Soil moisture sensor, Temperature sensor, wireless sensor network.

I. INTRODUCTION

Agriculture plays a vital role in every country economy. Generally, agriculture uses 80 % of fresh water. This percentage will be dominant in water consumption because of population growth, so this becomes a very important to create a system which is based on science and technology for sustainable use of water. There are so many systems available to achieve water savings in various crops from basic ones to more technologically advanced ones. In one system, plant water status was monitored and it is based on canopy temperature of the plant; another system was developed to arrange irrigation of crop water stress index. This paper uses a low-cost wireless device for data communication. An automated irrigation system is developed with a low-cost moisture sensor. In environmental application, sensors network has been used to monitor a variety of environmental parameters or conditions in marine, soil and atmospheric conditions. Application in agriculture has been used to provide data for appropriate management. Various commercial WSNs exist, ranging from limited and low-resolution devices with sensors and embedded processors. In a wireless node, the radio modem consumes more power. Recently there are too many wireless standards have been established such as local area network uses IEEE 802.11b (Wi-Fi) and wireless personal area network uses IEEE 802.15.1 (WPAN), IEEE 802.15.1 (Bluetooth) and IEEE 802.15.4 (Xee). In this paper, development of an automated irrigation system based on Wi-Fi and wireless communication is presented. The aim of this implementation is to reduce the water use using an automatic irrigation system. In this implementation, we are using 3 sensors i.e., soil moisture sensor, temperature sensor, Humidity sensor. These 3 sensors are interface with ESP8266MOD where we are transmitting the soil data to the PC using transceiver and also, we are using a motor for watering the field. 3 sensors are deployed in plant root zone.

In these years, the rise of our cell phones, tablets, automobiles, "smart" technology has expanded the market and has transformed into another standard in the business. Internet of things empowers the specific interrelationship among several appliances, equipment, and services based on Internet and this technology also helps further to provide comfort to people to do work easily. Smart irrigation is an innovative scenario where many researchers are taking interest and for decades it is developing and emerging. It shows the use of Arduino and ESP8266 based monitored and controlled smart irrigation systems, which is also cost-effective and simple. It is beneficial for farmers to irrigate their land conveniently by the application of automatic irrigation system. This smart irrigation system has ultrasonic sensor, water flow sensor, temperature sensor and soil moisture sensor that measure respectively and based on these sensors Arduino microcontroller drives the servo motor and pump. Arduino receives the information and transmits with ESP8266 Wi-Fi module wirelessly to the website through internet. This transmitted information is monitored and control by using IOT.

S.No.	Crop	Moisture Level (in %)	Water Requirement (in mm)	Optimum Temperature (in C)
1	Rice	20%	900-2500	25
2	Wheat	12%	450-850	22
3	Maize	18-24%	500-800	25
4	Soyabean	13%	450-700	14
5	Sunflower	9.50%	350-500	16
6	Corn	15.50%	500-750	35
7	Tomato	10%	600-800	30
8	Potato	12.50%	500-700	16
9	Onion	11%	350-550	24
10	Bean	16%	300-500	24

II. RELATED WORK

Irrigation can be broadly defined as the practice of applying additional water to soil to enable or enhance plant growth and yield, in some cases the quality of foliage or harvested plant parts. The water source could be groundwater pumped to the surface, or surface diverted from one position on the landscape to another. In many cases sustainable irrigation development requires concomitant development of surface drainage.

Irrigation may be the single most strategically important intentional environmental modification human have learned to perform. While irrigation's impact has not always been as critical to the global agriculture economy and food supply as it is today, it has always had major local impacts and profound historical and social consequences.

III. PROCEDURE

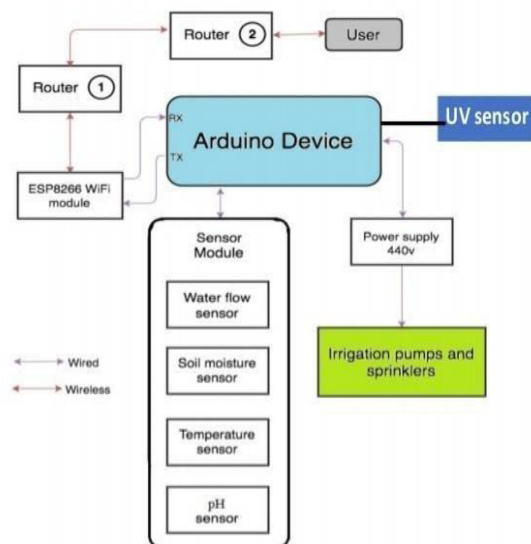


Fig. Structure of Irrigation system using ESP2866

A. Water flow Sensor

This sensor uses a pinwheel sensor to measure how much liquid has moved through it. The pinwheel has a little magnet attached, and there's a hall effect magnetic sensor on the other side of the plastic tube that can measure how many spins

the pinwheel has made through the plastic wall. This method allows the sensor to stay safe and dry. By counting the pulses from the output of the sensor, we can easily track fluid movement: each pulse is approximately 2.25 millilitres.

B. Soil Moisture Sensor

The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil. The sensor averages the water content over the entire length of the sensor.

C. Temperature Sensor

The core functionality of the DS18B20 is its direct-to-digital temperature sensor. The resolution of the temperature sensor is user-configurable to 9, 10, 11, or 12 bits, corresponding to increments of 0.5C, 0.25C, 0.125C, and 0.0625C, respectively. The DS18B20 powers up in a low power idle state. To initiate a temperature measurement and A-To-D conversion, the master must issue a Convert T command. The resulting thermal data is stored in the 2-byte temperature register in the scratchpad memory and the DS18B20 returns to its idle state. If the DS18B20 is powered by an external supply, the master can issue (read time slots) after the Convert T command and the DS18B20 will respond by transmitting 0 while the temperature conversion is in progress and 1 when the conversion is done.

D. PH Sensor

Crops soil required water to maintain the ph. A sensor called pH sensor is used for the measurement of nutrient contents in the soil.

E. Water pump:

It is used to water the crops and the driver circuit operates it. They play a fundamental part in agriculture as they pump water from the source to the agricultural field. Pumps can be used for many types of irrigation, such as drip, sprinkler, and using a hosepipe. A water pump is a machine used to increase the pressure of water in order to move it from one point to another.

F. DC Motor:

A DC motor is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors were the first type widely used, since they could be powered from existing direct current lighting power distribution systems.

G. Power supply:

5V power supply is used.

H. ESP8266 WIFI Module:

The ESP8266 WIFI Module is a self - contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network. The ESP8266 is capable of either hosting an application or offloading all WIFI networking functions from another application processor.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

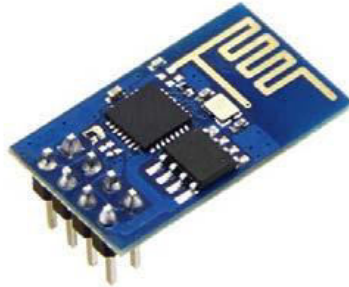


Fig. ESP8266 Module

I. Ultrasonic Sensor

An ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

IV. METHODOLOGY

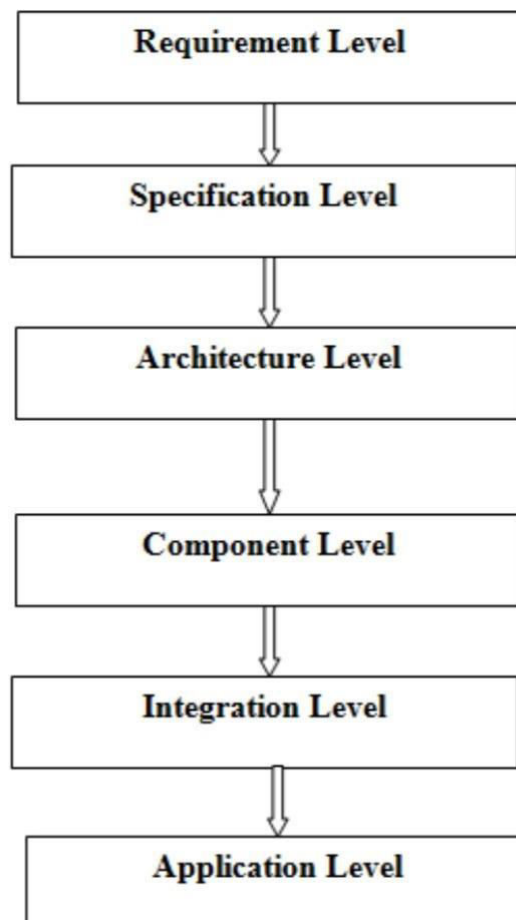


Fig. Design sequence of proposed automatic irrigation system.

A. Requirement Level

It is a first level of the design process of proposed an automatic irrigation system it is divided into two types and they are as follows.

I. Functional requirement

Functional requirements consist of technical details, data manipulation and processing, sensing and indication. The proposed system uses a sensing device to detect soil moisture, temperature and humidity. It uses an automatic indication to detect an automatic operation such as Motor Pump, Fan (ON/OFF), Buzzer Blow.

II. Non-functional requirement

It is mutually exclusive of functional requirement. The proposed system consists of monitoring and controlling water level of soil, environmental temperature and humidity. When this factor crosses the threshold value of particular crop it automatically start respective operation of Pump, Fan and Buzzer.

B. Specification Level

Specification is a detailed assessment of requirements of devices. In this project we are using some specifications that are WIFI Module i, e., ESP8266 Module, power supply and some of the sensors that are temperature sensor, soil moisture, ph. Sensor and ultrasonic sensor

C. Architecture Level

The algorithm for the proposed design is shown in above design. The sensor which is placed at field station is power up with DC power. At particular area in field the temperature and moisture of the soil is given by temperature sensor and soil moisture sensor respectively. And the values are transferred to base station in particular time intervals.

The value monitored by the sensors is uploaded in web by using ESP8266 Wi-Fi module. Wherever the user, continuous monitoring of the behavior of the soil is possible by Internet of Things (IOT).

D. Component Level

It is an important and independent part of system which performs the function in the architecture. It is the most important level for the design of the system. It consists of hardware and software component.

I. Hardware component

Hardware component is a physical device that is a part of the system which connects the other component, provide input and output to and from the application. The proposed system hardware components are Temperature sensor, humidity sensor, soil moisture sensor, WI-FI module, Motor pump, Buzzer, Relay, uv sensor.

II. Software component

It is interfaced between the hardware and PC. The features are inbuilt in a software application is called as a software Component.

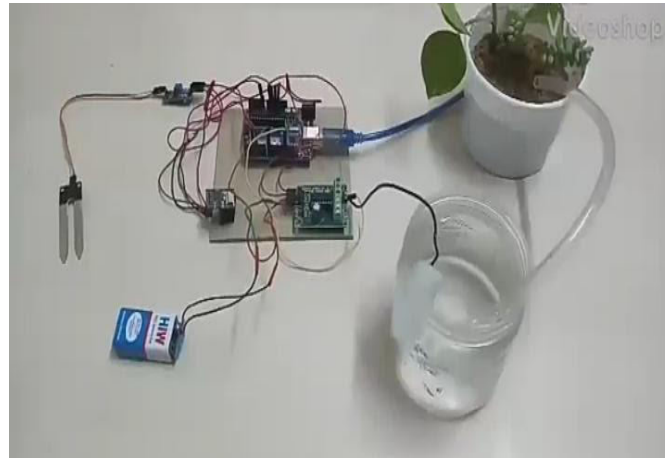
F. Application Level

The proposed system is applied in agriculture field to detect the temperature, humidity, moisture, which will improve the quality and quantity of crop productions.

V. RESULT & CONCLUSION

RESULT

The automated Smart Irrigation System using IOT is found to be cost effective for enhancing the techniques to preserve water resources and to optimize them for agriculture production. This system helps the farmer by working automatically and smartly.



This system also helps to reduce water consumption and by using this system the crop production increases to a great extent. Irrigation becomes easy, accurate and practical with the idea above shared and can be implemented in agricultural fields in future to promote agriculture to next level. The output from moisture sensor and level system plays major role in producing the output.

The pump, sprinkles and also the user can get the messages through the mobile phone automatically.



VI. CONCLUSION

Currently, farmers control irrigation method manually and irrigate their area at a systematic period. These mechanisms deplete high amount of water and the outcome is water loss. While dry areas have less rainfall and irrigation is challenging. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the operational amplifier which triggers the DC Motor pump to turn ON and supply the water to respective field area. When the desired moisture level is reached, the system halts on its own and the DC Motor pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

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