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IOT Based Crop Field Monitoring With Controlling and Irrigation Automation

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Abstract

A resource that all living species need is Water. It is therefore very precious and for enhancing agricultural productivity it is the critical input. There for expansion, of irrigation has been a key strategy in the development of agriculture in country. Today, farmer shaves several issues in agriculture due to lack of rain sand scarcity of water. The main motto of this paper to save time, money and power of farmer with an automatic irrigation system Manual intervention is required for the traditional farmland techniques. Human intervention can be minimized with the automated technology of irrigation. By using soil moisture sensor levels of soil moisture/humidity can be checked. Whenever there is a change in Humidity /moisture in the soil this sensor senses the change and an interrupt signal is passed to the micro controller and depending on this the irrigation system works. The automated irrigation system provides a web interface to the user so that the user can monitor and control the system remotely i.e., can make the irrigation system ON and OFF remotely.

Keywords: *Zigbee, Internet of things, irrigation*

1. INTRODUCTION

As our country is an agriculture-oriented country and the rate at which water resources are depleting is a dangerous threat hence there is a need of a smart and efficient way of irrigation. This project is designed to develop an automatic irrigation system which controls the pump on sensing the moisture content of the soil. In the field of agriculture, use of the proper method of irrigation is important. The main advantage of this project is to reduce human signal of varying moisture condition of the soil through the sensing arrangement. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. The status of the soil is transmitted over the internet. The sensing arrangement is made by using soil moisture sensor. The system has a network of soil moisture sensor and a temperature sensor placed in the root zone of the plants. A microcontroller handles sensor information; triggers pump and transmit data to the control unit.

An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller to control water quantity. This unit is powered by photovoltaic panels and has a wireless communication link with the control unit. The control unit has communication link based on a cellular-Internet interface that transmits data on the internet.

II. NEED OF AUTOMATIC IRRIGATION SYSTEM

It is easy and simple to install and configure. It saves energy and resources, so that they can be utilized in a proper way. By automating farm farmers would be able to smear the right amount of water at the right time. Avoiding irrigation at the wrong time of the day, reduce runoff from over watering saturated soils which will improve cropper formance. Automated Irrigation System makes the motor ON and OFF. Motors can be automated easily by using controller and no need of labor to turn the motor ON and OFF. Elimination of human error in adjusting available soil moisture levels it is time saving.

A. Internet of Things (IOT)

The internet of things collect and exchange data which is a network of vehicles, buildings, physical devices and other items embedded with sensors, electronics, software and network connectivity [2] . IoT creates opportunity for more direct integration of the physical world into

computer based systems which results inaccuracy, efficiency and economic benefit. An IP address is used as a unique identifier by devices for integration with the internet. Applications of IoT include Environmental Monitoring – monitors soil and atmospheric condition switch sensors for environment protection.

Transportation – includes smart traffic control, smart parking. Infrastructure management – monitors an controls the infrastructures such as railway tracks, Medical and Health Care Systems – emergency notification systems and remote health monitoring can be enabled.

II. SYSTEM ARCHITECTURE

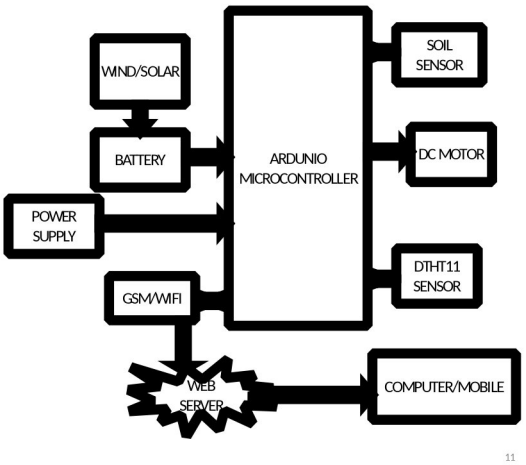

Figure: 1

A. Arduino

Arduino is an open-source electronics prototyping platform. It is based on flexible and easy-to-use hardware and software. The microcontroller on the board can be programmed using the Arduino programming language and the Arduino development environment. It is a tool for making computers that can sense and control more of the physical world than a desktop computer. It's an open-source computing platform based on a simple microcontroller board and a development environment for writing software for the board.

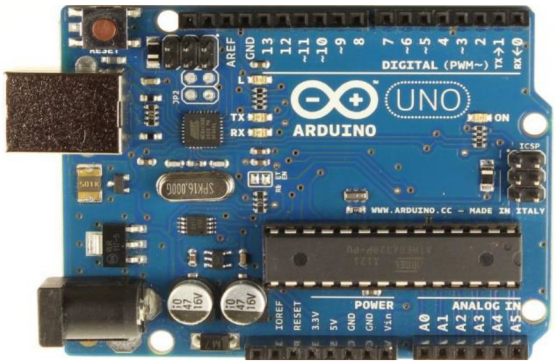

Figure: 2

B.GSM Module

GSM stands for global system for mobile communication. GSM is a mobile communication modem. GSM is an open and digital cellular technology used for transmitting mobile voice and data services. It operates at the 850MHz, 900MHz,

1800MHz and 1900MHz frequency bands. A GSM modem is devices which can be used to make a computer or any other microprocessor communicate over a network. A SIM card is required in GSM module to operate it over a network range subscribed by the network operator. It can be connected to a microcontroller through serial, USB or Bluetooth connection It can be connected to a microcontroller through serial, USB or Bluetooth connection

C. ZIGBEE

Zigbee is a wireless communication technology. Zigbee is preferred over other wireless technologies because of its low power consumption and its ability to connect a large number of devices into a single network. Zigbee technology uses the globally available, license-free2.4GHz frequency band. Zigbee uses a standardized set of high-level communication protocols sitting atop cost-effective, low-power digital radios based on the IEEE 802.15.4standard for wireless personal area networks.

Zigbee technology is widely deployed in wireless control and monitoring applications because of its low cost. It has a longer life with small batteries due to its low power consumption. The mesh networking provides high reliability and larger range.

D. Power Supply

A power supply is a device that supplies electric power to electric load. The term is most commonly applied to electric power converts that one form of electrical energy to another, it may also refer to devices which converts other form of energy (chemical, mechanical, solar) to electrical energy [3] . The output voltage or current to a specific value can be controlled by arregulated power supply; the controlled value is held nearly constant despite variations in either voltage supplied or load current by the power supply's energy source.

E. SENSORS (Soil Moisture Sensor)

It is an electrical resistance sensor. The sensor is made up of two electrodes. Soil moisture sensor reads the moisture content which is present around it. A current is passed across the electrodes through the soil and the resistance will be low and thus more current is passed through. The sensor module outputs a high level of resistance when the soil moisture is low. It has both digital and analog outputs. Digital output is

simple to use, but it is not as accurate as analog output.

F. Temperature Sensor

Here LM35 is used as a temperature sensor. It is an integrated circuit sensor which can be used to measure temperature with an electrical output proportional to the temperature. LM35 generates a higher output voltage. It is used to measure the surrounding temperature.

G. Web Page

A web page is a web document that is suitable for the web browser and World Wide Web. The language used here is PHP. It is a server side scripting language designed for web development. PHP code may be embedded into HTML code or it can also be used in combination with various web frameworks, web content management, web template systems.

In the web server PHP code is processed by PHP interpreter. In web page the values regarding soil moisture and temperature are displayed. By web page user can make the irrigation system ON and OFF remotely.

H. Soil Sensor (Circuit diagram)

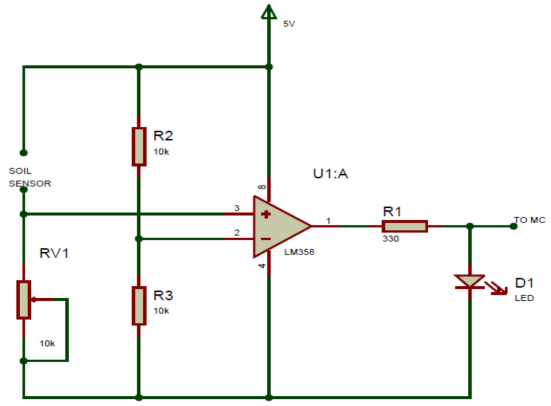

Figure: 3

I. Description

IC LM358 is designed as a voltage comparator. Its inverting input pin2 receives half supply voltage (2.5V) through the potential divider R1 and R2. Its non-inverting input pin 3 is connected to soil sensor and variable resistor VR1. Output of the comparator becomes high only when its pin3 gets a higher voltage than pin2. Normally pin 3 is low because it is not getting current from the positive supply. So output remains low. When the contacts of the sensor in soil, current passes through the contacts to the pin 3 of the comparator. This higher voltage at pin 3 causes the output to go high. LED lights glow.

J. DC motor

Figure: 4

III. RELATED WORK

A. DC Motor Driving Circuit

The most basic motor driver circuit is a single transistor switch that can only turn a motor on or off. The single transistor can turn the motor on in one direction only, clockwise or counterclockwise, depending upon how the motor is connected in the circuit. It also doesn't permit the motor to be electronically braked. The circuit diagram of a single transistor motor driver is shown below.

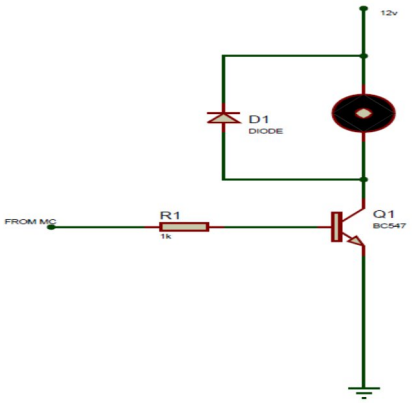

Figure: 5

B. Liquid Crystal Display

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data

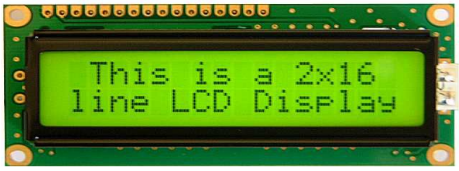

Figure: 6

C. Operation of Algorithm

The following steps are followed in automatic irrigation system.

Step 1: Begin the process.

Step 2: The initial power is supplied to GSM.

Step 3: Check soil moisture level.

Step 4: If soil moisture content is greater than a fixed value, then there is no need of irrigation.

Step 5: If the soil moisture and temperature content is less than a fixed value, then start irrigation.

Step 6: User can operate the system remotely through a web page.

CONCLUSION

This paper gives a brief idea about an irrigation system which is fully automated and is based on today's emerging technology that is the internet of things. This system is very useful for the regions where water scarcity is the major problem. This system ensures the efficient use of water in the irrigation system.

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