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Arduino Based Drip Irrigation System using the Internet of Things (IoT)

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ABSTRACT*:* This paper proposes intelligent and smart Irrigation system which can be used for controlling the watering or irrigation of flowering plants. It controls the irrigation of plants automatically where the need of human intervention can be reduced. This mainly focused on wastage of water, which is a major concern of modern era. It also aids time saving, cost effectiveness, environmental protection,low maintenance and operating cost and efficient irrigation service Arduino (open source) is used in the design of the prototype model in making the system compact and sustainable. The system has sensor which measures the moisture of the soil.

KEYWORDS*:* Arduino UNO microcontroller,12 volts DC source, Smart Irrigation, Relay Channel, Hardware Specifications:Battery 12 volts DC source, 3 Water Pumps, Water Reservoir, Ultrasonic Sensor, 2-channel Relay Mode, 2-channel Relay Mode, Moisture Sensor

I. INTRODUCTION

We have developed an Arduino-based drip irrigation system using the Internet of Things (IoT). This system allows irrigation to take place more efficiently, based on soil humidity, temperature and pH values sent to the micro. We have developed an Arduino-based drip irrigation system using the Internet of Things (IoT). This system allows irrigation to take place more efficiently, based on soil humidity, temperature and pH values sent to the microcontroller (Arduino UNO) which drives the solenoid valve via the driver circuit transistor (BC547). Based on the sensor measurements, at pre-determined thresholds, automatic irrigation is accomplished. The buzzer comes on, based on sensor values and these values are updated on the web as well as on an Android mobile device. Using the temperature and pH level measurements, climatic and soil conditions from the field, the required fertilizers for the crops are suggested by the system. This improves the method of cultivation and leads to better productivity. Using this system, the direction of the water flow in the pipes is automatically determined by means of a DC motor. It makes use of a soil moisture sensor, ultrasonic sensor, relay sensor, Arduino UNO microcontroller and a DC motor. Information about the motor operation and direction of water on the farm field are sent to the mobile message and Google mail account of the user. We have designed a smart irrigation system using a Arduino IDE software and implemented it using the Arduino microcontroller. The system programmed in C++ programming language operates automatically by sensing the moisture level of soil via the soil moisture sensor and turns ON/OFF the pump using a relay without the intervention of the farmer. In this way, it is made more convenient and water wastage is reduced. The sensing arrangement and the microcontroller are interfaced via an Op-Amp which acts as a comparator. When the microcontroller receives the signal, an output that drives the relay is produced and the water pump is operated. A Cellphone Screen is used to display the message and it also interfaces with the microcontroller and it is used to display the soil moisture content as well as the status of the water pump. In an attempt to develop a smart irrigation system, we used different types of controllers such as Programmable Logic Controller and on the Arduino Uno . There have been some attempt to address the issue of water management in irrigation system. The system is designed such that during operation, the wet zones are bypassed while dry zones are irrigated. The zone detection is carried out using soil moisture content sensors. This is an attempt to ensure adequate water management. In many of the previous studies, the problem of water scarcity is not adequately addressed. This paper therefore seeks to address this challenge by implementing a new approach that ensures prioritizing of irrigation pumps.

II. PROPOSED METHOD

Irrigation is most important for high yield of the farm. Today, by using WSN technology it is possible to monitor and control the environmental conditions as soil moisture, temperature, wind speed, wind pressure, salinity, turbidity, humidity etc for irrigation. Automatedirrigation performed by using solenoid valve and pump. Solenoid valve is an

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electromechanical valve used with liquid controller to control an electronic current through solenoid which is a coil of wire that uses to control the state of thevalve according to need of irrigation.

Direct Communication method provides collision free transmission of data, because allthe sensor nodes send data directly to the base station without the need of header node. This method is better where the base station is near but it is not optimum where the base station is far because sensor nodes consume more energy during transmission of data and if there is much data to the sensor node, sensor nodes quickly damaged. The data aggregation method is better to use rather than direct communication method.

The sensor node senses the data and send to the head node. The head node collects data from the entire sensor node, performs aggregation using various aggregation techniques, and then sends data to the base station. Thus by using aggregation method overall energy consumption reduce of the network.

2.1 Block Diagram:

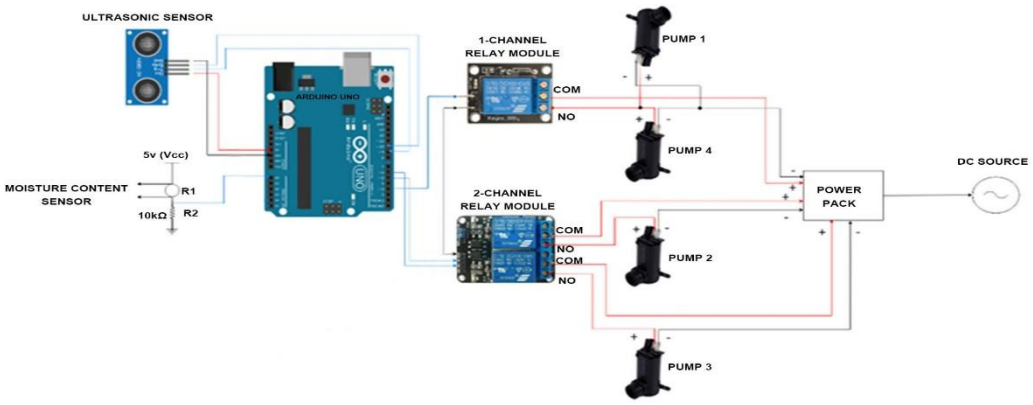

Figure 1 Block Diagram

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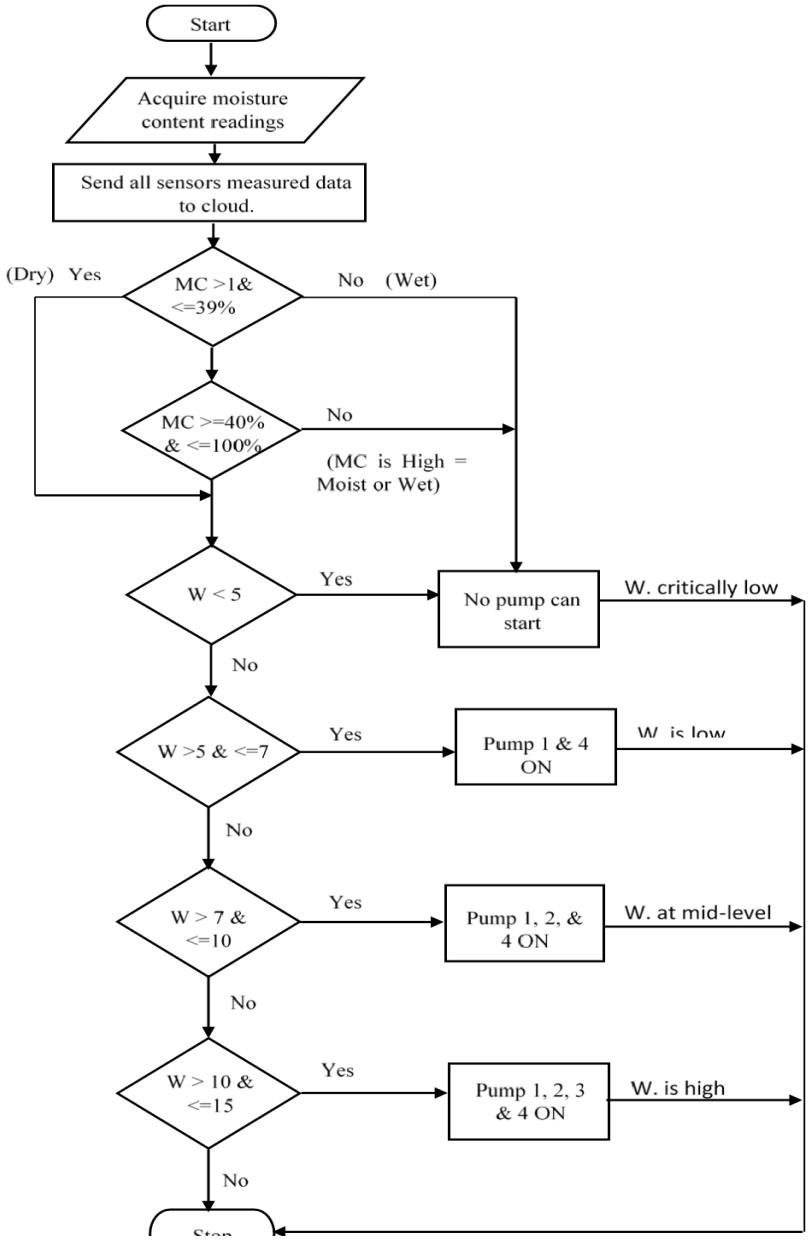

Figure 2 Flow Chart

2.2 12v Battery (DC source):

A twelve-volt battery has six single cells in series producing a fully charged output voltage of 12.6 volts. ... The size of the battery plates and amount of electrolyte determines the amount of charge lead acid batteries can store. The size of this storage capacity is described as the amp hour (AH) rating of a battery.

2.3 Ultrasonic Sensor:

Figure 3 Ultrasonic Sensor

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An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

2.4 Water Reservoir:

Water Reservoir is basically a vessel in which the water will be stored . We will be using a Rectangular Box in our case.

2.5 Moisture Sensor:

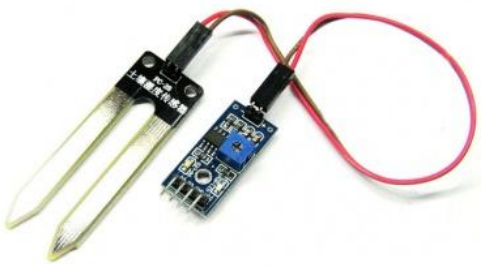

Figure 4 Moisture Sensor

The Moisture sensor is used to measure the water content(moisture) of soil. When the soil is having water shortage,the module output is at high level, else the output is at low level.This sensor reminds the user to water their plants and also monitors the moisture content of soil.It has been widely used in agriculture,land irrigation and botanical gardening.

2.6 2-Channel Relay Mode:

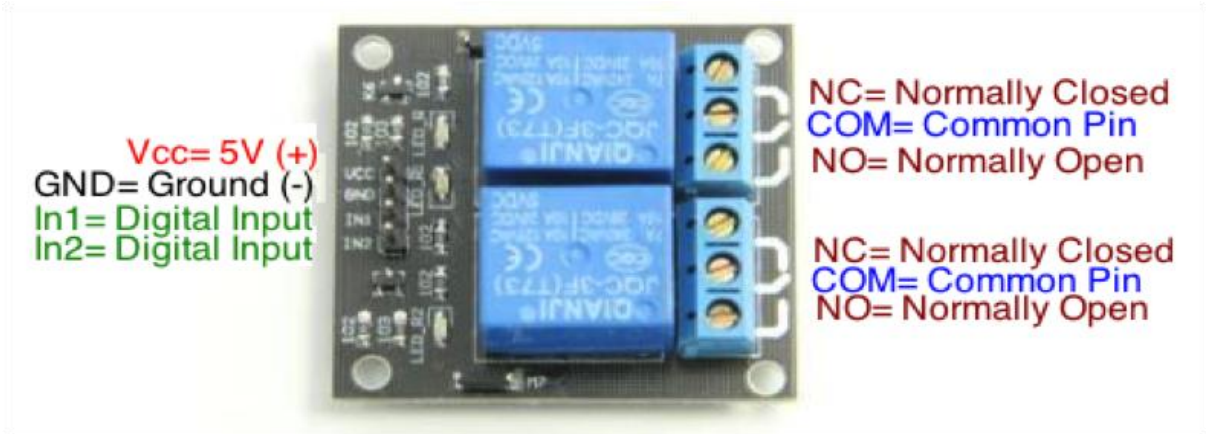

Figure 5 2-Channel Relay Mode

A relay is defined as an electrically operated switch; their main use is controlling circuits by a low-power signal or when several circuits must be controlled by one signal. The first relay was used in long distance telegraph circuits as amplifiers, basically they repeated the signal they received from one circuit, and transmitted it into a different one, theywere also used in early computers to perform logical operations.

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2.7Arduino UNO Microcontroller:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.[2][3] The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the

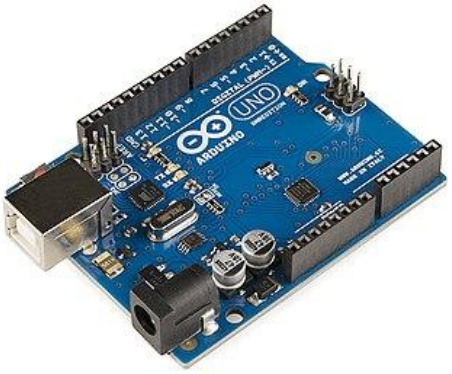

Figure 6 Arduino UNO Microcontroller

Arduino IDE (Integrated Development Environment), via a type B USB cable.It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

III. CONCLUSION

Smart irrigation system that optimises water usage is developed. This system guarantees the longevity of irrigation pumps; prevents water wastage through water recycling and prioritizes pump operations based on the level of water in reservoir. This way, it ensures that different plants are irrigated in relation to their varying water needs for effective growth. It would be useful in places where water scarcity is a challenge to the practice of irrigation.

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