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AUTO CONTROL OF WATER IRRIGATION SYSTEM PARAMETERS WITH HELP OF MICROCONTROLLER

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Abstract - *Automated irrigation system consists of a feedback control system that employs monitoring of environmental parameters and controlling irrigation. Environmental parameters such soil moisture, temperature and humidity plays an important role in overall development of the plant. Conservation of water and other resource can be achieved by optimizing these parameters. The advancement in technology has enabled us to use various sensors for measuring various parameters related to irrigation. This paper reviews for various sensors available to monitor above environmental parameters and focuses on its application for Watering the plants on the road divider. Paper describes an application of a microcontroller-based water irrigation system for the plants on the road dividers for controlled and monitored irrigation.*

Key Words: irrigation, microcontroller, sensors, humidity, moisture

1. INTRODUCTION

Conventional watering method for the plants on road dividers used to waste a lot of water as layman who used to water the plants doesn't have knowledge about exactly how much water do plants require which leads to wastage of water along with extra cost of the fuel, tanker's rent and human efforts. Automation can help save water, fuel as well as human efforts. This can be achieved with the help of auto control of water irrigation system with help of the microcontroller.

Here we present the project "auto control of water irrigation system parameters with help of microcontroller" which is a system that senses the various parameters and automatically switches the control valve so that plants are being watered whenever necessary depending on the condition.

An automatic irrigation system does the work quite efficiently and with a positive impact on the place where it is installed. Once it is installed in the respective site, the water distribution to plants becomes easy and doesn't require any human support to perform the operations and it would reduce errors which used to happen in watering the plants by reducing human involvement.

The system senses the various parameter required for the irrigation like moisture, temperature, humidity etc. Which are being sent to microcontroller Once the microcontroller gets the data from the different sensors installed it compares the data as programmed in a way, which generates output signals and activates the relays for operating the control valve to allow the water flow according to the scenario. The required connections from sensors are interfaced to the control unit for controlling the operations of the control valve.

1.1 OBJECTIVES

1. To give controlled supply of water to the plants based on the various parameters i.e. (soil moisture, temperature, humidity etc.)

2. To fulfil the demand of water supply by microcontroller based automatic water irrigation system for the plants.

3. To prevent wastage of water occurring in conventional approaches.

4. To reduce the human efforts and use of other sources which were used in conventional methods.

2. SYSTEM DESCRIPTION

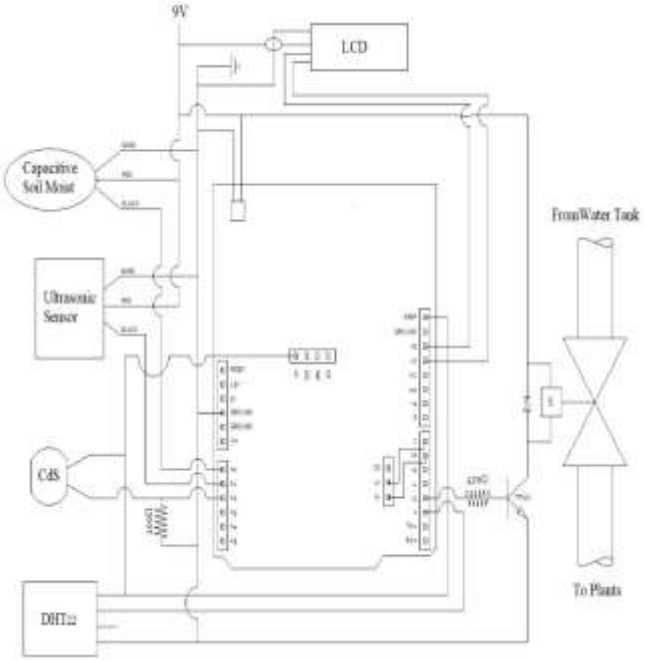

Fig 1 Circuit Diagram

2.1 Major Components

2.1.1 DHT22 Temperature-Humidity Sensor

The DHT22 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old. Simply connect the first pin on the left to 3-5V power, the second pin to your data input pin and the rightmost pin to ground. Although it uses a single-wire to send data it is not Dallas One Wire compatible! If you want multiple sensors, each one must have its own data pin.

2.1.2 Ultrasonic Sensor

An Ultrasonic sensor is used in the transmitter circuit, which measures the distance of water level from the upper point of the bottle or Tank. The distance is measured in centimetres and sent to receiver circuit using RF communication. Receiver circuit receives the data from transmitter circuit and converts it in terms of the percentage and shows on LCD. Ultrasonic sensor has two openings, one is Trigger and the other is Echo. Trigger makes high frequency sound waves. These sound waves are passed through the tank from top to bottom. The sound waves hit the water and are reflected back in the form of Echo waves. The Echo opening receives the Echo waves. The water level sensor Arduino measures the time between Echo and Trigger. This travelled distance is directly proportional to the time.

2.1.3 Capacitive Soil Moisture Sensor

A capacitive moisture sensor works by measuring the changes in capacitance caused by the changes in the dielectric. It does not measure moisture directly (pure water does not conduct electricity well), instead it measures the ions that are dissolved in the moisture These ions and their concentration can be affected by a number of factors, for example adding fertilizer for instance will decrease the resistance of the soil. Capacitive measuring basically measures the dielectric that is formed by the soil and the water is the most important factor that affects the dielectric. Capacitive measuring has some advantages, it not only avoids corrosion of the probe but also gives a better reading of the moisture content of the soil as opposed to using a resistive soil moisture sensor. Since the contacts (the plus plate and the minus plate of the capacitor) are not exposed to the soil, there is no corrosion of the sensor itself. The capacitance of the sensor is measured by means of a 555 based circuit that produces a voltage proportional to the capacitor inserted in the soil. We then measure this voltage by use of an Analog to Digital Converter which produces a number that we can then interpret as soil moisture.

Fig 2 Capacitive Soil Moisture Sensor

2.1.4 Arduino Uno

Arduino Uno is a microcontroller board developed by Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328. The current version of Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output. It allows the designers to control and sense the external electronic devices in the real world. This board comes with all the features required to run the controller and can be directly connected to the computer through USB cable that is used to transfer the code to the controller using IDE (Integrated Development Environment) software, mainly developed to program Arduino. IDE is equally compatible with Windows, MAC or Linux Systems; however, Windows is preferable to use. Programming languages like C and C++ are used in IDE. Apart from USB, battery or AC to DC adopter can also be used to power the board.

Fig 3 Arduino Uno

2.1.5 12V 7AH SMF Battery

SMF (Sealed Maintenance Free) batteries also known as the Value Regulated Lead Acid (VRLA) batteries are the flat plate sealed and therefore eliminate the risk of acid spillage during transportation. Due to their construction, it can be mounted in any orientation batteries that do not require topping-up and normally do not emit any fumes or gases on a continuous basis. They are completely, and do not require constant maintenance. These are used for high end.

2.1.6 Solenoid Control Valves

Solenoid Control Valve is an on-off control valve that either opens or closes upon receiving an electrical signal to the solenoid pilot control. This valve consists of a Hytrol main valve and a three-way solenoid valve that alternately applies pressure to or relieves pressure from the diaphragm chamber of the main valve. It is furnished either normally open (de-energized solenoid to open) or normally closed (energized solenoid to open).

3. PROPOSED WORK

To overcome the drawback of conventional method of watering the plants on road dividers using water we have incorporate the microcontroller technology for watering the plants on road dividers. An automatic irrigation system does the work quite efficiently and with a positive impact on the place where it is installed. Once it is installed in the respective site, the water distribution to plants becomes easy and doesn't require any human support to perform the operations and it would reduce errors which used to happen in watering the plants by reducing human involvement.

The process involves various sensors to analyse the amount of moisture in the soil and then if the moisture in the soil is low. the processor then produces an output signal that informs the water valve to open and reach the right destination to give the maximum effect. Thus, this system gives a very efficient way of irrigating the plants automatically without any human intervention. As soon as we turn up the machine the led will glow three times indicating the system is successfully started for this, high input for led int pin is provided. After the system is started it will check for the SD card and various sensor if it doesn't detect the SD card it will show the error for this we have used if condition for checking, if it detect all the system then it will sense the various data through sensor and it log into SD card as csv file under heading as per their values initially system will water the soil first time and log into SD card as watered. After that it will wait for an hour and again it will sense the data but these time it will check the current moisture with threshold value of moisture upon the condition it will water the soil. For condition checking we have used if condition, if the condition is false it will not water the soil and simply log the sense data of values watered status into csv file. For watering we use solenoid as solenoid will create reverse magnetic field it will lead to short circuit, we use 470-ohm resistor and npn transistor. If moisture is low then it will give the input of solenoid pin in high. For water tank level we constantly check the distance of ultrasonic sensor using while loop if distance get low it will lead to blinking the led as Warning the Whole procedure will repeatedly with constant time until manually turn off.

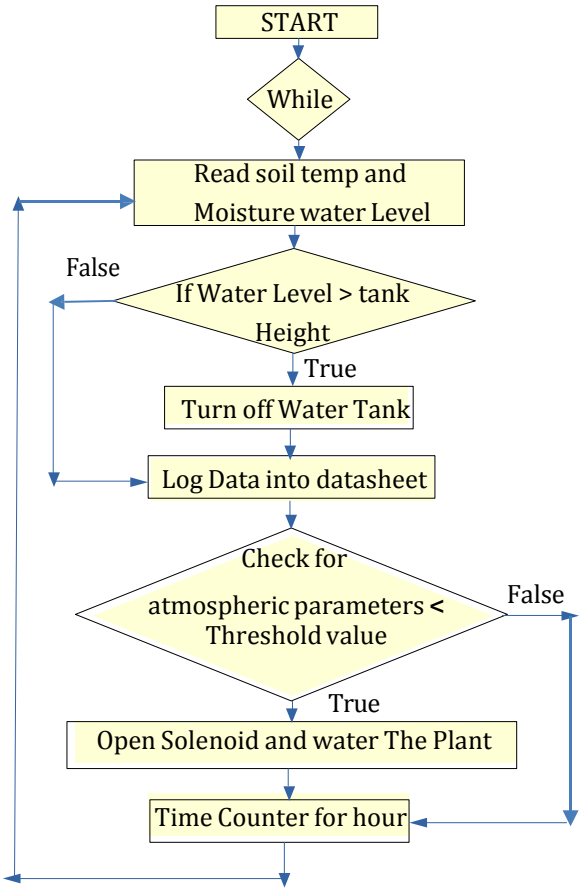

Fig 4 Flow chart

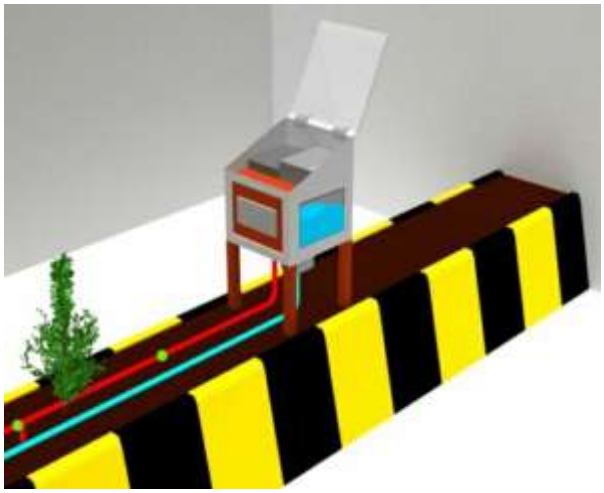

Fig 5 Proposed system

4. CALCULATION FOR SIZE OF TANK

Watering amounts will vary based on soil type and moisture content. Sandy soils will need more than 1" of water a week (or 1.5-1.75" of water a week in severe droughts) since those types of soils dry out faster than loam or clay-based soils, which require 1" of water a week.

According to the book "Growing Great Vegetables in the Heartland" by Andrea Ray Chandler, water application figures are as follows: it takes 3,000 gallons of water to a depth of 1" to cover 5,000ft^2. On a smaller scale, it takes 300 gallons of water to a depth of 1" to cover 500ft^2 or 60 gallons of water to cover 100ft^2.

Road divider cross section-50m×0.5m

Therefore, cross section to be watered-25m^2 = 269ft^2

$$\frac{3000 \text{ gal. water}}{5000 \text{ sq. ft}} = \frac{(x) \text{ gal. of water required per week}}{\text{square footage of area to be watered}}$$

$$\frac{3000 \text{ gal. water}}{5000 \text{ sq. ft}} = \frac{(x) \text{ gal. of water required per week}}{269 \text{ sq. ft}}$$

Therefore, gal. of water required per week = 161.4 gal. of water = 610.9 litres

Per day requirement of water

$$\frac{610.9}{7} = 87.3 \text{ litre}$$

Base on above calculations dimensions of tank are as follows

1) length=0.6m

2) width=0.5m

3) height=0.8m

Volume=0.6× 0.5× 0.8=0.24 m^3 =240 litre

To fulfil the requirement two tanks of 240 litre each will be used.

Therefore, total volume=480 litre

The irrigation requirements of plants are affected by weather variability. The water demand varies from day-to-day depending on crop growth stage and weather variables such as solar radiation, air temperature, humidity, and wind conditions.

Therefore, based on above calculations 480 litre of water can be utilized for minimum 5 days, but the period might increase depending on weather conditions.

5. RESULT, OUTCOME AND DISCUSSION

The designed microcontroller based automatic drip irrigation system is feasible and cost effective over the period of time when compared with other approaches of watering the plants on road dividers. In which appreciable amount of water is conserved by reducing the large amount of human efforts as system designed does not require any physical presence for monitoring during working without causing pollution which used to happen in conventional method of watering the plants. Furthermore, improvements can be done by giving power supply through solar energy.

6. CONCLUSION

The microcontroller based automatic drip irrigation system is implemented and found to be feasible and cost effective. It is advantageous over manual water supplying as it uses a mechanism like time-based control mechanism and sensor-based control mechanism in the system to fulfil the need of water requirement.

REFERENCES

1) S. Mathurkar and D. Chaudhari, —Smart Sensors Based Monitoring System for Agriculture using Field Programmable Gate Array", International Journal of Innovative Technology and Exploring Engineering (IJITEE), Vol. 3, Issue 4, May 2013.

2) O. Mirabella and M. Brischetto, —A hybrid wired/wireless networking infrastructure for greenhouse management,‖ IEEE Tranactions on Instrumentation Measurement, vol. 60, no. 2, pp. 398–407, Feb. 2011.

3) D. Wavhal and M. Giri, —Intelligent Drip Irrigation System‖, International Journal of Engineering Sciences and Research Technology, May 2014.

4) P. Bhosale and V. Dixit, —Water saving-irrigation automatic agricultural controller‖, International Journal of Scientific and Technology Research, Vol. 1, Issue 11, Dec. 2012.

5) Rahul G. Ghodake and Altaf O. Mulani Microcontroller Based Automatic Drip Irrigation System, Springer International Publishing AG 2018

6) Book- "Growing Great Vegetables in the Heartland" by Andrea Ray Chandler

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