Automatic Irrigation System Using DTMF

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Abstract—The main aim of this paper is to provide automatic Irrigation System using DTMF technology for Indian farmers with a facility to operate a motor at a distant and controlled using microcontroller 8051. Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator. Whenever there is a change in temperature and humidity of the surroundings these sensors senses the change in temperature and humidity and gives an interrupt signal to the micro-controller and thus the motor is activated and if the power supply is off we can start the motor with the help of DTMF. This paper represents the prototype design of microcontroller based automatic irrigation system which will allow irrigation to take place in zones where water in gis required, while by passing zones where adequatesoilmo is tureis in dicated.

Index Terms—Microcontroller; DTMF; Sensor; Motor

I. INTRODUCTION

Nowadays, water shortage is becoming one of the biggest problems of the world. Many different methods are developed for conserving water. We need water to maintain a green environment. Water is considered the basic need of humans. Water is needed for everyone's human beings, animals, plants, etc. Agriculture is one of the fields where water is required in large quantities. Waste of water is a major problem in agriculture. Every mistake in the use of water is harmful to the environment. There are many different techniques and systems to save water and control the wastage of water from agriculture.

A. Ditch Irrigation

Ditch Irrigation is a traditional method, where ditches are dug in the land and seedlings are planted in rows. Siphon tubes are used to move the water from the main ditch to the canals.

B. Terraced Irrigation

This is a very labor-intensive method of irrigation where the land is cut into steps and supported by retaining walls. The flat areas are used for planting and the idea is that the water flows down each step. This allows steep land to be used for planting crops.

B. Drip Irrigation

This is known as the most water-efficient method of irrigation. Water drops right near the root zone of the plant in a dripping motion. If the system is installed properly you can steadily reduce the loss of water through evaporation and runoff.

C. Sprinkler System

This is an irrigation system based on overhead sprinklers, sprayors, guns, installed on permanent risers. You can also use the system underground and the sprinklers rise up when water pressure is required, which is a popular irrigation system for use on golf courses and parks.

D. Rotary Systems

This method of irrigation is best suited for larger areas. Forthethsprinklerscan reach distances of up to 100 feet. The word “Rotary” is indicative of the mechanical driven sprinklers moving in a circular motion, hence reaching greater distances. This system waters larger areas with small amounts of water over a long period of time.

E. NEED OF DTMF IN IRRIGATION SYSTEM:-

Automatic irrigation systems are convenient, especially for horse travel. If installed and programmed properly, automatic irrigation systems can save you money and help in water conservation. Agriculture is a source of livelihood for majority Indians and has great impact on the economy of the country. In dry areas or in case of inadequate rainfall, irrigation becomes difficult. So, it needs to be automated for proper yield and handled remotely for farmer safety. In this paper we suggest a 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. This system will be very economical in terms of the hardware cost, power consumption and call charges.

II. SOFTWARE AND HARDWARE PLATFORM USED:-

A. Hardware

Microcontroller, ADC, Humidity sensor, Voltage amplifier, comparator, current to voltage converter, temperature sensor, solenoid, diode, resistors, and capacitors.
B. **Software used**

Multisim 10.2, diptrace, side 51, Kiel Software.

III. BLOCKDIAGRAM:-

**A. Humidity sensor**

The humidity sensor just senses the humidity or the moisture of the soil. The change in humidity is proportional to the amount of current flowing through the soil. The humidity sensors available in the market are too costly to be used for such small applications. So, for domestic purposes, we have designed a simple humidity sensor which works on the principle of the conductivity of soil. Whenever the soil is dry, the conductivity of soil is less and vice versa.

Our humidity sensor consists of two metal rods and it has a 9V battery. The two conducting metal rods are of Aluminium. These two rods are separated by a wooden block for supporting the two rods and keeping a gap between them. Constant The two rods are inserted into the soil. The 9V battery is connected in series with these rods. So, the current flows from the rod through the soil. Here, if the soil is dry, the current flowing is negligible. And if the soil is wet, the current sensed by the humidity sensor is then converted into voltage using the LM339 IC. The voltage is amplified using a transformer.

**B. ItoV converter and voltage converter**

The current/voltage converter converts current coming from the humidity sensor into voltage and this voltage is given to the voltage amplifier for amplification.

**C. Comparator**

It compares the reference voltage and the amplified voltage coming from the ItoV converter.

**D. Temperature sensor and LM339**

LM335 sensor senses the surrounding temperature. The output of this IC is an analog voltage. This voltage is given to the LM339 for comparing the present condition with the ideal one.

**E. Microcontroller**

The entire automation is done using microcontroller.

**F. Design of power supply**

Power supply consists of a transformer, bridge rectifier, and voltage regulating IC87805, 7812, 7912, +5V, -5V, +12VDC power supply is designed to provide VCCs as well as reference voltage to the various ICs.

**G. Step down transformer**

Stepdown transformer converts 230V from AC mains into 15VAC having a center tap transformer having 15V, 0V, 15V and 0.5A power. Transformer selection is based on the fact that the regulator IC supply voltage is around 14V, input considering dropout voltage (around 2V), in order to obtain 12V power supply. The current demand of ICs is 741, 7812, microcontroller, comparators etc., is satisfied using 500mA transformer.

Transformer steps down the voltage from 230V to 15V. It is then converted to 15V using a bridge rectifier. The bridge rectifier converts the voltage to 15V.

**H. Bridge rectifier**

Rectifier converts the voltage into a DC voltage. 4 diodes are connected in bridge. Its input is from the transformer and output is given to the voltage regulator ICs.

**I. Voltage regulator IC**

Voltage regulator IC gives constant DC voltage at output in spite of fluctuations in input.

**J. Temperature sensor ICLM351**

LM351 sensor senses instantaneous temperature and converts it into voltage. This voltage is then amplified and given to ADC.

**K. ItoV converter IC 741**

This IC converts current into voltage. IC741 is used for this purpose. Output voltage is then amplified and given to the comparator.

**L. Voltage amplifier 741**

This amplifier increases the voltage given as input. Its gain is calculated as:

\[ A_v = 1 + \frac{R_f}{R_1} \]

**M. Comparator ICLM339**

Comparator ICLM339 compares 2 voltages. Vref is adjusted by adjusting pot. Vref is given by formula:

\[ V_{ref} = \frac{(R_2)}{(R_1 + R_2)} \times X5 \]

We have used two comparators ICs. As discussed above the first comparator IC compares amplified voltage from the ItoV converter, now the second comparator IC is used to compare different temperature conditions LM391 IC has four internal comparators. Out of those four comparators we are using only two comparators. The output of the comparators gives the temperature is above or below.
20 degree Celsius. Another one compares whether temperature is above or below 30 degree Celsius. The output of this is given to the microcontroller.

N. Microcontroller IC AT 89C51
Programs given to microcontroller to check values of temperature and output of comparator which compares the voltage of the output of comparator and makes the LED ON or OFF for particular time interval. Time interval is different for different ranges of temperature programs written in assembly language.

O. Flip Flop IC 7474
Microcontroller AT 89C51 has clock frequency 12 MHz. For AD C0808, 6 80 KHz frequency is required. So, this frequency is derived from microcontroller clock using flip flop IC. IC 7474 is used as flip flop IC.

P. LED
It indicates the need of sprinkler. When LED is on, that means sprinklers should be on. It is off if there is no need of water.

Fig.1

IV. FUTURE SCOPE:
A. Saves water - Studies show that drip irrigation systems use 30 - 50% less water than conventional watering methods, such as sprinklers.
B. Improves growth - Smaller amounts of water applied over a longer amount of time provide ideal growing conditions. During irrigation extends watering times for plants, and prevents soil erosion and nutrient runoff. Also, because the flow is continuous, water penetrates deeply into the soil to get well down into the root zone.
C. Discourages weeds - Water is only delivered where it's needed.
D. Saves time - Setting and moving sprinklers is not required.
   A timer delay as per environment can be added to the system for automatic watering.
E. Helps control fungal diseases, which grow quickly under moist conditions. Also, wet foliage can spread disease.
F. Adaptable - A drip irrigation system can be modified easily to adjust to the changing needs of a garden or lawn.
G. Use of Sensors - The working of above project is basically dependent on humidity sensors which will be possible by using sensor technology and use of PH sensors.

V. CONCLUSION
The system provides with several benefits and can operate without manpower. The system supplies water only when the humidity in the soil goes below the reference. Due to the direct transfer of water to the roots, water conservation takes place and also helps to maintain the moisture level of the soil and root zone. Other root zone constants are extended. Thus, the system is efficient and compatible to changing environment.

Fig.2

REFERENCES:
[5] Introduction to LCD programming tutorial by Craig Steiner Copyright 1997 - 2005 by Vault information services LLC.