Micro Controller Based Automatic Plant Irrigation System*

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ABSTRACT

The main aim of this paper is to provide automatic irrigation to the plants which helps in saving money and water. The entire system is controlled using 8051 micro controller which is programmed as giving the interrupt signal to the sprinkler.Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator,When ever 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 sprinkler is activated.

Keywords : Micro controller;Temperature sensor;Humidity sensor;sprinkler

1 INTRODUCTION

Now days, water shortage is becoming one of the biggest problem in the world. Many different methods are developed for conservation of water. We need water in each and every field. In our day to day life also water is essential. Water is considered to be basic need of human. Water is needed for everyone human beings, animals, plants, etc .

Agriculture is one of the fields where water is required in tremendous quantity. Wastage of water major problem in agriculture . . Every time excess of water is given to the fields. There are many techniques to save or to control wastage of water from agriculture .

Ditch Irrigation

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

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. watering each plot. This allows steep land to be used for planting crops.

Drip Irrigation

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

Sprinkler System

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

Rotary Systems

This method of irrigation is best suited for larger areas, for the sprinklers can 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 a larger area with small amounts of water over a long period of time.

1.1 NEED OF AUTOMATIC IRRIGATION:-

Automatic irrigation systems are convenient, especially for those who travel. If installed and programmed properly, , automatic irrigation systems can even save you money and help in water conservation. Dead lawn grass and plants need to be replaced, and that can be expensive. But the savings from automatic irrigation systems can go beyond that. Watering with a hose or with oscillator wastes water. Neither method targets plant roots with any significant degree of precision. Automatic irrigation systems can be programmed to discharge more precise amounts of water in a targeted area, which promotes water conservation.

2 SOFTWARE AND HARDWARE PLATFORM USED:-

2.1 hardware used

Micro controller,ADC,Hunidity sensor,Voltage amplifier,comparator current to voltage convertor,temperature sensor,solenoid,diode resistors and capacitors.

2.2 software used

Multi sim 10.2,dip trace,side 51

3 BLOCK DIAGRAM:-

3.1 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 market are too costly to be used for such small household applications. So for domestic purpose, we have designed a simple humidity sensor which works on the principle of conductivity of the soil . whenever the soil is dry

the conductivity of soil is less and vice-versa.

Our humidity sensor consists of two metal rods and 9V battery. The two conducting metal rod used are of Aluminium. These two rods are separated by wooden block for supporting the two rods and keeping the spacing between them constant. The two rods are inserted in soil. The 9V battery is connected in series with these rods. So, the current flows from the rods through the soil. Here, if soil is dry, current flowing is negligible. And if soil is wet, current is sensed .This current is then converted in to voltage using I to v converter.

3.2 I to V converter and voltage converter

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

3.3 comparator

It compares the reference voltage and the amplified voltage coming from I to V convertor .

3.4 Temperature sensor and LM 339

IC LM35 senses the surrounding temperature. The output of this IC is analog voltage. This voltage is given to the LM339 for comparing the present condition with the ideal one.

3.5 Micro controller

The entire automation is done using micro controller.

3.6 Design of power supply

Power supply consists of a transformer, bridge rectifier, and voltage regulating ICs 7805, 7812, 7912. +5 V,-5V,+12V DC power supply is designed to provide VCC as well as reference voltage to the various ICs .

3.6.1 step down transformer

step down transformer converts 230V from AC mains into 15V AC have used a center tap transformer having -15V, 0V, 15V and 0.5 ampere. Transformer selection is based on the fact that regulator ICs require around 14v as input considering dropout voltage (around 2v), in order to obtain 12v power supply. And current demand of ICs 741, ADC, microcontroller, comparator etc is satisfied using 500mA transformer.

Transformer steps down ac voltage from 230v ac to 15v ac. It is then given to bridge rectifier. Bridge rectifier converts ac voltage into pulsating dc. It is then given to regulator ICs which output constant dc voltage. These voltages are given to other ICs as VCC or reference. Outputs of ICs 7805, 7812 &7912 are +5v, +12v &-12v respectively.

3.7 bridge rectifier

Rectifier converts ac voltage into dc voltage. 4 diodes are connected in bridge. Its input is from transformer and output is given to the voltage regulator IC's.

3. 8 voltage regulator IC

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

3. 9 Temperature sensor IC LM135

LM 35 IC senses instantaneous temperature, and converts it into voltage. This voltage is then amplified and given to ADC.

3.10 I to V converter IC 741

This IC converts current into voltage. IC 741 is used for this purpose.   Output voltage is then amplified and given to comparator.

3.11 voltage amplifier 741

This amplifies the voltage given as an input to it. Its gain is calculated as:-

$$Av=1+Rf/R1$$

3.12 comparator IC LM 339

Comparator IC LM 339 compares 2 voltages. Vref is adjusted by adjusting pot. Vref is given by formula:-

$$Vref= (R2/ (R1+R2)) X 5$$

We have used two comparator ICs. As discussed above the first comparator IC compares amplified voltage from I to V convertor. Now the second comparator IC is used to compare different temperature conditions. LM 339 IC has four internal comparators. Out of those four comparators we are using only two comparators. The one comparator compares whether temperature is above or below 20 degree Celsius. Another one compares whether temperature is above or below 30 degree Celsius. The output of this Ic is given to the Micro controller.

3.13 Micro controller IC AT 89C51

Program is given to microcontroller to check values of temperature and output of comparator which compares the Vref and amplified voltage of I to V convertor, and make the LED 'ON' for particular time interval. Time interval is different for different ranges of temperature.program is written in assembly language

3.14 Flip Flop IC 7474

Microcontroller AT89C51 has clock frequency 12MHz.For ADC 0808, 680KHz frequency is required. . So, this frequency is derived from microcontroller clock using flip flops. Ic 7474 is used as flip flop IC.

3.15 LED

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

4 CONCLUSION

The system provides with several benefits and can operate with less 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 to soil ratio at the root zone constant to some extend. Thus the system is efficient and compatible to changing environment.

Internal Circuit Diagram of LM339:-

5 ADVANTAGES

1. **Saves water** - Studies show that drip irrigation systems use 30 - 50% less water than conventional watering methods, such as sprinklers.

2. **Improves growth** - Smaller amounts of water applied over a longer amount of time provide ideal growing conditions. Drip 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.

3. **Discourages weeds** - Water is only delivered where it's needed.

4. **Saves time** - Setting and moving sprinklers is not required. A timer delay as per environment can be added to the system for automatic watering.

5. **Helps control fungal diseases**, which grow quickly under moist conditions. Also, wet foliage can spread disease.

6. **Adaptable** - A drip irrigation system can be modified easily to adjust to the changing needs of a garden or lawn.

7. **Simplest Method** - Start by drawing a map of your garden and yard, showing the location of plantings. Measure the distances required for lengths of hose or plastic tubing to reach the desired areas.
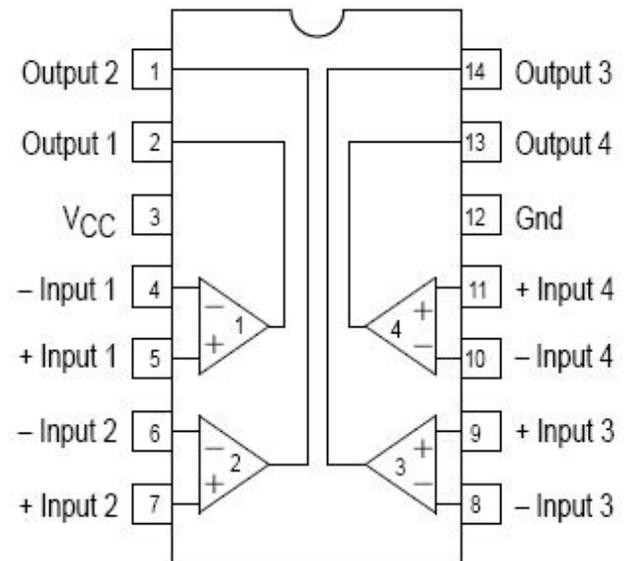
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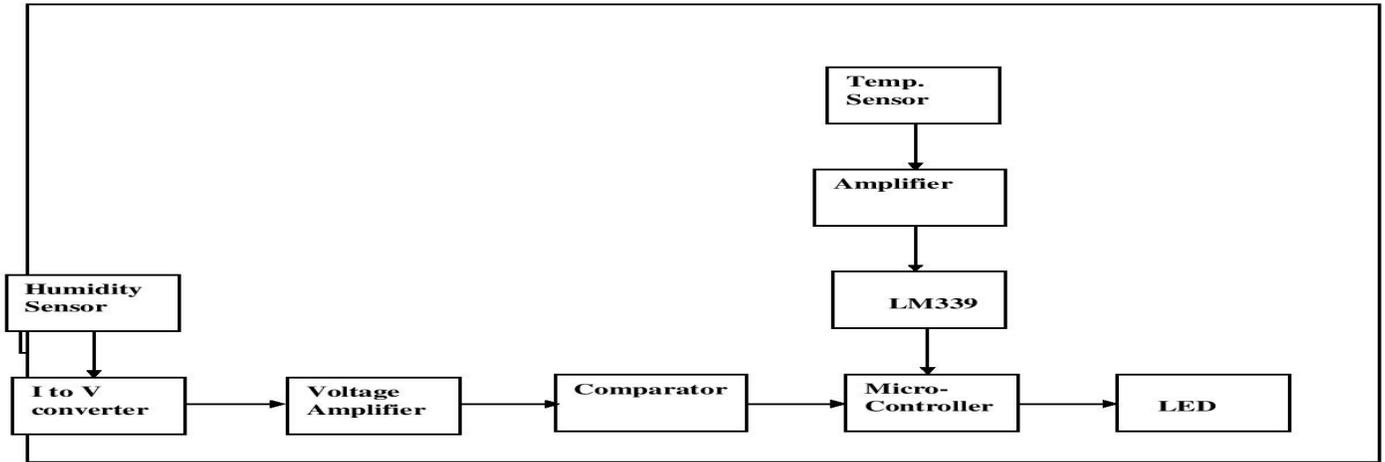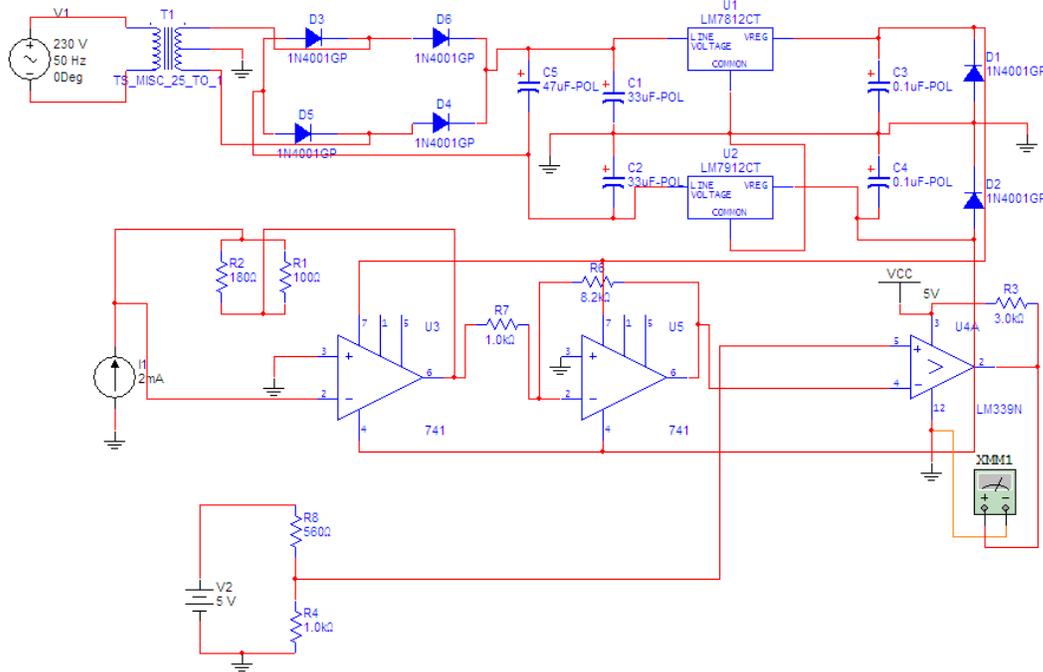
Fig Block Diagram

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Power Supply Design in Multisim 10 software

FINAL PCB LAYOUT