Moisture Sensors for Automatic Watering System For Indoor Garden

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Abstract

The Main Focus was to designAutomatic Watering System for Indoor Gardensregularly. The circuit comprises of sensor parts built using op-amp IC LM358. Op-amp's are configured here as a comparator. Two stiff copper wires are inserted in the soil to sense whether the soil is wet or dry. The Microcontroller is used to control the whole system by monitoring the sensors and when sensors sense the dry condition then the microcontroller will send command to relay driver IC the contacts of which are used to switch on the motor and it will switch off the motor when all the sensors are in wet condition. The microcontroller does the above job as it receives the signal from the sensors through the output of the comparator, and these signals operate under the control of software which is stored in ROM of the MC.

I. INTRODUCTION

The era is all about automation and specially people having small garden and terrace gardens with many fruit bearing trees and plants which require regular watering. The gardener these days are very lazy and often skip watering. This resulted in stunted growth of the plants or in the worst case scenario, some plants starts to withering away. Hence there was a need for some good solution like some form of automation without breaking the bank. Hence this project enabled us in developing an automated watering system for indoor plants with cost effectiveness and less human supervision.

II. BLOCK DIAGRAM

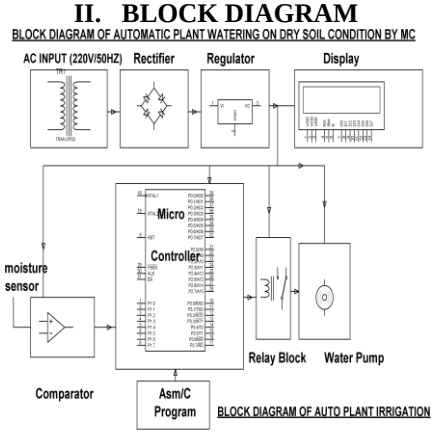


Fig 3.1: Project Block Diagram

III. HARDWARE REQUIREMENTS

Hardware Components

1. TRANSFORMER (230 – 12 V AC)
2. VOLTAGE REGULATOR (LM 7805)
3. RECTIFIER
4. FILTER
5. MICROCONTROLLER (AT89S52/AT89C51)
6. LCD
7. WATER PUMP
8. LM358 OP-AMP
9. BC547 TRANSISTOR
10. RELAY
11. 1N4007
12. LED
13. RESISTORS
14. CAPACITOR.

IV. SOFTWARE REQUIREMENTS

A. Keil C Cross Compiler

Keil is a German based Software development company. It provides several development tools like

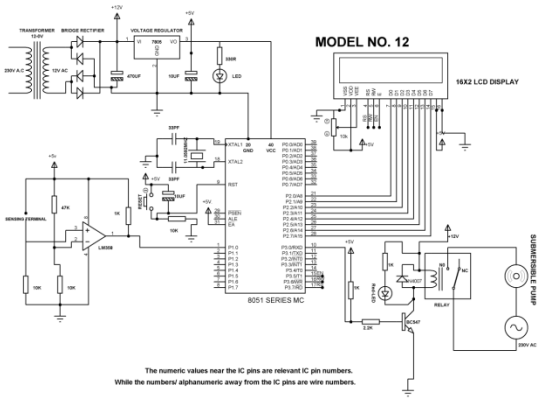
- IDE (Integrated Development environment)
- Project Manager
- Simulator
- Debugger
- C Cross Compiler, Cross Assembler, Locator/Linker

The Keil ARM tool kit includes three main tools, assembler, compiler and linker. An assembler is used to assemble the ARM assembly program. A compiler is used to compile the C source code into an object file. A linker is used to create an absolute object module suitable for our in-circuit emulator.

B. Embedded C

Use of embedded processors in passenger cars, mobile phones, medical equipment, aerospace systems and defense systems is widespread, and even everyday domestic appliances such as dish washers, televisions, washing machines and video recorders now include at least one such device.

V. SCHEMATIC DIAGRAM



A. *Description*

1) *Power Supply*

The circuit uses standard power supply comprising of a step-down transformer from 230Vto 12V and 4 diodes forming a bridge rectifier that delivers pulsating dc which is then filtered by an electrolytic capacitor of about 470µF to 1000µF. The filtered dc being unregulated, IC LM7805 is used to get 5V DC constant at its pin no 3 irrespective of input DC varying from 7V to 15V. The input dc shall be varying in the event of input ac at 230volts section varies from 160V to 270V in the ratio of the transformer primary voltage V1 to secondary voltage V2 governed by the formula V1/V2=N1/N2. As N1/N2 i.e. no. of turns in the primary to the no. of turns in the secondary remains unchanged V2 is directly proportional to V1.Thus if the transformer delivers 12V at 220V input it will give 8.72V at 160V.Similarly at 270V it will give 14.72V.Thus the dc voltage at the input of the regulator changes from about 8V to 15V because of A.C voltage variation from 160V to 270V the regulator output will remain constant at 5V.

The regulated 5V DC is further filtered by a small electrolytic capacitor of 10µF for any noise so generated by the circuit. One LED is connected of this 5V point in series with a current limiting resistor of 330Ω to the ground i.e., negative voltage to indicate 5V power supply availability. The unregulated 12V point is used for other applications as and when required.

2) *Standard Connections To 8051 Series Micro Controller*

ATMEL series of 8051 family of micro controllers need certain standard connections. The 4 set of I/O ports are used based on the project requirement. Every microcontroller requires a timing reference for its internal program execution therefore an oscillator needs to be functional with a desired frequency to obtain the timing reference as t =1/f.

A crystal ranging from 2 to 20 MHz is required to be used at its pin number 18 and 19 for the internal oscillator.Typically 11.0592 MHz crystal is used in general for most of the circuits using 8051 series microcontroller. Two small value ceramic capacitors of 33pF each is used as a standard connection for the crystal as shown in the circuit diagram.

3) *Reset*

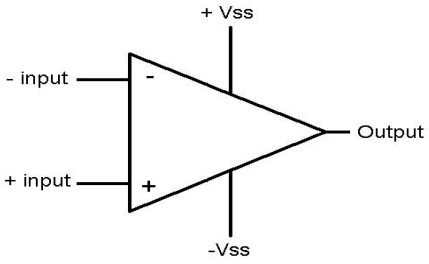
Pin no 9 is provided with an re-set arrangement by a combination of an electrolytic capacitor and a register forming RC time constant.

4) *Comparator*

How an op-amp can be used as a comparator?

Potential dividers are connected to the inverting and non inverting inputs of the op-amp to give some voltage at these terminals. Supply voltage is given to +Vss and –Vss is connected to ground. The output of this comparator will be logic high (i.e., supply voltage) if the non-inverting terminal input is greater than the inverting terminal input of the comparator.

i.e., Non inverting input (+) > inverting input (-) = output is logic high



If the inverting terminal input is greater than the non-inverting terminal input then the output of the comparator will be logic low (i.e., gnd)

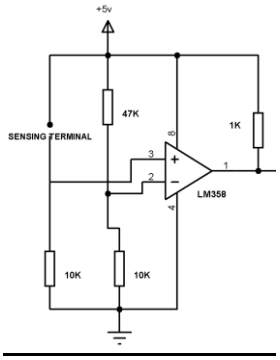
i.e., inverting input (-) > Non inverting input (+) = output is logic low

B. *Operation Explanation*

1) *Connections*

The o/p of the power supply which is 5v is connected to the 40 pin of MC and GND is connected to its 20th pin. Now the output of the OPAMP LM358 is connected to Pin 1.0 of Port 1.0. Data lines of LCD or D_0 to D_7 are connected to part 2, Pin 21 – 28 of Microcontroller. Read, Write, Enable pins of LCD are connected to Pin15, Pin16, Pin17 of Port 3 of Microcontroller. When Pin 3.0 of port3 is connected to the transistor (BC547) which drives the relay. When Pin 3.0 is high then the transistor get switch ON so that relay gets ON, since the path is closed. This makes the DC motor run

VI. WORKING



The inverting input of the Comparator LM358 i.e., Pin 2 is given to the fixed voltage i.e., in the ratio 47k: 10k, and the non-inverting input of the comparator is pulled down and is given to moisture sensing arrangement at sensing terminal. When the soil is dry, the soil resistance between the positive supply and the non inverting input is high resulting in positive supply to the non-inverting input less than the inverting input making comparator output as logic low at pin no 1. This command is given to MC. In this condition the MC outputs logic high at pin no. 10 that switches on a relay driving transistor due to which the relay is switched on and the pump motor is in ON condition. Thus water flow is started.

Then while the soil goes sufficiently wet, the soil resistance falls making available a voltage to the non-inverting input higher than inverting input, so that the output of comparator is logic high which is fed to MC. In this condition MC outputs logic low to a transistor which conducts by making the relay 'OFF' and the pump motor stops. Based on the program the conditions appear in the 16x2 lcd display whether the pump is ON or OFF.

VII.LAYOUT DIAGRAM

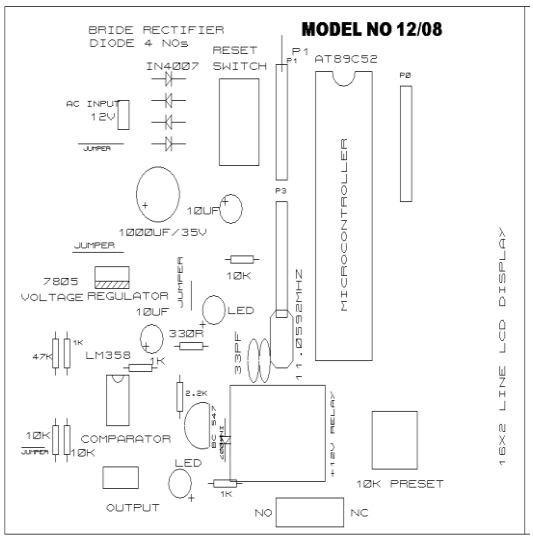


Fig.8.1: Layout Diagram

VIII. RESULT

The system takes the input based on moisture content in the soil and based on it the pump is turned ON/OFF automatically. As long as the moisture is low in the soil the pump is in ON state and once the moisture level is raised to the required level the pump turns OFF.

Watering the indoor garden plants is accurate and efficient with the use of above system. The out put of the system depends on the input received based on moisture content.

IX. CONCLUSION

The automatic watering system for indoor gardening plants sensing soil moisture content works very well. As seen from practical application results it automatically sense the moisture content and switches on the pump for watering, thus reduces the human dependency in watering of indoor plants. It effectively waters the plants without human intervention.

Also, the project can be extended to green houses where it can be used for efficient irrigation of the plants by the further improvement of the system. It reduces the overflow and wastage of water effectively.

REFERANCES

[1] "The 8051 Microcontroller and Embedded systems" by Muhammad Ali Mazidi and Janice GillispieMazidi , Pearson Education.

[2] ATMEL 89S52 Data Sheets.

[3] 3.Rishi, Ripul, Dilip Kumar. "Prototype Design of Indigenous GSM based Intelligent Irrigation System." International Journal of Computer Applications 73, no. 18 (2013): 36-39.

[4] Pulkithanswal, ìDesign of a central control unit and soil moisture sensor based irrigation water pump system.î IEEE Conference on. IEEE, 2013.