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# Solar Powered Microcontroller Irrigation System

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**Abstract**: In the field of agriculture, use of proper method of irrigation is important because the main reason is the lack of rains & scarcity of land reservoir water. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land. Another very important reason of this is the unplanned use of water due to which significant amount of water goes to waste. For this purpose; we use this automatic plant irrigation system. This system derives power from solar energy through photo-voltaic cells. Hence, dependency on erratic commercial power is not required.

**Keywords**: 8051 series Microcontroller, Solar Panel, MOSFET, Motor, Voltage Regulator.

## I. INTRODUCTION

In our proposal, we use solar energy which is being used to operate the irrigation pump. The circuit comprises of sensor parts built using op-amp IC. Op-amps are configured here as a comparator. Two stiff copper wires are inserted in the soil to sense whether the soil is wet or dry. A microcontroller is used to control the whole system by monitoring the sensors and when sensors sense dry condition of soil, then the microcontroller will send command to relay driver IC, the contacts of which are used to switch on the motor. It will switch off the motor when the soil is 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 microcontroller. The condition of the motor running i.e., ON/OFF is displayed on a 16X2 LCD which is interfaced to the microcontroller. Further the idea can be enhanced by interfacing it with a GSM modem to gain control over the switching operation of the motor.

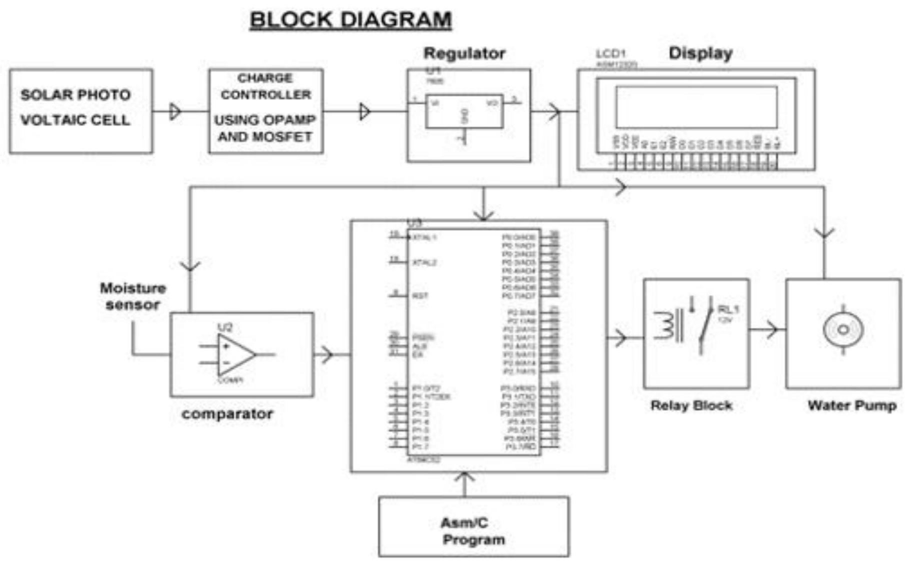


Fig 1. Block diagram representation of Solar powered Microcontroller Irrigation system

## II. ABOUT THE CIRCUIT

A. SOFTWARE REQUIREMENTS: Keil compiler
Languages: Embedded C or Assembly

B. HARDWARE REQUIREMENTS: 8051 series Microcontroller, Op-Amp, LCD, Solar Panel, MOSFET, Relay, Motor, Voltage Regulator, Diodes, Capacitors, Resistors, LED, Crystal, Transistors.

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A. Solar panel section: Battery B1 is charged via D10 and fuse. While battery gets fully charged Q1 conducts from output of comparator. This results Q2 to conduct and divert the solar power through D11 and Q2 such that battery is not over charged. The project uses one IC lm324 having 4 op-amps used as comparators that is U1: A, B, C, D. U1: A is used for sensing over charging of the battery to be indicated by action of U1: B output fed D1(red)and D12(green) for indicating battery status. Diodes D5 to D8 all connected in series are forward biased through R14 and D3. This provides a fixed reference voltage of 0.65*4= 2.6v at anode point of D8 which is fed to pin 2 U1: A through R11, pin 13 of U1: D, pin 6 of U1:B via R9 and pin 10 of U1:C via 5K variable resistor. Solar panel being a current source is used to charge the battery B1 via D10. While the battery is fully charged the voltage at cathode point of D10 goes up. These results in the set point voltage at pin 3 of U1: A to go up above the reference voltage because the potential divider formed out of R12, 5K variable resistor, R13 goes up.

This results in pin no 1 of U1: A to go high to switch 'ON' the transistor Q1 that places drive voltage to the Mosfet IRF640 .such that the current from solar panel is bypassed via D11 and the Mosfet drain and source. Simultaneously pin 7 of U1: B also goes high to drive a led D1 indicating battery is being fully charged. While the load is used by the switch operation Q2 usually provides a path to the (-ve) while the (+ve) is connected to the dc (+ve) via the switch in the event over load the reference voltage at pin 10 results in pin 8 of U1:C going low to remove the drive to the gate through the D4 the Mosfet Q2 that disconnects the load. In the event of over load Q2 voltage across drain and source goes up those results in pin no 9 going above pin no 10 via R22. In the event of battery voltage falling below minimum voltage duly sensed by D3, R6, RV5 and R16 combination at pin 12 results in pin no 14 going zero to remove the drive to Q2 gate via R20 and Rv1. The correct operation of the load in normal condition is indicated by D9 while the mosfet Q2 conducts.

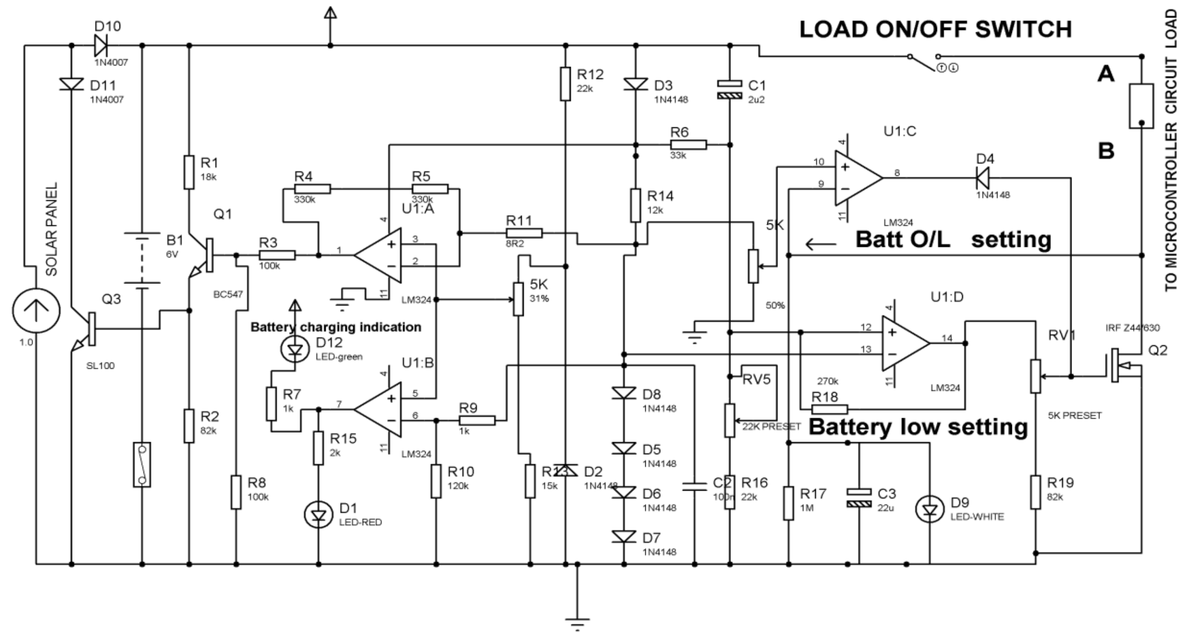


Fig 2. Solar Panel Section

B. MICROCONTROLLER CIRCUIT (for irrigation)

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 output 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.

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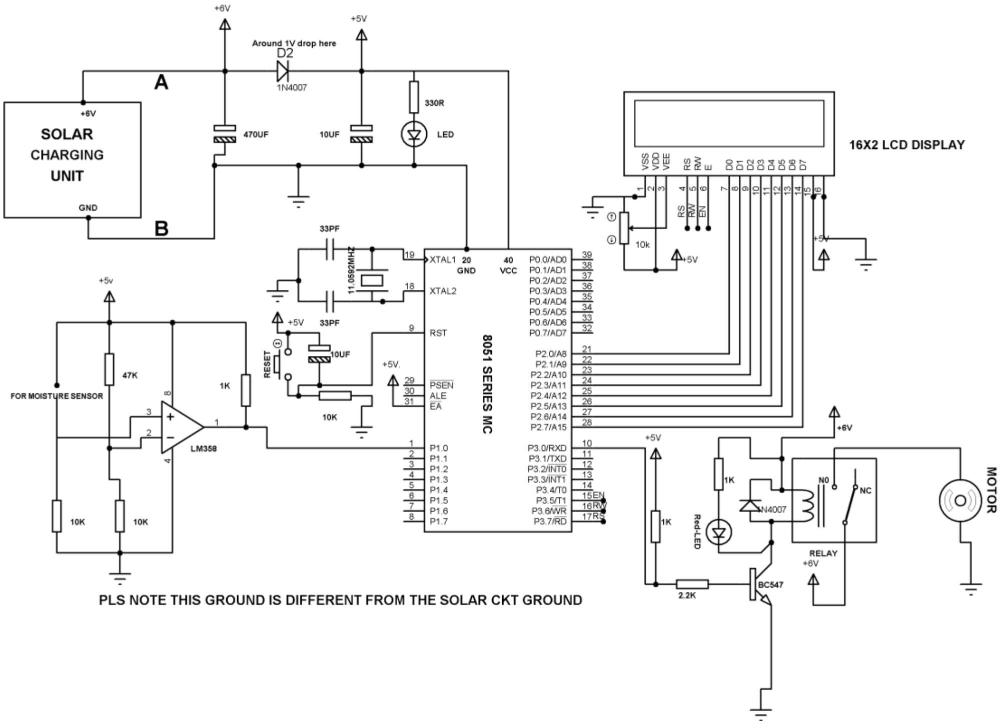
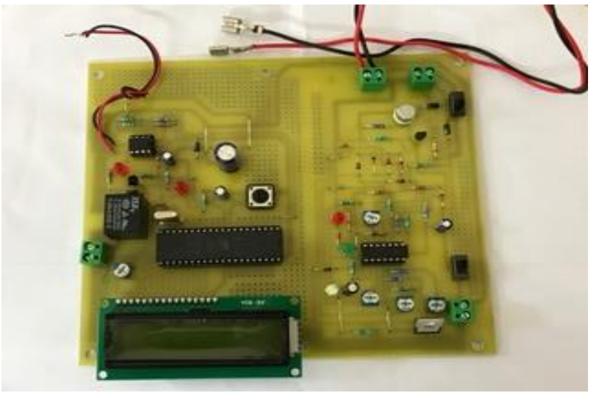
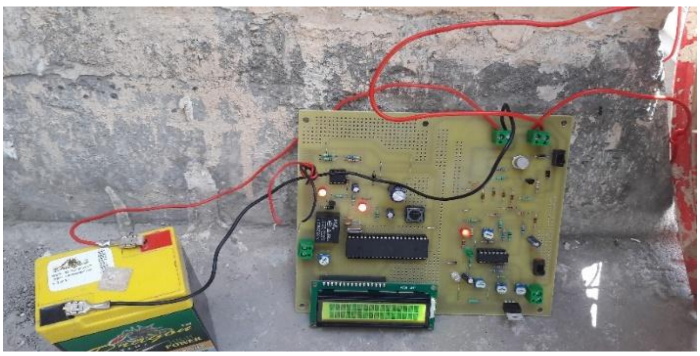



Fig 2. Microcontroller circuit for irrigation



## III.RESULT



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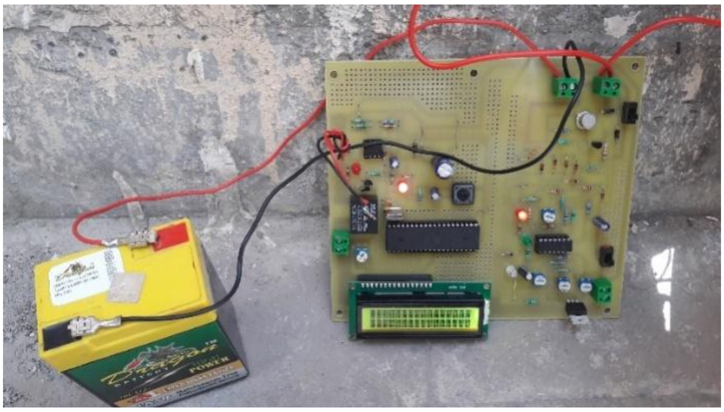
The circuit implemented works properly when connected and tested for following conditions. As the sensing wires are kept disconnected, moisture value is not same, hence, the motor starts and the LCD shows "Motor ON". As the sensing wires are connected and the moisture value is made same, the motor stops and the LCD displays "MOTOR ON" message.



## IV. FUTURE WORK POSSIBILITES

The circuit can be connected to telemetry devices which can make the system accessible from a distance. Also, using IoT, the farmers may be able to control their irrigation pumps sitting at their home and with less effort.

## V. CONCLUSION

Our proposal aims at providing renewable and autonomous approach to irrigation technology. The model broadly consists of a Solar Panel, Rechargeable Battery and associated circuits. The circuit consists of a charge controller section whose features are as follows:
1. To protect excessive charging from the solar panel.
2. To protect excessive load being drawn from the battery.
The microcontroller section is connected to the sensing circuit. The sensing circuit using a comparator checks the soil condition. With the help of LCD, the circuit presents the condition of soil and through microcontroller it controls the motor.

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