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Solar Based Irrigation System

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Abstract*: *This paper proposes an aim to provide Microcontroller (AT89S52) based Solar Irrigation system which saves electricity and by sensing soil moisture we will operate irrigation pump. 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 and due to unplanned use of water a significant amount of water goes waste. To overcome this problem we use automatic plant irrigation system and due to use of solar panel it is efficient. The details of simulation in Proteus 8 professional software, and embedded module have been furnished in this paper.

Keywords*: *Microcontroller, embedded module, Photovoltaic (pv) Cells, Sensor

I. INTRODUCTION

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 due to unplanned use of water due to which a significant amount of water goes waste. For this purpose; we use this automatic plant irrigation system. The system derives power from solar energy through photo-voltaic cells. Hence, dependency on erratic commercial power is not required. Monitoring the moisture level of the soil helps in determining when to irrigate and it significantly helps to improve the water level conversion and conservation of energy, maximization of yield, improvement of water quality and also in reducing the erosion of the soil. In irrigation, a specific crop has a different factor which determines the requirements of water. Irrigation of the plant typically requires actual weather data including relative humidity, speed of the wind and crop factors such as growth stage, variety of the plant, density of the plants in the field, properties of the soil and disease control

A. Photovoltaic Cells

1) Photovoltaic (PV) cells are made of special materials called semiconductors such as silicon, which is currently the most commonly used.
2) Basically, when light strikes the cell, a certain portion of it is absorbed within the semiconductor material.
3) PV cells also all have one or more electric fields that act to force electrons freed by light absorption to flow in a certain direction.
4) This flow of electrons is a current, and by placing metal contacts on the top and bottom of the PV cell, we can draw that current off to use externally.

B. Solar Panel

1) Expose the cell to light, and the energy from each photon (light particle) hitting the silicon, will liberate an electron and a corresponding hole.
2) If this happens within range of the electric field's influence, the electrons will be sent to the N side and the holes to the P one, resulting in yet further disruption of electrical neutrality.
3) This flow of electrons is a current; the electrical field in the cell causes a voltage and the product of these two is power.

II. PROPOSED SYSTEM

The proposed system design implements microcontroller (AT89S52) based solar irrigation system. Fig. 1 shows block diagram of proposed system in which solar panel is connected to battery through charge control unit and by using voltage regulator IC supply is given to microcontroller. We have used voltage regulator IC 7805, 7812 which gives 5V and 12V supply to operate microcontroller, LCD, OPAMP and relay. -12V are generating by using IC 7660. 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 and it will switch off the motor when the soil is in wet condition. The condition of the pump i.e., ON/OFF is displayed on a 16X2 LCD which is interfaced to the microcontroller. The circuit comprises of sensor parts built using op-amp IC. Op-amp's are configured here as a comparator.

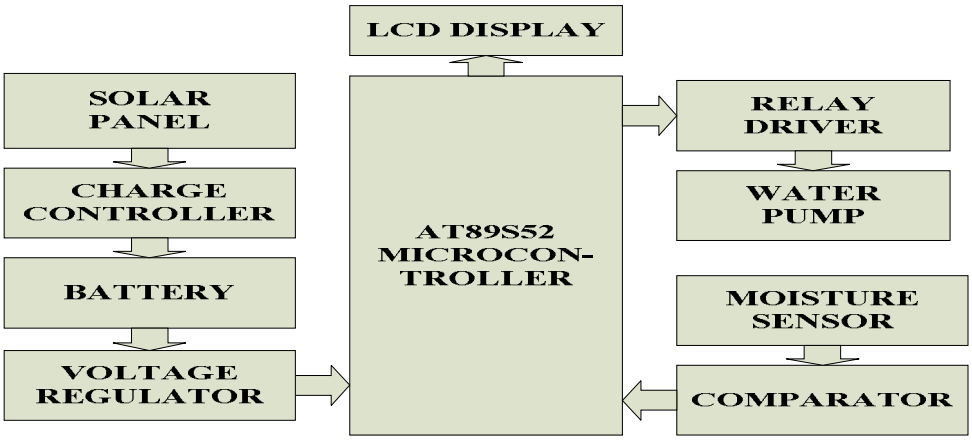

Fig. 1 Block diagram of proposed system

A. Microcontroller (AT89S52)

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. Microcontroller programmed in Embedded C language. Having useful Features like,

1) Operating Frequency: 0 Hz to 33 MHz
2) Internal RAM: 256 x 8-bit
3) Programmable I/O Lines: 32
4) I/O Ports: Ports A, B, C, D, E
5) Timers: Three 16-bit
6) Serial Communications: UART

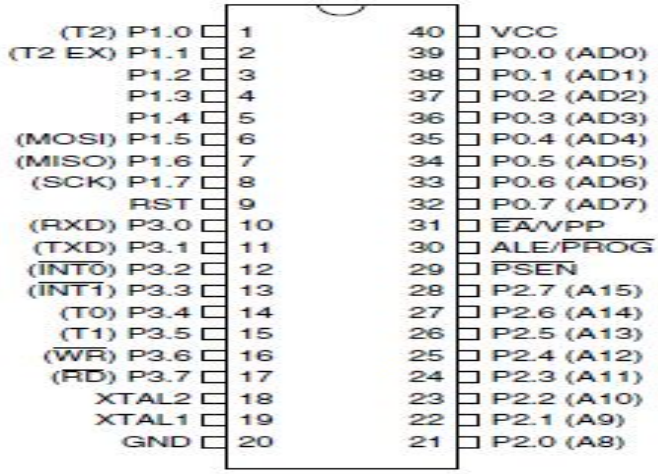

Fig. 2 Pin Diagrams of AT89S52 Microcontroller

B. Power Supply

To operate Microcontroller and Relay 5V DC and 12V DC power supply is needed respectively. The DC voltage coming from battery is converted to required DC signal by using Voltage regulator IC, 7805 and 7812.

C. IC7660

The ICL7660 performs supply voltage conversions from positive to negative with an input range of +1.5V to +12.0V resulting in complementary output voltages of -1.5V to -12.0V. Contained on the chip are a series DC supply regulator, RC oscillator, voltage level translator, and four output power MOS switches.

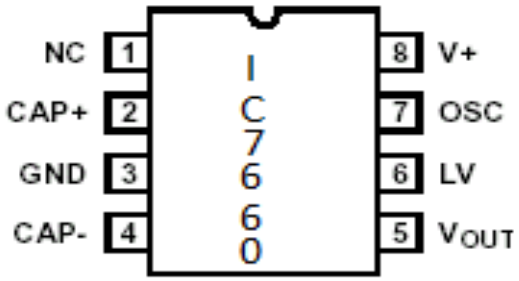

Fig. 3 Pin Diagrams of IC7660

D. Relay and Relay Driver Circuit

Relay is Electro mechanical switch which provide simulation between low level circuits and high level circuits. Relay consist of coil when electric supply is given then it will get magnetize and attract metal plate which will switch on relay and connected solenoid valve get start working. To control relay through microcontroller we have used Two NPN Transistor (BC547). Whenever logic 0 is applied from microcontroller, relay get magnetize and switch on solenoid valve and whenever logic 1 is applied relay will is in off state. Two Resistors (10Kohm) were used to make voltage division. To protect transistor circuit from back EMF we have given freewheeling diode (1N4007) connected between two input terminal of relay. The combination of transistor and resistor circuit's forms relay driver circuit.

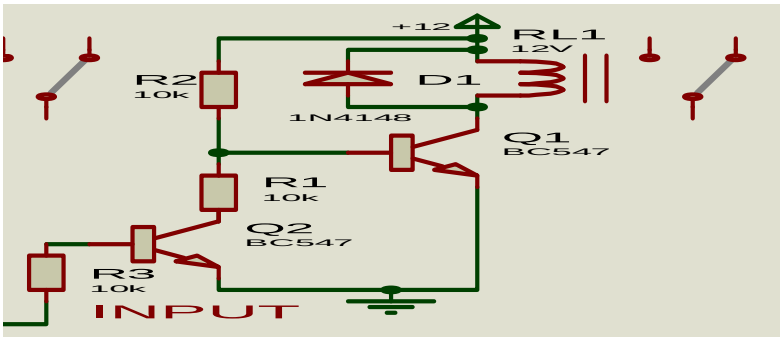

Fig. 4 Relay with Relay Driver Circuit

E. Moisture Sensor

Two stiff copper wires are inserted in the soil to sense whether the soil is wet or dry. To sense moisture we have used opamp IC 741 as a comparator and uses RED and GREEN LED for indication as shown in figure 5.

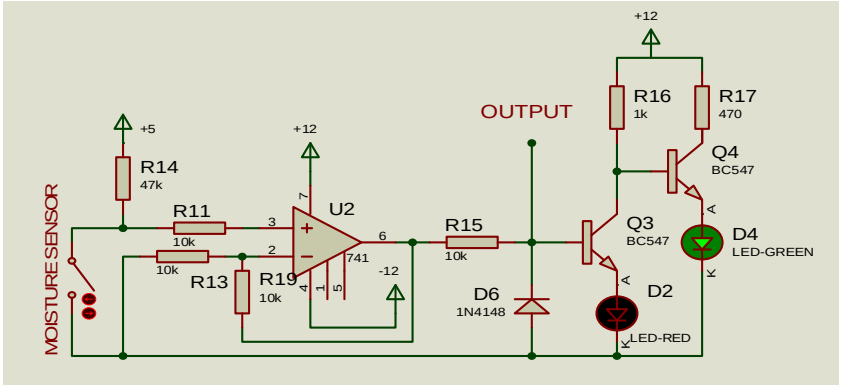

Fig. 4 Moisture Sensor Circuit

III. SIMULATION AND IMPLEMENTATION RESULT

In order to implement the proposed model a AT89S52 Micro controller and solar panel are used. Circuit simulated on Proteus 8 professional software and hardware implemented. The AT89S52 is an 8-bit controller with inbuilt 256 bytes of RAM, UART (Universal Asynchronous Receiver and Transmitter), Timers, SPI (Serial Port Interface) and I2C (Inter-Integrated Circuits).

Embedded C is used to program it. To turn on microcontroller 5V supply and for Relay 12V supply needed. Arrangement of relay circuit, LCD and sensor are shown in figure 5. When ever moisture sensor senses dry soil then comparator will show zero '0' output which is read by microcontroller by using IC MCP3204 (Analog to digital) and relay on command given to switch on motor. When ever moisture senses wet soil then comparator will show one '1' output which is read by microcontroller and relay get off which turn off motor.

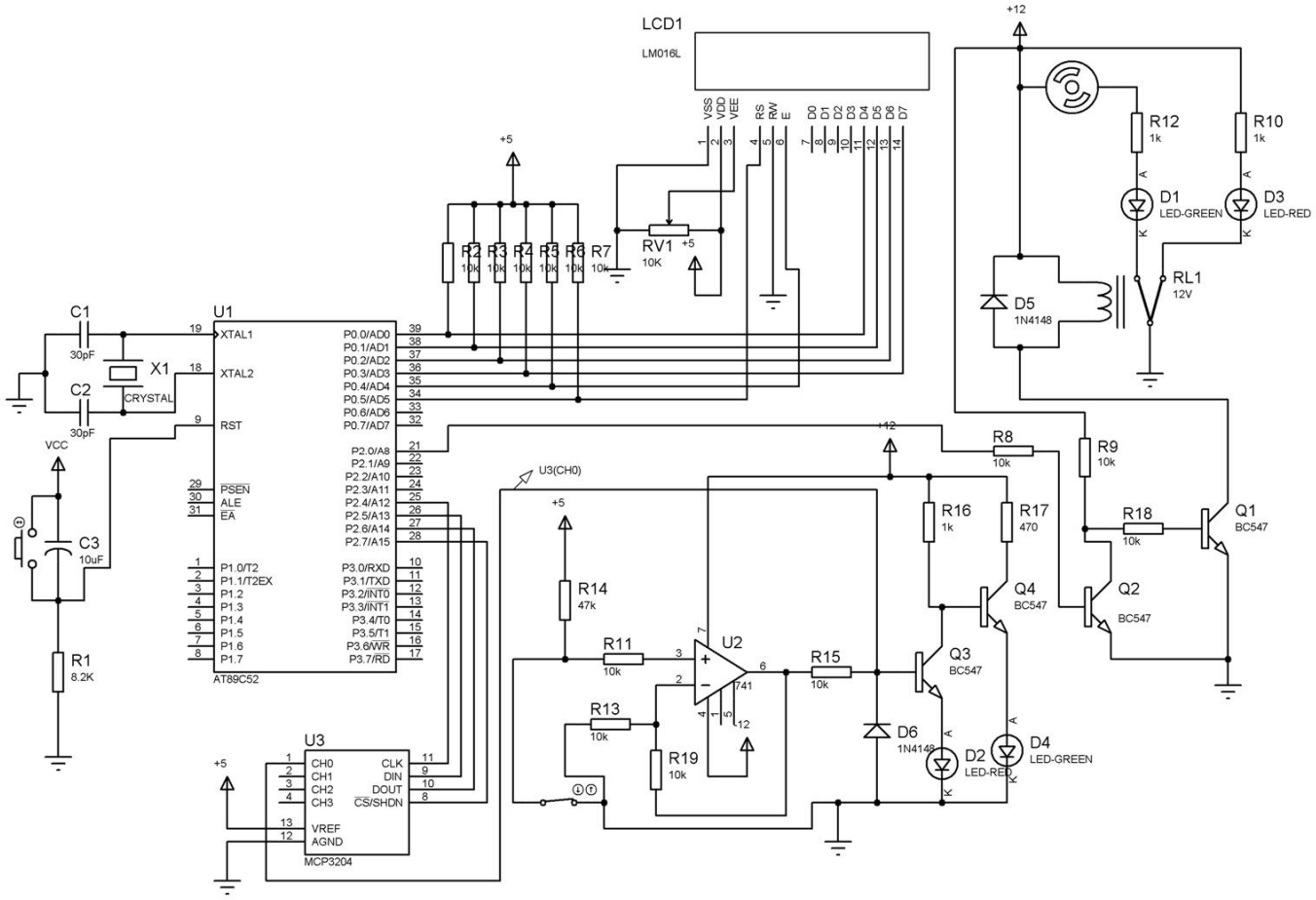

Fig. 5 Circuit Arrangement of Proposed System

Fig. 6 Hardware Circuit of proposed system(Sensor is in DRY soil)

Fig. 7 Hardware Circuit of proposed system(Sensor is in WET soil)

IV. CONCLUSIONS

Proposed system provides protection to crop from supplying of less and excess water which serving the farmers to urge optimum cultivation. Also, it will facilitate to create correct use of water, because the soil wet level differs from crops to crops and this may be taken care of by the soil wet and dry sensing element. because the entire system are going to be powered by solar power which is able to be hold on within the rechargeable batteries, electricity consumption will get reduce. The lifetime of solar panels is twenty five years so it is reliable to use for all farmers.

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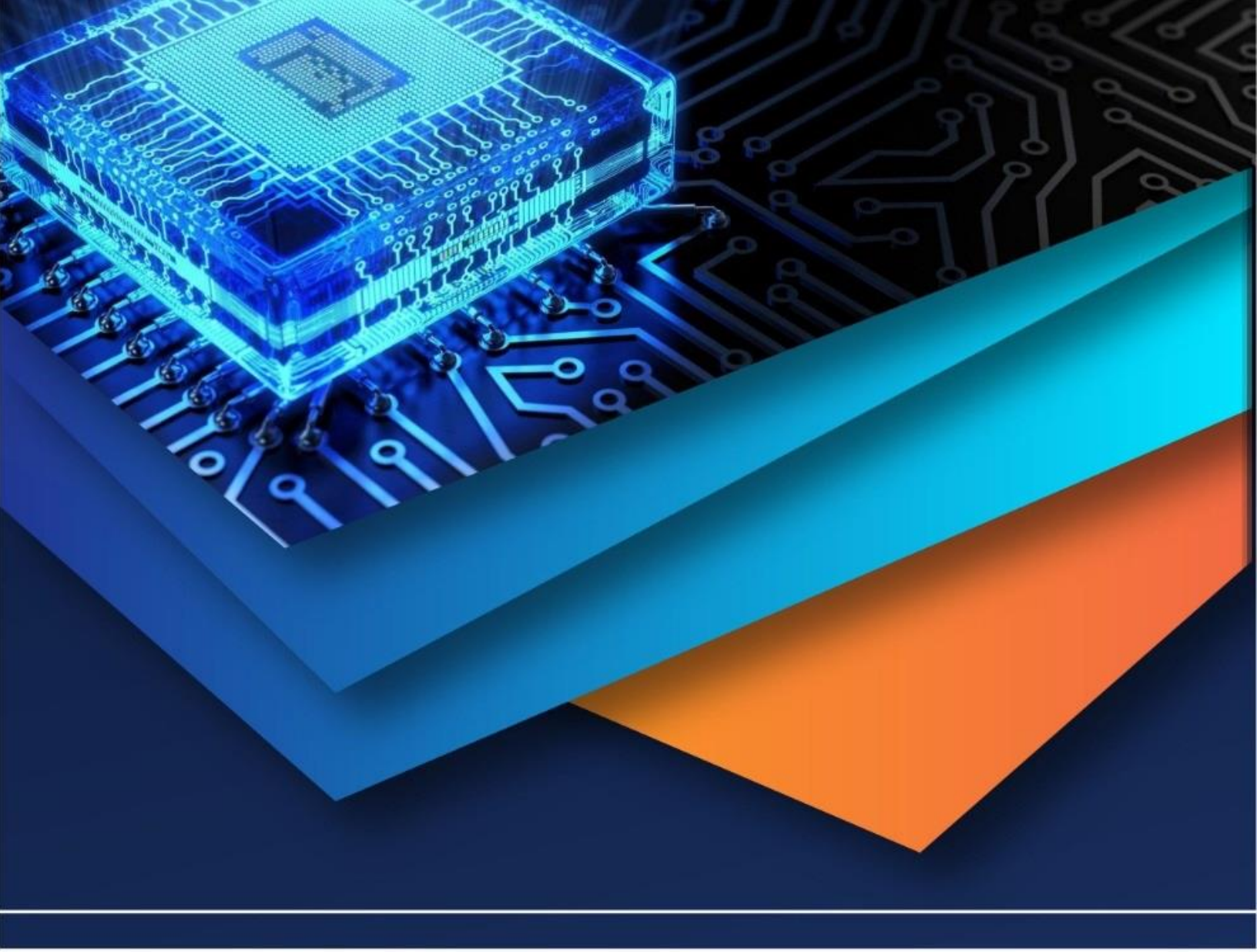

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