

Solar Water Pump with Automatic Irrigation

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Abstract

Gradually decreasing energy sources and increasing demand for energy in recent years, makes more efficient and positive use of current water resources together with global warming and drought. Therefore, efficient water management plays an important role in irrigated agricultural cropping systems. Since the sources utilized for the purpose of producing electricity are limited and their prices gradually increase.

A solar-based smart irrigation system enables user to monitor the relative soil moisture at many different location throughout the field to more precisely scheduled irrigation cycle. By using solar energy, we can save the electrical energy. The sensing system is based on feedback control mechanism with microcontroller unit depending upon the varied requirement of different crops we can irrigate our field. The flow of water through pump is dependent on signals sent by soil moisture. This system eliminates excessive wastage of water during irrigation.

Key Words: Global Warming, Water Management, Smart Irrigation, Solar Energy.

1. Introduction

Solar energy is widely available energy source in the world. Solar power is not only good by the view of the economy but also it is environment friendly form of the energy. Now days this energy is used in street light and in other domestic loads. In today's life due to advanced technologies the cost of solar panel decreases, that will help to use solar energy in various sectors. One of the applications of solar energy is in irrigation system. In India there is major problem of energy, therefore solar energy is best solution for Indian farmer. The continuously extraction of water from earth is resulting into decrease in water level from earth so that lot of land comes slowly in the un-irrigated zone, another reason of this is due to unplanned irrigation. Also now-a-day's population increases rapidly so demand of food also increases which doesn't get balance between demand and supply of food. To maintain this production of food should increase. Present work offers a simpler and economical solution to this problem.

2. Setup Requirement**A. Micro-Controller**

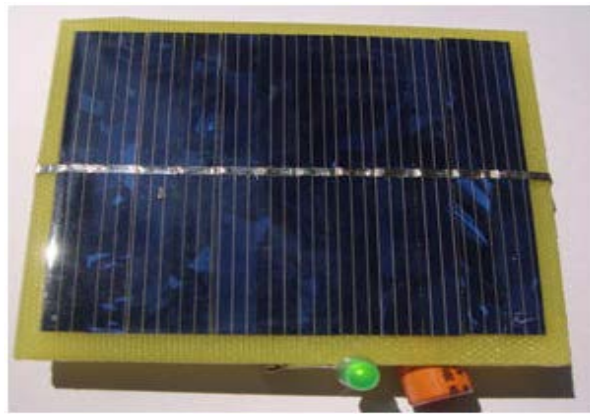
The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

B. Solar Panel

Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers. Some scientists call them photovoltaic which means, basically, "light-electricity."

A solar panel is a collection of solar cells. Lots of small solar cells spread over a large area can work together to provide enough power to be useful. The more light that hits A cell, the more electricity it produces, so spacecraft are usually designed with solar panels that can always be pointed at the Sun even as the rest of the body of the spacecraft moves around, much as a tank turret can be aimed independently of where the tank is going.

The current and power outputs of photovoltaic solar panels are approximately proportional to the sun's intensity. At a given intensity, a solar panel's output current and operating voltage are determined by the characteristics of the load. If that load is a battery, the battery's internal resistance will dictate the module's operating voltage.



C. Soil Moisture Sensor

Most soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant can be thought of as the soil's ability to transmit electricity. The dielectric constant of soil increases as the water content of the soil increases. This response is due to the fact that the dielectric constant of water is much larger than the other soil components, including air. Thus, measurement of the dielectric constant gives a predictable estimation of water content.



D. Pump

A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The submersible pumps used in ESP installations are multistage centrifugal pumps operating in a vertical position.



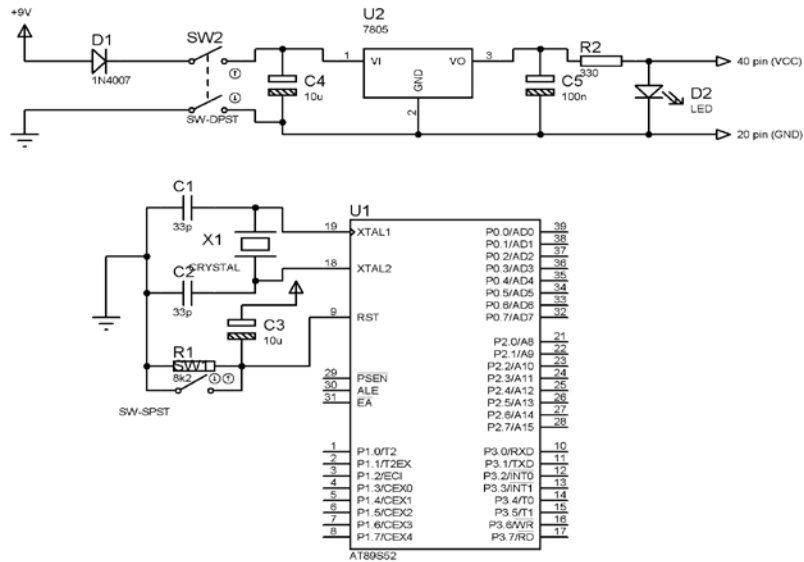
E. Battery (12 V, 1 AMP)



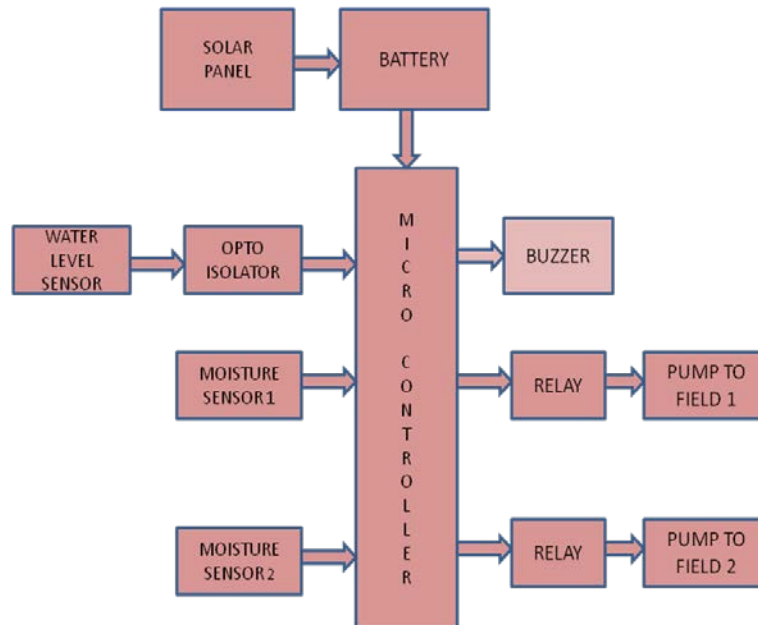
F. Component List

Sr. No.	Abbreviation	Component	Value
1	D1	DIODE	1N4007
2	SW1	SWITCH	-
3	C1,C5	CAPACITOR	10Uf
4	C2	CAPACITOR	100uF
5	C3,C4	CAPACITOR	33Pf
6	X1	CRYSTAL	11.0592MHz
7	RT1	REGULATOR	7805
8	IC1	40 PINS SOCKET(89S52)	-
9	L1	LED	3mm
10	R1	RESISTOR	270Ω
11	R5	RESISTOR	8.2KΩ
12	RST1	RESET SWITCH	-
13	B1	BUG STRIP	-
14	89S52	MICROCONTROLLER	-
15	89V51RD2	MICROCONTROLLER	-

3. Circuit Diagram



A. Block Diagram



4. Working

The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil and signal are sent to the microcontroller.

The microcontroller processes the data received from the soil moisture and turn on the pump of the field using relay where the water content is less and after irrigating the field pump turns off automatically.

Also there is water level sensor to detect water level. If the water level decreases to certain level, the signals are sent to the microcontroller which turns on the buzzer. There is opto isolator between microcontroller and water level sensor to avoid flow of current through the water.

Power for the entire system is provided using battery and the battery is charged using solar panel.

5. Microcontroller Program

1049-soil moisture sensor .ASM

Org 0000h

ljmp main 1

org 0023h ;srial interrupt service routine

ljmp serial ;jump to serial

org 0030h

main 1:

mov p0,#0f0h

mov p2,#0ffh

mov sp,#50h

mo vie,#90h :enable serial port

intrupts

Icall ser

Ljmp main

Serial:

Jb TI,txs

Mov a,sbuf

Cir ri

Txs: reti

Main:

Icall sen1

Icall sen2

Icall level

ljmp main

sen1:

jnb p0.6,sd1

Icall delay

Jnb p0.6,sd1

Jb 40h, sd1

Setb p0.0

ret

sd1: clr p0.0

ret

sen2:

jnb p0.7, sd2

Icall delay

jnb p0.7, sd2

jb 40h, sd2

setb p0.1

ret

sd2: clr p0.1

ret

level:

jb p2.0,Iv1

Icall delay

jb p2.0, Iv1

clr p2.7

setb 40h

ret

Iv1: setb p2.7

Clr 40h

Ret

Delay:

Mov r3,#255

here2: mov r4,#255

here1: djnz r4,here1

Djnz r3,here2

ret

ser: mov tmod,#20h;timer1 baud rate set

mov th1,#0fdh:9600

mov scon,#50h:n,1,8

setb TR1 ;start timer

ret

send: mov sbuf,a ;to transmit the data serially

tx: jnb TI, tx ;wait until ti is set

clr TI ;will clear ti so as to transmit next data

ret

delay2:

mov tmod,#21h

mov r1,#28

back: movtl0,#00h

mov th0,#00h

setb tr0

again: jnb tf0,again

clr tr0

clr tf0

djnz r1,back

ret

delay1:

mov tmod,#21h

mov r1,#14

back2: mov tl0,#00h

mov th0,#00h

setb tr0

again: jnb tf0,again2

clr tr0

clr tf0

djnz r1,back2

ret

delay0_5:

mov tmod,#21h

mov r1,#7

back3: mov tl0,#00h

mov th0,#00h

setb tr0

again3: jnb tf0,again3

clr tr0

clr tf0

djnz r1,back3

ret

delay0_51:

mov tmod,#21h

mov r1,#7

back31: mov tl0,#00h

mov th0,#00h

setb tr0

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again31: Icall park
        jnb tf0,again31
        clr tr0
        clr tf0
        djnz r1,back31
        ret

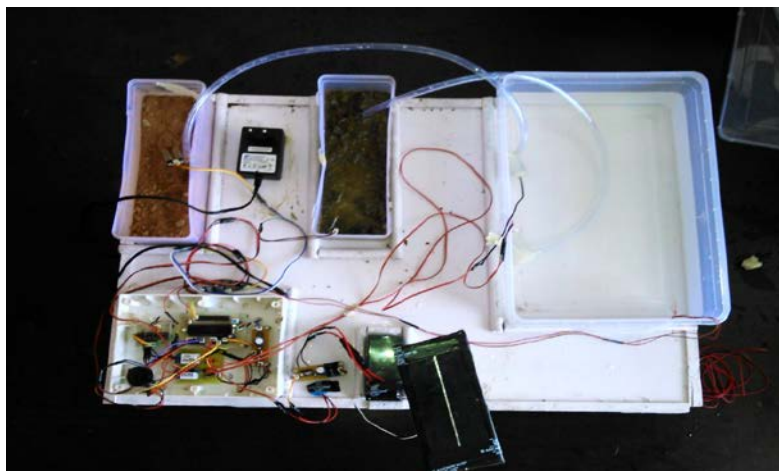
delay0_52:
        mov tmod,#21h
        mov r1,#3

back32: mov tl0,#00h
        mov th0,#00h
        setb tr0

again32: Icall park
        jnb tf0,again32
        clr tr0
        clr tf0
        djnz r1,back32
        ret

end
```

6. Experimental Setup



As we can see in the image, water tank is provided with two submersible pumps in it. The fields to be irrigated are aside to that in which soil moisture sensors are placed. Solar energy is stored in the battery using solar panel. Control circuit is also shown in the picture which controls the irrigation process.

Observations

Discharge from each pump – 1 lpm

Time for irrigation of area 250 cm^2 and 5 cm depth – 5 seconds

7. Conclusion

By implementing the proposed system there are various benefits for the government and the farmers. For the government a solution for energy crisis is proposed.

By using the automatic irrigation system it optimizes the usage of water by reducing wastage and reduces the human intervention for farmers.

Proposed system is environment friendly solution for irrigating fields. Solar pumps also offer clean solutions with no danger of borehole contamination.

The system requires minimal maintenance and attention as they are self starting. To further enhance the daily pumping rates tracking arrays can be implemented.

This system demonstrates the feasibility and application of using solar PV to provide energy for the pumping requirements for sprinkler irrigation.

Even though there is a high capital investment required for this system to be implemented, the overall benefits are high and in long run this system is economical.

8. References

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