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Automatic Solar Power Irrigation System

Bhosale Sachin Bhausaheb[1], Ghumare Keda Sanjay[2] , Phad Sagar Manik[3]
Guided By - Sharmila M[4]
[1](Electrical, SIEM, NASHIK, INDIA)
[2](Electrical, SIEM, NASHIK, INDIA)
[3](Electrical, SIEM, NASHIK, INDIA)

Abstract: *Agriculture technology is changing rapidly. This paper deals with design of solar based auto irrigation system. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor. It is the proposed solution for the present energy crisis for the Indian farmers. This system conserves electricity by reducing the usage of grid power and conserves water by reducing water losses.*
Keywords: *Solar panels, Irrigation system, Moisture sensor etc.*

I. Introduction

It is common to use diesel to power generators in agricultural operations. While the systems can provide power where needed there are some significant drawbacks including fuel has to be transported to the generator's location, which may be quite a distance over some challenging roads and landscape. Their noise and fumes can disturb livestock. Fuel costs add up, and spills can contaminate the land. For many agricultural needs, the alternative is solar energy. Modern, well-designed, simple to-maintain solar systems can provide the energy that is needed where it is needed, and when it is needed. These are systems that have been tested and proven around the world to be cost-effective and reliable, and they are already raising levels of agricultural productivity worldwide.

In India most of the power generation is carried out by conventional energy sources, coal and mineral oil-based power plants which contribute heavily to greenhouse gases emission. Setting up of new power plants is inevitably dependent on import of highly volatile fossil fuels. Thus, it is essential to tackle the energy crisis through judicious utilization of abundantly available renewable energy resources, such as biomass energy, solar energy, wind energy, geothermal energy and Ocean energy. The projection for irrigation water demand basically depends on irrigated area, cropping pattern, effective rainfall, and soil and water quality. Though our country claims to have developed in terms of science and technology, erratic power supply or complete breakdown for hours together has almost become routine today. If this be the case for urban dwellers, think about the farmers living in remote villages. They need power for irrigating their crops, or lighting their cattle sheds. What can they do? The reasons for having large gap between requirement and consumed energy could be the wastage of electrical energy. The foremost reason can be that the power supplied for agricultural needs is during the night hours. Farmers Switch on the pump motor and leave it „on" for the whole night. Farmers do not bother to switch off the pump motor when the land is filled with sufficient water level. This is the main source of wastage of electrical energy from the grid.

II. Methodology

In the solar pumping system photovoltaic cells are use as the energy adopter from the sun which converts the solar energy into dc electric supply. This dc electric power is stored in the battery or charge the battery of 12v dc. This battery supply is then regulated by the regulator which has output of 5v dc. This 5v supply is given to the microcontroller and LCD which operate on the 5v dc supply. Moisture sensor is use to sense the soil condition, which is a copper strip.

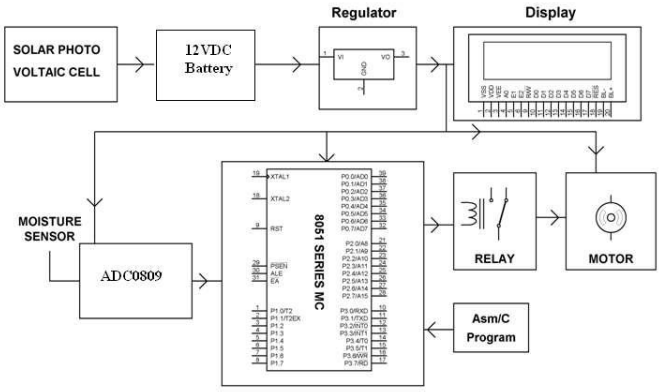

Fig.2.1 Block Diagram Of Solar Power Irrigation

This moisture sensor sense the continuity of the moisture in the soil .This device sense the moisture content in soil and sends signal to the analog to digital converter which convert analog signal into digital signal. The output from ADC is checked or controlled by the microcontroller. The controlled signal is displayed on the LCD. If the microcontroller gives the signal that moisture continuity is less or the soil is dry then this signal is given to the relay which is use as a switch or starter of the pump. After getting the signal the relay get operate and pump is started. As the moisture continuity increases the soil is sufficiently wet. Then again the signal is given to microcontroller from ADC who again get the signal from the moisture sensor. And the pump will stop working. In this way the solar power irrigation pump is operated by using solar power.

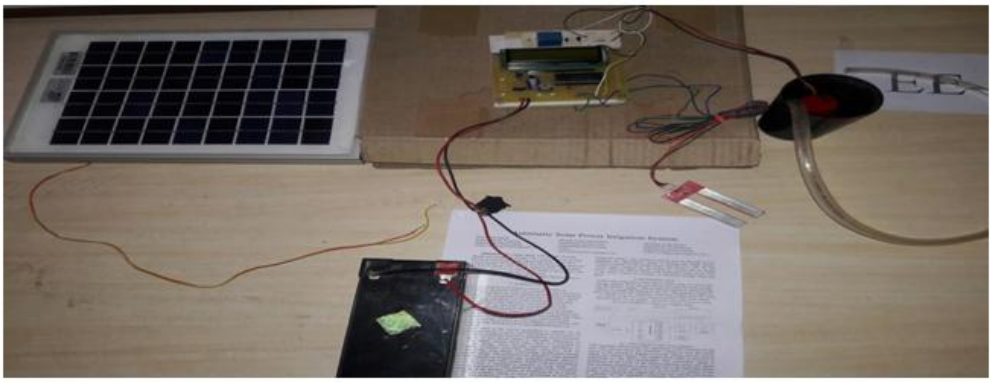

Fig. 2.2 Actual View of Solar Power -Irrigation.

III. Components

3.1 Component Description

3.1.1.**Solar panel:** A solar panel is set of solar photovoltaic modules electrically connected and mounted on structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications.

3.1.2**Battery**: Are energy storage device that are particularly use for powering small portable devices .here we use battery for storing energy from solar panel. This energy use for water pumping.

3.1.3.**Soil Moisture Sensor:** The Soil Moisture Sensor Module reads the amount of moisture present in the soil surrounding it. Ideal for monitoring a garden or your pet plant's water level. This sensor uses the two probes to pass current through the soil then reads the resistance to determine the moisture level. Since water conducts electricity, the higher the water content, the easier it for the electrons to move. Similarly the soil is in dry condition causes the current do not passes easily , the driver the soil the more resistance the electrons face. The varying resistance is translated to an analog output.

3.1.4**.Relay**: A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches.

3.1.5.**DC motor**: Electrical machine are converting energy. Motor take electrical energy and produce mechanical energy. Electric motor use in water pumping application. Surface pumps, located at or near the water surface, are used primarily for moving water through a pipeline. Some surface pumps can develop high

heads and are suitable for moving water distances to high elevations. The rated voltage of motor in model is 12V and the rated current is 0.5A.

3.1.6**.Microcontroller & ADC** :The 8051 microcontroller is a low-power, high-performance 16-bit micro controller. The microcontroller build in rom, ram output input ports, serial ports, timer interrupts and clock circuit. A microcontroller is an entire computer manufacture on single chip. Microcontroller are use as motor controller in irrigation system. The input output, memory and on chip peripherals of microcontroller are selected depending on the application. Microcontroller are power full digital processor, the degree of control and programmability they provide significantly enhances the effectiveness application. An electronic integrated circuit which transforms a signal from analog (continuous) to digital (discrete) form. Analog signals are directly measurable quantities. Digital signals only have two states. For digital computer, we refer to binary states, 0 and 1.The ADC 0809 data acquisition component is a analog to digital converter which convert the analog signal to digital signal.

3.1.7**16*2 LCD Display**: It is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

3.2Specification of components

SR NO	COMPONENT	SPECIFICATION
1	Solar Panel	5w
2	Battery	12V,7.2Ah
3	Dc Motor	12v
4	Moisture Sensor	4.2v,35mA
5	Relay	12V
6	Microcontroller	8051

3.3 SOFTWARE

1. Embedded C
2.We have used µVision Keil assembly language editor software to program in assembly language.

IV. Calculations

1.PV SIZING: Different size of PV modules will produce different amount of power. To find out the sizing of PV module, the total peak watt produced needs. The peak watt (WP) produced depends on size of the PV module and climate of site location. To determine the sizing of the PV modules, calculate as follows:

STEP 1: **Calculation of Total Load Connected** Total Load Connected =[D.C Pump Power Rating * Time of usage] + [Remaining Components Power Rating* Time of usage]

STEP 2: **Calculation of Total PV Panels Energy Needed** Total PV panels energy needed= Total Load Connected + Losses

STEP 3: **Calculation of Total Wp Of PV Panel Capacity Needed** Total Wp of PV Panel Capacity Needed = Total PV panels energy needed/ No of Illumination hours

STEP 4: **Calculation of No. of PV Panels Required** No. of PV panels = Total WP of PV panel capacity needed/ Rating of the PV Panel

2. BATTERY SIZING: The Amp-hour (Ah) Capacity of a battery tries to quantify the amount of usable energy it can store at a nominal voltage. All things equal, the greater the physical volume of a battery, the larger its total storage capacity.

STEP 1: **Calculation of total Load Connected** Total Load Connected = Sum of all appliances (power rating of each device * Time of usage)

STEP 2: **Calculation of Battery (Ah) Total Load Connected*Days of Autonomy/ Battery Losses*Depth of Discharge* N.B.V**

V. Future Enhancement

We completed our project successfully with the available sources. But the results and modifications are not up to the expectations. This can be further improved by incorporating the following modifications to obtain better results.

1.Solar tracker
2.GSM system
3.Water level indicator
4.Buzzer system

VI. Conclusion

By implementing this system varies benefit for farmers. Such as mitigate the poor distribution management, human effort and loadshading. In this system by using auto irrigation optimized use of water by reducing losses and wastage of water and reducing inter action of farmers. The large amount of energy produce by using solar panel this energy use for water pumping and remaining energy can also given to the grid with small modification in this system. This system easily implemented for well and environmental friendly. There is a high capital investment required for this system to be implemented but in long run this system is econmical.

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