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Solar Based Smart Irrigation System

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ABSTRACT: This paper deals with the design of solar system to collect maximum solar energy that is converted into electrical energy which in turn is used to power the irrigation system. Cost effective solar power can be the solution for all our energy needs. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor. Solar powered smart irrigation systems are the answer to the Indian farmer. The irrigation pump can be controlled in two modes namely

1. Automatic mode 2.Manual mode

In Automatic mode the water pump is switched on and off automatically based on moisture sensor value. In Manual mode the farmer has to go to the field where the system is installed to ON and OFF the water pump.

Keyword:-Irrigation system.

I. INTRODUCTION

The increasing demand for energy, the continuous reduction in existing sources of fossil fuels and the growing concern regarding environment pollution, have pushed mankind to explore new non-conventional, renewable energy resources such as solar energy, wind energy, etc. for the production of electrical energy. Since India receives sunlight all 12 moths of a year. Hence utilizing it in the different fields is a wise idea.

Solar energy is the most abundant source of energy in the world. Solar power is not only an answer to today's energy crisis but also an environmental friendly form of energy. Photovoltaic generation is an efficient approach for using the solar energy. Solar panels (an array of photovoltaic cells) are nowadays extensively used for running street lights, for powering water heaters and to meet domestic loads. The cost of solar panels has been constantly decreasing which encourages its usage in various sectors. One of the applications of this technology is used in irrigation systems for farming. Solar powered irrigation system can be a suitable alternative for farmers in the present state of energy crisis in India. This green way for energy production which provides free energy once an initial investment is made. In this paper we propose an automatic irrigation system using solar power which drives water pumps to pump water from bore well to a tank and the outlet valve of tank is automatically regulated using controller and moisture sensor to control the flow rate of water from the tank to the irrigation field which optimizes the use of water

II. COMPONENTS

Solar panel:

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting 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. In the system we use 17V solar panel.

Moisturesensor:

A moisture sensor is used to sense the level of moisture content present in the irrigation field. It has a level detection module in which we can set a reference value. This circuit can be used with analogy probes that produce a voltage proportional to soil moisture.

Relay:

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are used, such as Cube relays. Relays are used where it is necessary to control a circuit by a low power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Motor:

Centrifugal or submersible pumps are connected directly to the solar array using DC power produced by the solar panels. Solar pumps are available in several capacities depending upon the requirement of water. In this project we use DC motor which is connected by the 6V battery and 6V cube relay.

LED

A LED is a semiconductor device. It is a p n junction diode that emits light when forward biased. When an LED's anode lead has a voltage that is more positive than its cathode lead by at least the LED's forward voltage drop, current flows. Electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence; the energy band gap of the semiconductor determines the colour of light. In our project LEDs are used for power indications.

Resistor & Transistor:

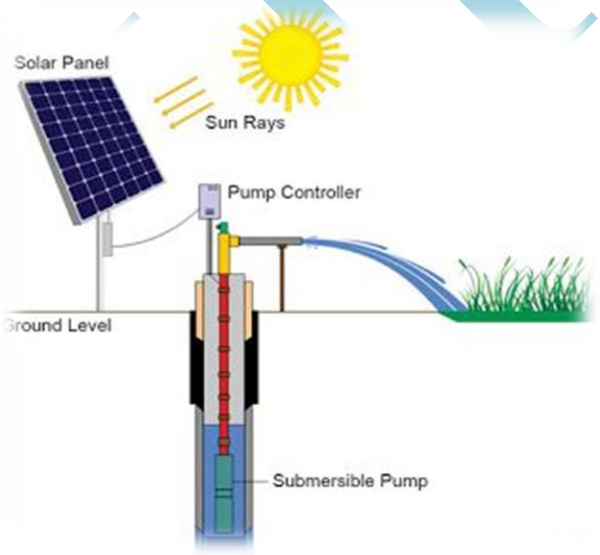
Many resistors are so small that it would be difficult to print their value and % tolerance on their body in digits. To overcome this, a coding system based on bands of distinctive colours was developed to assist in identification. Here we use five 10K ohm resistors Connected with the base of NPN transistor and five 470 ohm resistors connected with the LEDs which are further connected with the collector of NPN transistor.
In our project we use five NPN transistors (BC 547) in which the emitter of each transistor is connected with the ground of voltage regulator and collector of each transistor is connected with the voltage regulator and moisture sensor through LEDs.

Voltage Regulator:

A voltage regulator is designed to automatically maintain a constant voltage level. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. In our project we use 5V voltage regulator of 7805 series which is use to convert the 6V power given from battery to 5V.

III. OPERATION

This irrigation system mainly consists of two mode- Solar pumping mode and automatic irrigation mode. In solar pumping mode a solar panel of required specification is mounted near the pump set. Then using a control circuit it is used to charge a battery. From the battery using a converter circuit it gives power to the water pump which is submerged inside the well. Then the water is pumped into an overhead tank for storing water temporarily before releasing the water into the field.



In automatic irrigation mode the water outlet valve of the tank is electronically controlled by a soil moisture sensing circuit. The sensor is placed in the field where the crop is being cultivated. The sensor converts the moisture content in the soil into equivalent voltage. This is given to a sensing circuit which has a reference voltage that can be adjusted by the farmer for setting different moisture levels for different crops. The amount of water needed for soil is proportional to the difference of these two voltages. A control signal was given to a DC Pump whose rotational angle is proportional to the difference in voltage. The DC pump controls the cross-sectional area of the valve to be opened controlling flow of water. Therefore the amount of water flowing is proportional to the moisture difference. In our project 6V DC pump which is connected through battery and cube relay and the sensor is adjusted on level 3 which is use for sensing the moisture in the wheat's crop.

IV. RESULTS AND DISCUSSIONS

In this system we utilize the solar energy from solar panels to automatically pump water from bore well directly into a ground level depending on the intensity of sunlight. While conventional methods include pumping of water from bore well into a well and from this well onto field using another pump, our system uses only a single stage energy consumption wherein the water is pumped into a ground level tank from which a simple valve mechanism controls the flow of water into the field. This saves substantial amount of energy and efficient use of renewable energy. A valve regulates the flow of water into the field depending upon the moisture requirement of the land. In this system we use a soil moisture sensor that detects the amount of moisture present in the soil and depending upon the requirement of level of moisture content required for the crop the water flow is regulated thus,conserving the water by avoiding over flooding of crops.

V. 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. The excess energy produced using solar panels can also be given to the grid with small modifications in the system circuit, which can be a source of the revenue of the farmer, thus encouraging farming in India and same time giving a solution for energy crisis. Proposed system is easy to implement and environment friendly solution for irrigating fields. The system was found to be successful when implemented for bore holes as they pump over the whole day. 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 economic.

VI. BLOCK DIAGRAM

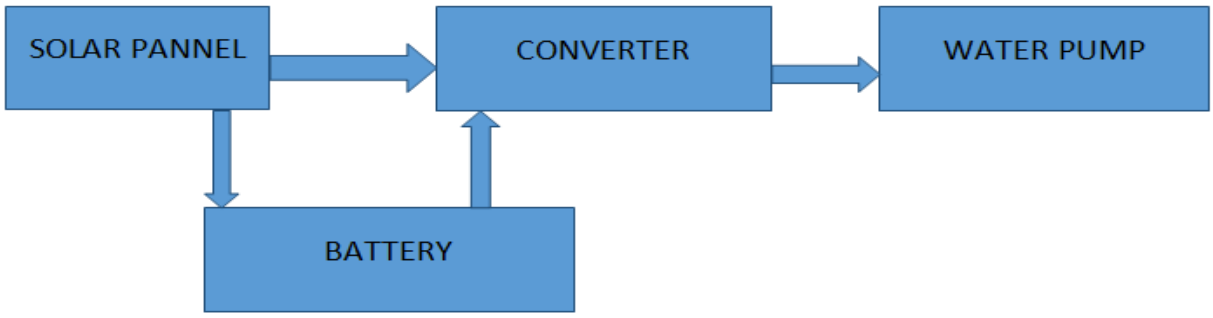


Fig. 1: Block diagram of solar pumping module

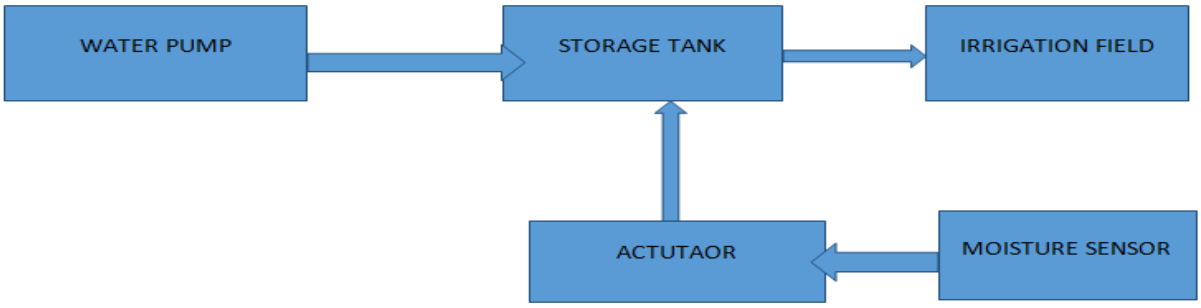


Fig. 2: Block diagram of automatic irrigation module.

Table 1 List Of Component

S.No.	COMPONENT	OUANTITY
1.	Solar Panel (17V, 150mA)	1 Nos.
2.	Battery (6V)	1 Nos.
3.	DC pump	1 Nos.
4.	Voltage regulator 7805 series (5V)	1 Nos.
5.	Cube relay (6V)	1 Nos.
6.	Soil moisture level sensor	1 Nos.
7.	Transistor (NPN BC547)	5 Nos.
8.	Resistors (10K ohm and 470 ohm)	10 Nos.
9.	LEDs	5 Nos.
10.	Diode	1 Nos.

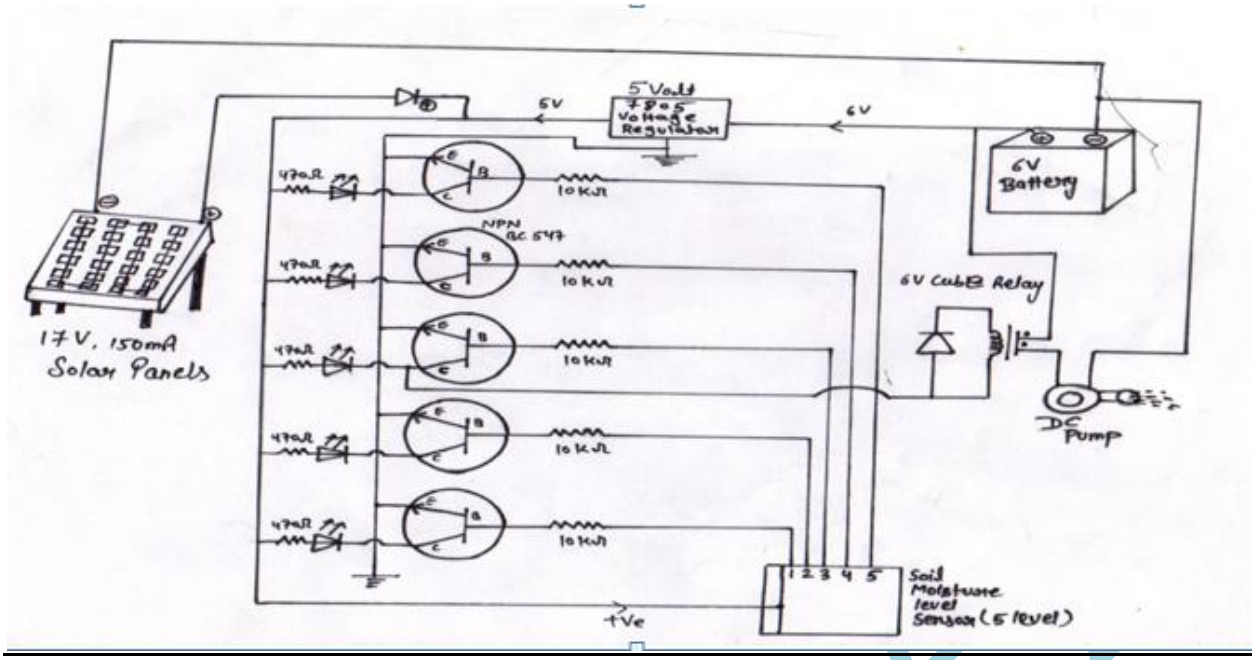


Fig. 3 Circuit diagram of Solar based smart irrigation system

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