JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"DESIGN AND DEVELOPMENT OF WATER PUMPING SYSTEM BY EXTRACTING SOLAR ENERGY USING LDR SENSOR"

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Abstract: Energy plays an important role in the material, social and cultural life of mankind. The energy needs are increasing day by day. This is the result of population growth and increase in the standard of living which is directly proportional to energy consumption. As we know that mankind will be never lacking in energy. Today it is liquid fluid, tomorrow it may be uranium with an element of risk. Risk exists where ever there is human activity and production of energy. Just as the supply of fossil fuel is finite thus there will be the supply of uranium. Perhaps, uranium would be exhausted quickly if it is used on a large scale. It is therefore harnessing the gigantic inexhaustible solar energy source reduces the dependence on fossil fuels. This pear practically implements the academic knowledge in the service of rural communities. It develop skill, planning, investigation. It develop the practical skills required for real engineering practice from conceptualization to effective realization.

KEYWORDS: **Solar Panel, Agriculture, Battery.**

I. INTRODUCTION:

The solar energy harnessing system has benefits for the environment because it doesn't release any pollutants into the atmosphere, unlike when fossil fuels are burned. So, as a long-term alternative to all the finite fuel systems, solar energy systems can be thought of. As a result, there is neither an energy deficit now nor one on the horizon. In widely dispersed settlements with little to no rural electrification and when underground water is available, the lifting of water for drinking or agricultural purposes is of major importance. If solar energy could be converted to mechanical energy and used to power small water pumps, rural communities would benefit greatly. For the purpose of pumping water in our project, we employ solar photovoltaic cells. The photovoltaic modules directly convert solar energy into electricity, which powers a dc motor pump for water pumping. It consists of solar photovoltaic modules, a dc water pump, and a power conditioner to prevent storage batteries from overcharging when there isn't sunlight. One of the greatest alternative irrigation techniques is a photovoltaic water pumping system. The variability in the spatial and temporal distribution of irrigation water availability places a heavy burden on water conservation measures. Therefore, a solar-powered automated irrigation system offers a sustainable method of increasing water use effectiveness in agricultural fields by eliminating the need for labor-intensive floods irrigation. Renewable energy sources reduce environmental pollution, and local energy generation is promoted. The application of this photo-irrigation system will be able to support socioeconomic growth. It is the suggested remedy for the country's farmers' current energy dilemma. This technology saves water by decreasing water losses and saves electricity by using less grid power. The suggested approach for irrigating fields is simple to use and environmentally favorable. When used for bore holes, which pump continuously throughout the day, the method has proven to be effective. Additionally, solar pumps provide pure solutions without the risk of borehole contamination. Since the system is self-starting, little maintenance and care are needed. The world's most plentiful energy source is solar energy. In addition to being a solution to the current energy issue, solar power is also a clean kind of energy. Solar energy can be used effectively through photovoltaic generating. Nowadays, using solar panels (an array of photovoltaic cells) to run street lights and power water is very common.

II.LITERATURE REVIEW:

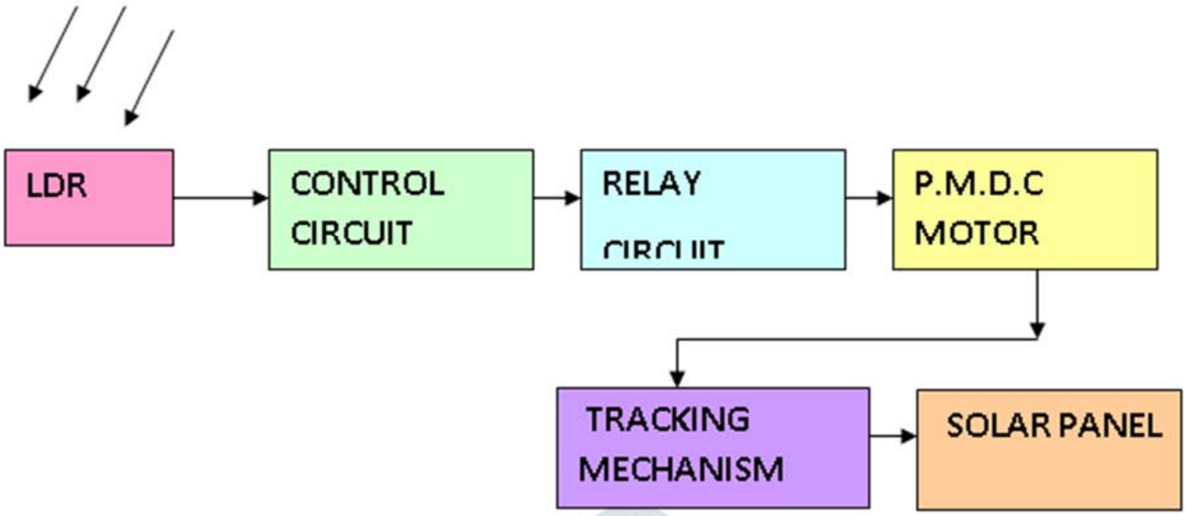
Photovoltaic (PV) technology is used for generating electricity from the incoming solar radiation. Several attempts have been made to evaluate, monitor and improve the performance of different components of a PV system: a PV module (Abdallah, 2004; Vick and Clark, 2004; Huang and Sun, 2007; Hansen et al., 2000; Lorenzo, 1994), a controller (H.ohm and Ropp, 2003), a battery, a pump (Vick and Clark, 2011), and a pump motor (Bhat et al., 1987). These, and similar studies have been effective for improving the efficiency of the PV system components. However, several factors need to be considered for an optimal PV system design to achieve the desired reliability of the system in a given environment. This involves a detailed investigation of all interacting physical (plant and soil type, irrigation system specifications, PV system sizing, site attributes), meteorological (solar radiation, air temperature, relative humidity, wind speed, precipitation) and managerial (irrigation scheduling) variables with the aim of achieving the desired reliability of the PV system. Ultimately, a technique that combines the center pivot irrigation system characteristics, daily crop water requirements, soil moisture status, irrigation applications, PV array output, load demands, and energy storage is required for evaluating a solar-powered center pivot irrigation system in terms of its reliability. This sort of holistic approach could be very beneficial for effective sizing of the system. Environmental conditions met outside the laboratory will cause a decrease in PV performance. Important environmental conditions to consider are the insulation, ambient temperature, and wind speed (Van Dyk et al., 2005). The setup of a PV system is also very flexible. The most efficient use of solar energy is when the panels are directly connected to the load. In fact, the success of water pumping lies partly with the elimination of the intermediate phase, namely the battery bank, for energy storage. With a direct connection between the PV array and the pump, water can be pumped during sunlight hours. The most efficient form of direct-connect systems is when the water is being pumped to an elevated storage tank, thus the electrical energy from the panels is converted to potential energy of the elevated water to be used on demand, often by gravity.The overall efficiency, from sunlight to water flow, has been recorded to exceed 3%. This 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 economical 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.

III.PROJECT METHOD AND METHODOLOGY:

The panel is kept under the sun for radiation. The photon energy from the sun lights that incident on the top metallic grid causes the electrons in the P-layer and holes in the N-layer to diffuse towards the junction. In this process the electrons collected on the N-side and holes collected on the P-side charge these two sides oppositely. This develops an open circuit voltage across the two terminals. The energy conversion process continues as long as light is incident on the active top surface of the cell.

The power developed by these cells are collected and stored in a battery. The power from the battery is sent to the DC motor. This charge stored is utilized for operating the LDR and IC comparator which intern operates the DC motor. A DC-AC inverter is coupled to this circuit for operating a electric water pumping. It runs the pump coupled to it. LDR senses solar radiation and sends the signal to the comparator where the actual comparison takes place between reference signal and sensor signal. Based on the comparison, comparator sends the electric signal to the dc motor which in turn rotates the solar panel.

Block diagram of solar water pumping system



IV.COMPONENTS USED:

SOLAR PANEL

The most useful way of harnessing solar energy is by directly converting it into electricity by means of solar photo-voltaic cells. Sunshine is incident on Solar cells, in this system of energy Conversion that is direct conversion of solar radiation into electricity.

In the stage of conversion into thermodynamic from is absent. The photo-voltaic effect is defined as the generation of an electromotive force as a result of the absorption of ionizing radiation. Energy conversion devices, which are used to convert sunlight to electricity by use of the photo-voltaic effect, are called solar cells.

Fig 1: Image of solar panel

BATTERY:

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

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Fig 2: Image of a battery

D.C. MOTOR:

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule.
When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

PUMP:

A pump is a device used to move fluids. A pump displaces a volume by physical or mechanical action. Pumps fall into three major groups: direct lift, displacement, and gravity pumps. Their names describe the method for moving a fluid.

The centrifugal pump is used in our system to pump the water. The pump that raises water from lower level to higher level by the use of centrifugal force is known as the centrifugal pump. These pumps convert the mechanical energy of a shaft in to kinetic and pressure energy of water.

In centrifugal pumps, the water enters the impeller through the eye of the pump, a passage along the shaft at the center of the impeller, and is pushed forward the periphery by the centrifugal force.

Transfer of energy from the impeller to the fluid takes place that gains in, kinetic and pressure energy. However, high velocity of the leaving water is not desired, as there is energy loss due to eddy ion the circular chamber that surrounds the vanes. Therefore, the velocity in to useful pressure energy. This is done by making the leaving water flow through a passage of gradually increasing area known as volute or diffuser. This gain in the pressure energy increases the delivery head of the pump.
If water supply is maintained at the centre, continues supply of water at high pressure is obtained at the periphery of the impeller. This may be utilized in delivering water to high altitudes. The suction head is generally limited to 7.9m of water to avoid separation or cavitations.

Fig 3: Image of a pump

PUMP EFFICIENCY:

Pump efficiency is defined as the ratio of the power imparted on the fluid by the pump in relation to the power supplied to drive the pump. Its value is not fixed for a given pump, efficiency is a function of the discharge and therefore also operating head. For centrifugal pumps, the efficiency tends to increase with flow rate up to a point midway through the operating range and then declines as flow rates rise further. Pump performance data such as this is usually supplied by the manufacturer before pump selection.

One important part of system design involves matching the pipeline head loss-flow characteristic with the appropriate pump or pumps which will operate at or close to the point of maximum efficiency. There are free tools that help calculate head needed and show pump curves including their Best Efficiency Points (BEP). Pump efficiency is an important aspect and pumps should be regularly tested. Thermodynamic pump testing is one method.

LDR SENSOR:

In our project one input voltage (Reference Voltages) is given to the PIN number 2 (- ve pin) of 324 IC from the variable resistor (10 K Ohm). The LDR output is given to the OP-AMP pin number 3 (+ ve pin). The LDR light dependent resistor is varying resistance with light intensity. This will be mostly linear to the light intensity. During the darkness the resistance of LDR shoots up to Meg ohm ranges. When LDR is illuminated by means of the sunlight, the resistance of LDR suddenly decreases (below 10 kilo ohm).

In normal condition the Resistance of the LDR is high. The voltages applied to the non-inverting terminal (+ ve) is low when compared to the inverting terminal voltages (- ve). In that time, the OP-AMP output is –V sat. (i.e -12 Volt). The transistor and relay are in “OFF” condition. In that condition, the bright light is in “ON” condition.

In Abnormal condition the Resistance of the LDR is low due to intensity of the light or fire. The voltages applied to the non-inverting terminal (+ ve) is high when compared to the inverting terminal voltages (- ve). In that time, the OP-AMP output is +V sat. (i.e +12 Volt). The transistor and relay are in “ON” condition. In that time, the bright light is in “OFF” condition, at the same time dim light is in “ON” position.

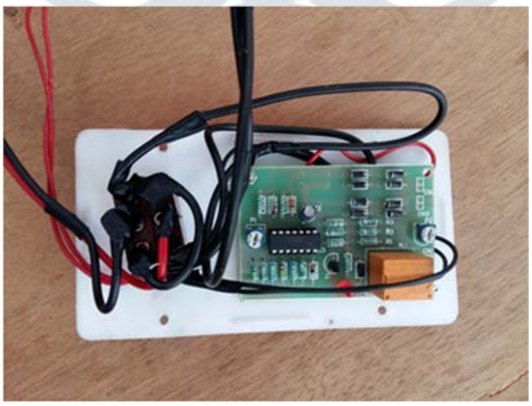

Fig 4: Image of a sensor

CIRCUIT DIAGRAM:

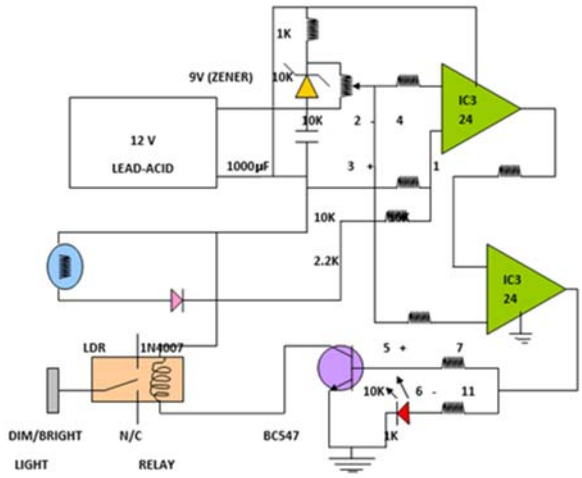

Fig 5:Circuit diagram of LDR sensor

DESIGN CALCULATION

Bearing No. 6202	
Outer diameter of Bearing (D)	35 mm
Thickness of Bearing (B)	12 mm
Inner diameter of Bearing (d)	15 mm
R1	Corner radii on shaft and housing
(From design data book) Maximum speed	14000 rpm
Mean Diameter (d_m)	(35 + 15) /2= 25MM
WAHL STRESS FACTOR	Ks= 1.85

V. ASSEMBLY:

Fig 6: Assembly part of the model

VI.RESULTS AND DISCUSSION:

Thus we have developed a Solar agricultural water pumping system with auto tracking which helps to know how to achieve low cost automation and multipurpose simple application. The application of this circuit produces excellent operation.By using more techniques, they can be modified and developed according to the applications. By using solar water pumping there will be no energy shortage nor will there be in the near future. Can be easily fabricated, made portable and useful for farmers. Therefore no grid power is utilized. No fuel is required for the operation giving a pollution free operation. The whole equipment is silent in functioning.

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

VII . CONCLUSION:

The Solar agricultural water pumping system with auto tracking is working with satisfactory conditions. We are able to understand the difficulties in maintaining the soldering and also quality. We have done to our ability and skill making maximum use of available facilities.

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