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Fabrication of Solar Power Reciprocating Water Pump

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ABSTRACT

The use of fossil fuels for industrial and domestic application over the last few centuries has resulted in over explanation of natural resources leading to deforestation and alarming rise in the rate of global warming. this has given impetus to explore alternative sources of energy with prime objective of harnessing the renewable energy resources as these are abundantly available, environment friendly nonpolluting with lowest running and operating costs like solar energy, wind energy, tidal energy is some of the examples. The solar energy is the harnessed b using solar photovoltaic cells and this energy is used to power the water pumping system. As the intensity of solar radiation varies from time to time, month of the season from maximizing the generation of solar power two axis orientation of solar panels is proposed and he generated electricity is stored in a lead acid battery and use of this power from battery source has inherent advantage of constant is in interrupted power supply these by ensuring continuous pumping of water taking place. Multiple sensors shall be used to orient the solar photovoltaic panel to desired direction and appropriate inclination so at ensure maximum power is generated from them, also to prevent over charging of battery and disconnecting the power source to mechanical water pump to ensure the energy stored in battery is maintained at a minimum level. The use of this system has advantage of zero carbon emissions, independent of conventional power source as it can be operated at any location provided sunlight is available and lowest maintenance and operating system.

KEYWORDS:Emissions, Sensors Fossil Fuelss, pV panel Water level sensor.

1. INTRODUCTION

A project is a significant, short-term, goal-oriented activity that involves a diverse set of skills and resources. It also refers to a collection of individuals that collaborate in a temporary organization to accomplish a goal. As half of their project work, they must construct any machine or building using mechanical principles. The most popular traditional energy sources are coal, oil, and gas. Hydro and renewable sources of energy, on the other hand, play a critical role in developing countries like India, wherein solar energy is abundant and ample [10]. Energy is divided into two types: commercial and non-commercial. Commercial energy is dominated by electricity, with oil products and coal coming in second and third. Industrial, agriculture, transport, and commercial expansion all impact commercial energy in today's globe [6, 7]. Firewood, cow dung, agricultural waste, renewable power, animal-powered vehicles, and wind energy are examples of non-commercial energy. Solar energy, wind energy, geothermal energy, tidal energy, and hydroelectric power are examples of renewable energy sources that may be gathered without generating hazardous pollutants.

2.LITERATURE REVIEW:

Sun-oriented energy ideas have traditionally been the subject of a lot of creative endeavor. The main goal is to increase the amount of energy delivered by solar cells by making the overall frameworks more efficient and cost-effective. Different techniques are proposed here to develop an efficient water pumping system, which is followed by technology for its system components. [1] Engineering of Bioresources by Erin William Solar water pump studies for small-scale irrigation are a well-established procedure on many Indian farms and are used at various levels around the world. Crop diversification is possible while crop yields are also increased. However, traditional irrigation systems, which rely on electric motors and fuel-powered generators, require a significant amount of conventional energy. The overall goal of this study was to see if photovoltaic (PV) modules could power a small-scale drip irrigation system's water pump. Field observations of worldwide solar radiation and PV electricity output were combined with computer simulations. Two amorphous silicon 42 W PV modules, directly coupled to a 12 V surface water pump, were installed in the summer and winter for field observations. Many types of solar-powered water pumping systems have been reviewed for several years, and this study focuses on diaphragm and solar photovoltaic (PV)-powered water pumping systems. To determine the pumping performance, efficiency, and dependability of the various systems, data was collected on diaphragm and helical pumps that were driven by various solar PV arrays at various pumping depths. Brian D. Vick and R. Nolan Clarck [2]. Voltage, current, temperature at the back of the panel, pressure, and flow were all monitored. The PV's electrical output and the volume of water pushed were determined using these observed metrics. The solar radiation and PV electrical output models were tweaked using site latitude, elevation, and panel tilt, as well as the following meteorological data: daily average, maximum, and minimum temperatures; and worldwide solar radiation.

3.OBJECTIVE:

1. To create a continuous pumping system that does not rely on energy .
2. To conduct a technological analysis of the system using a solar PV pumping system.
3. To obtain the lowest cost, create a mechanism that wastes the least amount of energy. Using cutting-edge technology to advance basic ideology
4. Electricity usage is rapidly increasing in today's world. Water and coal are the primary sources of electricity. Coal is responsible for 60% of all electrical generation. The availability of coal is rapidly dwindling. The earth's coal reserves will be depleted in the next 20 years. Renewable energy is the most sustainable alternative for the future. Solar energy is one of the most abundant renewable energy sources. Solar energy will help to lower the high consumption of conventional electricity.

4.METHODOLOGY :

Two key components make up a solar-powered water pumping system:

1.Photovoltaic Modules (Solar Panels) and Pumps are two types of photovoltaic modules (Reciprocating Pumps)

2.Solar-powered water pumping systems can be divided into two categories: There are two types of solar panels: 1) battery-based and 2) solar direct.

3.Photovoltaic (PV) panels, a charge controller, batteries, a pump controller, and a DC water pump make up a battery-based water pumping system. The system includes a Microcontroller for controlling the LDRs, Water level sensors, a Wi-Fi module with a reset option, a Crystal Oscillator, and the Mobile Blynk software.

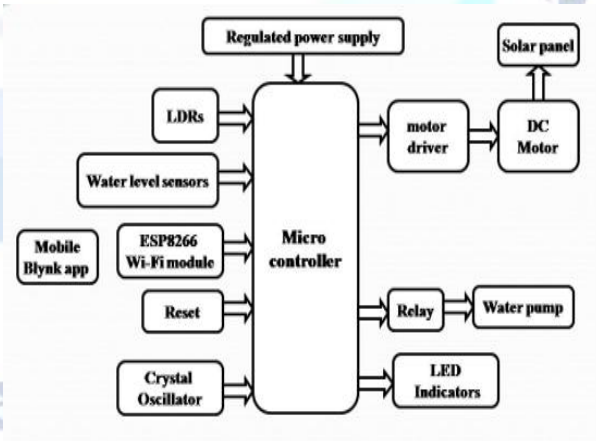

FIG 1.: Block diagram ofSolar Powered Reciprocating Water Pump

The solar panel gathers solar energy and stores it in the battery and rechargable battery capacity for up to 3 hours, as shown in the diagram. The microcontroller devices feature LDRs and water level sensors, and the microcontroller device controls the Mobile Blynk app.

The solar panel is used to observe the process of a solar-powered reciprocating water pump, the energy is stored in the battery, and the power is utilised to operate the reciprocating pump. The Mobile Blynk app is used to control this gadget. The sensor will be startled (the water level is full) once the water level has reached its maximum height, and it will be blicked once the level has dropped.The solar panel gathers solar energy and stores it in the battery and rechargable battery capacity for up to 3 hours, as shown in the diagram. The microcontroller devices feature LDRs and water level sensors, and the microcontroller device controls the Mobile Blynk app. The solar panel is used to observe the process of a solar-powered reciprocating water pump, the energy is stored in the battery, and the power is utilised to operate the reciprocating pump. The Mobile Blynk app is used to control this gadget. The sensor will be startled (the water level is full) once the water level has reached its maximum height, and it will be blicked once the level has dropped.

5. WORKING PRINCIPLE:

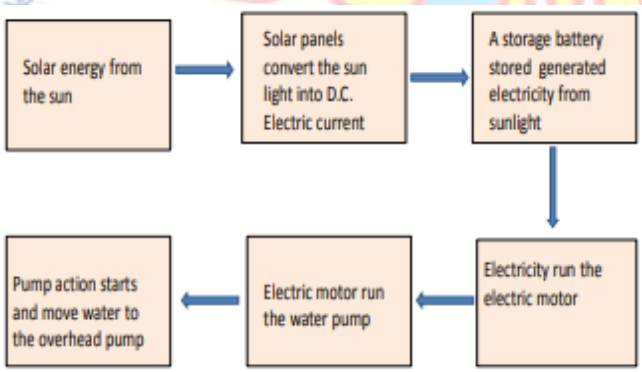

Fig 2. working process

A revolving pump is a dynamic pressure pumps that propels a fluid by collecting a certain volume and pushing it into an output pipe. Water flows into a Pumping chamber through an input valve and is forced out by an exit valve due to the action of a piston or diaphragm. They either are single acting (suction and discharge strokes are independent) or double acting (both suction and discharge strokes are independent) (suction and discharge strokes are independent in both directions). Pump with Rotating Action (Reciprocating Action Pump) During the suction stroke, the piston moves to the left, creating pressure in the cylinder. Because of the vacuum, the suction valve opens, allowing water to enter the cylinder. During the delivery stroke, the piston turns to the right. As the tension in the cylinder increases, the suction valve shuts and the delivery valve opens, pushing water into to the delivery line. The air container is used to maintain consistency in the discharge. Solar trackers consist of a motor and gear assembly controlled by a computer that responds to the position of the sun and saves the solar energy in the battery.

5.1Photovoltaic (PV) panels:

Photovoltaic panels account for most of the system's cost (up to 80%). The size of the PV system is directly proportional to the pump's size, the volume of water needed (m3/d), and the amount of solar irradiation available. A panel's power output is measured in watts. Under Standard Test Conditions, the SPV water pumping system should be operated with a PV array capacity of 200 Watts peak to 5000 Watts peak (STC). The desired PV array power output might be obtained by connecting enough modules in series and parallel. Individual modules utilized in the PV array shall have a minimum peak power output of 74 Watts under STC, with sufficient measurement tolerances. PV modules with a greater power output should be used. PV module(s) made in the United States that feature mono/multicrystalline silicon solar cells4.3 solar

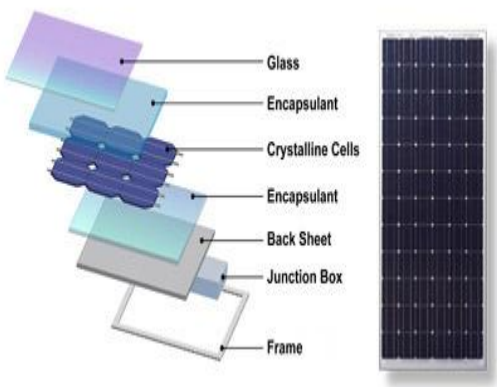

Fig :3 solar p-v panel

5.2 Dual axis solar tracker:

Solar power is the fastest growing means of renewable energy .the dual axis tracker system can increase tracker sun rays by from switching solar panel in various directions. The solar panel can rotate in all directions. The tracker system can be used to sense weather in all directions which is LCD display.

Fig: 4.Dual axis solar tracker

5.3 Water level sensor:

The working principle of the water level sensor is that when it is put into a certain depth in the liquid to be measure the pressure on the sensor front surface is converted into the liquid level height.

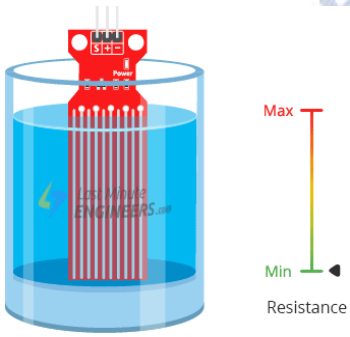

Fig:5. Water level sensor

Table :1.Maximum and Minimum values of water level sensor

S.N.O	Water level (liters)	Time (sec)
1	0.5	12
2	1	22
3	1.5	30
4	2	38
5	2.5	46
6	3	54

During the Minimum level of water, the readings is shown in the Blynk application which was see in mobile device and for each level the of the water application of device gets alerts for each maximum level and minimum levels.

6. PISTON:

A piston is a cylindrical device that reciprocates inside a cylinder and has a set length. The piston is attached to the top of a piston and has a diameter that is slightly less than the diameter of the cylinder bore. It's an important part that converts static pressure into mechanical power. The piston is equipped with a well-proportioned ring composed of relatively soft rubber, which allows for good sealing and little friction at operating pressure. The purpose of a piston is to convey the pressure of the air inside the cylinder to the piston of the oil cylinder. The piston has a double-acting mechanism. The piston pushes forward when the high-pressure air is released from the left side of the cylinder. When the piston is pressed hard from the left side of the cylinder, it slips backward. The piston must be as rigid and durable as possible. The efficiency and economy of the machine are dependent on the piston's performance. It must operate with little cylinder friction and be able to withstand the high compression force produced in the cylinder, as well as the shock load, during operation.

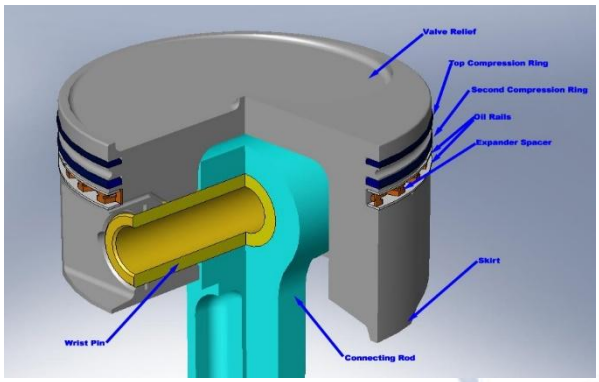

Fig:6.Piston model

At the factory, some cylinders are forged and carved into a valve ground (elliptical shape). An oval having one half that is the mirror reflection of the other is known as an elliptical shape. These piston shapes offer an edge in terms of adapting to the ever-changing size of the cylinder bore. The piston has an oval shape when it is cold. When the engine reaches operating temperature, the pin bore area of the piston expands more than the thinner regions of the piston. When the piston achieves operating temperature, it transforms into a spherical shape that fits snugly into the cylinder bore, improving sealing and burning efficiency.

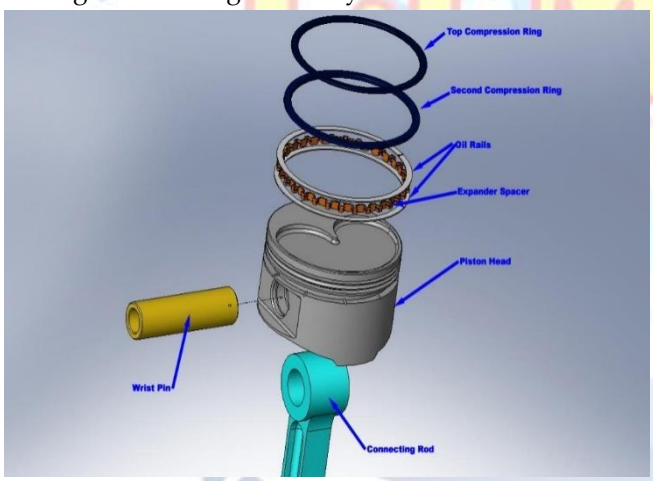

Figure 7- Piston Assembly

6.2 Reciprocating mechanism:

A reciprocating motion is an image . these images that cycles itself up or down or back and forth. It's used in a wide range of equipment, including piston engines and pumps. A single mutuality cycle is made up of two opposing motions called strokes. Using a crank, circular motion can be turned to reciprocating motion, and motion of the piston can be transformed to circular motion. The expansion of burning fuel in the cylinders, for example, pushes the piston down regularly, rotating the crankshaft through the connecting rod in an internal combustion engine (a kind of reciprocating engine). The crankshaft's continual movement drives the piston back up, ready for next cycle. The piston moves in a rotational movement, which the crankshaft converts to circular motion, which powers the vehicle or performs other vital functions. So, because crank and connecting rod are not completely enclosed, tremors felt while the engine is running are a result of the pistons reciprocating.

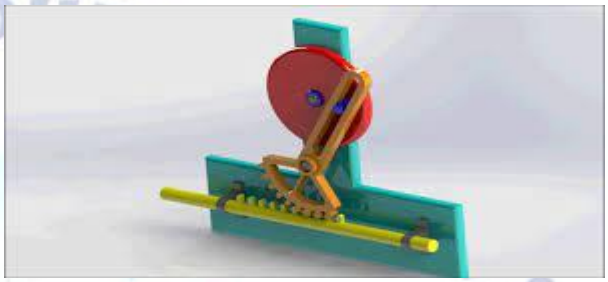

Fig:8.Reciporcating mechanism

7.EXISTING SYSTEM:

Earlier, the solar energy and the panels were not used, mainly because the electricity was connected to the motor and, by the reciprocating pump, we were using the water. It has two types of direct-coupled solar pumping systems. It contains the electricity from the PV modules, which is sent directly to the pump.

8.OPERATING AND PROPOSED THE SYSTEM :

You must now run the project prior switching on the board. A smartphone app that links to the blinking app may be used to operate the system. Your app's red indicator indicates that system is not linked to your phone. When you switch on the device, it connects to the network, collects sensor data, and allows you to control it.

Fig no 9.: Overall view of project

In this project, two tanks are used, one in the upper level and the other in the lower level. The top tank is

empty, while the lower tanker is full of water. There are no alerts in your blinking app programmed. These applications show integrated systems that you may use in your own app.

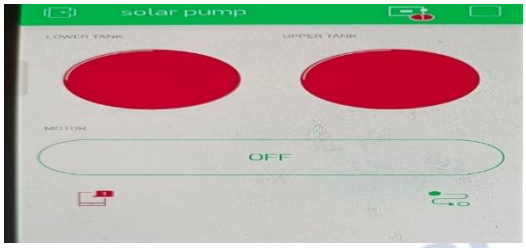

Fig 10. blynk operating in mobile

You will be able to manage your engine with your phone in the future thanks to the Internet with Things (IoT). There really are two tanks in your cell phone. The top tank is the right-hand tank, while the lower tank is the left-hand tank. The ability to charge the system and deliver water to a top tanker when the equipment is on, but the blinking application is switched on You just click a button on our smartphone to operate it. The water will be taken by the pneumatic water pump as the reciprocating mechanism drives the motor. The volume of water from of the lower tank to the top tanker is controlled by two non-return valves. You'll receive an alert in the blink app when the level of water in the smaller tanker decreases or increases in the top tanker.

8.RESULTS AND DISCUSSIONS:

The results obtained from the experimental set up comprising of solar flat plate collector, reciprocating water pump with D.C motor, batteries arduino circuit board connected to all above component along with water level indicator.The reciprocating water pump will start its operation after receiving input signal from the water level indicator.The water level indicator will send instruction to arduino board when water level in the tank has reached minimum level. the arduino board will active instruction the reciprocating pump to operated and it starts the pumping the water.The LDR sensors fitted to the solar panel. Sense the solar radiation and oriented solar panels two axes ensure that maximum sun light is so s collected by the flat plate collected and they by ensuring maximum power generation.The orientation solar panel gets updated when the different between the angle at inclination of the light rays exceeds beyond inclination solar panel. certain angle the LDR sensors will send the signal and oriented the solar panel to ensure that the energy from sun rays collected by the solar panel is maximum.The voltage of current data is collected for one day i.e on 17-feb-2022 with time interval of one hour. The collected data solar generation details are given below

Table: 2.Maximum power produced by the panel

Time (hrs)	Voltage	Current	Power
	(V)	(A)	(output)
6:00am	11	0.03	0.33
7:00am	13	0.04	0.52
8:00am	19.5	0.06	1.17
9:00am	20.02	0.2	4.004
10:00am	19.35	0.24	4.644
11:00am	20.2	0.26	5.252
12:00am	20.5	0.22	4.51
1:00pm	19.52	0.21	4.0992
2:00pm	20.11	0.19	3.8209
3:00pm	19.3	0.22	4.246
4:00pm	19.17	0.12	2.3004
5:00pm	18.33	0.04	0.7332
6:00pm	13.75	0.039	0.53625
		Avg	2.781996

The above table represent the power generated by p-v panel when dual axis rotation from east to west. with time ranging the voltage 6.00am to 6.00pm. the morning section at 6.00am it was observed that the voltage and current is at the lowest level i.e voltage 11V and current 0.03A respectively further as the time has elapsed it was found that both voltage and current has increased slowly. The output from solar panel is connected to arduino board which in the is connected to battery. This is done to prevent the battery from over charging and ensure proper protection given for same.

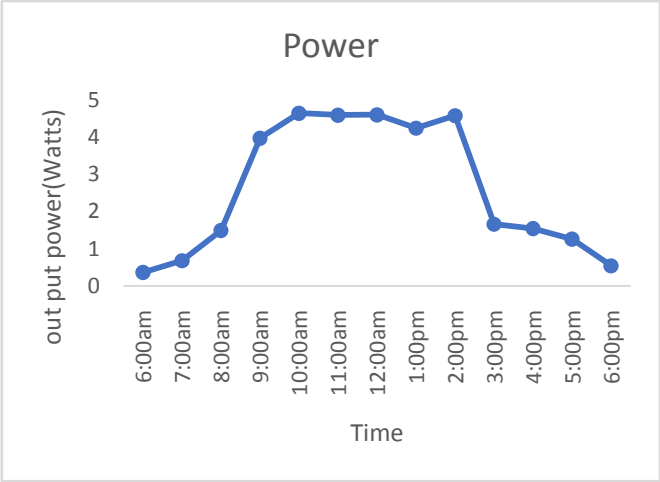

Fig: 11.Time Vs output

The above graph is represented the power generated against the time. From the graph it was observed power is internal at in the month is i.ea 17-feb-2022 and it was found. that the generated early constant and increase as peak value of 5.25 at 11.00 am. Later of found to decrease with passage of time. To increase gradually to near max value at 11.00am and it remains nearly constant from 11.00 am to 2.00pm is reaches maximum value of 11.00am to 2.00 pm. Later it was found to decrease.

9. CONCLUSION:

The solar powered reciprocating water pump test bench was fabricated and tested for its performance. It was observed that solar power generated from the solar panel was initially lower at 6.00am in the morning, reaches to at a higher range from 11.00am to 2.00 pm and gets reduced to minimum value with passage of time. It was observed that the discharge of water from D.C motor pump set was maximum when it was operated with battery in fully charge condition and reduces to a main value as the battery gets discharged. The pump set gets into operational condition with the help of impulse received from arduino board which in turn receives signals from L.D.R sensors. The total set up can also be operated by implementing I.O.T as it apprises the level of water stored in the tank and correspondently the uses can operate the pump set by switching on/off the D.C motor powered pump set to ensure the water levels in the tank is maintained at a desired level.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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