SOLAR POWERED WATER LIFTER USING GIANT WHEEL METHOD

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Abstract- *By using this machine large amount of water can be lifted from rivers easily and also quickly. The power for the motor is given from a solar panel. Solar panel consists of number of silicon cells, when sun light falls on this panel it generates the voltage signals, these voltage signals are given to charging circuit. The motor gets supply from the circuit .The motor is connected to the scoops by means of worm gear. When the motor starts rotating it leads to rotate the scoops by means of gears .Thus the water from the river surface can be collected in a tank.*

Keywords- DC Motor, Worm Gear,Solar Panel,Giant Wheel.

1. INTRODUCTION

Water is a common chemical substance that is essential for the survival of all known forms of life. In typical usage, water refers only to its liquid form or state, but the substance also has a solid state, ice, and a gaseous state, water vapor or steam. About 1.460 petatonnes(Pt) (10^{21}kilograms) of water covers 71% of the Earth's surface, mostly in oceans and other large water bodies, with 1.6% of water below ground in aquifers and 0.001% in the air as vapor, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Saltwater oceans hold 97% of surface water, glaciers and polar ice caps 2.4%, and other land surface water such as rivers, lakes and ponds 0.6%. A very small amount of the Earth's water is contained within water towers, biological bodies, manufactured products, and food stores. Other water is trapped in ice caps, glaciers, aquifers, or in lakes, sometimes providing fresh water for life on land.

Water moves continually through a cycle of evaporation or transpiration (evapotranspiration), precipitation, and runoff, usually reaching the sea. Winds carry water vapor over land at the same rate as runoff into the sea, about 36 Tt (10^{12}kilograms) per year. Over land, evaporation and transpiration contribute another 71 Tt per year to the precipitation of 107 Tt per year over land. Clean, fresh drinking water is essential to human and other life. However, in many parts of the world especially developing countries there is a water crisis, and it is estimated that by 2025 more than half of the world population will be facing water-based vulnerability. Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation. Approximately 70% of freshwater is consumed by agriculture.

Water can appear in three states; it is one of the very few substances to be found naturally in all three states on earth. Water takes many different forms on Earth: water vapor and clouds in the sky; seawater and rarely icebergs in the ocean; glaciers and rivers in the mountains; and the liquid in aquifers in the ground.

Water can dissolve many different substances, giving it different tastes and odors. In fact, humans and other animals have developed senses which are, to a degree, able to evaluate the potability of water, avoiding water that is too salty or putrid. Humans also tend to prefer cold water to lukewarm; cold water is likely to contain fewer microbes. The taste advertised in spring water or mineral water derives from the minerals dissolved in

it, as pure H_2O is tasteless. As such, purity in spring and mineral water refers to purity from toxins, pollutants, and microbes.

2. LITERATURE REVIEW

II. LITERATURE SURVEY

WATER:

Water covers more than two-thirds of the Earth's surface. But fresh water represents less than 0.5% of the total water on Earth. The rest is either in the form of seawater or locked up in icecaps or the soil, which is why one often hears of water scarcity in many areas.

Water is continuously moving around the earth and constantly changing its form. It evaporates from land and water bodies and is also produced by all forms of life on Earth. This water vapour moves through the atmosphere, condenses to form clouds and precipitates as rain and snow. In time, the water returns to where it came from, and the process begins all over again. Although water is constantly moving, its total quantity on Earth's surface is constant.

FORMS OF WATER:

Water is found in three different forms - liquid, solid or gas, depending on the temperature but it constantly changes from one form to another. Changes in temperature will determine which of these forms predominates in a particular area.

Liquid:

Water is usually encountered in the liquid state, because this is its natural state when temperatures are between 0° C and 100° C. 'Fresh' or drinking water is found as groundwater in underground aquifers, and on the surface in ponds, lakes, and rivers. Seas and oceans account for 97% of all water on Earth; but their waters contain dissolved salts and are therefore unfit to drink. In regions of young volcanic activity, hot water emerges from the earth in hot springs (examples are Garampani in Assam and Badrinath in Uttaranchal). How does this phenomenon occur? Surface water percolates downward through the rocks below the Earth's surface to high-temperature regions surrounding a magma reservoir, either active, or recently solidified but still hot. There the water is heated, becomes less dense, and rises back to the surface through fissures and cracks.

Solid:

Ice is the frozen form of water. It occurs when temperatures are below 0°C (32°F). For a given mass, ice occupies 9% more volume than water, which is why when water enters cracks in rocks and freezes it causes the rocks to crack and split. Being less dense than water, ice floats. This property of ice is vital to aquatic life in cold regions. As the temperature drops, ice forms a protective, insulating layer on the surfaces of streams, pools and other water bodies, allowing water to remain liquid in the layers beneath and life to survive. Glaciers, icebergs, and ice caps are all frozen water.

Gas:

Water is found in the atmosphere in its gaseous form, water vapour. Steam is nothing but vapourized water. In certain hot water springs called geysers, jets of steam and hot water rise one hundred feet or more from the ground. Geysers are found in Iceland, the North Island of New Zealand and in USA's Yellowstone National Park.

Worldwide, the consumption of water is doubling every 20 years - more than twice the rate of increase in population.

A large amount of water is wasted in agriculture, industry, and urban areas. It has been estimated that with available technologies and better operational practices, agricultural water demand could be cut by about 50% and that in urban areas by about 33% without affecting the quality or economics of life. But most governments do not have adequate laws or regulations to protect their water systems.

Due to the increase in population there has been a rise in the demand for food, space for housing, consumer products, etc., which has in turn resulted in increased industrialization, urbanization, and demands in agriculture thereby leading to both river and groundwater contamination.

Some interesting facts about water :

- 75% of the earth's surface is covered with water
- More than 97% of the earth's water is in its oceans
- About 2% of the available drinking water is frozen leaving only 1% for drinking
- The world's average rainfall is about 850 mm
- Water regulates the Earth's temperature. It also

regulates the temperature of the human body, carries nutrients and oxygen to cells, cushions joints, protects organs and tissues, and removes waste

- 60% - 75% of the adult human body is water - 82% of blood is water; 70% of the brain and 90% of the lungs are made up of water
- Blood in animals and sap in plants is composed mainly of water
- To cook 1 cup of rice you need 2 cups of water but to wash the pan in which it has been cooked you need 4-5 litres of water
- A dripping tap can waste up to 6 litres of water in a day
- More than half the creatures on the Earth are found under water
- Life on earth probably originated in water
- In the summer our bodies require about 2 litres of water daily. Here is the water content of some foods (approximate) - 95% in tomato, 91% in spinach, 91% in milk, 85% in apples and 80% in potatoes
- 10% of the earth's surface is covered with ice

There are more than one billion people particularly in North Africa and Western and South Asia, who lack access to a steady supply of clean water.

Access to water and sanitation, so crucial to human well-being and development, has now become a priority for the international community. To underscore the need for immediate action, the United Nations has designated 2003 as the International Year of Freshwater.

B. Component Details

1) DC Motor: In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion [1]. The dc motor show in Fig 1

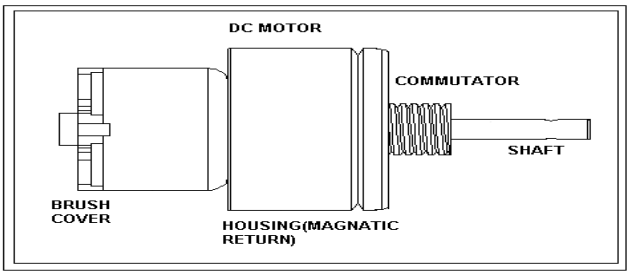

Fig. 1 DC motor

SOLAR PANEL

A solar panel is a device that collects and converts solar energy into electricity or heat. It known as Photovoltaic panels, used to generate electricity directly from sunlight Solar thermal energy collection systems, used to generate electricity through a system of mirrors and fluid-filled tubes solar thermal collector, used to generate heat solar hot water panel, used to heat water.

It is energy portal. A solar power technology that uses solar cells or solar photovoltaic arrays to convert light from the sun directly into electricity. Photovoltaic, is in which light is converted into electrical power. It is best known as a method for generating solar power by using solar cells packaged in photovoltaic modules, often electrically connected in multiples as solar photovoltaic arrays to convert energy from the sun into electricity. The photovoltaic solar panel is photons from sunlight knock electrons into a higher state of energy, creating electricity.

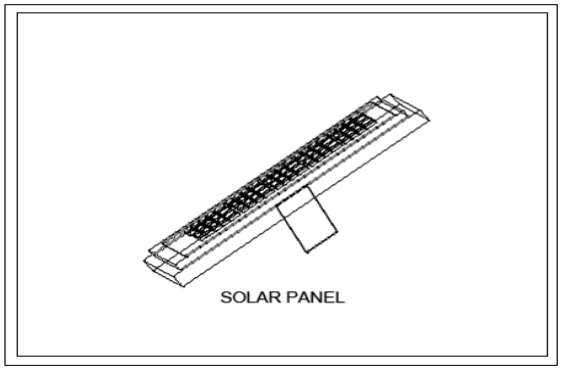

Fig no:2 solar panel

Solar cells produce direct current electricity from light, which can be used to power equipment or to recharge a battery. A less common form of the technologies is thermophotovoltaics, in which the thermal radiation from some hot body other than the sun is utilized. Photovoltaic devices are also used to produce electricity in optical wireless power transmission.

BATTERY

In our project we are using secondary type battery. It is rechargeable type. A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy. Primary batteries can only be used once because they use up their chemicals in an irreversible reaction.

Secondary batteries can be recharged because the chemical reactions they use are reversible; they are recharged by running a charging current through the battery, but in the opposite direction of the discharge current. Secondary, also called rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled.

Batteries have gained popularity as they became portable and useful for many purposes. The use of batteries has created many environmental concerns, such as toxic metal pollution. A battery is a device that converts chemical energy directly to electrical energy it consists of one or more voltaic cells. Each voltaic cell consists of two half cells connected in series by a conductive electrolyte.

One half-cell is the positive electrode, and the other is the negative electrode. The electrodes do not touch each other but are electrically connected by the electrolyte, which can be either solid or liquid. A battery can be simply modeled as a perfect voltage source which has its own resistance, the resulting voltage across the load depends on the ratio of the battery's internal resistance to the resistance of the load.

When the battery is fresh, its internal resistance is low, so the voltage across the load is almost equal to that of the battery's internal voltage source. As the battery runs down and its internal resistance increases, the voltage drop across its internal resistance increases, so the voltage at its terminals decreases, and the battery's ability to deliver power to the load decreases

DRAWING FOR SOLAR POWERED WATER LIFTING

Fig.10 Block Diagram

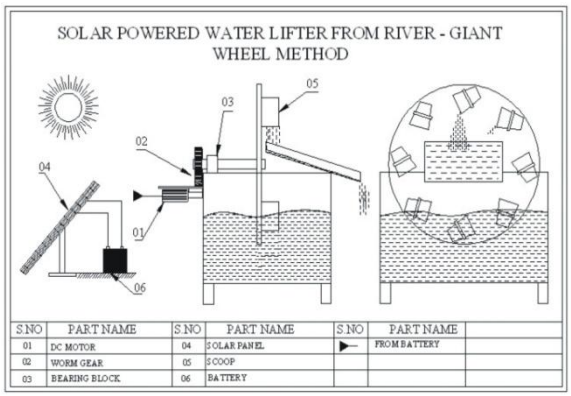

Fig no:3 solar powered water lifter system

B. SYSTEM WORKING Solar panel consists of number of silicon cells, when sun light falls on this panel it generates the voltage signals, these voltage signals given to charging circuit. Depends on the panel board size the generated voltage amount is increased. Here the worm gear and motor arrangement is used to control the rotation of the scoop. The motor gets supply from the solar panel. These scoops are arranged as it can touch the water surface. Below these scoops arrangement there is a tank which contains water. A tray and a collecting tray are arranged as shown in the diagram. When the motor rotates the scoops also starts rotating due the gear arrangement. So when the scoops rotate it reaches the water surface, when scoops leave the water surface it carries little amount of water in it. After scoop reaches the upper area the water spill in a tray due to gravitational force as the arrangement of the scoop is made so. The spilled water then reaches a collecting tray which is connected to the tank.

SOLAR PANEL CALCUALTION:

VOLT = 12 V

WATT = 5 W

W = V X I

5 = 12 X I

I = 5/12

I = 420ma

BATTERY CALCULATION:

B_{AH}/C_I = 8 ah/420ma

= 19 hrs

To find the Current

Watt = 18 w

Volt = 12v

Current =?

P= V x I

18 =12 x I

I = 18/12

= 1.5 AMPS

BATTERY USAGE WITH 1.5 AMPS

B_{AH} /I

8/1.5 = 5.3 hrs

30 RPM CALCAULTION DC MOTOR

SPEED = 30 RPM

VOLTAGE = 12 VOLT

WATTS = 18 WATT

Electrical (electric) power equation:

Power $P = I \times V$

Where

V = 12

W = 18

I=18/12

=1.5 A

H.P = .02414

TORQUE OF THE MOTOR:

Torque = (P X 60) / (2 X 3.14 X N)

Torque = (18X 60) / (2 X 3.14 X 30)

Torque = 5.72 Nm

WORM GEAR CALCULATION [APPROXIMATE]

Number of teeth on worm wheel = 32

Outer diameter of worm wheel = 50.5 mm

Inner diameter of worm wheel = 12 mm

Number of starts on worm = 9

Axial Pitch of Worm or Circular Pitch of Gear P: 6.23
Pitch Circle Diameter of Worm D1: 16.07
Pitch Circle Diameter of Gear D2: 63.47

Centre to Centre Distance Between Worm and Gear C: 39.774
The value of "L1 = [C^(0.875)]/2" : 12.54
The value of "L2 = [C^(0.875)]/1.07" : 23.45

Motor speed = N = 30 rpm

Power of motor = p = 18 watts

Diameter of shaft = 15 mm

Mild steel shaft shear stress = fs = 210 N / mm^2

Torque of the motor = T = p x 60 / 2 x π x N

= 18 x 60 / 2 x π x 30

= 5.729 N - m

Gear ratio (i) = n1 / n2

(n1) worm shaft speed = 30 rpm

= 30 / 32

(n2) worm wheel speed = 0.937 rpm

Torque of the worm wheel (t2) = p2 x 60 / 2 x π x N2

= 18 x 60 /2 x π x 0.937

= 183.44 N m

Angular velocity of worm wheel = 2 x π x 0.937 / 60

= 0.098rad

Maximum torque rate of the worm wheel = π/16 x fs x d^3

= π/16 x 210 x 15^3

= 2226.6 N m

Worm wheel torque is limited to the maximum limit. So our design is safe.

Hence the worm wheel used here rotates at = **0.937 rpm**

3.CONCLUSION

The project carried out by us made an impressing task in the field of water pumping area like agricultural etc..,

This project will reduce the cost involved in the concern. Project has been designed to perform the entire requirement task at the shortest time available.

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