Solar Tree for Utile Applications

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***Abstract*— Renewable energy systems are rapidly becoming more efficient and cheaper and their share of total energy consumption is increasing. As of 2019 worldwide, more than two-thirds of all new. Rapid deployment of renewable energy and energy efficiency technologies is resulting in significant energy security, climate change mitigation, and economic benefits. In international public opinion surveys there is strong support for promoting renewable sources such as solar power and wind power. Now a days with the growing population and energy demand we should take a renewable option of energy source and also we should keep in mind that energy should not cause pollution and other natural hazards. In this case the solar energy is the best option. This paper introduces a new solar technology that emulates how solar trees convert sunlight into energy. An Solar Tree which aims at serving the humanity toward the planet, having an ability to perform electrolysis of the water and obtain the Hydrogen (for fuel) and Oxygen (to be emitted in the air) along with generating electricity from solar energy with the help of PV (Photo-voltaic) panels on the top of the trees. The PV on the top of the tree will collect energy from the sun and convert it into electricity. A PV cell is made of a semiconductor material, usually crystalline silicon, which absorbs sunlight. The electricity is stored and is used to light the LED's on the tree, hence making it as a streetlight. The actual model can also be used to charge the gadgets like mobile phones and also can run DC motors. Oxygen and hydrogen can also be separated in pure water. Oxygen can be stored and used in medical field. Hydrogen can be hot air balloons.**

Keywords – *Solar Panel, Solar Tree, Energy storage, Electrolysis etc.*

I. INTRODUCTION

Trees are significant piece of life on earth as they give oxygen by devouring carbon dioxide, which is basic for survival of practically all living life forms on Earth. However, these days, people are chopping down billions of trees for paper, furniture, building supplies, and different purposes. The quantity of trees is diminishing while the number of inhabitants in people is developing rapidly. Accordingly, the oxygen levels are falling while the centralization of carbon dioxide in air is expanding.

Solar tree designs for lightning purposes do not have to power such huge consumers in comparison with light bulbs. Due to this no extra adds are needed in the case of an street lightning solar tree. The basic three components in the design are: The pillar – trunk, solar panels and light bulbs. Urban location causes the base of a serious construction material like concrete. The design for lightning purposes looks beautiful, with lots of rare elements like branches are standard elements set up just at a different pattern which start at different angles of array. Light bulbs are attached to solar panels from the bottom side so they cover an area according to solar panel calculations.

Our model is equipped for creating and discharging unadulterated oxygen in the climate utilizing inexhaustible assets. Notwithstanding it, hydrogen gas is delivered which is put away and can possibly be utilized as fuel later. We trust that such a structure won't just guide in providing unadulterated oxygen to urban condition yet in addition fulfil lighting needs of creating and created urban areas.

II. LITERATURE REVIEW

Sujitpatil Sun based tree requires exceptionally little space than customary sun powered board framework. The sunlight based boards on sun based tree convert sun powered radiation into power, which is utilized for disintegration of water into oxygen and hydrogen. Oxygen is discharged noticeable all around to inhale and hydrogen is put away as fuel. [1]

Jeng-Nan Juang. In this paper, a sun based following framework for sustainable power source is structured and worked to gather free vitality from the sun, store it in the battery, and convert this vitality to substituting current (AC). This makes the vitality usable in standard-sized homes as a supplemental wellspring of intensity or as an autonomous power source. [2]

Kalhan Kampasi. The sun based boards convert sunlight into power, which is utilized for deterioration of waste water into oxygen and hydrogen. Oxygen is discharged noticeable all around to inhale and hydrogen is put away as fuel. Light Emitting Diode (LED) lights, driven from the created power are utilized to emanate light amid night. The mechanization and control for the procedures is given by an incorporated Peripheral Interface Controller (PIC). [3]

III. METHEDOLOGY

Basic design of the project is shown in the block diagram. This task comprises of AVR Microcontroller, Light power sensor, LCD Display, LED load driver1, solar tree, charging control circuit, battery and oxygen generator. The sun powered vitality was changed over into electrical vitality by PV modules. This vitality was utilized to charge the battery-powered batteries. We utilized one battery of 12V. What's more, it send the flag to AVR Microcontroller. Photograph resistor or Light-subordinate resistor (LDR) or photocell is a light-controlled variable resistor. LDRs or Light Dependent Resistors are valuable particularly in light/dull sensor circuits and send the flag to AVR Microcontroller. AVR Microcontroller is customized to get the sensors flags and depending upon conditions happens LED will be controlled through Driver circuit board. LCD show is utilized for showcase a data reason. The oxygen generator is utilized to gauge the plant oxygen and the temperature of the environment.

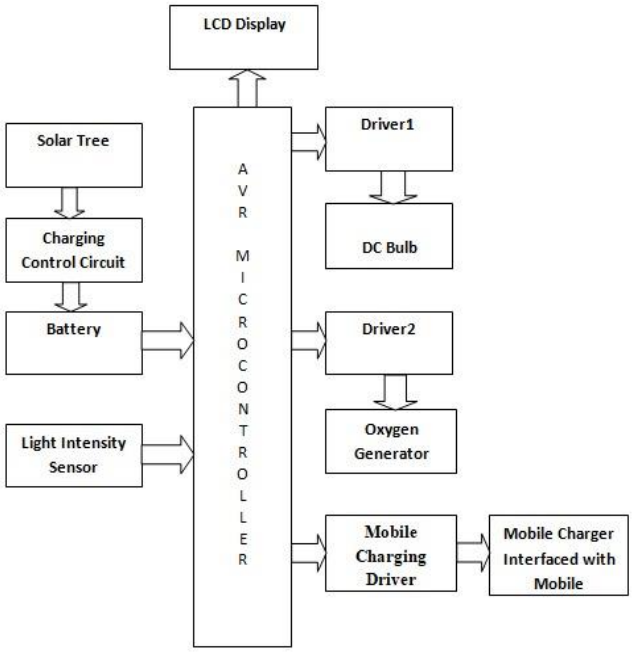


Figure 1: Block diagram of proposed method

1. *Solar tree*

Figure 2: Solar Tree

The course of action of sunlight based tree Spiraling Phyllataxy method is utilized in structuring of Solar Tree. For following most extreme power from sun this Technique helps the lower boards from the shadow of upper ones. The proficiency of the plant can likewise be improved by this innovation.

The sunlight based vitality was changed over into electrical vitality by PV modules. This vitality was utilized to charge the battery-powered batteries.

We utilized one battery of 12V. The diodes were associated in circuit so that they counteracted the turnaround stream of vitality, i.e., stream of power from batteries to sunlight based modules.

2. *Light Intensity Sensor*

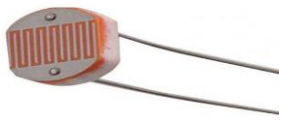


Figure 3: Light Intensity sensor

The main impulsion is to design a high quality solar tracker. It consists of three main constituents which are the inputs, controller and the output. Photo resistor or Light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000000 ohms, but when they are illuminated with light resistance drops dramatically. LDR‟s have low cost and simple structure.

3. LED load

Figure 4: LED Load

A LDR was utilized to control the action of LED lights. LDR gave us the estimation of power of light (lux). At the point when the perusing of the deliberate esteem fell beneath the set point esteem, the LED lights sparkled. In any case at the point when the perusing of estimated esteem surpassed the set point esteem, the lights remained off. The set point esteem was kept as 100lux. The set point esteem was fixed or balanced by programming the Arduino Atmega328 microcontroller. A polarized transfer was utilized for on-off motivation behind LED lights. We have used 12V, 9W DC bulb.

4. Oxygen generator

Amid electrolysis, it was noticed that the creation of hydrogen gas was more than that of oxygen. This was affirmed by condition 2 (decay of water). Keep in mind that the utilization of sulphuric corrosive is fundamental for electrolysis. The unadulterated water disintegrates in all respects gradually or does not break down by any means.

$$2\,H2O\,(l) \rightarrow 2\,H2\,(g) + O2\,(g) \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The measure of gas created relies upon the weight and focuses. It additionally relies on the measure of current provided to the electrolysis container. Expecting standard conditions, we determined the measures of oxygen and hydrogen delivered in one hour on disintegration of water by a battery when no other part was associated with the battery. Electric charge in 12V battery = 7.5Ah. We realize that. A thermistor was utilized to detect the temperature of the environment. It was important to hold the temperature within proper limits since high temperatures could be deadly as electrolysis includes creation of hydrogen gas. When the deliberate thermistor perusing surpassed the set point esteem, the electrolysis would close down. The set point esteem was set at 40 thermistor perusing. The on-off control was again accomplished with the assistance of hand-off (NO) and Arduino Atmega328 microcontroller.

5. AVR microcontroller

AVR Microcontroller is heart of the project. Embedded C language is used to do the programming. The AVR is a modified Harvard architecture 8-bit RISC single chip microcontroller which was developed by Atmel in 1996. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage, as opposed to one-time programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time.

6. LCD display

A liquid crystal display (commonly abbreviated LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power. In this project LCD Display is used for monitoring purpose.

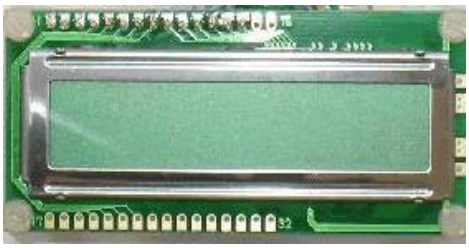


Figure 5: LCD Display

7. Battery

Figure 6: Battery

Battery is a gadget comprising of at least two electrochemical cells that convert compound vitality into electrical vitality. We utilized battery-powered lead corrosive batteries with ostensible voltage of 12V each and charge limit of 1.2Ampere-hours.

8. Relay

Relay is an electrically worked switch. An electrical contact is a segment found in transfers. Regularly Open (NO) contact is a contact that is open or in a non-conductive state when it, or gadget working it, is in non-empowered state. Additionally, Normally Close (NC) contact is in a shut or conductive state in non-invigorated state. A sum of three relays were utilized in the circuit

9. Electrodes

Electrolysis of water is deterioration of water into oxygen and hydrogen gas because of an electric ebb and flow being gone through water. This procedure was utilized to get hydrogen fuel and breathable oxygen. We used a container with two Copper Electrodes for our model.

IV. DESIGN AND DEVELOPMENT

The hardware arrangement of the model along with its working will be discussed under this section.

A. Hardware Design And Working

- The sunlight based boards were set on parts of sun oriented tree. We utilized four branches each conveying one solar module. The game plan of branches was to such an extent that sun powered boards could trap maximum solar vitality as daylight.

- The sun oriented vitality was changed over into electrical vitality by PV modules. This vitality was utilized to charge there chargeable batteries. We utilized a battery associated in arrangement to give us an all out voltage of 12V. The diodes were associated
- in circuit so that they prevented the invert stream of energy, i.e., stream of electricity from battery to solar panels.

- The recognizable proof of gases created by decomposition was done by gathering these gases in two distinctive test tubes and lighting each with a matchstick. One test tube made a pop solid. It was affirmed that this test tube contained hydrogen gas since hydrogen gas is highly combustible. The other test tube contained oxygen. Oxygen combustion but did not produce a pop sound.

V. RESULTS AND DISCUSSIONS

A. Power Output of Solar Panels

It was seen that the solar panels retain enough energy to charge the battery. total power of solar panel was determined to be 2.4 watts. The clarification is given beneath.

- Voltage and current yield of single solar panel =3V/150mA.
- Voltage and current yield of four solar panel associated in arrangement = 12V/100mA.
- All out voltage and current yield by paralleling two arrangement mixes = 12V/200mA. Power (W) = Current (A) × Voltage (V)
- Total energy output of solar modules (one hour) = 0.2Ah.

B. Charge Capacity of Solar Panels and Batteries

- The total energy supply of solar modules and batteries was calculated in terms of electric charge (Ampere-hour).
- Battery rating of single battery = 12V/1.2Ah.
- Total energy output of solar modules (one hour) = 0.2Ah.

C. Rate of electrolysis.

The rate of electrolysis was seen to be same for the duration of the day whether it was day or night, bright or cloudy. The rate does not rely upon level of charge except if the battery is completely released.

In our model, the electrolysis would stop just at full release of battery or if the battery voltage fell beneath 10V or surpassed 14V, which was doubtful under typical conditions.

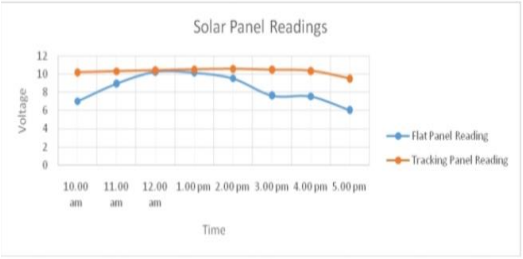


Figure 7. Graph of solar panel voltage with different time slots.

D. Measure of Hydrogen and Oxygen Produced

Amid electrolysis, it was noticed that the creation of hydrogen gas was more than that of oxygen. This was affirmed by condition 2 (disintegration of water). Keep in mind that the utilization of sulphuric corrosive is fundamental for electrolysis. The unadulterated water disintegrates in all respects gradually or does not deteriorate by any means as shown in equation 1.

The measure of gas created relies upon the weight and focuses. It additionally relies on the measure of current provided to the electrolysis container. Accepting standard conditions, we determined the measures of oxygen and hydrogen created in one hour on disintegration of water by a battery when no other segment was associated with the battery. Electric charge in 12V battery = 7.5Ah. We realize that,

Charge (C) = Current (A) × Time (s)… … . (3)

In this way, from condition 3, plainly in the event that we run 7.5A flow for 60 minutes, we get 27,000C of electrical charge.
Presently, a mole of electrons has a charge of 96,500C, so implies 27,000/96,500 = 0.28 moles of electrons will stream. Presently, two electrons need to stream for each water atom to be isolated so 0.28 moles of electrons split 0.14 moles of hydrogen and 0.07 moles of oxygen. Be that as it may, 1 mol gas = 22.4L of gas. Subsequently, 12V x 7.5A = 90 - watt hour of power can part 2.7 gram of water into 3.36L of hydrogen and 1.18L of oxygen. Note that the Above figuring's were done under perfect conditions in which the anodes draw all the current from battery at 12V. Assume, anodes (electrolysis process) draw 1A of current from the batteries; it would imply that the batteries have the ability to keep running for term of 7.5 hours.

Table (1) speaks to measure of hydrogen and oxygen gas delivered for various dimensions of battery charge. The amounts of hydrogen and oxygen delivered were determined in Litres. The measure of water deteriorated was determined

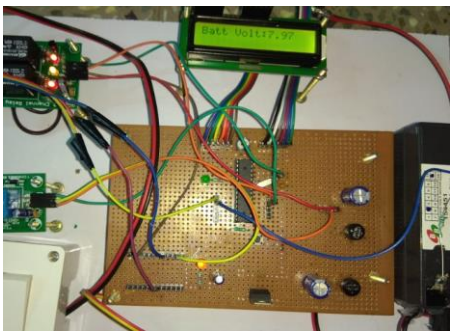
in grams. The Battery Charge section demonstrates the level of battery charge when the electrolysis begun.

Battery Charge(%)	Water Decomposed (g)	Hydrogen gas(L)	Oxygen gas(L)
100	2.7	3.36	1.68
75	1.9	2.46	1.23
50	1.3	1.68	0.84
25	0.63	0.78	0.39
0	0	0	0

Table 1. Amount of oxygen and hydrogen gas produced on decomposition of water by 7.5 Ah battery.

E. Gadget Charging

F. LCD Display



LCD screen successfully displayed battery voltage. It can be extended to utilize for advertisements, can be used to display time, temperature etc.

VI. CONCLUSION

Our designed and implemented “artificial tree" produces oxygen, but without the need for planting, soiling or watering. Such a design is can be implemented usefully in cities, where there are insufficient trees and the concentration of carbon dioxide gas in air is alarmingly high while levels of oxygen gas are low. In addition, our model also fulfils street lighting requirements of cities.

The solar panels can successfully produce sufficient amount of electricity which is stored in the battery and used to light up LEDs, powering up gadgets, to run dc motor and carry out electrolysis. The model is environment-friendly, saves money, is cheap to use and can be installed anywhere. Although the initial installation will require planning and resources, we believe the long-term benefits would be totally worth it.

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REFERENCES

[1] Sujit Patil, RavindraNangare, Rajesh Mane, Suraj Jadhav, Nilesh Patil, DhananjayGavali, “oxygen, hydrogen and light generation using solar tree”, International Journal of Industrial Electronics and Electrical Engineering, ISSN: 2347-6982 Volume-5, Issue-3, Mar.-2017.

[2] Jeng-Nan Juang and R. Radharamanan, “Design of a Solar Tracking System forRenewable Energy”, Proceedings of 2014 Zone 1 Conference of the American Society for Engineering Education (ASEE Zone 1),2014.

[3] KalhanKampasi, Suhas D. Shete, “pic-controlled oxygen and light generation using renewable resources” International Journal of Technical Research and Applications, e-ISSN: 2320-8163, Volume 3, Issue 5, PP. 198-203, (September-October, 2015).

[4] K Vinod Kumar and Carib.j.SciTech, “Analyzing The Results Of Renewable Energy Source Of Solar Botonic Trees Using Nano Piezo Electric Elements” Caribbean Journal of Science and Technology, Vol.2, 424-430, 2014.