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Artificial Solar Oxygen Tree

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Abstract: This paper introduces a new solar technology that emulates how trees convert sunlight into energy. An Artificial Oxygen Tree which aims at serving the humanity toward the planet, having an ability to perform electrolysis of the sewage 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 model will be placed on the sewage tanks and at the base, Electrolysis will be carried out. It's a process in which electrical power source is connected to the 2 electrodes which are placed in the water, and a current is passed resulting in to appearance of Hydrogen at the cathode and Oxygen at the anode. The Hydrogen will be stored in a tank and can be used as a fuel and oxygen to be let out in the air for breathing. 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. This electricity is stored and is used to light the LED's on the tree, hence making it as a streetlight.

The actual model can be used to charge the gadgets like mobile phones and laptops. Advertisements will be displayed on the LCD screen. This will attract the sponsors.

Keywords: Solar Tree, Solar Panels, Electrolysis, Street Light, LDR, Temperature Sensor, Gadget Charger.

I. INTRODUCTION

Trees naturally possess an ability to convert the carbon dioxide into oxygen. But today because of Humans Greed, We are cutting trees and forests and in that place, we humans are building white cement forest. Hence we are facing scarcity of pure air. The population is increasing and the number of tresses is decreasing still people are obliterating tress after tress, to build and fill their pockets. CO_2 is hazardous for humans but Trees convert CO_2 into oxygen which we humans need to survive. Further depreciating of trees will lead to an extreme Global warming problem, Acid Rain, a respiratory disease many more.
Hence science and technology have given birth tour savior, An Artificial Oxygen Tree.

II. LITERATURE REVIEW

Many research laboratories around the world are working towards the same objective to implement innovative and environment friendly industrial design solutions. K. S. Lackner's work includes the demonstrating and improving passive methods to remove carbon dioxide from the atmosphere in the context of addressing climate change[1][2].

This paper presents Solar Tree implementation as an alternate source of energy in urban cities. A new idea of a solar tree design us in the nano wire solar cell is presented. Nano wires possess high physical light absorption properties which can be improved tremendously Hence we can say that it is a revolutionary urban lighting concept and these technologies lead to the development of high efficiency. [3]

III. ELECTROLYSIS

An electrical power source is connected to two electrodes, which are placed in the water. Hydrogen will appear at the cathode (the negatively charged electrode, where electrons enter the water), and oxygen will appear at the anode (the positively charged electrode). Assuming ideal faradic efficiency, the amount of hydrogen generated is twice the number of moles of oxygen, and both are proportional to the total electrical charge conducted by the solution and less than ideal faradic efficiency.

Electrolysis of pure water requires excess energy in the form of over potential to overcome various activation barriers. The efficiency of electrolysis is increased through the addition of sulphuric acid.

IV. PROPOSED BLOCK DIAGRAM

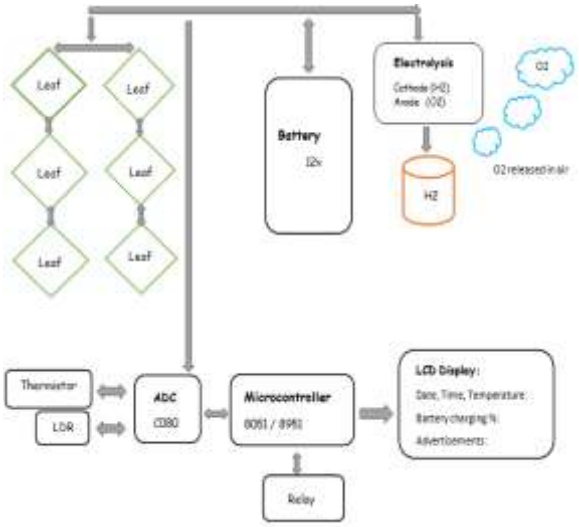

Fig.1Block Diagram

V. FUNCTIONAL UNITS

The proposed circuit diagram is shown below:

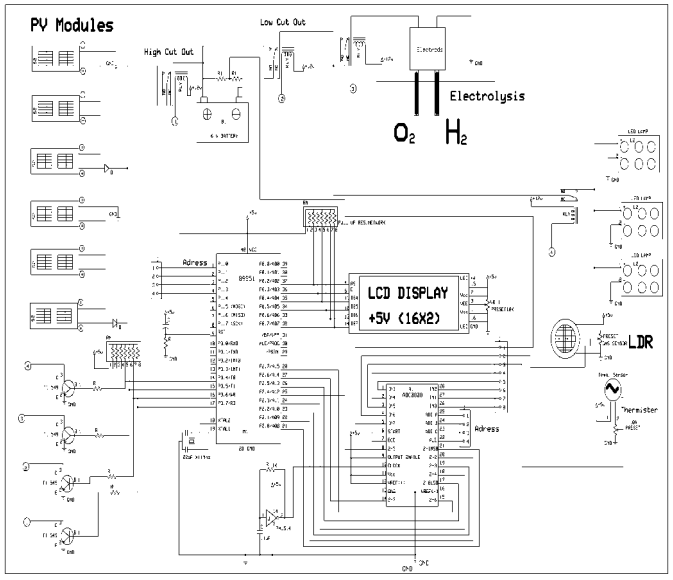

Fig 2. Circuit Diagram

A. Photovoltaic Modules

Photovoltaic (PV) modules collect energy from the sun and convert it directly into electricity. A PV cell is made of a semiconductor material, usually crystalline silicon, which absorbs sunlight. This energy directly gets converted into electrical energy, which is why they are efficient and convenient to use. Most PV modules contain a top protective layer, two specially treated layers of silicon and a polymer backing layer. In our model, we used six solar modules each made of polycrystalline cells.

B. Light Dependent Resistor
Light Dependent Resistor (LDR) is a component that is sensitive to light. An LDR or photo resistor is made up of semiconductor with high resistance. Cadmium Sulfide is popularly used. In our model, we used single 5mm size ceramic LDR.

C. Thermistor
The thermistor is a resistor whose resistance is dependent on temperature. There are two types; those with a resistance with an increase in temperature (positive thermal coefficient) and those with a resistance with a decrease in temperature (negative thermal coefficient). We used single 5mm size, a negative thermal coefficient thermistor in our model.

D. Light Emitting Diode
It is a two lead semiconductor light source. It is a p-n junction diode which emits light when it gets activated. With high power LED lights, it is possible to save a high percentage of energy. They have low maintenance costs. We used three strips of LED lights (blue color) in our model.

E. Electrodes
Electrolysis of water is decomposition of water into oxygen and hydrogen gas due to an electric current being passed through water. This technique was used to obtain hydrogen fuel and breathable oxygen. We used a jar container with two graphite (carbon) electrodes for our model.

F. Liquid Crystal Display
It is a flat panel display that uses light modulating properties of liquid crystals. LCDs are energy efficient and have a wide range of applications. We used a 16x2 LCD display screen with a voltage requirement of 5V.

G. Battery
The battery is a device consisting of two or more electrochemical cells that convert chemical energy into electrical energy. We used two rechargeable lead acid batteries with a nominal voltage of 6V each and charge capacity of 4 Ampere-hours each.

H. Relay
A relay is an electrically operated switch. An electrical contact is a component found in relays. Normally Open (NO) contact is a contact that is open or in a non-conductive state when it, or device operating it, is in a non-energized state. Similarly, Normally Close (NC) contact is in a closed or conductive state in the non-energized state. A total of four relays were used in the circuit.
I. ATMEL 8951

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In-System Programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible. The Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

Working:
We used 6 solar cells each of 4V, 12mA. We connect them with 3-3 pairs in series and then parallel. So total voltage will be 12V, 200mA. The collected solar energy will be used to power the electrolysis. In electrolysis, more bubbles at electrode mean more hydrogen at the cathode. Process in which waste water or pure water is used. It uses photons from sunlight to split water molecules into oxygen and hydrogen. In electrolysis process we have used Electrodes viz. cathode and anode .we get H_2 at cathode and Oxygen at the anode.

$$2H_2O\ (l) \rightarrow 2\ H_2\ (g) + O_2\ (g)\ (2) \quad .$$

The rate of electrolysis was observed to be same throughout the day whether it was day or night, sunny or overcast. The rate does not depend on the percentage of charge unless the battery is fully discharged. Microcontroller 89S51 is used for controlling the entire circuit. A sensor is used to measure the amount of light in the atmosphere and triggers the solar lamps to switch ON automatically at sunset and OFF at sunrise. At dusk, the solar tree automatically switches on its LED. Display advertisements or display weather conditions, and provide street lighting. LDR is used to sense the light intensity. As soon as light intensity decreases the LED's will be turned on. The thermistor is used to control the hydrolysis process, as the temperature increases during daytime there is a chance of hydrogen bursting. Thermistor will signal the 8951 to cutoff the supply to the electrolysis tank. If temperature crosses 35^{o}C then electrolysis stops because hydrogen can blast due to high temperature. If the battery goes below 10V then electrolysis stops. 12V is normal operating voltage.

RELAYS are used for this purpose. A relay is an electrically operated switch. Relay we are used of 12V SPDT: 1st relay for solar panels, 2nd relay for battery, 3rd relay for the temperature sensor, 4th relay for street light.

VI. RESULTS & DISCUSSION

A. Power Output of Solar Panels

It was observed that the solar panels absorb enough energy to charge the batteries. The total power output of solar modules was calculated to be 2.4 watts. The explanation is given below.

Voltage and current output of single solar panel =4V/100mA.

Voltage and current output of three solar panels connected in series = 12V/100mA.

Total voltage and current output by paralleling two series combinations = 12V/200mA.

Power (W) = Current (A) × Voltage (V) from equation 1, we get a total power output of solar modules as 2.4 watts.

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 = 6V/4Ah.

The total output of two batteries connected in series = 12V/8Ah.

The total energy output of solar modules (one hour) = 0.2Ah.

From above calculations, it was concluded that it would take solar modules forty hours at full working (maximum output) to fully charge a dead battery. But in reality, the lead-acid battery does not charge linearly with time and hence it would take more than 40 hours. Under normal circumstances, the batteries were charged enough during daytime to carry on function throughout the night.

C. Rate of Electrolysis

The rate of electrolysis was observed to be same throughout the day whether it was day or night, sunny or overcast. The rate does not depend on the percentage of charge unless the battery is fully discharged. In our model, the electrolysis would stop only at the full discharge of the battery or if the battery voltage fell below 10V or exceeded 14V, which was improbable under normal circumstances.

D. Amount of Hydrogen and Oxygen Produced

In our model, we are used 50ml test tube to collect the hydrogen and oxygen. We calculated that to fill whole test tube of 50ml, the time required is of 3min.

E. LED lights

The LED lights functioned properly and lit up automatically as soon as the light intensity reading dropped below 100lux. The lights turned off immediately as the light intensity exceeded 100lux. LED lights in ON state.

F. LCD Display

The LCD screen successfully displayed advertisements, battery voltage, timer, light intensity and temperature reading of thermistor.

Compared to the natural tree, artificial trees are easier to maintain. They further require no regular pruning and can be moved around easily according to the requirements. The trees ‘grow’ well in all climate and does not require water, sun, fertilizer, etc. It can replace the conventional tree in city areas.Like a natural tree, it can produce the oxygen for freshening environment It creates the Hydrogen Gas for fuel.It can also avoid water pollution by waste water electrolysis. It work as street light by advertisement display it will make income.It does not create any type pollution.Its create electricity from sun light.

Table I
Voltage and Current Rating of Solar Modules

Parameter	1 panel	3 panel	By paralleling 2 two series
Voltage Current	4V 100ma	12V 100ma	12V 200ma`

Table II
Battery Rating

Parameter	Single Battery	2 Battery in Series
Voltage Electric charge	6V 4Ah	12V 8Ah

Table III
Amount of H2 and O2

Time	Hydrogen	Oxygen
3min	50ml	25ml

VII. 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. As discussed in Results, our implemented design is capable of producing 25ml of oxygen and 50ml of hydrogen. The solar panels can successfully produce 2.4 W of electricity which is stored in the battery and used to light up LEDs 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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