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Solar and Antenna Powered Stand-Alone Structs

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ABSTRACT

This work aims in bringing out a new structure which could stand eliminated from the grid and can serve the public in different ways. These structures can be defined as the power producers. It is the combination of solar panels, which converts solar radiation to electricity and antennas, which attracts signals from atmosphere converting them into energy. The combination of both the mechanisms makes solar structs more reliable and efficient all round the clock. These structures are sure to be the kick-starter for tomorrow's smart cities. The solar panels and the antenna produce electricity without the help of grid and this power is stored in batteries. Then, they are utilised by various technologies and facilities present within the structure to provide a sophisticated surrounding.

Keywords: signals, solar panels, antenna, technology.

1. INTRODUCTION

In this world of increasing population and increasing technological developments, there is always a demand for energy. The non- renewable energies like coal, oil and gas are moving to the verge of extinct so there is an urgent need to rely on renewable energy sources like water, solar, wind, etc., Generation of energy by these renewable energy sources shows inclination. But the only renewable energy that is preferred to make life easier is solar. No other renewable source can be cost effective, easy to construct and more reliable other than solar. The conversion of sunlight to electricity [1] paved the way for eliminating many appliances and devices from the grid. Increasing the use of solar energy and relying more on it will help us eliminate the increasing demand for energy and also eliminates the risks of energy production from non-renewable sources. Solar energy having the advantage of being stored [2] has entered in many appliances and devices, made them smart and useful. Some of them are solar pumps, solar heaters, etc., and at the same time there is another one standalone system other than renewable energy source called the energy harvester. Energy harvester is meant for extracting signals from the atmosphere and converting it into some useful forms [3]. So the combination of the above mentioned smart solar palm and the energy harvester resembles the smart structs.

Apart from necessary needs, smart phones, tablets, Wi-Fi are in great need today. However this smart struct will meet all these needs and is also energy efficient.

2. LITERATURE REVIEW

Solar panels convert the sunlight into direct current. This principle created a revolution in energy saving mechanism. A typical solar panel produces 200 watts of electricity but they may vary according to the sun's intensity. The solar panels can be designed according to the needs and necessity. These solar panels can be implemented in various devices for making them energy efficient and stand alone devices.

Solar panels can be used flexibly and this laid the road in development of many solar products. Smart palms are those which work completely on solar energy. Palm was chosen to stand as symbol of sustainability. The structure projects itself at a height of 20 feet with each leaves extending up to 18 square meters. It is made up of concrete and fibre reinforced plastic thus making it withstanding even to extreme climatic conditions. The present structure consist a set of 15 solar panels on the leaves. It can generate energy of 7.2 kwh per day.

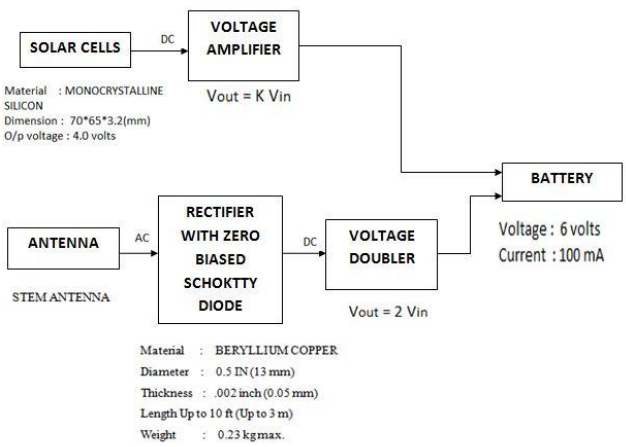
Table I: Evolution of smart structs

S.NO	TITLE	SOURCE	CONSTRAINTS
1	RF energy harvesting system and circuits for charging of mobile devices	IEEE transaction on consumer electronics	Battery backup
2	Resistor emulation approach to low power RF energy harvesting	IEEE transaction on power electronics	Designed with separate transmitter and receiver
3	Energy harvesting from RF/microwave signal	IEEE transaction on RF/microwave signal	Voltage obtainedis only 0.2v
4	RF energy harvesting with multiple antenna in the same space	IEEE transactions on antennas and propagation 2005	Multiple antenna with battery backup
5.	43% of sunlight to electricity conversion efficiency using cpv	IEEE journal of photovoltaic	Effects due to climatic conditions
6.	Assessment of solar radiation resources in Saudi Arabia	Journal of international solar energy society	Inadequate power

3. PROPOSED SMART STRUCTS

The smart structs are a power generating device which uses the combination of Solar Cells and STEM (Storable Tubular Extendable Member) antenna for power generation. The structs consists of solar cells, STEM antenna, rectifier with Schoktty diode [4], voltage doubler and a battery. The solar cells capture the solar radiation, convert them into DC electrical energy and store them in the battery. Stem antenna is used for capturing the signal, rectifier converts the received AC signal to DC signal and voltage doubler doubles the voltage. This energy is again sent to the battery. Figure I is the block diagram describing the process involved in smart structs.

Figure I: block diagram of smart structs



The solar cells used here, is the photovoltaic cells which captures the sun's radiation in an array of semi-conductors. The solar energy produced is dependent on the earth's orientation, rotation and also varies continuously with time and weather conditions. The amount of energy produced by the solar cells depends on the intensity of the sun's radiation. The energy captured is stored in a battery. On the other hand, stem antenna captures the signals present in the atmosphere and convert them into energy. 70 to 75 stem antennas are connected in combination of series and parallel [5]. There is an increase in voltage in case of series connection whereas in parallel connection, the current gets increased. Therefore in the combinational connection, both voltage and current gets increased. These stem antennas receives or scavenges the signal from the atmosphere. The signal is electromagnetic in nature which contains both electrical and magnetic properties. Hereby, it is concluded that the signal is in the form of AC i.e., continuous. The signal consists of small amount of magnitude as well as current. The received power is given to the rectifier which is made up of Zero Biased schoktty Diode, since it needs a very small voltage for its operation. The rectifier converts the incoming AC signal in to DC signal. The obtained DC signal contains some ripples thereby filtering circuit is added at the output side of the rectifier. The resultant voltage from the rectifier circuit will be increased with the help of the voltage doubler. Increasing the stages of the voltage doubler with the help of the charge pump, will raise the output value of the received power. The resultant power can be increased if the signal strength absorbed by the antenna is very high. If the signal strength is low then consequent power is obtained. So the final output is directly proportional to the signal strength [6].

The DC power obtained can then be utilised for various purposes. Since these structs are designed to be public servants, they contain many beneficiary elements for the society within them. The structs contain Wi-Fi facility which provides accessibility over a certain meters around its area. They also provide information about weather, local news, advertisements, etc, in the built-in touch screen. LEDs are present along with LDRs in these structs which can provide light at dark. The structs also has space for charging slots and above all it can power security cameras which offer safety to the society. The proposed structs also provides seating facility and the height of the

structure provides an added advantage to act as a shade from the sun.

4. CONSTRUCTIONAL DETAILS

The solar cells are joined to form solar panels which are mounted on the top of the structs. When the sun's radiation fall perpendicular to the panel, there is maximum

amount of energy produced. The nominal output voltage from a solar panel is about 12 to 15 volts [7].

Figure II: Solar panels

The STEM antenna is made up of beryllium with diameter 13 mm and thickness 0.05 mm. The antenna weighs 0.23 kg and the operating voltage is about 0.1 volts. The rectifier consists of Zero biased Schottky diode which has low forward voltage drop of 0.1 to 0.45 volts and fast switching action. The structs can be operated both day and night times, as well as in any climatic conditions because of the facility to generate

power at any time and store it accordingly.

Figure III: STEM Antennas

5. SIMULATION RESULTS

The STEM antennas produced the following outputs to prove the production of energy from signals.

5.1 Signal at 88 MHz

Signal is the electric current or the electromagnetic field used to convey data from one place to another. By the method of energy harvesting, these signals can be converted into useful form. The magnitude of an 88 MHz signal is shown in figure IV.

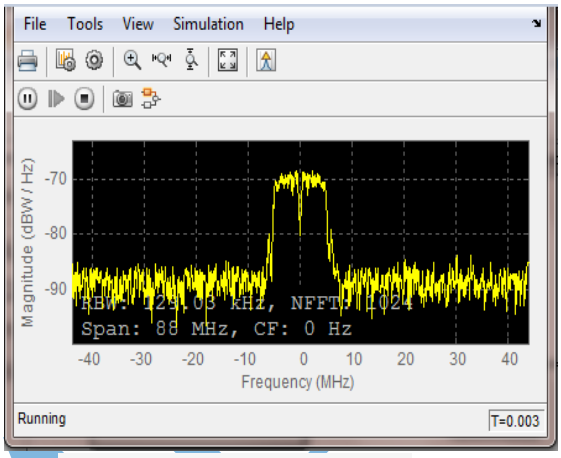


Figure IV: Simulation of a signal

5.2 AC Signal from Antenna

The radio waves from the atmosphere are attracted by the antenna by suitably tuning it. The output of the STEM antenna on receiving signal is shown in the figure V.

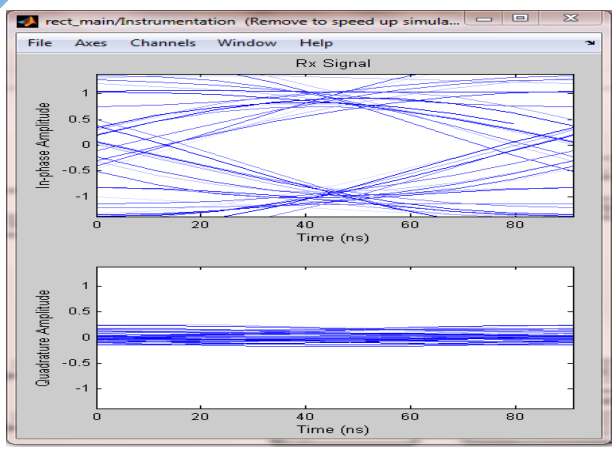


Figure V: Simulation of antenna output

5.3 Rectifier output

The rectifier converts the alternating parameter to a direct parameter. The output from the antenna is always alternating. In order to store it in the battery, it must be converted into DC by

the rectifier. The output of the rectifier is shown in figure VI.

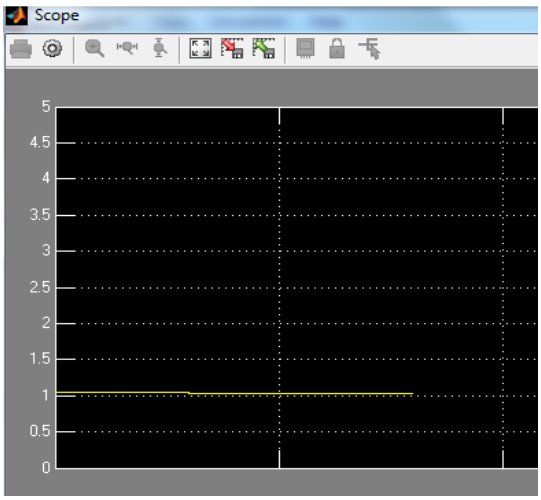


Figure VI: simulation of rectifier output

The combination of solar panels and the STEM antenna can produce an output voltage of 5 volts and an output current of 100 mA. This will generate a power of 0.5 watts which is sufficient to operate many electronic appliances by increasing or decreasing the magnitudes.

6. FUTURE SCOPE

- Using these enhanced structures in bus stops for the welfare of people in that locality. A smart, low cost and a equipped bus stop is always a YES
- This structures will also be a kick start for smart city developments
- Increasing the reliability of the structure by including variations especially in the material of construction to make it stronger.

7. CONCLUSION

Thus the joy of having a sophisticated surrounding comes into reality by these structures. These structures are sure to bring a revolution in smart cities. These days, appliances that stand alone from grid are most welcome because of the huge demand for power and complications in power generation. The paper also lifts the usability and versatility of non-renewable resources. It also furnishes the truth that the power production from non-renewable sources are not constrained only to some resources but extended to a wide range, the evident of which is the power production from antenna.

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