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Design & Development of Solar Educational Training Kit

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Abstract: **Ability of utilize free resources of energy to generate electricity is one of the major tasks for environmentally research engineers. Numerous researches have been conducted to convert sunlight to direct current through Photovoltaic (PV) system. Nowadays PV research has become a popular study and has gained attention of many engineers and researchers due to free application, improving efficiency and high reliable energy source availability and is predicted to grow in years to come. With understanding the importance. This paper proposes a model of a real time grid assisted from low power direct current to high power alternating current as a solar educational training kit for an early education process to understand about the sustainability of energy conversion process. Integrating the switching concept, grid connection will only be switched on if the stored energy in the battery is insufficient to energize or supply the training kit. In the nutshell, a simple and user friendly measurement training kit is intentionally designed for user's handwork purposes.**

Keywords: Solar educational kit, energy conversion, IV-characteristics, circuit implementation.

1.INTRODUCTION

The aim of this project is to implement an educational solar training kit to provide a practical platform for the students to experiment and hone their practical skills. As the demand of the electricity is growing dramatically, resources used to supply the electricity are not sufficient to satisfy the needs, the finite resources such as fuels, oils, coals, gases, are reducing critically and thus, the supplies of electricity is getting limited and the world is working hard to keep green. As a result, the ability of utilize free resources of energy to generate electricity is one of the major tasks for going green and so are to replacing the existing finite resources. The application of this is free, unlimited, efficient and reliable energy source . solar educational training kit for an early education exposure to understand about the sustainability of solar energy process. The module exposed the student about the principle of measuring voltage and current practically.

2.METHODOLOGY

2.1. Circuit Diagram

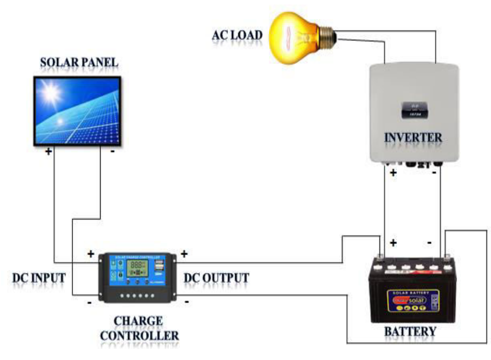

Fig.1: Solar conversion

2.2. Circuit Implementation

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Fig.2: Circuit implementation

2.3. Working Principle

The sunlight fall on solar panel it convert the sunlight rays into electricity energy. Then the electrical power will flow to the charge controller to regulate the electricity energy generation before storing the electrical into battery as source. The charge controller function is to regulate & avoid the overcharging when the battery is fully charged.then the battery stores the energy which will be used during the moment when the solar panel is not producing any electricity, then inverter can be directly connected to load connection .

The inverters invert 12v DC (direct current) from battery storage to 240v AC (alternating current). Thus the inverted electrical energy can be used as power the educational training kit.

3. IV-CHARACTERISTICS

Important parameters:

There are two curves of PV modules, that is IV curves & pv curve. In this graph red colour is IV curve & blue colour is PV curve.To check the solar panel efficiency the following parameters must be introduced

- **Voc:** This is the open circuit voltage which is the voltage provided by the solar panel when it is not connected to any load (open circuit condition). This value depends on the number of PV panels connected in series.
- **Isc:** This is the maximum current produced when the output ends are shorted together (short circuit condition).
- **Imp:** This is the maximum current provided by the panel under operating conditions (when a load is connected).
- **Vmp:** The maximum voltage under operating conditions.
- **Maximum power point (MPP):** This is the point where the power supplied to the connected load is at maximum (MPP = Imp*Vmp)
- **Percent efficiency:** The ratio between the maximum power the panel generates and the amount of solar irradiance incident on it.

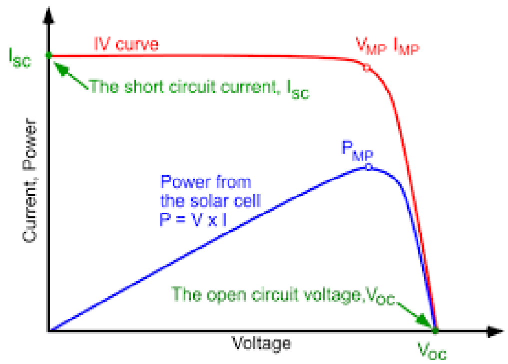

Fig.3: Graph on IV-Characteristics

3.1. Circuit Diagram

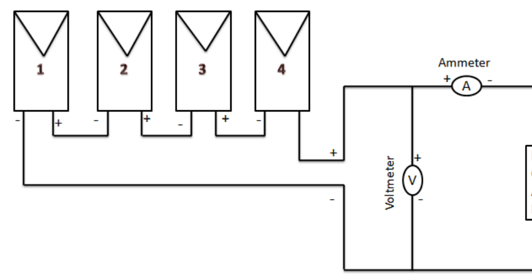

Fig.4: Circuit for series connection

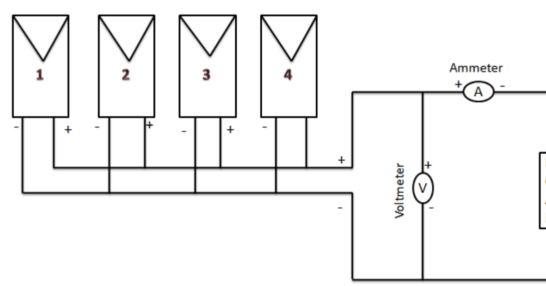

Fig.5: Circuit for parallel connection

3.2. Experimental Setup

Form a PV system with modules in either series or parallel and a variable rheostat with ammeter and voltmeter for measurement. Modules in series or parallel are connected to variable load. The effect of load change on output voltage and current of the modules connected in series or parallel can be seen by varying load resistance (rheostat).

PV module is characterized by its I-V and P-V characteristics at particular solar irradiation and temperature. I-V characteristics maximum current at zero voltage is the short circuit current (Isc) which can be measured by shorting of PV module and maximum voltage at zero current is the open circuit voltage (Voc). On changing the solar isolation Isc of the module increases while the Voc increase very slightly.

3.3. Experimentation Results

The readings obtained are tabulated as shown in Table 1 and 2 respectively and the corresponding graphs are drawn.

Table 8.1. voltage, current & power measurements of series

VOLTAGE	CURRENT	POWER
0.00	0.31	0.00
8.8	0.31	2.72
11.2	0.31	3.47
17.6	0.31	5.45
25.4	0.31	7.87
30.2	0.31	9.62
38.3	0.31	11.87
58.6	0.30	17.58
65.3	0.29	18.9
69.6	0.27	18.7
71.3	0.24	17.1
72.3	0.23	16.6
75.0	0.17	12.75
75.5	0.15	11.3
76.1	0.14	10.6
77.3	0.10	7.33
78.0	0.07	5.46
78.7	0	0

Table 8.2. voltage, current & power measurements of parallel

VOLTAGE	CURRENT	POWER
0.00	1.06	0.00
4.7	1.06	4.98
6.4	1.06	6.78
8.2	1.06	8.69
11.9	1.06	12.6
14.8	1.01	14.9
15.4	0.96	14.7
16.2	0.89	14.4
17.6	0.60	10.56
18.0	0.46	8.28
18.4	0.34	6.25
18.7	0.25	4.67
19	0.14	2.66
19.1	0.08	1.52
19.2	0.02	0.38
19.2	0	0

The I-V and P-V curves for series and parallel connection as shown in fig.6 & 7 respectively.

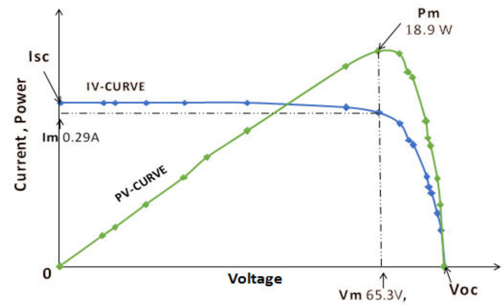

Fig.6: Graph on series

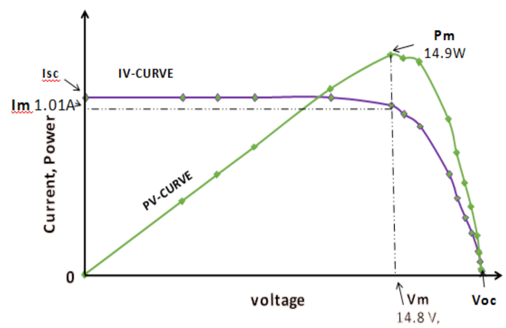

Fig.7: Graph on parallel

Inference: It is observed from the above fig.6& 7 that the net current of the system when the modules are connected in parallel is increased, and the net voltage of the system is increased when the modules are connected in series.

3.4. Circuit Implementation

Fig.7. Circuit implementation

4. CONCLUSION

A PV-based solar trainer that is simple and affordable has been developed in this work. The performance of the developed trainer has been shown by conducting two different experiments the results of the experiments have shown that the trainer can be effectively used to study the electrical characteristics of the solar panel, hence, educate students on PV based solar technology. The total cost of producing this trainer is a pointer to its affordability.By using the solar panel, the education about solar generation can be inserted in the syllabus of science subject. The solar educational kit act as an intermediate and an alternative method in introducing green technology to the user in a more practical method.

5. RESULT

Thus a small power consumption system can be used as a platform in introducing the basic idea of pv plant before high power pv plant construction. In the industrial sector it provides platform to the employs to interact with the high power transformation of pv plant.

6. FUTURE SCOPE

Over the past decade, the cost of solar has fallen dramatically. New technologies promise to increase efficiency & low cost further. Solar energy will soon be unbeatable compared to fossil fuels. In the coming years, technology improvements will ensure that become even cheaper. It could well be that by 2030, solar will have become the most important source of energy for electricity.

7. REFERENCES

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