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Advanced Utility Box

Basid Sheikh, Sana Shaikh, Virendra Kuril, Sandeep Shengokar, Ruchita Chaudhari, Alviya Mahevash, Noorunnisa Hussain, Prof. Sayyad Naimuddin

Electrical Engineering Department, RTMN University, Maharshtra, Nagpur, India

ABSTRACT

In the recent years, we have many problem such as energy crises and environment degradation due to the increasing CO2 emission and ozone layer depletion has become the primarily concern to both developed and developing countries. Our project utilizes the solar energy for its operation. Solar refrigeration using thermoelectric module is going to be one of the most cost effective, clean and environment friendly system. This project does not need any kind of refrigerant and mechanical device like compressor, prime mover, etc for its operation. The main purpose of this project is to provide refrigeration to the remote areas where power supply is not possible. Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A photovoltaic (PV) module is a packaged, connect assembly of typically 6×10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 watts

Keywords : STC, PV. TEM

I. INTRODUCTION

From last century till now refrigeration has been one of the most important factors of our daily life. The current tendency of the world is to look at renewable energy resources as a source of energy. This is done for the following two reasons; firstly, the lower quality of life due to air pollution; and, secondly, due to the pressure of the ever increasing world population puts on our natural energy resources. From these two facts comes the realization that the natural energy resources available will not last indefinitely.

In 1821, the first important discovery relating to thermoelectricity occurred by German scientist Thomas Seebeck who found that an electric current would flow continuously in a closed circuit made up of two dissimilar metals, provided that the junctions of the metals were maintained at two different temperatures. Without actually comprehending the scientific basis for the discovery, Seebeck, falsely assumed that flowing heat produced the same effect as flowing electric current.

Later, in 1834, while investigating the Seebeck Effect, a French watchmaker and part-time physicist, Jean Peltier found that there was an opposite phenomenon where by thermal energy could be absorbed at one dissimilar metal junction and discharged at the other junction when an electric current flows within the closed circuit. Afterwards, William Thomson described a relationship between Seebeck and Peltier Effect without any practical application. After studying some of the earlier thermoelectric work, Russian scientists in 1930s, inspired the development of practical thermoelectric modules based on modern semiconductor technology by replacing dissimilar metals with doped semiconductor material used in early experiments.

The Seebeck, Peltier and Thomson effects, together with several other phenomena, form the basis of functional thermoelectric modules. Thermoelectric

Refrigeration aims at providing cooling effect by using thermoelectric effects rather than the more prevalent conventional methods like those using the 'vapour compression cycle' or the 'gas compression cycle'.

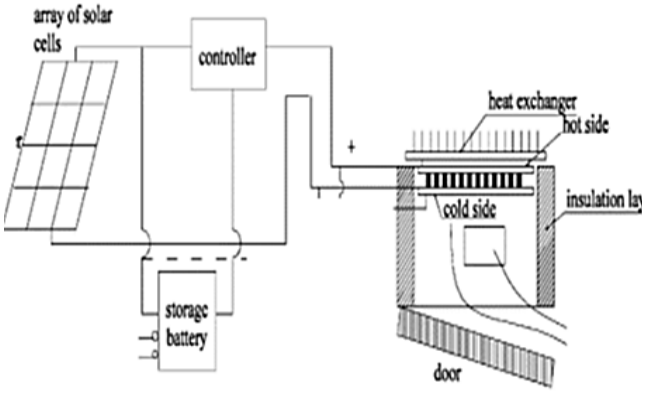
II. METHODS AND MATERIAL

A. Aims and Objectives

Here a solar panel has been used which will give the output to the battery but sometimes there might be an increase in the intensity of the sunlight so there is a possibility of having damage to the battery.

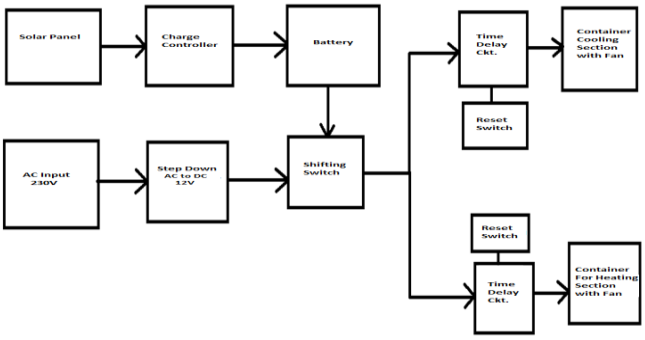
So here controller circuit will be used to provide constant voltage to the battery even when the intensity of the sunlight is high because when the intensity is high the solar panel will give double the voltage than it is required by the battery.

B. Proposed Setup



C. Working

First of all two compartments are made of the conducting material and coated with proper insulators. These are fixed as an assembly in a box made up of a proper material for ventilation and support (e.g. quark). Two thermoelectric modules are attached to the whole setup. Operating load can be taken from charge controller or through direct battery. A photo voltaic module attached with a charge controller is place in the sun at a proper position to get the most area of it in the sunlight. Thermoelectric semiconductor material used is Bismuth telluride. This charge controller is then attached to the battery. Now the whole setup is powered by the solar energy and working is obtained.



D. Methodology

The solar panel will supply the voltage through the controller circuit. The controller circuit will stabilize the voltage input flow from the solar panel to the battery. The battery will be saved from the damage.

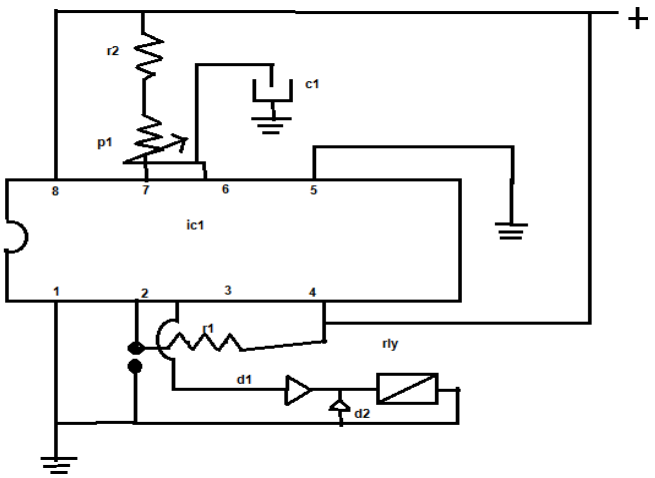
The charge controller circuit will also protect the solar panel in the night time when there will not be any sun light the battery will start discharging the reverse voltage will flow towards the solar panel and the solar panel will get damaged. This circuit will protect the battery as well as the solar panel. The shifting mechanism is installed in the circuit when the electricity will be used the input 230volt will be step down to the dc 6 volt. The two driver circuits can be run on solar or on the electrical energy it will be used as per requirement. When the user has decided to use the electrical energy to start the time delay circuits the shifting mechanism will be pressed on the electrical side the two time delay circuits will run on electricity. The reset switch is also installed after the time is over the circuits will be off to switch on again the reset switch will be pressed

When there will be no electricity or as per the requirement of the user if decided to run the two time delay circuits on solar then the shifting mechanism will be pressed on the other side in that case the time delay circuits will be run on solar and not on electrical energy. If one sources of energy is on then in that case

the other will be off. These circuits will work without programming.

The time delay circuits comprises of that is relay time clock if the timer is set between 1 sec to 1min or say if the timer is adjusted for 10 sec then in that case the cooling section will work or heating section circuits will be on for that particular time period set.

After the time is over the time delay circuit will be off and the load will be off. Same for both circuits. Individually both can be on or off as per the time set for each of them.



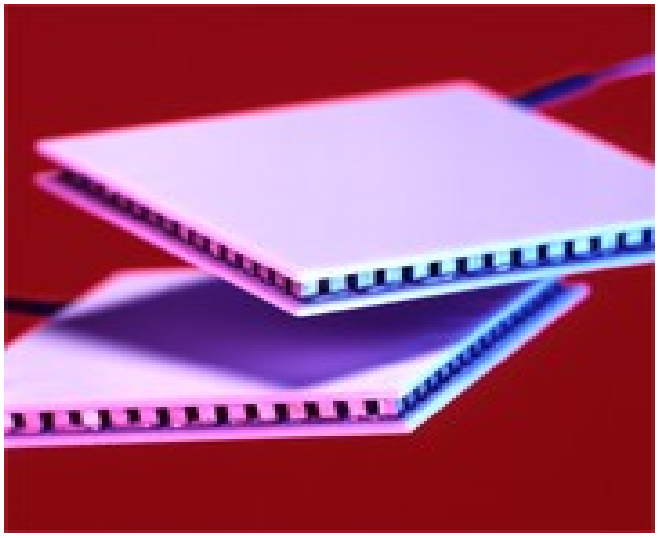
After the time is over the switch needs to be reset so that the voltage supply from the battery to the delay circuit and the to the plates will supplied continuously . The battery of 12 volt dc will be used for the delay circuit and also the power supply from the mains supply will be used. so here the 230 volt ac will converted top 12 dc pure dc and this two supply will supplied alternatively through the toggle switch that will be used for changing the power source from battery to mains.

The 1meg ohm potentiometer will be used to increase or decrease the time delay switching on circuit. It will work from 1sec to 100 sec.

E. Thermoelectric Module

Thermoelectric modules (Peltier modules) are solid-state heat pumps that operate on the Peltier effect. Heat pump [3] is a thermodynamic system, which transfers heat from low temperature body and gives out the same to high temperature body. The function of heat pump is to supply more and more amount of heat to hot body from cold body. In heat pump, heat is pumped from heat sink or a cold body and is supplied to hot body, on consuming external work supplied. A thermoelectric module [6]consists of an array of p- and n-type semiconductor elements that are heavily doped with electrical carriers. The elements are arranged into array that is electrically connected in series but thermally connected in parallel.This array is then affixed to two ceramic substrates, one on each side of the elements. A typical thermoelectric module is composed of two ceramic substrates that serve as a foundation and electrical insulation for P-type and N-type.Bismuth Telluride dice that are connected electrically in series and thermally in parallel between the ceramicsThe ceramics also serve as insulation between the modules internal electrical elements and a heat sink that must be in contact with the hot side as well as an object against the cold side surface. Electrically conductive materials, usually copper pads attached to the ceramics, maintain the electrical connections inside the moduleP-type dice are composed of material having a deficiency of electrons while N-type has an excess of electrons. As current (Amperage) flows up and down through the module it attempts to establish a new equilibrium within materials.enhance the electrical connections and hold the module together.Most modules have and even number of P-type and N type dice and one of each sharing an electrical interconnection is known as, "a couple."The current treats the P-type material as a hot junction needs to be cooled and the N-type as a cold junction needs to be heated. Since the material is actually at the same temperature, the result is that the hot side becomes hotter while the cold side becomes colder.The direction of the current will determine if a particular dice will cool down or heat up.In short, reversing the polarity will switch the hot and cold sides. First of all two compartments are made of the conducting material and coated with proper insulators. These are fixed as an assembly an a box made up of paper material for ventilation and support.Two thermoelectric modules are attached to the whole

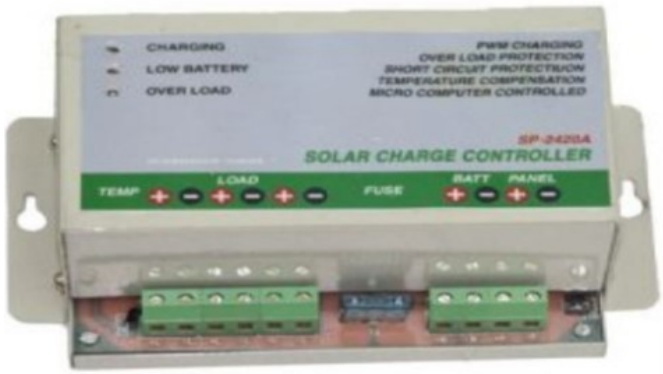
setup.Operating load can be taken from charge controller or through direct battery.



F. Charge Controller

Multi-layer timing for overload protection Globally latest & advanced technology Built with perfect blend of state of art of electronics & micro computing. Temperature compensation for better battery charging on various climate & terrain Slim & Sleek look Electronic blocking to save precious energy saved in battery.

The charge controller is a simple and efficient.precise controller designed to operate with the solar panel.Output drive current-7.5Amps



III. RESULTS AND DISCUSSION

CONSTRUCTION

The construction setup of the refrigerator is as follows, Thermo-electric module, Refrigeration chamber, Battery, Solar cell Frame.

Thermo-electric module

A thermo-electric module (TEM) is a solid state current device, which, if power is applied, move heat from the cold side to the hot side, acting as a heat exchanger. This direction of heat travel will be reversed if the current is reversed. It is a phenomenon that is opposite to the Seebeck effect. Combination of many pairs of p- and n-semiconductors allows creating cooling units - Peltier modules of relatively high power.

A Peltier module consists of semiconductors mounted successively, which form p-n- and n-p-junctions. Each junction has a thermal contact with radiators. When switching on the current of the definite polarity, there forms a temperature difference between the radiators one of them warms up and works as a heatsink, and the other work as a refrigerator.

Specification

Material used- Silicon - Bismuth
A = 0.04 x 0.04 = 0.0016 m2
Q max =33.3 watt
V max = 14.8 v dc
I max =6 amp

Battery

The battery is an electrochemical converting chemical energy into electrical energy. The main purpose of the battery is to provide a supply of current for operating the cranking motor and other electrical units.

Specification
Voltage 12v
Current 7.2Ah

Solar Cell

The direct conversion of solar energy is carried out into electrical energy by conversion of light or other electromagnetic radiation into electricity.

The dimensions of the panel are-
Length – 48.5 cm,
Width – 35 cm.
Number of sub-cells used is 72
Dimension of the sub-cells is,
Length – 4.8 cm
Width – 4 cm.
Maximum power is 20 W
Voltage is 17 V
Current is 1.16 A

IV. CONCLUSION

This circuit is especially working on the dc volt so the voltage consumption will be low as compared to the consuming directly 230 volt ac to the containers.

V. REFERENCES

[1]. www.ijrame.com/vol4issue2/V4i211.pdf
[2]. digitalknowledge.cput.ac.za/.../Solar%20refrigeration%20using%20the%20Peltier%20...
[3]. www.ijrat.org/downloads/jan-2015/paper%20id-31201515.pdf
[4]. https://www.researchgate.net/.../280775058_REVIEW_PAPER_ON_THERMOELEC