

Fabrication of Solar Power Refrigeration System Using Thermoelectric plates

MEKALA RAJU¹, G.MD.JAVEED BASHA M.Tech², H.RANGANNA M.Tech, (Ph. D)³

¹ PG Student, Department of Mechanical Engineering, St.Johns College Of Engineering &Technology,Kurnool(D.T),Andhra Pradesh

² Asst.Professor ,Department of Mechanical Engineering, St.Johns College Of Engineering &Technology,Kurnool(D.T),Andhra Pradesh

³ Associate Professor &HOD, Department of Mechanical Engineering, St.Johns College Of Engineering &Technology,Kurnool(D.T),Andhra Pradesh

Abstract

The project is to fabricate thermo electric refrigerator using solar energy. It is pollution less project, made by using thermoelectric module. It supports for cooling. Hence it proves to be very helpful. Exhaust fan is attached to the system to spread the cooling to the surroundings. Micro controller reads the temperature sensor values which are connected to the thermoelectric plate. The temperature values displayed on the LCD.It has no moving parts and thus maintenance free. It is an pollution less project, made by using thermoelectric module. It supports for both heating and cooling. Hence it proves to be very helpful. The research focused on simulation of a thermoelectric refrigerator maintained at 4oC. The solar thermoelectric avoids any unnecessary electrical hazards and provides a very environment friendly product and also the thermoelectric refrigerator does not produce chlorofluorocarbon (CFC). It is pollutant free-contains no liquids or gases, portable, compact, creates no vibration or noise because of the difference in the mechanics of the system. The project has

various applications like military or aerospace, refrigeration purpose, medical and pharmaceutical equipment etc

Keywords:PICmicrocontroller, Temperature sensor, LCD display, Exhaust fan, Thermo electric plate, SMPS.solarpanel.

1. Introduction.

Thermoelectric icebox also called as thermoelectric cooler module. Warmth will moved from one side to other, by applying low voltage DC control source to the thermoelectric module. Thus, one face of module gets warmed and other face will be cooled. Thermoelectric coolers and solid ice chests are tended to by the laws of thermodynamics and both refrigeration structures are destroys same models yet significant in shapes. Till now inspectors have discovered, distinctive laws impact are one of them. A Thermoelectric module is a solid state imperativeness converter made out of two let go substrates that fill in as a foundation from exceptional semiconductor material (P-N make). Which on obliging, they will show up

thermally in parallel and electrical in strategy. This module can be used for cooling and warming. The cooling impact made by TEM has unmistakable applications in warm affiliation and control of microelectronic contraptions.

Solar centrality based temperature controlled chamber is showed up in this endeavor. This framework is essentially moved in the remedial field. Using the Peltier module, the temperature controlled chamber is utilized for the twofold purposes i.e. cooling and warming.

2. LITERATURE SURVEY

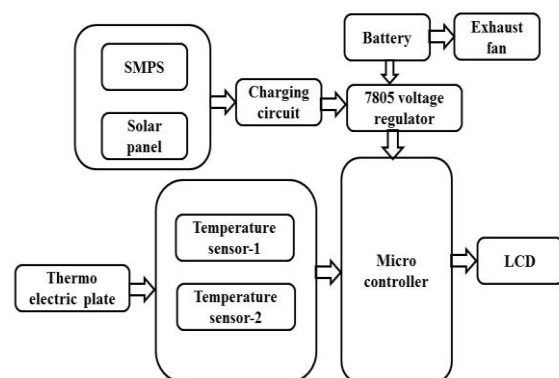
Jincan Chena et al.,[1]:-According to non equilibrium thermodynamics ,cycle models of single stage and two stage semiconductor thermoelectric refrigeration were experimentally investigated. By using the three important Parameters which governs performance of thermoelectric refrigerator i.e. coefficient of performance (COP), the rate of refrigeration, and the power input, development of general expressions performances of the two stage thermoelectric refrigeration system took placed. It was concluded that performance of thermoelectric refrigerator depends on temperature ratio of heat sink to cooled space. When this ratio is small, the maximum value of COP of a two stage Thermoelectric refrigeration system is larger than COP of a single stage thermoelectric refrigeration system; however maximum rate of refrigeration is smaller than that of a single stage thermoelectric refrigeration system. Hence it is convenient to use single stage thermoelectric refrigerator when ratio is small. When temperature ratio is

large two stage thermoelectric refrigerators is observed to be superior to single stage by both parameters i.e. maximum value of COP and maximum rate of refrigeration.

In early 1800's the modern thermoelectric coolers are invented which are based on the physical principles of thermoelectric cooling and heating. Thermoelectric modules were made available in late 60's. A German scientist, Thomas seebeck , found that continuous flow of electric current in a closed circuit which is made up of two dissimilar metals where as at two different temperatures junction of metals were maintained. In 1834, A French physicist, Jean Peltier, investigated the seebeck effect and found out the opposite phenomenon in which, the electric current flow within the closed circuit whereby thermal energy is absorbed at one dissimilar metal junction and discharged at other junction. This is the basic fundamental principle of thermoelectric systems

3. Implementation:

Solar Power Refrigeration System Using Thermoelectric Plates



In this wander temperature sensor and LCD are interfaced to the Micro controller. These sensors related with the thermo electric plate, Micro controller inspects the

temperature sensor regards which are associated with the thermoelectric plate. The temperature regards appeared on the LCD. Thermo electric plate works with peltier impact, on applying DC using battery, the assortment of pellet having positive and negative charge bearers alter warm hugeness from one substrate and unavoidably release it to the substrate at in invert side. In this approach, cool surface showed up in view of ingestion of warmth essentialness. This ingested warm essentialness is being released unexpectedly surface, ends up hot. Vapor fan is secured to the system to spread the cooling to nature.

4. Related Work:

The brief introduction of different modules used in this project is discussed below:

PIC Microcontroller:



PIC stands for Peripheral Interface Controller given by Microchip Technology to identify its single-chip microcontrollers. These devices have been very successful in 8-bit microcontrollers. The main reason is that Microchip Technology has continuously upgraded the device architecture and added needed peripherals to the microcontroller to suit customers' requirements. The development tools such as assembler and simulator are freely

available on the internet at www.microchip.com.

Peripheral Interface controller (PIC16F72):

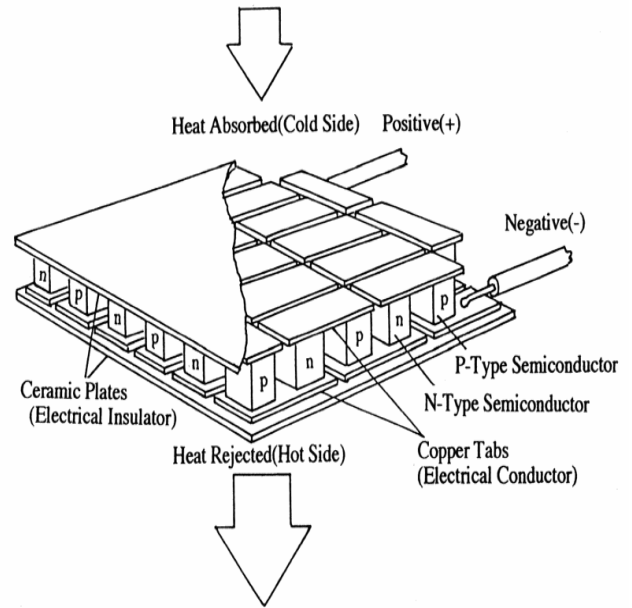
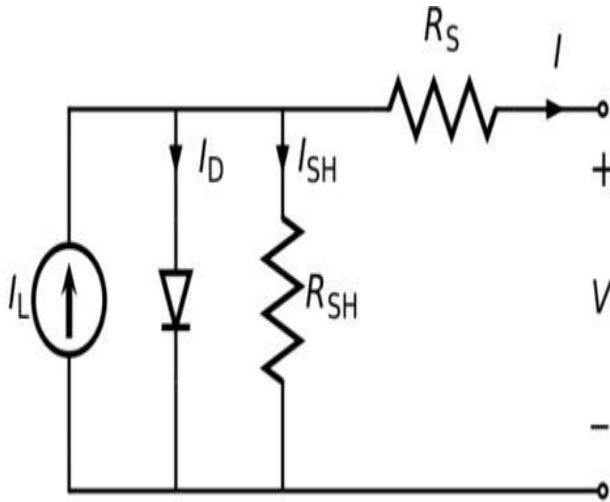
The PIC16F72 is one of the types of peripheral interface controller. A Microcontroller is a programmable digital processor with necessary peripherals. It consists of 4KB of ROM and 128 bytes of RAM. Operating voltage is about 2v to 5.5v.

Solar panel:

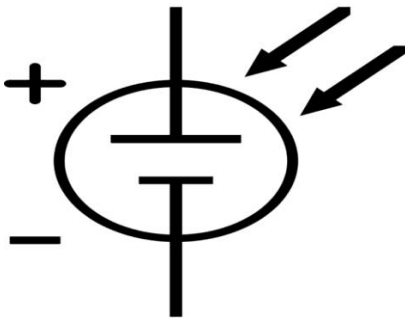
A solar cell or photovoltaic cell is a device that converts solar energy into electricity by the photovoltaic effect. Sometimes the term solar cell is reserved for devices intended specifically to capture energy from sunlight, while the term photovoltaic cell is used when the source is unspecified. Assemblies of cells are used to make solar panel, solar modules, or photovoltaic arrays. Photovoltaic is the field of technology and research related to the application of solar cells for solar energy. Solar cell efficiencies vary from 6% for amorphous silicon-based solar cells to 40.7% with multiple-junction research lab cells and 42.8% with multiple dies assembled into a hybrid package. Solar cell energy conversion efficiencies for commercially available multicrystalline Si solar cells are around 14-19%.

Solar cells can also be applied to other electronics devices to make it self-power sustainable in the sun. There are solar cell phone chargers, solar bike light and solar camping lanterns that people can adopt for daily use

Equivalent circuit of a solar cell



The equivalent circuit of a solar cell



The schematic symbol of a solar cell

PRINCIPLES OF OPERATION

Peltier effect is the basis of thermoelectric module operating principle. In peltier effect, on applying the voltage between two electrodes connected to sample of semiconductor material, temperature difference is created. A thermoelectric cooling (TEC) module is a semiconductor-based electronic part that breaking points as a little warmth pump. By applying DC control source to a TEC, warmth will be exchanged beginning with one side of the module then onto the following. It makes a cool and hot side.

THERMOELECTRIC PLATE:

They are comprehensively used as a piece of mechanical zones, for example, PC CPU, CCDs, flexible refrigerators, therapeutic instruments, and so forth.

Rechargeable battery:



A rechargeable battery, stockpiling battery, or aggregator is a kind of electrical battery. It involves at least one electrochemical cells, and is a kind of vitality collector. It is known as an optional cell since its electrochemical responses are electrically reversible. Rechargeable batteries come in various shapes and sizes, running from catch cells to megawatt frameworks associated with balance out an electrical dispersion network. Several distinctive blends of chemicals are generally utilized, including: lead–corrosive, nickel cadmium (NiCd), nickel metal hydride (NiMH), lithium particle (Li-particle), and lithium particle polymer (Li-particle polymer).

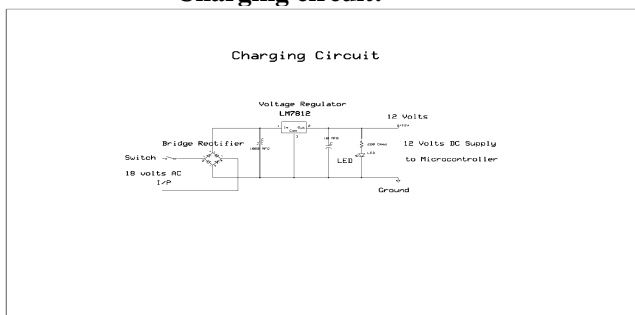
with the help of another capacitor used. We can get 12V Steady DC at the output terminal which can be indicated if the LED glows.

Smmps:

The AC to DC converter **SMPS** has an AC input. It is converted into DC by rectification process using a rectifier and filter. ... Then, the output of this transformer is rectified and smoothed by using the output rectifier and filter.



Charging circuit:



From the above circuit diagram, we can see that the 18v AC is being converted to 18V pulsating DC which is in turn converted to smooth DC with the help of the Capacitor. This 18V Smooth DC is converted to 12V DC by the Voltage Regulator 7812. At the output of the regulator, we get some spikes which are not desirable. These spikes are removed

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REFERENCES

- [1] Onoroh Francis, Chukuneke Jeremiah Lekwuwa, Itoje Harrison John,—Performance Evaluation Of a Thermoelectric Refrigerator [IJEIT], Vol. 2, Issue 7, Jan 2013, PP 18-24.
- [2] Kirti Singh, NishitaSakhare, SangitaJambhulkar, —Compressor-less Refrigerator cum Oven [IJRASET], Department of Mechanical Engineering, Vol. 3, Issue 4, April 2015, PP 1014-1019.
- [3] ChakibAlaoui, —Peltier Thermoelectric Modules Modeling and Evaluation, International Journal of

Engineering (IJE), Volume (5) : Issue (1) :
2011, PP 114-121.

[4] Prof. VivekGandhewar, Miss. PritiBhadake, Mr. Mukesh P. Mangtani, —Fabrication of Solar Operated Heating and Cooling System Using Thermoelectric Module, [IJETT], Vol. 4, Issue 4, April-2013, PP 586- 590.

[5] Sandip Kumar Singh and Arvind Kumar, — Thermoelectric Solar Refrigerator, International Journal for Innovative Research in Science & Technology(IJIRST) Volume 1, Issue 9 , February 2015 ISSN (online): 2349-6010, PP 167-170.

[6] Mr.Swapnil B. Patond, Miss. Priti G. Bhadake, Mr. Chetan B. Patond, —Experimental Analysis of Solar Operated Thermo-Electric Heating and Cooling System, International Journal of Engineering Trends and Technology (IJETT) – Volume 20 Number 3 – Feb 2015, PP 125-130.

[7] P. Dasthagiri, H.Ranganna, G. Maruthi Prasad Yadav, —Fabrication and Analysis of Refrigerator cum Chilled Water Dispenser, Advanced Engineering and Applied Sciences: An International Journal 2015; 5(1): PP 7-14.

[8] Simon Lineykin and Sam Ben-Yaakov,—Modeling and Analysis of Thermoelectric Modules [ISRAEL] PP 2019-2023.

[9] MayankAwasthi and K.V Mali, —Design and Development of Thermoelectric Refrigerator [IJMERR], Vol. 1, October-2012, PP 389-399.