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A Review on Smart Ac Using Peltier Module

Neha chourasia, Akshay W. Gomkar, Sadhana S. Nemani, Shivshankar R. Tiwari , Jagruti B. Bansod, Arshad S. Khan

Assistant Professor (HOD ETC Dept) GNIT, Dahegaon Nagpur, India.
Scholar, ETC Department GNIT, Dahegaon Nagpur, India.
Scholar, ETC Department GNIT, Dahegaon Nagpur, India.
Scholar, ETC Department GNIT, Dahegaon Nagpur, India.
Scholar, ETC Department GNIT, Dahegaon Nagpur, India.
Scholar, ETC Department GNIT, Dahegaon Nagpur, India.

Abstract: *The presently in use air conditioning system produces cooling impact by refrigerants like Freon, Ammonia etc…using these refrigerants will get maximum output however, one among the main disadvantages is harmful gas emission and global warming, this problem can be overcome by using thermoelectric module air conditioner and their by protecting the environment. If, standard vapour compression type of air conditioner presently employed in vehicle is replaced with this one with an arrangement for its placement. It would reduce the overall weight of vehicle and increase fuel economy. It will have a smart functioning like when we want to control it we just need to give voice command to our android phone like "ok Google turn on my AC ".same likewise for turned it off". It is IOT based and we can control it using remote control too. Thermoelectric cooling system have benefits over standard devices like, compact in size, light weight, high reliability, no mechanical moving element and no operating fluid.*

Keywords*: Peltier module, thermoelectric air-conditioner, Vehicle, Global-warming, IOT based.*

I. Introduction

Air conditioning is one of the major consumers of electrical energy which causes energy shortage. It is also one of the main causes of global warming. We know how beneficiary air conditioner is. It increases the efficiency of human being, provide us with cool air and comfortless. Besides all these air conditioners have some disadvantages. Humans may suffer from headaches, nasal issues etc. In extreme cases pneumonia and asthma attacks can also develop. These air conditioners don't affect only humans but also, they indeed contribute to greenhouse effect. So, the best way to get rid of this is by making use of natural resource rather than using electrical energy. So, the best alternate is thermal energy which uses Peltier effect which has the ability of cooling the specific area. This model does not need any compressor, primer moving parts etc. The main objective of this project is to deliver a low-cost air-conditioning system which works on Peltier module that can be used at remote areas where people cannot afford high cost air conditioning system.

II. Literature survey

[1] Allwin Jose, Alan D'souza, Sarvesh Dandekar, Jitesh Karamchandani, Pavan Kulkarni, "Air Conditioner victimization Peltier Module", 2015 International Conference on Technologies for property Development (ICTSD-2015), Feb. 04 – 06, 2015, Mumbai, Asian country 978-1-4799-8187-8/15/$31.00 ©2015 IEEE

In this paper author gives a picture of a conceptual design of an air conditioner using Peltier modules to achieve desired amount of cooling. The appearance of this thermo electrical variety of air conditioning resembles a standard window air conditioning. This brings the simplicity in construction. The air conditioning is meant to require up the cooling load in volume of house as in typical vehicles like cars. If typical vapour compression style of air con presently utilised in vehicles is replaced with this one with an appointment for its placement, it would reduce the total weight of vehicle and increase fuel economy.

[2] Pavan Attavane, Arjun G B, Rajath Radhakrishna, Santhosh Rao, "Jadav Solar powered portable food warmer and cooler based on peltier effect" 2nd IEEE International Conference On Recent Trends in Electronics Information & Communication Technology (RTEICT), May 19-20, 2017, India 978-1-5090-3704-9/17/$31.00 © 2017 IEEE1975

In this paper, we aim at presenting a preponderant, propitious and a simple solution for performing both cooling (Refrigeration) and heating effects in a more efficient manner by the utilization of solar energy. The Peltier module is more efficient, static and easy to handle. It is reliable and eco- friendly. A prototype has

been designed and realized accordingly. All the parameters of the system are experimentally obtained and the measurements are acquiescent with the conventional.

[3] Akram M.N, Nirmani H.R, Jayasundere N.D, "A study on thermal and electrical characteristics of thermoelectric cooler TEC1-127 series," 2016 7th International Conference on Intelligent Systems, Modelling and Simulation, 2166-0670/16 $31.00 © 2016 IEEE DOI 10.1109/ISMS.2016.42

Thermoelectric Cooler (TEC) is widely used in industry for refrigeration applications. Although, ample researches are done on TECs, those are based on either modelling of TECs or applications of TECs. Hence, users notice it troublesome to assemble needed info of TECs. When those are to be used in applications.

[4] Yang Wang, Yani Zhang, Peng Ji, Xiangrong He, Guangyu Fan, ''Investigation on Reliability of Thermoelectric Cooler for Space Remote Sensing" 2013 International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE).

This paper in the main investigates numerous factors that influence the standard and therefore the reliableness of a thermoelectrical cooler (TEC) for house applications. TE material degradation and metal junction's detachment are 2 major factors that cause the degradation or failure of investigator. Qualification and screening tests are required to create investigator be wide applied to house remote sensing.

[5] Rohit Sharma, Vivek Kumar Sehgal, Nitin, Abhinav Thakur, Adnan Munir Khan, Ashis Sharma, and Pankaj Sharma, ''Peltier Effect Based Solar Powered Air Conditioning System'' 2009 International Conference on Computational Intelligence, Modelling and Simulation, 978-0-7695-3795-5/09 $26.00 © 2009 IEEE DoI ten.1109/CSSim.2009.40

This paper demonstrates associate environmental friendly methodology for implementing associate air-con or cooling system. In specific, the cooler doesn't use up the earth's restricted fuel reserves nor will it hurt the world setting either by depleting stratospheric gas or by causative to global warming through the emission of greenhouse gases.

III. Research Methodology

*1. Working***:**

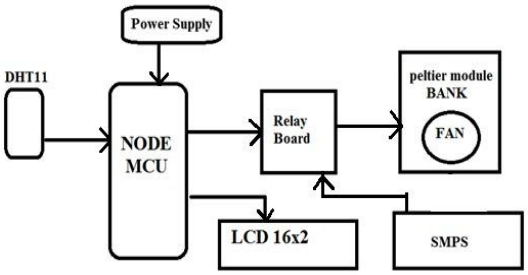

Fig.1 Block Diagram of air conditioning using Peltier module

Basic Block diagram with description of fig.1 System will have Peltier module which will be used as a air cooling material. Over the Peltier module we will have a heat sink with fan. DHT11 sensor will be used for temperature and humidity sensor. LCD will be used to show temperature and humidity value. Node MCU board will be used as controller board having in build WIFI module. We will connect it to internet connection. Relay module will be used to control the devices with the help of google assistance. SMPS power supply will be used to power up devices.

Overall working of the project is like a smart device having facility to get controlled via Google assistance. It will have a cooling chamber made of Peltier modules. Cooled air will be send inside and hot air will be sent outside as it will be a window ac. It will have a smart function like when we want to control it we just need to give voice command to our android phone like "OK Google...Turn on my AC". This command will turn of your ac. In similar way when you say "OK Google… Turn off my AC" your ac will get turned off. For that internet connectivity is the necessary condition. Temperature sensor and humidity sensor will be there to show temperature and humanity on LCD module connected to the board.

MATHEMATICAL MODELLING

COP Equations:

Assumptions:

The COP is a measure of the amount of power input to a system compared to the amount of power output by that system

$$COP = \frac{\text{power output}}{\text{power input}} \qquad \text{(Eq 1)}$$

The COP is therefore a measurement of efficiency; the higher the number, the more efficient the system is. The COP is dimensionless because the input power and output power are measured in Watt. The COP is also an instantaneous measurement in that the units are power which can be measured at one point in time.

Consider a simple electric heater. All of the electricity that is input to the unit is converted to heat. There is no waste and the power output (in heat) equals the power input (in electricity), so the COP is one. The COP can be used to describe any system, not just heating and cooling.

An air conditioning system uses power to move heat from one place to another place. When cooling, the air conditioning system is moving heat from the space being cooled (usually a room), to somewhere it is unwanted (usually outside). A heat pump uses the same principles, but it is moving heat from outside (the cold side) to the space being heated inside (the living space).

The maximum theoretical COP for an air conditioning system is expressed by Carnot's theorem, reduced to the following equation:

$$COP_{maximum} = \frac{T_C}{T_H - T_C} \qquad \text{(Eq 2)}$$

Where TC is the cold temperature and TH is the hot temperature. For space cooling, the cold temperature is inside the space; for space heating, the cold temperature is outside. All temperatures are expressed in Kelvin. To convert from °C to Kelvin, add 273.15. To convert from °F to °C, subtract 32, multiply by 5 and divide by 9.

As you can see from equation 2, as the difference between the hot temperature and the cold temperature increases, the COP becomes lower, and vice versa. This means that an air conditioning system is more efficient when the room temperature is closer to the outside temperature and will use more power when there is a larger difference in these temperatures.

As an example, consider the maximum theoretical efficiency of an air conditioning system that is cooling a room to 23°C (73.4°F). If the outside air temperature is 32°C (89.6°F), the theoretical maximum efficiency is:

$$COP_{maximum} = \frac{T_C}{T_H - T_C} = \frac{(23 + 273.15)}{(32 + 273.15) - (23 + 273.15)} = 32.9 \qquad \text{(Eq 3)}$$

IV. Component list

1. Hardware list:

*Peltier Module (TEC1-12715)***:** Peltier modules are electronic devices designed for cooling objects to below the ambient temperature or maintaining objects at a specific temperature by controlled heating or cooling. Peltier Module is a device used to cool the coolant from its cold side. Thermoelectric coolers operate according to the Peltier effect. The effect creates a temperature difference by transferring heat between two electrical junctions. A voltage is applied across joined conductors to create an electric current. The main application of the Peltier effect is cooling and we will use it for heating too.

*Switched Mode Power Supply***:** The switching regulator integrated with the electronic power supply for the conversion of electrical power from one form to another form which desired characteristics is called as switched mode power supply. SMPS transfers power from a DC or AC source to DC loads such us personal computers. It converts voltage and current characteristics. The pass transistor of a switching mode supplies continually switches between low dissipation, full-on and full-off states, and spends very less time in the high dissipation

transitions. By this way, it minimizes the wasted energy. Theoretically, there is no power dissipation in the switched mode power supply.

Exhaust Fan: It is a fan which is used to remove moisture out of a room. It helps to remove any odors. The primary purpose of the exhaust fan is to control the interior environment by venting out smoke and other contaminants which may be present in the air. It can be integrated into a cooling or heating system. It disperses the air harmlessly. It can be used in summers to push warm air out for temperature controlling. It can be used as an alternative for air conditioner.

Heat Sink: It is a passive heat exchanger which transfers the heat produced by any electronic devices to air or liquid medium to maintain a constant temperature throughout.

Node MCU – IOT board within build Wi-Fi module:
Node MCU is an open-source firmware and development kit that help helps you to prototype or build IOT product. It includes firmware which runs on the ESP8266 Wi-Fi from express if system, and hardware which is based on the ESP-12 module. The firmware uses the LUA scripting language. It is based on the Eula project, and built on the express if NON-OS SDK for ESP8266. MCU stands for Micro-controller unit. Which really means it is a computer on a single chip. A microcontroller contains one or more CPUs along with memory and programmable input/output peripherals. They are used to automate automobile engine control, implantable medical devices, remote controls, office machines, appliances, power tools, toys etc.

DHT11: The DHT11 is a basic, low cost digital temperature and humidity sensor. DHT11 is a single wire digital humidity and temperature sensor, which provides humidity and temperature values serially with one-wire protocol. DHT11 sensor provides relative humidity value in percentage (20 to 90% RH) and temperature values in degree Celsius (0 to 50 °C).
*LCD module***:** Display device with 16x2 Size.
AC cabinet: To fix our system.

2. Software

i. Adafruit cloud services will be used for IOT development.
ii. Google assistance will be configured with the help of IFTT.
iii. Embedded C will be used for the controller board coding.

4.2. Proposed Work

SR.NO.	COMPONENTS	DIMENSIONS	QUANTITY
1	AC CABINET	660mmX705mmX 430mm	1
2	PELTIER MODUALE	50X50X3.9mm	4
3	ALUMINIUM BLOCK	320X6.5X3.8cm	1
4	HEAT SINK	8X8cm	4
5	RECTANGULAR FIN	68X35cm	1
6	SMPS	O/P =12.5Amp	1
7	NODE MCU BOARD	-	1
8	DHT 11 SENSOR	-	1
9	LCD MODULE	-	1

Table -1: Design Dimensions

V. Conclusions

i. The main components used to run this system are Peltier, heat sinks, cooling fan, Node MCU board, and aluminium pipe and temperature sensors. These components are assembled and mounted on aluminium pipe with the desired circuit connections.
ii. The module is made to work automatically with the help of code using a node MCU board. This system was targeted as an AC and temperature of the cooler air should be lowered from ambient.
iii. An idea of AC is based on Peltier effect; it generates a heat that transfer and temperature difference across the ceramic substances that causes the hot on one part of the Peltier module and cold on other side of the Peltier module have ample precision and total heat transfer capabilities while meeting its accuracy requirements.

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