



Air Conditioning System in Car using Peltier Plate

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ABSTRACT

An air conditioning system in a car using a Peltier plate is a type of thermoelectric cooling technology that uses the Peltier effect to cool the air. The Peltier effect is a phenomenon where a current flow between two materials can create a temperature difference between them. This temperature difference can be used to cool or heat the air in a car. This abstract will provide an overview of how a Peltier plate works, its advantages and disadvantages, and its potential impact on the automotive industry.

I. INTRODUCTION

The air conditioning system is an essential component of any car, especially in regions with high temperatures. Traditional air conditioning systems use a compressor to cool the air, but this technology is known for its high energy consumption and greenhouse gas emissions. To address these issues, researchers have been exploring alternative cooling technologies, such as thermoelectric cooling. One such technology is the Peltier plate, which uses the Peltier effect to cool the air.

The Peltier effect is a thermoelectric phenomenon discovered by Jean Charles Athanase Peltier in 1834. It is based on the principle that a temperature difference between two materials can create an electric potential difference when a current flows through them. This effect is used in the Peltier plate, which consists of two semiconducting materials that are connected by a junction. When an electric current flows through the junction, one side of the plate becomes cold while the other becomes hot. This temperature difference can be used to cool or heat the air in a car.

In recent years, there has been growing interest in using Peltier plates in air conditioning systems for cars due to their low energy consumption, quiet operation, and potential for integration with renewable energy sources. However, there are also challenges associated with this technology, such as its relatively low cooling capacity and higher cost compared to traditional systems. This paper will provide a detailed analysis of the Peltier plate air conditioning system, including its operation, advantages, disadvantages, and potential impact on the automotive industry.



II. LITERATURE REVIEW

Vrushali Deshmukh, Abhishek Dharme, Manish Gaikwad; Air Conditioning System in Car Using Thermoelectric Effect, (Volume 5) Issue 6, June 2017:

In present scenario, hvac system (commonly used in the air conditioners) is very efficient and dependable but it has some demerits. It uses refrigerants like freon, ammonia, etc. Due to the use of such refrigerants maximum output can be obtained but it leads to much harmful effect to our environment i.e. The global warming. That leads to the emergence of finding an alternative of the conventional hvac system, i.e., Thermoelectric cooling and heating system. The present paper deals with the study of thermoelectric air conditioner using tec module. Thermoelectric cooling system have advantages over conventional cooling devices, such as compact size, light in weight, low cost, high reliability, no mechanical moving parts, and no working fluids.

• **Akshay Thalkar, Pranav Vaidya, Sagar Nikam, Swapnil Patil, Lalit Shendre Study of Thermoelectric Air Conditioning for Automobiles Volume: 05 Issue: 01 Jan-2018 p-ISSN: 2395-0072:**

Air conditioning systems is used in many automobile applications. The conventional process using refrigerant can cause serious problems to the environment. In this study we developed an air conditioning system based on thermoelectric properties. In this air conditioning, there is no use of compressor and pump for the refrigeration. A Thermoelectric module is an electrical module, which produces a temperature difference during current flow. The emergence of the temperature difference is based on the Peltier effect. The thermoelectric module is a heat pump and has the same function as a refrigerator. The heat flow can be turned by reversal of the direction of the current. Our aim is to introduce the new HVAC system using a thermoelectric module which shall overcome all the disadvantages of the existing HVAC system.

• **Santosh Doifode Prof. A. M. Patil; Review of Thermoelectric Air to Air Cooling for Cars, Volume III, Issue IV, April 2014, (ISSN 2278 – 2540):**

Today, an automobile is a necessity for everyone. For a long or short journey people need a car regarding safety, the environment and most importantly, comfort. Owing to these reasons, many vehicles are equipped with heating, ventilating and air conditioning systems. In today's world, no one feels comfortable in a vehicle without an HVAC system. Therefore, HVAC becomes an integral part of human life. Today's present HVAC system is very efficient and reliable, but it has some demerits. It has been observed during the last two decades that the O3 layer is slowly destroyed because of the refrigerant (CFC and HFC) leakage to atmosphere. Other demerits include. The compressor is driven by the crankshaft of the engine. So, it consumes about five to 10% power of the engine. The cost of present HVAC system is extremely high; Maintenance and repairing cost of this system is extremely high. So, to overcome these demerits by replacing the existing HVAC system with a newly emerging thermoelectric couple or cooler. This works on Peltier and Seebeck effect. Thermoelectric cooling can be considered as one of the major applications of thermoelectric modules (TEM) or thermoelectric coolers (TEC). The main objective of this project is to design a cooling system installed on a conventional blower of car AC. The idea of cooling is based on the Peltier effect, as when a dc current flows through TE modules it generates a heat transfer and



temperature difference across the ceramic substrates causing one side of the module to be cold and the other side to be hot. The purpose of the project is to make use of the cold side to cool the ambient air to a lower temperature, so that it can be used as a personal cooler. Testing and measurements will be performed using on car (Maruti 800). the fact that the TE cooling for cars can lower the ambient temperature by 7 degrees Celsius.

• **Manoj S. Raut, Dr. P. V. Walke; Thermoelectric Air Cooling for Cars, ISSN: 0975-5462, Vol. 4 No.05 May 2012:**

As a mechanical engineer I am trying to overcome these demerits by replacing the existing HVAC system by newly emerging thermoelectric couple or cooler which works on Peltier and seebeck effect. Thermoelectric cooling can be considered as one of the major applications of thermoelectric modules (TEM) or thermoelectric coolers (TEC). The main objective of this project is to design a cooling system installed on a conventional blower of car AC. The idea of cooling is based on Peltier effect, as when a dc current flows through TE modules it generates a heat transfer and temperature difference across the ceramic substrates causing one side of the module to be cold and the other side to be hot. The purpose of the project is to make use of the cold side to cool the ambient air to a lower temperature, so that it can be used as a personal cooler. Testing and measurements are also performed using on car (Maruti Suzuki Zen). A simple temperature controller to interface with the cooling system has also been incorporated. Based on an analysis of sizing and design of the TEC air cooling for car, it can be deduced that the cooling system is indeed feasible. Readings taken during testing also testify to the fact that the TE cooling for car can lower the ambient temperature by 7 degrees Celsius.

III. Design and Component

1. Thermoelectric Generator
2. Battery
3. Peltier Plate
4. Heater
5. Switch mode power supply
6. Temperature sensor
7. Cooling Fan
8. Thermocol Ice Box
9. Heater Heating Plate

The air conditioning system in a car using a Peltier plate works by utilizing the Peltier effect to create a temperature difference between two semiconducting materials. The Peltier plate is typically installed between the air intake and the cabin of the car.

When an electric current flows through the Peltier plate, one side of the plate becomes cold while the other becomes hot. This temperature difference is created due to the movement of electrons between the two semiconducting materials. The cold side of the Peltier plate absorbs heat from the air passing through it, and the hot side releases the heat to the outside environment.



Fig. 1. Design of Air Conditioning System in Car using Peltier plate.

IV. Result

SR.NO	V(Output voltage),V	ΔT (Temperature difference)
1	0.30	20.0
2	0.60	52.0
3	0.86	77.3
4	1.02	80.8
5	1.40	83.1
6	1.90	86.4
7	2.10	89.4
8	2.56	90.2
9	2.86	93.0
10	3.18	94.0

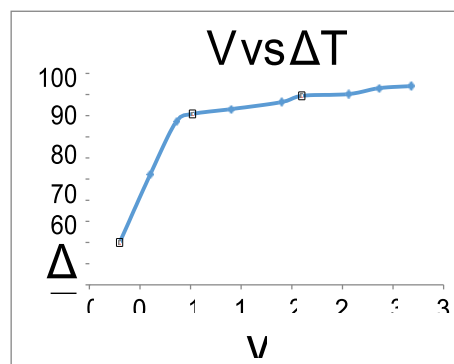


Fig.2. Temperature difference vs. voltage graph

2] Voltage vs. current



SR.NO	V(Output Voltage),V	I(Current),A
1	0.30	0.11
2	0.60	0.18
3	0.86	0.25
4	1.02	0.29
5	1.40	0.30
6	1.90	0.35
7	2.10	0.40
8	2.56	0.45
9	2.86	0.50
10	3.18	0.65

3] All weather conditions result-

Day	Night	Summer		Winter	Rain	Peltier Palte Temperature	Time in sec
24	30	25		21	29	30	0
28	28	27		23	28	29.56	5
30	26	30		24	27	29	10
32	25	33		26	26	26	15
34	24	35		27	25	24	20
36	23	37		28	24	21	25
38	22	39		29	22	20	30
40	21	41		32	21	19	35

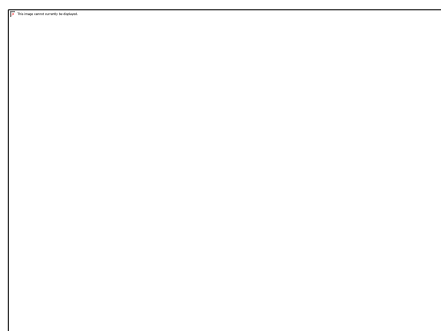


Fig.3. All weather conditions graph



V. CONCLUSION

Thermoelectric generation can be a suitable energy source in space, especially in situations where other power sources cannot operate. An alternative energy source is photovoltaic, which actually have a much higher efficiency (up to approximately 40%, as compared to approximately 5% for a thermoelectric generator). In addition, thermoelectric generators are inexpensive, easy to handle, and robust, as they are solid-state devices with no moving parts. In conclusion, these thermoelectric generators can be useful in electrical systems, including satellites, robots, and automobiles.

water-based cooling system has advantages in terms of stability as well as capability to maintain the temperature different between hot and cool side of the TEM.

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