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Heat Reduction in CVTs using Peltier Air Conditioner

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Abstract*: CVT(Continuously Variable Transmission), is the mechanism used in few automobiles(like cars), which is one of the biggest deciding factor on the performance of the automobile, because of the large amount of heat it dissipates due to extreme friction on rotation, thereby increasing the mechanical losses. This heat dissipated can be reduced using the peltier cooling system. The heat from the peltier module is removed by employing the concept of heat pipes.

Keywords: Air Conditioner, Cooling, CVT, Peltier.

I. INTRODUCTION

A. Continuously Variable Transmission (CVT)

Continuous Variable transmission is a trend setting innovation of programmed transmission which is used to get endless gear apportion among driver and driven pulley. CVTs need not bother with the gear boxes with set count of gears. Interminable ratio of gears is acquired by changing diameter of belt width over pulley.

B. How does it work?

CVT comprises of two customizable cone shaped pulley driven using V-belt. Main pulley is associated with side of the engine and small pulley to wheel side. The separation between pulleys is conversely corresponding to the speed of the belt drive. The apparatus proportion is fluctuated by moving the two stacks of one pulley closer together and the two bundles of the other pulley more remote separated, which changes effective width of both the pulleys. Consequently, by altering the separation between pulleys we can acquire wanted amount of diameter proportion without step gears.

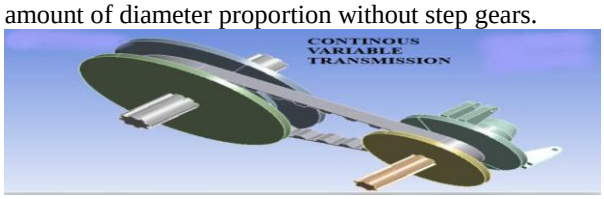

Fig.1.Continous Variable Transmission

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C. Why CVT?

The continuous variable transmission is 35% more efficient than the ordinary manual transmission. Due to a lower power loss, it gives itself an advantage of an improved acceleration. It also free from having step transmission and delivers an extremely high torque. The variable load conditions and demand of power allows better ride. The CVT comprises of 25% of moving parts.

Although it is so much advantageous, there is a main problem in this type of transmission. The friction. The friction in the CVTs are little higher, which cause extreme heat loss. This heat loss can be brought down using a cooling system like the Peltier air conditioner. The contact between V belt sidewalls and pulley groove is the primary heat generation source in CVT. This temperature age influences the lifetime of pulley and the belt because of material debasement. Extension of belt because of heating leads to loss of transmission capacity and less sturdiness of CVT parts [1].

D. Applying Peltier Cooling on CVT

CVT performance and life can be increased with design of belt and with Peltier cooling system. Hybrid electric vehicles also employ this transmission.

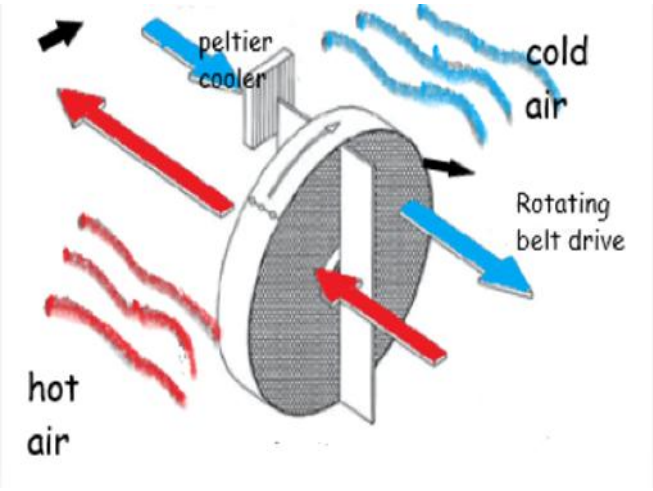

Fig 2. Application of Peltier cooling in CVT

Electric motors can avoid low speed with high torque troubles by utilizing CVT with the cooling system. In upcoming advancements, cars incline to observe the usage of CVT with Peltier cooling system[2].

II. PELTIER AIR CONDITIONER

A. Introduction – Thermoelectric modules

In thermoelectric materials, electrical energy can be directly changed over into thermal energy and vice-versa. This is achieved by two primary thermos-electric effects: the Peltier effect and the Seebeck effect. Peltier effect suggests that due to a flow of current in a thermoelectric material, one end absorbs heat and the opposite end emits the same. The Seebeck effect suggests that when a thermoelectric material is under a temperature gradient, an electric potential is obtained. Thermoelectric cooling is the process of innovative cooling, which utilizes thermoelectric coolers (TECs).

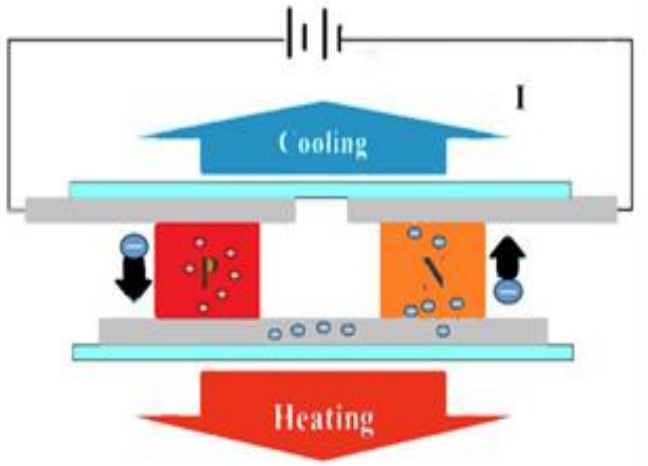

Fig.3.Peltier Mechanism

They are advantageous than the conventional coolers by their high dependability, no moving mechanical parts, compact, light-weighted, with no working liquid. In addition, it could be controlled by a direct-current source. The rule of thermoelectric cooling is that, at the point when a voltage or DC flow is associated with two extraordinary conductors, a circuit can be made that considers consistent heat transmission between the channel's intersections. The process of ruling out the heat inside the room is called air conditioning.

By utilizing thermoelectric module-based air-conditioners we can conquer the current air-conditioning framework by altering it to be eco-friendly. A customary cooling framework contains three central parts - the evaporator, blower and condenser. The evaporator or cold area is where the pressurized refrigerant is permitted for expansion, boiling and evaporation. Amid this difference in state from fluid to gas, energy (heat) is consumed. In the chilly junction place, the energy in the form of heat is consumed by negatively charged electrons while they travel from a low energy (p-type) semiconductor component, to a higher energy (n-type) semiconductor component. The power source provides the electrons with energy to travel within the framework. In the hot area of junction, the energy is ousted to a heat sink while the electrons travel to a lower energy (p-type), from a high energy (n-type). The power supply gives the energy to move the electrons through the framework. At the hot area of junction, energy is ousted to a heat sink as electrons move from a high energy level component (n-type) to a lower energy level component (p-type) [3].

B. The advantage of peltier ACs over conventional ACs.

The conventional method for creating a cooling effect by like vapor pressure and vapor absorption air condition. They deliver cooling using chemicals lie ammonia, freons, etc.

Although it gives good results, it isn't eco-friendly. It emits many toxic gases in the atmosphere like chloro flouro carbons. The air conditioners are noteworthy domestic machines, which is used to reduce the temperature and the humidity of an indoor region. The cooling uses a regular refrigeration cycle, however overall dissipation is utilized, ordinarily for cooling in structures and engine vehicles. Ordinarily we are utilized in the vapor pressure air-condition framework, it has many moving parts and just as produce destructive gases to the earth [4].

By utilizing thermoelectric module-based air-conditioners we can conquer the current air-conditioning framework by altering it to be eco-friendly.

C. Introduction to the research

Each day, newer technology is created, to make the human life more convenient and simpler. Smart systems are being developed to reduce human effort in day today life. Here we bring such a system, called Peltier smart air conditioning system, which actually uses thermoelectric module for cooling and heating, with a switching device built with a microcontroller.

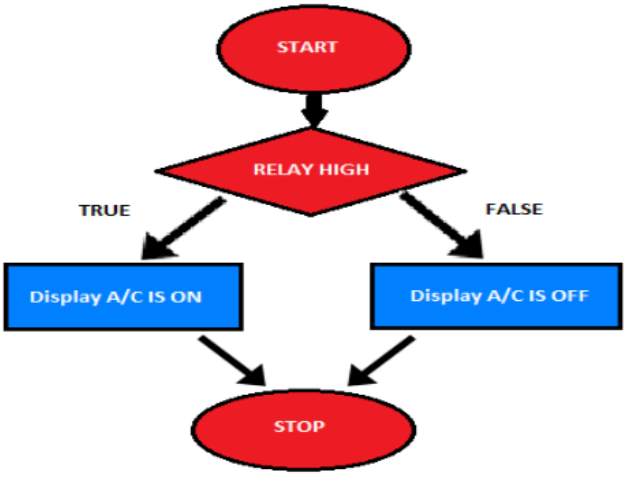

Fig.3.Flow Chart of Algorithm

1. SMPS

Switched mode power supply is an electronic power supply that uses a switching regulator to effectively change over electrical power. Like some other power supplies, a SMPS moves power from a DC source or from AC source to DC loads, for example, a PC, while changing over voltage and current qualities. We have used an SMPS in our project in order to power our Peltier module. The Peltier module is rated at 12V. Hence we supply a 12V DC power from the SMPS. The SMPS steps down the 220V AC input, rectifies it to obtain a 12V DC output voltage and the ripples are removed using a LC filter.

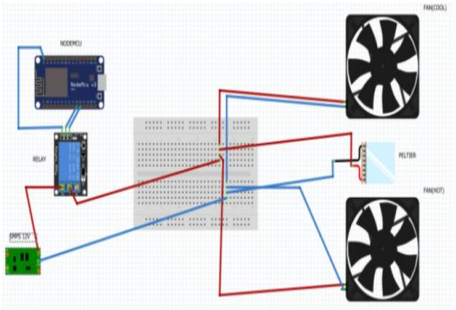

Fig.4.Ciruit Diagram

2. NodeMCU

NodeMCU is microcontroller with ESP8266 Wi-Fi module embedded on it. This is used to wirelessly connect to any other devices. In this way we can establish a data transfer path between the connected devices, until the devices are connected on the internet. In our project NodeMCU plays a vital role in establishing the wireless connection between the mobile and the relay. The AC can be controlled by switching on or off the relay from the phone, via the NodeMCU.

D. Working

The main working principle behind this system is in connecting the peltier module and fans embedded on heat sinks to the dc power supply, through the NodeMCU, which is also connected to other electronic components listed above as shown in Fig. 5. Monitoring of a/c is done by the NodeMCU, which communicates data to the user through an app. If the a/c is on or off, it communicates to the status to the user with a short message in the app. If you want to switch on or off the air conditioner, all you have to do is touch the button in the app, which communicates to the microcontroller and sends the signal to the relay module to switch high or low [5].

III. MOBILE INTERFACE USING ANDROID

For the Android support we need to design an Android app. The Android app will have the following features - The Android app should be user friendly i.e., easy to use, it must be in sync with the device and should show instantly when the switch is open or closed, and it must have a control button which will take over control of the air conditioner.

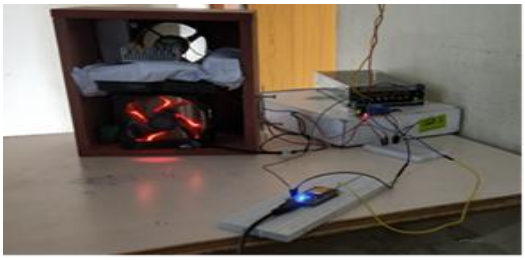

Fig.5.Model of the Air conditioner

For developing this app, we used another app which is available in android which is called the Blynk App. This app has the predefined templates so that we can use them for creating apps which does many basic functions like the ones mentioned above.

IV. CONCLUSION

The Peltier effect could be put into use as an air conditioner. This is much better and efficient than the conventional ACs. They are a compact system, need less maintenance also more ecofriendly as they do not emit toxic gases. The Peltier cooling systems can be used not only for domestic purposes, but they have future applications in vehicular systems and for cooling of other equipment in a system. The CVTs are one such example. They, when used in a machine can get heated up to 90° C to 95°C. This will cause more frictional and heat losses. By using the Peltier cooling system, the heat could be reduced by up to 10°C to 15°C. This will reduce many losses, frictional and thermal, and might increase the lifetime of the material. Hence, this is a better way of cooling system and a simpler alternative solution for the problems conventional air conditioning systems.

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