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Smart Charging Of Commercial Vehicle's Battery Using Peltier Device

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Abstract

The Fundamental Objective of this project is to save our earth from the waste of heat energy which is produce by the commercial vehicle. This heat energy mainly comes from there engine and exhaust. This heat energy pollutes the atmosphere due to which it increases the temperature of the atmosphere more than the actual temperature of the atmosphere. So, a small step toward to save the environment to decrease this kind of excessive energy loss and We are introducing a system by which we can recycle the waste heat energy and covert that energy in form of charge. This energy is totally made from the engine heat which is actual a power loss from a engine in the form of heat that will recycle the power loss in the form of Electric current and further we can store this electric current in the battery or we can use this electric current to charge the vehicle battery. As we all know today world is facing with a big crisis of power generation because the demand of power is high as compare to the generation of power that produces. So we are switching more towards to the renewable energy sources. In this project we use the Technic of Seebeck effect this effect create a voltage when there is temperature difference between the thermocouples device where if we put one side of device is heated and other is colder side this can generate the electric current.

Keywords: Seebeck Effect, Thermocouple, Peltier.

1. Main text

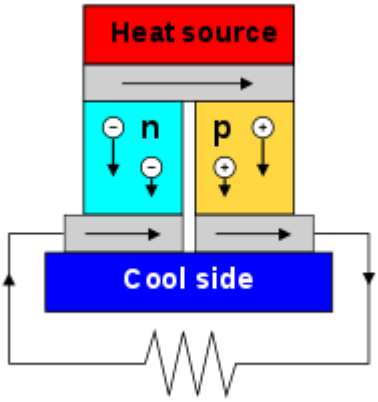
In today era where So many countries governments are spending a lot of money and time on global warming to save earth from the increase in the average temperature that we all know main source of pollution is petrol and diesel vehicles which is produce a lot of heat energy from their engines and through all that heat energy in our atmosphere as we all realize in today time we can't cut down this heat energy loss. here we also think about what are other resources to cut down that excusive heat energy the result we get is electric car but what about who already owns this commercial vehicle the approx. total 1.01 million people in India is having a commercial vehicle so this can't cut down this heat loss but we can recycle this heat loss in form of electric current. So we are introducing a system where we can recycle the waste heat energy in form of electric current where we all known the main heat energy loss is come from engine and exhaust. What we can do is to connect two Peltier devices in series in the engine we will create one aluminum box where we fill that box with the liquid nitrogen gas. This gas have low temperature and cooling temperature point as we known Peltier device which is thermocouple device which is made up of two different material so in Peltier when we give temperature difference between both side the voltage is generated by the Peltier.

1.1. Seebeck effect:

The Seebeck effect create a voltage when there is temperature difference between two dissimilar electrical conductor or semiconductor[1]. When heat is applied to any one side of two conductor or semiconductor, heated electrons move forward to the collar side and if this two conductor is connected with any circuit or led the direct current will start flowing to the circuit but the major issue with seebeck effect is it produce very small voltage normally the output of seebeck effect device is in few microvots at it is in per kelvin of temperature and kelvin difference at the junction.

The Peltier which is generating few millivolts (thousandths of a volt) this devices can connected in series to increase the output voltage. If larger the array of seebeck effect those gadget can generate good electric city if a larger temperature difference will maintain for longer time across the two junction.

Thomas Johann Seebeck discovered the phenomenon in the 1800s. More recently, in 2008, physicists discovered what they are calling the *spin Seebeck effect*. The spin Seebeck effect is seen when heat is applied to a magnetized metal. As a result, electrons rearrange themselves according to their spin. Unlike ordinary electron movement, this rearrangement does not create heat as a waste product. The spin Seebeck effect could lead to the development of smaller, faster and more energy-efficient microchips as well as spintronics devices.

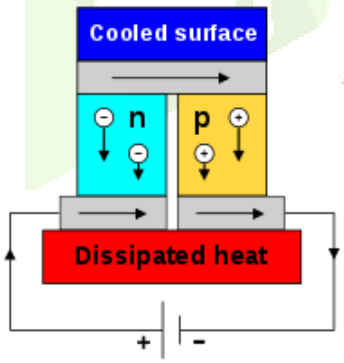


See-Beck Effect

1.2. Peltier Effect:

The Peltier effect is the presence of heating or cooling at an electrified junction of two different conductors and is named after French physicist Jean Charles Athanase Peltier[2], who discovered it in 1834.Peltier effect, if the heating of one junction and cooling of another junction or temperature difference between two thermocouple conductor or semiconductor when electric circuit is maintained in a circuit

In a circuit consisting of a battery joined by two pieces of copper wire to a length of bismuth wire, a temperature rise occurs at the junction where the current passes from copper to bismuth, and a temperature drop occurs at the junction where the current passes from bismuth to copper. When a DC voltage source is connected between the electrodes, the negatively-charged side becomes cooler while the positively-charged side becomes warmer. The negative electrode is placed in contact with the component, device or medium to be cooled, while the positive electrode is connected to a heatsink that radiates or dissipates thermal energy into the external environment.



Peltier Effect

1.3. PARAMETERS OF THERMOELECTRIC MODULE

As this Peltier will placed between the engine and radiator of the car, that liquid cooling Technic for one side and other side is heat up by the engine heat which is generally a power loss of engine electric current will start flow, and it produce potential difference between battery terminal. The Peltier will be connected to series because the battery need maximum voltage to charge it.

Seebeck voltage is measured using the Harman method [3]. These measurements are then used to obtain dynamic values of TEM fundamental parameters: electrical resistance, thermal conductance and Seebeck coefficient, from which the TEM figure-of-merit can be calculated. Test conditions, i.e., current flowing through the module can be varied by the user. The thermal circuit used by the characterization system includes an auxiliary TEM that enables to emulate a controlled ambient temperature, which increments the repeatability and versatility of each test. Additionally, the dynamic response can be varied by interchanging the

thermal load. Repeatability tests show a dispersion between direct measurements of less than 50mK for temperature measurements and less than 4mV for voltage measurements.

1. Cold Side Temperature: The major problem with using the Peltier is to carry heat is the fact due to the high work function of metals which are the only practical emitters, the lowest cooling temperate is around 600 °C - clearly not useful except in the most unusual applications. But as we put this device inside the bus so the liquid colling Technic is used where the liquid is going to cool down the Peltier is liquid nitrogen.

2. Hot Side Temperature: Peltier create a temperature difference on each side to generate the electricity current so in hot side of the Peltier the heat that carried from the engine heat which is actually a waste energy which we will recycle and also save our planet from global warming.

3. Temperature Difference: The two temperature Tc & Th and the difference between △T is a very important factor. △T has to be accurately determine if the cooling system is to expressed as operating desired. The following equation

$$\triangle T = Th - Tc$$

4. Cooling Load: The most difficult and important factor to be accurately determine a TEC is a amount of heat to be removed or observed (Qc) by the cold side of the TEC. In this project Qc was calculated by finding the product of mass flow rate of air, specific heat of air and temperature difference. Then the temperature difference in the system between inlet temperature and outlet temperature of the cooling system. The mathematical equation for Qc is

$$Qc = mCp\triangle T$$

5. Heat Sink A heat sink is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant, where it is dissipated away from the device, thereby allowing regulation of the device's temperature at optimal levels.

2. Working Principal:

A simple and easy to use system where two series connected Peltier devices placed in between the fan and engine of vehicle and other two series connected Peltier in the exhaust the reason behind choosing this places is because in this area the high number of heat loss will happen and the all four are connected with the battery one diode is also connected in the Peltier to prevent the backflow since the unidirectional flow of current and also increase the reliability of the system the Peltier effect creates a temperature difference by transferring heat between two electrical junctions. A voltage is applied across joined conductors to create an electric current. When the current flows through the junctions of the two conductors, as we created the temperature difference between the two side of Peltier

From one side it gives heat from the engine which is waste energy that will be recycled and the second side will placed near the fan that will use liquid technology to create the temperature difference that will cool the system and the liquid used will come in the form of crystal and we will put the gas inside the aluminum box that connects this system on commercial vehicle which daily running of more than 500 km due to high distance the heat generation will be high and If Larger the array of seebeck effect those Peltier can generate good electric city if a larger temperature difference will maintain for longer time across the two junctions. And the second set of Peltier which is connected in exhaust the one side of Peltier heat will come from the exhaust but the other side the cooling Technic we will use is natural cooling that will gives us one heat sink of the Peltier device and this natural difference can create the disturbance of temperature to the thermocouple.

Advantage

- This system will help to clean the environment open the door toward the green energy.
- This system is less in cost and more reliable.
- The system is not so complicated
- The system is small in size.

Disadvantages

- Less output power consumes more time to charge a battery so it is only efficient for long distance this system is not suitable for short distance.

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References

1. *https://searchnetworking.techtarget.com/definition/Seebeck-effect*
2. *https://www.britannica.com/science/Peltier-effect*
3. *https://en.wikipedia.org/wiki/Thermoelectric_effect*
4. *https://onlinelibrary.wiley.com/doi/abs/10.1002/er.5461*
5. *https://www.research-collection.ethz.ch/handle/20.500.11850/15932*
6. *https://science.sciencemag.org/content/285/5428/703.abstract*
7. *https://onlinelibrary.wiley.com/doi/abs/10.1002/aelm.201700013*

https://www.sciencedirect.com/science/article/abs/pii/S0306261913007721