A Review on Cooling in Two wheeler Helmet by using Peltier Effect

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Abstract - In present time due to global warming effect the atmosphere changing which results in increasing in temp. In present days we find no of cases of death due to two wheeler road accident. The main reason is people are not wearing helmet. This causes head injuries in accidents. Apart from fact that helmets available everywhere but the main reason behind not using the helmet is uncomfortable temp. This invention relates to reduce the temp. inside the helmet so person who wearing the helmet can feel cool inside. This reduction of temp. made by Peltier effect. The peltier module works on the basis of thermoelectric effect which means it provides cooling at on side and remove heat at other side.

Index Terms - Thermoelectric Module, Heat sink, Battery.

Introduction

Thermoelectric are based on the Peltier Effect, The Peltier Effect is one of the three thermoelectric effects; the other two are known as the Seeback Effect and Thomson Effect. Whereas the last two effects act on a single conductor the, peltier effect is a typical junction phenomenon.

Thermoelectric cooling uses the Peltier effect to create a heat flux between the junction of two different types of materials. The peltier effect is the presence of heating or cooling at an electrified junction of two different conductors. The device has two sides, and when DC electricity flows through the device, it brings heat from one side to the other, so that one side gets cooler while the other gets hotter[1]

Seeback effect is the conversion of heat directly into electricity at the junction of different types of wire. When two ends of a conductor are held at different temp. electrons at the hot junction at higher thermal velocities diffuse to the cold junction. Seeback discovered that making one end of a metal bar hotter or colder than the other produced an emf between the two ends.

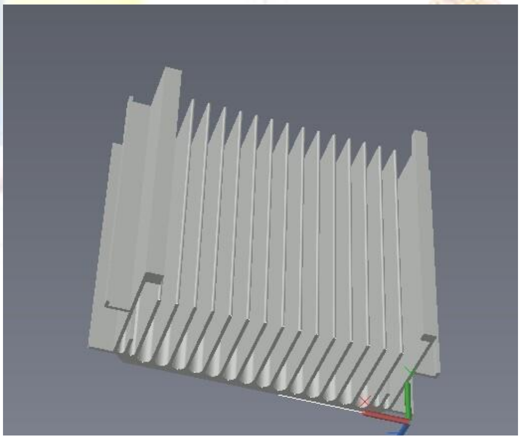
Thermoelectric

Construction

Two unique semiconductors, one n-type and one p-type, are used because they need to have different electron densities. The semiconductors are placed thermally in parallel to each other and electrically in series and then joined with a thermally conducting plate on each side [2]. When a voltage is applied to the free ends of the two semiconductors there is a flow of DC current across the junction of the semiconductors causing a temperature difference. TECs are typically connected side by side and sandwiched between two ceramic plates. The cooling ability of the total unit is then proportional to the number of TECs in it.

MATERIALS AND METHODS

The major components of the air conditioned thermoelectric helmet include: cooling chamber, electric fan as an air pump, heat sink, the thermoelectric module with built-in electric fan and lithium polymer batteries. The electrical power was supplied to the addition, by using helmet by means of a 3.7 V battery. In addition, by using a chamber, the cool air can be transferred to the rider's head directly without losing the air into the surroundings. The chamber is also equipped with a small fan to circulate the air in the chamber and then transfer it to the rider's head. The heat sink was used to enhance and increase the rate of heat transfer from the hot surface of the thermoelectric module so that the heat will be discarded outside the helmet.



The total weight of the new helmet, including the fan, battery and heat sink, was estimated to be 1.150 Kg.

Heat Sink

A heat sink transfers thermal energy from a higher temperature device to a lower temperature fluid medium. The fluid medium is frequently air, but can also be water, refrigerants or oil. If the fluid medium is water, the heat sink is frequently called a cold plate. In thermodynamics a heat sink is a heat reservoir that can absorb an arbitrary amount of heat without significantly changing temperature. Practical heat sinks for electronic devices must have a temperature higher than the surroundings to transfer heat by convection,

Fig. 1 Heat Sink

radiation, and conduction[3]. The power supplies of electronics are not 100% efficient, so extra heat is produced that may be detrimental to the function of the device.

$$Qk = -Ka\frac{dt}{da}$$

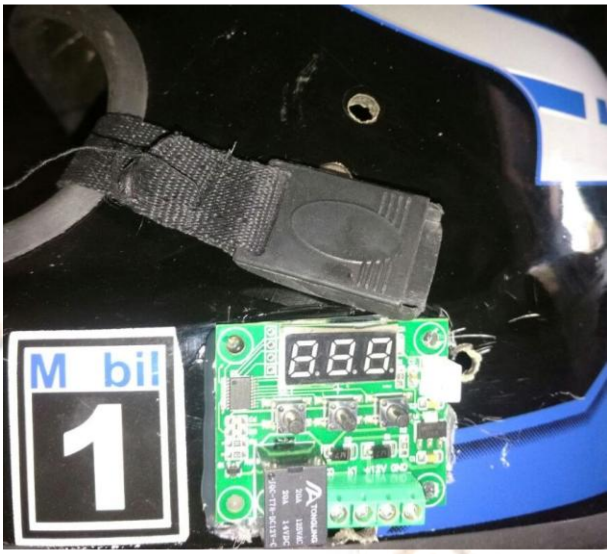
The above equations show that

- When the air flow through the heat sink decreases, this results in an increase in the average air temperature. This in turn increases the heat sink base temperature. And additionally, the thermal resistance of the heat sink will also increase. The net result is a higher heat sink base temperature.

- The increase in heat sink thermal resistance with decrease in flow rate will be shown later in this article.

- The inlet air temperature relates strongly with the heat sink base temperature. For example, if there is recirculation of air in a product, the inlet air temperature is not the ambient air temperature. The inlet air temperature of the heat sink is therefore higher, which also results in a higher heat sink base temperature.

- If there is no air flow around the heat sink, energy cannot be transferred.



Lithium Polymer batterie

5V DC battery: Cylindrical cells typically have a positive terminal nub at one end, and a flat negative terminal at the other. A cell with a nub on the positive terminal is called a **button-top**, and a cell without a positive nub is called a **flat-top.** It is important to check the battery contacts in a device before attempting to install cells, because some will not work with flat-tops or with button-tops whose buttons are the wrong diameter. Some devices have a small bump or spring where the positive terminal of the cell connects, and this allows the use of either button- or flat-top cells. Other devices have a flat area that can only be contacted by a button-top. To prevent damage if a cell is inserted backwards, some devices have a

Fig. 2 5V DC Battery

raised plastic ring around the positive contact. This stops the flat negative end of a cell from connecting accidentally, but also stops the positive end of a flat-top or of a button-top with too large a button from connecting.

Electric Fan

The use of the fan is very important in this design. The fan works as the pump for transferring cooled air from the cooling chamber into the helmet. The Fan also included in the design for air distribution purposes. The fan will be installed on top of the cooling chamber and acts as an electric pump that supply cooled air . The fan is designed with dimension of 40mm in height. A higher dimension of fan is needed in order for the design to have closed space of air transfer, between the cooling

Fig. 3 Exhaust Fan chamber and protective foam of the helmet to avoid cool air leak[4].

Temperature Control Unit

A on/off temperature control is the least expensive of the control types, and also the most simple in terms of how it works. The control is either on or off—if the temperature drops below a certain point, the control signals to the machine to turn raise the temperature. Likewise, if a temperature goes above a certain point, the control is triggered to tell the machine to lower the temperature. A common example of on/off systems is a household thermostat. When the temperature drops below a certain point, the controller triggers the heater to raise the temperature back to the programmed value.

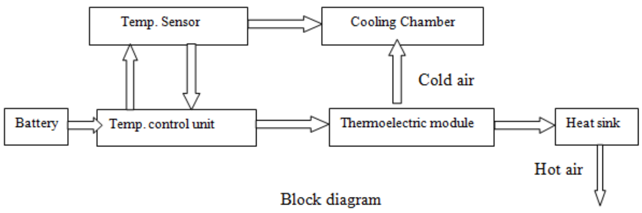
Fig. 4 Temperature Control Unit

Working process

In our project "Cooling in two wheeler helmet by using peltier effect" working process is as follow. The main component involve in our project is shown in diagram which is as;

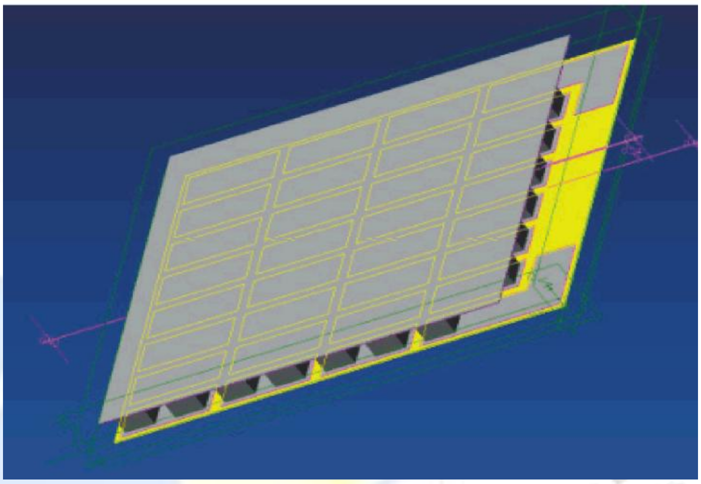
Battery, Temperature control unit, Thermoelectric module, Temperature sensor, cooling chamber, Heat sink.

Block diagram



Block diagram

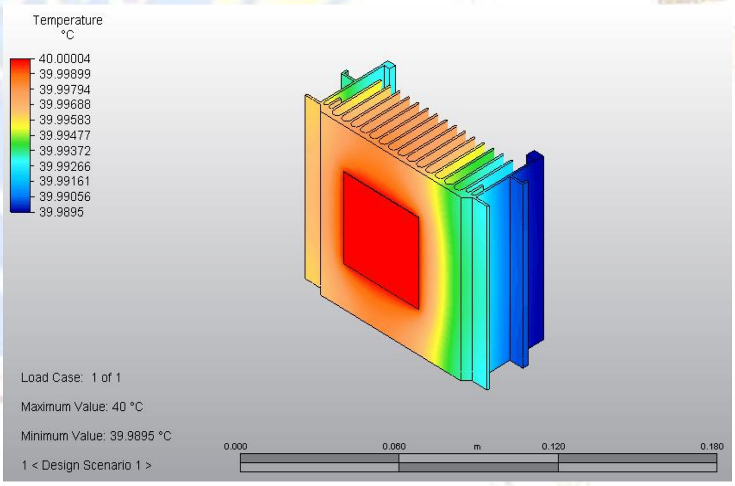
This is closed system in which power is supply through the 5V dc lithium polymer battery. When the power is required in system which is provide by this 5V dc lithium polymer rechargeable battery. It supply power in thermoelectric module through temperature control unit In temperature control unit required temperature is setted and controlled.



Temperature sensor is one type of feedback element which is sense the temperature inside the cooling chamber. Where first temperature is sense then it gives signal in temperature control unit.

In thermoelectric module which is based on peltier effect. In this system two junction is available one is hot side and another is cold side. When the system is in working, it receives power from the battery and produced cooling effect, where cooling air is entered in cooling chamber and remaining hot air in the system is emitted in atmosphere through heat sink.

Now, in cooling chamber cooling air is entered which is produced by peltier effect and cooling air is circulated inside the cooling chamber and provide cooling in helmet & hot air remove through aluminum pipe.



It is necessary to set the temperature in temp. control unit , what we required to maintain temp. inside the cooling chamber. Once the temperature is maintained inside the cooling chamber then temperature control unit stops the power supply to peltier effect.

RESULT AND DISCUSTION

Simulation Results: Figure 5 shows the thermoelectric module design. The original helmet design is made according to the thermal analysis and the size of the required heat sinks. Figure 6 shows the simulated heat transfer analysis in the heat sinks using **Autodesk simulation** software. It shows the minimum and maximum temperatures during operation. The result clearly shows the efficiency of the heat sink used to dissipate heat.

Fig. 5 Thermoelectric Design

Field Test: The helmet is then tested on open air by wearing it while riding the motorcycle. The parameters of the field test and the results obtained are as follows: speed of travel: 40km/h, motorcycle: Bajaj Discover 100cc, atmospheric temperature: 42°C, duration of test: 15 minutes and the temperature inside the helmet: 28°C and the cooling effects rate: 3

Fig. 6 Heat Transfer Analysis of External Heat Sink

(from 1-5 where 1 is considered to be poor and 5 is the best). This test was conducted on the location in the Grow more faculty of engg. Himatnagar. The result is measured using a single thermocouple and then recorded after 10 minutes.

II. CONCLUSION

The modeling of a cooling system based on peltier effect for a helmet has been done. The targeted cooling performance is achieved and future improvements will be carried out to enhance the cooling performance of the design. This will include the use of a higher power thermoelectric in the future design to improve its performance. However, a problem of higher demand from the power source needs to be successfully addressed first. More, a problem of noise created by the internal fan should be replaced by low noise fan.

III. REFERENCES

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