

Low Cost And Smart Cooling System For Tractor Cabin

¹Kulothungan.S, ²T.Lokesh, ³A.Ajith
¹Associate Professor, ²Student, ³Student
 IFET College Of Engineering

Abstract - The Tractor is one of the friendly automobile in agriculture field. It is Being used for various purpose of Agriculture. Since, It is Designed to operate maximum condition only in Off-roads such as agricultural lands, the Driver Doesn't feel Comfort in the Tractor & Also the heat from the Engine cause change in body temperature and the coolant gases used can Cause Several Throat diseases. In Present Cooling Systems, It uses "Condenser Coil Cooling", The cost Spend on this cooling system is too high. To Overcome this, We developed a low cost cooling system using "Peltier Module". This type of Cooling requires low power of 12V battery source. The power is taken only from engine. The Whole System is Controlled by means of Arduino Controller. The Temperature Raised is being detected and signaled via arduino controller, It turns on the cooling system and cooling gets distributed all over the cabin.

Keywords - Peltier module, Thermo-electric Air-Conditioner, Arduino Controller, Heat sink.

INTRODUCTION:

In thermoelectric materials, electrical energy can be directly converted into thermal energy and thermal energy into electrical energy. Direct conversion between electrical and thermal energy is possible because of two important Thermoelectric effects: the Seebeck effect and the Peltier effect. The Seebeck effect refers to the existence of an electric potential across a thermoelectric material subject to a temperature gradient. The Peltier effect refers to the absorption of heat into one end of a thermoelectric material and the release of heat from the opposite end due to a current flow through the material. Thermoelectric cooling, commonly referred to as cooling technology using thermoelectric coolers (TECs), has advantages of high reliability, no mechanical moving parts, compact in size and light in weight, and no working fluid. In addition, it possesses advantage that it can be powered by direct current (DC) electric sources, When a voltage or DC current is applied to two dissimilar conductors, a circuit can be created that allows for continuous heat transport between the conductors junctions this is the principle of thermoelectric air-condition. Air conditioning is a process of removing heat from a room or other applications. Many ways of producing a cooling effect by like vapour compression and vapour absorption air condition. These air conditioners are producing cooling effect by using refrigerants like Freon and ammonia etc. It gives maximum output but, one of the disadvantage is producing harmful gases to the atmosphere. The harmful gases are chloro fluoro carbon and some other gases are present. These types of air conditioners have wide range of applications. An air conditioner is a major home appliance, system, or mechanism designed to change the air temperature and humidity within an area. The cooling is typically done using a simple refrigeration cycle, but sometimes evaporation is used, commonly for comfort cooling in buildings and motor vehicles.

Cooling system-In Automobiles

The working of automotive air condition system is similar to all other air conditioning system. The refrigerant vapour from the evaporator is compressed to high pressure by the compressor. The compressor is driven by the engine through a belt drive. It is connected by a electromagnetic clutch witch serve engage and disengage the compressor required. A variable displacement AC compressor is sometime used to match compressor capacity to varying cooling requirement. Refrigerant pressure and temperature increases in the compressor and convert it into vapour form. This high pressure and temperature refrigerant vapour from the compressor then discharge to the condense, which is a heat exchanger situated in front of vehicle. In the condenser the refrigerant liberate heat and convert into liquid form. Sometime the ram air is not sufficient so an extra engine or electric driven fan is used to cool down the refrigerant. This cooled but high pressure refrigerant allow to pass form dehydrator to extract any moisture. Dry refrigerant liquid is then made to pass through expansion valve mounted at the inlet side of the evaporator. The expansion valve allows the refrigerant liquid to expand to low pressure in the evaporator. The process of expansion to low pressure makes the refrigerant to evaporate and thereby cool the evaporator. A sensing devices, called temperature tube signals the diaphragm in the expansion valve to vary orifice size depending upon the refrigerant temperature at the evaporator outlet, thus achieving automatic temperature control. The evaporator is similar in construction to the condenser. During the work all the parameters affecting Air quality are automatically optimized, according to the requirements of the specific bridge considered.

Available Non-Vapor-Compression HVAC Technologies

Researchers identified 17 non-vapor-compression technologies suitable for application in air conditioning. They are namely thermo-elastic system, membrane heat pump, evaporative liquid desiccant system, magneto caloric system, Vuilleumier heat pump, evaporative cooling unit, thermoelectric system, ground coupled solid desiccant A/C, absorption heat pump, sterling heat pump, thermo-acoustic system, adsorption heat pump, thermo tunneling, stand-alone solid desiccant A/C, standalone

liquid desiccant A/C, ejector heat pump, and Brayton heat pump. To identify the most promising potential technologies apart from vapor-compression system among above-mentioned technologies, a scorecard analysis was performed to evaluate each technology option based on the criteria of technical energy savings potential, non-energy benefits, and cost/complexity. Each criterion was assigned a weighting factor to reflect its overall importance, and ranking of each technology options was carried out in the list by their final scores.

BRIEF HISTORY OF AIR CONDITIONING SYSTEMS

The earliest attempt at developing a mechanical comfort cooling system for a vehicle is credited to William Whitely. In 1884, he suggested placing blocks of ice in trays under horse-drawn carriages and blowing air inside by attaching a fan to the axle.

In 1930, C & C Kelvinator designed a Cadillac owned by John Hamman Jr. of Houston, Texas with 0.37 Kw Kelvinator refrigeration unit powered by a 1.1 kW gasoline engine. Two flues on either side of the front seat took the air down to a fan, which circulated cool air throughout the passenger compartment.

In 1939, Packard marketed the first mechanical automotive A/C system which worked on a closed cycle. system used a compressor, condenser, receiver drier, and evaporator to operate the system. The only system control was a blower switch. The major problem with the system was that the compressor operated continuously (had no clutch) and had to have the belt removed to disengage the system which was generally during the winter months.

After World War II, Cadillac advertised a new feature for the A/C system that located the A/C controls on the rear parcel shelf, which meant that the driver had to reach the back seat to switch the system off. This was still better than reaching under the bonnet/hood to remove the drive belt.

In 1954–1955, Nash-Kelvinator introduced air conditioning for the mass market. It was the first A/C unit that was compact and affordable with controls on the dash and an electric clutch.

Later developments observed in succeeding years :

1. In 1955, general motors (GM) developed the first A/C and heating unit that was front mounted.
2. The popularity of auto A/C increased significantly and the number of installed A/C systems on the vehicle tripled from 1961 to 1964. In 1965, GM crossed the five million A/C unit production mark.
3. In 1973, cycling clutch orifice tube (CCOT) was developed that resulted in the compressor off for 1/3 of the time rather than continuously running, thus improving fuel economy.
4. Due to adoption of Montreal Protocol by United Nations in September 1987, the first major revolution in the A/C system occurred by replacement of R-12 to R-134a to eliminate the ozone depletion in stratosphere by introducing a refrigerant having chlorine replaced by fluorine in its composition.
5. Although the global warming potential of R134a was significantly lower than R12, 1300 vs 7800, it is still a substantial element for global warming. Europe has published F-gas final regulation to phase out R-134a from mobile A/C during 2011–2017. US California Air Resources Board Climate Change proposed regulation to phase out R134a from heavy equipment starting 2010 and from cars starting 2017.
6. Worldwide the research in this area is being focused to develop alternative refrigerants which can withstand standards of environmental acceptability, performance, and safety. Some examples are CO₂ and R152a. Additionally, parallel research is on progress to develop air-conditioning systems which can contribute to considerable fuel savings in addition to environmental acceptability.

FLOWCHART

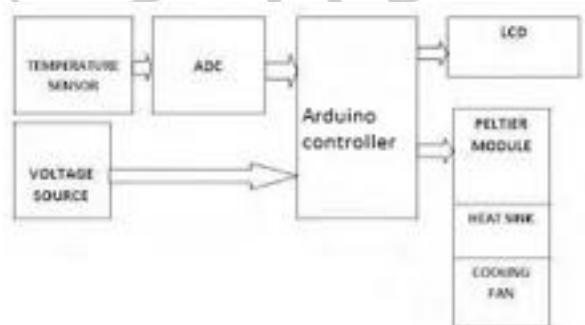


Figure Explaining the Flowchart

DESIGN DIAGRAM

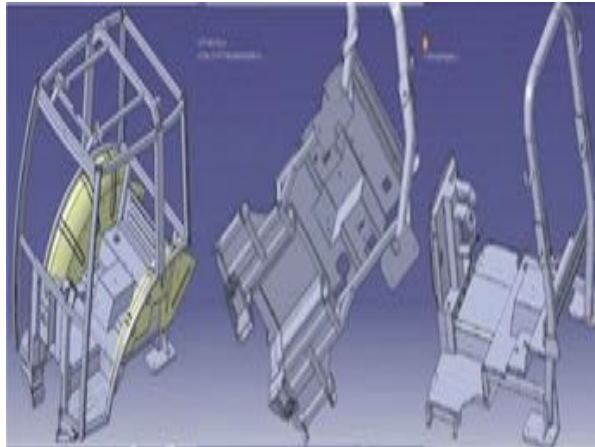


Figure showing Design Diagram of Tractor Cabin

PHOTOCOPY



Figure showing the Tractor Cabin Imparted with Cooling System.

CONCLUSION

Considering , the Driver's Comfortness this project get its design. A thermoelectric cooling system coupled with a gravity assistant heat pipe was designed and developed based on a theoretical model to enhance the heat dissipation from hot side of thermoelectric module. To figure out the performance of this proposed TEC system, an experimental apparatus was built in a climatic chamber. The cooling capacity, inlet and outlet air temperature through the thermoelectric module, and the temperature within the test box were measured, compared with a TEC system with heat sink.

REFERENCES

1. ElCosnier W., Gilles M., Lingai., An experimental and numerical study of a thermoelectric air-cooling and air-heating system. *international journal of refrigeration*, **31**,1051 – 1062,(2008).
2. Sujin., Vora and Seetawan., Analyzing of Thermoelectric Refrigerator Performance. *Proceedings of the 2ndInternational Science, Social-Science, Engineering and Energy Conference*, **25**,154–159,(2000) .
3. Wei., Jinzhi., Jingxin & Chen.,Theoretical and experimental investigation on a thermoelectric cooling and heating system driven by solar. *Applied Energy*, **107**, 89–97, (2013).
4. Riffat and Guoquan., Comparitive investigation of thermoelectric air- conditioners versus vapour compression and absorption air- conditioners. *Journal of Applied Thermal Engineering*, **24** , 1979-1993,(2004).
5. Riffat and Qiu., Design and characterization of a cylindrical water cooled heat sink for thermoelectric airconditioners. *International journal of energy research*, **30** , 67-80,(2005) .
6. Astrain D., Vian J.G., & Dominguez M., Increase of COP in the thermoelectric refrigeration by the optimization of heat dissipation. *Applied Thermal Engineering*, **23**, 2183–2200,(2003).
7. Shen., Xiao., Chen & Wang., Investigation of a novel thermoelectric radiant air-conditioning system. *Journal of Energy and Buildings*, **59**, 123–132.(2012).
8. Virjoghe., Diana., Marcel & Florin., Numerical simulation of Thermoelectric System. *latest trends on systems*,**15**(2) , 630-635,(2009).
9. Maneewan., Tipsaenpromand Lertsatitthanakorn., Thermal comfort study of a compact thermoelectric air conditioner. *Journal of electronic materials*, **39**(9), 1659-1664, (2010).
10. Manoj S., & Walke., Thermoelectric Air Cooling For Cars. *International Journal of Engineering Science and Technology*, **40**(5), 2381-2394,(2011).