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Thermoelectric Peltier Cooling with Temperature Controller

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***Abstract*- In this paper, a control system is designed for a cooling and Heat-retention system using Peltier device and Arduino. The main purpose of our project is to construct small cooler. And to it is not harmful to environment.**

Keywords: Peltier, device, temperature controller, heat sink

INTRODUCTION: In the past years, refrigerators used fluorocarbon gas generally. However, using such refrigeration is prohibited, because this may lead to disruption of ozone layers. Moreover environmental problems have been serious in recent years.Peltier element which does not generate any vibration noise and it does not use any gas for working. The Peltier discovered that one side generates endothermic and another side generates radiation when direct current is applied to two different metals and the hot side and cold side reverse when opposite direction of current is applied. This phenomenon is called Peltier effect.In this paper, we propose a temperature control system for ThermoelectricPeltier cooler.

A] Thermo electric construction.

The first thermoelectric phenomenon was discovered by French physicist meteorologist Jean Peltier.

The basic thermoelectric cooler unit is a thermocouple which consists of a p-type semiconductor element, or pellets. Copper commutation tabs are used to interconnect pellets that are traditionally made of bismuth Telluride-based alloy.

Thus, a typical thermoelectric cooler consist of thermocouples connected electrically in series and sandwiched between two alumina ceramic plates. The number of thermocouple may vary greatly from several elements to hundreds of units. When dc supply is applied across peltier cooler it causes temperature differential between TEC sides. As a result, one side of TEC gets cooling, while other side of TEC gets heating.

B] Peltier effect.

Thermoelectric coolers operate according to the peltier effect. The effect creates a temperature difference by transferring heat between two electrical junction.

A voltage is applied across jointed conductors to create answer electric current. When the current flows through the junction of the two conductors heat is removed at one junction and cooling occurs. Fleat is deposited at the other junction. The main application of the other peltier effect is cooling. However the peltier effect can also be used for heating or control of temperature. An every case a dc voltage is required.

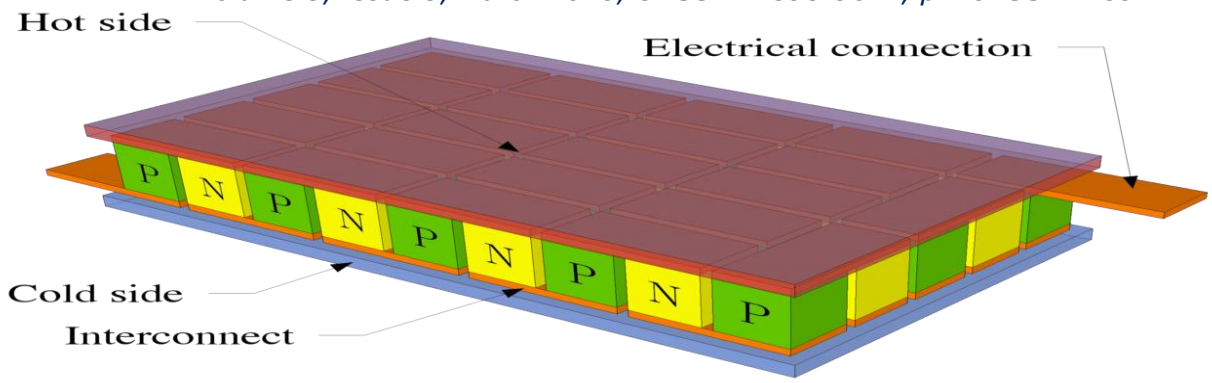

Fig.1 Peltier Effect

C] Heat absorption.

Cooling occurs when a current passes through one or more pairs of elements from N to P type; there is a decrease in temperature at the junction resulting in the absorption of heat from the environment.

The heat is carried along the elements by electron transport and released on the electrons move from a high to low energy state.

The Peltier heat absorption is given by

$$Qp=Pq$$

P is Peltier coefficient; Q is the charge that passes through the junction

A single stage thermoelectric cooler can produce maximum temperature difference of about 70 degree Celsius.

D] Simulation and Block Diagram

1] Block Diagram

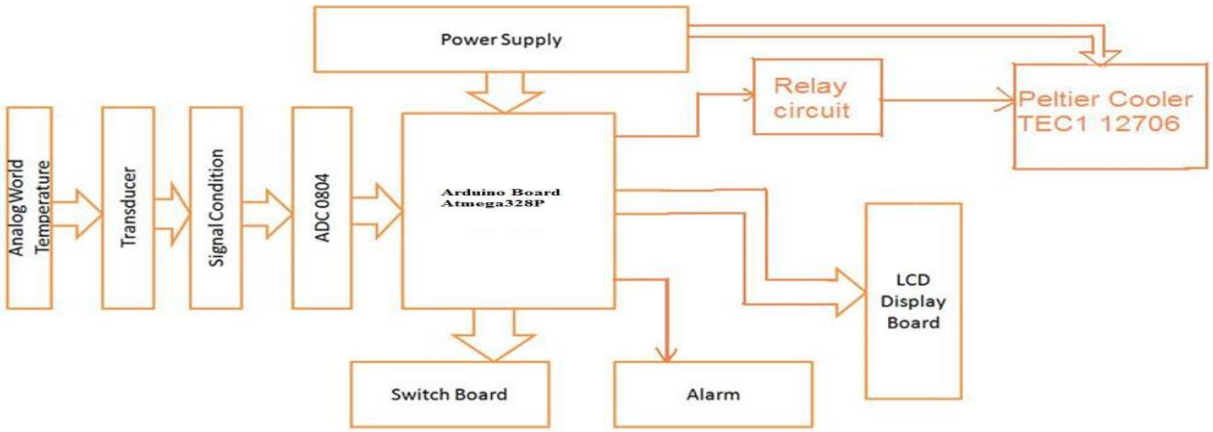

Fig.2 Block Diagram

This block diagram is about how to work this project. Arduino is the heart of the project. world temperature is sense by LM35 by applying voltage temperature is increase or decrease. And get the analog waveform . for converting analog signal into a digital signal with the help of ADC. Ardio compare the applying temperature and the room temperature. Variation of temperature and to get to voltage on LCD display. Alarm buzz when the temperature is above the voltage value. A relay is an electrically operated switch.

No movig parts make them very reliable.

Approximately 10^5 hours of operation at 100 degrees celsuis longer for lower temperature.

Ideal when precoise temperature below ambient.

Heat transport controlled by current input.

Able to operate in any orientation.

Compact size make them usefulbfor application where size or weight is a constraint.

2] Schematic Diagram

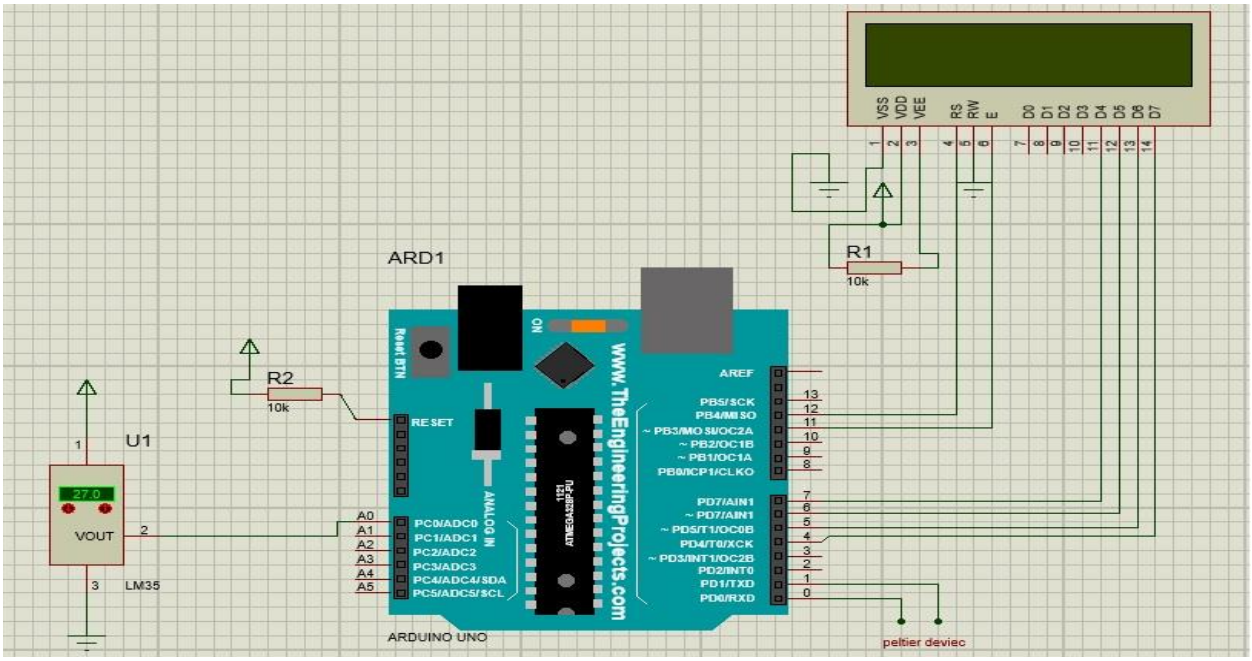

Fig.3 Schematic Diagram

Conclusion

As a conclusion to this project we have purchase some parts of our hardware and design the circuit. We are working on simulation process. We have also testing the equipments. By using just a peltier module operating at 12v DC and 2amperes of current, without any moving parts and without using any conventional cooling system like the vapour compression system or the air conditioning system we have been able to develop lower temperature conditions using our model of the peltier cooling device.

References

1) "Ultrathin Thermoelectric Devices for On-Chip Peltier Cooling"¬ Man Prakash Gupta, Min-Heesayer, SaibalMukhopadhyay, Member IEEE Published date: 9-Sept-2

2) "A Cooling and Heat-retention System Actuated by Peltier Device Considering FanMotor Control" TakafumiHatano, Mingcong Deng and Shin Wakitani, Published date: 18to22-Aug

3) An Approach for Heat Flux Sensor-Less Heat Inflow Estimation Based on Distributed Parameter System of Peltier Device" HidetakaMorimitsu, Eiichi Saito and SeiichiroKatsura, Published date: 7-10 Nov, 2010

4) "Improvement of Thermal Environment by Thermoelectric Coolers and Numerical¬ Optimization of Thermal Performance" Ning Wang, Xiao-Chun Li, Member, IEEE, and Jun-Fa Mao,Japan

5) "Experimental study on operator based nonlinear temperature control of an aluminum plate actuated by a peltier device" Mingcong Deng; Akira Inoue ; Yuichiro Tahara Published date: 20-22 Aug. 20

6) "Cooling control of aluminum plate with a Peltier device thermal process by using a robust right coprime factorization approach" Dongyun Wang, Lei Zhang, Guotao Zhang and Kai Yang.