Thermoelectric Refrigerator

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Abstract

As summers are approaching, everyone would need a refrigerator. In many cases, people can't afford regular size refrigerator. Especially student in hostel can neither afford it nor would take to carry such big appliance along with them when they leave. Also these refrigerators consume power up to of 500W, which is not allowed in most hostels.

Presented here is a Thermoelectric Refrigerator that can easily be built in spare and cheaper components. The refrigerator consumes around 60W of power. There is a control system in a refrigerator that monitors the temperature and size is small, so it can be kept quite comfortably in a small room .It is a better product for common people as it is cost effective.

Index Terms: Thermoelectric module, seeback effect, silicon sealent.

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1INTRODUCTION

Thermoelectric Refrigerator is a cooling product. Mechanical part of refrigerator consist of a thermocol box of size 60cm x 60cm x 60cm, aluminium metal sheet, air pump, CPU heat-sink, Direct current electric fan, thermoelectric module,switch mode power supply and a relay. The working is controlled by microcontroller ATMEGA8.

The thermoelectric module sucks heat from the water inside the refrigerator box and keeps cooling it down. On thermocol box we fix the aluminum sheet at one broader side. Above this we will fix the thermoelectric module which has two sides, one side is cool side contact with metal sheet and other side is hot. Above this we will attach a heat-sink, which throws out heat outside the thermocol box, and the electric fan is used to cool hot side of thermoelectric module.

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1.1 ATmega8 CONTROLLER

The controller used here is a member of AVR microcontroller family, it is **ATmega8**. This member has many features similar to that of **ATmega32**. But it has reduced number of features and capabilities, yet it has enough features to work with.

Memory: It has **8 Kb** of Flash program memory (10,000 Write/Erase cycles durability), **512 Bytes** of EEPROM (100,000 Write/Erase Cycles). **1Kbyte** Internal SRAM
I/O Ports: 23 I/ line can be obtained from three ports; namely Port B, Port C and Port D.

Interrupts: Two External Interrupt source, located at port D. 19 different interrupt vectors supporting 19 events generated by internal peripherals.
Timer/Counter: Three Internal Timers are available, two 8 bit, one 16 bit, offering various operating modes and supporting internal or external clocking.
SPI (Serial Peripheral interface): ATmega8 holds three communication devices integrated. One of them is Serial Peripheral Interface. Four pins are assigned to Atmega8 to implement this scheme of communication.
USART: One of the most powerful communication solutions is **USART** and ATmega8 supports both synchronous and asynchronous data transfer schemes. It has three pins assigned for that. In many projects, this module is extensively used for PC-Micro controller communication.
TWI (Two Wire Interface): Another communication device that is present in ATmega8 is Two Wire Interface. It allows designers to set up a commutation between two devices using just two wires along with a common ground connection, As the TWI output is made by means of open collector outputs, thus external pull up resistors are required to make the circuit.
Analog Comparator: A comparator module is integrated in the IC that provides comparison facility between two voltages connected to the two inputs of the Analog comparator via External pins attached to the micro controller.
Analog to Digital Converter: Inbuilt analog to digital converter can convert an analog input signal into digital data of **10bit** resolution. For most of the low end application, this much resolution is enough.

1.2 CODING

The coding is going to be done in java. The basic logic is that the temperature of water is sensed through temperature sensor IC which is interlaced to the microcontroller's ADC pin 24. When the temperatures reaches 9 degree or above, relay RL1

gets energized and switches on the thermoelectric module is switched off .This is the logic used in code

2. THERMOELECRIC MODULE

Actual cooling done by thermoelectric module TEC1-12706 .It works on the principle of seebeck effect. According to the principle when current is passed through two dissimilar metal junctions, one junction is kept heated while other junction kept cool a voltage is developed across junctions. The module is 40x40x36mm in size. Although it operates over 4V-16V, recommended operating voltage is 12V. Depending on the temperature on hot side, TEC-12706 is capable to transferring 50-60 Watts of heat. Outer construction of this module is ceramic and metal junctions are inside along two surfaces. As shown in fig. 3, the side on which model number is printed is the hot side and other one is cold side.

Polarity of voltage is very important; red wire should be connected to 12V and black to ground. If the polarity reversed, hot and cold sides get reversed as well. Heat produced on the hot side must be dissipated. Otherwise the module will heat beyond limit. We can use any heat-sink such as the one used for CPU in a computer. Temperature of hot side has direct effect on how much heat the module can suck from the cold side. Here we have mounted the DC fan over heat-sink to dissipate heat more efficiently

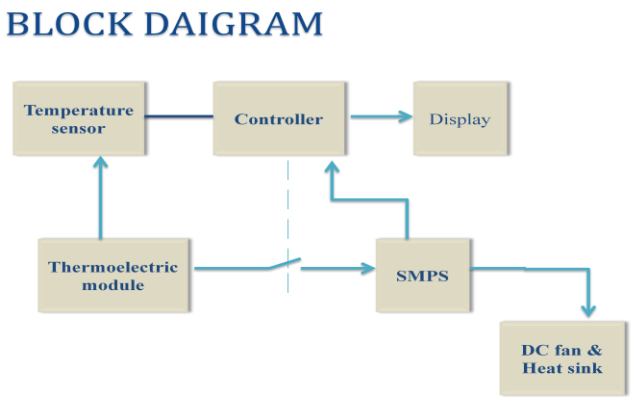

Fig1

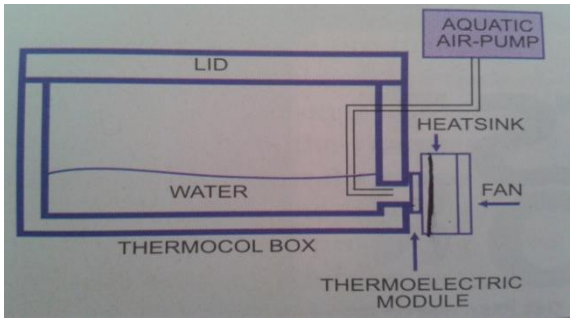

Fig 2 Architecture of fridge

3. CONCLUSION

The units of energy production can be developed in the various regions by using thermoelectric modules. In these days the society face the energy crisis but also the harmful effects of pollution. The thermoelectricity is a “Green Technology” to generate electricity without any harmful effect. The educational institutions, furnace regions, metro cities, industrial areas, universities and other locations can be selected for the establishment of such energy centres where the waste heat can be easily available and can be recycled after conversion to the same system. Thermoelectric cooling devices can be applied to industries, buildings of hot regions and to the houses in summer.

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