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Portable Air Conditioner based on Hybrid Method of Peltier Effect Cooling and Liquid Based Cooling

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Abstract: ***All the researches done on peltier AC's are purely based on the peltier effect. The model of AC developed here is based on a new approach of hybrid cooling system utilizing both peltier effect and liquid based cooling. It is a compact system with very light weight components used in it and is also very easy to use. It is a portable design with a new efficient cooling method.***
Keywords: ***Peltier effect, Stable Cooling, Hybrid Cooling, Portable A.C., Cost effective***

I. INTRODUCTION

Currently, there is no Peltier based Portable A.C. in market which allows automatic temperature control. Most of the A.C. in the market are very big in size and are not easy to carry while travelling.

So, the objective of this project is to make a Portable A.C. which is compact, lightweight, and cost-effective air conditioner. It gives precise and stable cooling. This hybrid system is more efficient than the conventional A.C. [3] It also requires less maintenance.

Normal Air Conditioner which are based on compression unit lead to global warming. This Air Conditioner design is based on the Peltier effect and it does not contribute towards global warming[1]. The vibrations created by the moving components (like compressor, big fans) adds up to the maintenance cost and results in reduced life of the conventional A.C. In this A.C design the key component used is Peltier module which results in Peltier Effect[1].

Using this effect, the desired temperature is achieved by the cooling side of the Peltier module which reduces the temperature of the water container[4]. Due to this the temperature of water inside the container drops up to the given input value. The controller inside the Portable A.C. continuously measures the current temperature at the cooling side and compares it with the given input value by the user. An encoder is used to give necessary inputs to the A.C. Cooling fans are placed on the heating side as well as on the cooling side.

The fans on the heating side reduces the temperature of the hot side of the Peltier module. This helps in heat dissipation and allows the A.C. to reach lower temperature values. The fans on cooling side suck the air from the surroundings and pass it from the cold region and then throws it out of the A.C. using another cooling fan. In this way a very simple and cost- effective method results in achieving extremely low temperatures.

II. LITERATURE REVIEW

The conventional A.C. requires moving components like compressor which adds up in the maintenance of A.C. The vibrations created by the moving components (compressor) results in reduced life of the conventional A.C. In the Peltier A.C moving components like compressor are not needed which would not create any vibrations. Hence the maintenance and life of the Peltier A.C would be more as compared to the conventional A.C.

In conventional A.C. working fluid is required which have a chance of leakage. Freon is used in the conventional A.C. which contributes to depletion of the ozone layer, whereas Peltier A.C. doesn't contribute to it. Due to components like compressor the conventional A.C. becomes more bulky than the Peltier A.C.

Currently, there is no Peltier based Portable A.C. in market which allows automatic temperature control. Conventional ACs are difficult to carry due to the bulky components used in it. Most of the A.Cs in the market are very big in size and are not easy to carry while travelling. The objectives of the proposed projects are to design compact, lightweight, and cost effective air conditioner ,to design AC which do not contribute to global warming, to design AC which gives precise and stable cooling, to design AC which requires less maintenance.

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III. BLOCK DIAGRAM

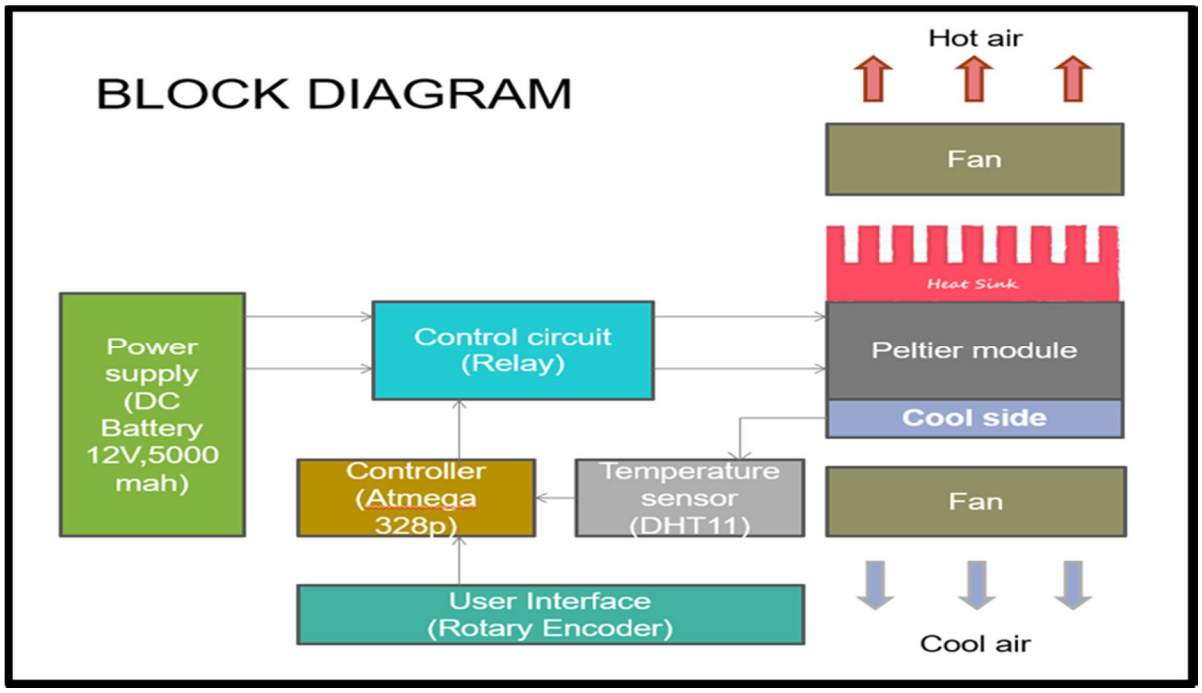

Figure 1: Block Diagram of Portable Air Conditioner

IV. WORKING

A. In the system design our ultimate aim is to maintain cool side of Peltier module and AC at desired temperature.

B. By using temperature sensor, we are monitoring cool side temperature and comparing it with desired temperature using controller. The sensor used here is DTH11 sensor. It can measure the temperature as well as humidity. Inside it there is thermistor to measure the temperature. In it the humidity is measured by the moisture level.

C. According to that controller will give feedback signal to relay circuit and it will control the supply to Peltier module. Atmega 328p is the controller which is used here. Atmega 328p has 28 pins in total.

D. By using user interface user can set desired temperature and also monitor actual temperature. Rotary encoder is used as the user interface. The user gives the input by the rotary encoder.

E. An encoder is used to take inputs from the user. The temperature which is set by rotary encoder is the temperature at which the cooler needs to cool the room.

F. Heat sink absorbs heat energy from hot side of Peltier module and dissipates it into atmosphere. It absorbs the heat and dissipates it in the surrounding. It is made up of aluminum and copper.

V. ALGORITHM

1) First the controller circuit of ATmega 328p is turned on by applying supply to it.

2) Then inside the code as mentioned all the devices connected to the controller are initiated by setting up communication through some initial commands.

3) First LCD is initiated.

4) Then the DHT11 sensor is initiated.

5) To set up the temperature for the room set up the temperature value for the AC by using rotary encoder. It is done by the user.

6) Check if temperature value is set.

a) If set compare the input temperature value with the current temperature value and operate the relay accordingly.

- If Measured Temperature less than or equal to Set Temperature then turn the relay off.
- If Measured Temperature greater than Set Temperature then turn the relay on.

b) If not set then return to step 5.

7) If reset switch of encoder is pressed, then return to step 6.

VI. FLOWCHART

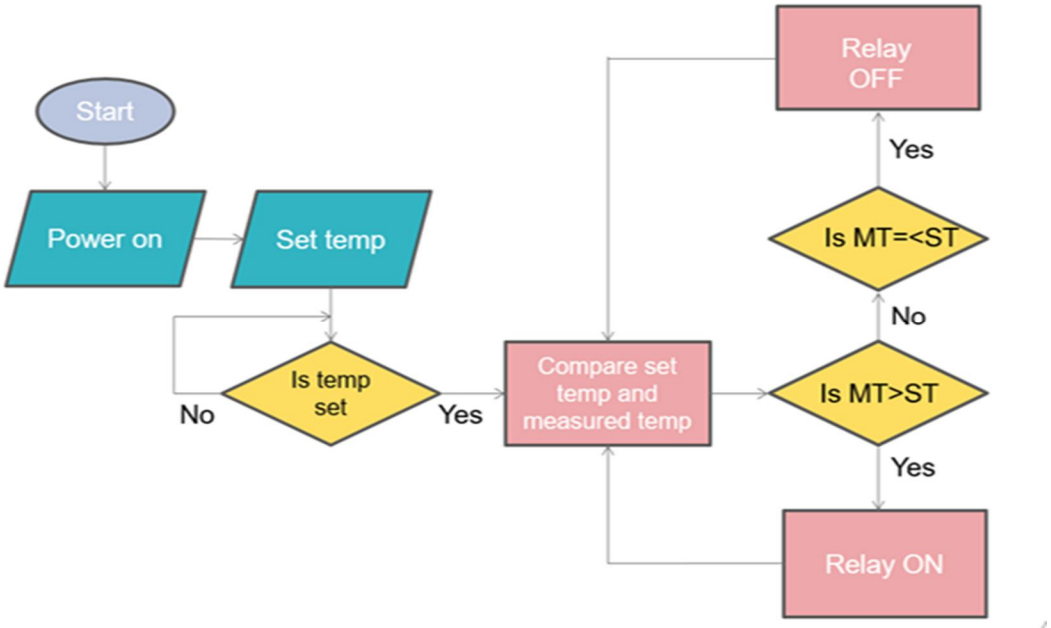

Figure 2: Flow Chart

VII. SIMULATION AND RESULTS

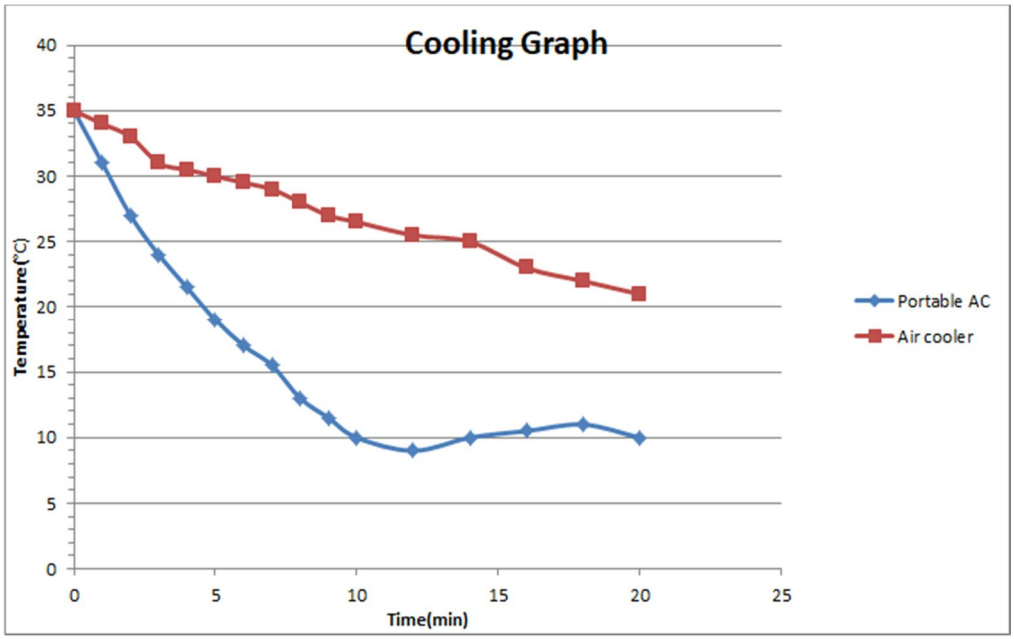

Figure 3: Comparison of conventional cooler and proposed system

Above proposed system is simulated in Proteus software for the electronic circuit. System successfully achieved the desired temperature drop as per given inputs. The timer function used here has precisely controlled the peltier module to achieve stable temperature.

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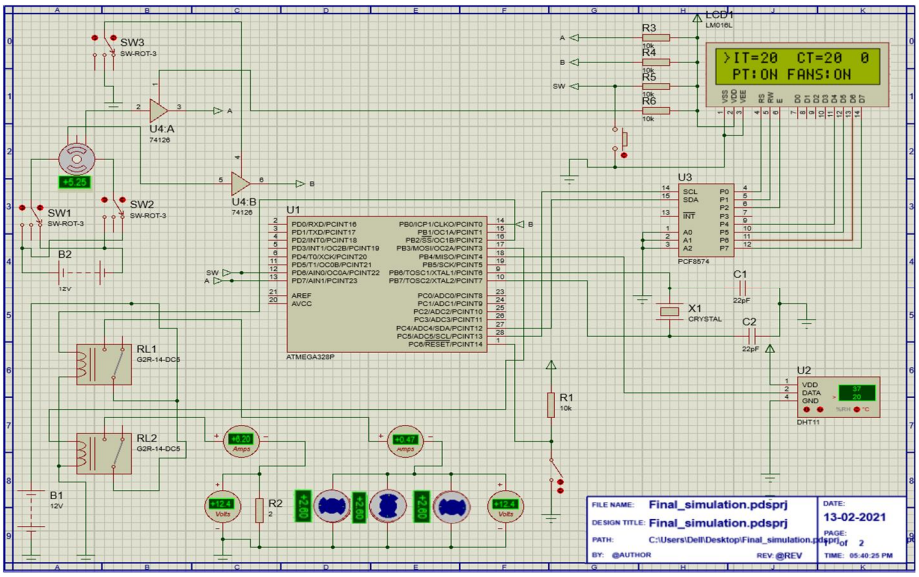

Figure 4: Simulation

VIII. ADVANTAGES OF PROPOSED SYSTEM

A. This AC consumes less space.
B. Cost of the AC is less.
C. Highly precise and stable cooling.
D. Long life.
E. Low maintenance.
F. No risk of leakage of gases.
G. Does not contribute to Global Warming.

IX. APPLICATIONS

A. It can be used for cooling in Polymerase Chain Reaction (PCR) Techniques.
B. It can be used to maintain the temperature in laser systems.
C. It can be used for domestic cooling.
D. It can be used in vehicles for cooling.
E. It can be used for cooling small rooms.

X. CONCLUSION

Peltier module based air conditioners can be an optimum solution when there is a need to cool an object to below the ambient temperature or to maintain an object at a specific temperature. This AC gives precise cooling compared to vapor-compression based AC. This AC consumes less space and the manufacturing cost is also reduced. It can act as a good solution for portable cooling up to very low temperatures with minimum components. It gives instant cooling as compared to other portable coolers present in the market. This method provides stable cooling for a long time in a single charge of the battery.

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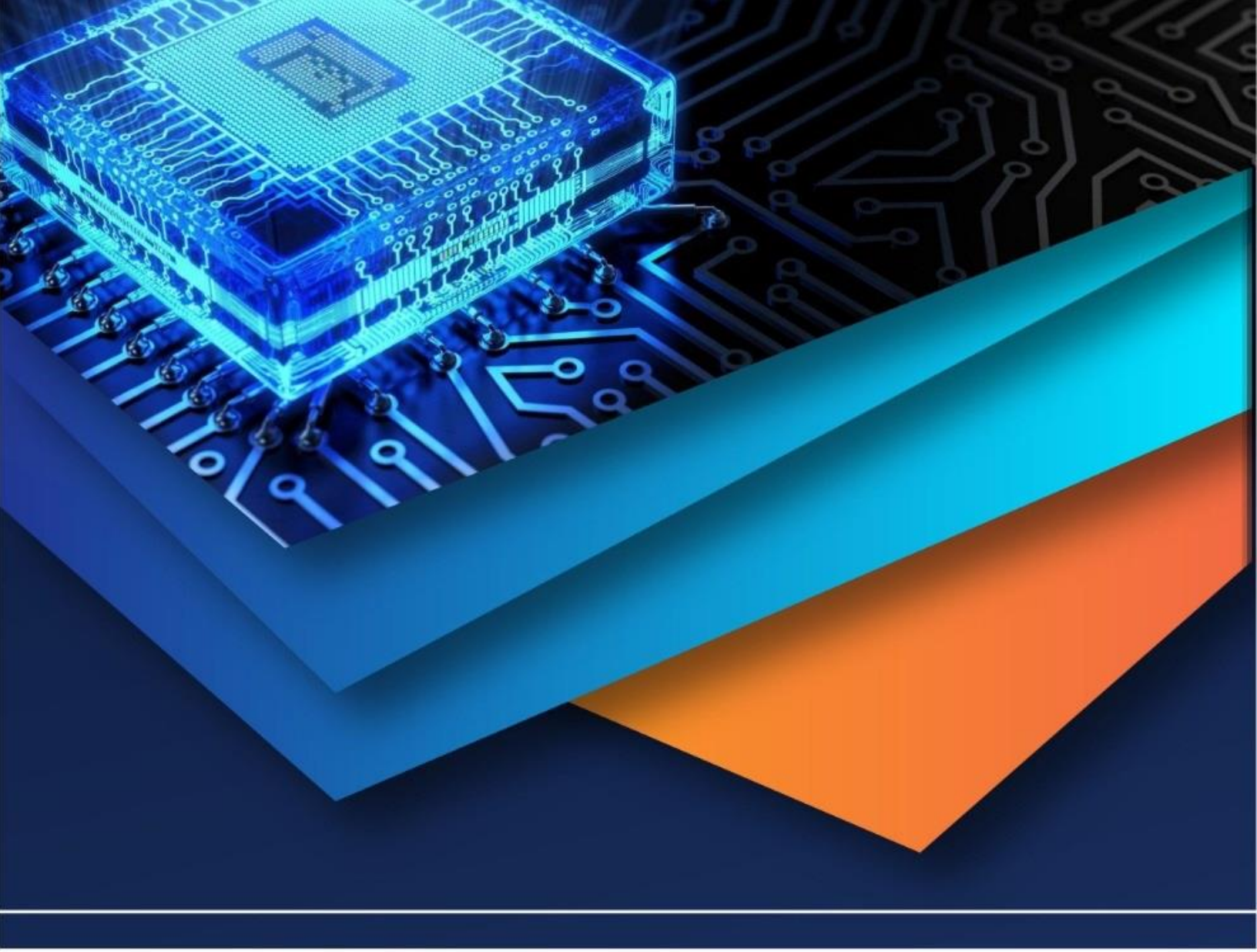

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