Compact Air Conditioner

Prof. Manjunatha Y R,[1.1] Madhu Varun Reddy K A,[2*] Samyak S,[2] Sriramprasad S[2]

[1,1]Assistant Professor,[2] Students
[1] Department of Electronics and Communication Engineering, S J C Institute of Technology, Chickballapura, India,
[2], Department of Telecommunication Engineering, S J C Institute of Technology, Chickballapura, India.

[1] manjoo.yr79@gmail.com

Abstract

Refrigeration and Air conditioning results in global warming and ozone depletion, caused by the release of chlorofluorocarbons. It is also one of the major consumers of electrical energy which causes the energy shortage and also the people in most of the places feel uneasy due to temperature variations, people need their thermal comfort but it cannot be compensated by the conventional Air conditioners because they are not mobile. The sudden change in environmental conditions may also leads to major health issues. The proposed system is the best alternate of conventional cooling techniques with temperature monitoring Bluetooth based device which includes thermal energy that uses the peltier effect which has the ability of cooling the specific area .This system enables us to sense both body temperature, environmental conditions and controls the temperature either manually or automatically. The overall operation is to measure the temperature of the body and environmental conditions that displays on LCD module and mobile screen through Bluetooth module. The cooler and heater will provide either cooling or warming effects to the users.

Keywords: Peltier effect, Air conditioning, Thermo-electric effect, Cooling system

1. INTRODUCTION

Air conditioning is a process that controls various parameters such as humidity, temperature and air motion depending on the applications. It provides cooling and heating of air. Conventional refrigerators and air conditioners fulfil the need but they are expensive and not affordable to poor people. It produces harmful gases to the atmosphere and it is unable to provide the thermal comfort to everyone. The peltier based air conditioning systems have very low manufacturing cost and less maintenance. The thermoelectric coolers works on Peltier effect [4]. The thermo electric coolers act as solid state heat pumps. The different type of semiconductors has different peltier coefficients. The array of thermoelectric modules is arranged in series electrically and in parallel thermally. Cooling occurs when current passes from n-type to p-type. The heat is carried through transport of electrons and on opposite side heat is released. It provides thermal comforts based on the requirement by providing the hot or cold effects. It is an efficient device that can be operated by any smart phone with Bluetooth. Now a day's People are very busy and these automatic devices provide them the desired environment by sensing the temperature of the body and surroundings and provide the suitable comfort [6].

2. Experimental Details

Primarily there will be a peltier module that works on peltier effect. The cold side of the module is inside the box and hot side of the peltier module is attached with heat sink. The three-way switch is used to change the polarity of the supply. By changing the polarity of power supplied to the module, we can change the cold to hot side and hot to cold side simultaneously. Portable batteries are used as supply to peltier module to obtain the temperature changes of the peltier

module. The LM35 senses the temperature of the surrounding environment and sensed value of temperature is applied to controller through A-D Converter. After processing the data received the values are displayed on the LCD and also on android phone. The temperature can be controlled using Bluetooth terminal application in the Android phone via Bluetooth.

Description of block diagram:
The compact air conditioning system consists of two sections: Peltier system and android phone

Peltier system:
- The Peltier modules are commonly called as Thermo Electric Coolers (TEC's), it can be used either to produce heating or cooling effect shown in figure 2
- It creates a temperature difference between the two sides. One side gets cool and the other side gets hot.
- When the DC current flows through the device, the Peltier module brings heating and cooling effect.
- The hot side is connected with the heat sink, so that the heat remains at surrounding temperature, while the cooler side goes below the room temperature.
- More number of Peltier modules are connected together in parallel for lower and higher temperature
- To that Peltier device a boost converter has been designed in order to supply desired current which is required for its operation.
- It senses the surrounding temperature in the analog form and is given to Arduino where it is converted to digital form and displayed on the LCD module.

Android phone:
The temperature can be controlled using Android phone with Bluetooth Terminal installed on it. We can send signal to Arduino using Bluetooth terminal in the form of commands. By using Bluetooth terminal application we can control temperature

3. RESULTS & DISCUSSION

Temperature Monitoring Bluetooth Controlled Module:
The LM-35 sensor is used for sensing the temperature changes and then sent to the smart phone using Bluetooth device. This system provides easy monitoring of temperature data on a smart phone. The receiver's side consists of the smart phone. The Peltier module with heat sinks and cooling fans are connected to the circuit that reduces the surrounding room temperature from 30 deg C to 3-4 deg C.
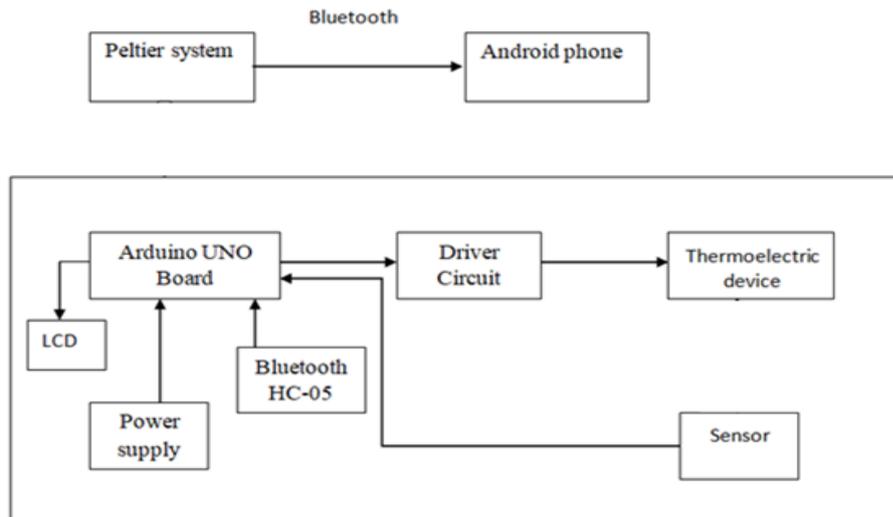The system consists of LM- 35 temperature sensor, Bluetooth module. The climatic conditions are sensed by the temperature sensor continuously and it will display on the mobile screen. Bluetooth module is used to communicate Arduino with mobile application. The LM35 temperature sensor continuously monitors the surrounding temperature and gives the data to arduino. The arduino takes the analog data as its input and gives the digital data to the LCD module. The LCD module displays the current temperature every second. The peltier module one side produces heat and the other side it produces cooling effect. If the polarity changes the heating side produces cooling and the cooling side produces heating and it can be operated by three way switch
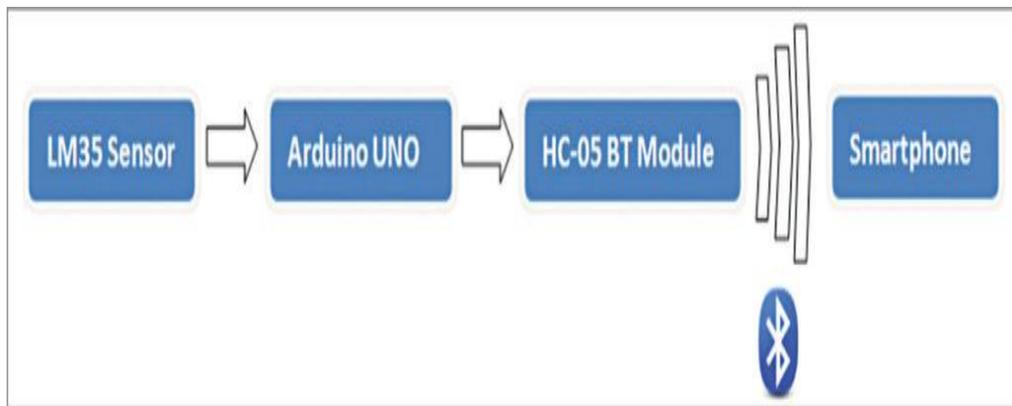
Bluetooth and android phone:
The Bluetooth module is connected to a microcontroller board and also connected to smart phone. Integrated Development Environment software allows users to write code for the application and connects to Arduino to upload code.

- The Arduino coding is programmed in the following manner.

- The code starts with defining of variables and declaring of functions.
- The main loop of the program will takes the input as a surrounding temperature from LM35 sensor in the binary form.
- The Arduino is responsible to convert it from binary to decimal form.
- The LCD module exhibits the current temperature which is sensed by the LM35 sensor which was given as an output by the Arduino.
- If the conditional statement is true that is, if the temperature is greater than set value, the cooling effect will be started with the help of Peltier module, else it goes for another conditional statement.
- If this conditional statement is true that is, if the temperature is less than set value, the heating effect will be started by connecting heat sink on one side of the Peltier module, else it goes for the main statement.
- After the heating/cooling effect, it enters into the main loop. The one side of the peltier heats up, if we want chillness after some time we need to change the polarities of the peltier.
- This change of action is done by three way switch and this is done because the battery consumes less current.
  This system can work automatically or we can set manually also, according to the user requirement.
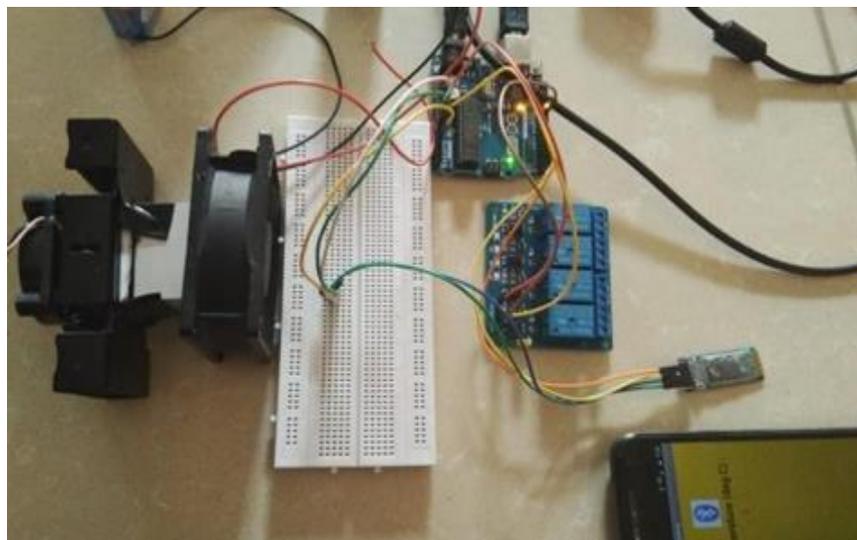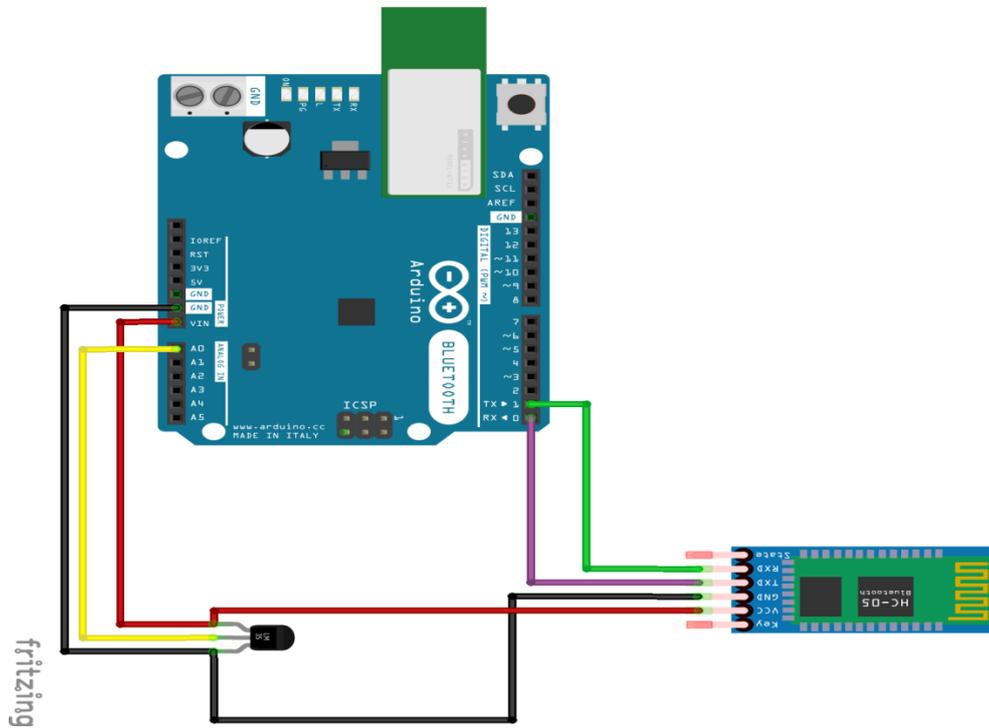
Figure 1. Block Diagram

Figure 2. Hardware-Software Interfacing
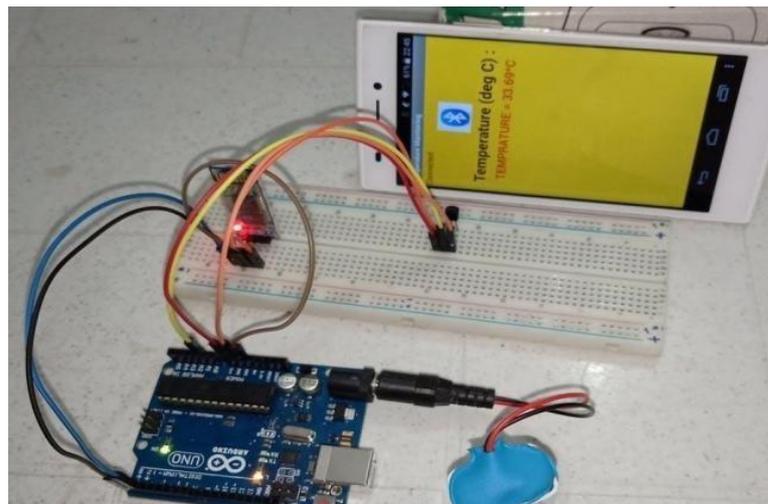
Figure 3. LM-35 temperature sensor, HC-05 Bluetooth module connected to   arduino to display the temperature on the android phone.

Figure 4. 3D Model design

Figure 5. Hardware implementation

Figure 6. Hybrid system(compact air conditioner)

4. CONCLUSIONS

The temperature controlled cooling systems with monitoring facility using Bluetooth technology is highly reliable and efficient than other cooling systems. This can be used like a portable refrigerator in the medical area for storing blood and pharmaceuticals. Though it can cool a specific small area, by increasing the number of peltier plates it's efficiency can be improved. In portable conditioners the temperature can be increased/decreased in less time. These peltier based air conditioning systems will be a alternative for existing air conditioning systems by enhancing its performance. Hence it is better to have a cooling system that can be used for refrigeration and air conditioning ie, hybrid systems to reduce the amount of energy consumption. These low cost compact air conditioning systems are very useful to poor people to store the medicines.

Future Enhancements

There are further enhancements that can be added to the prototype for further development.
- It can be further enhanced with the increasing peltier modules.
- The prototype can be designed like a peltier jacket to assist on extreme hot and cold conditions.
- Though it acts as a portable hybrid system in remote areas for both cooling and refrigeration, its efficiency can be précised by enhancing the thermoelectric cooling technology.

Acknowledgments

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