



MINI PORTABLE REFRIGERATOR WITH AUTOMATIC DOOR

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Abstract: Refrigerators are considered to be an important household item that falls under the category of cooling appliances. The basic structure of the refrigerator consists of a thermally insulated compartment which through a proper mechanism lowers down the temperature inside it and transfers the heat from inside to the external environment. As it keeps the temperature lower so it is used to keep and store the food items which can be spoiled at ambient temperature. Refrigerators in almost all the sizes are available at the market but they are restricted and limited for indoor usage only as they require electricity and are large. But presently, people are more inclined towards outdoor activities and they need to have a refrigerator to keep the essential items saved from spoilage and wastage. So, this project has designed a mini refrigerator that is powered through the batteries and is portable which can be easily used outdoors as well.

Index Terms – Arduino, Sensor, Refrigerator.

I. INTRODUCTION.

This chapter introduces the project. It further states the objectives of the project and specifications of all the related equipment and electronics to be used in its making. Lastly, it states the standards that are utilized while working on this project. Mini refrigerators are small in size, they can be kept anywhere and yet won't consume huge space. They are most suitable for small office spaces, dorm rooms, bedrooms. People with limited space often consider replacing a full-fledged refrigerator with a mini-fridge. Most students have snack, and some regularly eat one or more meals each day in their room. Unless your diet consists of all packaged foods, you'll need a little fridge to store your perishable food and drinks. Refrigerators also have other uses like preservation of caught fish. This is employed extensively by large fishing trawlers that are out at sea for months or even big trucks that transport frozen fish. Other uses include preservation of bodies in the morgue and storage of some volatile chemicals just to name a few. There are the big industrial freezers that are of bigger volume and can maintain much lower temperatures than the regular refrigerators in households and also the small mini

refrigerators that have a wide variety of uses because of their portability.

II. LITERATURE SURVEY

It states the research and review on literature regarding the related projects and performs a comparative analysis. It also states how this project differs from those mentioned in the literature review. Here are some literature surveys on this topic : In [1], the paper explains Semiconductive materials used to create Peltier thermoelements. They have P-N interactions there, thus this indicates that. Actually, they are a series connection of several P-N connections. Additionally, they are severely doped, which refers to the presence of particular additions that will increase the amount of extra or missing electrons. In [2] , the paper explains about propane is used in domestic fridges and freezers. Propane's operating pressures and temperatures are well suited for use in air conditioning equipment, including chillers. In [3] , the paper explains maximum temperature difference between the hot side and the cold side of a TEC.. The TEC will have two wires coming out of it, if a voltage is applied to those wires, then a temperature difference across the two sides is achieved, if the polarity is reversed on the wires - then the temperature difference is also reversed. In [4] , the paper explains the challenge of managing the heat produced by electronic parts never goes away. Microelectronic circuits that incorporate hundreds or even millions of transistors have largely replaced the discrete transistor era and its high-potential low-power circuit designs. In [5] , the paper explains an open source programmed circuit board called Arduino can be used in a wide range of makerspace projects, both straightforward and intricate. This board has a microcontroller that may be configured to recognise and manage physical things. The Arduino is able to communicate with a wide range of outputs, including LEDs, motors, and displays, by responding to sensors and inputs. In [6] , the paper explains tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family. In [7] , the paper explains the only difference between infrared radiation and the visible radiation that our eyes can see is that infrared radiation has a wider spectrum of wavelengths. We can distinguish between different wavelengths of visible light because they appear to us as different colours. The wavelength of red light is longer than that of blue light, while that of the majority of other colours lies in the middle.

III. IMPLEMENTATION

A hydraulic oil cooler, for instance, will remove heat from heated oil by utilising cold water or air. A heat exchanger is a device that transfers heat from one medium to another. As an alternative, a swimming pool heat exchanger warms the pool water using hot water from a boiler or a solar heated water circuit. From the below Fig 4.1 schematic diagram we can see the implementation of Peltier Module in Refrigerator.

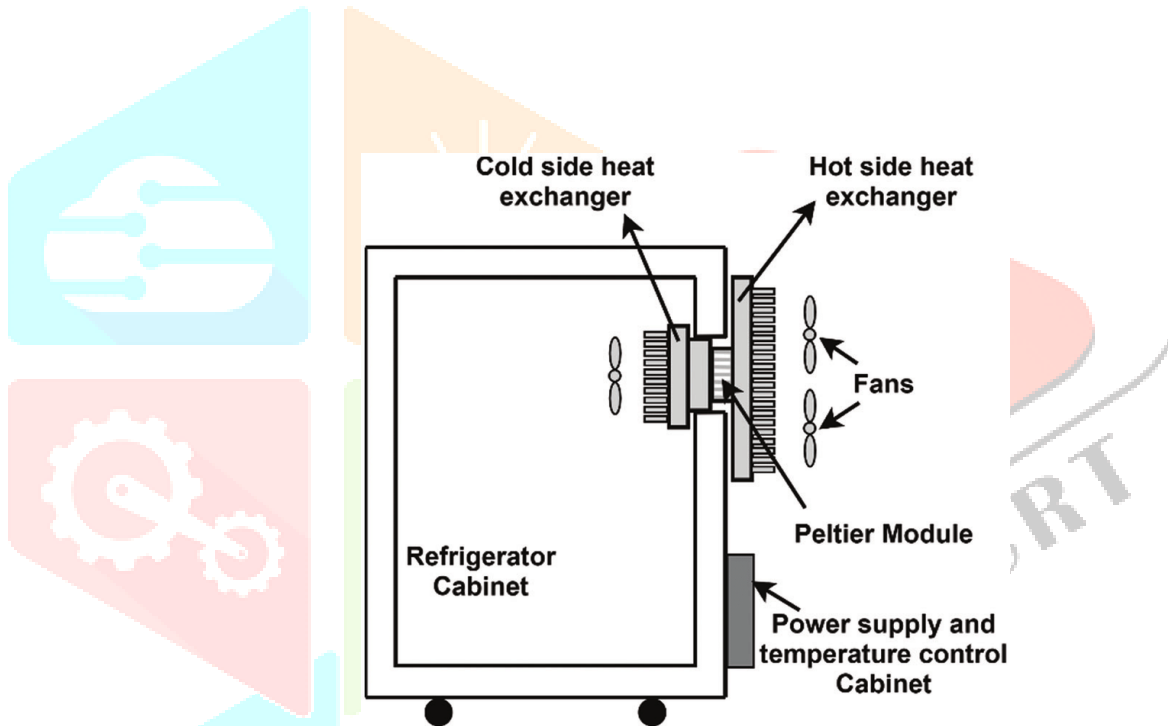


Fig: SCHEMATIC DIAGRAM OF THE PROJECT

A . Cooling Process

The idea underlies the operation of a refrigerator, and fridge: pumping heat from one system to another while thermally isolating both systems to cause the pumped heat from one system to cool. The other system, meanwhile, continues to heat up. Typically, the device functions as a radiator, transferring heat to a washbasin, which is frequently the environment. As a result, the target system's heat is transferred to the surroundings.

The processing steps:

- The fridge is provided power supply from 12V DC 7-5 amps battery .
- To start the fridge, the switch on the fridge is turned on or the wire should be connected by soldering incase of no switching used.
- When the switch is turned on the Peltier devices and Pump start functioning.
- The water from the sump is pumped to the upper smaller rectangle and directs to the hotter side of the Peltier (P1).
- The hot side of the second Peltier is cooled by the smaller rectangle and directs to the hotter side of the Peltier (P1).
- The hot side of the second Peltier is cooled by the sump.
- Cold sides of the both Peltier transfers the chilling effect to the evaporator.
- The Peltier thermoelectric Device will be so arranged in a box with proper insulation system and heat sink so

that efficient cooling takes place at all the time.

- To turn off the fridge switch can be turned off.

B. IR sensor and Servo motor processing

The processing steps :

- Fix the rotating shaft of the servo motor with the cardboard gate such that it can rotate freely.
- When you enter inside the range of the IR sensor then the servo motor will start rotating and the door will open automatically.
- The door will also be closed automatically by itself after a time delay of two seconds.
- You can increase the time delay as per your requirement by modifying the code which is given below.
- The red LED will glow when the door is closed successfully and the green LED indicates that the door is going to open.
- You can also check the refrigerator using Arduino and IR sensors made by us.

C . Arduino processing and Pin connections

The processing steps :

- Take a servo motor and connect its VCC wire with the 5 volts pin of the Arduino.
- Then connect its negative wire with the GND pin of the Arduino.
- Join the signal wire of the servo motor with the digital-9 pin of the Arduino.
- Connect the VCC pin of the IR sensor module with the 5 volts pin of the Arduino and the GND pin of the IR sensor module with the GND pin of the Arduino.
- Attach the OUT pin of the IR sensor with the digital-7 pin of the Arduino. Now take two LEDs and connect their negative legs with the GND pin of the Arduino via a 220 ohm resistor.
- Join the positive leg of the red LED with the digital-11 pin of the Arduino.
- Connect the positive pin of the green LED with the digital-10 pin of the Arduino.

Reference Flowchart for the Program:

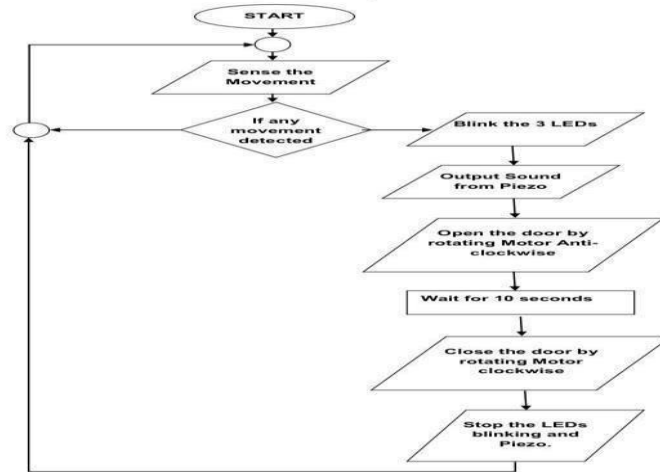


Fig : Arduino IDE flowchart

IV. CONCLUSION AND FUTURE WORK

While working on the project, we learned many new things and developed the skills required to conduct research, practical work, and report writing. As a result of all these learnings, we became more confident in our field. The project of manufacturing a mini-refrigerator was very interesting to perform as we set the objectives which were quite realistic like we wanted to develop a refrigeration system that could be used to keep things cool while traveling or doing outdoor activities while keeping their size small and portable and we achieved this task. We observed the Peltier effect and vapor compression effect practically. The refrigerator worked well but it has a limitation that it took much time to cool and besides that, it remained cool for a longer time. It was not although energy-efficient to the extent we wanted it to be. In addition to this, we learned many other skills like marketing, buying the essential things while considering the budget, working in a group, and communicating with all the parties involved in the projects. It gave us a vast idea of the energy conversion system and gave us a great understanding of the manufacturing process. We learned 3D modeling Software and grabbed the knowledge of how to convert your CAD model into the practical. The developed refrigeration system is functional as per the batteries and electricity or power availability which makes it restricted in use so new research and project can be made while considering other options like heat, solar system, etc. The project can be made in a better manner if it is made through a thick and high aluminum pipe material as it would speed up the heating process of the refrigerator so that it may become cool earlier than now. It is also recommended to see the alternates for compressors as this would reduce the cost of the system and would increase its capacity .

REFERENCES

- [1] "PCB Heaven – Peltier Elements Explained". *PCB Heaven*. PCB Heaven. Retrieved 1 May 2013.
- [2] "Module 99: Propane as a refrigerant for use in chillers for air conditioning applications". *CIBSE Journal*. September 2016. Retrieved 2020-01-22.
- [3] "The Heatsink Guide". Retrieved 3 May 2013.
- [4] "Using Peltier modules for thermal management of electronic systems". *Electronics Weekly*, 4 October 2011.
- [5] "Arduino UNO for beginners - Projects, Programming and Parts". *makerspaces.com*. 7 February 2017. Retrieved 4 February 2018.
- [6] "Arduino Uno Rev3". Archived from the original on 2018-02-21. Retrieved 2018-02-21.
- [7] "Infrared Technology". *thermalscope.com*. Archived from the original on 8 November 2014. Retrieved 1 November 2014.

