International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

# Exploring the Design of Solar and Foamed Based Temperature Maintenance System for Cooler

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**Abstract**

Refrigerators are an important household item that comes under the category of cooling appliances. The primary structure of the refrigerator consists of a thermally insulated compartment which provides a mechanism that lowers the temperature inside it and transfers the heat from the inside to the external environment.

As it keeps the temperature low as per user requirement, it is used to preserve the food items that can be spoiled at ambient temperature. Refrigerators in available in many sizes on the market but they have some limitations for indoor usage only as they require electricity and are in large amounts. However, when people are more moving towards outdoor activities, they need to have a refrigerator to keep the necessary items which will prevent spoilage and wastage. So, this paperwork has designed a mini refrigerator that is powered by batteries and is portable which can be easily used outdoors as well.

This paper deals with the working of small-size refrigerators. Thermoelectric Cooler Design is to be used as an aid in the design of thermoelectric cooler devices. This work is used to quickly model and compare alternative designs. An optimum coefficient of performance and heat pumping can be quickly determined. Other major features include the ability to change the material properties and dimensions of couples.

**Keywords:** Refrigerator, Thermoelectric, Portable, Optimum

## 1. Introduction

Among the passive cool boxes, there is a vast choice. For the as simple as clever principle of indirect cooling with ice there are two essential points: product processing and insulating layer. As in a house, it makes a difference if the walls are thick or thin or if they are lined with thin or thick insulation. The right balance ensures preferably long-lasting temperature stability on the inside. At this exact point, the construction of the Petro-max ultra-passive Cool Boxes starts: insulation, or more correctly thermal insulation, is a general term used to describe products that control heat loss or heat gain by providing insulation between areas that are significantly different in temperature.

The need to reduce energy consumption in various places has increased during the last decades due to increased environmental awareness. When two micro environments with different temperatures are separated, thermal energy transfers from the higher temperature to the lower. The magnitude of the heat transfer is dependent on the properties of the insulation, temperature difference, and the area in between the environments.

## 2. Problem Statement

In our day-to-day life, we find it difficult to keep water in our bottles or anything else cold While traveling or in summer seasons the cold water we carry gets warm very quickly due to the surrounding temperature. It is also very difficult to carry other devices that can keep the bottle cool and they are also costly and many people cannot afford this item.

This is the problem we have thought of and done research on it to find its solution. We have done some analysis and made a final model which can keep the bottle cold for a longer time and it can also keep many things cold for a longer time. It can be used during long trips because it is portable affordable and easy to use also. Our model is a simple setup of devices like a Peltier cooler, a temperature sensor for display, foam sheets, silver sheets or aluminum sheets for an insulating layer, and a fiber box on which we can assemble all these devices. This model is the solution we have thought for the problem we have faced.

## 3. Objective

The objective of this project is to overcome the day-to-day problems we face. The items get warm and some of them get degraded like vegetables and many else, so after research, we have found that if we keep items at low temperatures we can preserve them for a longer time.

The main objective of this project is to design a temperature-maintaining system that helps to keep the items cold for a longer time and which is portable while optimizing the cost of production.

## 4. Implementation and Simulated Designs

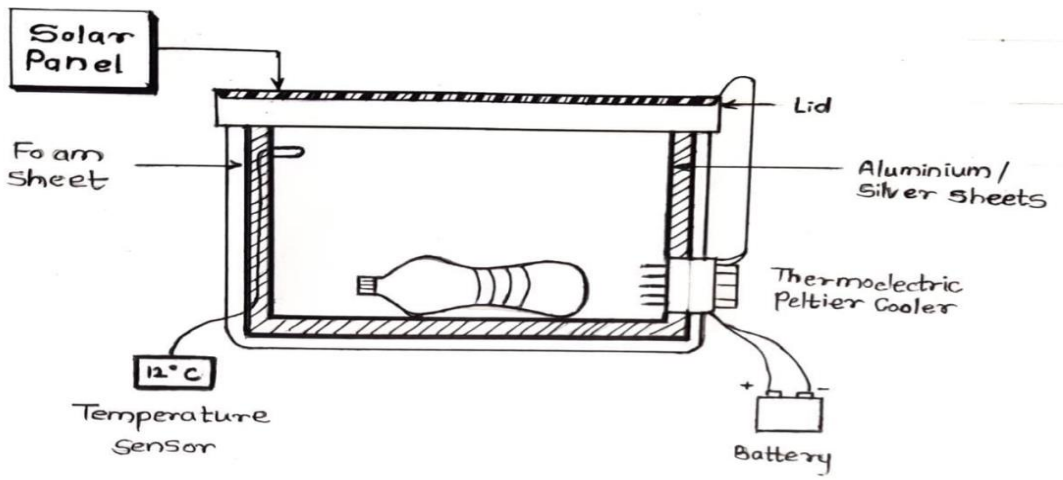


**Figure 1: Modeling of Temperature Maintenance Cooler (Line Diagram)**

Figure 1 shows a line diagram of the Modeling of the Temperature Maintenance Cooler, in which a solar panel is attached at the top cover. A complete layer of foam sheet covers the entire inside surface of the container to prevent heat losses and this foamed layer also integrates with the aluminum or silver sheets. It also has a temperature sensor for continuously monitoring the temperature levels of the system and adjusting the cooling effect according to requirements. A thermo-electric Peltier cooler along with the battery power supply works to maintain the cooling effect.

From the preliminary study of the design of the line diagram of the Temperature Maintenance Cooler, Figure 2 shows the CAD Model of the Electrical Components of the Temperature Maintenance Cooler and Figure 3 shows the CAD Model of the Layer-wise Components of the Temperature Maintenance Cooler.

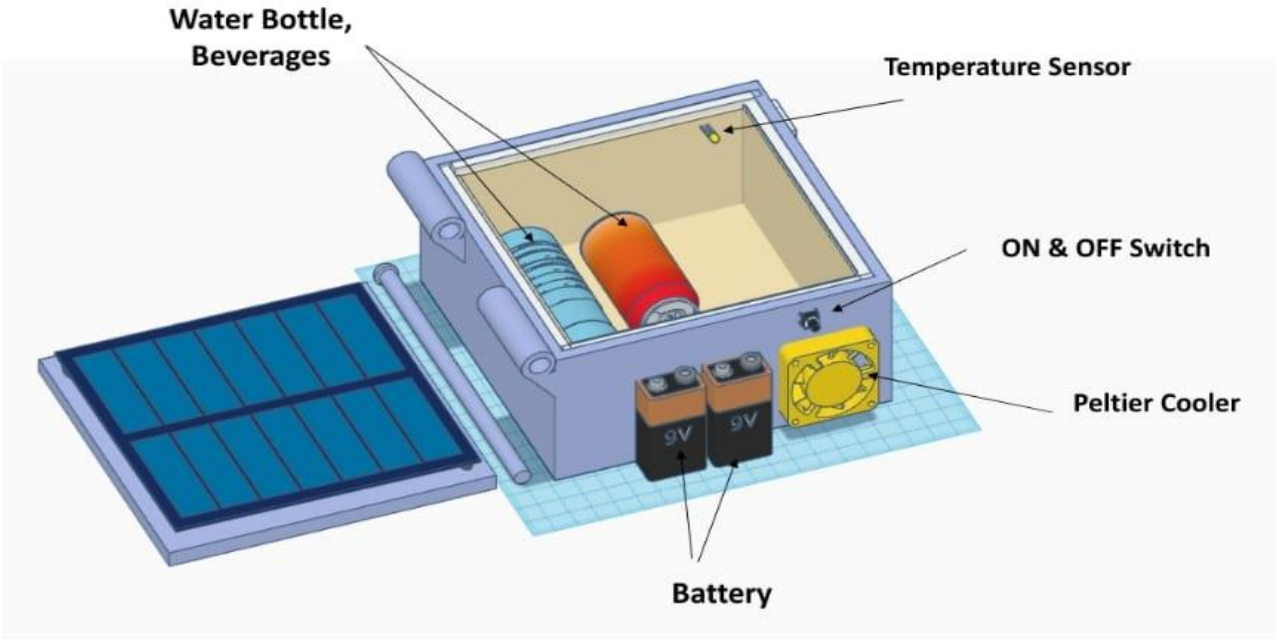


**Figure 2: Electrical Components of Temperature Maintenance Cooler (CAD)**

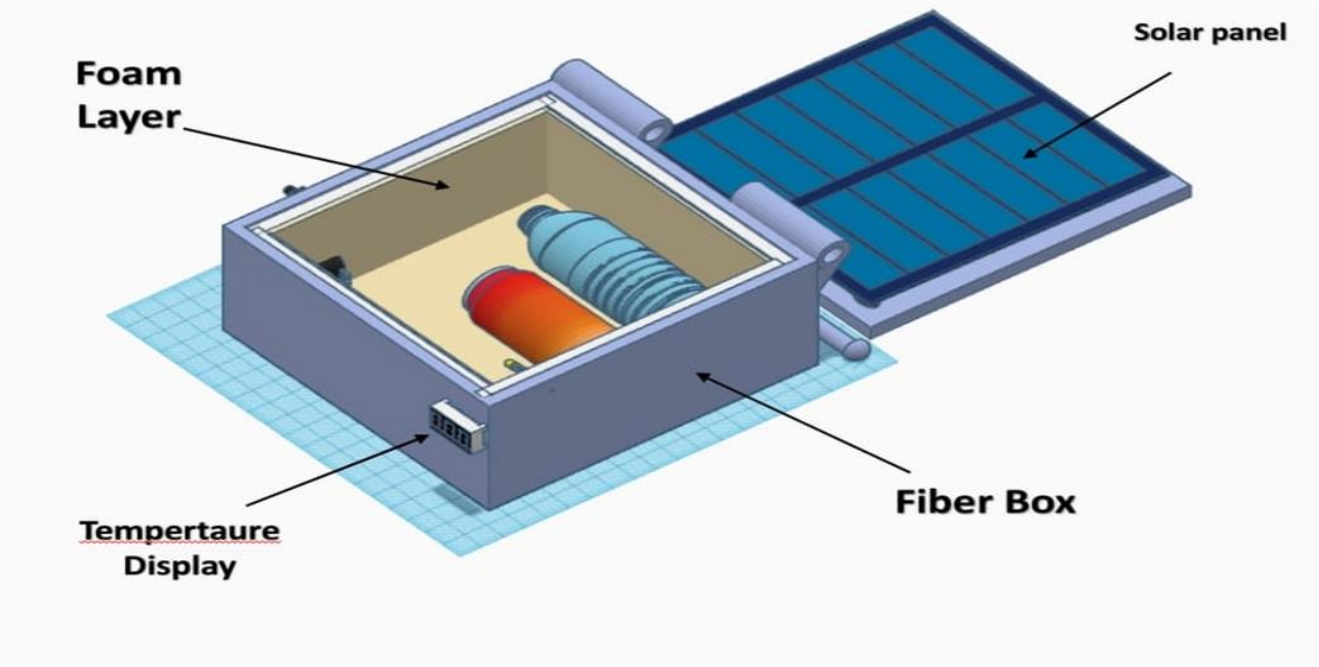


**Figure 3: Layer-wise Components of Temperature Maintenance Cooler (CAD)**

## 5. Future scope

The research 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. It is also recommended to see alternates for compressors as this would reduce the cost of the system and would increase its capacity.
Keeping an eye on the future point of view this project has some areas of improvement where it needs to be developed and made more pocket-friendly and portable.

## 6. Conclusion

In this research work the issue of keeping beverages, cold drinks & water bottles cold for a long time. 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 projects can be made while considering other options like heat, and solar systems.

## Acknowledgement

With all due respect and gratitude, I would like to thank all the people who have helped me directly or indirectly with the completion of this dissertation work.
I express my hearty gratitude towards, the Head of the Department of First Engineering for guiding me to understand the work conceptually and also for providing the necessary information and required resources with his constant encouragement to complete this dissertation work.
With a deep sense of gratitude, I thank our Principal and Management of the NMIET for providing all necessary facilities and for their constant encouragement and support.
Last but not least, I thank all the Teaching & Non-teaching staff members of the first Engineering Department for providing the necessary information and required resources. I am ending this acknowledgment with deep indebtedness to my friends who have helped me.

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