



PORTABLE AC

PROJECT REPORT

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ACKNOWLEDGEMENT

- We would like to express our sincere gratitude and appreciation to Dr. Mukesh Kumar for his valuable guidance and support throughout the course of this project. His insightful suggestions, thoughtful feedback, and expert knowledge have been instrumental in shaping the direction and outcome of this project. Dr. Kumar's unwavering commitment to excellence and dedication to his students' success have been truly inspiring. We have been fortunate to have had the opportunity to work with him and learn from him, and we are grateful for his generosity and kindness. We would also like to thank the faculty and staff at the IIT Ropar for providing the resources and facilities that have enabled us to complete this project. Their support has been invaluable, and we are deeply grateful for their contributions to our education and professional development.

AIM OF THE PROJECT

- The aim of this project is to build and design a portable air conditioning unit. It provides a portable and efficient cooling solution for various applications. It utilizes the Peltier effect and heat sink to provide efficient and environmental-friendly cooling for small indoor spaces. This project will focus on designing and optimizing the performance of the Peltier cooling system and it offer user-friendly controls for adjusting temperature and airflow."

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APPARATUS

- Some of the following materials are required to build a portable AC :
 1. Cardboard, wires, cutter, glue gun, ..etc
 2. DC fan
 3. Heat sink
 4. Portable electronic thermometers (PETs)
 5. Adaptor
 6. Switch
 7. Peltier module
 8. SMPS

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INTRODUCTION

In recent years, during the hot summer months the demand for air conditioning has risen. However, conventional air conditioning systems are often large, expensive, and require installation by a professional. Portable air conditioners offer an alternative solution, providing a more suitable and affordable way to cool a small areas. This project aims to design and develop a portable air conditioning unit based on the Peltier effect and heat sink technology. The use of Peltier or heat sink will enable the development of a portable AC unit that is smaller, efficient, and cost-effective compared to traditional AC units. The Peltier effect allows the transfer of heat energy through an electric current, which is then dissipated by the heat sink, providing a cooling effect. The project will involve designing and building a model of portable AC unit using materials and components. The model will be tested under various conditions to ensure its performance and efficiency. The final product will be a portable AC unit that is easy to use and provides efficient cooling.

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THEORY

• WHAT IS PORTABLE AC ?

- Portable Air Conditioners is a self-contained device that can be set up anywhere besides a window and a socket as the name suggests are portable and can be carried from one place to another unlike the wall mounted air conditioners. They are much easier to install and are more energy efficient. Portable AC units are also more affordable and can be moved from room to room as needed. It is an affordable and efficient alternative. It is suitable for small rooms.

WORKING PRINCIPLE

- The main function of the portable AC is to provide cool air for us. The 12V DC adapter supplies power to Peltier cooler and fan. Peltier cooler and heat sink are two components in portable air conditioners that facilitate transfer of heat from inside to outside. Peltier cooler also called Thermoelectric module. It helps in absorbing heat from one side and releasing it on the other side. Here in our portable AC, It is placed on the inside and the hot side of Peltier cooler is connected to the heat sink. The major purpose of the heat sink is to dissipate heat, therefore it has a large surface area for the same. Heat is dissipated from inside to outside providing a cooler environment for the fan which continuously rotates the air and lets the cool air out through the designed window or door.

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COMPONENTS OF AC(PORTABLE)

• 12 VOLT DC SUPPLY

- It plays an important role in a portable AC. A 12VOLT DC fan is an important component of a portable air conditioner. The 12V DC fan helps in circulation of air and facilitates heat transfer. first it draws the hot indoor air over the hot side of Peltier Cooler causing the hot air to be drawn to the cooler side of the peltier cooler or thermoelectric module. Secondly, it blows the cooler air back to the room. The location of the fan is such that it is placed on the cooler side of the thermoelectric module so the air continuously flows inwards in order to maximize the cooling effect. Without the fan, the cooling effect would've been drastically reduced. Also the fan is low power by the 12-volt DC Adapter and hence its rating should not exceed 12V too.

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2. SWITCH

The purpose of switch is to turn on/off the 12V DC power supply that is used in portable AC.

3. HEAT SINK

The heat sink is an important component of a portable air conditioner . Heat sink is designed to transfer heat . The purpose of this is to dissipate the heat generated by the Peltier cooler and also provides a surface area that can efficiently transfer the heat to the surrounding air. it is made up of a conducting material aluminium. It is placed on the cooler side of peltier cooler and it absorbs the heat from the hot side of the Peltier cooler and dissipates it into the surrounding. So the three that three processes of conduction, convection and radiation have been followed. Heat sink maintains the temperature of Peltier cooler throughout the functioning of the AC. So the heat sink should be there because if it was there then the efficiency not be reduced that of the Peltier cooler would not overheat and also the efficiency of its damage is reduced.

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•4. PELTIER DEVICE

Peltier used in portable ac. It uses a very thin thermoelectric module through which the required heat transfer can be achieved. When the current flows through the junctions of the two conductors, heat is removed at one junction and cooling occurs. Heat is deposited at the other junction. The main application of the Peltier effect is cooling. However the Peltier effect can also be used for heating. Usually semiconductor devices are used as a Peltier thermoelectric.

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ADVANTAGES

1.PORTABLE: They can be carried from one place to another as the name suggests. This makes them more feasible to provide air conditioning for small rooms and movable devices like air conditioning of cars is done by portable air conditioners.

2.CHEAP AND AFFORDABLE: They are cheap and affordable and can be bought for lesser cost compared to compressor-based air conditioners.

3. SAFE: These are typically safer since they run on 12V DC supply.

4. LESS POWER CONSUMING: The adapter converts the 220 V AC Supply to 12V DC supply and hence they run on lesser power.

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DISADVANTAGES

- **LIMITED COOLING CAPACITY:** Since they are powered by a less 12V DC source compared to compressor based air conditioners, they aren't typically capable of cooling an entire house and are suitable only for small rooms, cabins, cars.
- **HIGH AMPERE RATING:** Even the small prototype pf portable AC consumes current of 6 ampere or more. This even exceeds the ampere rating of small compressor-based AC which work on 4-5.5 A current.
- **OVERHEATING OF THERMOELECTRIC MODULE:** The thermoelectric module may heat up and damage itself, thus damaging the entire functioning of a portable air conditioner. Thus, a heat sink is always required.

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DISCUSSION AND ANALYSIS

- The experimental results obtained from the project demonstrate that the portable AC unit is capable of cooling a small room or a confined space effectively. The cooling capacity of the unit is determined by the size and the number of Peltier modules used in the system. The Peltier modules used in the portable AC unit generate a temperature gradient when a current is passed through them, resulting in heat transfer from one side to the other. The hot side of the Peltier module is connected to a heat sink that dissipates the heat into the surrounding environment, while the cold side is connected to a heat exchanger that absorbs heat from the surrounding air.
- 13 • The performance of the portable AC unit is also dependent on the efficiency of the heat sink and the heat exchanger used in the system.

CONCLUSION

- We have successfully designed and constructed a portable air conditioning unit based on the Peltier effect and heat sink technology. The device can effectively cool a small enclosed space and is compact, lightweight, and easy to transport. The project has been an excellent learning experience for us, and we have gained knowledge and skills in various areas, such as thermodynamics, electronics, and mechanical engineering. We have also developed teamwork and project management skills, which will be valuable in our future endeavors. With further research and development, we believe that the device can be improved to increase its cooling capacity and efficiency, and make it more environmental friendly. Overall, this project has been a great success, and we are proud of the outcome. We hope that this project will inspire others to explore the possibilities
- 14 Peltierbased air conditioning technology, and contribute to the advancement of