DESIGN AND DEVELOPMENT OF A BATTERY POWERED PORTABLE COOLER UTILIZING PELTIER MODULE WITH TEMPERATURE CONTROL

A PROJECT BY:

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INTRODUCTION

- This research paper presents the design and development of a battery-powered portable cooler that utilizes a Peltier module for cooling, with temperature control. The cooler is designed to be lightweight, portable, and easy to use, making it suitable for a range of applications such as camping, picnics, and outdoor events. The use of a Peltier module allows the cooler to operate without any moving parts, making it more reliable and less prone to mechanical failure. The temperature control feature ensures that the cooler maintains a constant temperature within the desired range, providing efficient cooling for perishable food items and drinks. The use of a battery as a power source makes the cooler environmentally friendly and eliminates the need for an external power source. Overall, this research paper presents a practical and useful application of Peltier cooling technology in a portable and convenient form.

LITERATURE SURVEY

1. A REPORT ON PELTIER (THERMOELECTRIC) COOLING MODULE. a review by Madhan Mohan Reddy T., Sagar T., VenkataMahendra T., & Punitha ,published in IInternational Journal of Research Publication and Reviews in April 2022 proposed a smart pet feeder system that utilizes a camera and Wi-Fi connectivity to allow owners to remotely monitor their pets while they eat. The system can be controlled via a mobile app and includes features such as portion control and scheduling.

2. Review on Thermoelectric (Peltier) Module published by Nagesh Kudva, Veeresha R K, Muralidhara in July-2020.The authors provide an overview of the working principle of Peltier modules, which use the Peltier effect to transfer heat from one side of the module to the other. They also discuss the different types of Peltier modules, including single-stage and multi-stage modules

3. Peltier Module for Refrigeration and Heating using Embedded System published by Saket Kumar, Ashutosh Gupta, Gaurav Yadav, Hemender Pal Singh, in October 2015, The article describes the design and implementation of a Peltier module-based cooling and heating system using an embedded system that includes a microcontroller, temperature sensors, and other components.

4.Design and Testing of Cooling Jackets using Peltier Plate - published by Muhammad Jahangir,M. Atiq Ur Rehman,Abdul Basit Awan,Raja Hamza Ali in October 2019, The authors describe the design and fabrication of the cooling jacket, which consists of an aluminum housing that encloses a water jacket, with Peltier plates attached to the outside surface of the aluminum housing.

5. Characterization High Temperature Thermoelectric Modules published by Satchit B. Mahajan, Reginald D. Pierce,Robert J. Stevens in nov-2013, proposed a smart pet feeder system that utilizes deep learning algorithms to monitor pet feeding behaviour and detect potential health issues.

6. A Review on Peltier Device and Heat Dissipation of It’s Hot Surface Using Fins published by Tithi Sharma, Pratham Jain, Smit Patel, Nishyank Bhatt, Prof. Kunalsinh Kathia in Mar 2022, A Review on Peltier Device and Heat Dissipation of Its Hot Surface Using Fins" published in March 2022 is a review of the Peltier device technology and the use of fins for heat dissipation

SUMMARY FOR LITERATURE SURVEY

The collection of research papers discusses the potential of thermoelectric cooling technology, specifically Peltier modules, as an eco-friendly and efficient alternative to traditional cooling systems. The papers explore the functioning and performance of Peltier modules, including their low power consumption, compactness, and lack of moving parts. Various applications of Peltier technology are discussed, including refrigeration, waste heat recovery, electronic device cooling, and even a cooling jacket for outdoor workers. The papers also highlight areas for improvement, such as reducing irreversibility in the Peltier cooling system to improve efficiency. Overall, the papers emphasize the importance of continued research and development in the field of thermoelectric cooling technology to improve its performance and expand its range of applications.

OBJECTIVES

The Main objective of this project:

To design and develop a battery-powered portable cooler.

To utilize a Peltier module for cooling.

To incorporate temperature control to maintain desired cooling levels.

To optimize power consumption for longer battery life.

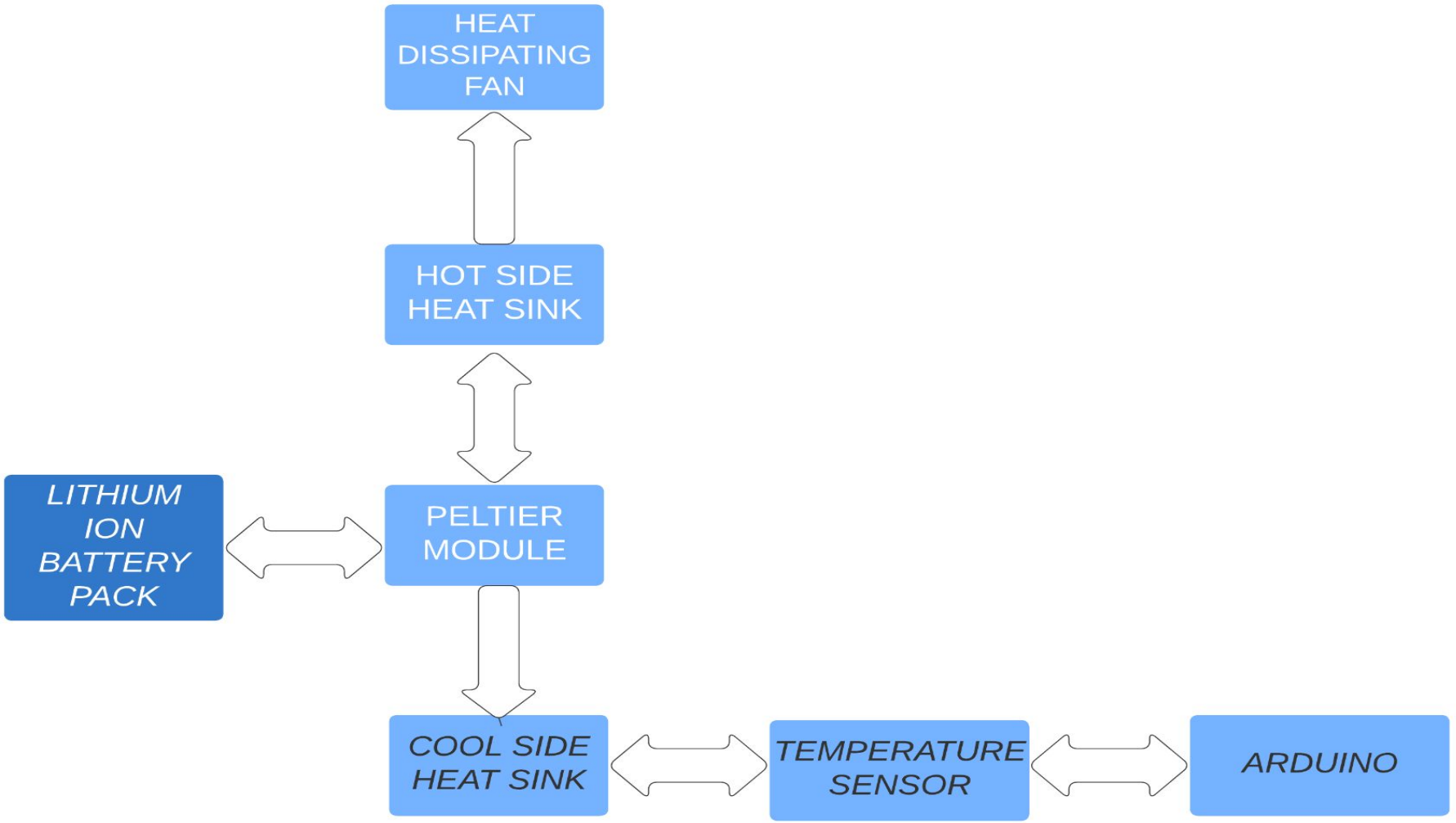
To create a compact and portable design for ease of use and transportation.

PROJECT EXPLANATION

- This project is about the design and development of a battery-powered portable cooler utilizing a Peltier module with temperature control. The block diagram of the project includes a Peltier module, a heat sink, a temperature sensor, a microcontroller, a power source, and a cooling chamber. The project aims to achieve a compact, energy-efficient, and portable cooling solution that can maintain a stable temperature inside the cooling chamber. The Peltier module serves as the heart of the cooling system and provides the cooling effect by transferring heat from one side to the other. The microcontroller controls the operation of the Peltier module and monitors the temperature inside the cooling chamber with the help of the

- temperature sensor. The heat generated by the Peltier module is dissipated using a heat sink, and the power source provides the required energy to the entire system. The cooling chamber is where the items that need to be cooled are placed. By controlling the operation of the Peltier module, the system can maintain a stable temperature inside the cooling chamber, thereby keeping the contents cool.

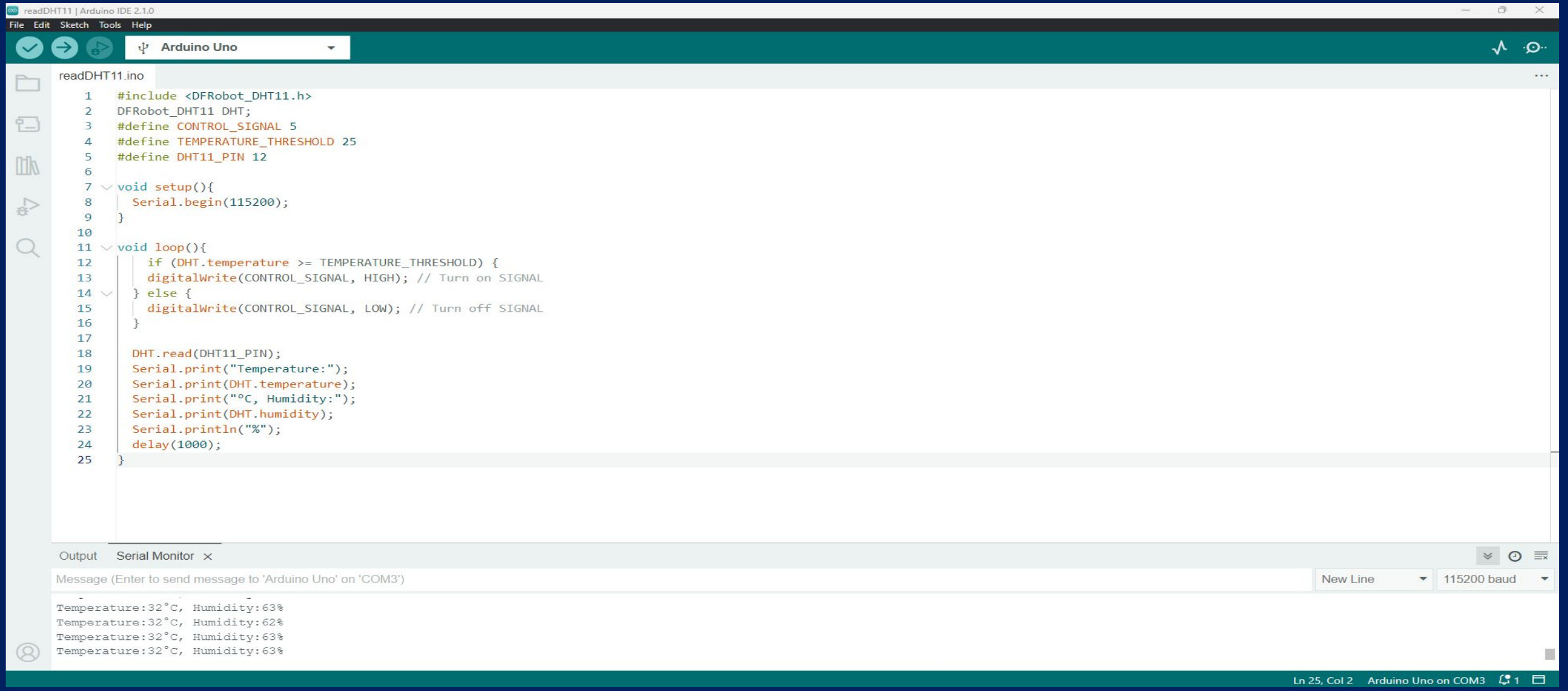
BLOCK DIAGRAM



COMPONENTS USED

- Peltier Module
- Jumper Wires
- Lithium Ion Battery Pack
- Arduino Uno
- Temperature Sensor(DHT-11)

PROGRAM CODE



SETUP CONFIGURATION

The pins of the arduino controller are connected as follows:

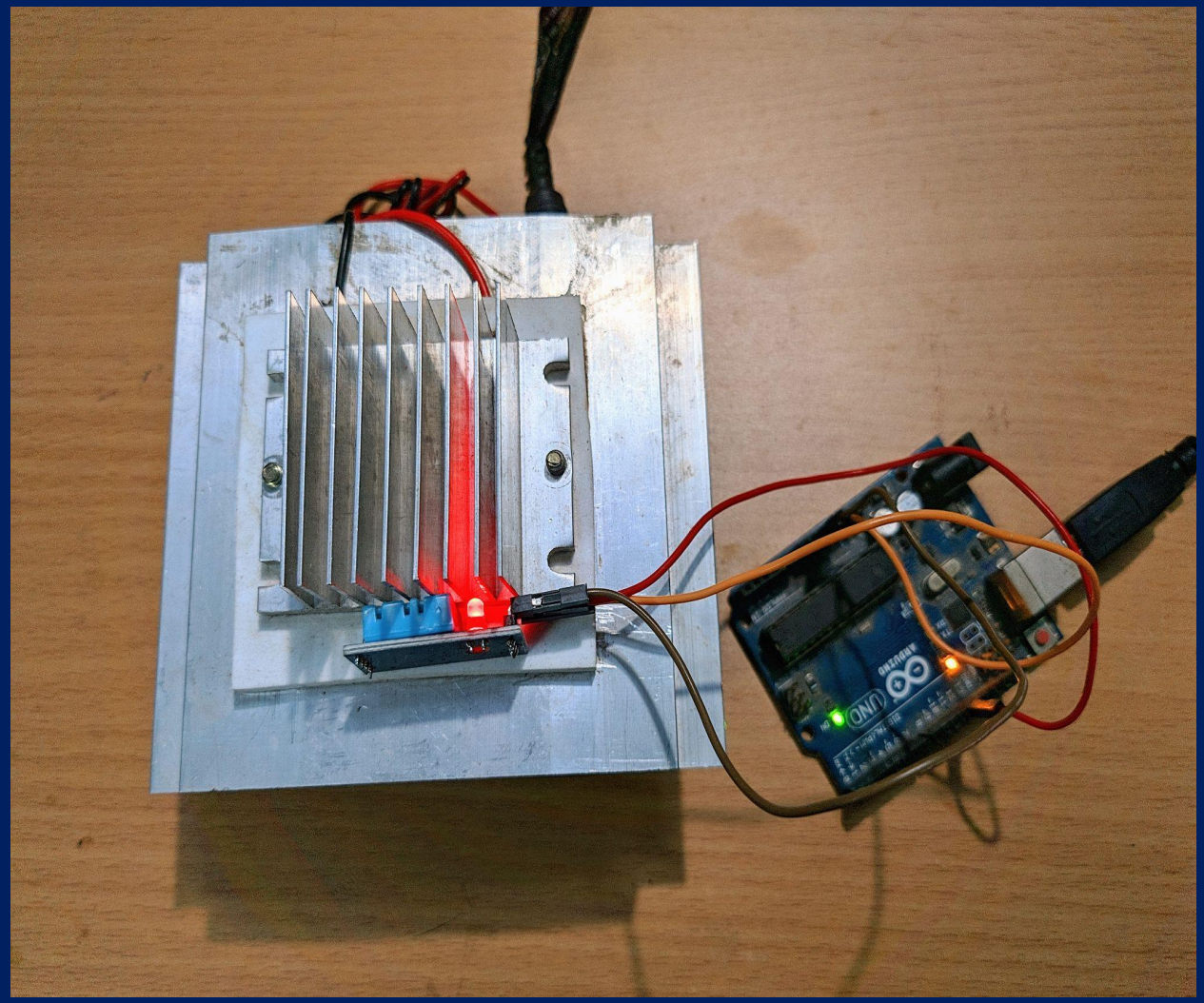
The DHT11 sensor is connected to digital pin 2 of the Arduino.

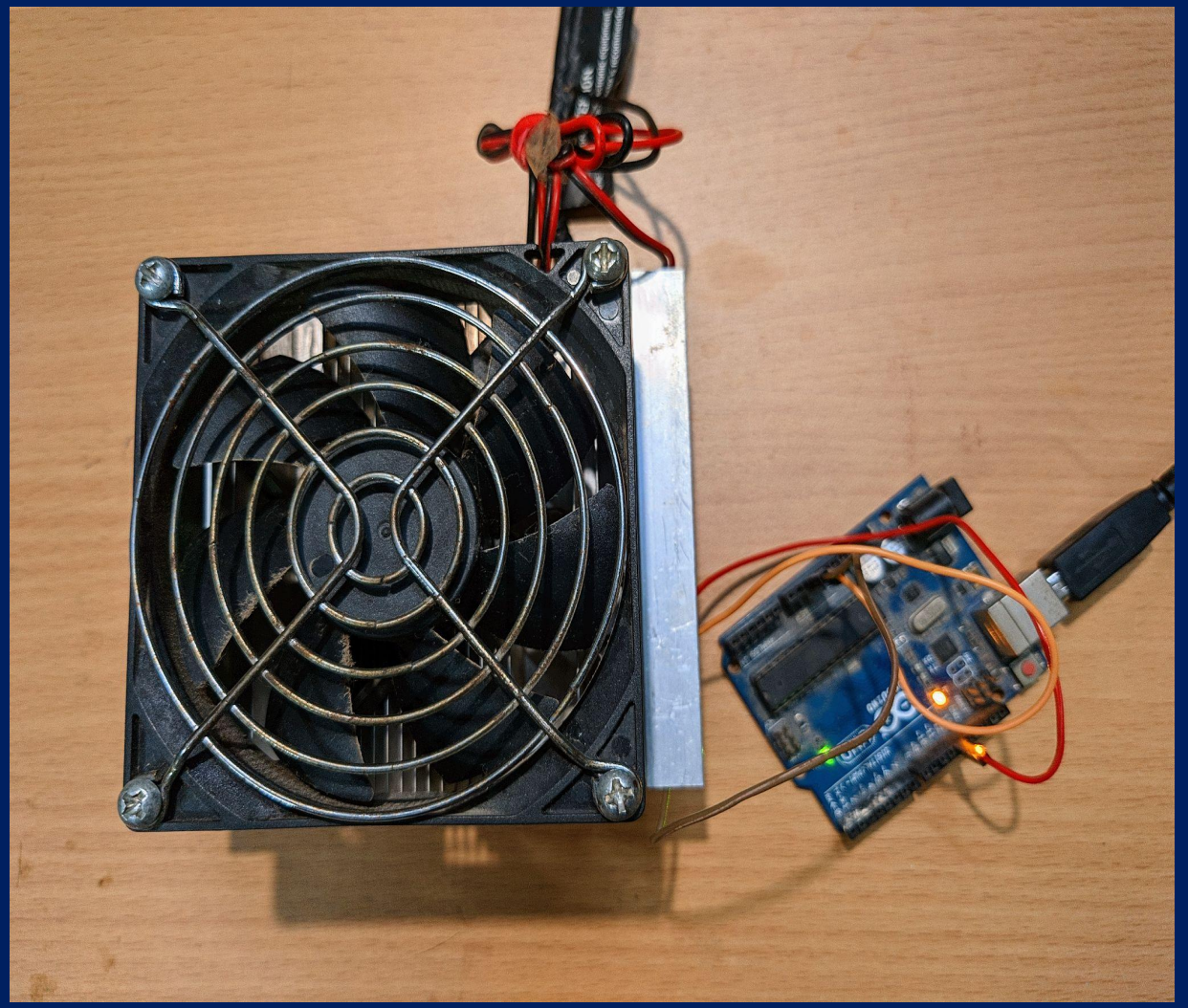
The ELECTRONIC SWITCH / RELAY is connected to digital pin 5 of the Arduino.

If the temperature reading from the DHT11 sensor is greater than or equal to THRESHOLD TEMPERATURE , the ELECTRONIC SWITCH / RELAY is turned on by setting the CONTROL_SIGNAL PIN to HIGH. If the temperature reading is less than 25 degrees Celsius, the ELECTRONIC SWITCH / RELAY is turned off by setting the CONTROL_SIGNAL PIN.

The temperature and humidity readings from the DHT11 sensor are printed to the serial monitor of the Arduino with a delay of 1 seconds between readings.

HARDWARE SETUP





CONCLUSION

In conclusion, building a portable cooler using a Peltier module is a great project for those who are interested in exploring the concept of thermoelectric cooling. This project involves using a Peltier module to transfer heat from one side of the module to the other, thereby creating a temperature difference that can be used to cool a small space or container. With some basic electronics and thermal management knowledge, this project can be easily implemented and provides a useful cooling solution for a variety of applications, including camping, picnics, and outdoor events.

REFERENCES

- Google Scholar
- Online tutorials and resources
- Youtube
- Teachers/staff in charge
- Chat Gpt

Thank you!