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DEPARTMENT OF ELECTRICAL AND ELECTRONIC  
ENGINEERING

EEE212 Project Report

**Smart Refrigerator**

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## **Abstract**

Write your abstract here

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# Chapter 1

## Introduction

Home appliances have become a necessary part of our lives, providing comfort and luxury. A refrigerator is one such appliance that is crucial in one's household, rarely powered off. It is an engineering feat, which combines multiple engineering fields under one. The hardware and electronics are in perfect sync with each other providing cooling. This is the main reason that we chose to build a mini-refrigerator for this project. Our aim was to build a small fridge, one that could cool 3-4 cans of drinks. It would require no manual temperature control, i.e. the cooling inside the fridge was automatically controlled when the temperature dropped too low and vice versa. The report that follows describes how the project was approached, progressed and finally completed, with results and observations explained. It would attempt to become a guide to those who would want to build this mini-fridge.

# Chapter 2

## Background

### 2.1 Peltier Effect

The Peltier effect can be described as the temperature difference created when voltage is applied between two pieces of electrodes or conductor, which are directly connected to a semiconductor. It is also called the Thermoelectric effect, as a thermoelectric device is used to create a voltage difference in most cases. The Peltier effect allows heat or cold to be transferred from one medium to the other, utilizing the current flow between the two conductors. The figure below illustrates the Seebeck Circuit, which is used in cooling applications such as in a refrigerator.



Figure 2.1: Magnetic Latching Relay

### 2.2 Relay

A relay is an electrically operated switch. Many switch on/off mechanically using electromagnets.

Relays are used where it is necessary to control a circuit by a specific low-power signal. For our project, we used a Magnetic Latching Relay with a single coil. The

relay operates in one direction when power is applied with one polarity, and will reset when polarity is reversed

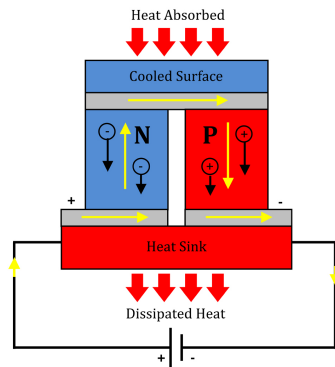


Figure 2.2: The Seebeck circuit as the peltier cooler

# Chapter 3

## Methodology

Describe your method here: the Asymptote and Matlab programming languages that you use in this project.

### 3.1 Item List

Following is the equipment used in building the refrigerator:

- 12V 6A Thermoelectric Cooler
- Magnetic Latching Relay module
- Arduino Nano
- Temperature Sensor
- 12V 10A power supply
- Perforated Board
- Soldering Equipment
- Foam boards
- Hinges
- Plexiglass Panels
- Hot Glue-gun
- Pro's Kit Mini-drill

### 3.2 Circuit Schematic

The circuit is designed to react towards the temperature change. The peltier module is control by a relay, which would receive output data from one digital port on Arduino nano board, on the power supply chain. A temperature sensor,

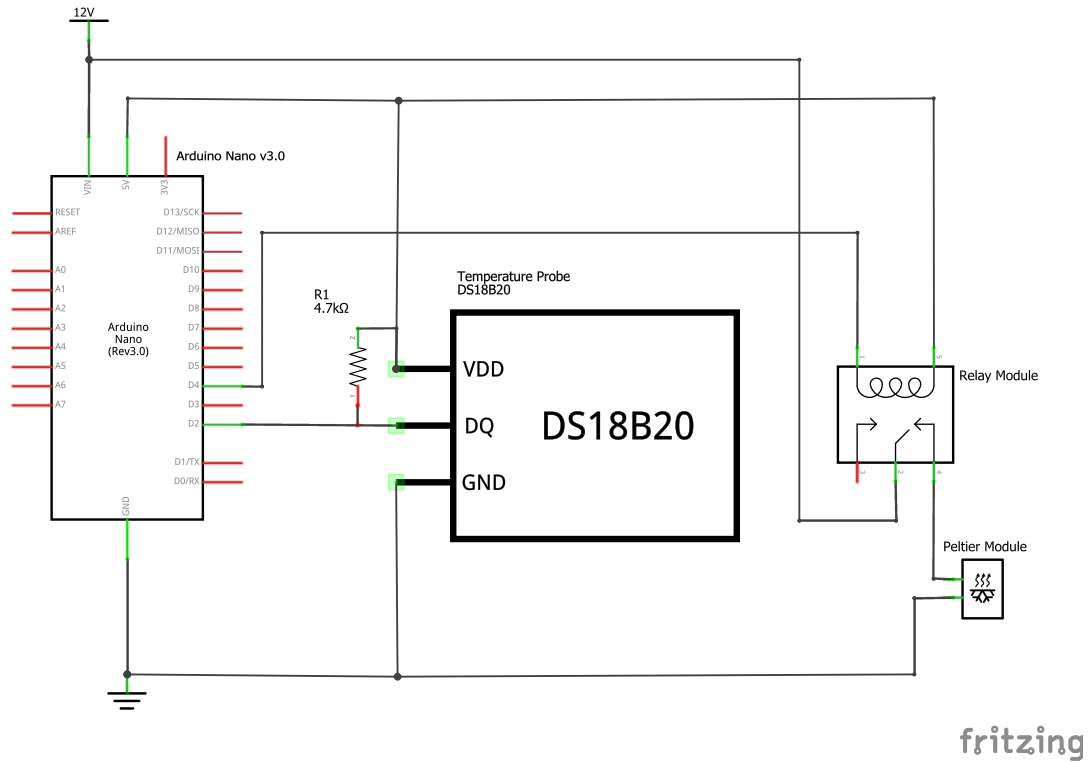


Figure 3.1: Circuit Schematic of our control circuit

which would detect the current temperature, is connected to another digital port on Arduino. Both Arduino and Peltier module are powered by a 12 volt supply while the temperature sensor and relay are powered by the 5 volt power supply of nano board.

### 3.3 Code

All codes used in this project are listed in the Appendices.

### 3.4 Procedure

The following procedure was followed when assembling the refrigerator.

- In order to build the refrigerator, plexiglass panels were used. The reason being because they are cheaper than other materials and temperature insensitive. The panels were cut to dimensions and assembled using hot-glue



gun. The whole box was split into 2 compartments, back one for the all the electronic equipment, while the front compartment would act as the fridge.

- Foam boards were glued to the inside of the refrigerator when box was completed. This would later provide insulation from the heat outside, trapping the cool air in.
- The thermoelectric cooler was then placed in between the back and the front compartment.
- The Arduino circuit was then assembled using the circuit schematic explained previously.
- After testing the circuit was functional, the doors were attached to the fridge in the front. The back compartment was kept open, exposed to air, in order maintain air flow. The hot air from the cooler was able to escape easily.
- After fully assembled, multiple tests were conducted in order to test the temperature and cooling inside the fridge. These are discussed in the next chapter.

# Chapter 4

## Result and Discussion

The section below discusses our results and observations for the mini-fridge.

### 4.1 Figure

\*\*\*picture of our final product\*\*\*

# Chapter 5

## Improvement

Describe the improvements that you have done in this project.

# Chapter 6

## Conclusion

Here comes the conclusion!

# Bibliography

# Appendices

```

1 #include <OneWire.h>
2 #include <DallasTemperature.h>
3 #define ONE_WIRE_BUS 2
4 #define Relay_Pin 4
5 int Low_temp=3;
6 int High_temp=7;
7
8 OneWire oneWire(ONE_WIRE_BUS);
9 DallasTemperature sensors(&oneWire);
10
11 void setup(void)
12 {
13   Serial.begin(9600);
14   sensors.begin();
15   pinMode(Relay_Pin, OUTPUT);
16   digitalWrite(Relay_Pin, LOW);
17 }
18
19
20 void loop(void)
21 {
22   sensors.requestTemperatures();
23   Serial.print(sensors.getTempCByIndex(0));
24   if (sensors.getTempCByIndex(0) < Low_temp){
25     /*Turn-off the relay module*/
26     digitalWrite(Relay_Pin, HIGH);
27   }
28   if (sensors.getTempCByIndex(0) > High_temp){
29     /*Turn-on the relay module*/
30     digitalWrite(Relay_Pin, LOW);
31   }
32 }

```