

## CHAPTER 1 - INTRODUCTION

### 1.1. Background

The importance of the locker box is dated back to approximately 2500 years ago in Greece. In ancient Greek literature, it is said that there are three essential parts of training center; besides wrestling rings, there are also some places which athletes use to undress and take a shower and put their personal belongings into lockers. Before locks were invented, there were some locker room attendant that will guard the lockers so that they would be safe from thieves. Since then, lockers have developed to function as more than just storing clothes or personal belongings of athletes. Ever since the invention of locks, people have locked away their items or belongings that have high value to keep them safe.

In the era of online shopping and delivery services, people's shopping lifestyles have also changed. People in Indonesia can now order items online from Shopee, Tokopedia, or Blibli and have it delivered by courier services such as JNE, Sicepat, Anteraja, and others, or order food and beverages and items and have them delivered by online motorcycle delivery services such as Gojek or Grab. The rise of COVID-19 cases in Indonesia helped raise awareness of locker importance as a storage media to secure items or food or beverage delivered before they are delivered to the buyer. Nowadays, people can order any items or food or beverages that they want, and have it stored inside the locker before they pick it up. It is also a good way to minimize direct contact with other person in times of COVID-19.

However, the problem with this locker box is that the locker box haven't got a method to keep the food or beverage stored inside from deteriorating. The temperature inside the locker is room temperature, if not hotter, and that could make the food or beverage lose its freshness, and damage the taste before it could be consumed by the buyer. So, Popbox, the company responsible for the production of smart steel lockers wanted to collaborate with Swiss German University to implement a cooling system for their

lockers so that the food or beverage or ingredients that are bought online can still keep their freshness until it arrived into the hands of the buyer.

The smart steel locker works step by step. First, the buyer order item or food or beverage or ingredients online, then they choose what kind of delivery service that they want (i.e. JNE, Sicepat, Anteraja, Gosend, or Grabsend), then they tell the courier to store their order inside the locker, the courier will receive an unique code to open the locker once they stored the buyer's item inside, and then the courier will send the code to the buyer via Whatsapp. When the buyer want to open the locker, they need to input the code into the screen provided on each locker, and then the designated locker for their stored items will open by itself, and then the buyer can receive their item.

### **1.2. Research Problems**

1. The Coefficient of Performance using Thermoelectric Cooling method is significantly lower than using conventional Air Conditioning method.
2. Keeping each locker's temperature the same for the same amount of time.

### **1.3. Significance of Study**

This study is significant for 3 reasons :

1. To encourage the application of Thermoelectric cooling in domestic and industrial scale.
2. To understand the Thermoelectric cooling refrigeration system as a possible solution to refrigeration method that is easier to maintain and lower energy consumption.
3. It can be beneficial as a reference for the next researchers who wants to discuss similar topics so that they could solve the common problems about Peltier module usage.

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#### **1.4. Research Questions**

Question #1 : Is new smart refrigerated locker cooling system easy to maintain?

Question #2 : Is the cooling system able to withstand the extreme temperatures of Indonesia's weather?

Question #3 : Is the cooling system able to cool down the internal temperature from 35°C to 15°C in 15 minutes?

#### **1.5. Research Objectives**

1. To make a new cooling system for the smart refrigerated locker that is easy to maintain.
2. To make a cooling system that can withstand the extreme temperature of Indonesia's weather.
3. To make a cooling system that can cool down the internal temperature from 35°C to 15°C in 15 minutes.

#### **1.6. Hypothesis**

Hypothesis #1 : The new cooling system for the smart refrigerated locker is easy to maintain.

Hypothesis #2 : The cooling system will be able to withstand the extreme temperature of Indonesia's weather.

Hypothesis #3 : The cooling system can cool down the internal temperature from 35°C to 15°C in 15 minutes.