

# Category 3 Inventions Log Book

Group Name: Project Frigus | 3-06

Group Members:

- 1) Gabriel Goo Sien Yang (Leader)
- 2) Lim Ying Hong
- 3) Tan Jun Long
- 4) Chen Ian EN

## 1. Problem finding

**1 A Document a list of problems you have identified. Your documentation should show clearly how your group came up with the problems.**

1. Treating injuries such as burns and fractures is complicated. Poor execution of treatment can lead to the aggravation of injuries and cause severe infections to the wound. How can we solve this?
2. In countries like India and Switzerland, road accidents are common. Many drivers try to beat the red lights and end up in an accident. Can we improve this idea and implement it in more densely populated countries?
3. Recently, people do not clean up after themselves at hawker centres, inviting cockroaches and birds flying in and occupying tables. How can we ensure that our tables are kept clean?

**1 B You should have selected a problem based on some considerations. Identify and justify these considerations.**

We have selected problem 1, which we find the most suitable to tackle because the number of people who get injured in Singapore is high. In 2019, non-fatal major injuries increased by 5 per cent to 629 cases. Minor injuries also rose by 8 per cent to 13,111 cases last year, which is

huge when compared to the number of road accidents in 2019, which was 3153. In Singapore, many road accidents are Personal Mobility Device related, something that cannot be solved using 3D zebra crossings and holograms. The problem of creatures in hawker centres is a small issue, since many in Singapore are responsible enough to clean up after themselves.

**1 C List some problems your group would like to solve. List also the considerations for selection of problems in the evaluation grid below. Score the considerations, against the problems, with points 1 (least significant) to 4 (most significant). Sum up the total points for each problem. Identify that problem you would like to solve.**

Injuries / Criteria	Prevalence of cases	Originality	Adaptability	Total
Instant Burn Treatment	3	3	4	10
Fractures	3	2	1	6
Bleeding Wounds	3	1	2	6

The reason we chose burns was due to the adaptability of treatment. The basic treatment for burns is to run a burn under water for 10 minutes, and tape a sterile, non-fluffy material over it to prevent infection. This is tedious and requires practice. By making it more-user-friendly, the risk-of infection and the time taken to treat burns will be greatly reduced. Fractures, however, are very fragile and any slight movement could cause the fractured bones to move, doing more harm than good. We aim to create a product that can facilitate treatment even without first-aid knowledge.

## 2. Define the problem

**2 A Extent of problem (Research and discuss the problem and write down the problem statement)**

Burns are a common injury in Singapore. 150-220 people get burned annually, ranging from the industrial sector to the domestic household; burns can affect anyone anywhere. Furthermore, many burns have worsened due to improper treatment leading to infection. Thus, the problem is

that due to insufficient treatment knowledge, many in Singapore end up getting infected or suffer unnecessary pain.

## **2 B Compare and contrast the existing or similar solutions.**

A. Traditional taping- using water to cool the burn, then using plastic and micropore tape to cover and sterilise the wound.

Pros: Effective, prevents infection

Cons: Hard to implement, time consuming

B. Tilapia fish skin

Pros: Cheap, efficient, eco-friendly

Cons: Inaccessible (Mostly used for extremely severe burns and for long-term treatment), not well-received

C. Aloe vera cream

Pros: Accessible, speeds up treatment and reduces infection

Cons: Used for long-term purposes, redundant for on-the-spot treatment.

## **3. The proposed solution**

### **3 A Describe your proposed invention.**

We plan to create a band-like ice-pack product using carbon dioxide to cool the wound. It will be piped through silicone tubing which will be fitted underneath the outer layer of neoprene. When activated, the user will attach the band onto the wound, securing it with velcro strips and then activating the canister through a nozzle to release the gas, cooling the wound swiftly and effectively.

### **3 B Explain the purpose of your proposed invention and the potential benefits to users.**

Our invention is more convenient than the traditional method. It allows us to cool the burn while bandaging it up, making it much less tedious. Treatment can be executed effectively, efficiently and in a more sterile manner, reducing the chances of wound infection due to valuable time lost during treatment.

### **3 C In what ways would your proposed invention be different and/or better than existing solutions, if any?**

Our solution is efficient, easy-to-use, revolutionary, unique when compared to household

solutions. Our solution uses carbon dioxide instead of running water to imitate the cool and running motion of water, and does not require prior preparation like keeping cold. It also requires less time and effort to put on. While tilapia fish skin can only be found in hospitals, our product will be more accessible to the public.

Studies done by the National Center for Biotechnology Information state that infections are independently associated with mortality. In a series of 175 patients with severe burns, infections preceded multiorgan dysfunction in 83% of patients. A recent autopsy study corroborated this stating that >60% of deaths in patients with burn injury were attributable to infectious complications. Furthermore, the Clinical Microbiology Review “Burn Wound Infections” states “Much of the steady decline in burn wound infections... the incidence of burn wound sepsis fell from 6% to 1% and the mortality rate for burn-related complications decreased from 40% to 18%.”

**3 D What are some problems you expect in the course of your proposed invention?**

Firstly, our invention will not be as effective if the burn is on the main body, for example the stomach. Our invention is unable to cover wide flat surfaces, and the person will have to apply pressure to keep the padding on.

Secondly, our invention may cause ice burns to the wound. If it is too cold, it may cause further harm and damage to the burnt tissue.

**3 E What and when are the major milestones (project timeline) in your invention?**

Steps	Who?	Date
Forming of Group	Entire team	5th January
Brainstorming	Entire team	12th January
Finding a mentor	Ying Hong	17th January
Registering Project	Gabriel	18th January
Starting slides	Gabriel and Ying Hong	20th January
Beginning Written Report	Ian En and Jun Long	16th March
Proposal evaluation	Entire team	7th April
Making infographic	Ying Hong and Gabriel	10th May

#### **4 A Explain how and why the materials were chosen for the prototype/ product of your invention**

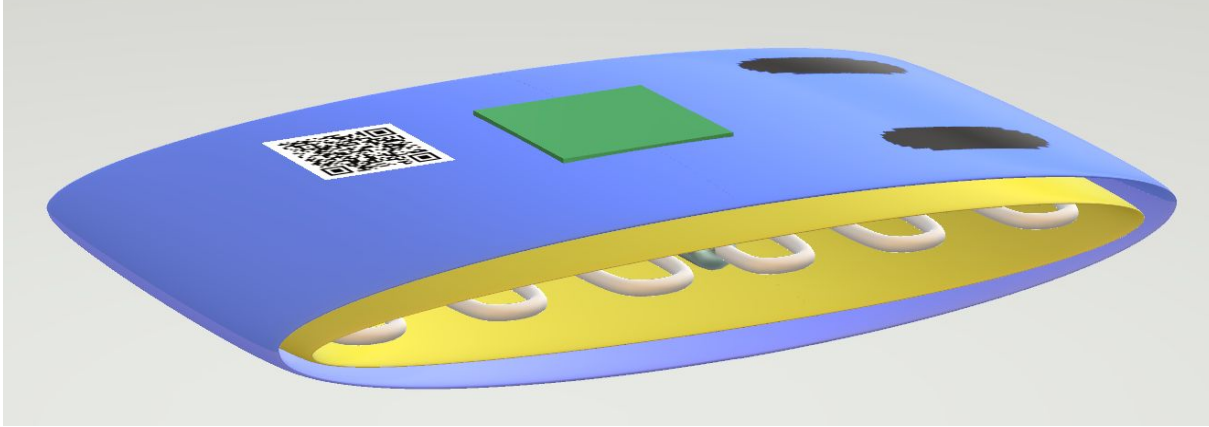
- **Neoprene**, a material often used for wrist guards. Being flexible, easily adjustable, and functioning over a wide range of temperatures, it is a non-fluffy material hence it will not stick to the wound.
- **Carbon dioxide canisters**. These canisters are refillable, and carbon dioxide is an effective coolant that can mimic the effect of water on a burn.
- **Airtight pump system**. This would allow the victim to be able to release the carbon dioxide gas at will in order to allow the prototype to lower its temperature to the most suitable for the victim.
- **Velcro straps**. Velcro is easy to use, cheap, and widely accessible. It is also unaffected by changes in temperatures. Velcro will be the material used to strap and secure our invention.
- **Netted fiberglass**, which will serve as an insulator of heat to prevent the wound from becoming too cold too fast.
- **Air valve**, which will help with easy activation of the carbon dioxide canister to initiate the cooling process.
- **Silicon tubing**. This is the tubing which carbon dioxide will flow through to mimic the effect of water. It is durable and has many different widths.

#### **4 B Explain why construction of a prototype is not possible and the proof of concept is needed in your case.**

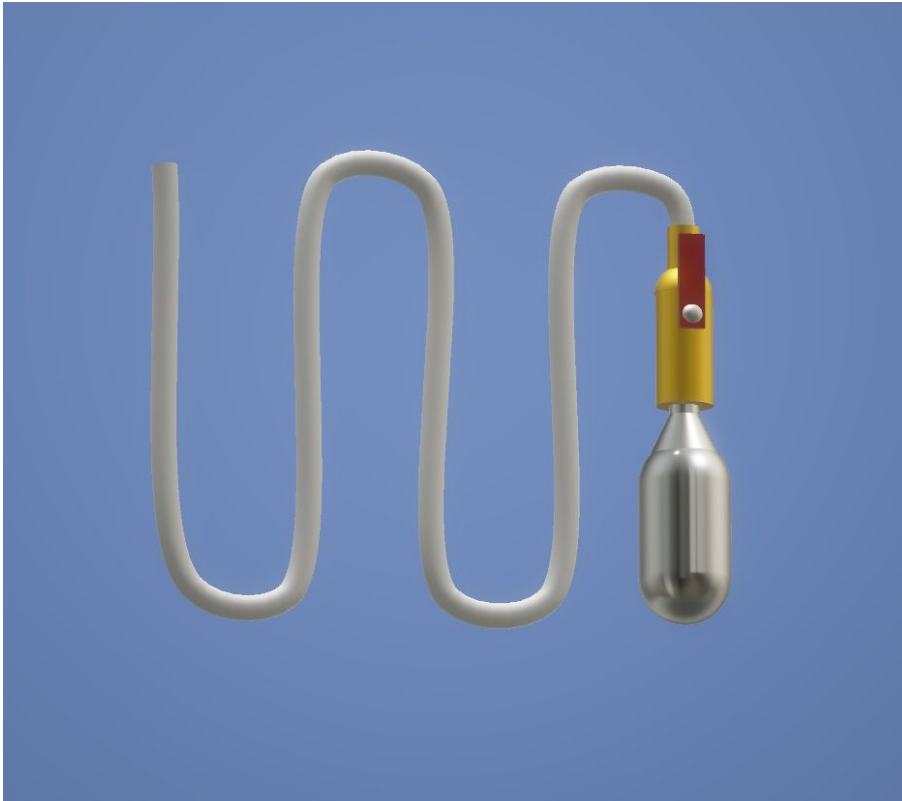
Due to the COVID-19 pandemic, group meet-ups are limited and our mentor has also advised us against building a prototype as we may not get the result that we want. Since we required many materials which are difficult to source out especially during the pandemic where materials from overseas may be unable to ship over or may even take weeks. The different components require much time to complete and since only one member would be able to build it, the prototype would require an even longer time to build.

#### **4 C Envisioning the building process**

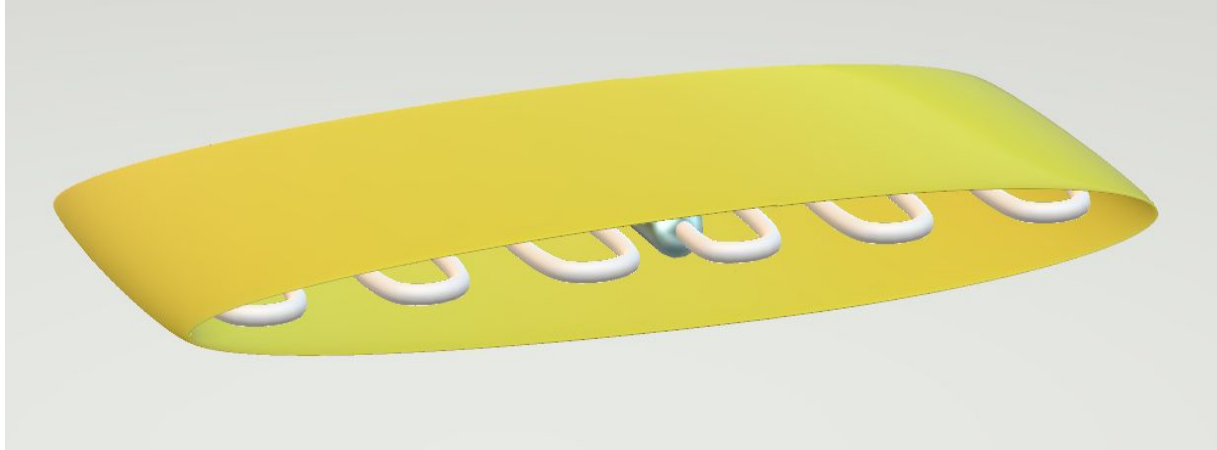
Despite the COVID pandemic, we proceeded to plan how we would build the product. Firstly, we would install the tubing to the nozzle of the carbon dioxide canister. The piping will make a complete circuit around the canister to increase the surface area of contact of the gas for efficient and effective cooling once the gas is released. Secondly, we will envelope the cooling mechanism with double layers of fiberglass to prevent the product from becoming too cold too fast. Lastly, double-layers of neoprene will be added around the insulator, providing it with structural support with means of securing the invention and activating the canister.



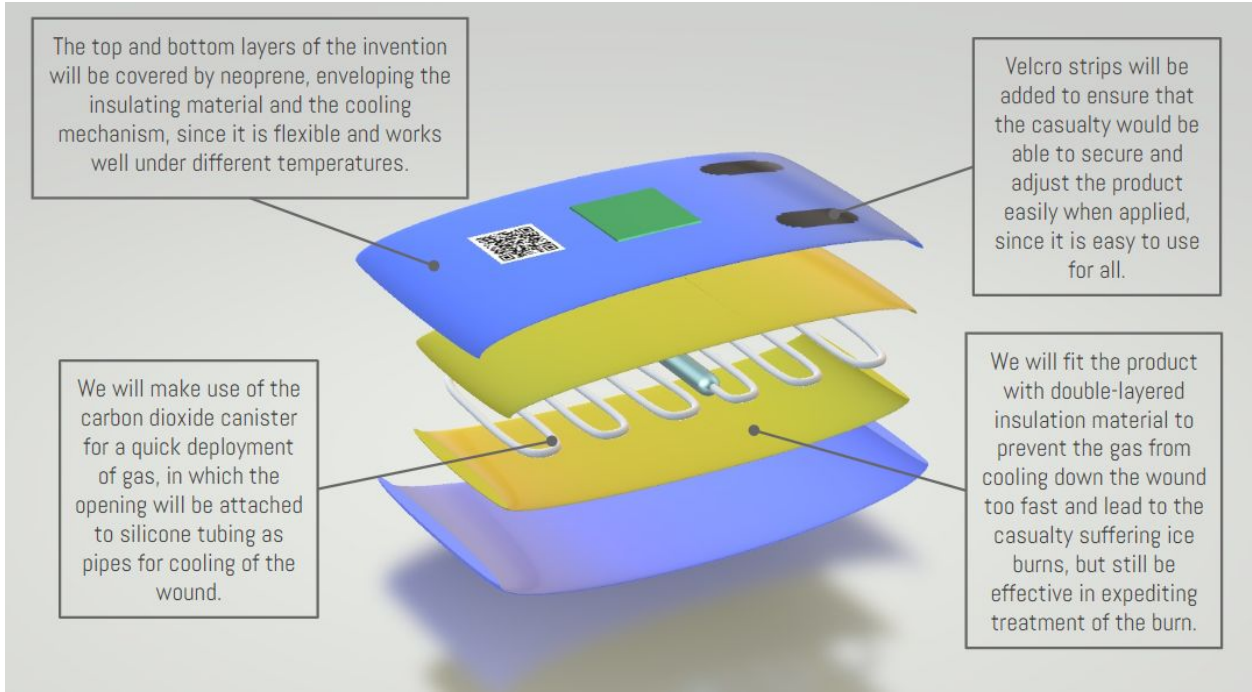
General overview of our envisioned product.



Model of the designed cooling system utilising carbon dioxide.



Model of the designed cooling system utilising carbon dioxide, with the yellow area representing the insulator.



A visual breakdown of the envisioned product.

**4 D Briefly explain how the digital rendering can effectively show how your invention will work and the different considerations.**

The detailed sketch will show how the invention works by explaining each function of the prototype, as well as simulate the effect the prototype has on a burn.

**5 A Write down your prototype/ product test criteria and check against it if it works. Identify areas of weakness for modification. Indicate the test iteration and date of test.**

Test Iteration: Not possible.

**OR if you are creating an animation / video to show how your invention will work, write down the different possibilities / outcomes [success or failure] if a full-scale prototype is to be constructed.**

We have created a detailed diagram on how the product will look and its different features. After receiving several comments on our product, we decided that these would be the probable outcomes.

Outcome 1: The rarest possibility is for our product to be perfect on first try, without any flaws. This means that our product is able to treat burns effectively, without running the risk of being damaged easily or having its integrity compromised.

## 6. References

**6 A Cite the references you have used for your project work. Your source of reference should come from different types (eg books, magazine, websites, journal articles, interview, photographs, product brochure, reviews etc.)**

- Sushi-free-vector-icons-designed-by-Freepik. (2020). Retrieved-7-August-2020, from [http://www.flaticon.com/free-icon/bandage\\_184452#term=bandage&page=1&position=6](http://www.flaticon.com/free-icon/bandage_184452#term=bandage&page=1&position=6)
- Flaticon. (2020). Retrieved-7-August-2020, from <https://www.flaticon.com/search?word=heartbeat>.
- (2020). Retrieved-7-August-2020, from <https://www.sgh.com.sg/events/education/12th-asia-pacific-burn-congress>
- Now, T., Stories, T., Columns, G., Dolphins, S., & Content, S. (2020). How-Tilapia-Is-Helping-Brazilian-Doctors-Help-Burn-Victims. Retrieved-7-August-2020, from <http://awesomeocean.com/guest-columns/tilapia-brazilian-help-burn-victims/>
- (2020). Retrieved-7-August-2020, from [https://static.bhphoto.com/images/images500x500/1233102641\\_504596.jpg](https://static.bhphoto.com/images/images500x500/1233102641_504596.jpg)
- (2020). Retrieved-7-August-2020, from <https://www.wpiinc.com/media/catalog/product/cache/4971985c7a0566f634dcc03a3aa27e21/5/0/503023.jpg>
- User, S.-(2020).-Other-first-aid-products - Aloe Vera Burn Gel - Plum. Retrieved-7-August- 2020, from <https://plum.eu/products/firstaid/other-first-aid-products/aloe-vera-burn-gel>



- Flaticon. (2020). Retrieved-7-August-2020, from <https://www.flaticon.com/search?word=checklist>.
- US-National-Library-of-Medicine.-(2020)-Retrieved-3-August-2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7224101/>
- US-National-Library-of-Medicine.-(2020) Retrieved-3-August-2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1471990/>
- US-National-Library-of-Medicine.-(2020) Retrieved-3-August-2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2822136/>