Project Title: Tissue Solved

Category 3: Inventions
Group ID: 3-09

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Abstract

Tissue Solved is a product that aims to solve the problem of tissue paper packets coming undone in pockets -- getting crumpled, torn, wet and unsanitary -- while keeping it quick and convenient to remove individual tissue sheets from the tissue paper packet.

1. Problem Finding

1.1 Problems in our daily life

We used a three-pronged brainstorming approach: we assessed pressing global problems such as plastic use and the greenhouse effect; we discussed everyday problems we face; and we read up on current issues. Through brainstorming, we identified multiple everyday problems we face, including food spillage, crumpled tissue and overweight school bags.

1.2 Problem selection

We brainstormed on the main idea threads, and eliminated problems with pre-existing solutions or those beyond our resource scope at the same time.

We defined a good invention as one that solved more issues than it creates; was within our capabilities to prototype; and had pre-existing solutions that could be improved on.

After multiple discussions, we narrowed down our ideas to three options:

1) A food container which keeps food upright;
2) A tissue packet holder which prevents crumpling and soiling of tissue paper; and
3) A foldable trolley which eases the transport of heavy bags.

We decided to select the problem and idea based on its significance (reach and scale), feasibility and effectiveness (projected amount of improvement to be done). With the help of the decision-making matrix (Figure A1), we decided to embark on the idea of the tissue

packet holder, due to its high feasibility score. The problem was deemed significant as large amounts of tissue that are unused, but soiled, have to be thrown away.

2. Our problem

2.1 Defining our problem

We decided to tackle the problem of our tissues in tissue packets getting crumpled and loose. The tissues in tissue packets get crumpled as the plastic wrapped around it is fragile and loose-fitting, thus the tissue gets crumpled when an external force is exerted on the packet. Furthermore, tissues in open packets come loose in pockets when one carries out sports and vigorous activities. In addition, perspiration transfers onto open packets, rendering tissues within the packets wet and soiled. Our target audience is people using tissue packets, especially active people and allergy sufferers needing tissues daily.

2.2 Needs Analysis

We carried out a needs analysis survey on 30 people. About 9 in 10 of them use tissue packets (Figure B1). About 80% of the respondents mentioned that their tissues often get crumpled in tissue packets (Figure B2). About 70% of the respondents mentioned that their tissues often get loose in tissue packets (Figure B3). The survey shows that our contemporaries share this problem.

2.3 Market Products

We searched current solutions to the problem.

The paper handkerchief (Figure C1) prevents the tissue packet from coming apart but it is cumbersome to pull a tissue out. Before use, the folded handkerchief has to be carefully unfolded, increasing the amount of process in the way of catching a sneeze. There is a high risk of pulling out multiple sheets at once. Moreover, the tissues can get crumpled easily.

The cloth tissue packet cover (Figure C2) reduces the tendency for the tissues to come undone in the packet but is ineffective during vigorous activity. Also, the cloth cover will get soiled from perspiration.

The portable tissue box (Figure C3) is bulky and hard, making it inconvenient for the active. It is also highly uncomfortable and obstructive, making it nearly impossible to put in your pocket. In other words, it is an irrelevant solution for active users.

3. Our Big Idea

Our invention aims to create a tissue packet holder that firstly, makes putting in the tissue packet easier through an alternative means (hereafter called “insertion hole”) Secondly, it would prevent the tissue paper from getting crumpled or loose from the packet. Lastly, it would maintain a convenient way to take individual sheets out (hereafter called “extrusion hole”).

Our invention aims to keep the tissue clean by keeping it in the water-resistant pack. Our invention will allow people to remove tissue one at a time more easily. It will help the unwell and allergy sufferers to maintain good hygiene by making it easier to carry and use tissues. The tissues should not escape its packet within bounds of regular use, and the tissue packet stays strong but flexible and light enough for active people to carry anywhere, everywhere.

Along the way, we conquered inventor’s block through dedicated research on areas of design, foldability and material science. We did not know how to use tools like the 3D printer, but we consulted relevant personnel. We ensured our momentum by producing a prototype every 3 weeks.

4. Construction Process

4.1 Needs Analysis Survey on Material Choice

We carried out a needs analysis survey for our materials on 32 people. About 9 in 10 of our respondents agreed with our use of silicone as the body for the new product (Figure D1), while about 60% of our respondents agreed with our use of velcro as an additional material (Figure D2).

4.2 Materials

For the main prototype body, we used foam at first, but it could not achieve our invention criteria as it was not waterproof and it did not lend itself to being sewn together. We later used silicone as it is elastic, waterproof and malleable.

For the insertion hole, we used zips for the first and second prototypes. However, the zip caught on itself. For later prototypes, we used velcro and buttons. Both were durable materials, although velcro needed more effort than buttons to undo.

4.3 Insertion hole

In designing the insertion hole, we started out with the concept of a hole around the sides, bound by a zip. However, we realised that the zip would get caught. It was also hard to zip and unzip. We then tried combining the insertion and extrusion holes in the second prototype but it made every use of the prototype cumbersome and process-ridden. We thus settled on a separate insertion hole, along one length at one side, in the final 2 prototypes.

4.4 Extrusion hole

In the first three prototypes, the extrusion hole was designed as a permanent slit on one face of the prototype. The challenge was the slit was constantly exposed to the elements, namely air and moisture. A zipped extrusion hole (as in the second prototype) was also cumbersome to use. Extracting an individual tissue sheet was not a smooth process.

In the final and fourth prototype, we modified the extrusion hole to be a fully sealed slit. A unique design made up of 4 pieces of quadrant-shaped cardboard was added, the pieces adhered to both sides of the slit (see Figure E4B). With a single finger action, the slit opens up to allow tissue to be pulled out easily. With the release of the finger action, the slit returns to be fully sealed. This design ensured the prototype stayed waterproof.

Refer to Annex E for pictures of prototypes and sketches

4.5 Antislip layer

We realised the need for an inner anti-slip layer as a further measure against tissues coming loose inside the prototype. In the second and third prototypes, we used a thin plastic sheet, but the plastic sheet created bulk as it trapped air between layers. In the final prototype, we lined the prototype internally with a thin plastic netting. This netting did not create bulk yet prevented movement of the tissue packet inside the prototype, reducing crumpling of tissues.

5 Modification and Evaluation

To test our prototypes, we placed each iteration of the prototype in our front trouser pocket and carried on daily activities, including walking and sitting, for two hours. We then removed the prototype from our pockets to test how well it stayed waterproof, easy and quick to use, uncrumpled and intact. We used tables (Figure F1) to compare our prototypes with current commercially available solutions.

Through our testing (Table F2 & F3), we made adjustments to our prototypes. For example, we made our final prototype much smaller than the previous prototypes as we realised that we needed a pocket-sized prototype to carry around.

Summary of test results

	Tick		
Iteration (2,3,4)	Pass	Fail	Potential Failure
Water resistance	✓ ✓	✓	
Ease and speed of use	✓	✓ ✓	
Protection from crumpling and folding	✓ ✓	✓	
Prevention of tissue from coming out	✓ ✓ ✓		
Bulk	✓		✓ ✓

Red - second prototype
Blue - third prototype
Green - final prototype

Annex A: Decision Making

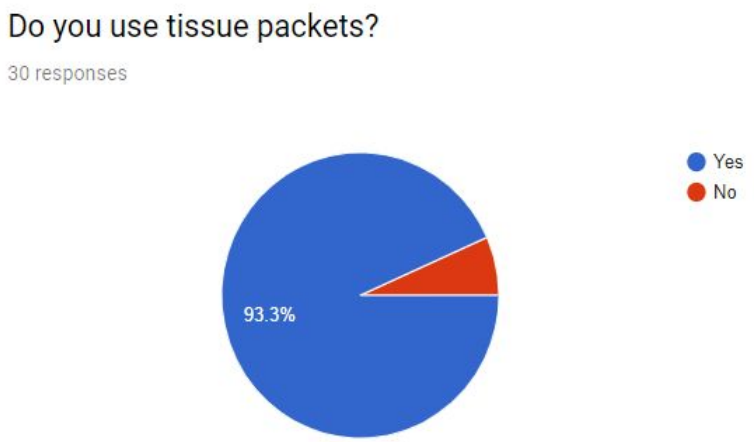
A1: Decision Making Matrix

Criteria	Food Delivery Box	Tissue Packet Holder	Foldable Trolley

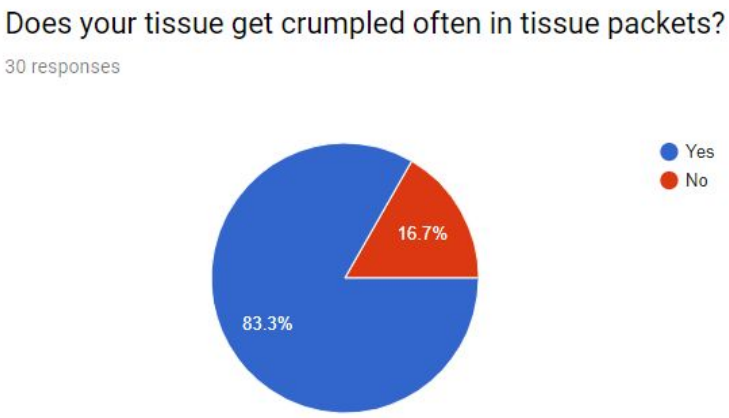
Significance /10	8	8	6
Feasibility /10	2	9	4
Projected effectiveness of proposed solution /10	6	6	5
Total /30	16	**23**	15

Annex B: Needs Analysis 1

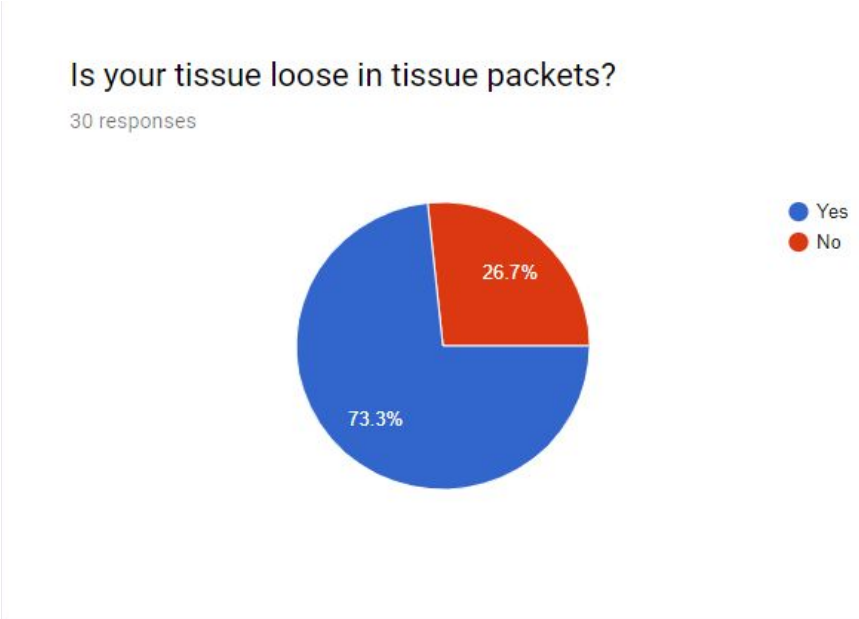
B1: Pie chart on the number of respondents who uses tissue packets



B2: Pie chart on the number of respondents who experience their tissue getting crumpled into tissue packets



B3: Pie chart on the number of respondents who experience their tissue getting crumpled in tissue packets



Annex C: Pictures of existing solutions

Figure C1: Picture of Paper Handkerchief

Figure C2: Picture of Cloth tissue holder

Figure C3: Picture of Portable tissue box

Annex D: Needs Analysis 2

Figure D1: Pie chart on the number of respondents who preferred to use silicone as the body of the product

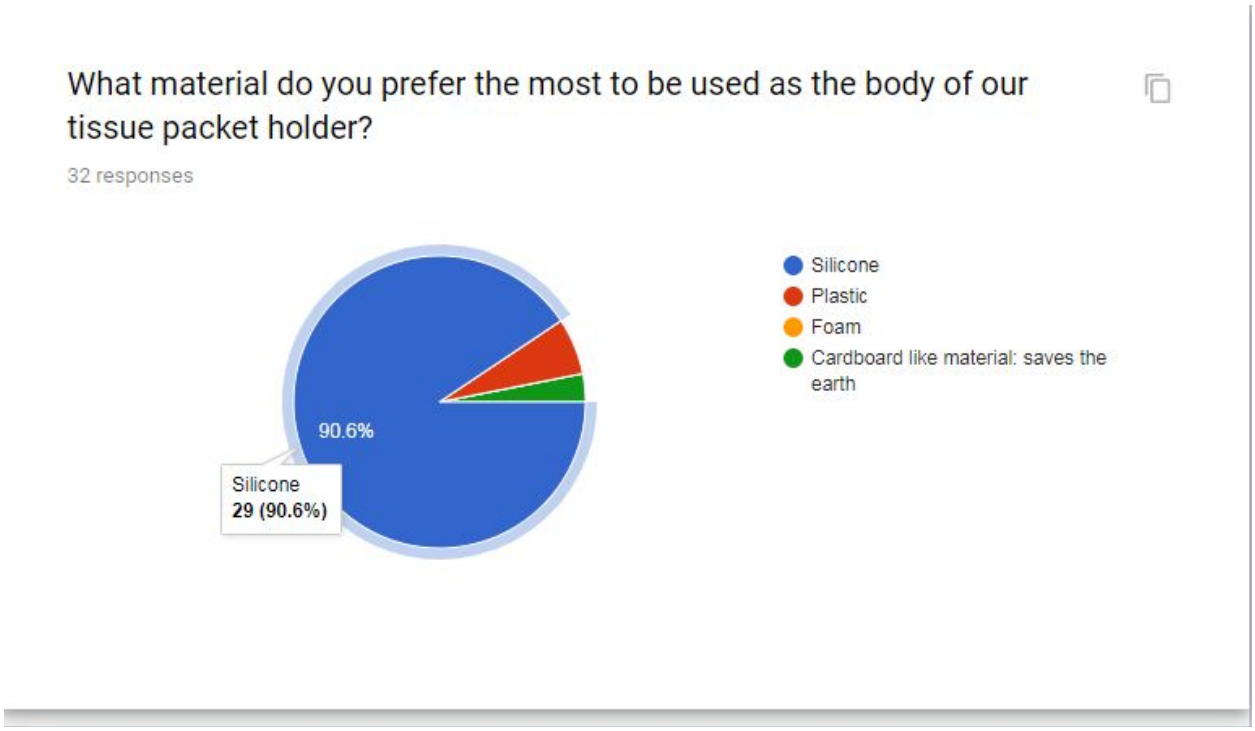
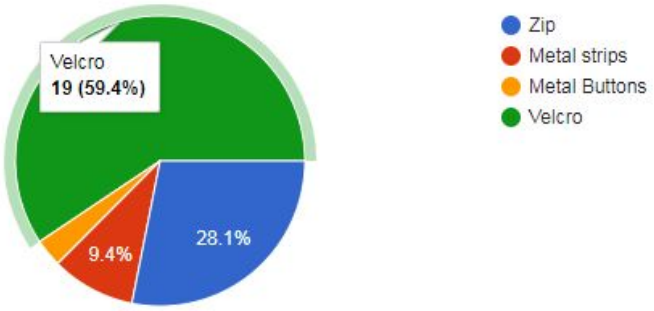


Figure D2: Pie chart on the number of respondents who want to use velcro as an additional material

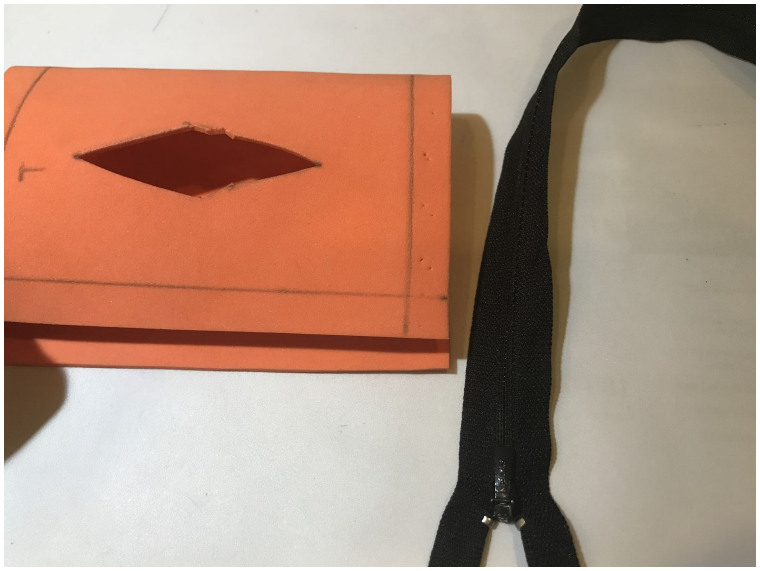
What additions do you guys prefer for our prototype? (Mainly for the insertion of the tissue packet)

32 responses



Annex E: Our prototypes

Figure E1: Prototype 1 (Foam + Zip)



** could not be constructed*

Figure E1B: Sketch to prototype 1

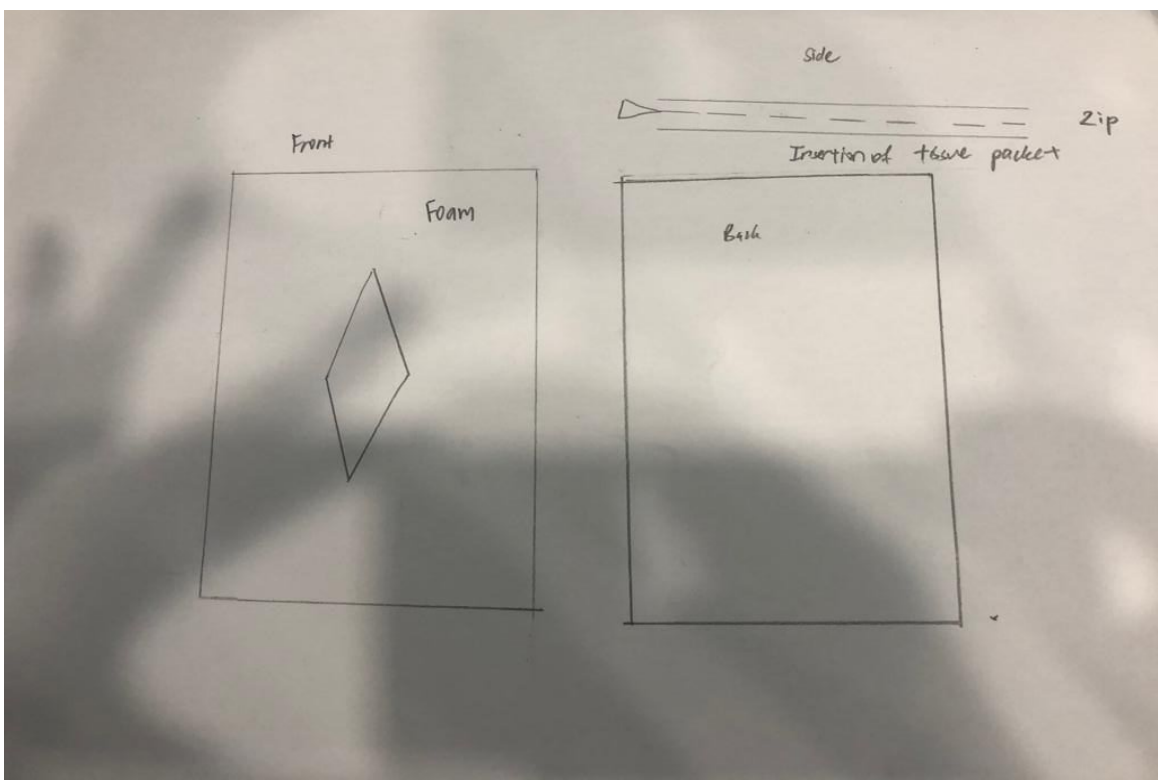


Figure E2: Prototype 2 (Silicone + Zip)

Figure E2B: Sketch to prototype 2

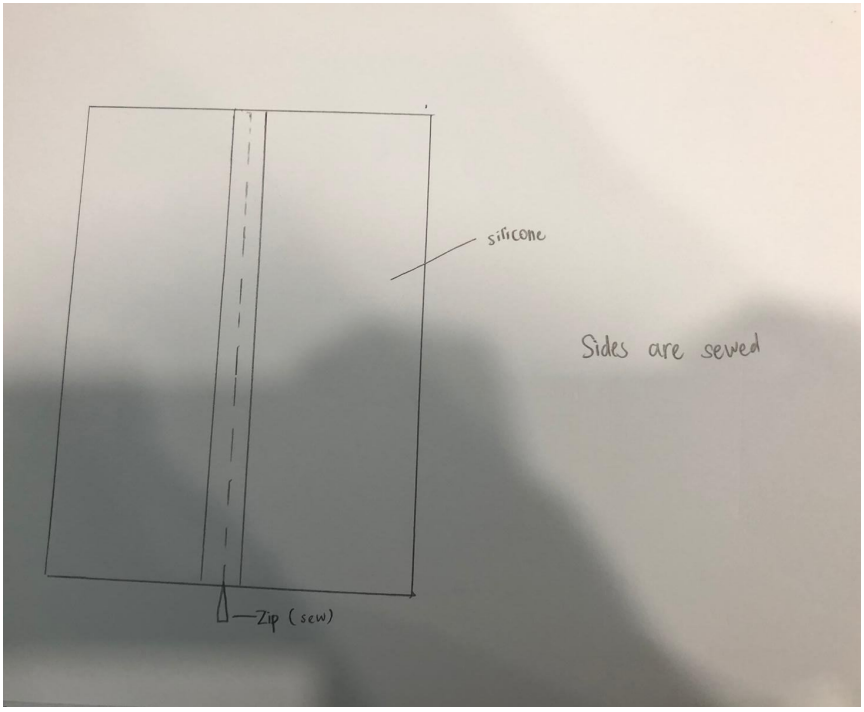


Figure E3: Prototype 3 (Silicone + Velcro)

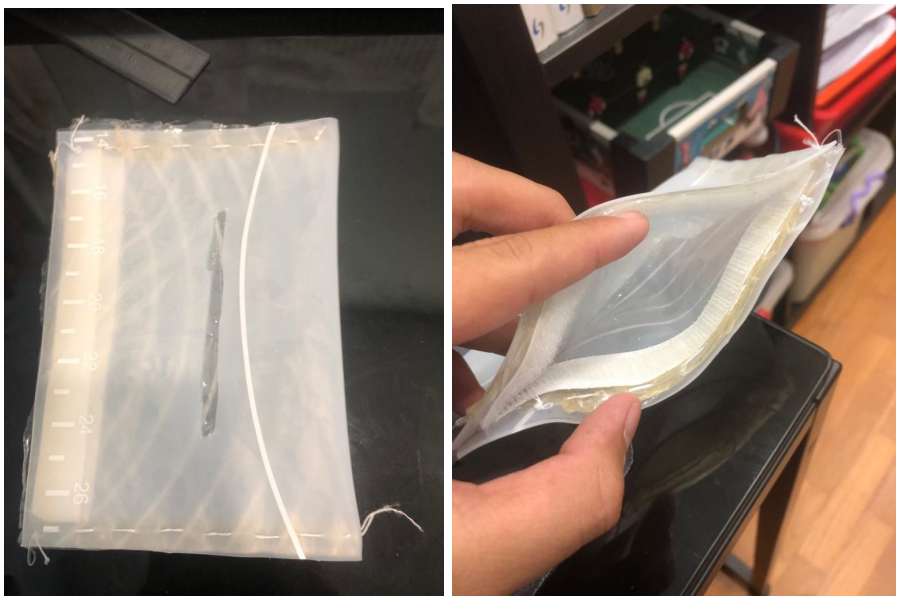


Figure E3B: Sketch to prototype 3

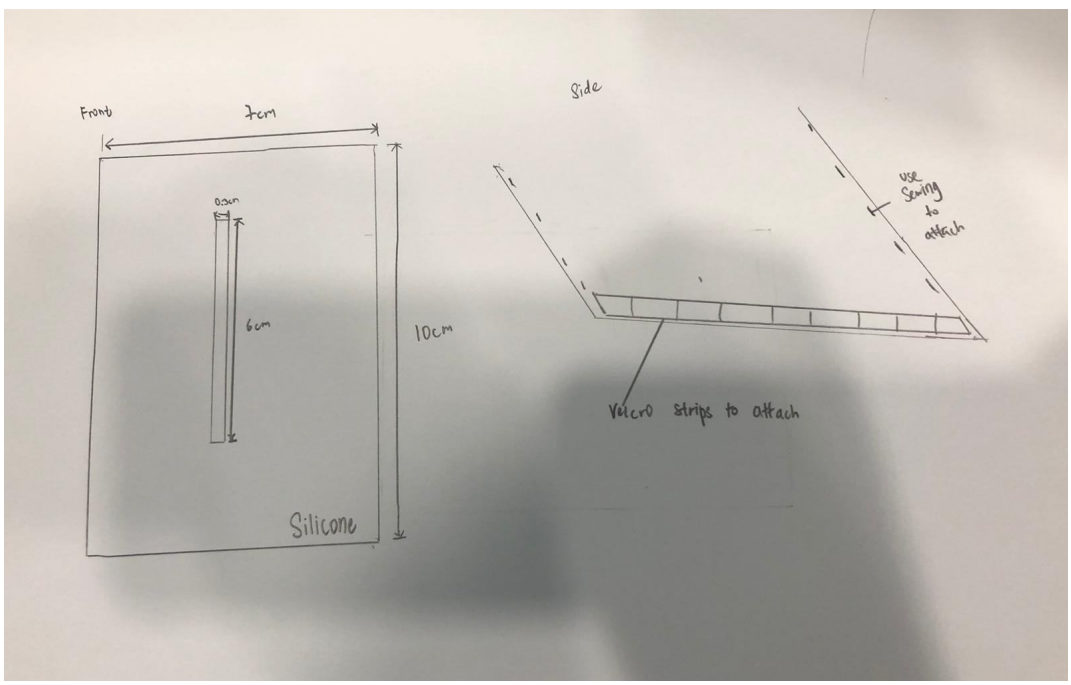


Figure E4: Final/Prototype 4 (Silicone + Plastic netting + Button)

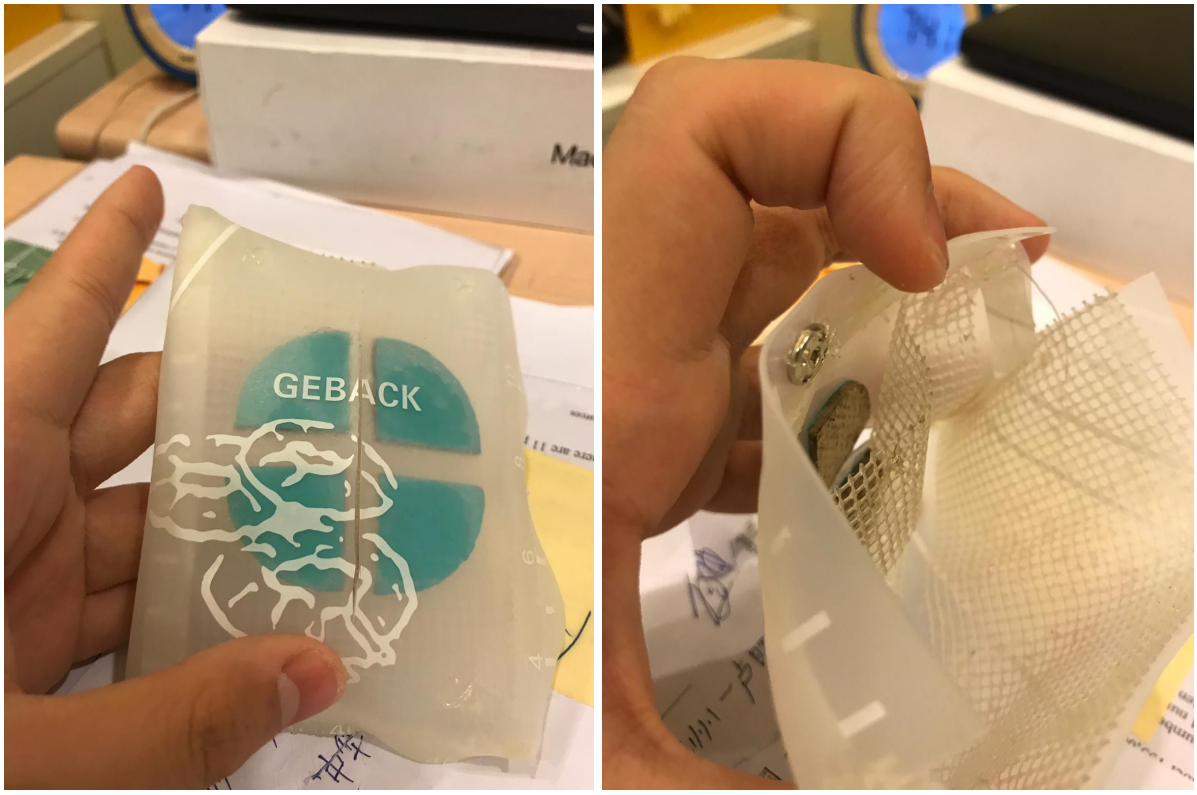


Figure E4B: Proof of concept of Final Prototype

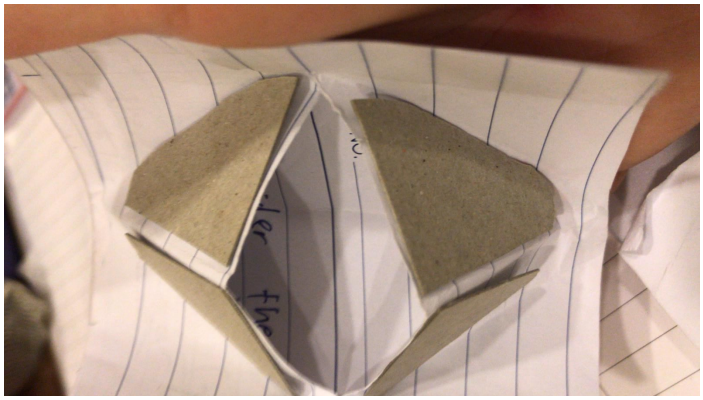
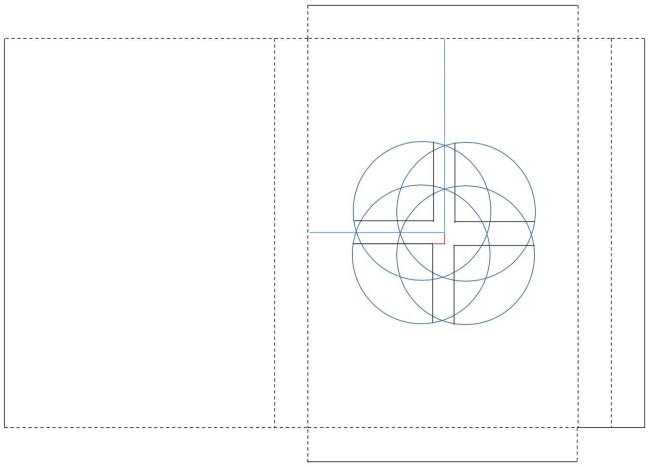


Figure E4C: Cutting template for Final Product



Annex F: Evaluation

Figure F1: Evaluation and comparison table (on a scale of 1-10, 1 being “least” and 10 being “most” along the criteria)

Criteria	*Cloth Packet Holder*	*Paper Handkerchief*	*Tissue Box*	*Prototype 2*	*Prototype 3*	*Final Prototype 4*
Secure /10	*6*	*3*	*9*	*9*	*9*	*9*
Prevent crumpling /10	*4*	*2*	*9*	*9*	*9*	*9*
Convenient /10	*8*	*7*	*1*	*4*	*8*	*9*
Waterproof /10	*1*	*1*	*3*	*10*	*8*	*9*

Overall effectiveness/40	*19*	*13*	*22*	*32*	*34*	*36*

Figure F2: Testing for Prototype 2

Test Iteration: 1 (Prototype 2)	Tick			Remarks
Test Date: 28 June	Pass	Fail	Potential Failure	
Waterproofness	✓			When the hole is zipped, it is completely protected from any water
Ease and speed of use		✓		The hole has to be unzipped to remove the tissue
Protection from crumpling and folding		✓		Moves around within the packet and may get caught with the plastic layer inside
Prevention of tissue from coming out	✓			Nothing can come out when the hole is zipped
Bulk			✓	The tissue is packet is slightly enlarged because of sewing around the sides

Figure F3: Testing for Prototype 3

Test Iteration: 2 (Prototype 3)	Tick			Remarks
Test Date: 28 June	Pass	Fail	Potential Failure	

Waterproofness			✓	Water can seep in through the sides and the top
Ease and speed of use			✓	No faster than the regular tissue packet
Protection from crumpling and folding	✓			Protects from the crumpling better with the buffer space from the velcro
Prevention of tissue from coming out	✓			Velcro can theoretically come off but not within the bounds of normal use
Bulk			✓	The tissue is packet is greatly enlarged from velcro and buffer space

Figure F4: Testing for Final Prototype 4

Test Iteration: 3 (Final Product)	Tick			Remarks
Test Date: 2 August 2019	Pass	Fail	Potential Failure	
Waterproofness	✓			Water can seep in through the top, but not within normal usage
Ease and speed of use	✓			It is much more convenient to remove the tissue by just squeezing the packet,, without the risk of tearing or crumpling it.
Protection from crumpling and folding	✓			Protects from the crumpling better by making a tighter packet

Prevention of tissue from coming out	✓			Button can come out but not within bounds of normal usage
Bulk	✓			The tissue is sewn to fit the packet precisely

Annex G: References

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