Hwa Chong Institution
Project Work
Category 3 Inventions Log Book

Title of Project: Smart belt
Group Name: 3-16
Group Members: 1. Jeriel Tan 2. Steven Wang 3. Keane Tan 4. Wang Zixiang

1. Problem Finding

(The beginning...)

Identify a problem you would like to solve. You may want to brainstorm for problems using different approaches eg thematic, survey or general brainstorming etc.

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

1. Difficult to install and remove car booster seats
2. Shaky table in school
3. Coins are hard to find in a coin pouch
4. Faeces stains on toilet bowl

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

1. Shaky table is not much of a problem as long as students learn to take care of school property
2. There are already good solutions to cleaning faeces stains on toilet bowls
3. Its is not realistic for us to create a coin sorter in a small pouch and it's going to be very difficult.
4. Difficulty in installing car booster seats is a problem faced by many people including ourselves.

1 C List some problems your group would like to solve. List also the considerations for selection of problem 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.

Problem Evaluation Grid

*add more columns and rows where necessary

Considerations for Selection	Problems		
	#1 Coin sorting	#2 Car booster seat	#3 Cleaning faeces stains
Is it really a problem?	2	3	1
Existing solutions	2	3	1
Cost	3	1	2
Is it possible to solve?	1	2	1
Total Score	8	9	5

2. Define the Problem

(This is one…)

Now that the problem has been identified. It is important to gather information on the extent of the wto conduct surveys and research on existing solutions.

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

The variation in the different models of car seats make the booster seats difficult to install. This mainly happens in rental cars and taxis, where parents are in a rush to install. Furthermore, Grab drivers in Singapore are not supposed to accept children below 135cm without a booster seat. Since booster seats are huge and bulky, it is not feasible for parents to carry it around when taking taxis or when overseas. (other countries have similar regulations on child booster seats.) Currently all booster seats are pretty inconvenient and bulky, hence the need for our project to make it more accessible and convenient.

2 B Compare and contrast the existing or similar solutions.

All current solutions involves installing and removing the booster seats. This brings about great inconvenience when travelling. Although certain car models have such mechanisms where booster seats are pre-installed, the extra cost for this feature in this car is $500 and above, which is extremely extravagant although convenient. As such, we have decided to make an improved booster seat that can be integrated in the car seat or is foldable so as to make it more portable.

3. Your BIG IDEA#

(Developing the idea….)

Write down your proposed invention and why you want to do it. State also how you think your proposed invention is better.

3 A Describe your proposed invention.

Our proposed invention will be integrated in the car seat. This is to increase the convenience of lugging the booster seat around for young children. the

booster seat can increase in height and can be adjusted to the height of either a booster seat or just a normal seat. After much consideration, we found the idea of an integrated car seat to be a novel one and wanted to provide a cheaper solution for the masses.

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

The purpose of our proposed invention is to make the booster seat more portable and convenient to bring around. This will benefit mainly Grab drivers as well as parents with kids who regularly use ride-share apps, as it will allow them to conveniently bring around the car seats for their children. This will help increase the safety of young passengers.

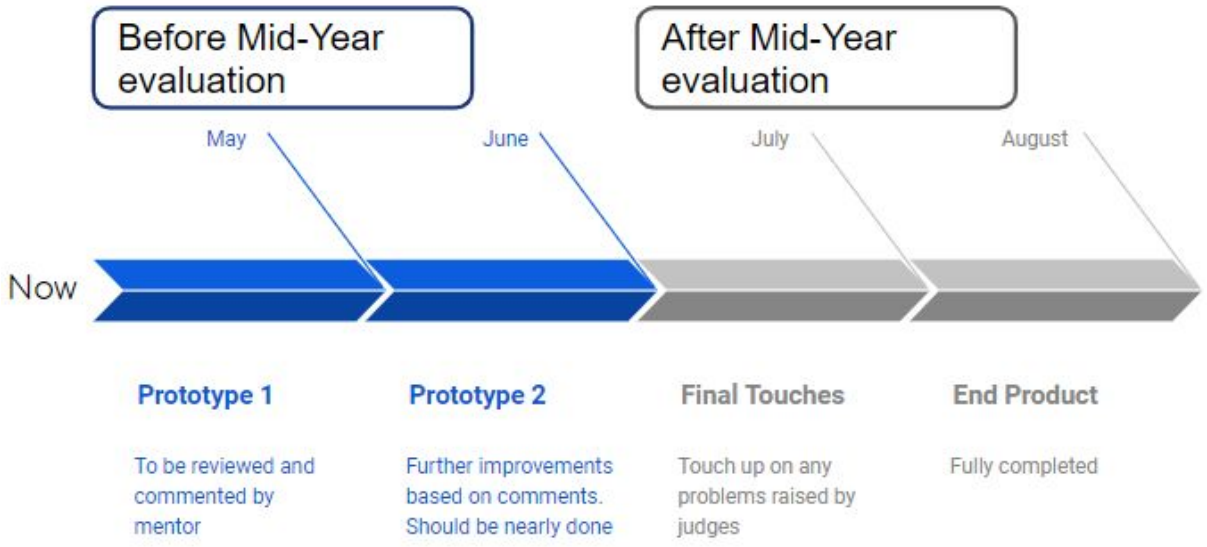
3 C In what ways would your proposed invention be different and/or better than existing solutions, if any?

It will be convenient to use to adjust the height of the chair to suit the young children. It is adjustable and can fit any height of children whereas the ones on the market are bulky and inconvenient to carry around. Due to the lack of complexity in the mechanism, manufacturing can also be cheap enough and affordable for many people.

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

We will meet some problems designing the mechanism to move up and down smoothly.

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



#must be able to be constructed based on current / emerging technologies, must not violate the laws of Science or go against the laws of nature.

4. Construction <u>or</u> Modelling Process*

(This first... then that...)

You are now onto the fabrication of your prototype/ product. You need to select material and understand how to put them together so that your prototype/ product can perform its function.

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

We chose to utilize wood due to the fact that it is a durable yet easy to work with material. Metal might be a sturdier material that we might consider in the future, but it is hard to work with, thus we decided to utilize wood for our prototype. Furthermore, it is also readily available in the Makerspace

4 B Explore these considerations that may guide the construction of your prototype/ product.

One consideration that we had to take was to make sure that the mechanism was easy to produce. This would ensure that it would be easy to replicate the prototype later on to improve it.

4 C Document the prototype/ product development stages. You may use drawings, photographs or videos.

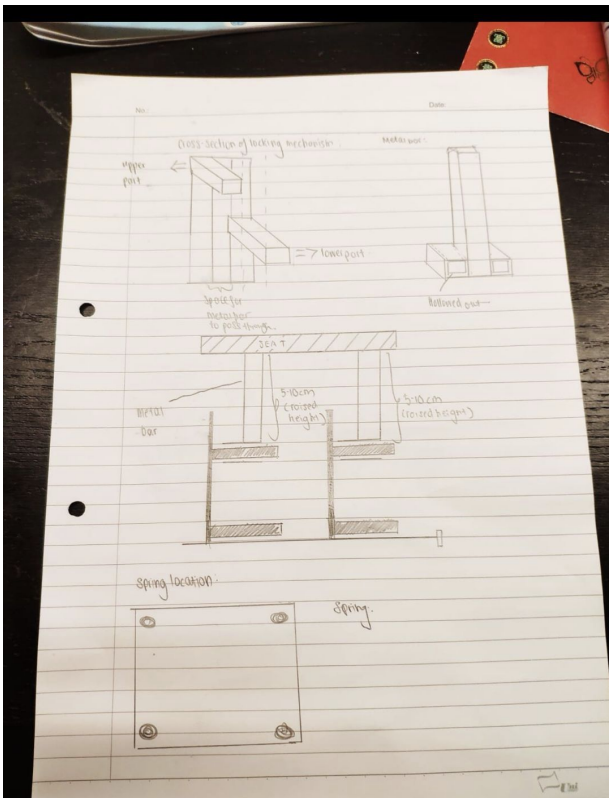
In the beginning, our idea was to use a mechanism similar to that of a camping chair. We had to consider that the base of the chair would decrease in area when extended, which would cause the mechanism to shift around, and hence would be unstable. Since this idea had too many flaws, we decided not to prototype it.

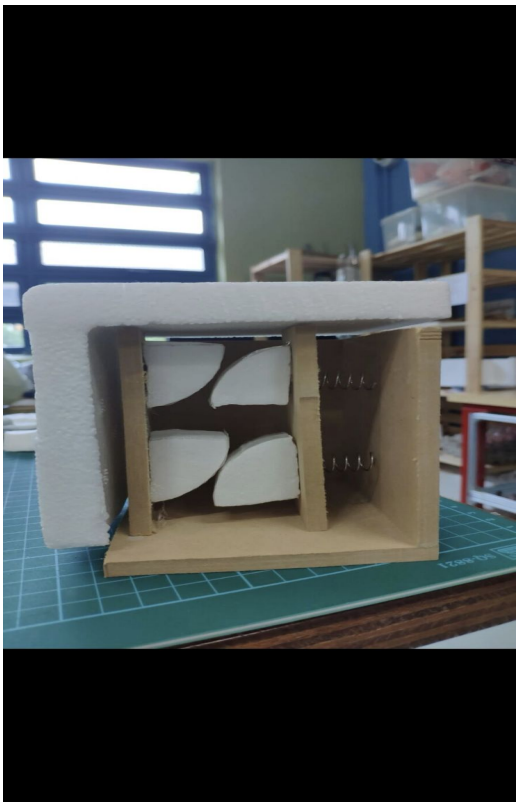
After the camp chair idea, we instead decided to use a mechanism that uses a catch. Basically, the seat is connected to four metal poles below it, with a tube at the end of it. When you slide the top of the seat forward, the tube moves back and out of the catch, allowing you to pull it up. Then, you can push the top of the seat backwards, and the tube will slide into the second catch. However, we realised that the top catch would interfere with bottom catch. We did a prototype of this, and it worked out fine but the problem of the interference was still prevalent so we decided we had to change something.

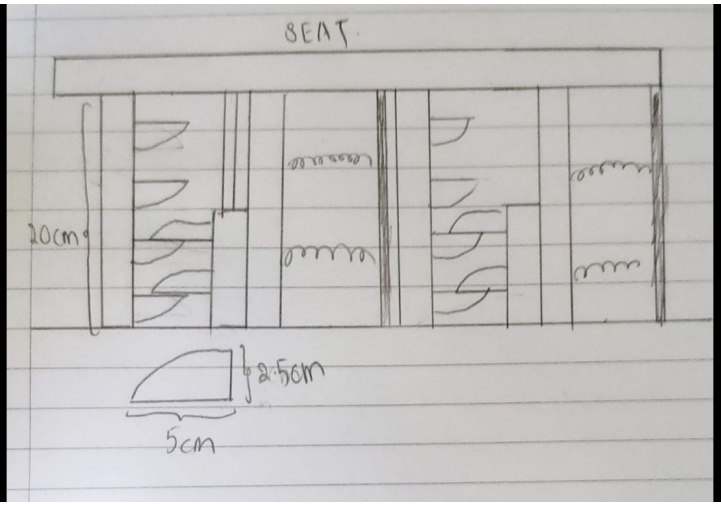
Finally, we decided that we should use another type of catch mechanism. We cut out a shape like a quadrant and square put together. The way it works is that when the seat is being pulled up, the rounded surfaces will be pushing against each other, and will push upwards. However, if you try to push it down it will not be possible because the flat surfaces are against each other

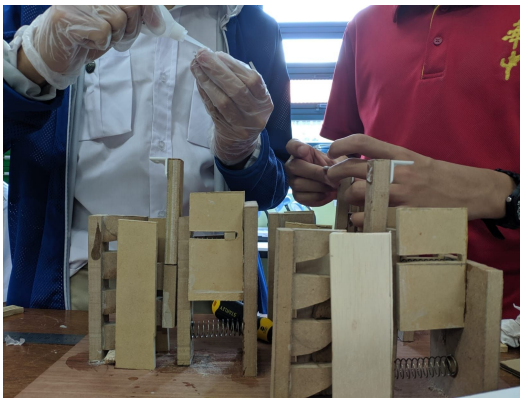
For our final prototype, we added another two of the mechanism to make it more stable and support more weight. We also used wood to restrict the platform the moving when we are trying to pull the seat up. However due to the uneven pressure, we quickly realised that it was still unbalanced but ran out of time to fix it. We also purchased better quality spring which make the prototype to be pushed in more easily. Lastly we covered it with an acrylic board.

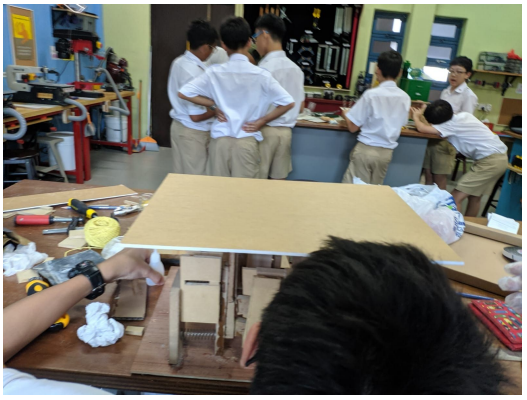
However this prototype is not the best and there is certainly room for improvements. Since the prototype is made of many pieces of wood stuck together, it will be fragile and might break off any time. However, if we continue to develop this prototype we would use stronger materials such as metal.

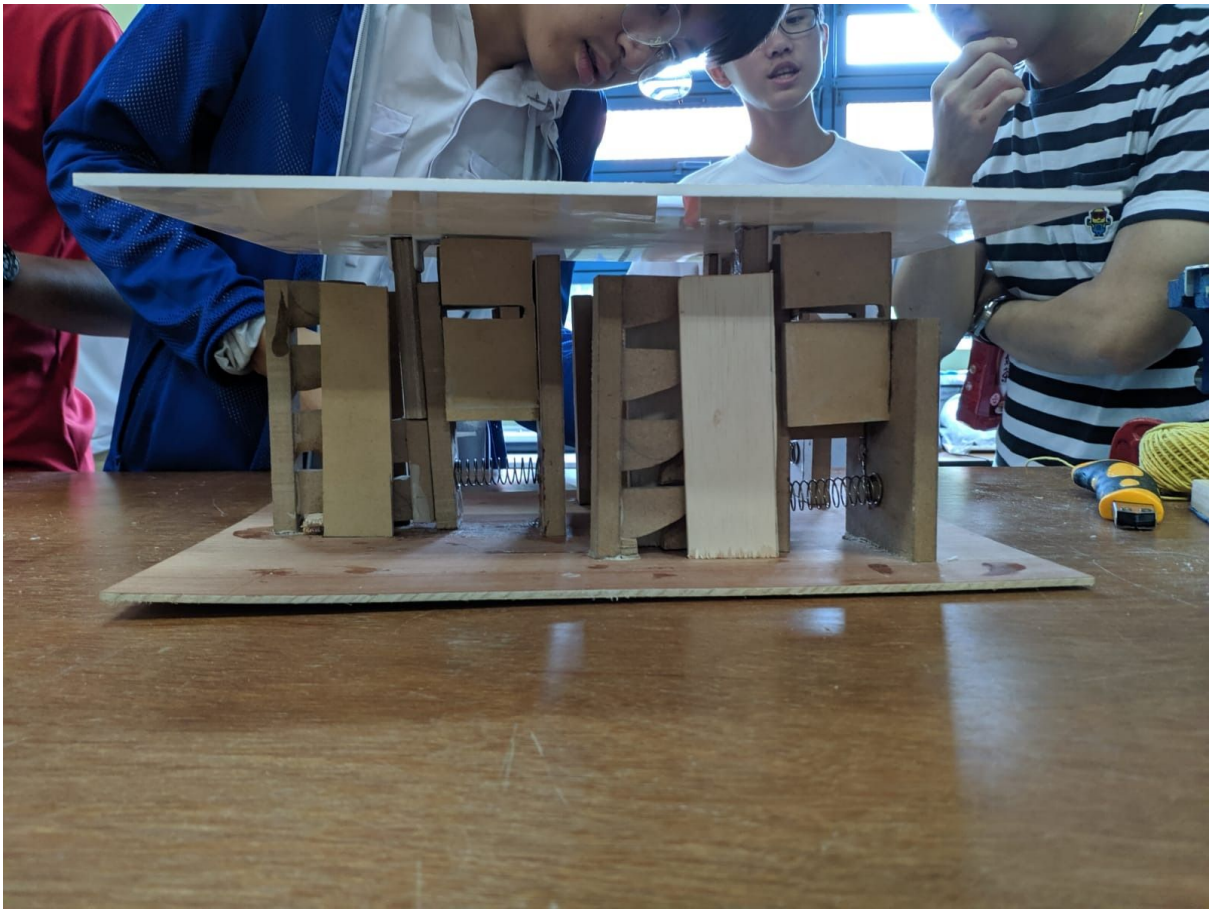

Cross-Section of locking mechanism
upper part
lower part
Hollowed out
SEAT
Metal Bar
5.10cm (round height)
5.10cm (round height)
Spring location.
Spring.

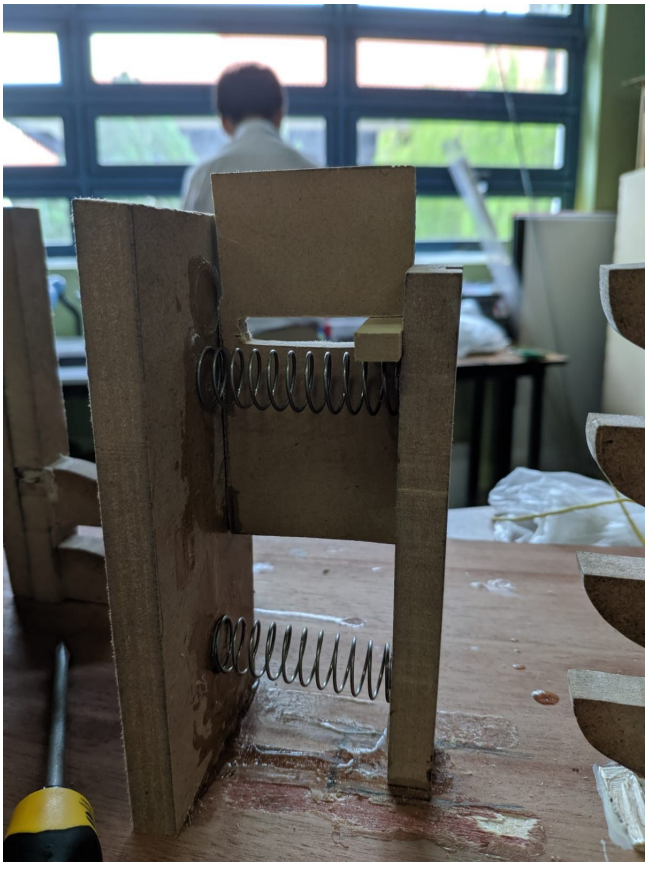


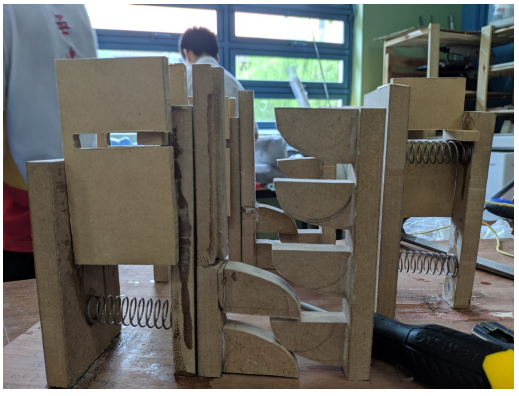

SEAT.
20cm
2.5cm
5cm











OR

If construction of the prototype is not possible, then you have to create an animation / as a proof of concept that it can be applied in a bigger scale.

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

4B Briefly explain how the video / animation can effectively show how your invention will work and the different considerations.

Warning:

- *Video / animated simulation only if prototyping is absolutely no possible.*
- *Video / animated simulation must be logical and convincing that the invention works.*
- *Constraints must be clearly included in the logbook or the project will be heavily penalized.*

5. Modification and Evaluation

Upon the completion of your prototype/ product, you would need to see if it is working the way you want it to work. Check if your product has met the identified purpose and the user's need; and implement necessary modifications and improvements. This process may take several rounds.

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:	Tick			Remarks
Test Date: 26/3/2019	Pass	Fail	Potential Failure	
Test Criteria 1: Strength	✓			The prototype is sturdy and should be able to hold up the child
Test Criteria 2: Safety			✓	Prototype may shift about when the car is moving
Test Criteria 3: Feasibility			✓	The prototype is feasible, but LTA might not approve of installation

Test Iteration:	Tick			Remarks
Test Date: 2/5/2019	Pass	Fail	Potential Failure	
Test Criteria 1: Strength			✓	The prototype would not hold up the weight of the child as all the weight would be focused on one beam
Test Criteria 2: Safety	✓			The prototype's mechanism works fine, and theoretically the system should work
Test Criteria 3: Feasibility			✓	The prototype is simple, feasible and creative, however, we have to make sure this modification to the car will not affect performance of car if not the LTA would not approve

Test Iteration:	Tick			Remarks
Test Date: 11/6/2019	Pass	Fail	Potential Failure	
Test Criteria 1: Strength	✓			The prototype can secure the child's weight, but the material needs to be metal, not wood
Test Criteria 2: Safety	✓			The system is safe, and even allows for different height incrementals to suit the child for his/her comfort
Test Criteria 3: Feasibility	✓			The prototype can be done, though a lot of work needs to be put in

*Add more rows for more criteria
** Repeat table for next test iteration

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.

6. References

Read http://www.bibme.org/citation-guide/apa/ on how to cite 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.)

[1] Product Dimensions. (n.d.). Retrieved from https://www.car-seat.org/showthread.php?132795-Product-Dimensions

[2] Product Dimensions. (n.d.). Retrieved from http://footclinic.club/car-seat-dimensions

[3] Vehicle Modifications. (n.d.). Retrieved from https://www.onemotoring.com.sg/content/onemotoring/home/owning/modification.html

[4] Car Seats: Information for Families. (n.d.). Retrieved from https://www.healthychildren.org/English/safety-prevention/on-the-go/Pages/Car-Safety-Seats-Information-for-Families.aspx

[5] MAKE YOUR VOLVO MORE YOU. (n.d.). Retrieved from https://www.volvocars.com/sg/cars/options/accessories-new

[6] (n.d.). Retrieved from https://www.carclub.com.sg/child-on-board-child-seat-rules-in-singapore-you-should-be-aware-of/

[7] (n.d.). Retrieved from https://boards.straightdope.com/sdmb/archive/index.php/t-320207.html

[8] Modifying Your Vehicle. (n.d.). Retrieved from https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/modifying-your-vehicle.html