

Hwa Chong Institution
Project Work
Category 3 Inventions Log Book

Title of Project: <u>Automatic Window Cleaner</u>
Group Name: 3-01
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1. Problem Finding

(The beginning...)

Identify a problem you would like to solve. You may want 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.

We identified many problems during the brain-storming process. After much thought, we came down to the following:

1. People often drop the items that they are holding
2. People face danger when cleaning windows in high rise buildings
3. People find it a chore when cleaning whiteboards

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

- 1) (If a product were to be made to solve the given problem) The impact of our product on the society if it were to be introduced into the market
 - There would not be as much need for a product to be made based on the given problem since the (perceived) impact of it on the society is not strong enough
- 2) The significance of the problem
 - It evaluates the need for the product to be made
- 3) How well alternative solutions are able to solve the problem
 - This determines whether or not the product is to be made since there would be no need for a product to be made if there is already an alternative solution that can solve the given problem well enough

Problem 1: This problem, although significant, already has other alternative solutions for it easily available in the market. Also, due to gravity, no matter how powerful the grip of our product, there is still a chance of the user dropping the item, making it not as effective. Since there is already a large number of alternative solutions in the market (which are effective), our new product would also not make a very large impact on society.

Problem 2: The second problem is one of great significance. It directly relates to our lives, and our choice to solve this problem may determine life or death for others. Also, alternative products which are currently in the market have proved to be not as effective when solving the problem, still involving a risk when cleaning windows.

Problem 3: Compared to the others, this problem is not as significant since the cleaning of the whiteboard only takes a person up to 10 seconds of his/her time. Hence, this problem is ruled out.

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	#2	#3
Consideration 1	2	3	3
Consideration 2	4	3	1
Consideration 3 (This score is subtracted from the sum of the rest of the scores – See consideration 3 above)	4	2	2
Total Score	2	4	3

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 problem and/or evaluate the usefulness of existing solutions based on *some criteria*. You may need to conduct surveys and research on existing solutions.

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

Many people face dangers when trying to clean the outer surface of windows, to an extent that there are quite a number of deaths caused by this problem alone.

2 B Compare and contrast the existing or similar solutions.

- Magnetic Window Cleaner
 - To operate this, users still have to reach out to the outer surface of the windows if their hands are not long enough
 - Also, if they happen to remove the window cleaner from one side of the window, the other side may fall and injure people below
 - Not as convenient

- Mamibot PreVac 650
 - The cost of this product is extremely expensive
 - It must be operated by the user at all times since it would not be able to move pass the frames of the window pane, making it extremely inconveniently
 - The product consists of many parts which makes it very complicated to operate

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.

To make a window cleaner that is able to clean the window each time when the window is opened/closed.

It would consist of a sponge being attached to a piece of plastic.

It would be positioned right in between the inner surfaces of the window to clean the inner surfaces each time the window pane brushes against the sponge and it would be positioned (with a hook) on the outer surface, cleaning the window pane too each time it brushes against the sponge.

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

- To solve the problem regularly faced by people: People face danger when trying to clean the outer surfaces of the window
- 1) Our product would allow users to clean the outer surfaces of the window without purposely reaching outside of the window, greatly reducing the dangers posed.

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

- 1) It would be more convenient compared to conventional methods of window cleaning
- 2) The cost of our product is cheaper

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

- There would be difficulty when trying to attach our product (the window cleaner) to the frame of the window
- It would be hard to attach the sponge to the plastic trunking firmly

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

- Trying to overcome the obstacle of attaching the sponge to the window frame so that it would be firmly attached
(March – May) & (July)
- Improvement of our product through the making of new prototypes
(May) & (July – August)
- Attaching the sponge to the plastic trunking firmly
(May & July)

#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 or 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

Sponge

We went through an intensive choosing process which consisted of:

- 1) Testing the cleaning capacity of the types of sponge
- 2) Testing for absorption of water







Plastic Support (Cable Trunking)

- Durable
- Strong
- Waterproof
- Cheap

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

- How well our product works (Must be able to clean a certain amount of dust)
- Stability of our product (Parts of the product must not be too flimsy)
- Design of our product / How well our product looks (Must be aesthetically pleasing / Looks good enough)

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

Modelling processes

- Firstly, we had to choose a suitable sponge to be used for cleaning and it needed to have a high cleaning capacity and would not be too rough so as to move the window with ease and not scratch it. We tried out with different sponges such as polyethylene sponge, polyester sponge, and normal fabric. We also conducted experiments to see which one was the best. We sprinkle talcum powder on the

window surface and used the sponges to clean it. The results showed that polyethylene sponge was the most suitable.

- Then we had to determine a type of support. Since the sponges were too flimsy on their own, we needed a support to secure the sponges such that they do not fall off or break. We chose to use cable trunkings as they were cheap and strong. (The retail price was 2.50 per metre, so the price if bought in bulk is probably cheaper, perhaps, we would only need around half a metre for one of our products) They were also extendable which allowed us to make our products fit windows of different sizes.
- We then had to stick these parts together. We thought glue would be able to stick the parts together, but the glue seeped into the sponge and could not stick to the cable trunking. So we tried sewing instead. However, sewing was really flimsy as the sponges were soft and allowed the string to move around. We then thought of using velcro. Velcro was stable and strong and it would also not seep into the sponge. We tested it out and it worked really well. We also cut a indentation into the sponge to fit the cable trunking for extra security.
- We also made the the sponge able to glide up and down on the cable trunking. At first the window could only fit windows of certain sizes. So we thought of a way to make it able to clean windows of different sizes by sliding the sponge up and down.

Prototype 1: Polyethylene sponge stuck onto a cable trunk with velcro. It is modified so that the sponge is able to move up and down the wire casing.



Prototype 2:

Sponge is attached to a thinner piece of plastic, and a structure is added so that the cleaner is able to clean the outer surfaces of the window.



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.

- 1) Must be SAFE to operate
- 2) Must be Sturdy
- 3) Design of product
- 4) Must be Cheap (For our product to be affordable to the general public)

Test Iteration:	Tick			Remarks
	Pass	Fail	Potential Failure	
Test Date:				
Test Criteria 1	✓			
Test Criteria 2			✓	Our product might detach itself from the window if used too many times. However, some parts of the product are quite sturdy.
Test Criteria 3	✓			Although it looks acceptable, certain parts of the product have room for improvement.
Test Criteria 4	✓			

*Add more rows for more criteria

** Repeat table for next test iteration

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.)

Department of Statistics Singapore - <https://www.singstat.gov.sg/>

Straits Times Singapore - <http://www.straitstimes.com/singapore/maid-fell-30-storeys-while-cleaning-window-coroner>