

Hwa Chong Institution

Project Work

Category 3

Inventions Log Book

(Revised for 2020)

Title of Project: A self-sanitizing door handle
Group Name: 3-45
Group Members: 1) Wang Hongyu 2) Julian Oon Kang Xiang 3) Tay Hong Joseph 4) Song Sheng Guang

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.

When we were brainstorming our ideas, we looked at the different problems that were commonly encountered by students, teachers and other people in their daily lives. Some genres that we explored were like the problems faced at home, for example people always forgetting to remove the stagnant water from their flower pots, which may result in the breeding of Aedes mosquitoes that can spread dengue fever, or the problems faced in school by students, for example students may get lost in a huge school like Hwa Chong Institution.

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

The criteria we used to evaluate the problems were the severity of the problem, the time the problem may last and the impact of the problem. At first, we have about ten problems, of which one is increasing cases of dengue, another one of the problems is the increase in spread of Covid-19.

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		
	Dengue fever	Getting lost in school	Increased spread of Covid-19

Severity of the problem.	3	2	4
Time the problem may last.	2	3	3
The impact of the problem.	3	2	4
Total Score	8	7	11

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)

Problem selected: Increasing spread and cases of the Covid-19 virus.

As COVID-19 continues its onslaught around the globe, we have decided that we will not sit on the back bench, and instead come up with a solution to reduce the number of virus transmissions. Based on internet research pages, it shows that Covid-19 spreads easily through contaminated surfaces like a door handle. The COVID-19 virus can remain on surfaces for as long as 3 days, especially if it is a stainless-steel surface like a door handle after being touched by an infected person. The infected person can cause the virus to be on his hands through coughing and sneezing which releases the virus in the form of droplets. Based on scientific research, people tend to touch their face very frequently. Through touching the face after touching a contaminated surface without sanitizing the hands, viruses will spread if they come in contact with the mucous membranes found in the eyes, nose and mouth, hence causing the person to get infected. Since a door handle is also a most frequently touched surface in public for example to open classroom doors or going to the toilet,

there will be a high possibility of spreading the COVID-19 virus through contact.

2 B Compare and contrast the existing or similar solutions.

We have looked into an existing solution in the market.



This is a self-sanitizing door handle made by two university students. There is a power generator inside the door handle which converts the kinetic energy produced when the door is being opened into electrical energy. Then, UV light is activated, causing a chemical reaction in the chemicals on the glass tube to kill all bacteria and viruses living on the door handle.

PROS

- This can reduce spread of flu and other viruses.
- Efficient.

CONS

- The door handle will be very expensive as it includes a power generator and has a photocatalytic coating made from the grounded mineral titanium dioxide.
- The door handle will be fragile and easy to break as it is made of glass. Also, if the door handle fails to work, viruses will survive on the glass for up to four days, causing a higher chance of being infected with the virus.
- Exposure to UV light may cause damage to health.

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 invention is a self-sanitizing door handle. The self-sanitizing door is made of hollow stainless steel, with rubber tubing and 3 spray nozzles on each handle. The hinge area has a storage tank for disinfectant and a specially designed pump. The disinfectant comprises of benzalkonium chloride, isopropyl alcohol and tea tree oil. These ingredients are very effective against microbials and tea tree oil has a pleasant smell. The door handle is designed such that when it is pushed, it will squirt disinfectant out from the 3 spray nozzles on the handle such that both the user's hand and door handle gets sanitized.

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

Our invention can sanitise the door handle immediately after use, reducing manpower needed for cleaning doors. It also helps to reduce the spread of coronavirus via contact. Thus, users do not need to worry about touching a contaminated surface and getting their hands dirty, causing the user to have a less chance of contacting Covid-19.

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

Our proposed invention comprises of cheaper materials used and thus will be affordable. Also, our product does not require UV light which may cause severe harm to the body as it only requires disinfectant.

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

The proposed invention may malfunction and may need to be refilled very frequently.

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

February 14: Registered our project.

February 21: We had our first meet up to brainstorm ideas.

February 26: We had our self-sanitising door handle idea.

March 2: We came to a conclusion that the self- sanitizing door handle is useful and we will choose it as our project.

March 3: We started encouraging people to do our survey about our project.

March 13: We got 50 survey results.

April 12-14: We finished our first evaluation slides.

May holidays: We met up again online to discuss on how to improve the previous bulky design to a better one.

June: We thought of different ideas and for the rest of the month, we just focused on preparing for exams.

August 1: We started doing our final term evaluation slides with the best idea selected.

August 11: We have finished and did some last-minute editing for our slides and also practiced presenting.

August 12: We presented to the two judges.

From August 12 to now: We wrote our written report.

#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. Proposed Construction or Modelling Process*

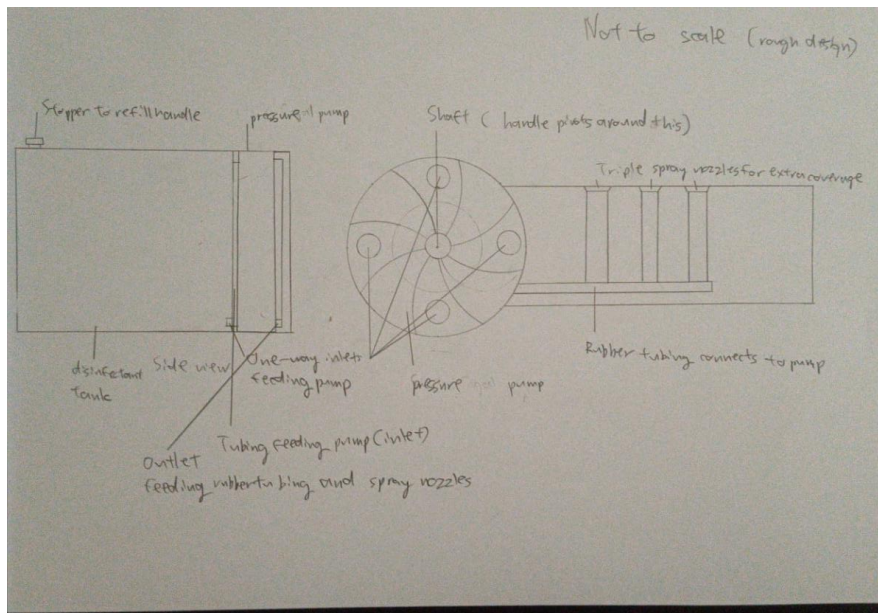
(This first... then that...)

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.

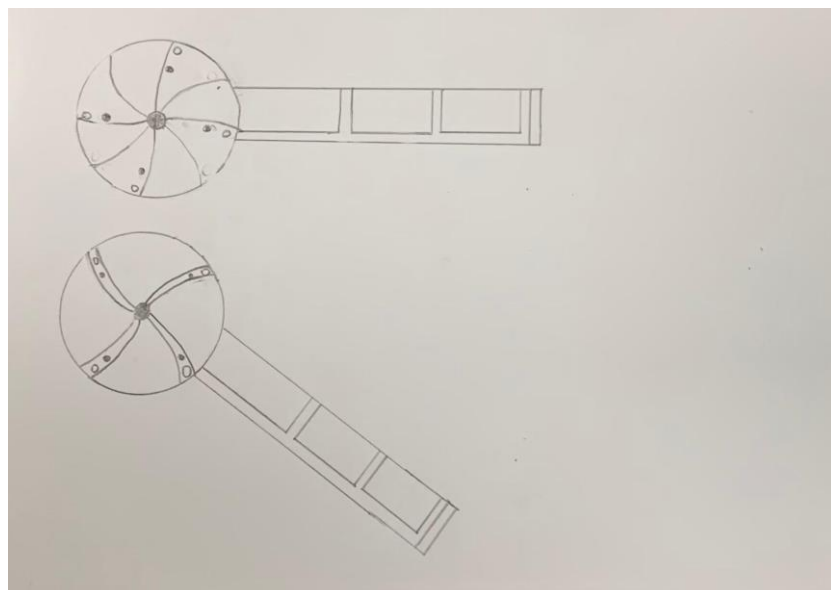
4 A Explain how and why the materials were chosen for the prototype/ product of your invention.

The materials are chosen to satisfy the criteria that it must have. We at first wanted to choose brass for the material for the door handle as it is anti-bacterial and anti-viral such that it can kill most of the germs on the door handle first before the disinfectant kills all the bacteria and viruses left on the door handle. However, brass is a very corrosive type of metal and cannot stand disinfectant, thus at last we decided to go with graphene oxide to coat the door handle instead due to its anti-corrosive and fast germ-killing abilities.

4 B Propose how the prototype/ product will be constructed or developed. You may use drawings and photographs.



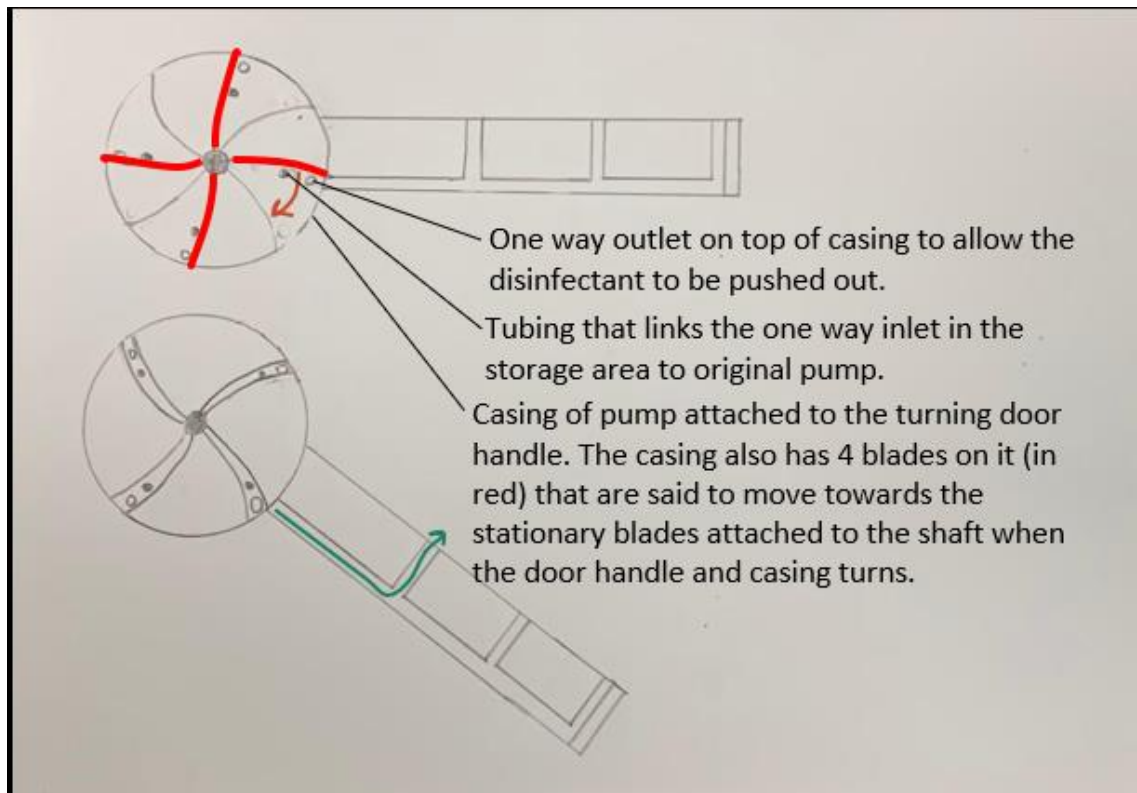
This is one of our drawings. The left-hand side drawing is the side of the door handle which will be hollow to contain the disinfectant and also will have a stopper to refill. There is a one-way inlet to take in the disinfectant from the storage area when the door handle is pushed back. The inlet is then linked to the four tubings.



The tubings will then be connected to the pump as represented by the shaded circles at the back of the pump, which the blades are made up of metal with rubber coating and the case itself is made up of stainless steel. The one-way outlets, at which are represented by unshaded circles on the top of the casing will be connected to four pipes that later joins together and connects to the three spray nozzles that will squirt out the disinfectant.

Four of the blades will be welded to the shaft that doesn't move while the other four blades are attached to the casing which moves together with the handle.

The working principle:



When the handle is pushed downwards, the casing attached to the handle will also turn, bringing the four blades towards the other four stationary blades. This increases the pressure in between the blades, pushing the disinfectant out from four one-way outlets on the top of the casing. Then the disinfectant will flow into the rubber tubing system connected to the outlets (not drawn) and out of the three spray nozzles to sanitize the user's hand and at the same time disinfect the door handle.

When the door handle is released, the casing with the four blades that are moving will return to its normal position away from the stationary four blades anticlockwise. This will reduce pressure in the pump, causing the disinfectant to be sucked in by the one-way inlet in the storage tank through tubings that link the inlet to the pump, from the storage tank behind, filling the pump.

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. 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.)**

<https://www.bbc.com/future/article/20200529-the-surfaces-that-kill-bacteria-and-viruses>

<https://www.google.com/amp/s/theconversation.com/amp/copper-is-great-at-killing-superbugs-so-why-dont-hospitals-use-it-73103>

<https://www.jamesdysonaward.org/en-US/2019/project/self-sanitizing-door-handle/>

<https://www.smithsonianmag.com/science-nature/copper-virus-kill-180974655/>