

Hwa Chong Institution
Project Work
Category 3
Inventions Log Book
(Revised for 2020)

Title of Project:

➤ Ammonia Sensor & Odour Digester

Group Name:

→ Group 3-39

Group Members:

- 1) Ee Zhao Hui (Group Leader)
- 2) Cedric Koh
- 3) Sean Ho
- 4) Pek Yu Xuan

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) Pungent smell commonly found in toilets
 - a) Whenever we use the toilets, we could often smell urine, and when we discussed this with our mentor, we found out that all of us actually faced the same issue, so we did an investigation and found out that the smell of the toilets are unpleasant
- 2) People often slouching when using computer screens
 - a) Using computer screens are a daily habit for many, especially office workers, and many do not adopt the appropriate posture, and it could result in hunchbacks and many different problems
- 3) Handicapped in wheelchair often require assistance
 - a) The handicapped require assistance from others, especially those in wheelchairs, we then wondered whether this reliance on others can be solved
- 4) Difficulty to wake up in the mornings
 - a) Waking up in the mornings is something that most people dread, and is a common issue faced by almost everyone

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

All our problems thought of have to be put into our problem evaluation grid, which includes a total of 3 considerations. These considerations are outreach, relevance to daily life and severity.

Outreach refers to the population that would be affected by the problem, and we targeted to solve problems that affected more people instead of those which affected only a small group of people.

Relevance to daily life is how common it actually is among the population of people that face the problem, whether it is faced daily, weekly or monthly. We set our sights on solving problems that occurred on a more frequent basis.

Severity is defined as how strong the impact is on the people affected despite the frequency of the problem or the size of the population affected, and we aimed to solve the most severe problem.

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.

Problem Evaluation Grid

*add more columns and rows where necessary

| Considerations for Selection | Problems | | | |
|------------------------------|---|--|--|---------------------------------------|
| | Pungent smell commonly found in toilets | People often slouching when using computer screens | Handicapped in wheelchair often require assistance | Difficulty to wake up in the mornings |
| Severity | 3 | 4 | 2 | 1 |
| Outreach | 3 | 2 | 1 | 4 |
| Relevance to daily life | 4 | 2 | 1 | 3 |
| Total Score | 10 | 8 | 4 | 8 |

Conclusion:

Problem 1 (Pungent smell commonly found in toilets) is the problem which most requires solving.

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)

Although the pungent smell of a toilet may seem like a small matter at first, on closer inspection, we can find larger problems embedded within the core of this issue. First of all, the toilet is an essential part of our lives as we need to dispose of the waste within our body in a sanitary way. With a pungent odour emanating from the washroom, our time spent within this place will be unpleasant, which brings me to our next point. Due to the unpleasant nature of the toilet, the people who are using it may be affected negatively, and placed in a bad mood. This may in turn lead to the decreased productivity of the person in whatever field of the affected person, whether it be school, work or something else. The odour of the toilet is also incredibly persistent, and may still linger or persist within the toilet despite a thorough cleaning by the cleaners.

2 B Compare and contrast the existing or similar solutions.

Current Solutions: Air freshener (cheap, doesn't get of smell just covers it), Other sensors (expensive, ours is connected to a wider range of systems)

Currently, there are solutions to combat the problem of a pungent washroom. The solutions are that of an air freshener, or an ammonia sensor. These solutions may be used in conjunction with each other, or individually. First solution is the Air Freshener, which gives the air a pleasant scent until it runs out. Compared to other possible solutions, this is the cheapest. However, it only covers the smell with another, which might not work as the scent may be overwhelmed. The air freshener must also be replaced after a certain time. Then there is the use of other sensors, which we found on the Straits Times [1], which also detects a variety of other chemicals in the air. This solution optimizes manpower and resources by sending alerts of when a toilet is in need of cleaning, which is quite similar to ours. However, it is quite costly to build and implement and we have automated cleaning systems, that uses odour digestors to clean the toilet and get rid of the smell.

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.

We are proposing to use an ammonia sensor to link to a system, which tracks the levels of ammonia (and thereby the urine smell at different periods of time), and triggers the release of odour digesters to curb the smell. The system that is connected to the sensor will then save the data and the data can be used to track average “peak hours” of the toilet which can better help cleaners to know when to clean the toilets.

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

Firstly, it can provide a chart to show us when the ammonia levels are the highest, and thereby when the urine smell is the strongest, allowing the cleaners to know what time they should go clean the toilets and therefore, cleaning the toilets effectively

Secondly, it can also trigger odour digestors which would spray certain chemicals to cancel out the urine smell in the air, as well as perhaps sanitizing the toilet at the same time, overall helping to make the toilet a cleaner and better place

Thirdly, when it tracks irregularities, it can also notify the cleaners, and the cleaners can go check out the problem, whether someone didnt flush or there was a leak in the pipes, thereby solving certain problems as well. This is similar to the first point, but more specifically directed to irregularities.

Overall, it makes the toilets cleaner as a whole, and lessens the cleaners’ burden and makes their work more effective.

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

Our proposed product is much cheaper than other existing solutions on the market. Our product uses generic parts and components that can be bought for cheap and in bulk as well. Other solutions like the Restroom Visitilizer System (as can be seen on the Straits Times) [1] uses a system that requires specialised parts that must be manufactured individually, which are specific in detecting many chemicals at once. Our product achieves the same goal but is able to have a much cheaper cost as no component needs to be specially made, even though it might be less accurate, we believe that it can still accurately inform us when there is a urine smell, especially since ammonia takes up a huge part of the urine smell, with urea being a big part of urine, and urea being made up of toxic ammonia. [2]

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

Firstly, the odour digestors used might need to go through certain trials to see its effectiveness. Secondly, we also need to ensure that the prototype is sturdy and made out of a strong enough material that can be hidden easily and is durable to with stand any chemicals it may come into contact with in the toilet. The prototype may also require constant maintenance as it is subjected to heavy use and will likely be used for extended periods of time before we can remove it and inspect it for issues.

Secondly, there is a possibility that cleaners might not be used to this system, and they might not have a proper schedule to follow especially during the first few weeks.

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

During the start of march, we discussed a few of our ideas with our mentor, and finalized our basic idea and our targeted problem.

At about April, we had our first slides done, with a basic sketch, and a confirmed idea on how our invention would work.

At May, we continued planning for our prototype but soon, found that it was really quite difficult to do so, with many of the components unavailable and out of reach.

At the middle of June, we started doing our second version of the slides. We created more surveys and collected more results, to get a more accurate and deeper understanding of the public's view of our problem and our solution.

At the start of July, we had most of the slides done, with more details and further elaboration. We also added a few different components that we had found, when during research for the prototype, so that people could visualize the product better. We also added the criteria we used to choose the components, even though the components weren't available to us.

*Our research on Ammonia Sensors [3]

At the end of July/ start of August, we had most of the things for our inventions planned out, in the form of our slides. With surveys representing the public's opinion on our invention, to details of the invention being presented, our invention was finally presented in one piece.

#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

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

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

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.

The product's prototype requires us to utilise a sensor and a cable to feed the data into another device like a computer. This requires us to use **physical** electronic components that we were unable to access during the Circuit Breaker period. During the Circuit Breaker Period we were unable to get our hands on the most crucial components of our prototype like the sensor. The company that sold the ammonia sensor that we needed for our product/prototype ran out of stock for the sensor. When we emailed them about the lack of availability of the sensor, they

explained that it was due to a disruption in their manufacturing process and closing down of factories.

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



The illustration of our product shows how the product is placed in the toilet and how it will be able to detect the ammonia levels in the toilet and how the odour digester will be deployed when ammonia levels exceed a certain amount. The illustration shows how the system is connected and the possible issues such as dirt and inaccessibility where the sensor is placed.

Even though we ended up doing the prototype virtually, we had researched many different ammonia sensors and different compartments for our planned prototype [3], which we might still try to do in the future.

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.)

[1]

<https://www.straitstimes.com/singapore/environment/new-gadget-sniffs-out-when-toilets-need-cleaning>

[2]

<https://courses.lumenlearning.com/boundless-ap/chapter/urine/#:~:text=Urine%20is%20an%20aqueous%20solution,toxic%20ammonia%20and%20carbon%20dioxide.>

[3]

<https://www.gas-sensing.com/support/gas-information/ammonia-sensors/aeroqual-ammonia-sensor-0-1000-ppm-nh.html>

<https://www.gas-sensing.com/replacement-sensors/ati-ammonia-sensor-00-1010.html>

https://www.figarosensor.com/product/docs/TGS%20826%20%2805_04%29.pdf

<https://www.figaro.co.jp/en/product/sensor/>

