

Hwa Chong Institution

Project Work

Category 3 Inventions Log Book

Title of Project: Contactless Water Dispenser
Group Name: Contactless Water Dispenser
Group Members: <ol style="list-style-type: none">1) Wang Xinchun2) Wang Xinjie3) Jin Zhi Ang4) Huang Weide

1. Problem Finding

(The beginning...)

Identify a problem you would like to solve. You may want to brainstorm for problems using different approaches e.g. 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.

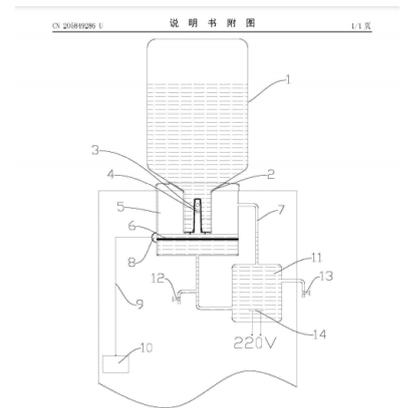
1. Bacteria and viruses can spread via the lever and buttons of ordinary water dispensers in Singapore. Our group thought of this due to the ongoing COVID-19 situation and our hygiene and safety is of utmost importance so we thought of creating a contactless and automatic water dispenser that minimises bacteria and virus spread.
2. People often fill their bottles with too much water and it causes lots of water loss. Although very little water overflows each time someone refills their bottle, as more and more people refill their bottle and as time passes by, the water would accumulate and a lot of water would be wasted.
3. (Dispensers that are self service such as at fast food restaurants) The dispensers at fast food restaurants are another place where bacteria and viruses can spread. The staff gives you a cup, and you fill it up with a type of beverage. However, people's hands are often dirty and unhygienic and people often play with it (e.g. spinning it and touching all surfaces of it). This spreads the bacteria and viruses onto the cup and when they go to press it against the lever, the bacteria/viruses spread onto the lever and the germs that were left there by the previous users would also be transferred onto the person's cup. Thus, this would increase the chance of viruses/bacteria spreading into our body and cause illness. In this crisis, hygiene is very important so minimising and reducing the spread of germs is crucial. Thus, this was another problem that we had thought of.
4. Another issue that we had thought of is dispensers need to be often cleaned as germs, mould, etc can build up inside its systems and it can leak into the water source that we drink. Thus, we thought of a dispenser that was easy to disassemble and assemble for quick and easy cleaning so that it would be less troublesome and time-consuming to clean.

Patent search done:

Hand-less water dispenser

We went to Google Images and we found this product that is already on the market that dispenses water via a nozzle by pressing a button using your feet. This product is quite similar to what we are trying to invent but we will try to avoid plagiarising this product.





<https://patentimages.storage.googleapis.com/06/64/4e/05e5bba2494dcf/CN205849286U.pdf>

We went through Google Patents and we found this water dispenser. It is a water dispenser that has a filtration system but it is not contactless. The cup will still touch the surface of the dispenser and germs will still be able to spread. Thus, this product is of no similarity to what we are trying to invent.

We went through google search and found our school water dispenser. It has 2 nozzles. The main nozzle to dispense water into a container, such as water bottles, and the secondary nozzle is to dispense water into the mouth. The surface of the main water dispenser has a lot of germs, as the mouth of peoples bottles typically touch it, which transmits lots of germs to it. Thus, this product is similar to our problem-- spread of germs.



<https://www.hitechaem.com/product/espero-water-cooler-wa-600-2/>

<https://sites.google.com/site/innovationprog/archives>
(Water Dispenser Frame)(Page 4)

We went through the IVP archive and found an item called "Water Dispenser Frame" . It is a water

dispenser which comprises a swing and requires someone to tilt it to pour liquids down into a cup. This involves contact with a human which can spread germs. Thus, this was not related to our design.

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

1. What objects around us spread germs easily?
2. What problems do disabled people encounter on a daily basis?
3. Which of the 3 problems: Hygiene, Safety, or Affordability affect the people the most?
4. How can we reduce the waste of water?
5. Through what methods are water wasted?
6. Which method of water wastage wastes the most amount of water?
7. How can we reduce plastic waste or any non biodegradable waste in the ocean?
8. How can we reduce the spread of germs?

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		
	Some water dispensers are out of the reach of disabled people and elderly or might be dangerous for them as they might injure themselves..	The amount of water wasted at water dispensers is a lot as people often overflow their bottle with water which causes leaks. Lots of non-biodegradable waste is also thrown into the ocean which causes pollution.	Lots of germs spread at water dispensers as the nozzles of school dispensers touch the bottle which contains saliva and the fast food dispenser levers can also spread germs.
How can we reduce plastic waste or any non biodegradable waste in the ocean?	1	4	2
How can we reduce the spread of germs?	1	2	5

How can we reduce the spread of germs?	2	2	4
Total Score	4	8	9

However, we felt that the spread of germs is much more important now. Thus, we decided that our main problem would be Problem #3(Spread of germs.).

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)

Germs can spread easily via levels or buttons. Therefore, in order to reduce spread of germs and viruses, we hope that invention, by using physics, will minimize contacts with the dispenser and a lesser spread of germs.

Another problem is the electricity used by water dispensers. Most dispensers use electricity which is uncommon in those rural areas and third world countries. Therefore, our invention would not only be affordable by the cheap and eco-friendly materials we use, rural areas and third world countries can also use them due to the unrequired use of electricity

2 B Compare and contrast the existing or similar solutions.

Firstly, let's state the 2 existing solutions.

1. Sensors

Water dispensers with sensors are very prominent nowadays due to technological advancements and the development of countries into first world countries. However, sensors in water dispensers can be expensive. An article from ATO shows that the price of proximity sensors ranges from \$30.09 to \$40.15. With the additional costs of cooling systems, electrical wires, metal, etc, the cost will add up and it would be very costly.

2. External components to release water.(e.g: using feet to release nozzle)

Although this may seem like a viable solution, this will cost even greater amounts of money as an additional button must be added outside of the dispenser.

Name	SKU	Installation type	Detection range	Unit price (USD)	
				Buy 1 pcs	Buy 3 pcs
Proximity Sensor, Inductive, 4 mm	ATO-PSI-4A1	Shielded	1mm±10%	40.15	27.43
Proximity Sensor, Inductive, M5	ATO-PSI-5A1	Shielded	1mm±10%	40.15	27.43
Proximity Sensor, Inductive, M6	ATO-PSI-6A1	Shielded	1.5mm±10%	40.15	27.43
Proximity Sensor, Inductive, M8	ATO-PSI-8A1	Shielded	1.5mm±10%	39.55	25.71
	ATO-PSI-8A2	Unshielded	2mm±10%		
Proximity Sensor, Inductive, M12	ATO-PSI-12A2	Shielded	2mm±10%	38.79	23.57
	ATO-PSI-12A4	Unshielded	4mm±10%		
Proximity Sensor, Inductive, M18	ATO-PSI-18A5	Shielded	5mm±10%	39.45	25.43
	ATO-PSI-18A8	Unshielded	8mm±10%		
Proximity Sensor, Inductive, M24	ATO-PSI-24A8	Shielded	8mm±10%	39.75	26.29
	ATO-PSI-24A10	Unshielded	10mm±10%		
Proximity Sensor, Inductive, M30	ATO-PSI-30A10	Shielded	10mm±10%	39.95	26.86
	ATO-PSI-30A15	Unshielded	15mm±10%		
Proximity Sensor, Capacitive, M12	ATO-PSC-12AA	Shielded	2mm±10%	40.15	27.43
	ATO-PSC-12A2	Unshielded	5mm±10%		
Proximity Sensor, Capacitive, M18	ATO-PSC-18A5	Shielded	5mm±10%	39.09	24.43
	ATO-PSC-18AB	Unshielded	10mm±10%		
Proximity Sensor, Capacitive, M24	ATO-PSC-24A8	Shielded	8mm±10%	39.34	25.14
	ATO-PSC-24AT	Unshielded	15mm±10%		
Proximity Sensor, Capacitive, M30	ATO-PSC-30A10	Shielded	10mm±10%	39.55	25.71
	ATO-PSC-30AH	Unshielded	20mm±10%		

Hence, we conclude that existing solutions are very expensive and require **electricity** to operate. However, ours do not require electricity to run, and there will be no contact between the human and machine, which would reduce germ transmission. The cost would also be greatly reduced, suitable for third world countries or people encountering financial instability.

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.

Create a contactless water dispenser that does not require energy to function. Being contactless will decrease the chances of viruses and bacteria spreading. Consuming no electricity allows it to be used even in rural areas. Our invention would consist of 1 main body, the dispenser itself. The dispenser would then be made up of 3 main components-- The pressure plate, the gear and the nozzle mechanism, and the container for water.

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

With the contactless feature of the water dispenser as well as the use of zero electricity we hope it can reduce germ and bacteria spreading and can be helpful to rural areas with no source of electricity or money to buy such expensive water dispensers.

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

Ours would not need to run on electricity, hence, it can be used by people encountering financial problems as well as reduce the contact between humans and the dispenser thanks to the contactless feature of our invention.

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

Building the prototype might be a little difficult as we are unsure what materials are the most suitable for building the different parts of the prototype.

We would also face challenges on the exact proportions of the prototype such that it would be easy to construct, workable and of the most efficiency.

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

Meeting log:

Session 1: **14 Jan**

Created a survey about what problems the students are facing and also discussed which mentor we wanted and the basics of the Invention category.

Session 2: **22 Jan**

We looked at the results of the survey and decided that the answers were not useful and it was also the day we decided on what we wanted to do after lots of brainstorming.

Session 3: **8 Feb**(Meeting with Mdm Tham)

Talked about problems and solutions for our product and what to do for the week and how to do the task properly.

Session 4: **4th Mar**

Started on PW Log Book....

HW:

1. Google 3 existing contactless water dispensers that are already on the market and discuss them and input them in the logbook.
2. Locate another 2 patents for similar products(input diagram) and put them into the log book.
3. Discuss in the group what is the next move after all the above is completed.

Session 5: **9 March**

1. Started on PW Proposal slides, and edited the log book accordingly.
2. Brain stormed additional solutions and problems.

HW: Edit the PW Proposal slides and get it ready for IVP expert mentor submission.

Session 6: **12 March**

1. Attended the SG Enable Zoom Sessions

Session 7: **25 March**

1. Edited parts 1b and parts of part 1c.

(Note: Meeting was only with Weide as the others had earlier 3rd language buses.)

HW:

1. Edit the IVP proposal slides to the expert mentors and use better vocabulary based on the comments by Mdm Tham.
2. Start the prototype design by using legos as we plan to go to the Robotics Club CCA place to use legos to build the prototype.
3. Finish up the entirety of Part 1 of the logbook as most of the people are already on the second part of the logbook.

Session 8: **29 March**

Attended IvP Learning Experience with Temasek Polytechnic about product designing.

Session 9: 1 April

Presented our proposal to expert mentors for IvP.

Questions asked:

Presence of Filter;

Material of Dispenser (Aluminium is not often used while Stainless Steel is a better choice.)

Session 10: 4 April

Project Work Proposal Evaluation

Comments by evaluators:

1. Update logbook
2. Criteria for project
3. Prototypes will be hard to build.

Session 11: 5 May

Project Work Meeting

1. Completed section 2 of logbook
2. Discussed on next plans
3. Try out some 3d modeling softwares

HW:

- Complete the log book until section 4
- Draw prototype sketches as Meeting #2 with expert mentors is on 13/5

<https://www.evidenceaction.org/who-we-are-2/>

Session 12: 7 Jun

Project Work Meeting

1. Completed parts of slides for Final Evaluation
2. Finished some parts of Logbook
3. Discussed on next plans

Session 13 with Mdm Tham (12 Aug)

1. Add animations for the slides. (eg. the parts for sketch. add circle and arrow.)
2. Table for costs of the components
3. Add a filter drawing to the sketch diagram(cooling system if possible)
4. Research on the cost of the existing and school water cooler.(state product price)
5. Research on sensor cost
6. Target audience change to urban not rural
7. Finish logbook
8. Finish slides

Session 14 (16 Aug):

Project Work Meeting

1.Finished Logbook

2. Submitted written report

3. Touched up on slides.

#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

We chose wood for our prototype because they were easy to find and build with. The wood would mainly be used to build the frame of the prototype as when wood is in contact with water, it would start to rot and decay, forming an unhygienic environment for water to be in, which thus would contaminate the water.

We chose food grade stainless steel for our final product as it is strong and somewhat affordable. We did not choose other metals such as iron, nickel, copper, etc, as they are prone to oxidation. As they are in frequent contact with the water inside the dispenser, they would start to oxidize due to

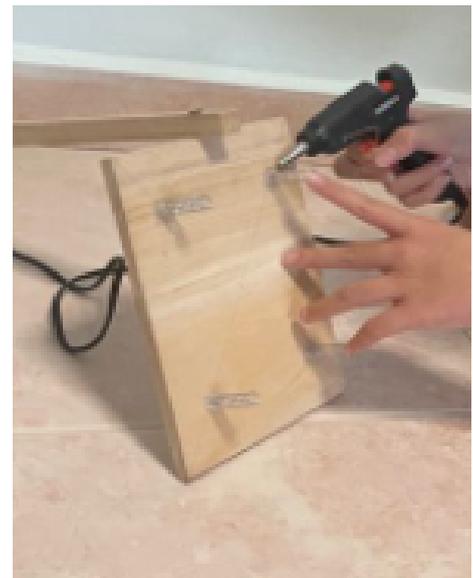
the presence of water and oxygen. The rust would start to fall off into the water, contaminating the water.

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

We would first build the frame of our prototype, according to the dimensions set. We would also maintain that the stainless steel interior is tightly packed and nailed together to prevent water leakage that would cause rotting of the wood. We would also ensure that the nails are set in place as well. We would use nails instead of screws as nails are much more stronger when put under force. When it is bent, it can still stand back upright after it is bent back, unlike screws, which can snap in a single bent.

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

The photographs are the development process of our first working prototype, which mainly consisted of wood as we could not acquire the food grade stainless steel in time.



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 on 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
	Pass	Fail	Potential Failure	
Test Date: 10/8/21				
The pressure plate is able to move down with minimal force	<input checked="" type="checkbox"/>			The pressure plate was able to move down when a cup was placed on it, deeming it a pass.
The dispenser performs its function without contact or electricity	<input checked="" type="checkbox"/>			Once the cup was placed onto the pressure plate, no other forms of contact were used and water was dispensed.
The objects are able to dispense once the mechanism is activated	<input checked="" type="checkbox"/>			Water was dispensed once the cup was placed onto the pressure plate,

*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 (e.g. books, magazines, websites, journal articles, interviews, photographs, product brochures, reviews etc.)

Waterlogic (n.d.). WL7 Firewall©(FL7 FW) Retrieved March 4 2021, from <https://www.waterlogic.com/en-ca/office-water-dispensers/products/wl7-firewall/>

Proximity Sensor Price List (2015, November 20). Retrieved from <https://www.ato.com/proximity-sensor-price-list>

黄军 (2016, April 21) 基于物联网系统的含非接触式水位检测装置的饮水机. Retrieved from <https://patentimages.storage.googleapis.com/06/64/4e/05e5bba2494dcf/CN205849286U.pdf>

Evidence Reaction(n.d.) Dispensers for safe water. Retrieved June 5 2021, from <https://www.evidenceaction.org/dispensersforsafewater/>

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