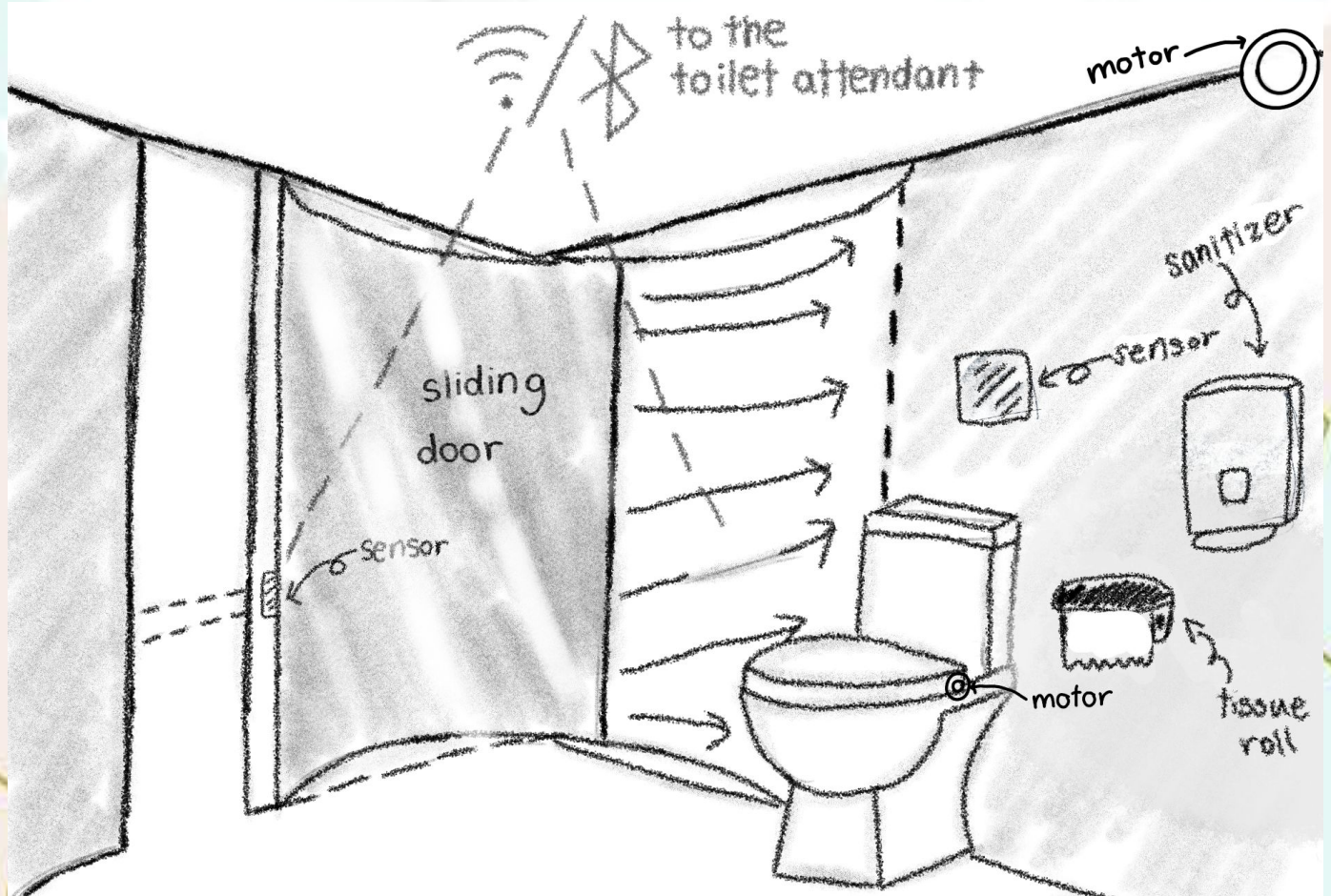
VTC STEM Challenge 2021

Touch-Less Smart toilet system

True Light Middle School of Hong Kong

Our Design : Smart Toilet System

- Touchless
- Contamination free
- Hygiene
- Well planned



What is this

Smart Toilet

- **Touchless** - avoid direct contact with sensors, toilet seat cover, flush button and toilet cubicle door
- **Contamination free** - can ensure seat cover is closed when flush, which can avoid germs and bacteria contamination
- **Hygiene** - toilet attendants will be alerted and reminded to clean the washroom in time, especially during peak hours
- **Well planned** - we can analyse the data collected from the sensors and understand the average daily and hourly usage, as well as the peak and off-peak hours of all washrooms in the school campus. These data can be used as a guideline for planning manpower, cleaning schedules and ensure enough stock of toilet paper and cleaning supplies

Steps to use

1. Wave hand to the door sensor
2. The door closes automatically
3. Toilet cover opens automatically
4. Give the user toilet paper sanitizer automatically(future plans)
5. Wave hand to the toilet sensor
6. The toilet cover closes automatically
7. The toilet flushes automatically
8. Wave hand to the door sensor
9. The door opens automatically

What motivates us to do it

Have you ever experienced going to a stinky toilet?

In Hong Kong, many toilets, especially female toilets are extremely untidied and stinky. The impact of poor hygiene standard will not only increase the risk of infection, this will also affect the general image of Hong Kong. During the pandemic, these "toilets", which contains various kinds of **germs and virus**, could **affect the public's health** issues or even increase the **spread of coronavirus**.

Most washrooms do not have a washing basin inside the cubicle, people would simply **touch the door lock** immediately after going to the toilet. This may cause a **vicious cycle** when the next user touches the lock while getting in. Thinking from a different perspective, in school campus, students, especially those in kindergarten or primary school, may not have strong awareness of personal hygiene. The chance of spreading virus or being infected under the existing toilet cleanliness condition would gradually increase.

Therefore, smart toilet can **reduce the direct contact with toilet doors and toilet covers** can effectively reduce the chances of spreading coronavirus or even the students being infected.

How does it work

Toilet cover and flush system sensor:

- After using the toilet, we just need to place our hands in front of the sensor, the toilet cover will close automatically and flush afterwards
- The whole touchless system can minimise environmental contamination as well as the chance of being infected when touching the flush button and the toilet seat cover
- Solar energy would be used for the power supply of the sensors in order to save energy

How does it work

Door sensor:

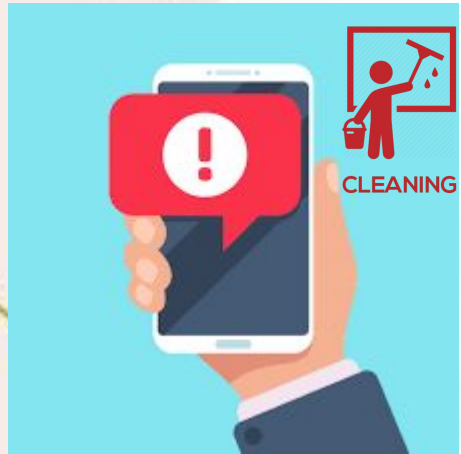
- To ensure privacy, sensor will only be installed on the back of the door in the toilet cubicle. People outside cannot open the door if someone is inside the cubicle.
- Without touching the door, we just simply need to wave our hands to activate the the door which will be closed, locked or opened automatically.
- In most toilets, washing basins are usually located in the main washroom area. We can only sanitise our hands after we leave the cubicle. The use of door sensor can minimise the chance of spreading any germs or virus when touching the door lock

How does it work

Extra functions for both of the sensors

Both sensors will also have a count function. Once the sensors are activated for 15 times, an alert message will be sent to the toilet attendant and remind him or her to sanitised that cubicle on the first priority due to high usage.

This helps to improve and maintain the hygiene standard



Materials for Prototype

Parts

-Micro computer (Lego/ Microbit for prototype)

-2-4 motors

-2-4 ultrasonic sensors

-Smartphone (for receiving message)

-Toilet model

-Sliding door model

Idea

-Installing motors and sensors to the toilet cover and door models externally

-Communicating with a simple microcomputer

-Transmitting data through Wifi/Bluetooth

Feasibility -- SWOT

S

Strengths :

-It's user friendly and convenient as only putting your hands in front of the sener will do. It's easy to handle for any age group.

W

Weaknesses :

-Malfunction of the sensors may lead to cleanliness and safety issues.
-Public acceptance of this new technology in least development countries or villages.

O

Opportunities:

-It can be launched to many toilets in different kinds of places not only schools but other infrastructures such as shopping malls.

T

Threats:

-Existing toilet size or layout may not allow us to implement this smart toilet system.
-Technical hitch. For example if the door suddenly couldn't open itself by sensing, the person inside will be locked. It may take a longer time to rescue him/her. (follow-up solutions in "future plans" section)

Why did we choose this

Purpose of making this system

Due to the serious pandemic, we couldn't ignore the existing toilet problem, which is closely related to the spread of virus. In our school campus, with a smart toilet system, this can avoid direct contact with the door lock, toilet cover and flush button. When flushing the toilet, some toilet water may split to other surfaces inside the toilet cubicle. While touching them, the germs or virus in the droplets would be transferred to you or even brought them back to your home. Especially children, without knowing these kinds of informations, they may have a higher chance, transferring the germs back to their home. As this pandemic may last for a long period of time, this system could reduce the infecting cases.

Why did we choose this

How can it protect us and make our life more convenient

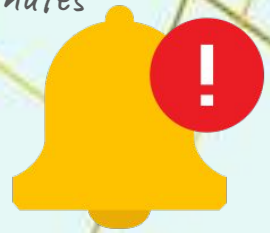
With the help of this system, we no longer have to lock or open the toilet door anymore. Many people would resist going to the toilet in shopping malls as they think that the washrooms are so dirty and full of germs. Germaphobes may even resist going to public toilets. While having a chit chat with my schoolmates, I knew that many of them resist going toilet just because they think the washroom in our school is dirty! Well, when you feel like you should go but are resisting due to various kinds of excuses, it may affect your own health as enduring to go to the toilet would harm your kidney. Students are still in puberty, harming the kidney would strongly affect our development. After setting up this system, it does not only can let us go to the toilet in a more convenient way, it can also improve the health of people.

Future plans

Improve the existing or adding functions to the system in order to convenient our society

- **Touchless toilet paper dispenser**
  - Pre-measured length of paper will be dispensed after the user lock the door for 20 seconds
  - Eliminating any need to touch the dispenser and minimise the possibility of infection
  - Reducing waste of toilet paper and save the earth

- **Toilet emergency alarm system**
  - Pre-set toilet emergency alarm system in case the door is locked for over 30 minutes
  - The toilet attendants will receive alert message and can immediately checked if the toilet user needs any assistance
  - Toilet user could also activate the alarm button sensor in case of emergency



Future plans

Implementing these kind of smart toilet to all the toilets

- Increase the public's awareness of personal hygiene
  - By not touching buttons in the toilet, the public should realise that avoiding the contact between high-touch surfaces could protect them from being infected. Even though it is a must to touch those items, they should immediately use hand sanitizer to clean their hands.
- Improve overall hygiene standard in all washrooms as toilet will flush automatically after usage and a more effective cleaning schedule will be implemented.
- Minimise microbial contamination can reduce the risk of spreading infectious diseases through indirect contact transmissions.

Improving the count function

- Let the enterprises/school set the amount of people used the toilet before the signal is sent to the attendant. As to make it more efficient due to the different amount of people existing in each situations

Future plans

With the analysis of the smart toilet sensor figures, we could understand the usage of public toilets and adjust the toilet attendants cleaning schedules to maintain the hygiene standard, especially during peak hours. Also, we can ensure enough toilet supplies, likes toilet paper and sanitisers stock in place.

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