Appendix A – Engineering Design Drawings

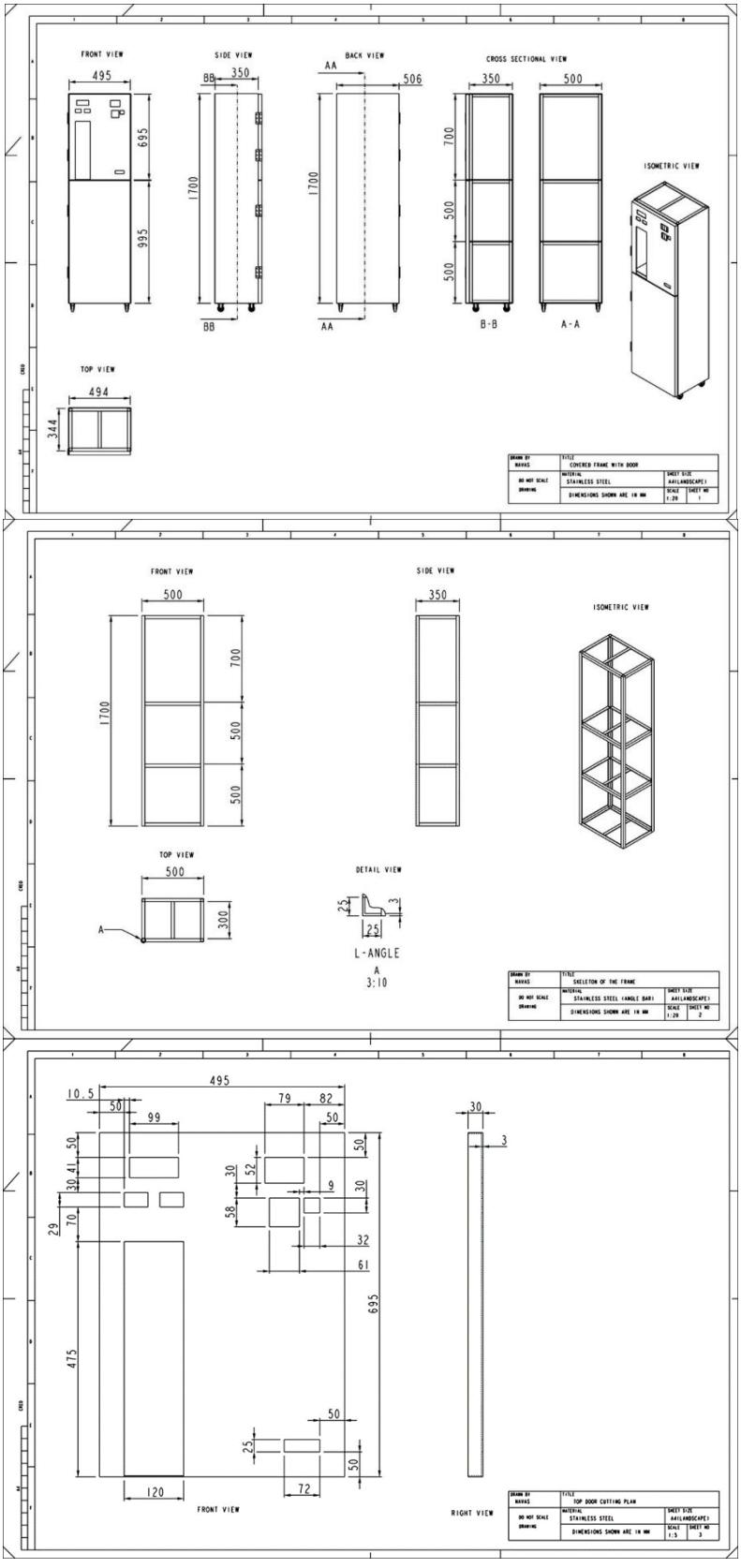

Figure A1. Engineering Drawings in the following order (1. Frame with Door Design, 2. Frame Skeleton Design, 3. Top Door Cutting Plan)

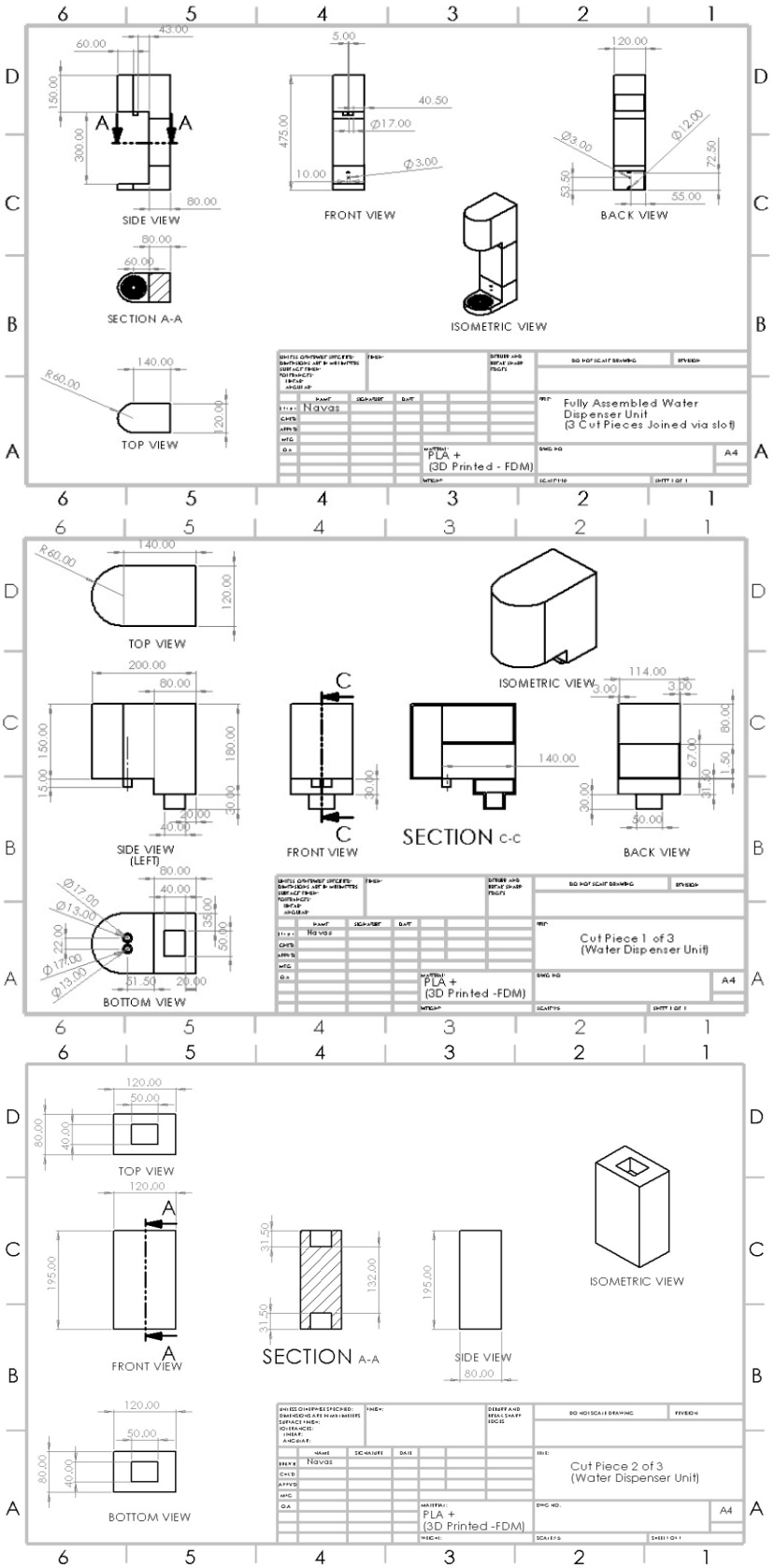

Figure A2. Engineering Drawings in the following order (1. Water Dispenser Unit, 2. Cut Piece 1, 3. Cut Piece 2)

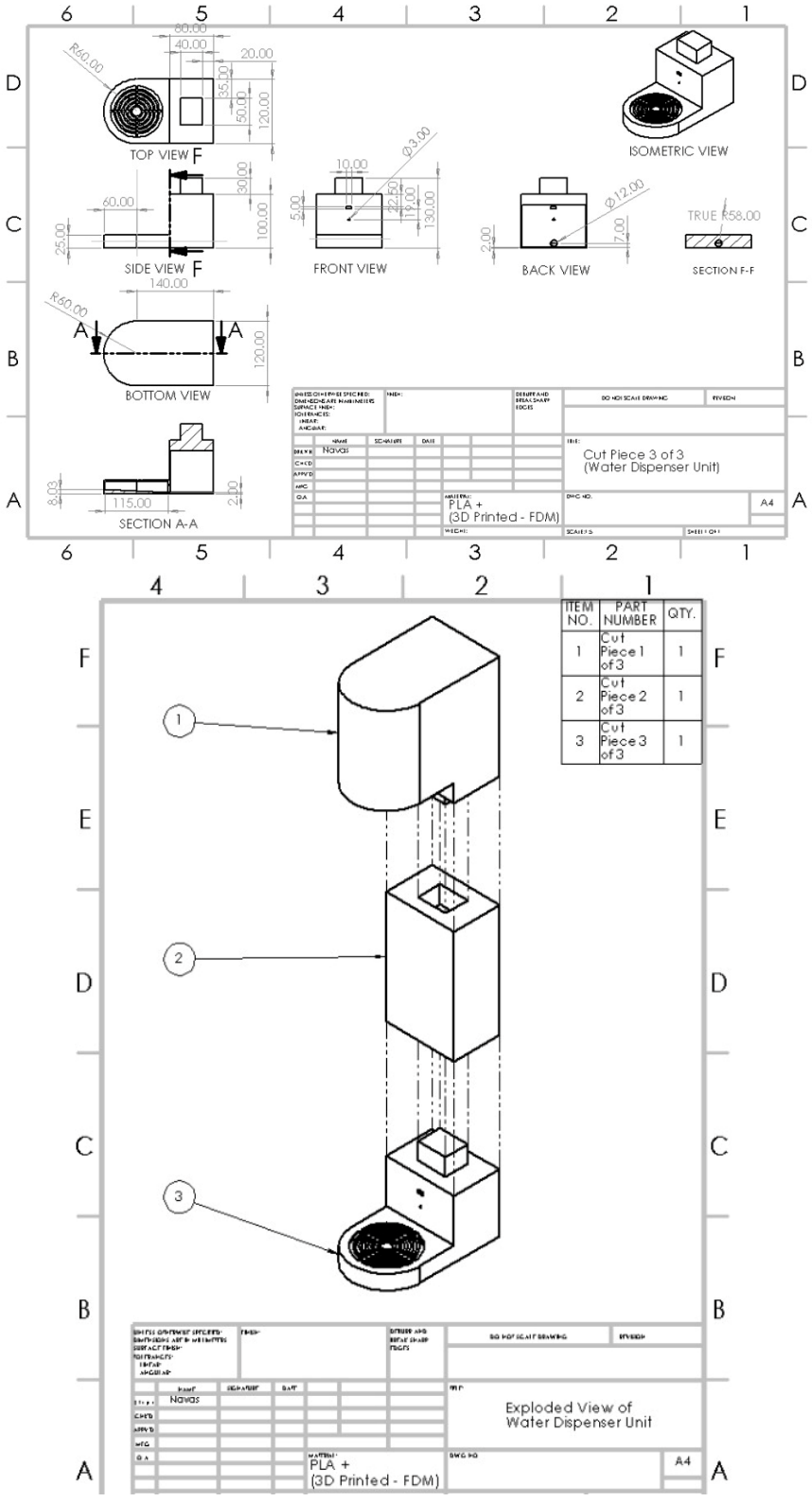

Figure A3. Engineering Drawings in the following order (1. Cut Piece 3, 2. Exploded View of Water Dispenser Unit made of Cut Pieces)

Figure 1. 1. Lid Assembly of Reserve Tank (top left), 2. Lid Assembly of Normal Tank (top middle), 3. Lid Assembly of Warm Tank (top right), 4. Pipe Fitting for Solenoid & Flow Sensor (mid-left) 5. Assembly of Extension with Wiring (mid-right), 6. Assembly of Front Interactive Area (Bottom left) 7. Wiring @ back of Interactive Panel (Bottom Right)

APPENDIX A – Sample Google Form

Designing a SMART Water ATM Questionnaire

As part of my Final Year Project, I am designing a SMART Water ATM with advanced features to enhance water dispensing services. This questionnaire aims to gather valuable insights on the current issues faced by users of water coolers and your water intake habits. Your input will help optimize the final design.

About the SMART Water ATM:

The SMART Water ATM will feature sensors to measure water levels, monitor water temperature, assess ambient conditions, track water consumption, and ensure water safety. Users will interact with the system by scanning their Identity Card, which is equipped with an RFID tag. An additional option to dispense disposable cups with lids is also planned.

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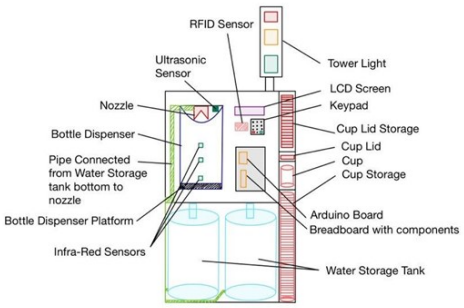
Figure 1: Schematic Drawing of SMART Water ATM Prototype



Next Page 1 of 5 Clear form

Designing a SMART Water ATM Questionnaire

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* Indicates required question

Part 1: Your Participation

This questionnaire consists of four parts and will take approximately 5-10 minutes to complete. Rest assured; your responses will remain confidential.

If you consent to participate, please click 'I agree' below. Thank you for dedicating your time to this project.

Do you consent to participate in this survey? *

- ○ I agree
- ○ I disagree

Back Next Page 2 of 5 Clear form

Designing a SMART Water ATM Questionnaire

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* Indicates required question

Part 2

MCQ Questions (Q1 ~ Q10)

Part 2: MCQ *

Q1. How much water do you think you will consume per day when you are outside ? (250 ml per cup)

- ◯ 0.5 L
- ◯ 1.0 L
- ◯ 1.5 L
- ◯ More than 1.5 L

Q2. Which temperature range of drinking water do you prefer? *

- ◯ Cold Water (0 ~ 23 °C)
- ◯ Hot Water (50 °C and above)
- ◯ Room Temperature Water (24 ~ 28 °C)
- ◯ Mix of Hot & Cold Water accordingly

Q3. Do you refill your water bottle outside? If yes, which option *

- ◯ Yes, Tap Water
- ◯ Yes, Water Cooler
- ◯ Yes, Portable Water Dispenser
- ◯ No

Q4. How often do you purchase bottled drinks in a day? *

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ More than 2

Q5. What type of Bottle do you carry a water bottle with you when going out? *

◯ Used Plastic Bottle

◯ Thermo-Flask

◯ Sports Bottle

◯ High Quality Plastic Bottle

◯ Other:

Q6. What is the closest capacity of the Bottle? *

- ◯ 250 mL
- ◯ 500 mL
- ◯ 1000 mL
- ◯ More than 1000 mL

Q7. What is the approximate Height of the Bottle with a Cap? *

◯ Less than 21 cm

◯ 21 cm (size of HTA 1L Plastic Bottle)

◯ 24 cm (size of average thermo-flask)

◯ More than 24 cm

Q8. Are you concerned about your water consumption every day? *

- ◯ Strongly Concerned
- ◯ Concerned
- ◯ Neutral
- ◯ Not Concerned
- ◯ Strongly Not Concerned

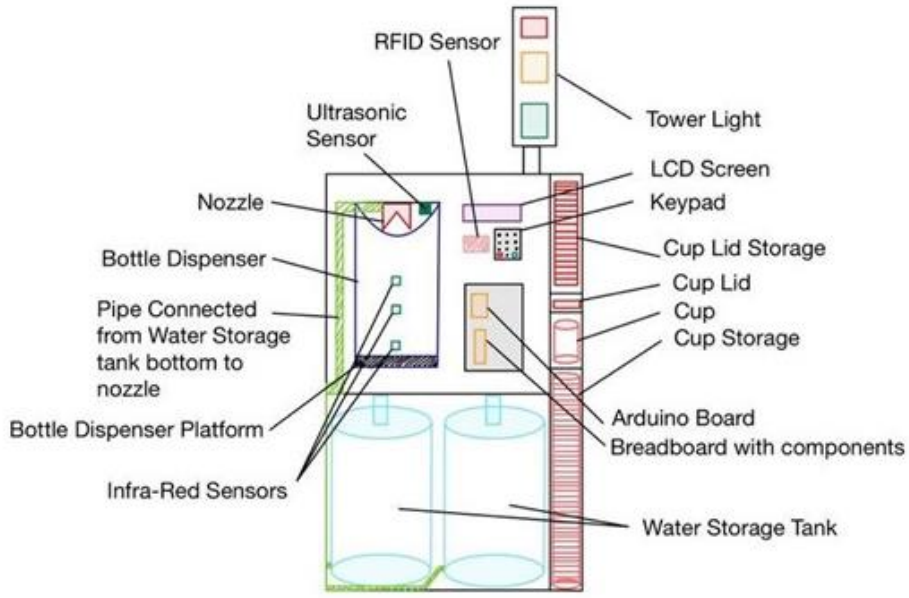
Q9. Do you think the addition of dispensing disposable cups with lids is necessary? *

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

Q10. Do you think you will benefit from working prototype features mentioned in the description (See Figure 1 below)? *

About the SMART Water ATM:

The SMART Water ATM will feature sensors to measure water levels, monitor water temperature, assess ambient conditions, track water consumption, and ensure water safety. Users will interact with the system by scanning their Identity Card, which is equipped with an RFID tag. An additional option to dispense disposable cups with lids is also planned.



- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

Designing a SMART Water ATM Questionnaire

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* Indicates required question

Part 3

Open-Ended Questions (Q11 ~ Q15)

Q11. Which public places do you think lack drinking water dispensers? *

Your answer

Q12. Do you have any concerns with water coolers being near restrooms? *

Your answer

Q13. Do you feel comfortable using a recycled water bottle to collect water from a dispenser? *

Your answer

Q14. Do you have any recommendations you would like to suggest for an improved version of the water dispensers available on the market? *

Your answer

Q15. How do you evaluate whether the water you drink is safe? *

Your answer

Designing a SMART Water ATM Questionnaire

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* Indicates required question

Part 4

Personal Particulars

Please type your name below: *

Your answer

Are you a male or female? *

- ◯ Male
- ◯ Female

State your age range: *

- ◯ 13 ~17
- ◯ 18 ~ 21
- ◯ 22 ~ 30
- ◯ Above 30

What is your current Occupation status? *

- ◯ Student
- ◯ Engineering Related
- ◯ Management Related
- ◯ Unemployed
- ◯ Other:

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Customer Survey

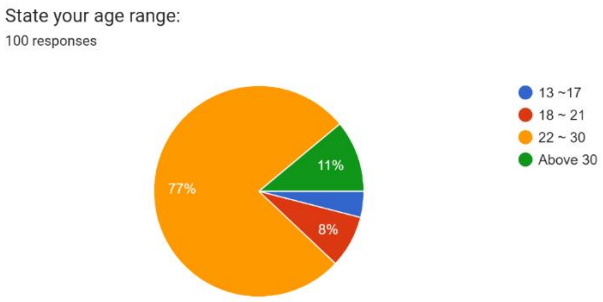
Survey Procedures

The survey aimed to gather valuable insights from a diverse sample of 100 participants on the usage of water dispensers around Singapore. The survey questions were first crafted to identify user preferences and to understand whether the current prototype being planned satisfies the needs of people. The crafted questions are then sent for approval from the project supervisor. After changes deemed necessary by the supervisor are made, a Google form is created. The created form is then tested on a known individual by sharing the form link and observing the individual filling in the form, this is to see if a random stranger can understand the content of the form and fill it up with ease. Once this pilot testing is successful with no issues being surfaced, the Google form link is sent out to others via WhatsApp, Telegram, and other forms of social media. Once 100 responses are received, the settings of the Google form are set to stop accepting responses. The results are then exported to an Excel Sheet to analyse survey results. Refer to Appendix A for the sample of the Google Form created.

Analysis Survey Results

Description Statistics

The survey was conducted with the public from 18th Sept 2023 to 23rd Nov 2023. A total of 101 responses were collected but 1 was rejected as it was deemed invalid.

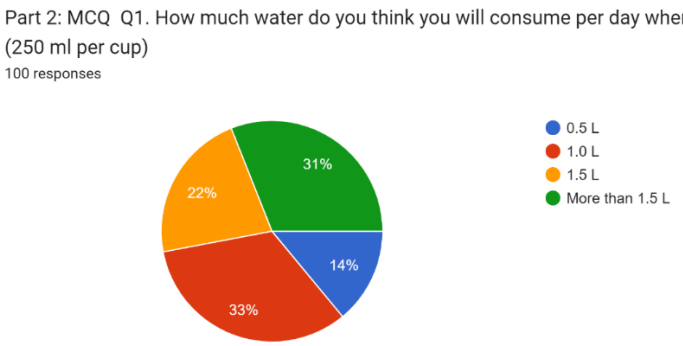


Pie Chart 1: Age Range of Respondents

From Pie Chart 1, the participants in the survey represent a diverse range of people from different occupations and ages. Most of them were between the ages of 22 to 30 while 11% of them were above 30.

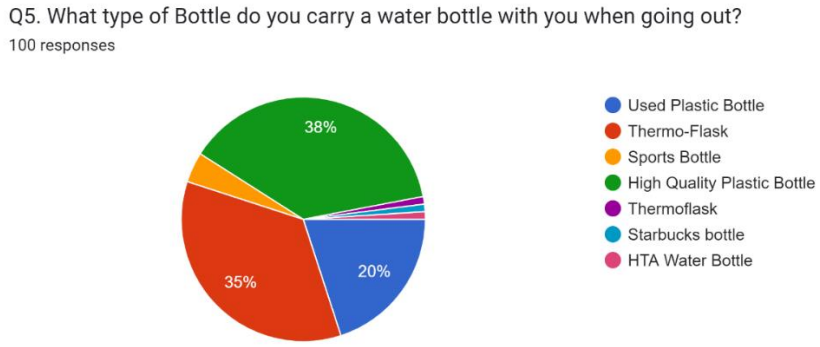
Quantitative Analysis MCQ

The following multiple-choice questions' results were analysed: Q1, Q5 to Q10. This was because these questions' results directly contributed to the design of the Smart Water ATM with a Bottle Dispenser Prototype. MCQ Questions 2, 3 and 4 were just asked to gather feedback on the usefulness of the upcoming prototype.



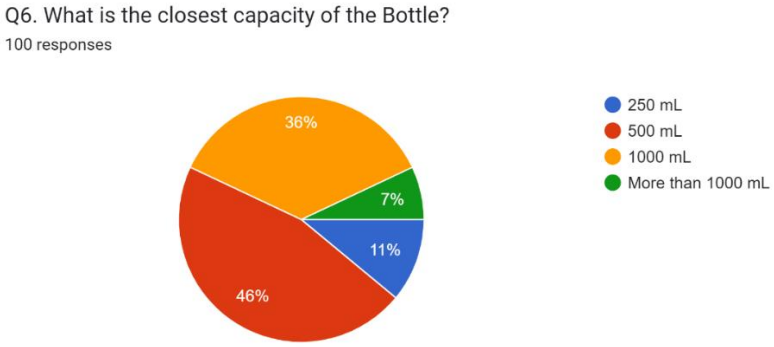
Pie Chart 2: Q1 Results

From Pie Chart 2, it can be observed that 14% of the respondents claim to drink only 0.5l, while 33% of them claim to drink 1 litre of water, 22% of them claim to drink 1.5l and 31% claim to drink more than 1.5l per day.



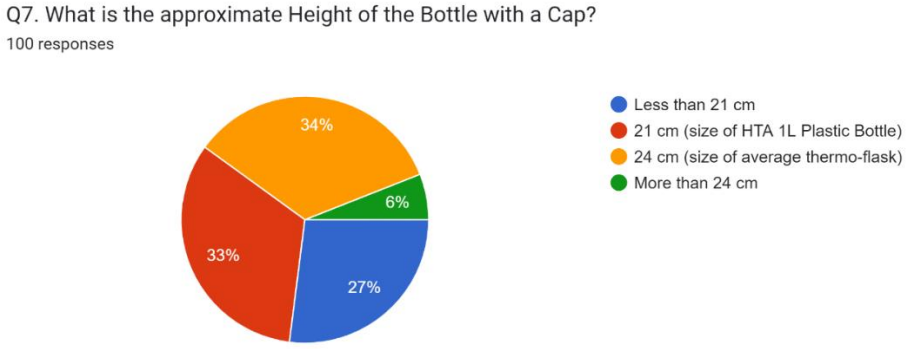
Pie Chart 3: Q5 Results

From Pie Chart 3, most of the respondents (38%) tend to use a High-Quality Plastic Bottle while another 35% use HTA Water Bottles. 20% of respondents carry Starbucks bottles.



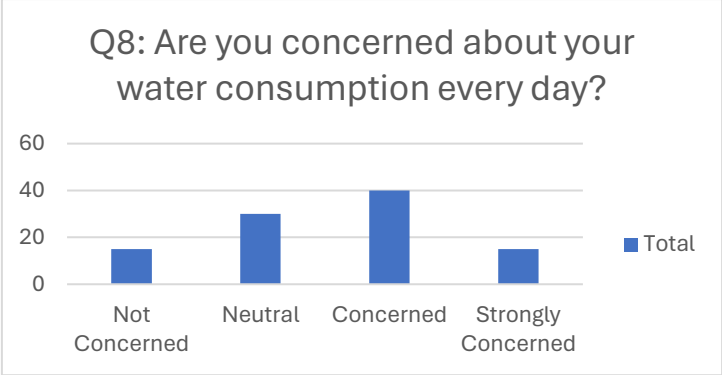
Pie Chart 4: Q6 Results

From Pie Chart 4, it can be observed that most of the water bottles carried by respondents are 500 ml bottles while 38% of respondents carry 1000 ml bottles.



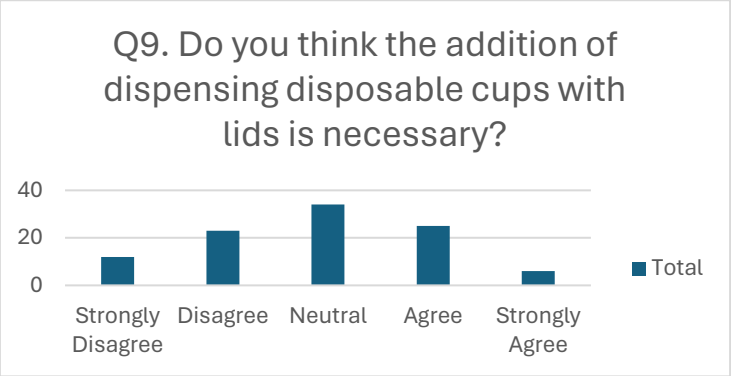
Pie Chart 5: Q7 Results

From Pie Chart 5, it can be observed that the approximate height of the bottle with a cap appears to be evenly distributed between the ranges of below 21cm to 24cm. Only 6% of respondents have water bottles more than 24cm in height.



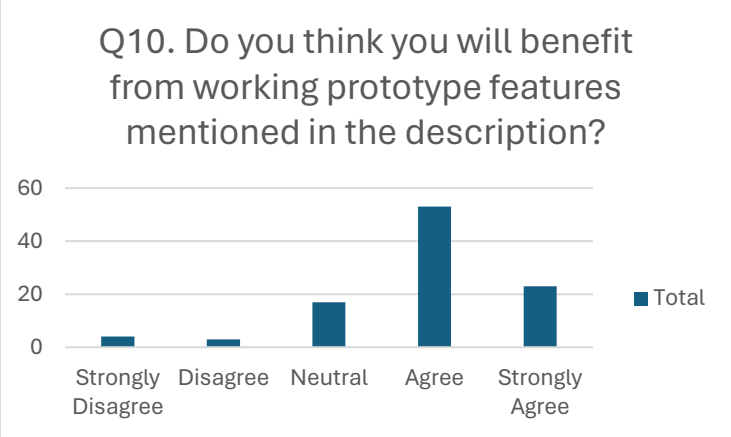
Bar Graph 1: Q8 Results

From Bar Graph 1, more than half, about 55% of the respondents, are concerned about their water consumption.



Bar Graph 2: Q9 Results

From Bar Graph 2, most of the respondents felt neutral and against the idea of the addition of dispensing disposable cups with lids on the prototype.



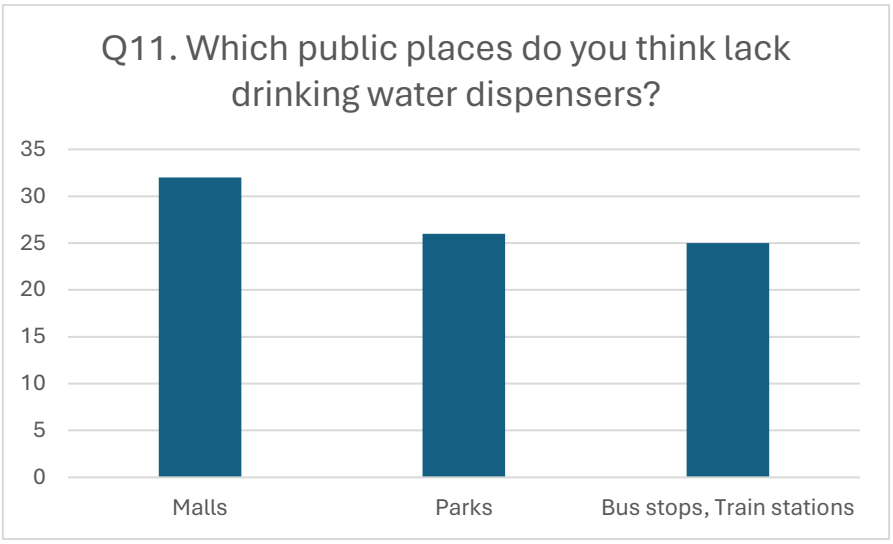
Bar Graph 3: Q10 Results

From Bar Graph 4, it can be observed that most of the respondents, 76%, believe that they will benefit from the working prototype.

Qualitative Analysis OE

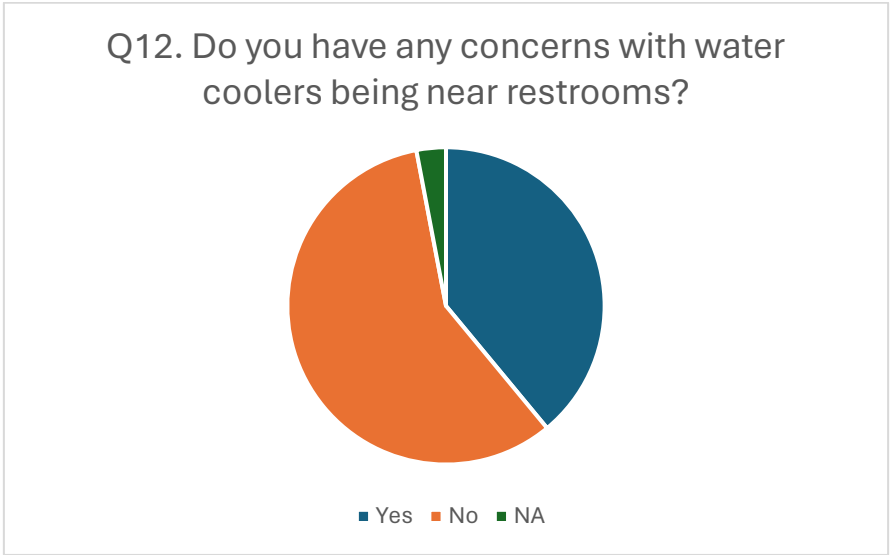
For the qualitative Open-Ended analysis, the results exported from Google Forms to Excel sheet are categorized into the common variations for answers. The result is then quantified and plotted in bar graphs below.

Only the following open-ended questions' results were analysed below: Q11 to Q13.This was because these questions' results contributed to aligning with the aim of the project. Open-ended Questions 14 and 15 were asked just to verify if the respondents had the same reasoning and idea that supported this new design.



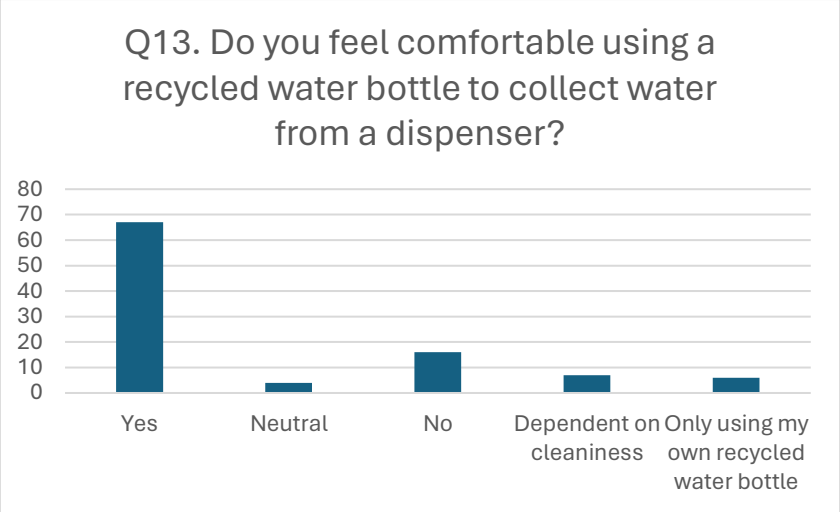
Bar Graph 4: Q11 Results

In this question, respondents could fill in multiple answers. From G. Form Result Analysis 9, the most common answers were Malls (32), Parks (26) and Bus stops and Train stations (25).



Pie Chart 6: Q12 Results

From Pie Chart 6, the majority of the respondents said that they did not have any concerns with water coolers being near restrooms. However, the people who said yes cited hygiene, users not washing hands after using the toilet, smell of toilet and bleach, germs and the surrounding areas being wet.



Bar Graph 5: Q13 Results

From Bar Graph 5, while most of the respondents felt comfortable using a recycled water bottle to collect water from a dispenser, some of them had concerns about cleanliness while some of them would only use their recycled water bottle.

Summary of Survey

A significant number of respondents expressed interest in using water dispensers. They also felt that certain locations like malls, parks, bus stops and train terminals were lacking in access to water dispensers. Most of them said that they carry High-quality water bottles or HTA bottles and the height of the water bottles was between 21 and 24 cm with a capacity of 500 to 1000ml. These dimensions will be considered while designing our prototype.

We also realised from G. Form Result Analysis 7 that most of the respondents felt that disposable cups with lids are not necessary with only 31% requesting that feature. Hence, based on the survey results, we did not add that feature to our prototype.

In conclusion, the qualitative data collected from our survey offers a nuanced understanding of designing a Smart Water ATM with a Bottle Dispenser. The diverse perspectives shared by our participants contribute to a comprehensive overview, laying the foundation for informed decision-making and future research in this area.