Navigating Campus: A User Experience Project Report

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Executive Summary

With over 15000 students, the University of Toronto Mississauga campus has twelve buildings each with multiple floors and hundreds of classrooms. Learning to navigate these buildings and rooms is difficult for new incoming students and even returning students as they return from online classes during the COVID-19 pandemic. Our team explores this problem space in an effort to make this process easier, less confusing, and make students feel confident when searching for their new classes. Secondary research through webpages and scholarly articles and primary research through surveys and interviews were conducted to gain insight into this problem space. Interviews were conducted with UTM students who were asked about their experience with navigating campus as well as about the resources and methods used when navigating. We decided upon interviews as they would allow us to collect highly detailed, qualitative data and identify specific pain points and issues. We also conducted surveys as the cost and effort needed to distribute them is low, meaning we could easily amass the data needed for research. Surveys would also allow respondents who were not comfortable with in-person interviews to be included. Findings from both primary research methods were compiled into As-is & to-be diagrams, affinity maps, an empathy map, and personas. From these, we identified issues with the signs on campus and difficulty for students to access information on campus facilities. With the key findings from the research in mind, we propose a mobile app solution due to the format's benefits in ease-of-access, feature capabilities, and accessibility features. Additionally, this format was selected as a small survey was distributed to students and alumni and a mobile app was the preferred design for 75% of the sample (n=8).

Keywords: UTM, student life, student resources, navigating campus, indoor mapping

Project Background

Overview

University campuses are oftentimes large and complex; with numerous buildings and thousands of rooms to accommodate the student population, navigating a campus is a difficult task. In order to navigate a large campus, new students must learn building names and room locations which may not be straightforward due to the complex shapes and layouts of buildings. In this report, we explore the problem space of navigational difficulties on the University of Toronto Mississauga campus.

The team first conducted secondary research and analyzed existing trends, solutions, and gaps in this problem space through various articles and competing campus navigation applications. Afterwards, surveys and interviews with students were used as primary research methods to gain knowledge of the strengths and pain points current navigation systems offer. As-is & to-be diagrams, affinity maps, an empathy map, and personas were developed from primary findings to identify common themes and needs.

From these themes as well as additional research conducted, several possible solutions were proposed. Through the use of Big Ideas clusters, Prioritization Grids, How-Might-We's and Hills, the merits and costs of each solution were carefully considered and a final solution was decided upon.

Target Users

The project's target users were identified to be University of Toronto Mississauga (UTM) students typically aged 18-23 years old (first to fourth year). UTM staff or faculty and visitors

were considered but excluded due to a lack of data collected from these audiences which future research may wish to explore. However, due to the quantity of students which greatly outnumber and have an increased frequency of navigating campus compared to alternative audiences, this proposal provides a foundation that can be iterated on.

Use Contexts

This design solution will be used on the University of Toronto Mississauga campus and assist our target users in navigating to their destination on campus. They will interact with our mobile app solution through smartphones. Users will feel reassured and confident when they are given a route to their destination. They will be able to do this while walking through campus or sitting in lecture and looking for the location of their next class. Whenever a UTM student needs to travel to a destination on campus but does not know where it is, they can utilize our mobile app to receive directions - a pattern which they are most likely to be familiar with if they have used similar mapping apps like Google Maps or Apple Maps. Our solution will help UTM students find their way because the last thing they need to worry about is getting lost on campus.

Problem Statement

Currently, the main solution to navigation problems are signs that guide users to certain areas, facilities and specific rooms within buildings. However, these signs fail to provide users with specific locations and information on facilities and also have no way for user interaction, meaning that users are unable to seek clarification if the signs are unclear. In such cases, users often resort to other methods. Our solution will attempt to be an interactive system where users are provided clear directions to minimize situations where the user is unsure of where to go. The system will also serve to provide users with relevant information on campus facilities and

locations which the existing signs are unable to do. Our primary and initial focus will be on the interactive aspect as well as specificity in order to ensure the user needs are met.

Extra Research & Findings

Secondary Research

Additional secondary research was conducted on the University of Toronto Map web app available at map.utoronto.ca. This was a solution we did not address in our previous report however, due to its association with University of Toronto and existing as the current mapping solution for students, we investigated it to develop our design solution.

The University of Toronto Map website features an outdoor map with points indicating the locations of certain buildings. Upon interacting with these points more information is given about buildings regarding what topics are taught there and descriptions of the student facilities there. The map also allows you to showcase specific information such as student services, food, washrooms, etc. The main issues with this map is that everything is pointed out from an outside view and does not give clear directions where exactly it is in the buildings.

Figure 1: The description of the UTM Library provided on map.utoronto.ca

A major pain point we noticed while investigating the website was upon selecting a facility such as the UTM Library, very little information was displayed. Although some included a link to their more detailed website or a phone number, many appeared similar to the listing in Figure 1. This forces the user to navigate to additional websites to search for extra information.

Although the University of Toronto Map provides some level of wayfinding through its wayfinding button, the route is poorly displayed in a semi-transparent neon yellow. This is a poor

contrast against a mainly green map and may cause accessibility issues for colour-blind users or poor user-experience issues. Additionally, we discovered that the routes generated through wayfinding were less convenient, suggesting convoluted routes such as the one seen in figure. Routes were also limited to the outdoor paths between campus buildings as indoor maps were unavailable.

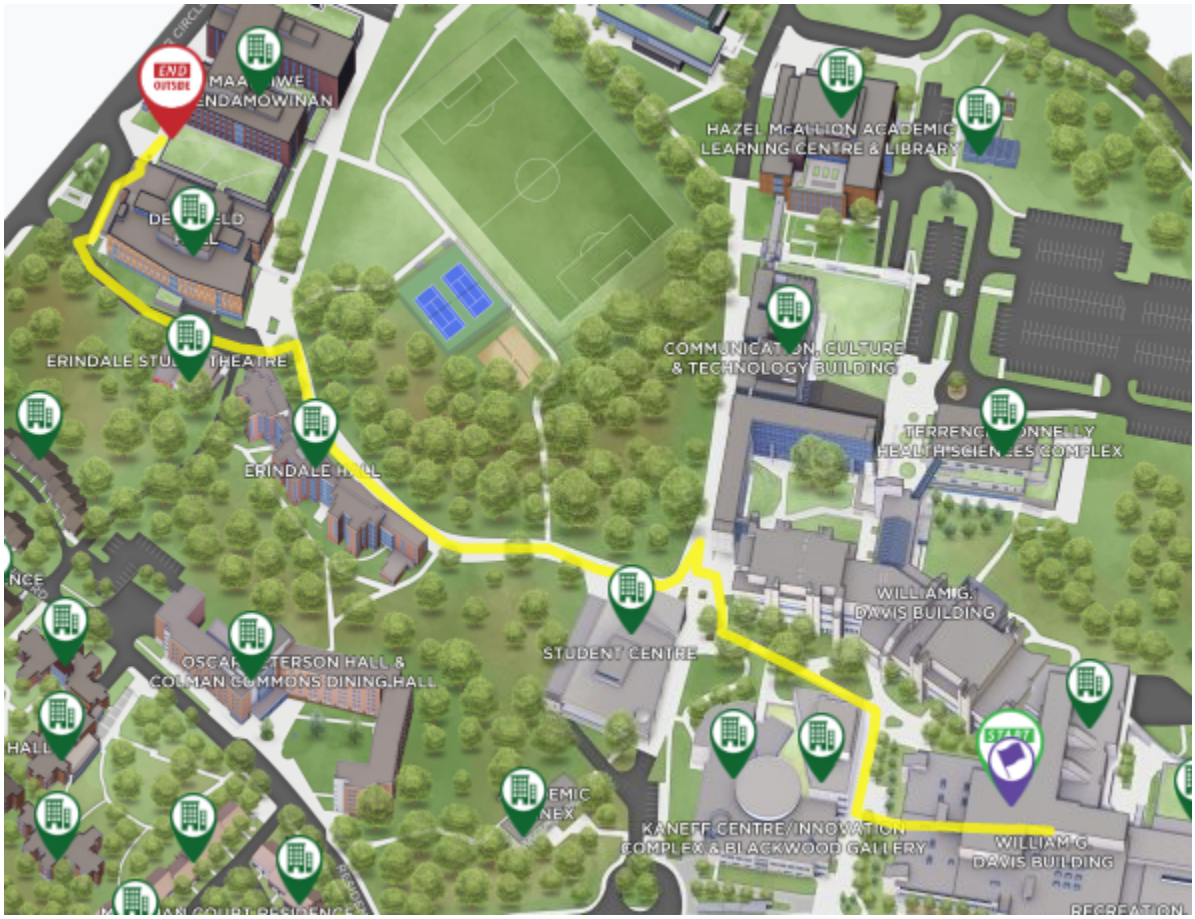

Figure 2: The wayfinding route from the HCC to MN 3rd floor study rooms.

As one may see, the University of Toronto Map application has many flaws and could be improved upon. Although it has many useful features such as wayfinding and unique ones such as the campus tours which display points of interest on campus, there remains a deficit in solutions to help students navigate the indoor rooms.

Primary Research

It should be said that our primary research came after our ideation process and was conducted to finalize our decision and see what students valued the most in the solutions brought forth. In our additional primary research we conducted a group interview to conclude our decision on which method would help students navigate buildings more effectively. Similar to our earlier research we conducted the same protocols of consent and any necessary briefing. In this particular session all students preferred that we do active note taking over recordings. Our rationale for doing a group interview compared to individual interviews was to have more participant opinions in one session but to also facilitate discussion amongst the participants, giving us more insight onto our questions. As an added benefit the participants' discussion was able to avoid “groupthink” and have continuous debates over which solution is better. In total we had a discussion of 8 students in one room and asked them directly the following questions.

- If UTM were to implement further navigational tools to help students navigate the indoors of buildings which would you prefer?
- Based on your answer, what reason would you prefer your answer compared to the other?

Based on their answers there were a total of 6 students who preferred the app and 2 who sided with using a kiosk as their method of indoor navigation.

Key Findings

Based on our primary research we discovered more insights on the pros and cons of using either a kiosk or app (see Appendix B). What we found to be an important point of argument for the participants were the convenience and costs of the chosen methods. For example, students

who sided with the mobile app argued that a majority of people have phones and could use the app whenever to be guided to their room. This was also supported by the idea that they would have a constant way to view directions compared to remembering them from a kiosk. On the other hand, the students who support the kiosk argued that users might not have a phone and that the app might require internet access that they might not have. They also mentioned affordances that kiosks have for indoor navigation over mobile apps that are mostly used for outdoor navigation like Google Maps. While both methods can aid in navigation, we found a compelling point that kiosks can only serve a limited number of students at a time, and with many students and visitors at UTM that would require many kiosks. This leads us to our next major point, costs. In terms of software development we noticed that apps would be more costly as it would require development for both Android and IOS platforms compared to kiosks that would require development for only one platform. What we found that apps have over kiosks was hardware costs, kiosks themselves cost money, and with our previous point of needing many to serve the number of students that would require more kiosks. Another point we found for costs was maintenance, apps versus kiosks would be cheaper due to the physical nature of kiosks and that apps would only require software maintenance whereas kiosks would require both.

Ideation

Ideation Process

With the research we had collected from both primary and secondary sources, we began to ideate on potential solutions. We used multiple ideation frameworks and activities to generate solution suggestions.

With hopes of creating a diverse set of solutions, we used the Big Ideas activity. On a FigJam board, we brainstormed a variety of solutions with coloured sticky notes with different colours representing different team members. We then grouped ideas into related categories, identifying solutions ranging from “Improvements to Existing Solutions” to “Non-Human Guides.”

Using the generated ideas from the Big Ideas activity, we created a prioritization grid. Through votes and discussions, we organized the solutions based on their amount of effort and amount of impact. This activity allowed us to weigh the feasibility of a solution and begin discussions on more in-depth details behind specific ones.

The how might we activity was used to assist in the idea generating process, proposing questions based on user pain points and goals discovered in research. These questions allowed us to empathize with users and truly understand their wants while proposing solutions.
Similarly, hills were produced to narrow down key features we wanted in our final design proposal.

Ultimately, all of these activities helped us discover needs, empathize with target users, and construct a huge variety of possible solutions to our problem statement. Through this ideation process, we generated three strong ideas that needed to be thoroughly discussed and weighed against each other. A more in-depth discussion for this final contemplation can be found in the solution decision section and the final outcome and selected solution follows.

Big Ideas

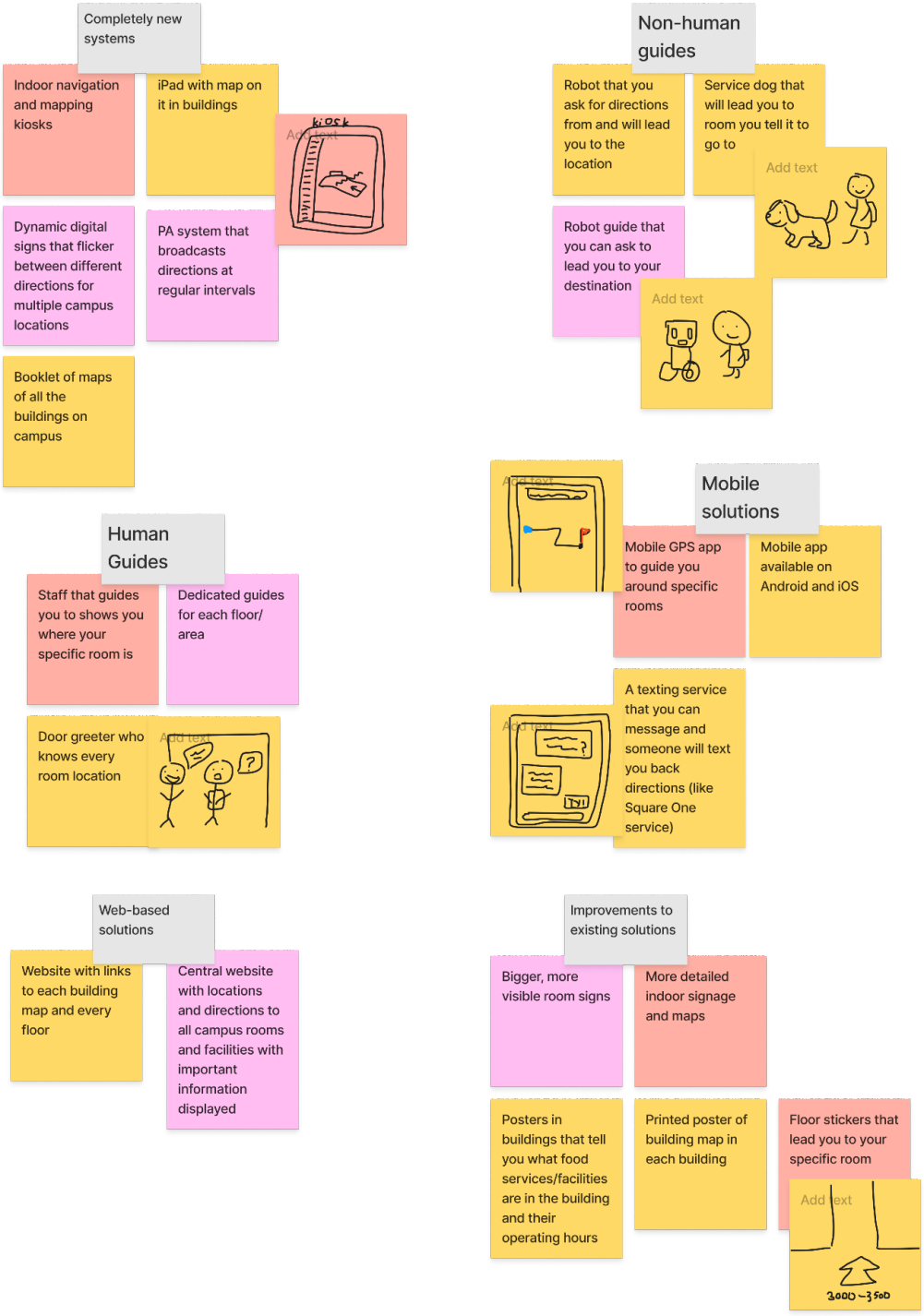

Figure 3: Our Big Ideas activity brainstorming results.

After brainstorming, we arranged our ideas into six themes or clusters. Improvements To Existing Solutions would be taking solutions and infrastructure already implemented on campus and making improvements to them in order to better fit the needs of our target users. Web-based Solutions are websites or web applications that will guide users to their destination. Similarly, Mobile Solutions are applications or services on mobile devices that accomplish the same goal. We also categorized Human and Non-human Guides as two separate themes. They both entail having an entity lead users to their destination but differ in whether the entity is human or non-human, such as an animal or a robot. Finally, we have ideas that fit into the Completely New Systems category which are innovative new solutions which may take existing systems and expand upon them to minimize user pain points and improve their overall experience.

Prioritization Grid

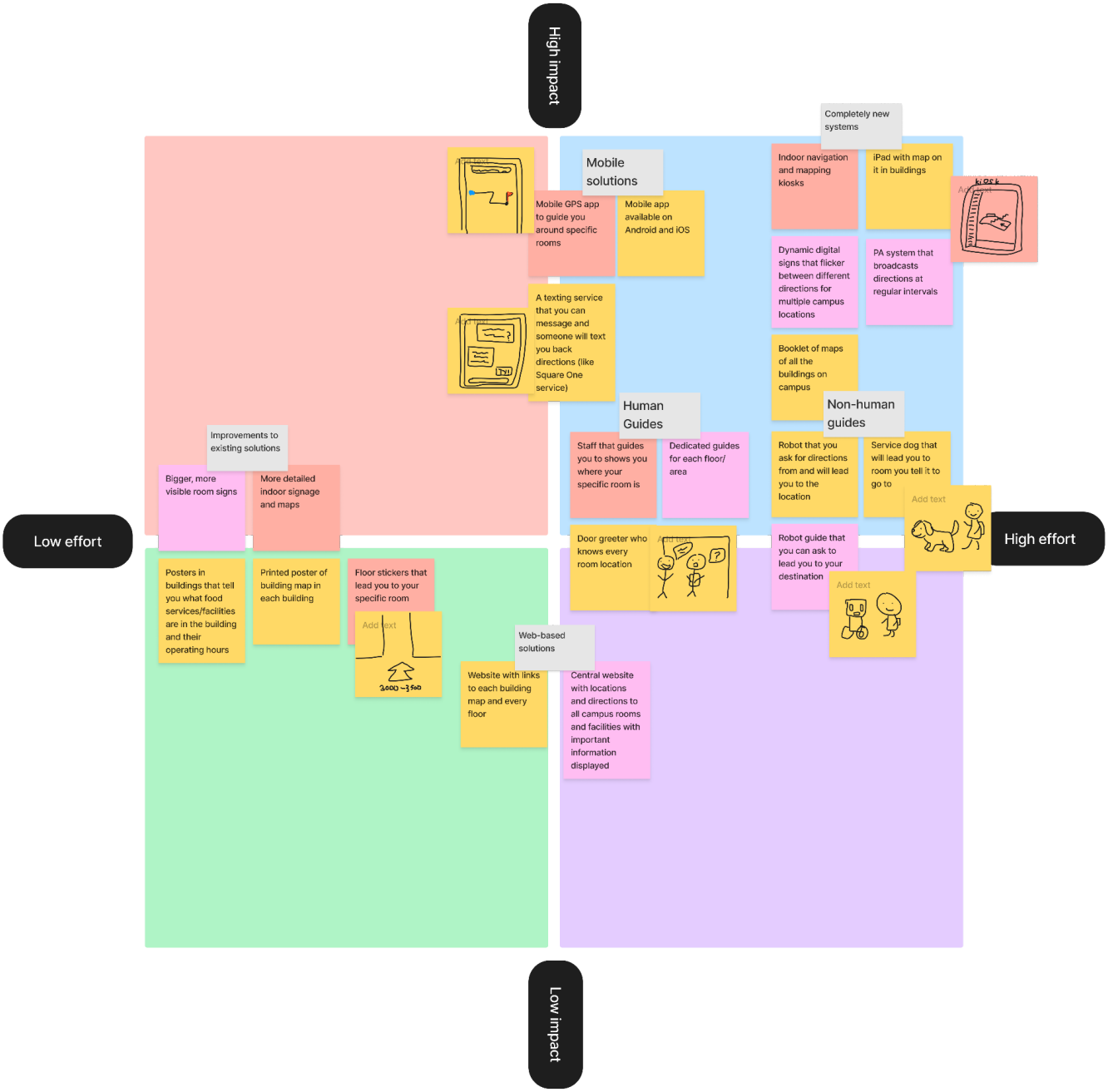

Figure 4: A prioritization grid created using the ideas from the big ideas activity.

In our prioritization grid, we arranged the themes or clusters based on the impact implementing the solutions would have as well as the effort needed in order to implement them.

From this grid, we identified the two themes that would have the highest impact, Mobile Solutions and Completely New Systems. In terms of effort needed, Mobile Solutions was placed as lower effort than Completely New Systems. Thus, the ideas in Mobile Solutions were put into consideration for our proposed solution.

How Might We

How might we give UTM students information about campus facilities when they do not have anyone to tell them?

How might we help lost UTM students get to class on time when they cannot ask for help?

How might we guide lost UTM students to class when the signs are confusing for them?

How might we provide UTM students with directions to get to their classroom when they are already in the correct building?

How might we make UTM students feel confident they are going the right way to their classroom?

Hills

Figure 5: The results from the hills activity session.

UTM students can get directions to their classroom without navigating multiple pages/websites

UTM students can get information about student facilities (ex. RAWC, HCC) operating hours, contact info, etc. on a central platform

UTM students can get directions to their classroom with feedback that they're going the right way

Based on the criteria we established from our Hills, we paid close attention to any potential solutions that would be able to satisfy these requirements.

Solution Decision

See Appendix A for pros and cons tables on three ideas: Kiosks, mobile app, digital signs. It is worth noting that our primary research was done at this point to finalize our group's decision on what solution we would further develop from this point.Based off our prioritization grid, our group decided that both kiosks and mobile apps were our most suitable solutions with equal effort and payoff. With two strong solutions though, our group was divided and this created long discussions on which solution was best suited given our research at the time. Unsure of which one to pick we created a pros and cons chart of the ideas with a new third idea to possibly reconcile both solutions. Unfortunately, a final decision could not be made and we resorted to our primary research to make a final decision. Based on the group interview conducted our group settled on creating an app.

Design Proposal

Digital Interface Format

We propose a design for this problem statement which uses a mobile app supporting both iOS and Android phones as the digital interface. This format was chosen for its ease-of-access, feature capability, and accessibility features.

In this mobile smartphone era, students actively use their smartphones for day-to-day activities. As such, many students have easy access to a mobile device and most likely have and use a mapping app such as Google Maps, Apple Maps, or Waze in their daily lives. Mobile apps are convenient to download and use. Although there may be concerns about internet or wi-fi connection, University of Toronto campuses offer free wi-fi networks to students such as the UofT or eduroam networks.

In addition to their availability, mobile phones also grant additional features that may not be present in alternative solutions. These features include GPS tracking, commonly used on apps like Google Maps, and augmented reality (AR). These features are discussed in further detail later, but are nonetheless points of interest and may be considered for future development on features.

Finally, we suggest that mobile phones tend to have a greater amount of accessibility features. This may look like magnification options, colour-blindness options, or speech-to-text. Although it may be difficult to account for all disabilities, mobile devices offer many opportunities for inclusive design.

With all of this in mind along with our primary research, we propose a design solution which uses the mobile device interface.

Must-Have Features

Indoor maps of campus buildings

The app should offer users the ability to look through indoor maps of every floor in every building on campus. A user should be able to use their mobile phone's touch screen to scroll around a map. This will help the user explore the maps of campus

Wayfinding

To help students find their destination, whether it be a classroom or a washroom, a wayfinding feature was a must-have. There are multiple methods including a simple route display or real-time GPS tracking. Due to the level of difficulty of real-time GPS tracking, especially when involving altitude and indoor locations, we included a discussion on real-time GPS tracking in the better-to-have section. In this minimum viable product proposal, we suggest that a simple route display from a start location to an end location is a more feasible idea that still creates a huge impact. We see this pattern in mapping solutions such as shopping mall map kiosks, which simply display a route suggestion to the user to glance at before heading on their way. However, we believe that this method in combination with the mobile app medium fulfills Nielsen's sixth heuristic: recognition rather than recall. Although users are unable to receive real-time feedback of their traveling path (Nielsen's first heuristic), users can utilize the app similar to shopping mall map kiosks but with the added benefits of having the route at their fingertips until they reach their destination.

Facility exploration

To aid in the discovery of student facilities on campus, a list should be accessible on the app which allows users to explore options such as student resources (ex. RAWC, HCC, etc.), washrooms, food, or accessibility resources (ex. elevators, accessible washrooms).

Facility information

Currently, facility information is found on various web pages. For example, on the Health & Counseling Centre's website (https://www.utm.utoronto.ca/health/), the phone number and email are available on the home page but in order to see operating hours, users must navigate to their separate "Hours of Operation" page. Displaying all of this info in a single page or central location was suggested in our ideation process. This also improves upon UofT Map's current method, which lacks consistency in displaying facility information and oftentimes redirects users to more websites to find the information.

Better-to-have Features

Real-time GPS tracking

Real-time GPS tracking is a complex feature. Currently, it is well-known in its usage in outdoor location navigation, such as on highways and roads. Unfortunately, when inside of a building or structure, location tracking through traditional GPS becomes unreliable due to structural interference and difficulty identifying altitude changes. Instead, indoor location tracking and positioning relies on indoor positioning systems

which require complex technology and networks (Sewio RTLS, 2021). Due to the complexity and increased costs of these requirements, real-time GPS tracking is certainly a better-to-have feature in comparison to the less immersive but simpler solution of plainly displaying routes.

Augmented Reality Features

One interesting solution that was discussed was the idea of augmented reality (AR) features. Through augmented reality, users could turn on their cameras and follow a route using their camera screens. This provides real-time feedback and fulfills Nielsen's first heuristic, similar to real-time GPS tracking. However, this feature is also in the better-to-have section due to its complexity. Again, like real-time GPS tracking, this feature is difficult to implement in indoor settings. Currently, similar AR features such as Google Maps AR mode is only available for use outdoors.

Room Info and Schedule

Our room schedule feature would be similar to our feature providing information for student resources except for rooms this time. This feature was based on the printed schedules that would be listed on room doors and windows showcasing what classes would be in said room at what times. If a user would also like to get information on rooms regarding resources and room schedule the user could be given a list or a brief explanation on amenities in the room and a schedule of the classes. An example of the amenities mentioned could be outlets for charging laptops, left handed seats, wheelchair ramps and more.

Information Architecture

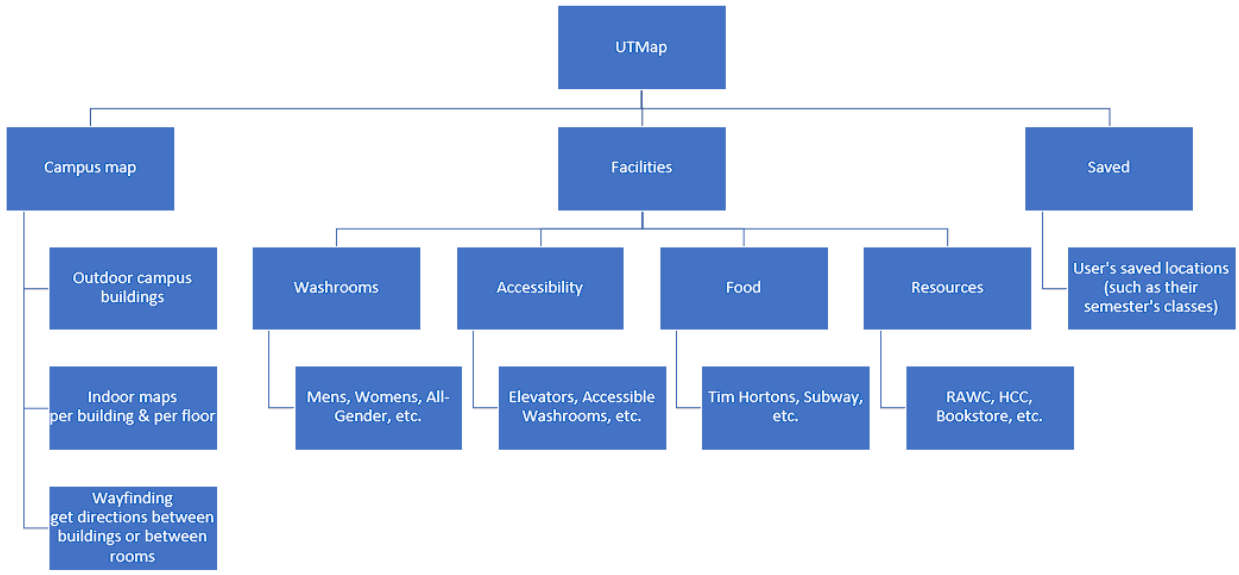

Figure 6: A proposed information architecture diagram for an indoor campus mapping solution

We propose that the UTMap application be organized in the selection shown in Figure 6. The campus map section will mimic design patterns seen in popular mapping applications such as Google Maps and Waze. These patterns were also seen when exploring secondary resources such as University of Toronto's Map [4]. These apps allow a user to use their touchscreens to view and move the map around and so, our app would allow this feature as well. However, as discussed previously, University of Toronto's current map only offers an outdoor map view of campus buildings. Our app will allow users to explore outdoor campus buildings, but also provide the ability to explore buildings' indoor maps of each floor, granting users the ability to

search for and identify their classrooms. As the final must-have feature of the campus map section of the app, wayfinding or providing users with directions to a destination would be implemented. Users will use this feature by inputting a start location such as a room or building and their desired destination. A visual indicator for the route will be displayed on the app, allowing the user to see and follow this path to their destination.

The next section addresses a solution to help students discover facilities without a reliance on word of mouth to learn about them. Inspired by University of Toronto's Map web app, we provided a page to explore a list of facilities on campus. This list mimics the categories on the UofT Map, featuring accessibility resources, food locations, student resources, and washroom locations.

To-be Storyboard

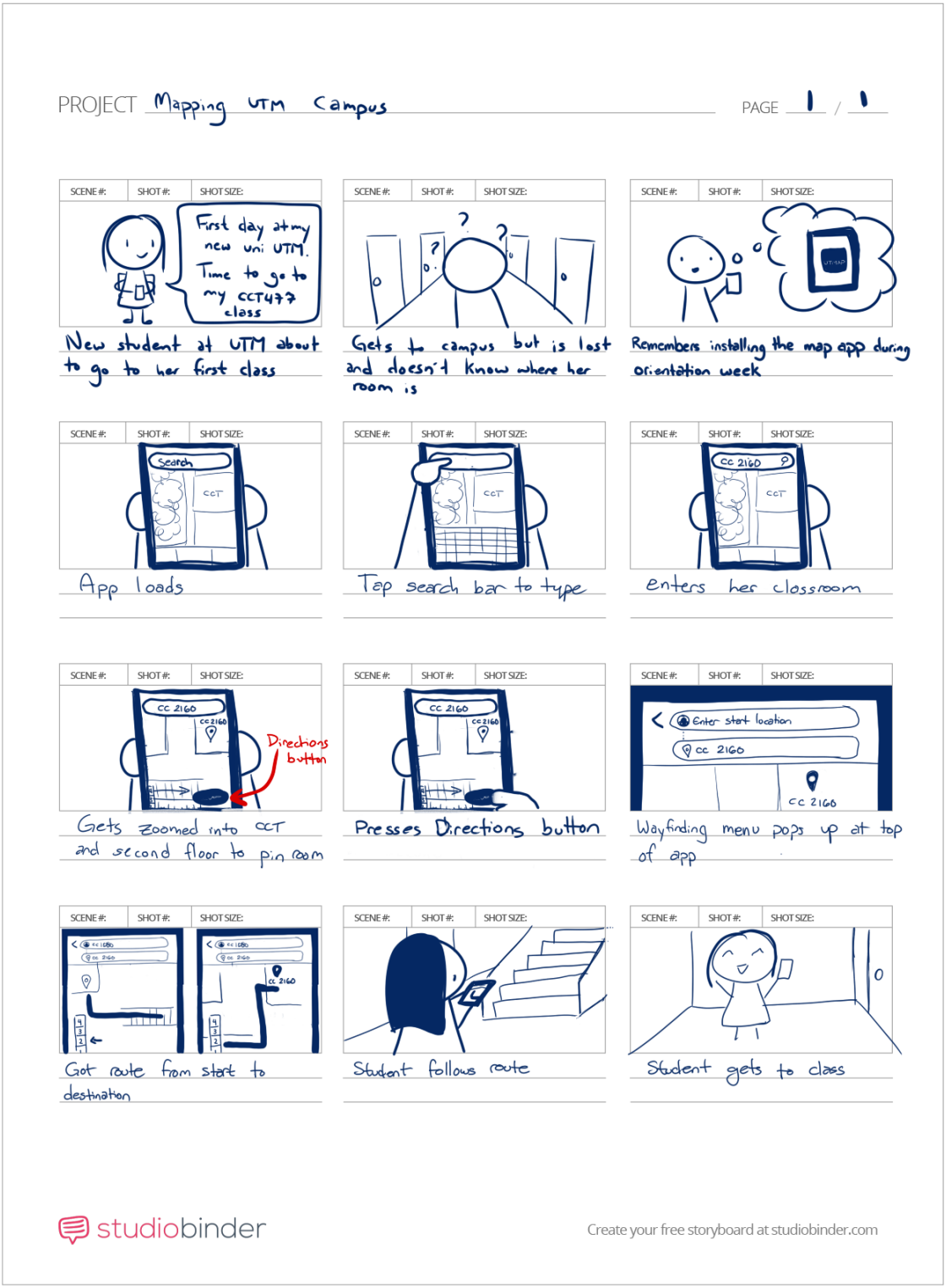

Figure 7: A storyboard of a target user (a UTM student) using our proposed solution

Wireframes

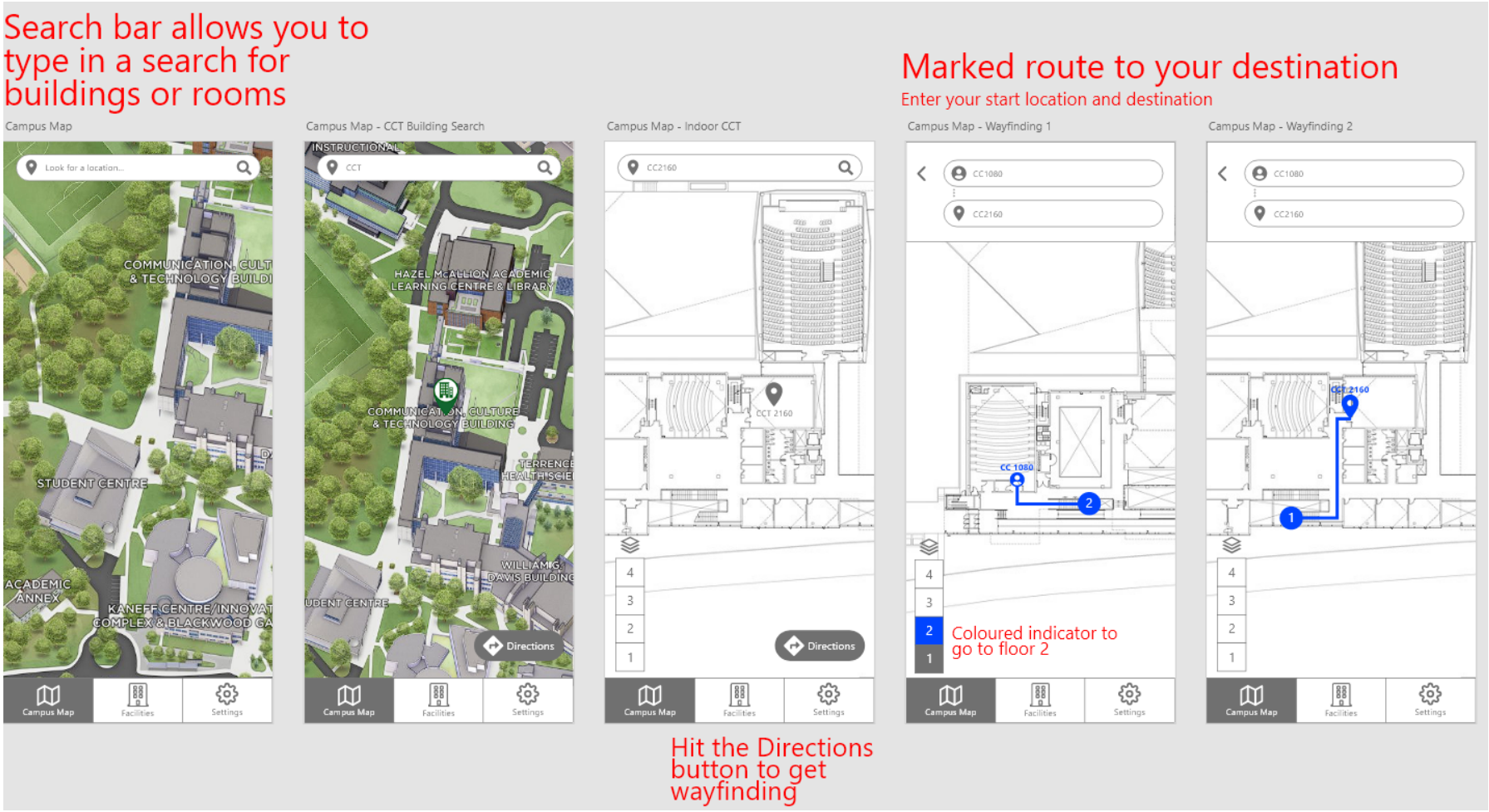

Figure 8: A wireframe showing the outdoor maps and indoor wayfinding of our proposed design.

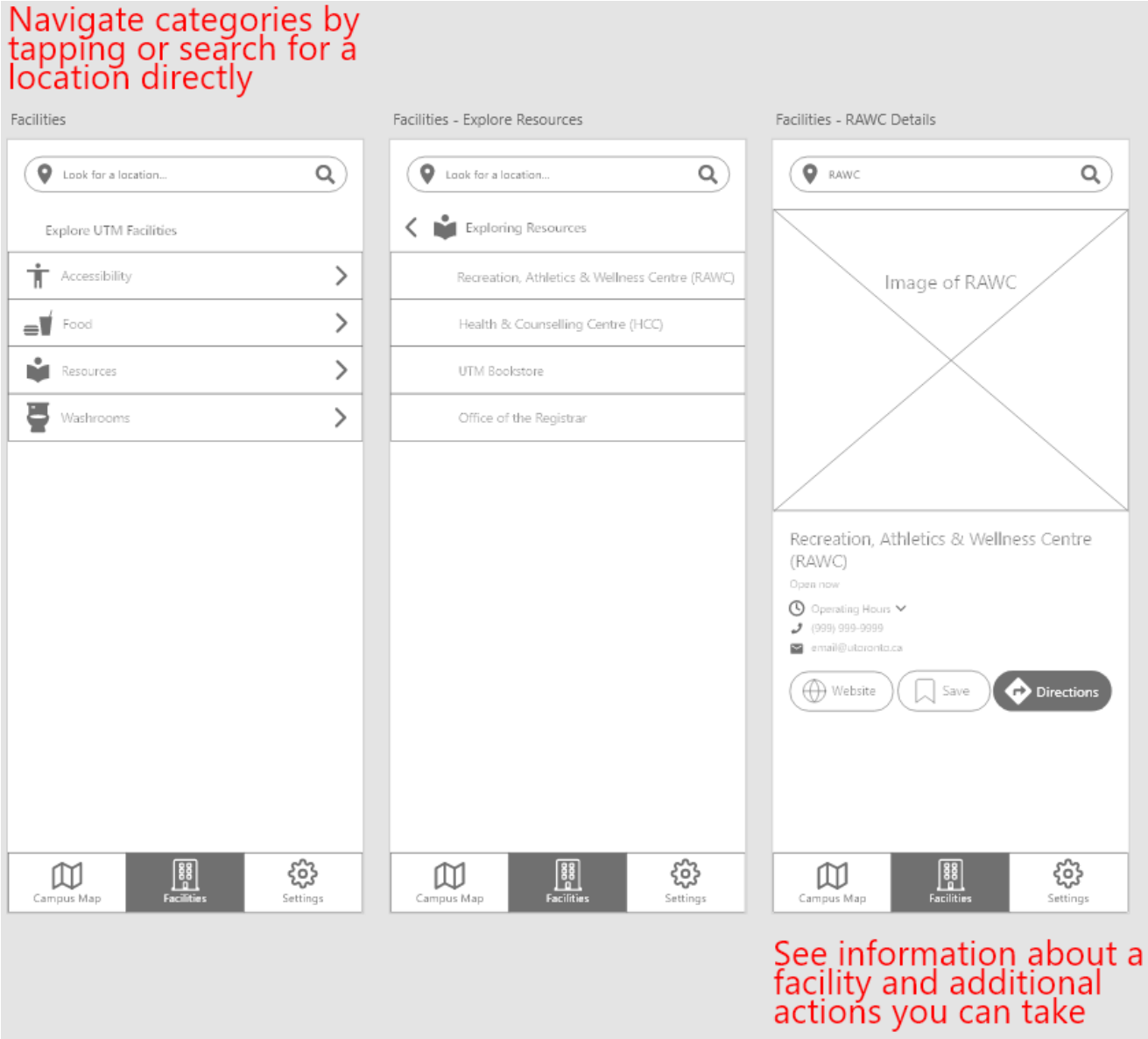

Figure 9: A wireframe showing the facilities explorer of our proposed design.

Design System

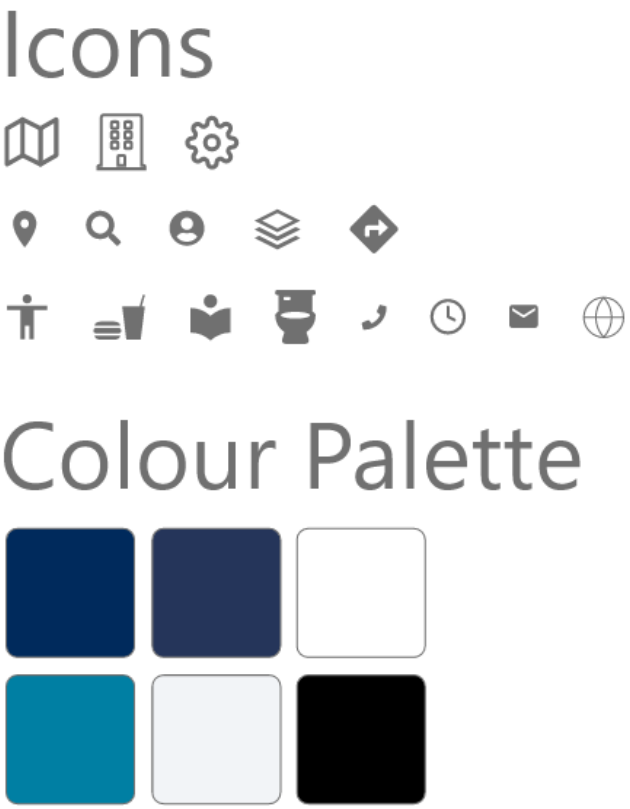

Figure 10: A suggested design system featuring icons and a colour palette based on UofT.

Next Steps

Due to time limitations and difficulty with sourcing participants due to the end of the term, a larger sample size could not be achieved. Thus, further research should be conducted on both additional UTM students as well as other potential users and stakeholders. For instance, UTM staff, faculty, visitors along with members of the general public should be interviewed since they may present perspectives and findings that student interviews may not have. Furthermore, user testing on the wireframes would be beneficial for determining any navigational and usability issues within the system which may generate additional iterations of the design. Exploration into better-to-have features such as indoor positioning systems or augmented reality may also be considered if there is available time and resources.

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Appendix A

Digital Kiosks

Table 1: A pros and cons list for a digital kiosk solution.

Pros	Cons
- Can be strategically placed - Interactive - Very accessible and available to all students/visitors/staff - Fairly easy to implement - Can be customized, language etc	- Maintenance issues - Takes up space - Hygiene concerns? - Less accessible for visual impairment

Mobile app & web app

Table 1: A pros and cons list for a mobile app solution.

Pros	Cons
- Everyone uses Google maps/relies on their phones to give them directions - Available at anytime, any location - Individualized - don't need to wait in line to use it since it's available on your personal smartphone - Accessibility: Screenreaders on phones can access the information - No reliance on memorization, provides list of directions/information to guide you the entire process - Only software development needed	- Some people don't have phones/laptops/internet (argument: uoft/eduroam provides internet) - Sometimes uoft internet is bad (would globally affect solutions that use uoft network) - Need to support Android & iOS (and multiple browsers if available on web app) - If someone's phone runs out of batteries they can't use it - GPS tracking won't work indoors

Digital Kiosks as Signs

Table 1: A pros and cons list for a digital kiosk as signs solution.

Pros	Cons
- Allows for redesigning of signs for future improvements - Can still provide general sign usage while also working as a kiosk - Can guide the user to the more specific room based off input (general kiosk functionality)	- More costly to implement as it uses both software and requires multiple screens - Not fully accessible to those with disability (visually impared) - Have to design a new piece of hardware

- Accessible to the public without requiring anything - Requires only to develop software for 1 platform	-

Appendix B

App

- Pros
    - More convenient reminder on what path to take
        - "Def app, I have bad memory so I can constantly look at my phone as opposed to trying to remember the path I needa take"
    - Could real-time navigation/can be a constant reminder
    - Can also to made to be used offline
    - More accessible to users as most people have a phone already
- Cons
    - UTM apps are not used and not generally well-known and are usually hard to discover
        - Count-point: UTM could advertise the app more via posters, word-of-mouth etc
    - Requires developing for IOS and Android
    - Could require wifi
    - Not usable if the person doesn't have a phone
    - Requires that the user sacrifice storage space on their phone

Kiosk

- Pros
    - Better affordances as kiosk are better known indoor navigation devices
    - More intuitive layouts to use for indoor navigation (i.e. phones has google maps for only outside but nothing for navigation indoors)
- Cons

- Requires memorizing the path you need to take
- Can only serve a limited amount of users (can become crowded)
- Needs you to go out of your way to get to the kiosk
- Requires both hardware costs and software development costs along with maintenance