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CPSC 4140
February 28, 2018

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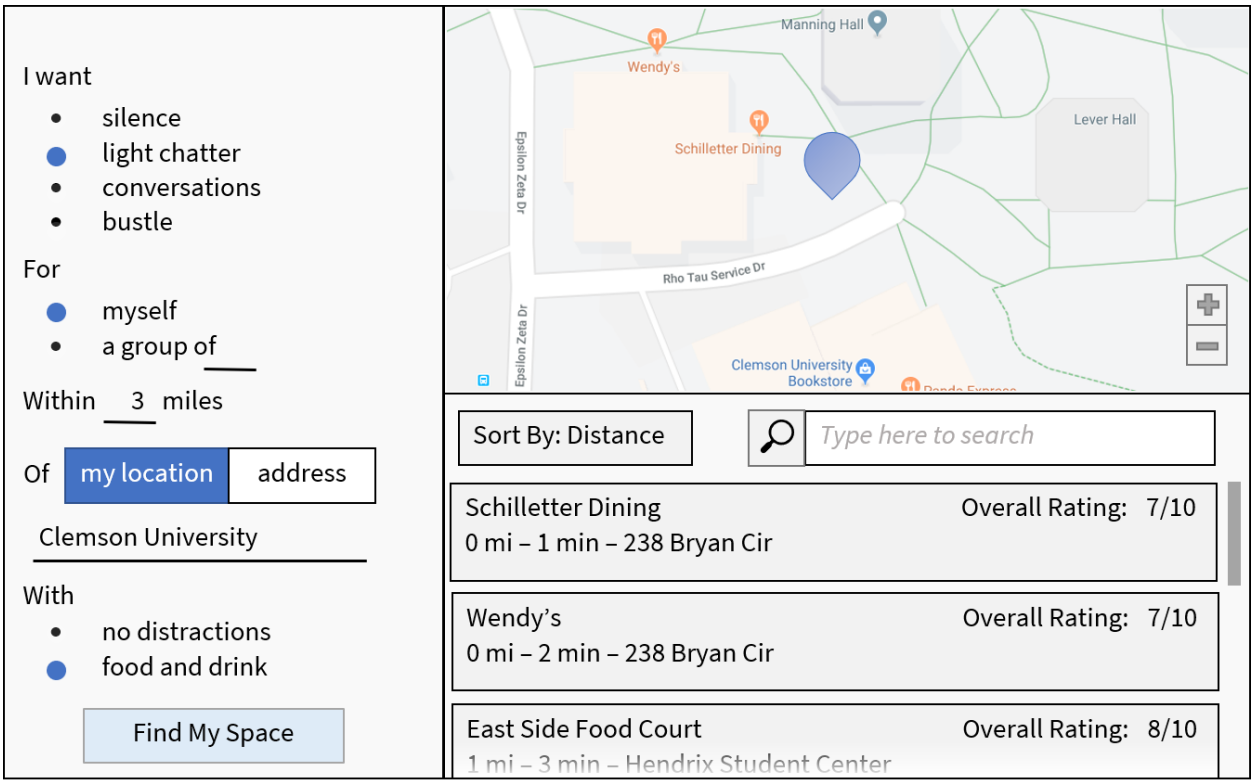
Project Overview

Our project will be addressing the domain of “be a more efficient you” to identify and alleviate a common daily hassle that wastes time and reduces efficiency. We are interested in this domain because we think there are many common daily problems and difficulties that can be easily avoided or eliminated through the application of positive human-computer interactions. Being a more efficient person allows for less stress from unnecessary challenges, opens more free time in your schedule, and allows for a greater amount of energy and thought to go towards what you find more important. Tasks such as identifying the best parking lot on campus to check on the way to class or work, the optimal route from one location to another, and finding a location to study that meets one’s environmental needs are areas where people are losing efficiency.

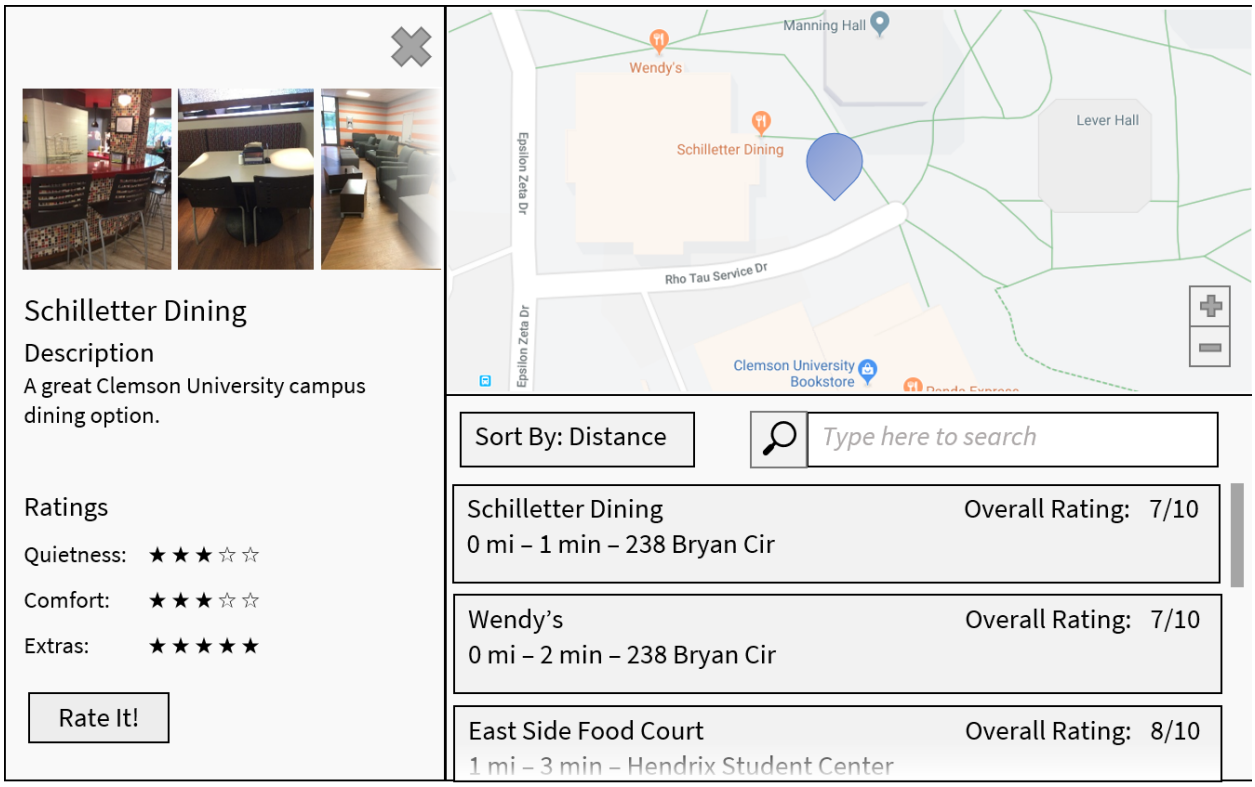
After the feedback from P1, the team has decided to shift its focus to solve the following problem: people waste time and effort when finding a work or study location that is not always optimal. New data from this endeavor will be included within the design justification sections of the designs, and the updated stakeholder analysis will show our findings at the end of this document.

Design 1: Web Application

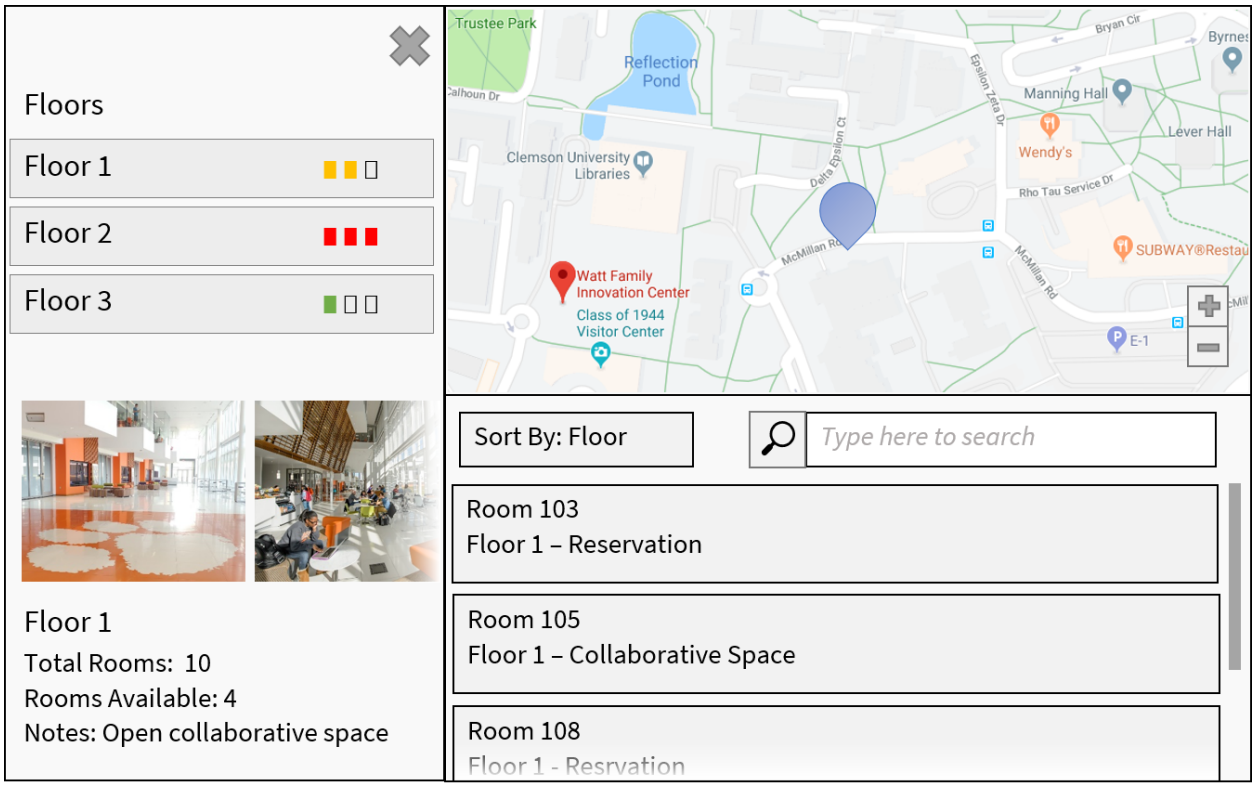
Mockups



Finding a Space

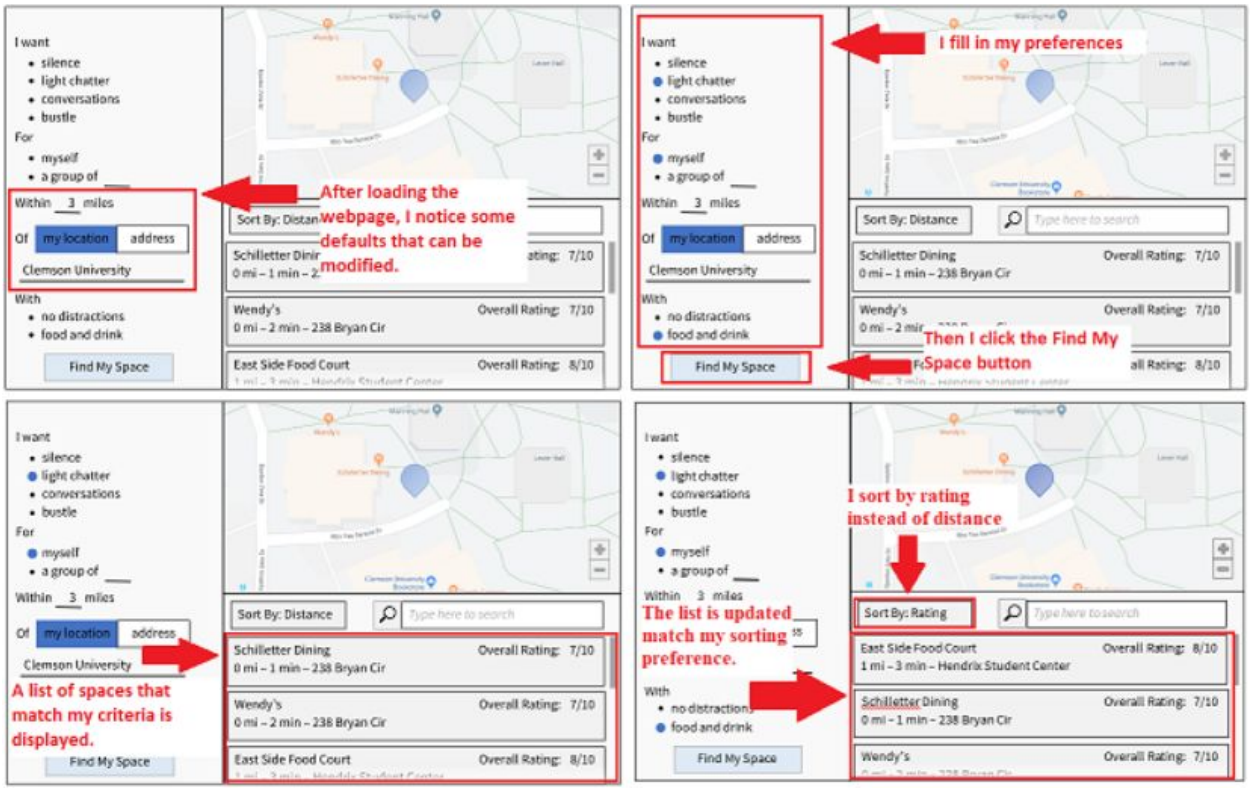


Viewing Space Details

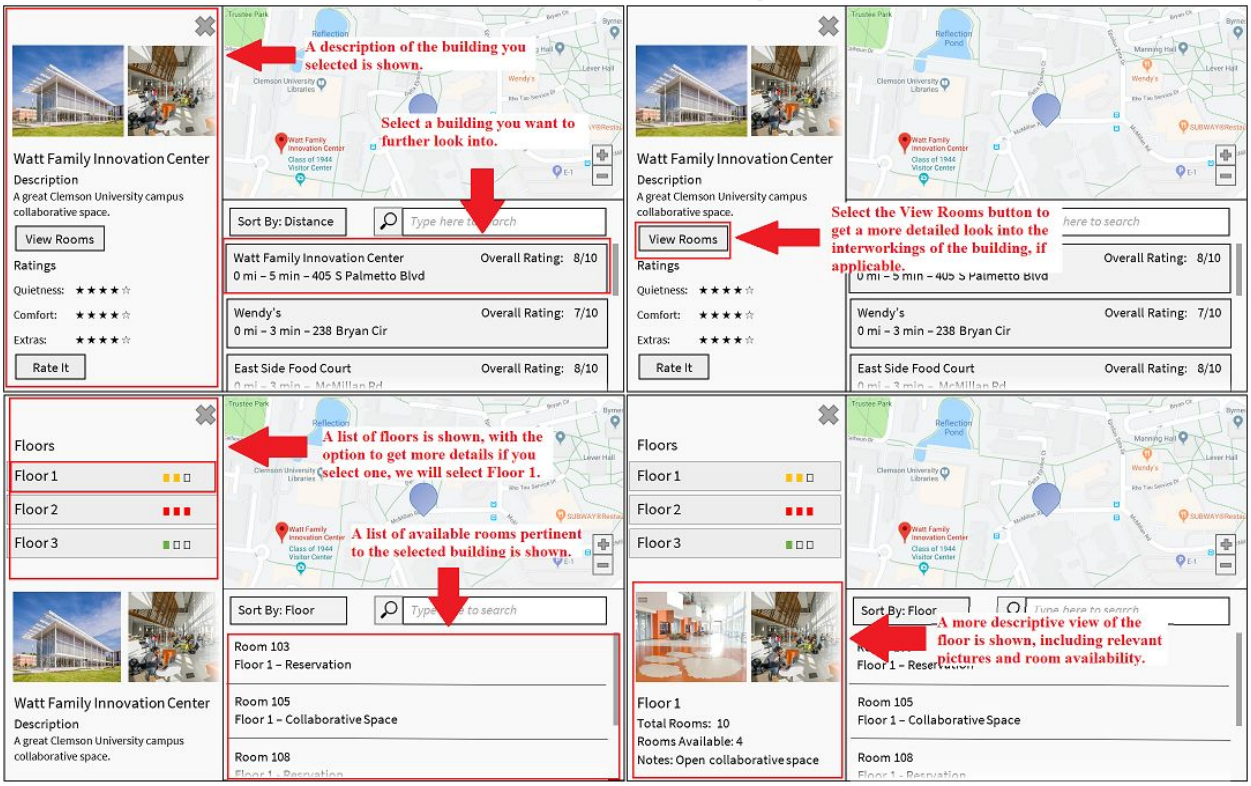


Finding Rooms

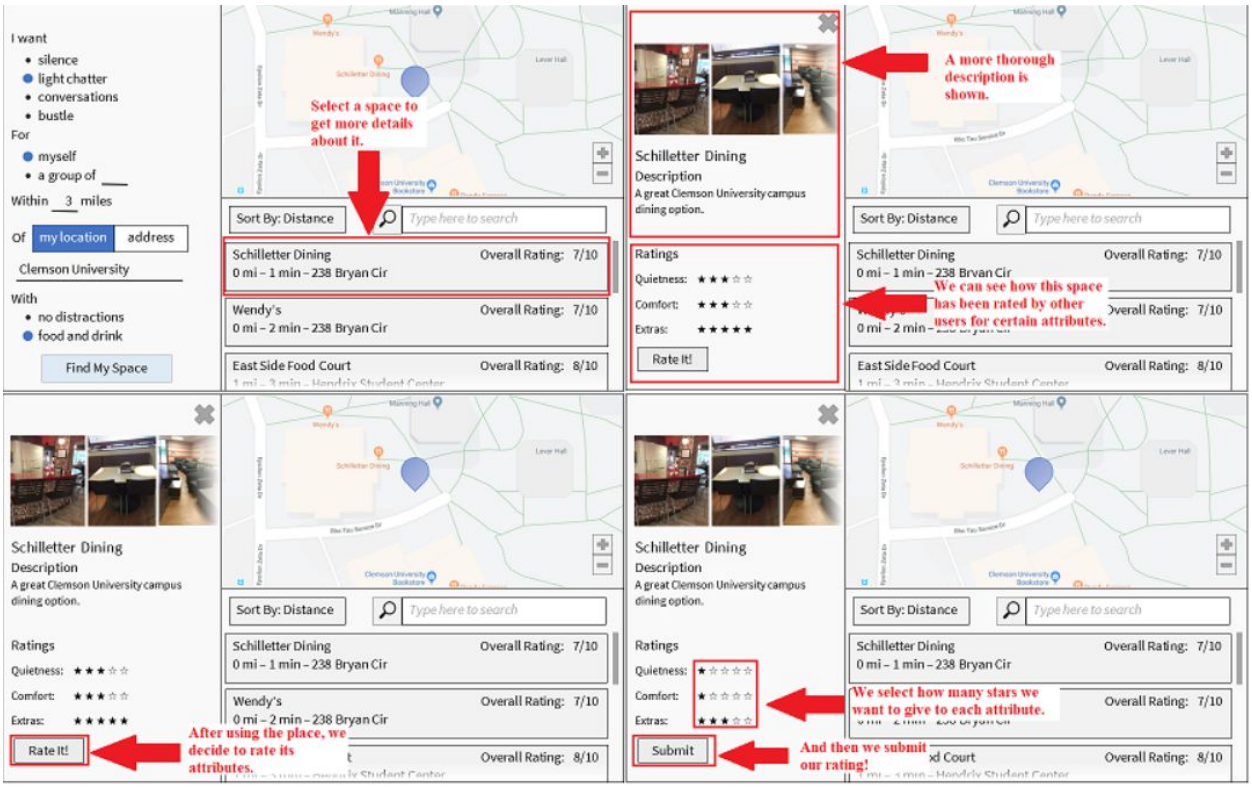
Design Narrative



Find a Building



Find a Room



Rate a Building

Design Justifications

This design is a standard web app that can be opened on a desktop or mobile browser. The app layout is designed to be intuitive for users which allows primary and secondary stakeholders to use the app without difficulty. The layout has three main areas: the sidebar to the left, the map area to the upper right, and the search results area to the bottom right. Over the course of the app's usage, the left sidebar switches between asking for input and displaying information. The map area always displays a map utilizing Google Maps API which allows triggers for handling custom events. The results area displays building or room results found after processing the user's inputs. This setup is similar to Google Maps which allows users to adapt to and accomplish the tasks they want quickly and easily. This setup is also modular to allow developers to easily add features in the future.

The inputs area has a natural language form to improve the user experience by asking simple yet thorough questions. The first question asks users for their preferred noise levels based on survey results where over seventy-five percent of respondents picked noise level as the one of the most important aspects of a space. These inputs set the preferences used to compile the search results. The search results can be filtered or sorted to allow users to quickly find what they want. Users can find buildings, rooms, and even spaces, depending on how thorough and lenient the database is set up. This

flexibility is the result of combining several ideas based on feedback. The results only show spaces that are available rather than showing all spaces and indicating that some are available. This choice came from the survey question where fifty percent of respondents had difficulty finding space due to lack of availability. The second-highest difficulty was finding space that was near other locations of interest. Based on this response, the map is always available to show nearby locations and the search results can be sorted by distance to the user's input location. Users can click on building results to view details, images, and other users' ratings. This design choice was also based on the survey because fifty percent of respondents replied that the second most important aspect of a space was the atmosphere.

The mockups shown above are local to Clemson University but this app can be used on other campus universities since the information used by the app comes from a back-end database. A future stretch goal for this app is to enable it for use by the general public rather than limiting it to just university campuses. The app will be free because seventy-five percent of respondents stated that they would not be willing to pay for technology that helped them find a space.

Strengths

- Search before arrival
  - The fact that this solution is connected via the internet allows our users to remotely interact with the system, meaning they can search for their perfect space before they intend to arrive on campus or at the building.
- No cost to student or university
  - Besides the cost of hosting our application which is negligible when you consider a universities budget, our application is free to use. It doesn't involve any hardware besides a device with an output display that can be connected to the internet, which is a requirement that most universities have for their students.
- Allows for user customization
  - There are a lot of attributes that certain buildings and rooms have that users look for or explicitly say they don't want. With an interactive system such as a web application, we can take in user input and filter our search results based on their input. This makes this solution user-friendly which should be an important aspect in any solution.
- Enables crowdsourcing
  - Since our solution is connected to the internet and is interactive, we can implement real time crowdsourcing into our solution to give users who have stayed at locations we recommend a way to give other potential users a honest review of the place.

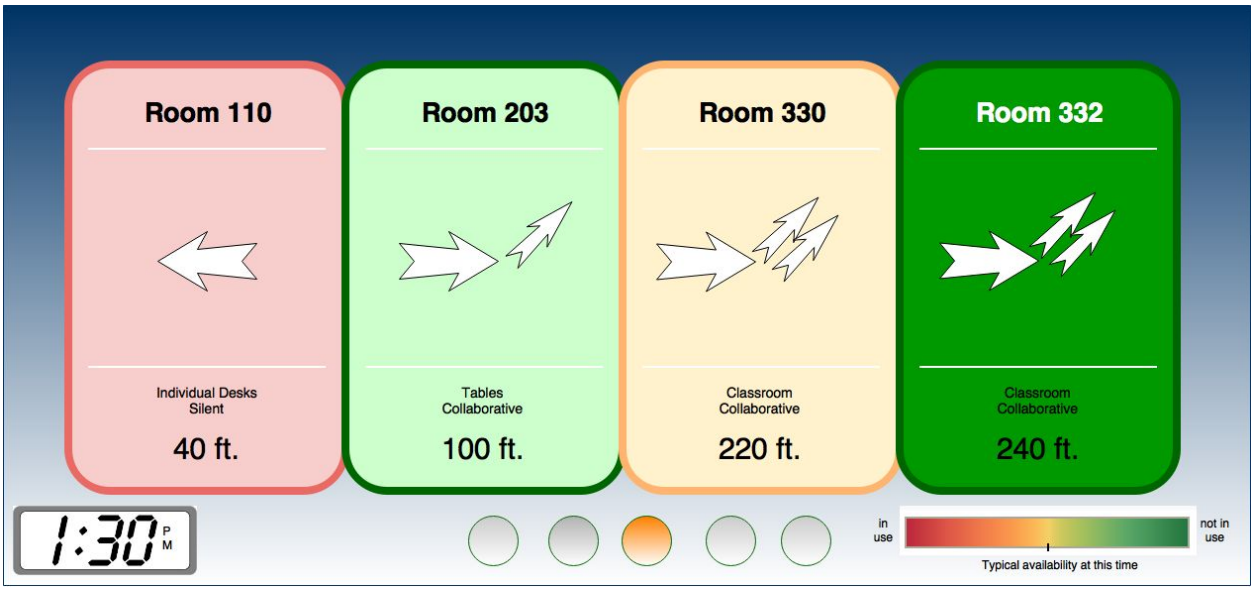
Weaknesses

- Involves sequencing to find a space

    - There are a lot of steps that a user has to take to get to a point where they are satisfied with a recommended space. Typically, a user would have to have access to a device, open a browser, browse to our website, customize their search criteria, search the results, and decide on a building / room. Other solutions which might not be as customizable can be a lot quicker for a user to find a space.
- Accessibility
    - To be able to use this solution you need access to a device that is connected to the internet and has an output display. Some people don't have access to such a device and would either not be able to use our solution or would have to physically travel to a public space that has these tools available, which takes away one of our major advantages of being able to be accessed before you arrive on campus.

Design 2: Dynamic Availability Display

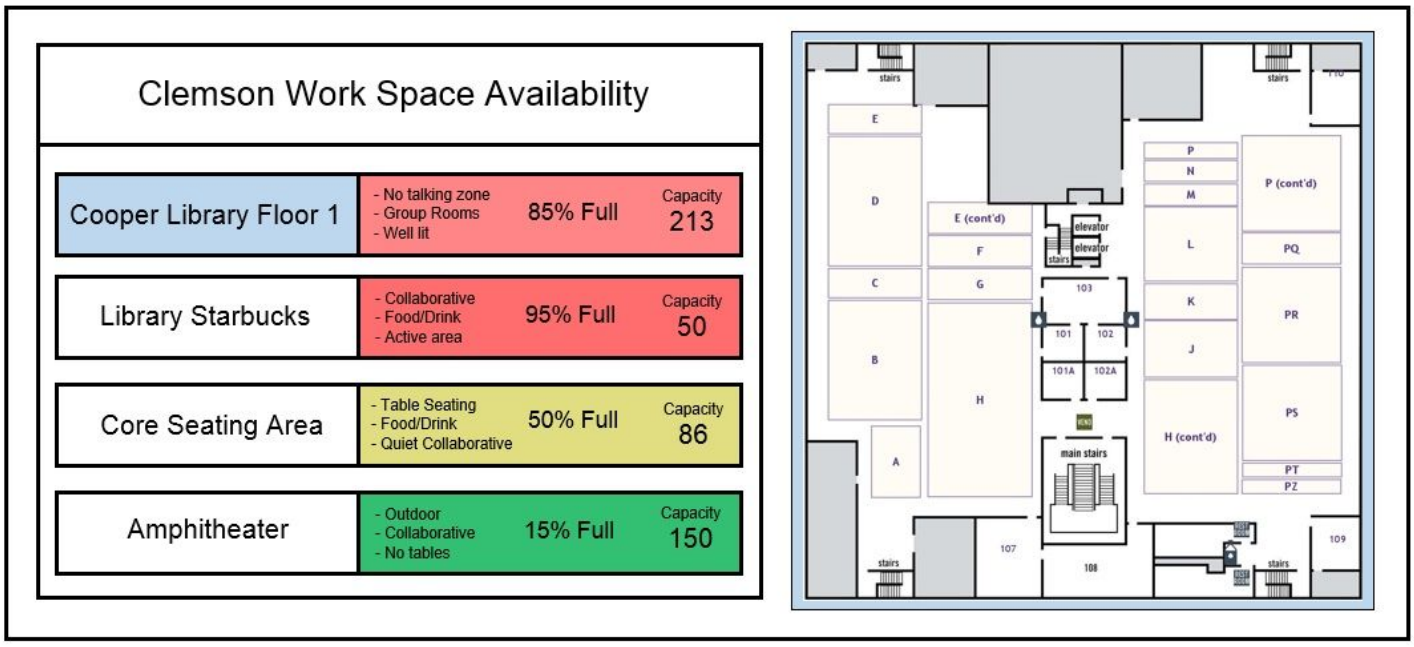
Mockups & Design Justification



This first mockup of the Dynamic Display design was created for our studio to demonstrate some of the core features of the design. For this design we choose to explore the modality of a display board similar to what you see in an airport for flight gates. We thought it would be a worthwhile design consideration for a system that takes limited input, but users can quickly interact with it to get the information they need and on their way quickly and on a system that doesn't have major technological requirements. This design only requires some sort of display to be running the software, so a simple case would be using one of the televisions on the first floor of the library to be scrolling through common locations on campus and show passing students the availability of each and the relative location to the display.

In this mockup the user can see four options on the screen at a time which shows where the space is (in this case 4 rooms for the library), whether the location is on the above or below floors (by the angled arrows), how close the space is to the display (the measurements at the bottom of the screen), and the typical availability at the current time shown through the gradient color scheme. During our studio we received feedback on this design that indicated it was liked for being quick and easy to implement in multiple places on any normal college campus. It was, however, mentioned that a map of the spaces would be helpful, the arrows don't make the clearest sense about the relative location and aren't super necessary since its less useful for wayfinding than to give data on available spaces, and isn't the most accessible.

We also as a group gave feedback to our original design after the studio and realized the system was not easy for color blind users as the colorations are the only indicator of capacity and that an indicator for more live data would be more useful (whether that be in conjunction with a web application or pulling data through some other way including senses at entrances on campus to approximate load).



Based upon that original feedback, we redesigned the display system to be this second mockup. We retained the same basic idea for the design, which includes a scrolling display of available locations on campus, which includes the attributes of the location, the capacity, and both colors the box to indicate capacity, but also prominently displays the percentage full for the location. Also as the locations scroll, one of the location maps is displayed on the right and indicated by the highlighted name box to show users the rough layout of the location. Feedback from peers indicated the most important pieces of information were the location and how full it was, so we tried to maintain the coloring system, but added the percentage as a the largest font in the right

box so this was easy for users to find and also displayed the name of the location in a gridding pattern that was easy to associate with the location title on the left.

So similarly to the original design, this would be a design board that could be run and displayed to any visual display such as a television to allow users to quickly glance for an immediate location that is open nearby or wait for a particular location to scroll around and see how it is doing while noting the availability of other locations as well. We also looked into a way to determine capacity real-time and got feedback from the Watt Center about how they monitor power consumption throughout the building to give an estimate of how full somewhere is. This is particularly useful when it comes to seeing if rooms are available for their room reservation system since the lights turn off if there is no motion after a certain amount of time and that power change is noticeable, which may be a possible expansion to this design or incorporated with another to give better real time monitoring of room over floor capacity. It has been demonstrated at other universities that this is a feasible way of monitoring rooms assuming the electrical system is equipped to handle it [2][3]. This design would primarily focus on building or floor capacity though and entrance sensors would still help with that.

Design Narrative

To use this system, a primary user would find a location with an active display such as the entrance to the library, Watt, or access a website with the display (since that would be an easy addition and make it more accessible). The user would then look at the board and observe the four locations currently displayed for study space. While looking at the left bar they would be able to observe the estimated availability of the location, the particular attributes of the location if they're looking for something in particular, and capacity of the location to judge whether or not they believe they would find an appropriate spot if they traveled to the location.

The user would be able to quickly glance and see the location name and availability due to either color or the prominent text indicating how full it is. Alternatively, the user could wait for a particular location to appear through the scrolling menu and figure out if their preferred location seems likely to be available. While it is scrolling they can look at the map of the featured locations (which also scrolls, but possibly at a different pace) and read about the characteristics of other locations to potentially find and try a new location to work or study at. The information they are able to quickly glean from the display system would allow the user to make a more informed decision about where to work or study and thus more quickly be able to get to working in a desired location without having to waste time searching individually to see if they are available.

Strengths

- Quick and easy to use
    - This system is fairly easy to use since the information is plainly displayed and should be apparent to the user what they are reading. The system is also quick

to use as a user just has to walk in front of it to get the information they are looking for and head to the location of their choice.

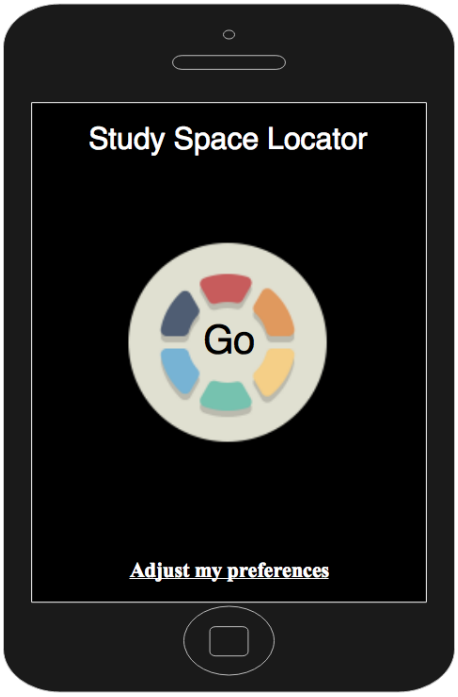
- Low implementation costs
  - The only hardware the system needs to operate or be added to a new place on campus is a television that is able to run the application. This makes almost any television located on campus able to be converted and used as one of these displays for users to interact with.
- Placed in convenient locations
  - This system can be placed in convenient locations such as the entrance to the library where a user can walk in looking for a space, pass by the board, get information about an available floor they would like to go to, and immediately make their way there or skip to their second choice if it is full.
- Consistent use cases
  - The use cases for this system are very straightforward since it is a display system. A user will come to the system looking for information about a work or study space on campus and acquire the information from using the board. This is consistent and straightforward when it may come to implementing this design.

Weaknesses

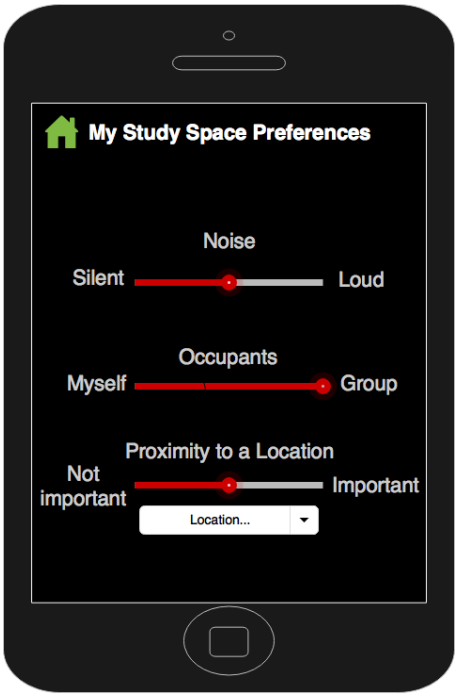
- Live data collection
  - Since the system is primarily a display board, it does not have the simplest or most reliable form of availability sensing without external systems. Data collection could come from normal hour by hour availability, but this system would likely affect that and not be able to display the effect and reach a steady-state. Extra sensors could be used to track in/out traffic for buildings, but this would incur additional costs albeit add accuracy.
- No user input
  - This board only displays information for users to visually read, which limits accessibility to visually impaired users. A user also will have a more difficult time finding out information about a particular location (which it may help to just display more on the screen for this)
- Limited by location
  - The board is not mobile and is therefore confined to the display it is being played on. This means that a user must always find an active display to use it and remember the information given. Also if information is incorrect and somewhere is full, then the user may have to come all the way back.
- Limited information for the user
  - The user is not able to select the information they would like to see, which there could be a lot more information listed along with the locations. Space on the screen makes this a challenge to list every possible characteristic about the location and list as many locations on the screen as to make it an efficient process that is readable.

Design 3: "Compass" Mobile Application

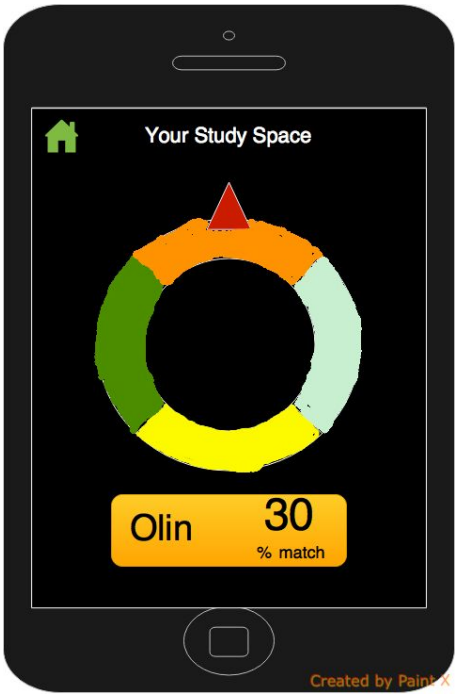
Mockups



Home Screen



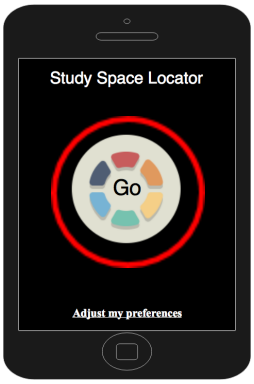
Preference Screen



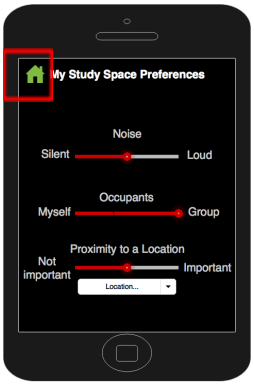
Compass Screen

Design Narrative

The user will be brought to this screen as the home screen of the application. If the user already has their preferences set, then they can just open the application and select the “Go” button (highlighted below) in the center. The user can also select “Adjust my preferences” in order to select the criteria that are most important to them when choosing a work or study space.



If the user does select “Adjust my preferences”, then they will be interact with the following screen. They can use slider bars to adjust three criteria. For “Noise” they can adjust a sliding scale from “Silent” to “Loud”. They can select if they are finding a space for themselves or for a group. They can adjust how close they would like to be to a desired location and set the location. Once the user is done they can return to the home screen by selecting the home button icon (highlighted below) on the top left of the screen.



The most important use case, however, occurs once the user selects “Go” on the home screen. The compass-like screen will appear and the user will see a circle with the outer edges colored and an appended red arrow pointing to the top of their screen. Users will turn the orientation of the phone (and thus their bodies also) to try to place the red arrow in a circle that is of a more green color. The color scale will range fluidly from green (best available match to the user’s preferences) to red (worst available match

based on user's preferences). The location will be displayed at the bottom of the screen with a match rating based on their preferences. Once the user has settled on a satisfactory option, they will simply keep following the arrow on their screen to the building or room. Thus, the red arrow does not represent "true north" like it does on a compass. In this case "true north" is dynamic and the user will keep the red arrow within the colored section of their choosing.

Design Justifications

This is a mobile application that mimics some design and functionality of a compass application. The stakeholders utilizing this type of design will most likely be primary due to the simple nature of the tasks involved. Secondary stakeholders would also visit the same screens and utilize the same functionality. We thought this design would be beneficial because 83% of respondents to our survey said that they use a mobile device while traversing campus. The scope of this design is more simple than the first two designs but aims to provide a unique and intuitive solution to help users find the best possible work or study space based on their current location and uses spatial awareness to drive user workflow.

The home screen is centered around 2 functionalities. The "Go" button maps the color wheel icon that is displayed to the color wheel that will display on the compass screen. The button that prompts the user to the main functionality of the application also takes advantage of a person's tendency to look at the center of the screen.

For the sake of the simplicity in design, we have added only the features that were most important to those from our survey data. Other than availability, "proximity to other locations" was the most important reason why respondents (33%) found that work/study room finding was difficult. Thus, we wanted to give the users the ability to select a location they would like to be near. "Atmosphere" (50%) and "Noise Level" (75%)

were the two most important criteria when respondents were asked, “Which TWO elements of a study/work space are most important to you?”

In terms of the compass screen, the red arrow is mapped to the direction that the user is walking. The circle model was used to give users a feeling of familiarity because they have most likely used something like a compass before. The colors are there to provide context on which location the user should navigate to. The dark background aims to provide contrast so that the colors are distinct.

Strengths

- Simple
  - There is not a lot of information for the user to digest in order to make their decision and follow their way to their study spot. The preferences are minimal and are driven by what affects users in their environment.
- Mobile
  - Enables the use of mobile technology, which is the basis for many human and computer interactions on a college campus or anywhere in general.
- Focused
  - The solution is driven by one main use case and that is to empower the user to find the best possible spot, no matter where they are, so that they are not searching multiple spaces and locations.
- Adaptable
  - The colors are able to change based on the user’s location and the locations of the potential study spaces around them. They can also interact with the system throughout its use. They do not have to store information once and then recall. It is always readily available to them.

Weaknesses

- Not robust
  - There is a lack of functionality when compared to some of the other designs. The user does not have access to a map of where they currently are and does not allow the user the ability to plan ahead where they will try to study.
- Accessibility
  - The design is focused on visual and spatial cues, but could have better options to help those that are visually impaired, such as textured lines in addition to the color or audio feedback.
- Lack of feedback
  - The arrow and the display of the location at the bottom are really the only sources of feedback to ensure that the user is headed in the correct direction.

Users in the Problem Space (Updated Stakeholder Analysis)

A primary stakeholder would be someone who is looking to utilize the “best” work/study space possible. “Best” is left up to the interpretation of the user and is based on their own preferences, some of which may include the noise of surrounding area, the technological capabilities available, or the seating capacity. The primary stakeholders would most likely be students on college campuses, but could include faculty and other campus staff. Students would be primary stakeholders because they would be the most likely to need spaces on campus to work and study. Many students have jobs and take classes that they study for, which requires them to have good space to work at. Faculty are primary stakeholders because they also might want to find a space to meet with students, other faculty, or find locations for working around campus that are not their offices. Students can be split up into several different categories based on their reasoning for needing a space or their use of a space. Some possible subgroups of students could be: Undergraduate students, graduate students, on-campus living students, off-campus living students, college-specific students, and new students. For example, on-campus students might need a private study space more than somebody who lives off-campus because on-campus students are typically living with other students where there is limited noise blocking. Existing solutions in this space include search portals, where users can search for study spaces. These options, however, essentially function as databases for locations and most of the locations are in the university’s library [1][4].

Secondary stakeholders would need to find the best space every now and then or help others find an optimal spot. This includes community members, prospective students, local business owners, staff in high-traffic areas, facilities workers, visitors, and resident assistants who may want to help their student residents. Another secondary stakeholder would be the people who maintain the system. This would include those in information technology or facilities operations. The information technology team may have to maintain the database attached to our solution and maintain the hosting of the solution. The facilities operations team will have to install and maintain any hardware that may be required for our solution [2].

Tertiary stakeholders would include the school’s governing body, Board of Trustees, sponsors, industry partners, admissions, and news sites who report that the solution exists and might show it off to their audience. The impact they may experience is good feedback from alumni for the continuation of making the campus more technology friendly, which may in turn increase grants to the university or donations from alumni. This type of system would also help with recruiting students to come to the university as it makes student life easier and more efficient. They may also be impacted by having to use some of the universities budget to financially host whatever solution we decide on.

Bibliography

[1] "Find a Study Space", *University of California Berkeley Library*. [Online]. Available: http://www.lib.berkeley.edu/using-the-libraries/find-study-space

[2] "Spacefinder", *University of Cambridge.* [Online]. Available: https://spacefinder.lib.cam.ac.uk/

[3] "Study Space Finder", *University of Minnesota.* [Online]. Available: https://studyspace.umn.edu/

[4] "Study Space Locator", *UCI Libraries.* [Online]. Available: https://www.lib.uci.edu/study-space-locator