Redesigning the UC Davis Elevator Button Interface

A digital solution for UC Davis elevators

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Abstract

The elevator is a common machine that vertically transports people and goods within a multi-story building. As there is significant dependability on the elevator system for any building, it is critical to make the riding experience pleasurable for every user. However, there are observed shortcomings such as long waiting times, tight spaces, and difficulties in accessibility with buttons, labels, and lighting. We took this project as an opportunity to improve on a specific, targeted issue of the elevator: *the physical button interface*. To encapsulate our redesigning process, we surveyed a focus group of UC Davis students to understand elevator needs and experiences, developed two personas with our data, and theorized an implementation of a digital screen. Further, we implemented low-fidelity and high-fidelity prototypes to tackle user needs and goals within the elevator button interface. As a result, our simple and sleek elevator design resolved many of the issues that users had, such as actively conveying elevator direction, highlighting buttons to prevent ambiguity, and displaying important emergency information accessible to all users. We discussed our findings and implications of the final prototype implementation.

Introduction

Elevators are a common example in HCI because of their prominent use and varying interface. The interfaces are simple and have few functionalities like moving up, down, and emergency information in case of a malfunction or human emergency. However, small issues like pressing the wrong button, keeping the door open for hurrying passengers, and messy unintuitive buttons make riding certain elevators a hassle. To combat these problems, we looked at several UC Davis elevators to see if students share the common issues of riding an elevator. To gauge the user's perspective further, we created a questionnaire that asked simple, yet informative questions about UC Davis students' experience riding the elevator. A few of the questions that we asked were: "What emotions do you experience when riding an elevator," "If you had to open the door for an incoming elevator passenger, how do you usually go about it?" and "On a scale of 1 to 5, how often do you rely on floor indicators for knowing the elevator's direction?" Our results reflected negative emotions while riding the elevator, lack of floor indicators, and nonfunctional buttons for opening/closing doors. These questions and results helped us formulate our personas: (1) a frequent elevator user and (2) a non-frequent elevator user. Once defined, we visualized and implemented our design through lo-fi and hi-fi prototypes, striving for readability, cleanliness, and detail. We also focused on the compliance of HCI principles, such as accessibility, visibility, recognition rather than recall, user control, and minimalist design.

In this report, we will discuss our exploratory findings, prototype implementation, and the discussion of our final results. The variety of options that digital screens provide, such as ability to display information clearly and consistently, adaptation of virtual interfaces through code and design, and an easy-to-use interface, will allow users to enjoy riding the elevator. Using the data and the information that we have gathered from our survey, we implemented a cleaner look for the elevator panel.

Background

Much of our project inspiration came from other students who did similar projects or analysis on elevators in their respective areas. The first article we addressed was by Ted

Wang, titled OOD - Design and Elevator [1]. Understanding the design of the elevator gave us a good understanding of the fundamental services that an elevator had and issues users could have with stopping and moving, particularly relating to the open door/ close door buttons. The second article was a peer review of elevator design using Don Norman's Heuristics titled Analyzing Elevator Control Using Nielsen-Norman's Usability Heuristics by Shravya Simha [2]. From this article we gained a lot of insight about the different HCI principles like memory load and aesthetic that helped us later design our lo-fi and hi-fi prototype.

Exploratory Findings

To get a better understanding of our audience, we sent out a survey to UC Davis students. In this survey, we asked them questions regarding their general experience with the elevators on campus. From over a dozen responses, data relating to their emotions during the whole process, specific interactions with the elevator interface, and other behaviors were collected to be analyzed. We then used this information to create two elevator-rider personas.

In most elevators, there are two buttons that manually open and close the door. In Figure 1, four-fifths of survey participants prefer to stick out their arm or leg to keep the door open instead of pressing a button. This suggests that the current state of the elevator interface may have too many features that most riders do not use, either because it takes too long to press or it's placed too awkwardly. We took these results into consideration when we were prototyping our design of the elevator.

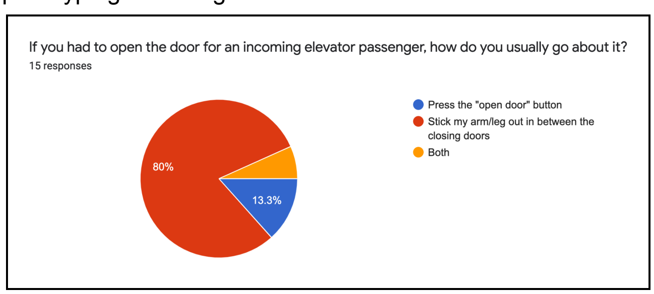

Figure 1: Pie chart showing how UC Davis students typically keep the elevator door open for others.

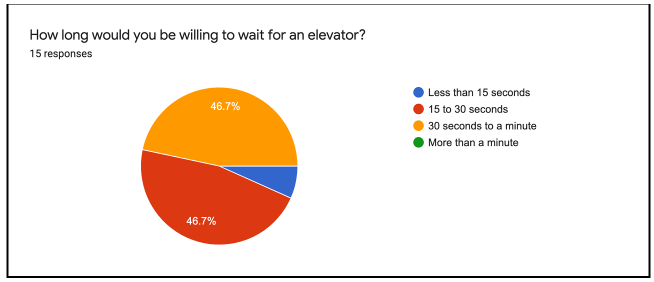

Figure 2: Pie chart showing how long UC Davis students are willing to wait for an elevator.

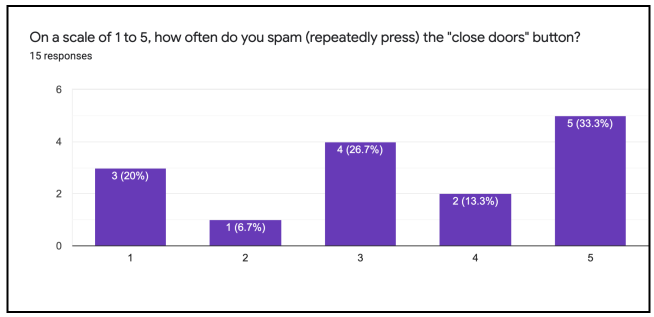

Figure 3: Bar graph indicating how many UC Davis students repeatedly press the "close door" button.

We subsequently organized our findings into two personas: (1) a frequent elevator user and (2) a non-frequent elevator user. The frequent elevator user was posed as a college student under a time constraint, causing her need for improvement in the speed of button registration. The non-frequent elevator user did not face a time constraint but sanitary issues instead, causing his need to press the elevator buttons with his elbow. Both personas shared common needs of improvement in the visibility of floor indicators, button lights, and speed of button registration for safety.

Prototype Implementation

We started sketching what we wanted our elevator redesign to look like, and after many drafts came up with a lo-fi prototype that fit our needs. Since a common problem for elevator users was not clicking appropriate buttons, we wanted to improve visibility. So, for the inside of the elevator, we made a large digital screen with clearly labeled digital buttons such as open/close, a red stop button and an alarm button. We also displayed the time and date, and added a button for news along with a button for music selection. We made a digital screen for the entrance of the elevator as well, showing which floor the elevator is on.

In order to make our redesign of the elevator interface follow specific HCI principles such as visibility, consistency, and recognition, we made a few changes to our lo-fi prototype. In our hi-fi prototype, we didn't include the news button or the music button, because we thought this could be a distraction. We also changed the inside of the elevator to have the floor number on the same digital panel as the rest of the buttons to keep the design consistent.

For our hi-fi prototype, we chose to remove features such as a button for news and a button for music selection. We originally had these in our initial prototyping, but felt it might be too overwhelming for elevator riders. We wanted to focus on the interior and exterior panels of the elevator in order to elevate these experiences for elevator riders. We created both panels using Figma and ran a simulation of what the elevator panel would look like when running. With the implementation of a digital panel, we hoped to solve the issue we found that UC Davis students had with the responsiveness of buttons.

For the exterior panel, we chose to have a simple, sleek black background and white button design in order to make it easier to see the buttons being displayed. When the buttons are pressed, they would illuminate in an orange color to indicate that they were being pressed. We also added a floor indicator to the exterior panel itself in order to show where the elevator currently is in the building so riders can estimate how long it would take for the elevator to reach them.

Figure 1: **Exterior Panel**

For the interior panel, we wanted to keep the same design as the exterior for consistency. We also wanted to have the numbers ascend from the low to high, so we started with one at the bottom and had four towards the top. This allows for easy press of the desired floor, then hitting the "close door" button, which we found was a common occurrence in our survey findings. We also took into consideration the placements of the "door open", "door close", "stop run'', and alarm buttons of previous designs, and wanted to separate the door function buttons from the other two in order to prevent accidental misinputs. We also added a display for the time and weather, as we found that several people tend to check their phones during their ride. We accordingly wanted to display relevant information for our users. We also added the floor indicator display on the interior panel to stay consistent with the exterior panel and previous designs for familiarity with elevator riders. If someone has ridden an elevator before, then they should be able to use our redesign with little to no trouble.

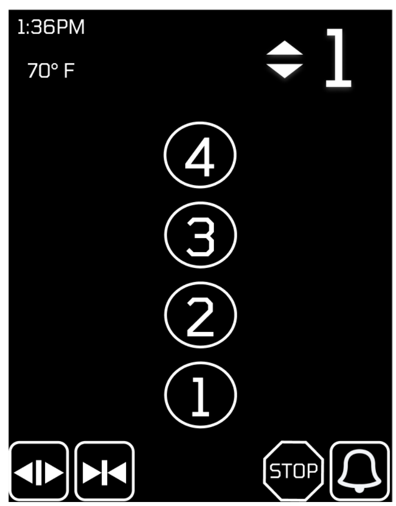

Figure 2: Interior Panel

Discussion

We recognize a few shortcomings within our final prototype implementation of the elevator button interface. In an effort to focus on user needs and experiences from our survey, we overlooked three main issues within our design: (1) accessibility, (2) scaling, and (3) sanitation.

With a digital screen, users are restricted to pressing the floor button with only their fingers. This presents a constraint within our interface, as users would have greater flexibility to push physical buttons with other body parts, such as elbows, hands/fists, and feet. Whether the user opts for this action out of personal preference or carrying many items when entering the elevator, the screen lacks user control and freedom. If we continue to pursue our current implementation, we would have to re-consider this constraint on future designs.

Secondly, our prototype modeled the architecture of UC Davis campus buildings with up to four floors. For a simplistic and clean look, we designed the buttons to be in a vertical formation, with floor #1 positioned at the bottom and floor #4 at the top. While this setup is intuitive and is intended for the user to identify their floor level easier, it presents a restriction for large-scale buildings. With a building of 30 floors, it would be challenging to maintain a vertical formation for the button interface. We would have to accordingly adapt our design to maintain simplicity for the user, depending on the size of the building.

Lastly, our intention of a digital screen was to be cleaned easily and more effectively, especially due to concerns of sanitation within the elevator. However, we realized later that cleanliness depends on the perception of the user, and does not necessarily mean that screens are cleaner than physical buttons. Our implementation could be re-adjusted so that the screen has a periodic self-cleaning feature, where it would be cleaner than the average set of physical buttons throughout the day.

Outside of our prototype, our group lacked communication and time management to organize increased user input throughout our design process, especially for the “Empathize” and “Test” stages. Ideally, we would have wanted more survey responses by sending out the survey earlier in the quarter. Additionally, we did not eventually create a focus group for user feedback for our lo-fi and hi-fi prototypes. This will be discussed further in the next section.

Future Work

With more time and resources, we imagine our project to greatly benefit users of UC Davis campus elevators. After redefining our goals from observations made in *Discussion*, we would implement those changes in our lo-fi and hi-fi prototypes. This time, however, we would want to perform user testing and receive critical feedback on our prototypes. In our focus group of target users, we would also try to conduct informal interviews, asking detailed questions about the button interface experience that was outside of the survey’s scope.

After multiple iterations of the design process, specifically the “Prototype” and “Test” stages, we would like to build a physical prototype of the button screen and implement it into one of the elevators for testing. We could either (1) implement a virtual software that allows UC Davis students to log into an account, access a virtual elevator interface and take a tour as well as interact with the buttons or (2) have a live implementation of the elevator interface on site and collect data from students. With larger data about the effectiveness of the system in place, we will be able to make a case to the university about costs, our survey findings, and about why we should implement these changes on elevators at the UC Davis campus.

Peer Rating

Bhargava Sharma - 20% contributed to all aspects of the problem but had a strong role in on field analysis of elevators, progress report, timeline of events, and final paper (Abstract, Introduction, Background).

Joseph Yousofzai - 20% contributed to all aspects of the problem but also had a strong role in creating the high fidelity prototype both in concept and in implementation by using Figma in order to create the demo that was used in the presentation. Also contributed to the final paper through the Prototype Implementation portion.

Aliya Abbas - 20% contributed to all aspects of the problem and had a strong role in creating the lo-fi prototype, and final paper through prototype implementation. Also contributed to the creation of personas and initial background research.

Anchal Lamba - 20% contributed to all aspects of the problem but had a strong role in field analysis of UC Davis campus elevators, progress report, creation of personas, and the final paper (Discussion, Future Work).

Ethan Muon - 20% contributed to all aspects of the problem, but concentrated his efforts into developing the survey, collecting results, and providing recommendations for both the personas and design based off of analysis of the survey. Also managed the Google Drive of all of the files, in addition to helping string together the skeleton of the presentation slidedeck.

References

[1] Ted Wang. 2021. OOD - Design an Elevator. (May 2021). Retrieved March 18, 2022 from https://tedweishiwang.github.io/journal/object-oriented-design-elevator.html

[2] Shravya Simha. 2019. Analyzing Elevator Controls using Nielsen-Norman's usability heuristics (March 2019). Retrieved March 18, 2022 from https://uxdesign.cc/analyzing-elevator-controls-using-nielsen-normans-usability-heuristics-53e385fa8003