Thesis Project Portfolio

Accessible Navigation Mapping:
Supporting People with Mobility Disabilities for Wayfinding

(Technical Report)

Enhance Inclusion and Accessibility with User-Centered Design Practices

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Shiyu Liu

Spring, 2024

Department of Systems Engineering

Table of Contents

Executive Summary

Accessible Navigation Mapping: Supporting People with Mobility Disabilities for Wayfinding

Enhance Inclusion and Accessibility with User-Centered Design Practices

Prospectus

Executive Summary

Introduction

In a world with rapid technological innovations and societal development, the interdependent relationship between technical endeavors and society often reveals significant insights into how we could better align the interests of all affiliated groups and design technologies suitable for all. The technical project and the STS research would consider human factors during technological development. By understanding the practical challenges of UVA Grounds' navigation for individuals with mobility disabilities, researching the tools required for leveraging such challenges, as well as assessing the broader theoretical ways for enhancing the accessibility of technology, the overall project aims to foster a design environment that's both socially aware and functionally effective.

Capstone summary

College and university campuses always present challenges for individuals with mobility disabilities to navigate. The ultimate goal for the Capstone project is to improve the UVA Grounds' accessibility and help individuals with mobility disabilities to better navigate the Grounds by providing a comprehensive wayfinding resource. The project first identified the information and accessibility features needed to accommodate these individuals better. A more disciplined process for collecting and analyzing this information will then be proposed after this project. The primary scope of this project is the barriers within the UVA Engineering School. This project will focus on laying the foundations for wayfinding and navigational aids as a part of a more comprehensive solution for people with special needs to navigate the school. Before data collection, a literature review on previous wayfinding projects at other universities was performed to better cater the implementation towards the needs of our community. After

preliminary research, we gathered information regarding features that individuals with disabilities would like to be informed about when navigating the campus through a survey. By completing this process, we could define a more disciplined way of collecting such information and implementing such insights into the navigation system. Additionally, we investigated various latest technological tools, such as AI-powered mapping systems and LiDAR, to enhance the navigation experience. This endeavor not only aims to transform the engineering school's approach to accessibility but also serves as a foundational model for a university-wide accessible navigation application in the future.

STS summary

The STS research explores the importance of incorporating human factors into the design process to enhance inclusion and accessibility in the technological development sector. Within the Social Construction of Technology (SCOT) framework, the research addresses how user-centered designs could be optimized to ensure maximum diversity, equity, and inclusion. The project centers on identifying and improving aspects of the design process to foster inclusivity and counteract the societal effects of technological products. Anticipated findings are expected to provide insights into current challenges throughout the design process, such as the interdependent relationship between the user and the development team, the general usability and user experience of products, technology stabilization, and the efficacy of the SCOT framework in analyzing the connection between technology design and society. A discourse analysis focusing on the online language learning platform Duolingo aims to provide such valuable insights. This research is significant to STS and Engineering, as it underscores the urgent need for a user-centric and inclusive approach to design. It would highlight the societal implications of

design challenges and call for an immediate reevaluation of technological design practices. The goal is to encourage the development of technologies that are more inclusive, equitable, and reflective of diverse user needs, thereby contributing to a more inclusive society. Through its findings, this research aims to contribute meaningful insights into optimizing the design process within the framework of STS and engineering disciplines.

Concluding reflection

The project's two parts provided valuable insights into the relationship between technological innovation and sociotechnical analysis. Integrating technical considerations into social practices would increase the efficiency and effectiveness of such practices, while incorporating social awareness into technological developments would ensure the product's accessibility. The STS research provided a grounded basis on how engineers and designers include users in the design process. The research findings stress the importance of considering all social groups, including technological and societal, to deliver a product with maximum DEI (diversity, equity, and inclusion). On the other hand, the Capstone project validates the importance of the research findings by examining a hands-on experience to work with affiliated parties and ensure the functionality of our proposed navigation system designing process. Working on both projects simultaneously provided a holistic view of technology's role in a real-world context, allowing us to further the technological development process guided by social responsibilities.