SafeRoutes – Be Free and Safe in Istanbul Mobile Application Project

CS 549 – Human Computer Interaction

Sabancı University

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Introduction

The public and urban space involves various uncertainties and anxieties around safety. These anxieties are not unified. On the contrary, they are gendered and political. Fear of crime and sense of safety in the city vary greatly through different groups of society and existing power relations within various regions. Among those groups, women experience risks of safety, harassment and attacks on a daily basis (Erkan & Topcu, 2021).

In our mobile application, we would like to focus on women's safety in Istanbul, the biggest metropolitan city of Türkiye, and provide a platform of solidarity and information exchange regarding different areas and routes in the city. Users will be able to comment on different routes and streets and discuss possible dangers. By enabling users to rate street safety dynamically, we will create an adaptive platform that communicates collective awareness through map-based visualizations. Through the users' collaboration, the application will offer the optimized safest route for the specific day and time. In this way, the project contributes to HCI literature around urban interaction design and crowdsourced perception.

Literature Review

The core problem our project addresses is that women's safety in urban spaces is severely compromised by the subjective feeling of fear which is called perceived safety (Şenol, 2022). This fear is so strong that it directly affects women's ability to move freely in the city. It forces them to engage in avoidance behaviors like changing their planned routes or travel times (Hamedanian & Ghadermazi, 2022) and use safety strategies (Şenol, 2022). This navigation problem is so massive that studies show that up to 82% of women avoid conventional routes due to fear of harassment, proving that current navigation mobile apps are simply not meeting this critical user need (Kaur et al., 2021).

Essentially, this fear is largely driven by street harassment, an event that is persistent, yet almost completely missing from police records (Shah, 2016). In addition, a sense of safety is not solely measurable through statistics. Erkan & Topcu (2021) detected that even in a district of Istanbul considered "safe," women experienced a significant level of fear of crime compared to men. This fact shows that women's perception of safety is shaped by the physical characteristics of the space and more importantly, by established social gender norms, independent of actual crime rates. Therefore, any safety map relying on solely official crime statistics is inherently

incomplete. Furthermore, the perception of risk is not static. It changes dynamically based on the time of day and temporary crowd density, not just fixed elements like street lighting (Cui et al., 2023; Kamalipour et al., 2014). This dynamic quality is the key missing piece in existing safety mobile apps. Therefore, our project will focus on collecting dynamic, crowdsourced subjective scores to finally bridge this critical gap in safe urban mobility.

The existing mobile application in the literature for women's safety is divided between reactive emergency solutions and proactive mapping systems (Chaudhari et al., 2017). For instance, applications like HearMe focus primarily on immediate response during a crisis using features like siren activation and quick access with hardware buttons (Akash et al., 2016). These solutions are designed to react to danger rather than to prevent it. Our project belongs to the proactive mapping category, aiming to promote empowerment by providing users with critical information before they start their journey.

The most significant example in this category is SafetiPin which utilizes a crowdsourced safety audit methodology based on eight key urban design factors such as lighting and visibility (Leão et al., 2019). Thereby it is facilitating e-participation in urban planning (Manazir et al., 2019). Despite these strengths, the SafetiPin model has two fundamental limitations that our project is designed to overcome. SafetiPin’s data is largely static and it lacks a routing solution. It relies on audits that rarely change. It is leading to its own findings that the decline in safety during high-risk evening hours is "not very significant" (Viswanath & Basu, 2015). This demonstrates the app fails to capture the dynamic, hour-by-hour changes in risk that we know strongly influence safety perception (Cui et al., 2023). Despite mapping risk, these proactive tools fail to offer an intelligent routing solution that can effectively prioritize safety scores over path length in the decision-making process (Kaur et al., 2021). Our project addresses this critical gap by converting these static safety scores into dynamic, time-based risk metrics and integrating them into an actionable multi-objective routing algorithm.

Urban navigation has advanced significantly with the widespread use of Geographical Information Systems (GIS), which are now the core technology for solving challenges like path planning and traffic management (Ioannou et al., 2002; Kumar et al., 2023). However, traditional platforms such as Google Maps are notably deficient in providing essential information regarding the safety and quality of suggested routes (Bura et al., 2019). While some research attempts to address this by proposing algorithms that recommend the safest route over the shortest one, these often rely on calculating risk using official, registered crime records (Bura et al., 2019). This approach is fundamentally limited. Existing literature confirms that official records fail to capture the reality of risk in a region because persistent issues like street harassment frequently go unreported and unformalized (Shah, 2016). This critical error in traditional navigation systems underscores the necessity of moving beyond static data to interactive platforms that utilize individual user feedback to accurately assess and optimize route safety in urban environments.

Research Hypotheses and Questions

H1: In metropolitan areas, there is a critical need for a user-centered interactive mobile application that visualizes women's collective safety perceptions to provide safer urban navigation. This hypothesis will be examined through qualitative research including user interviews, survey analysis and thematic analysis of safety perceptions.

H2: A mobile application that integrates crowdsourced safety perceptions will increase women's sense of security while navigating urban spaces. This hypothesis will be investigated by mixed research methods, combining quantitative survey analysis with qualitative user feedback from the experimental usability testing stage of our project.

RQ1: How do safety perceptions vary temporally (by time of day or week) and how can these changes be effectively visualized using both quantitative map data and qualitative user insights?

RQ2: How can visual and interactive design affect women's perceptions of safety within the city through qualitative experience narrative?

Methodology

This project is based on HCI concepts of participatory design. We chose participatory design because the sense of safety is a personal and emotional experience for every woman that can only be expressed well by involving users directly in the design process. This approach allows us to co-create the system with participants rather than for them. And it also ensures that design decisions reflect their lived experiences of safety and fear in the city.

We will examine how an interactive mobile application with map design can affect women's perceptions of safety in urban settings using experimental usability testing and iterative prototyping process (Dix, 2004). Iterative prototyping was selected because it allows continuous improvement based on real user feedback, enabling us to match visual and interactive elements with emotional comfort, trust, and clarity. This ensures the design remains relevant, user-centered, and empathetic throughout development.

A low-fidelity prototype of our mobile application will be first sketched in Miro and via Wacom drawing tablet at Sabancı University CoSpace to ensure creative flexibility. Once the initial prototype is ready, usability testing will be conducted through survey methodology via Google Forms. We chose usability testing because it allows us to evaluate whether the application is intuitive, accessible, and emotionally comfortable for users navigating safety-related information. Also, we will conduct a survey-based approach to reach a diverse group of women efficiently and gather both quantitative and qualitative insights at scale.

The research phase will be based on mixed methods with the target group consisting of women living in different districts of Istanbul. We will be conducting a survey focusing on participants' daily mobility patterns, perceived safety challenges in different urban settings, usage of map applications and their feedback on the idea and prototype. This survey will consist of both multiple choice and open-ended questions. We will aim to identify both the existing patterns and participants' perspective involving their emotional and social drives (Adams et al., 2016). By examining both behavioral trends and subjective experiences, we aim to better understand the relationship between mobility patterns and women's emotional well-being in urban spaces. The results will be visualized and analyzed through quantitative analysis tools such as Python, Pandas to identify meaningful correlations and communicate findings through clear visual representations.

After the experimental user testing stage, a high-fidelity prototype will be developed using Figma. The prototype will demonstrate an interactive and dynamic map interface where users can rate streets and routes according to their safety perceptions on a scale (e.g., 1 to 5) and view collected results as color-coded visualizations, such as green for safe and red for unsafe. This stage will emphasize usability and user experience, focusing on visual clarity and ease of interaction.

Through this methodology approach, the project aims to achieve both a functional prototype and empirical user insights into how interactive and dynamic visualization can contribute to safer urban navigation experiences for women. By prioritizing user feedback and experimental usability testing, this project will be established on human-centered design principles.

Expected Outcomes

The expected outcome of this project is a functional, interactive prototype of a mobile application that empowers women to rate, share, and visualize the perceived safety of urban streets and routes in Istanbul. Users will be able to determine the safest paths for their daily journeys through real-time, map-based visualizations. These routes will include public transportation connections, based on aggregated, crowdsourced safety ratings. These safety scores will be represented through color-coded geospatial dashboards to communicate varying safety levels across different times and locations. Within the scope of this project, the product will remain an interface and HCI design which is an interactive prototype. In the future, this work may continue as an impact entrepreneurship initiative in collaboration with women focused NGOs.

Beyond the prototype design, the project aims to deliver empirical findings from user studies and usability testing, providing data-driven insights into how visual and interactive design choices affect women's perceptions of safety and trust in digital navigation tools. The collected user feedback and survey results will inform iterative design improvements, demonstrating the

value of participatory and human-centered design principles in addressing gendered urban mobility challenges.

In terms of novelty and contribution, SafeRoutes introduces a gender-aware, dynamic, and community-driven mapping model that differs fundamentally from conventional safety apps based solely on crime statistics. By integrating subjective safety perceptions with temporal and spatial dynamics, this project contributes to Human–Computer Interaction (HCI) literature through its focus on context-aware interfaces, participatory sensing, and inclusive urban interaction design. It also offers a practical framework for potential collaboration with public safety agencies and urban planners, paving the way for future integration into smart-city infrastructures.

Timeline & Work Breakdown

Week	Task	Responsible Member
1-4	Project Proposal	Aişe, Enes, Kadir, Sarin
5-7	Interaction Prototype Development (Figma)	Enes
6-9	Experimental Usability Testing and Analysis	Aişe, Sarin
10-12	Iterative Prototyping	Kadir
13-14	Final Report & Presentation	Aişe, Enes, Kadir, Sarin

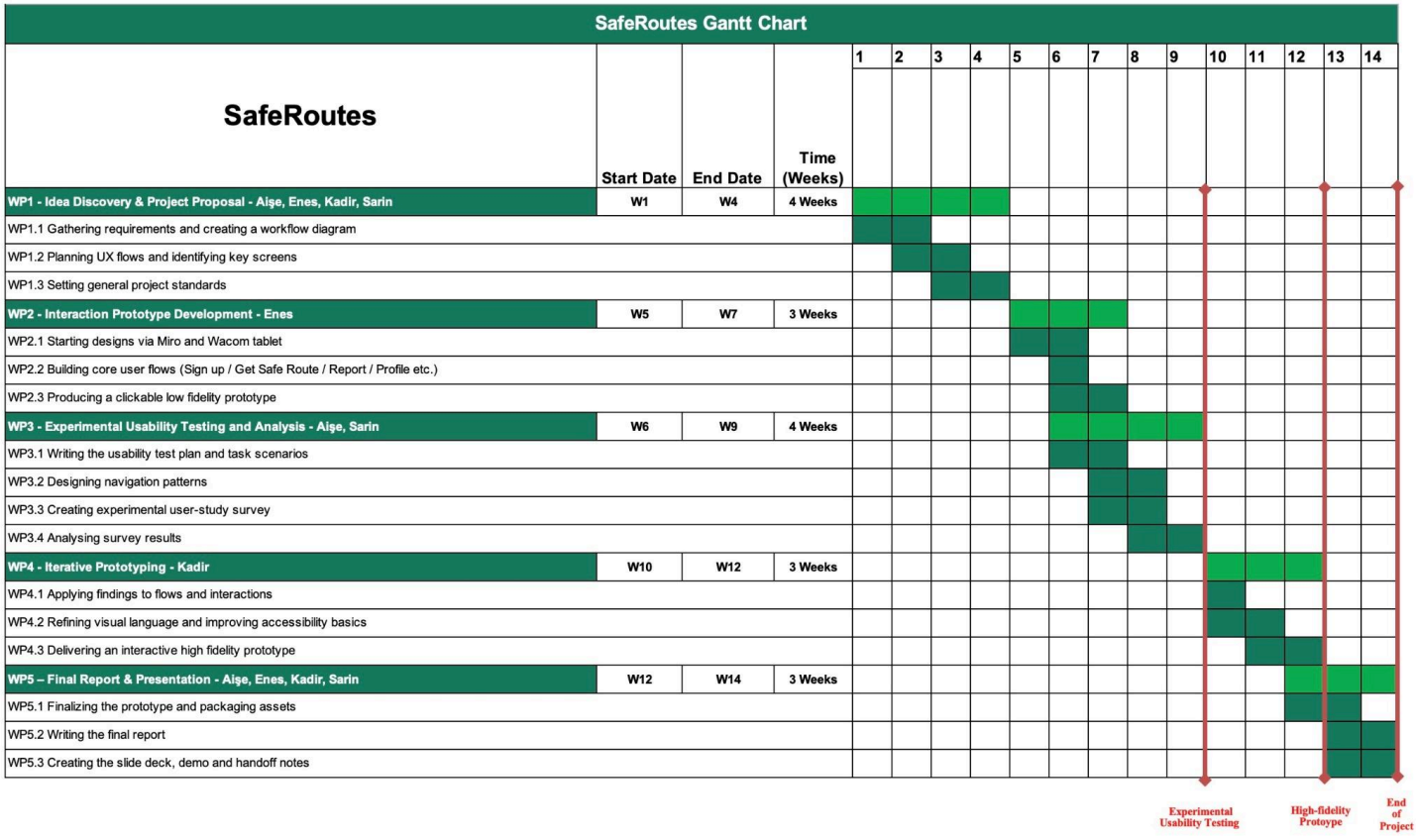
Project Roadmap

Our project will be carried out in five main work packages over fourteen weeks. The first four weeks (WP1) focus on idea discovery and planning. During this stage, we gather requirements, plan UX flows, and set general project standards.

Between Weeks 5 and 7 (WP2), we will start designing the low-fidelity prototype using Miro and a Wacom tablet from CoSpace.

We will examine experimental usability between Weeks 6 and 9 (WP3). We will prepare the survey, test scenarios, and collect user feedback to understand how people interact with the design. The insights from this phase will guide the improvements made in the next stage. Iterative prototyping will be the focus of the next three weeks (WP4). We will construct the high-fidelity prototype, improve accessibility, and optimize the interface based on user feedback. Finally, in the last three weeks (WP5), we will prepare the final report, slides, and demo. The complete project will be submitted by the end of Week 14.

We have two key milestones in this plan. The first one is at the end of Week 9 for the finalizing experimental usability testing, and the second at the end of Week 12 for the high-fidelity prototype. The project will finish in Week 14 with the final handoff and presentation.



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