Off The Rails: Promoting inclusive and sustainable industrialization

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Abstract

This report introduces a novel approach to promoting inclusive and sustainable industrialization through the development of an innovative transportation application. Existing solutions from local governments and private companies primarily focus on optimizing travel from origin to destination, often neglecting user engagement and behavioral incentives. Our application, "Off the Rails," addresses these gaps by fostering an engaging and enjoyable commuting experience while actively incentivizing sustainable transportation choices, such as public transit and micro-mobility. Through features like progress tracking, challenges, and tangible rewards, users are encouraged to reduce reliance on personal automobiles, contributing to lower emissions and improved urban mobility. By aligning individual incentives with community-wide sustainability goals, this application presents an innovative solution for fostering environmentally conscious commuting behaviors.

Background and Introduction

The United Nations General Assembly's Sustainable Development Goal 9 aims to "build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation." Specifically, target 9.4 seeks to "upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities" by 2030.

Our work aligns with this goal by targeting sustainable transportation—an essential component of resource-efficient, environmentally sound urban development. To achieve meaningful impact, we focus on encouraging the usage, efficiency, and adoption of sustainable commuting options. However, for individuals to feel empowered to use such options, these systems must be efficient, accessible, and easy to use.

Unfortunately, many sustainable transportation options fail to meet these criteria. Users often face the challenge of navigating multiple applications to plan and facilitate their commutes. These applications frequently vary in usability, and transitioning between platforms is particularly cumbersome in large metropolitan areas with multiple transit authorities. The advent of micro-mobility solutions, such as e-scooters and e-bikes, has added complexity, further fragmenting the commuting experience and making it difficult to integrate diverse transportation modes into a cohesive journey.

This inefficiency disrupts the seamless connection of environmentally beneficial transportation options, discouraging their adoption. By developing a unified application, there is a significant opportunity to address these issues by integrating dissimilar systems, enabling users to plan and execute sustainable commutes more effectively. This technology bridges the gap between diverse modes of transportation,

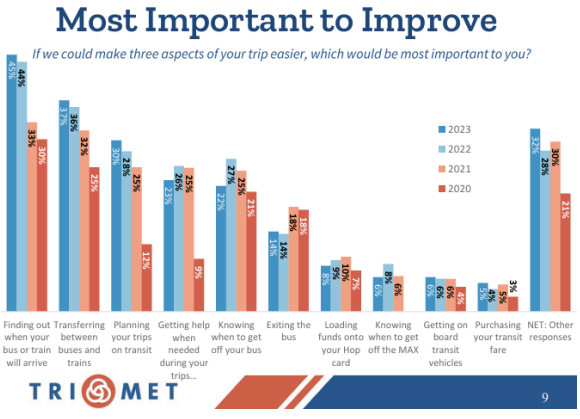
fostering a more connected and sustainable urban mobility ecosystem.

Research & Design

We began our research and design process by observing users and developing personas representative of our target user base. Observations focused on commuters in the Portland metropolitan area, particularly those using the TriMet MAX light rail and bus systems. We noted that many users employed a combination of transportation methods to access or leave TriMet hubs, including bicycles, scooters, walking, and other forms of individual transport. Traditional modes such as personal vehicles, rideshare services, and carpools were also observed. However, some sustainable transportation options were found to suffer from issues related to timeliness and reliability.

The 2023 TriMet Customer Effort Score (CES) Survey identified several critical areas for improvement in the public transit experience, including:

- "Finding out when your bus or train will arrive."
- "Transferring between buses and trains."
- "Planning trips on transit."
- "Getting help during trips on TriMet."
- "Knowing when to get off your bus".



These findings informed our research and helped shape the design objectives for our application.

Additional critical data from the American Public Transportation Association (APTA) provided a broader context for our work:

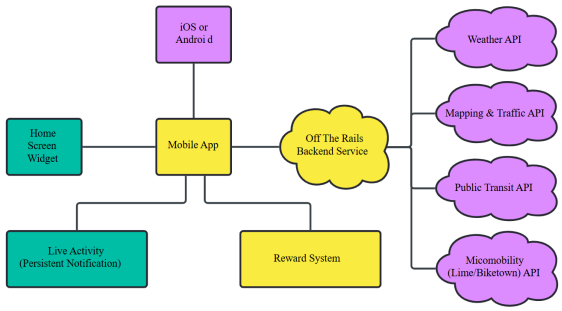
- Public transportation comprises various modes, such as buses, light rail, subways, and commuter trains.
- Approximately 6,800 organizations offer public transit services in the United States.
- Millennials consider public transit one of the best options for digital socializing and community connection.
- Public transit is 10 times safer per mile than automobile travel.
- Commuters can reduce their likelihood of accidents by over 90% by choosing public transit over driving.
- On average, households spend 16% of their income on transportation, with 93% of that amount going toward automobiles.
- A household can save more than $13,000 annually by using public transportation and living with one fewer car.
- Public transportation saves the U.S. 6 billion gallons of gasoline annually.
- Communities investing in public transit reduce national carbon emissions by 63 million metric tons each year.
- More than two-thirds of public transit users walk to their stop or station.

Using our research and observations, we developed user personas that guided the design and feature selection for our application. These personas helped us identify key user goals, which our application aims to address:

- Minimize and reduce costs of commuting.
- Maximize efficiency and timeliness.

- Reduce environmental impact.
- Maintain a high degree of flexibility across transportation options.
- Limit impact to and from traffic.
- Commute safely.

We compared existing applications such as Transit, TriMet's suite of tools, and Google Maps to identify gaps and opportunities. This analysis informed the creation of a feature set designed to best serve our target users. We constructed a high-level architecture design of the proposed system, seen here:



We then developed sketches to create a low-fidelity prototype and test plan. These efforts were aligned with usability goals and benchmark tasks. Key features of the initial prototype included:

- Quick Launch: Users can initiate a trip directly from their phone's home screen or a widget, providing fast access to commuting options.
- Trip Management: Users can select departure and destination points, choose transportation modes, and adjust or cancel trips as needed.
- Incentives for Sustainability: The application incorporates awards and achievements to incentivize sustainable transportation choices, fostering engagement and eco-conscious behavior.

This iterative process ensured that our design addressed both user needs and sustainability goals while maintaining a focus on flexibility and efficiency.

High-Fidelity Prototype and Test Plan

The high-fidelity prototype was developed using Figma, which enabled a polished, realistic design that closely approximated the look and feel of the minimum viable product (MVP). This interactive prototype allowed test users to engage with the application in a way that simulated its intended functionality.

To evaluate the prototype, we implemented a test plan involving at least five expert users. Testing included observational analysis of user interactions and a post-test survey to collect structured feedback.

Testing Process

The expert users were invited to explore the high-fidelity prototype and provide insights into its usability and design. Our test group represented a diverse range of experience with transportation methods available in the Portland metropolitan area, including public transportation, micro-mobility, walking, and biking. While our application is designed for general use rather than catering to highly distinct user groups, it enables customization to accommodate varied commuting priorities.

We conducted multiple usability tests within the constraints of time and resources, focusing on how effectively users could interact with key features. The application's goal is to provide users with an enjoyable, rewarding, and intuitive commuting experience, encouraging sustainable transportation options.

Testing and Observations

The testing process provided valuable insights into the usability and effectiveness of the prototype. Users consistently reported feeling informed about their actions and progress within the application, aided by clear interface elements that kept them aware of their commute's status. Navigation was straightforward, with all users successfully interacting with the application without significant

difficulty. The design's intuitive layout and clear navigation paths allowed users to accomplish tasks efficiently.

Although users were able to navigate the prototype with ease, minor challenges arose due to features that were not yet functional. These limitations occasionally required clarification, prompting suggestions to include guided walkthroughs and tooltips to enhance usability. Nevertheless, users found the terminology familiar, consistent, and easy to understand, which reduced the learning curve and facilitated seamless navigation.

During trip setup, all users were able to address key preferences, including selecting a start and end location, initiating a commute, and concluding trips. Users successfully completed their journeys, including interacting with checkpoints and claiming rewards. Importantly, no significant usability errors or navigational challenges were observed, and users did not report any need to recall complex information while using the application.

The survey results reinforced these observations. A majority of users—80%—strongly agreed that the application was intuitive and easy to use, while the remaining 20% agreed with this sentiment. Navigation was similarly well-received, with 60% of users strongly agreeing that it was straightforward, and 40% agreeing. Feedback on the application's aesthetic was overwhelmingly positive: 80% rated it as excellent, while the remaining 20% gave it a score of 4 out of 5.

Some users expressed interest in greater interactivity and raised concerns about incomplete features, though no critical usability issues were identified. Errors were handled effectively, and no significant barriers to problem identification arose during testing. Users also reported that the application was intuitive enough to navigate without additional documentation or guidance. However, to further support users, we plan to incorporate a walkthrough video and written documentation to enhance the onboarding experience.

The high-fidelity prototype and usability testing provided valuable insights into the design's strengths and areas for improvement. While users responded positively to the overall experience, further refinements—such as enhanced interactivity and integrated guidance—will ensure the application is even more intuitive and effective in encouraging sustainable commuting behaviors.

Conclusion

Off the Rails is an innovative application with significant potential to revolutionize user engagement with sustainable transportation. By fostering increased resource-use efficiency and encouraging the adoption of clean, environmentally sound technologies, the application aligns with the goals of inclusive and sustainable industrialization. Its novel approach to commuting combines utility with engagement, making sustainable transportation more accessible and appealing.

With the completion of the high-fidelity prototype and initial usability testing, Off the Rails is well-positioned to move toward a minimum viable product (MVP) and a fully developed concept. The application is not only an exciting tool for facilitating commutes but also a potentially marketable and profitable product. By integrating awards and achievements, it motivates users to adopt sustainable commuting habits while simultaneously offering opportunities for advertising revenue. Businesses could partner with the platform to promote sustainable products or provide users with discounts and incentives, further enhancing its value and appeal.

Looking ahead, Off the Rails has ample room for growth and evolution. Its central mission will remain to inspire and empower users to discover efficient, effective, and environmentally friendly ways to commute for work, education, and leisure.

For more details about the various project phases and prototypes, please visit our website at [hci.ari-s.com](hci.ari-s.com).

References

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Appendix

Group member	**Writing**	**Prototyping**	**Notebook**	**Presentation**
Ari	10%	40%	45%	5%
Travis	45%	10%	30%	15%