

Overview

Rural industrial hubs may engender rapid economic growth and infrastructure development while requiring a large workforce, which must adhere to strict arrival times. Without an efficient public transit system, employees and their families may travel to jobs, education, and doctor's offices using cars, giving rise to congestion, pollution, and socio-economic inequity. Off-the-shelf solutions based on fixed-line or on-demand may not serve diverse needs such as determining funding for transit services, strict scheduling requirements, and serving large, dispersed demand that extends beyond the hub's surrounding rural areas. Hence, this proposal presents a multi-modal transit approach that combines fixed-line bus and on-demand micro-transit services for Blue Oval City (BOC), an upcoming industrial hub in Stanton, Tennessee, which is expected to employ 10,000 workers daily with recurring shifts. The project will provide innovative solutions for the service challenges, including route planning, scheduling, and seamless integration of fixed-line and micro-transit. It will also provide novel solutions for the socio-economic challenge, such as designing a sustainable fare structure that serves the needs of BOC stakeholders and community members. Addressing the transportation and mobility challenges faced by the workforce at BOC will enhance access to employment opportunities, critical resources, and services, ultimately improving quality of life and community resilience. The proposal seeks to identify and address inefficiencies and inequities in access to transportation services for BOC employees. This includes examining issues such as gaps in information, lack of coordination, and inadequate infrastructure that contribute to transportation challenges. The proposal will engage multi-domain teams of research and civic partners to co-create a scalable pilot project that leads to measurable, inclusive, and equitable outcomes.

Intellectual Merit

Our goal is twofold: first, we aim to develop and deploy an efficient, data-driven AI system that optimizes a multi-modal transit network specifically designed for the unique challenges of industry hubs in rural areas, and second, we identify potential fare structures that would make the project sustainable for all stakeholders. Below, we briefly describe our approaches and their impacts. Micro-transit as a feeder for large workforces: We propose developing scalable AI models to overcome the limitations of current micro-transit algorithms. This will allow us to efficiently handle the high volume of anticipated employee trips by connecting micro-transit as a feeder to the large buses. Creation of service zones for larger geographical areas: We will design and develop algorithms for service zone creation that consider available service resources. Our goal is to identify the optimal placement of pick-up and drop-off stops across areas in the city, allowing us to manage the headways for both micro-transit and fixed-line systems. Guaranteed Timing: We propose the creation of decision-making frameworks and scheduling algorithms to account for rotating shifts. Thus, guaranteeing on-time pick-up and drop-off for employees regardless of their work schedules. We propose to develop economic sustenance plans through stakeholder engagement. We will collaborate with all stakeholders, including public and private entities, to design a financially sustainable fare structure incentivizing ridership. Finally, we will work with the community to ensure social equity. This includes exploring how the system can improve access to healthcare, education, and other essential services.

Broader Impacts

While efficient and reliable public transit primarily benefits employees, its effects will be felt by people who live, work, or drive through the area. Accessibility promotes business growth around the surrounding area and can offer more affordable living conditions to people living in the nearby urban cities. Thus, it is crucial to involve various stakeholders in the design and development of this pilot. A successful pilot provides the team the capability to develop a path that would help other cities achieve efficient multi-modal public transit. This will also allow the team to extend our framework for moving resources such as freight travel, which serves as a backbone for many industries, contributing to their sustained growth and success. The project will directly support the education of Ph.D. students in computational and social sciences. Our team will ensure that students recruited for research experiences come from diverse backgrounds, including women and underrepresented groups.