Uplift: Commuter-to-Commuter Ridesharing Service

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Abstract
Due to limited resources, low-income community members find challenges in accessing transportation for their employment that requires regular visits. Public transportation is one of the most commonly used forms of transportation because of its accessibility and affordability. However, it has significant problems of unreliable bus schedules, disintegrated networks of transit systems, and disrespectful behaviors of other passengers. This paper analyzes the factors of negative experiences that passengers have during their rides through interviews and observations. We introduce how the commuter-to-commuter ridesharing service called Uplift that automatically creates the tailored route for the users in proximity based on their preferences in distance or time, can enhance their experience of commute and improve the community's accessibility to mobility.

Author Keywords
Ride-sharing; mobility network; carpool; public transportation; passenger transportation; commuter

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

Figure 1. Exterior of Rosa Park Station and Buses

Figure 2. Interviewing at Rosa Parks Transit Center

Introduction

According to the United Way, a non-profit organization that supports community development, 40% of Michigan households earn insufficient income for their basic needs, such as housing, childcare, food, health care, and transportation, even though their income is above the Federal Poverty Level [1]. According to the U.S. Bureau of Labor Statistics, 62% of Michigan jobs have hourly wages of less than $20, which makes it difficult for a family of four with one parent employed to cover their basic necessities that needs an hourly payment of at least $25.17 [1][4]. Most of these low-income employees work in service industry, such as health care, retail, construction, and food preparation, which requires minimum education [4]. Therefore, the low-income employees are often left with limited options for health care, childcare, food or car insurance. Because the service workers must be physically present at the site, transportation becomes a prerequisite.

Transportation costs represent 16% of the family budget and 25% of a single adult [1]. According to the Bureau of Labor Statistics, the average annual expenditure for public transportation is $780 per person (Bureau of Labor). For a car-owner, the annual average cost for vehicle purchases, gasoline and motor oil, and other vehicle expenses accumulate to $10,577 [3]. Therefore, low-income employees are limited to public transportation for their means of mobility. Indeed, Detroit is ranked eighth among the nation for the number of households without cars, according to Slate. However, the main problems of Detroit public transit system are that its disintegrated transportation network between the city and suburb, dramatic decline in the number of passengers, and lack of support or maintenance.

"Poor transit access is linked to unemployment, low income, and low economic mobility [2]. High turnover rate due to low-wage employees' limited access to resources, such as a reliable transportation, risks employer's talent resourcing, hiring, and retaining. The cost of turnover, which includes fees for third-party recruiting agencies, career network fairs, online job postings, referral rewards, training, equipment, and lost productivity, is estimated to be $3,420 in 2014, according to the Society for Human Resource Management [5]. This may cause costly consequences for the society as well, because of the reduced economic productivity and raised insurance premiums and taxes [1].

The aim of this paper is to identify the limitations of public transportation as a main method for commuting and to propose an alternative or improved means of reliable transportation for low-income employees using affordable information technology. Our interviews with the United Way, Detroit Department of Transportation (DDOT), and a social impact entrepreneur reveal the profile of low-income employees, public transit systems, and the current limitations in Michigan (Figure 1). Then, we investigate the factors of negative experience on public transportation through our interviews with the passengers at Rosa Parks Transit Center and the observation of the environment (Figure 2). From these findings, we propose Uplift, a commuter-to-commuter ride-sharing service that matches a driver with commuters in proximity of distance and estimated travel time. Not only the low-income employees, but also any drivers and riders in the same urban areas can utilize Uplift for the benefits of improved access to mobility and economic opportunities, and neighborhood support.

	Key Findings
1	Detroit lacks connecting transit system
2	Low-income employees do not have access to car
3	Low-income employees often change their phones
4	Commuting is considered as a part-time
5	Bus service is irregular
6	Bus stop is located and managed poorly
7	Frequent malfunction of fare boxes increases operational costs
8	DDOT bus system has improved its security
9	DDOT drivers used to pass people in when the line was long
10	Bad road conditions and constructions cause delays in transit system
11	Routes are inefficient; they are inconveniently designed for transfers

Table 1. Interview Key Findings

Methods

Before the interviews, we have developed a protocol for each types of the interviewees, such as public transportation service providers, fundraiser volunteer organization staffs, and public transportation riders, based on our initial background research on the issues of public transit system and low-income neighborhoods in Detroit. The first set of interviews was with the Policy & Advocacy Specialist at her office in the United Way, which is an organization that works as a governing or managing body of non-profit organizations for community-centered projects, a social impact entrepreneur who has done multiple neighborhood development projects in Detroit, via video conference, and the director of the Detroit Department of Transportation at his office. The second set of interviews was with 10 passengers at Rosa Park Transit Center, which is a main hub for the Detroit transit system located at the heart of Detroit Downtown (Figure 1). For the first set of interviews, each one lasted about one to two hours; the second set lasted about 10 to 15 minutes for each interviews.

Findings

From the first set of interviews, we were able to confirm that Detroit lacks integrated transportation networks with other transit systems in suburb, including DDOT, SMART, Detroit People Mover, AAATA, M-1, Transit Windsor, Amtrak, and Megabus (Table 1). Most of them are limited to their neighborhoods and even though they have stations in proximity, the uncoordinated schedules make the passengers almost impossible to transfer to another. Also, carless passengers consider riding public transportation as another part-time job, because including the travel to bus stops, wait times, and travel times, it can easily take 2 hours in average.

We consulted with Razi Jafri, the social impact entrepreneur, to listen to his experiences in neighborhood development projects and tips for designing an interview with the target users. He highlighted that the timeliness and consistency of the bus schedule matter. Even though a lot of the public transit system adopted the real-time bus tracking system, low-income passengers cannot access to such information due to data cost or unaffordability for smart phones. Also, bus stops can be another inconvenience to the passengers who have to wait for unexpected time for the arrival of the buses, because often the bus stops lack roofs, shelters, or benches. Some are vandalized that new passengers cannot tell their existence.

From the interview with DDOT, we were able to understand the issues with the transit system, which include operational costs for easily breaking fare boxes, inaccurate data collection of ridership and buses, and bad road conditions and their constructions causing delays. He also pointed out that transit systems in Detroit are in discordance that even though their bus stops are in close proximity, their bus schedules do not work together, thus making transfers impossible.

The second set of interviews revealed more about the issues of public transportation from the perspectives of passengers based on their experiences. Nine out of the ten interviewees regularly use transportation at least three or four times per week for work or school, except one interviewee who answered that he came to the public transit center to pick up his friend. They were

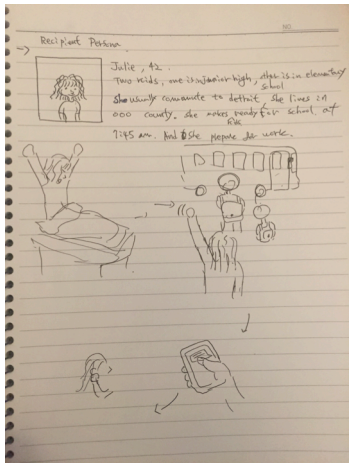

Figure 3. Design Sketch: User Scenario Storyboard

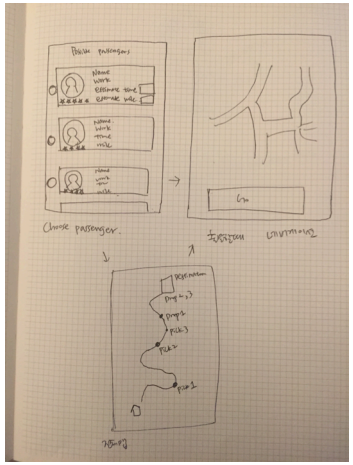

Figure 4. Design Sketch: Wireframes

using DDOT Monthly GoPass, which costs $47.00. A single ride costs $1.50 for an adult, $0.75 for a student and a Medicare cardholder, and $0.50 for a senior or a passenger with a disability. Transfers cost an additional $0.25 for students, and $0.10 for a senior, a passenger with a disability, or a Medicare cardholder. All the interviewees thought bus fares are reasonable. In case of emergency, most of them rely on a friend or a family member who has a car, but three of them answered that they will ride a bus. All the interviewees who use public transportation regularly answered that the bus stops are located near enough to their homes, and the average wait time for the buses was 15 to 60 minutes. When asked about the difficulties or inconveniences of public transportation, 40% of the interviewees answered that too many transfers led to long wait and travel times, followed by crowded buses and unpleasant behaviors of other passengers. None of the interviewees has used a ride-sharing service, even though they heard from their friends and family who have used it. The reason for them not using the ride-sharing service was because they think it is unreliable and unsafe. However, there was one interviewee whose friend has given him a credit for Lyft, and looks forward to try the mobile application later, which he downloaded on his phone. 10 out of 10 interviewees answered that the best form of transportation is a car that they can own.

From the observations at the site of Rosa Parks Transit Center, the average number of passengers in the lobby was around 20. There were more male passengers than female passengers, in the ratio of 13 to 7. The majority race of the passengers in the lobby was African Americans. The passengers seem to have smartphones but rarely use them while waiting. When they were using phones, it was mostly for phone calls, rather than web browsing or accessing a mobile application. One side of the lobby was a glass wall, through which the passengers in the lobby could see which buses are coming. Each bus stop seemed to have a screen where it was supposed to show the real-time of bus arrivals, but at that time, they were not working. The transit center was divided into two floors, where the upper floor has an access to a Megabus station.

Problems & Solutions

Our target users are commuters who have fixed schedules and locations for a departure and an arrival. Based on our interviews and observations, we were able to summarize their top problems with using public transportation into the following: 1) the unreliable bus schedules that require long wait times, 2) uncoordinated bus system that causes multiple transfers, which extends the travel time to even longer, and 3) unpleasant interactions with other passengers. From these key findings, we started with a user scenario storyboard and building wireframes (Figure 3,4). We sketched our idea into the service that can 1) provide accurate transit tracking information and affordable access to it, 2) minimize the number of transfers and choose an efficient route, and 3) discourage disrespectful behaviors of passengers during the ride.

Features

Our target users are divided into two categories: 1) drivers and 2) riders (Figure 3). Because of their different roles, each user group has different features. First, the drivers, who are car owners and volunteers to provide ride for others, will sign up to the service via either mobile or a webpage (Figure 3). When creating

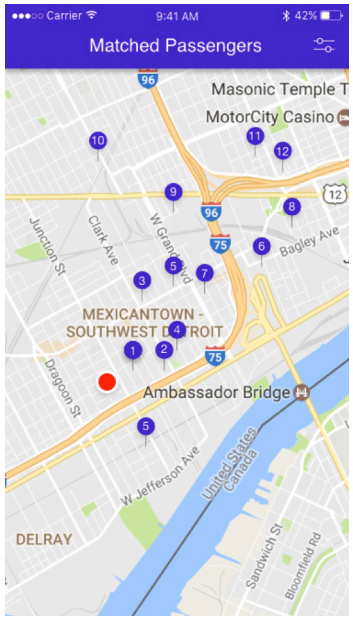

Figure 5. Final Prototype: Matched Passengers

Figure 6. Usability Testing

an account, the drivers set their profiles, employment information, the times and locations for departure and arrival for a round trip from their home to work, distance in miles they are willing to cover, the vehicle information for passengers, and a passenger's selection time. When approved by the system, the drivers will be given a sticker they can use on their car to signify to the passenger's selection time that they scheduled. Drivers see from the automatically created list of best matched passengers based on the algorithm of evaluating their reviews, estimated additional time, and additional distance to choose which passengers to give a ride (Figure 5). When finished with choosing the passengers, the drivers will be able to see an integrated, multi-stop map with where they should pick up and drop off their passengers, so that drivers can take the most efficient route. After reviewing the map, the drivers can start the navigation for driving guidance. When the passengers get on the vehicle, if they have not set up the payment method on their account, they will be given an option to pay cash to share the cost of the ride. When the drivers are at their final destinations, the mobile application will prompt them for rating the passengers, so that they can report and alert the negative behaviors of the passengers to other drivers. When drivers log into their accounts, they can track their own ride transactions with the information of the passengers, additional time and distance it took for each ride. Also, there will be a weekly trend report of how many drivers were able to give how many riders, so that it can measure the impact of the service and encourage the users.

For the riders, they can also sign up via either mobile or a webpage. When creating an account, riders are required to have employment verification and to save their contact information and the employers contact information in the system. Then, the riders set up the locations and times for pick-up and drop-off for a round trip from home to work. For riders, they can set up multiple locations for either work or a bus stop to maximize their possibilities of matching with the drivers. Riders are given with an option to set up a payment method, which will allow the cost of ride-sharing will be withdrew each time they use the service. Also, the riders will set up the notification time, so that when the match fails, the riders can still have enough time to take a bus to their work. At the time of the notification, the riders will receive a text message from the system to notify either the matching succeeded or not. If the riders were matched with the drivers, they will receive the detailed information about their rides, such as the drivers, vehicle information, estimated pick-up time, and estimated drop-off time (Figure 6). About 10-15 minutes before the arrival of the drivers, whose locations can be tracked via the GPS system on their phones, riders will receive another notification text message. The riders are required with an exact change for the ride fare, which should be comparable to the amount of a single ride fare for public transportation. After the ride, if the passengers experience any alerting behaviors of the drivers, they can report them to the system.

Usability Testing

To evaluate the effectiveness of our service and its value proposition, we recruited one full-time employee who is a designer at an automotive company, and three students from the University of Michigan School of Information by approaching them in the school building (Figure 8). Each interaction lasted from 15 to 30 minutes. The interviewers started with an introduction

of who they are, what the usability testing is and what it is for, and what Uplift is. Then the interviewees were given three tasks of 1) creating an account either as a rider or a driver, 2) selecting passengers based on the service's recommendations, and 3) rating a passenger or reporting a driver using our initial set of prototypes.

The usability testing participants expressed concerns or curiosities about the methods of employment verification, payment transactions, and reward for drivers during the follow-up interviews. Some of the detailed comments on the specific features are about displaying a map of final route with pins that indicate the locations of stops or the passengers, profiles of passengers when showing the best matched results, and how to demonstrate the impact of the service by tracking the number of riders and drivers. There was also a new idea of the beacon stickers that can be detected via a mobile application, which may improve accessibility of the service for passengers with disabilities when tracking the location of their rides on the street. Through the usability testing of our service, we were able to improve our interface designs but the further researches to be done for validation of users, safety, and sustainability.

Conclusion

Our problem was the inconvenient and unreliable public transportation system in Detroit for low-income employees. Through our interviews and observations, we were able to confirm our understandings of the issues with low-wage passengers limited access to resources, and Detroit public transit system's lack of maintenance, network, information, and service, which cause its passengers to struggle with long wait and travel times, unpleasant experiences during rides, and access to employment and other opportunities.

Acknowledgements

We thank all the participants for our interviews and usability testing, from the United Way, DDOT, Rosa Parks Transit Center, University of Michigan, and Ford.

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