OnePaceAway: Pedestrian Navigation for OneBusAway

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Problem and Solution Overview

OneBusAway is a useful application providing real-time bus transit information. It can display bus stops on a map, approximate bus arrival times for a given stop, and display a full schedule for specific routes. Users can also choose the nearest bus stop on the desired route and find out when their bus is coming. Although this application does a great job giving transit information to users, it does not actually help users to know whether or not they can catch their bus. OnePaceAway, an addition to OneBusAway, is a solution that provides real-time estimates of how long it would take for users to travel to a bus stop from a location as well as how fast they must travel in order to stay on schedule.

Contextual Inquiry Participants

This feature for OneBusAway targets current users as well as potential OneBusAway users that haven't used the application due to its lack of travel times as a pedestrian. We identified this demographic from our goal of helping bus riders know how fast they need to walk to their bus stop without having to wait too long for their bus to arrive. In order to better understand the current problems existing with bus riders, we conducted a contextual inquiry around the University District over multiple days and spoke with a diverse group of bus riders. Finding participants over multiple days was an attempt to see if behaviors would change depending on the day of the week.

Due to scheduling constraints, three of us conducted the contextual inquiry. We approached individuals when they were either on their way to, or already waiting at, the bus stop. Throughout this process, we observed bus riders as they walked from their original location to their bus stops - a few used OneBusAway and we had the chance to observe their interactions with the current version of the application.

Participant 1 - Natassia
Natassia is a retired elderly woman that uses OneBusAway (on both weekends and weekdays) because she is distrustful of the posted time schedule at the bus stop for its inaccuracy. However, she notes that the OneBusAway schedule is also frequently inaccurate and so tries to arrive at the bus stop five minutes earlier than the time on the schedule. She prefers not to

run in order to make it to the bus stop, instead preferring to walk at a brisk pace. Natassia also checks OneBusAway from the web before arriving and leaving events (softball and basketball games) to see if she needed to hurry over to her stop. She has the personal philosophy of "if you miss your bus, you're early for the next one".

Participant 2 - Jenny

Jenny is a student at the UW that uses OneBusAway to see if her bus is running on-time for any given day. She occasionally uses the printed time schedule at bus stops, but mostly uses OneBusAway on her iPhone to find the schedule. Jenny normally walks at a casual pace to get to her bus stop, since her usual travel only involves going to and from campus to University Village, where she lives.

Participant 3 - Christopher

Christoper is a middle-aged man that doesn't use OneBusAway. He looks at the bus stops for their time schedules and occasionally views the schedules online. After he reaches his bus stop, he waits. When leaving his home, he typically checks the time of the bus and tries to arrive five minutes before the bus arrives. While on the way to the stop, he walks unless if he sees the bus on its way. If possible, he tries to get his friend to drive him to the bus stop, or he walks/drives himself. Christopher doesn't find his riding behavior changing on either weekends or weekdays.

Particpant 4 - Gary

Gary is a UW student and uses the Android version of OneBusAway, but finds the schedule in the app to be inaccurate more frequently than he would like it to be. If the waiting time at one bus stop is too long, he uses OneBusAway to find a different stop. His average wait time at a bus stop is about 10 minutes.   Gary walks to the bus stop, regardless of the schedule, because he can take multiple buses to his destination but will run if no one is watching him. He considers the time of day when estimating how long it will take for him to walk to his bus stop (he will walk at a more leisurely pace during rush hours because the bus will be late, otherwise he might hurry his pace).

Participant 5 - Penelope

Penelope is another elderly woman that uses the SMS version of OneBusAway at her bus stop, and wants us to note that the SMS version of the application is very important to some people. She uses the metro schedule from home and estimates her walking times while taking traffic and crosswalk times into consideration.

Contextual Inquiry Results

Here, we'll cover the major topics common in our inquiries.

Reliability

OneBusAway is intended to provide more accurate arrival times for buses than those on time schedules posted at bus stops. However, several participants remarked from their experiences that the app also has a tendency to be inaccurate. Natassia in particular emphasized times given by OneBusAway are not always reliable which compels her to arrive at the bus stop 5 minutes earlier than the displayed time. Similarly, Gary tries to avoid relying too much on OneBusAway, instead using it as one of his many resources when planning his bus trips. While most participants had positive thoughts when asked how useful a pedestrian bus stop

departure/arrival time and navigation feature would be to them, some expressed concerns over such a feature's reliability in light of OneBusAway's current difficulties.

From these results, the ideal course of action would be to investigate why OneBusAway is sometimes unreliable and attempt to improve its accuracy. Unfortunately, we do not have the ability to modify core functionality in OneBusAway, and will need to account for this issue in our application.

Road Conditions

Most participants had a set routine they followed while taking transit, and a few had special cases in which they would deviate. A common factor between participants for changing their transit routines were changes in the road conditions. Gary walks at a more leisurely pace during rush hour because he knows that the bus will be late due to traffic congestion. Penelope typically takes into account traffic lights and busyness of adjacent streets when planning a time to leave her house to catch her bus, but leaves earlier when it is raining or snowing because she knows that the weather conditions will slow her down. In general, participants did not change their behavior between weekends and weekdays.

In the context of our application, these results show that we will need to take these various conditions into account when estimating travel time to a bus stop and adjust accordingly. Specifically, we will need to consider the following factors:
- Traffic lights
- Environmental conditions such as rain or snow
- Time of day (rush hour)
- Traffic congestion

Access

OneBusAway supports many different platforms, including online, SMS, calling in, and different smartphones. From talking with our participants, we found that all forms of access were actively being used. Natassia often uses the website to check bus times when leaving her home, whereas Gary and Jenny uses OneBusAway on their smartphones to check how long they need to wait at each stop. Penelope, not having a smartphone of her own, is an exclusive user of SMS and notes that one of her friends bought a smartphone just to be able to access OneBusAway from it. She also stressed how important having SMS support in OneBusAway is to her and wants developers to support more SMS functionality.

It is clear that no one medium of OneBusAway is more important nor widely used than another. In designing our application, we should consider how we can design common functionality that can then be propagated in some form into each of the main OneBusAway tools. Otherwise, we risk alienating some of OneBusAway users from using the feature.

Ease of Use

Most participants liked OneBusAway for its simple, friendly-user interface that allowed them to quickly find information that they are looking for. They also described the application as fairly easy to learn and intuitive to use, which was a boon for more older participants like Natassia and Penelope who were less familiar with technology than younger participants. We should try to maintain the user-friendliness of OneBusAway when designing our application and avoid

introducing unnecessary complexity that may confuse the app's older user base.

Existing and New Tasks

Easy Task

Jessica is a freshman attending the University of Washington. She is trying to get home by bus after her first day of class and is unfamiliar with the campus. Furthermore, inclement weather has settled and the roads are completely covered in snow. To solve her predicament, she opens OneBusAway on her phone and uses OnePaceAway's navigation feature to find the fastest routes to her stop. The app notes the snowy weather and road condition outside, then provides an appropriate estimate of 15 minutes walking time to her stop. She also finds out when her bus will arrive. Now, knowing how to get to her stop and how long it would take her, Jessica waits indoors to avoid the cold weather and leaves her building 15 minutes before her bus arrives.

This easy task is mainly done by users unfamiliar with a location and not knowing how long it would take them to travel to a bus stop.

Moderate Task

George is a 32 year old wishing to get home after a long day at work at a Red Square concession stand. He needs to take the bus to King Street Station so that he can take the Sounder train home. Although his bus arrives at the stop in 10 minutes, George, doesn't want to close early and risk losing sales. He stays 5 more minutes to serve the last-minute customers, then quickly closes shop. He then accesses the OneBusAway app on his iPhone and sees that his bus arrives in 5 minutes. Confirming the route to his stop using the app's navigation feature, he then turns on OnePaceAway's pacing feature and begins heading to his stop. However, his speed is slow due to having a limp in his leg. OnePaceAway detects that George's current page will cause him to miss his bus and alerts George that he should speed up. Receiving the cue from the app, George starts running and barely makes it in time to catch his bus at the stop.

This moderate task is mainly done by users who are often rushed for time and in a hurry.
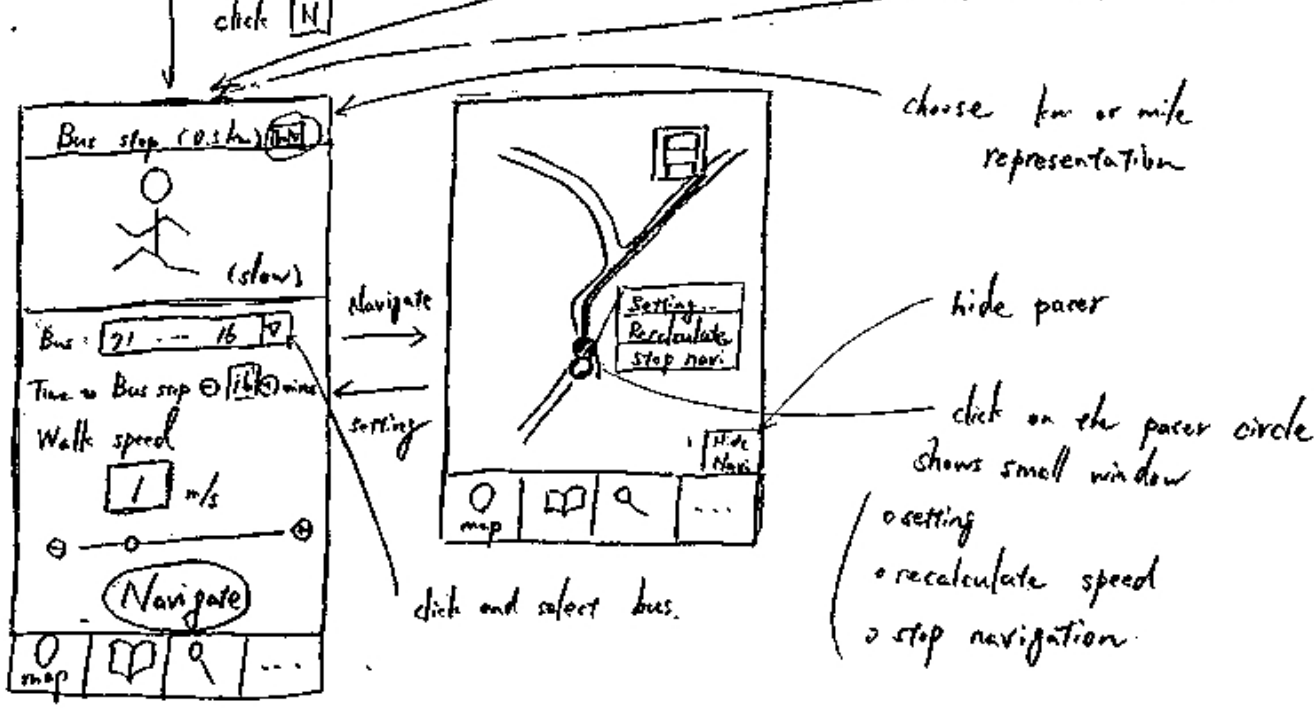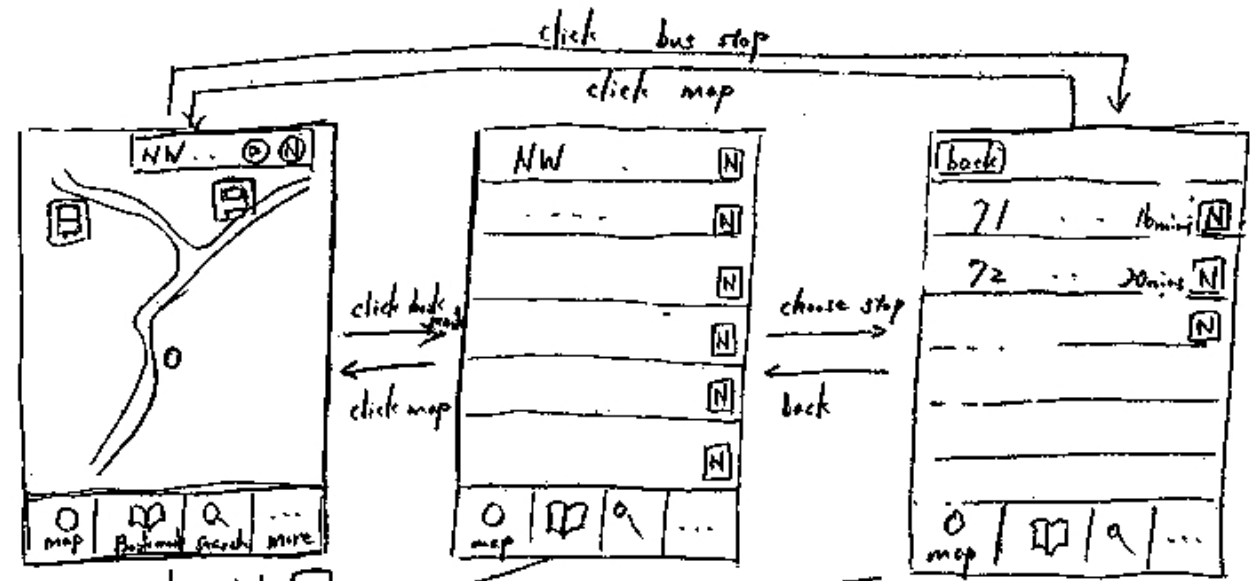
Difficult Task

Jack is a 50 year old UW professor who recently lost use of his legs in a car accident and has been wheelchair-bound for a week. Today, he has plans to meet with a friend in a neighboring city, which he will travel to by bus. This is the first time he will be navigating the streets in a wheelchair. He checks the OneBusAway website from his computer and uses OnePaceAway to find a wheel-chair accessible route to the bus stop. He also uses the app to find out how long it would take for his to travel to the stop. To account for potential inaccuracy in its schedules, OnePaceAway suggests arriving at the bus stop 5 minutes before the time arrives. With the guidance from OnePaceAway, Jack safely arrives at his bus stop. Checking the schedule on OneBusAway again on his phone, he sees that he has 5 minutes to spare and settles in to wait for his bus.

This difficult task is mainly done by disabled users searching for wheelchair accessible routes to a bus stop.

Design Sketches
Sketch 1: Moving Pacer System

click bus stop

click map

NW.. ⊙ Ⓝ

NW   Ⓝ

[back]
71 .. 18min Ⓝ
72 .. 20min Ⓝ
        Ⓝ

click back →

click map

choose stop

back

○ map | Bookmark | Search | more

○ map | 📖 | 🔍 | ...

○ map | 📖 | 🔍 | ...

click Ⓝ

Bus stop (0.5km) Ⓝ

(slow)

Bus : 21 -- 16
Time to Bus stp ⊙ 16 min
Walk speed
[1] m/s
⊖ ─○────── ⊕
(Navigate)

○ map | 📖 | 🔍 | ...

Navigate →

← setting

Setting
Recalculate
stop navi

Hide
Navi

○ map | 📖 | 🔍 | ...

click and select bus.

choose km or mile
representation

hide pacer

click on the pacer circle
shows small window
○ setting
○ recalculate speed
○ stop navigation.

This design adds one new screen to the original OneBusAway application. It also adds a button(N:Navigation) to the map, bus stop list, and bus schedule screens so that users can have quick access to the navigation setting screen. The navigation setting window allows users to set the arrival time manually because some users want to get to their bus stops earlier or later than the estimated bus arrival time. People usually prefer simple designs, so this navigation pacer is shown in a circle and will move toward the bus stop with a constant speed. The walking icon in the navigation setting window will show approximately how fast users should move in easy animations so they can see if they can actually follow the set speed. The design additionally allows users to set the pacer's speed and calculate when they will get to the bus stop. In the map screen, while pacer is running, users can hide or recalculate the pacer, change navigation settings, or stop the feature.

Sketch 2: Textual Navigation System
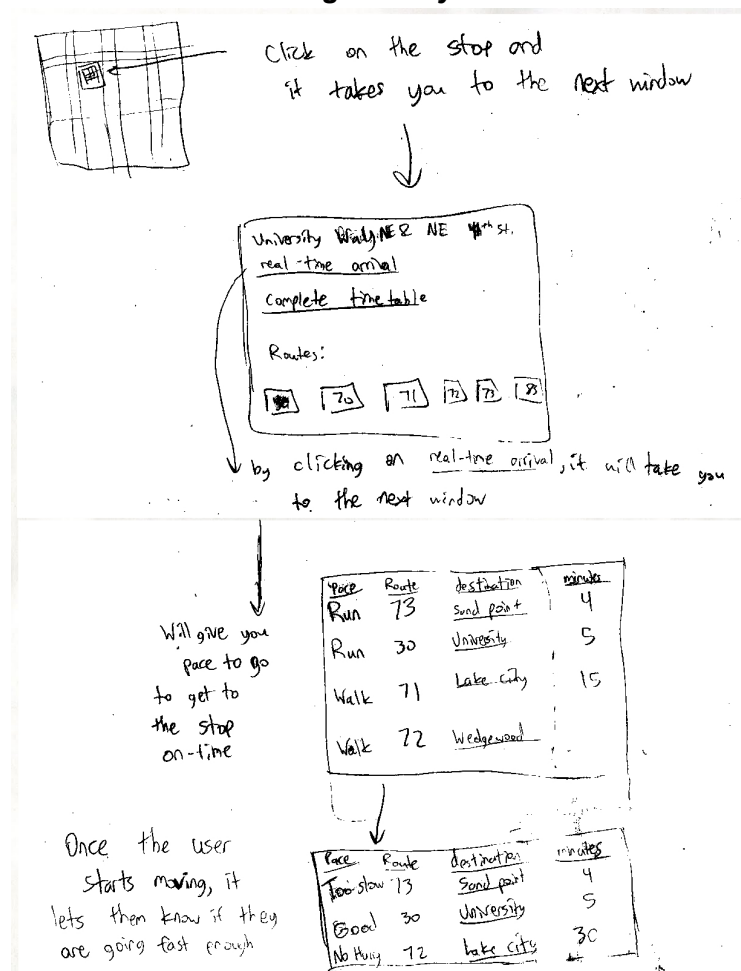
The top two pages are just screens from OneBusAway. The third screen has a Pace setting for the user to see to give an approximate speed for how fast they need to go to get to the stop. Once the user starts moving, it will take them to the last window where they can see how much

faster or slower they need to go to get to their bus stop. The application would also show the estimated time of arrival for the user.

### *Sketch 3: Human Navigation System*
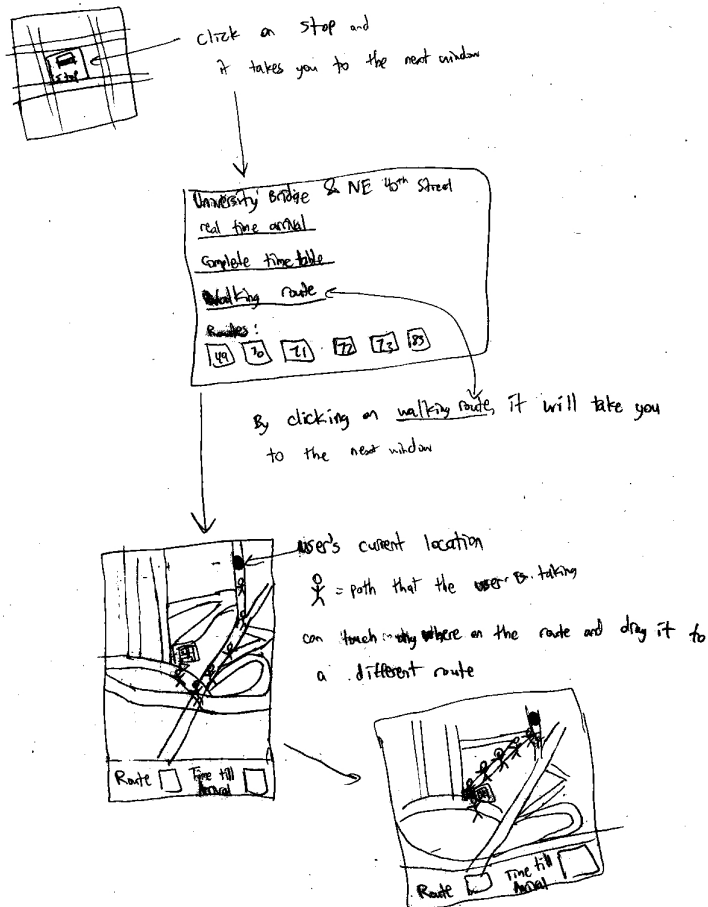
The first screen takes you to a pop-up that shows the second screen. OneBusAway already had the first two links, then I added a walking route link that takes you to a map, the third screen. This screen automatically shows the user the speed they need to travel to get to the soonest arriving route. The information for this route appears at the bottom. Stick figures appear up between the GPS coordinates of the person and the location of the bus stop. The user can click anywhere along this route and drag it to a new route. This can be seen in the transfer between the last 2 pictures.

The walk symbol, 🚶, also works to notify how fast the user should move

🚶 = walking

🏃 = running

If the user is on time, then their circle or other icon will appear on the route. If they are behind then they will be behind the route.

On time/early

Behind/late

Route ▢ Time till Arrival ▢

Route ▢ Time till Arrival ▢
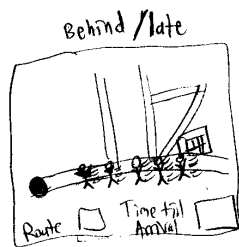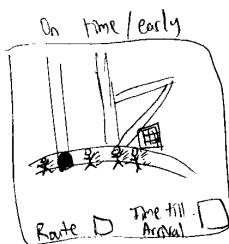
These pages go through the symbols and how the map might appear if someone is early or on time. These pages appear when the page refreshes to see how the user is moving along.