




Taxi Dash: Serendipitous Discovery of Taxi Carpool Riders

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Abstract. During winter, scheduled bus services can experience delays in locations where extreme and persistent snowfall affect road conditions. Commuters rushing to school or work often choose more flexible modes like taxis. However, taxi fares are more expensive for a single passenger, most especially students. In this paper, we present the design and implementation of a carpool application for taxi services in Hakodate, Japan. Considering the high level of shyness among Japanese university students, the application intends to facilitate serendipitous discovery and group formation among Japanese students expressing intent to take taxi services.

Keywords: Group formation · Carpooling · Web applications
Human-centered computing

1 Introduction

The main motivation of this application is the scenario of students waiting patiently for a delayed bus to arrive, specially in the morning while going to school. Instead of walking to school under harsh weather conditions, they usually take the taxi alone, but doing so on a regular basis would not be economical. Thus, a taxi carpool solution is suggested to alleviate the expensive fare.

Forming groups for taxi carpools can easily be accomplished off-line, even without the help of digital solutions, since students are already waiting in proximity around bus stops. However, the high level of shyness among Japanese students [1, 2] creates a barrier for on-the-fly group formation to happen.

Existing solutions like Uber¹, Grab² and Wunder³, offer rider-sharing but they mostly operate with private car owners. Grab offers taxi hailing in its application but it has yet to open its services in Japan.

Our solution allows users to easily join taxi carpool groups being formed within their vicinity. We simplify the user experience by focusing on the scenario

¹ <https://www.uber.com/en-JP/>.

² <https://www.grab.com/sg/>.

³ <https://www.wunder.org/>.

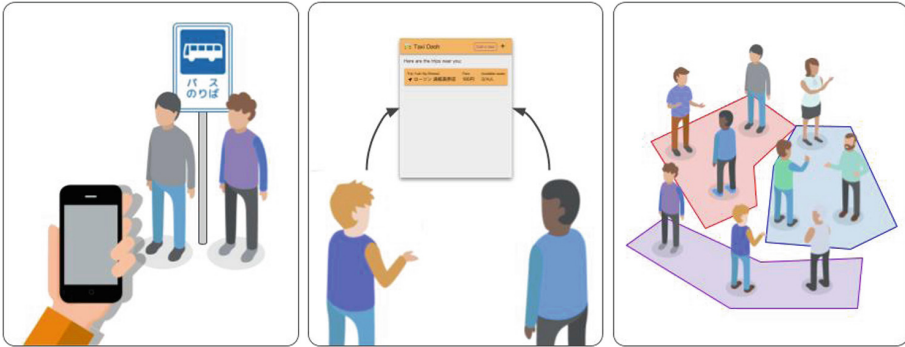


Fig. 1. Taxi Dash lowers the barrier and simplifies the experience of group formation through a context-aware application.

of people waiting for the morning bus going only to the university (Fig. 1). It is assumed that they are already waiting around bus stops. This paper describes the design and implementation of the current application, as well as the architecture of the solution.

2 Design and Implementation

This section provides the detail of the overall architecture of the solution and the current implementation of the Taxi Dash application.

2.1 Overall Solution

The Taxi Dash solution implements a Model-View-Controller architecture. The user-facing application is implemented as a web application instead of a native mobile application for cross-compatibility and scalability. This design decision ensures that the application can have responsive rendering regardless of mobile device resolution and form factor.

The solution is designed to be context-aware. The meetup points shown to users are collected from Google Maps. When a user tries to join or organize a trip, we filter them using a distance radius of 500 m to ensure that they can quickly move to a meetup point. Initially, we only provided bus stops as meetup points but based on user feedback, these can be hard to find for taxi drivers. Thus, we decided to replace them with points-of-interest (POIs), convenience stores, and other known establishments with enough parking space for waiting. While we have removed bus stops from the list of meetup locations, we still made sure that the new locations are located near bus stops going to the university.

The current limitation of this implementation is that getting the location of the user takes a relatively longer time. On our most recent tests, it takes around 2–4 s for the browser to get the location.

2.2 Application Design

For the application, we followed Material Design to ensure simplicity and good usability. It is a visual language that leverages on classic good design principles. With a sizable adoption rate among regularly used applications like Asana and Airbnb, along with Google products, we can assure its familiarity. Lastly, we wanted to keep the look and feel of the web application as close as possible to a mobile application.

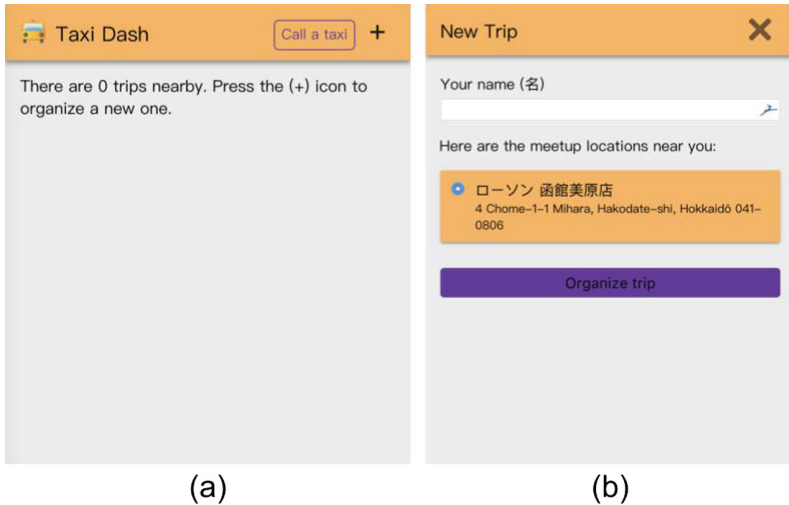


Fig. 2. (a) The home page showing no organized trips, and (b) a list of meetup points nearby for organizing a new trip.

Organizing a Trip. After the location of the user is detected, a list of trips being organized nearby are shown. If there no trips nearby (Fig. 2a), s/he can organize by tapping the (+) icon. First, the user must enter his/her name or nickname (Fig. 2b). Then, a meetup location must be selected from a curated list shown to the user. It only shows locations within a 500 m range, ordered from nearest to farthest. The nearest option is selected by default.

To simplify the experience, users can only select from the curated meetup locations provided, unlike other location-based applications. Each trip assumes that everyone is going to the same location, which in this case is the university.

Lastly, each trip is assigned a unique trip name (i.e. *Trip Yuki* in Fig. 3a). This can be used to easily identify passengers at the meetup location, if in the case of multiple trips organizing there.

Joining a Trip. If there are trips already organized near the user, they will be shown, with the closest meetup location as the first option. Aside from the name of the trip and meetup location, the user is also shown the number of available

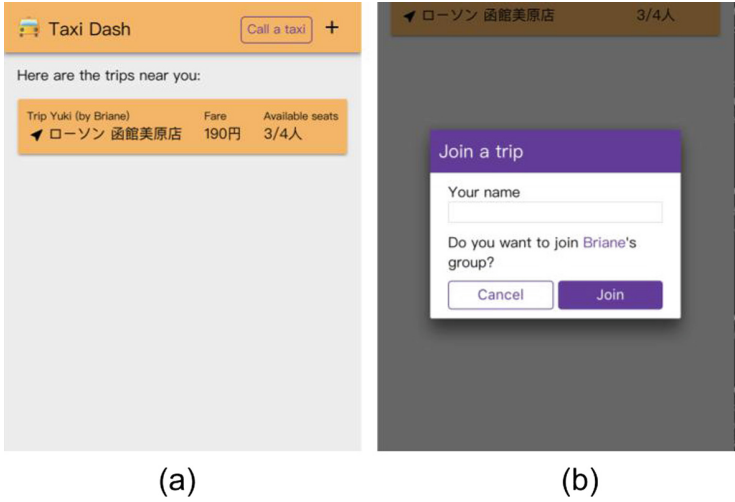


Fig. 3. (a) A list of trips being organized, and (b) the dialog for joining a new trip.

seats left and the amount each person has to pay (Fig. 3a). After a user selects a desired trip, he/she needs to provide a name to proceed (Fig. 3b).

Waiting for the Trip. As each trip gets organized, any passenger can call the taxi company or hail a passing taxi. They can copy a number from the pre-defined list of taxi companies shown in Fig. 4a.

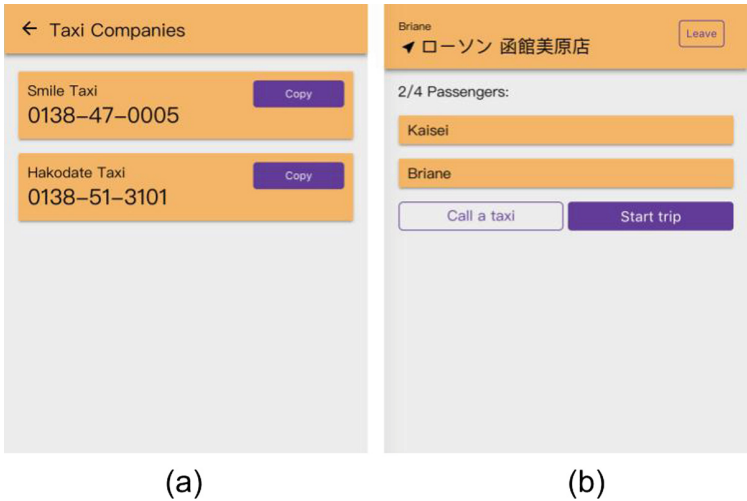


Fig. 4. (a) The list of taxi companies in Hakodate, and (b) the details of a trip the user just joined.

Leaving a Trip. Passengers, even the organizer, can leave the trip any time as long as the trip hasn't started yet (Fig. 4b). If everyone leaves, the trip will be canceled and will not appear in the list of available trips.

3 Usability Evaluation

In its early stage, a preliminary usability evaluation was conducted using the System Usability Scale [3]. It is short but a reliable assessment of the usability of any system. It is an industry standard and valid even with small sample sizes.

With an initial sample of 5 respondents, the application yielded a fair average score of 59.9. For those who gave low scores, they noted the low robustness and compatibility issues with other desktop browsers (i.e. MS Edge).

4 Conclusion and Future Work

We have developed a web application that lowers the barrier of group formation among Japanese students for taxi carpooling purposes. In its current implementation, we were able to cover the critical use case scenarios but has only received a fair average score in the preliminary usability evaluation.

For future work, we want to further improve the responsiveness to other form factors and resolutions, implement notifications for newly organized trips, and a dashboard for taxi drivers to highlight areas with increasing taxi demand. We are also considering the option of organizing a carpool and picking up passengers along the way. Additionally, we want to evaluate its effectiveness in promoting carpooling with more respondents. Our ultimate goal is to experiment on further simplifying this experience like in the case of the Amazon Dash button⁴ where a user can push the button whenever s/he wants to join a taxi carpool group and s/he can leave without anything done if s/he can't wait.

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⁴ <https://www.amazon.com/ddb/learn-more>.