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UTAS-Ride: organization-based ridesharing platform for commuters

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Research in Process

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Abstract

While commercial ride-sourcing service providers, like Uber, have gained enormous popularity over the last decade, non-commercial and incidental ridesharing is rarely an option for ride seekers. Although incidental ridesharing is beneficial in easing urban congestion and environment, it is not accepted by a number of people due to stranger danger and time delay. Organization-based ridesharing allows co-workers within the same organization to share rides for commuting purposes. The similar commuting time and certain level of acquaintance among co-workers make organization-based ridesharing more acceptable than other forms of ridesharing. Thus, this paper proposes an organizational ridesharing platform called UTAS-Ride for mobile devices. UTAS-Ride allows its users to create a unique carpool for the affiliated organization and share rides with co-workers in the carpool. Functions like user validation and routing are provided to separate different user groups and calculate routes. The platform is an exploration regarding organization-based ridesharing on mobile devices.

Keywords: carpooling, travel behavior, organizational model, static ridesharing, human mobility.

1 Introduction

Transportation network companies (TNCs) that allow drivers to provide ride services to riders via smartphone App have rapidly developed across the world over the last decade. Ridesharing and ridesourcing are two terms that people frequently use when describing the services provided by TNCs like Uber and Lyft. However, there are distinct differences between ridesharing and ridesourcing when it comes to vehicle miles travelled (VMT) reduction and the purpose of travelling. While drivers participating in ridesourcing are deemed as hired drivers who are driven by profit, ridesharing emphasizes non-commercial and incidental shared trips on account of the similar routes shared by drivers and passengers (Shaheen & Cohen 2019). In other words, ridesharing activities reduce VMT by combining similar trips into one trip, whereas ridesourcing activities are concerned with transporting passengers for profit, which does not necessarily reduce VMT. Compared to the drive-alone and ridesourcing strategy, ridesharing is deemed as a more environmentally friendly way of transportation due to its contribution to mitigation of congestion, reduction of greenhouse gas (GHG) emissions and energy conservation (Chan & Shaheen 2012).

Although ridesharing is beneficial to traffic and environment, there are concerns about safety and reliability that may limit the development of ridesharing platforms. The concerns are here for a reason: DiDi Chuxing, the biggest TNC in China, has suspended its hitching services after two murders of female passengers in three months (He 2018). Pratt et al. (2019) find in the text analysis of 2061 tweets that shared ride services receive more negative comments than positive ones, and people complain about stranger danger. Li et al. (2019) find 10 minutes average delay caused by ridesharing compared to exclusive ride services. One solution of problems mentioned above could be sharing work trips with co-workers as co-workers have certain level of acquaintance between each other, and they are generally required to arrive and leave the same workplace in the similar timeslot.

However, to our best knowledge, there is no platform specifically designed for ridesharing between co-workers that can be universally adopted by anyone in any organization. We, therefore, developed an Android-based application specifically for ridesharing at the organizational scale, called UTAS-Ride. The goals of UTAS-Ride are to provide a platform on which any member of an organization can create a unique carpool for all members within the organization to share rides with each other.

The remainder of this paper is organized as follows: a literature review relating to deterrents, benefits and development of organization-based ridesharing is introduced in the next section. Section 3 presents the description of UTAS-Ride from perspectives of user and data interaction. Limitations of the application are provided in Section 4. Conclusions and future work are presented in Section 5.

2 Literature Review

The concept of 'ridesharing' can be traced back to World War II when the US government wanted to encourage workers to share rides with one another for the conservation of rubber. As the time goes, the focus of ridesharing has shifted gradually from the conservation of rubber to general energy conservation, and further to mitigating congestion and environmental concerns (Chan & Shaheen 2012). The modern form of ridesharing was first introduced by Psaraftis (1980) as a Dial-A-Ride Problem (DARP), which involves a demand-responsive transportation system which assigns a fleet of vehicles to satisfy demands of customers who need to be carried to specific locations.

With the popularization of Internet-enabled portable devices, TNCs, like Uber, Lyft and Didi, taking the advantage of real-time geographical information technologies make it possible for all car owners to provide on demand ride service to customers who need a ride (Cramer & Krueger 2016). However, the focus of these TNCs is no longer about pairing up people with similar trips but enabling car owners with the aim of generating incomes to provide exclusive ride services to passengers. Based on the nature of pooling services, Shaheen and Cohen (2019) categorize the ride services driven by profit as ridesourcing services instead of ridesharing services. Studies have shown that ridesourcing services no longer have beneficial impact on urban traffic and environment. Jin et al. (2018) state that ridesourcing increases the number of cars on the street and reduces the usage of public transit. Henao and Marshall (2019) find an empty mile rate of 41% per ridesourcing driver in Denver and 84% more VMT of the whole transportation system due to the existence of ridesourcing services. Unlike ridesourcing services, studies have shown that shared rides can efficiently reduce the vehicle usage. Based on the simulation by Li et al. (2019) using ride trajectory of DiDi Chuxing, sharing rides with others can efficiently reduce the vehicle hours travelled (VHT) by 22%. The study by Coulombel et al. (2019) indicates that 25% increase in average vehicle occupancy, which is caused by ridesharing, leads to 5% decrease in CO_2 emission and 2% decrease in social cost.

Although ridesharing is more beneficial to the urban traffic and environment than drive-alone and ridesourcing strategy, it is rarely an option of transportation for a number of reasons. The investigation conducted by Nielsen et al. (2015) shows that safety concerns, inconvenience, social exclusion and awkwardness are some factors influencing people's willingness of participating in the ridesharing in Denmark (Nielsen et al. 2015). A survey based on users in the metropolitan areas in the United States indicates that, apart from safety concerns and inconvenience, racial, sexual and class-based discriminations also play negative roles in keeping people from ridesharing (Sarriera et al. 2017).

With the increasing concerns about psychological effect, safety and discriminatory attitudes caused by ridesourcing and ridesharing, it is worth discussing whether ridesharing within the organization contributes to a reassuring and hassle-free ride experience. Based on the study based on a web survey by Correia and Viegas (2011), psychological barriers associated with riding with strangers play the key negative role in keeping people from work trip carpooling, while work organization provides a comfort zone with a base level of trust and similar work schedule that evokes more confidence in people who perform work trip carpooling. Silpa and Mary Priyanka (2019) state that social discomfort and stranger danger when traveling with strangers undermine people's willingness of ridesharing, and social connections among acquaintances should be considered when ridesharing to overcome these barriers.

Organization-based ridesharing takes place in the scenario where colleagues or members of an organization share rides with each other for commuting purposes. Ridesharing at the organizational scale used to be encouraged in the US over the 1960s-1980s as the US government encouraged large-scale organizations to match their members who neighbor to share rides (Chan & Shaheen 2012). It was proven to be successful in mitigating the urban congestion and parking shortage. Numerous studies regarding the impact of organization-based ridesharing (often called as employer-based ridesharing back then) on energy conservation had done over 1960s-1990s when employer-based ridesharing was encouraged. However, the work trip carpooling started to decline with the fall of oil price and the expansion of fuel economy in the 1980s and 1990s, as well as social changes in suburbanization, population age demographic and education levels (Ferguson 1997). There are some other drawbacks of work trip carpooling with colleagues. Match rate is heavily and positively affected by the number of carpooling participants (Correia & Viegas 2005). The carpool at the organizational level is much smaller in size compared to that in the commercial sphere, resulting in relatively lower match rate recorded for organizational carpooling. In addition, flexible work schedule is also a deterrent to work trip carpooling. Habib et al. (2011) indicate that work trip carpooling is hard to attract people with a flexible work schedule due to the difficulty of matching a small number of people with a wide range of commuting time.

Even though the organization-based ridesharing has been marginalized along with the decline of work trip carpooling in the 1980s and 1990s, studies has been conducted in the recent decade regarding the potential and capacity of organization-based ridesharing in today's society. Bruglieri et al. (2011) propose a ridesharing platform called PoliUniPool that allows members of two universities to share rides with others, which is expected to satisfy more than 90% of the user requests. However, their implementation does not provide a universal approach that can be generalized to other organizations. The case study of Zipcar conducted by Shaheen and Stocker (2015) finds that 40% of members have deferred their plans of buying a vehicle on the account of employer-based ridesharing provided by Zipcar, a car rental company. In terms of the potential of organization-based ridesharing, the study conducted by Amey (2011) based on the data from MIT commuter survey indicates that 50-77% of MIT members can participate in ridesharing on a daily basis whilst only 8% of them are doing it.

3 UTAS-Ride

UTAS-Ride is an application programmed for devices with Android 4.1 and above, and it is a platform for people who tend to share rides in a safe and familiar environment. Inspired by the extreme shortage of parking facilities and the difficulty of finding park spots in peak hours, UTAS-Ride aims to maximize the capacity of commuting vehicles while addressing people's concerns about safety and cost issues of common ridesharing applications. Unlike common car hailing and ridesharing platforms such as Uber (including UberPool) and Lyft that match riders and drivers regardless of links between their social roles, UTAS-Ride is capable of joining and creating the unique carpool for anyone who belongs to certain organizations, making UTAS-Ride a solution to address people's concerns mentioned by Nielsen et al. (2015) and Correia and Viegas (2011). While the project is coded in JAVA for devices with Android 4.1 and above, the calculation and display of routes are supported by Google Direction API and Google-Directions-Android by JD Alexander (https://github.com/jd-alexander/Google-Directions-Android). Data storage and interaction are done via Google Firebase.

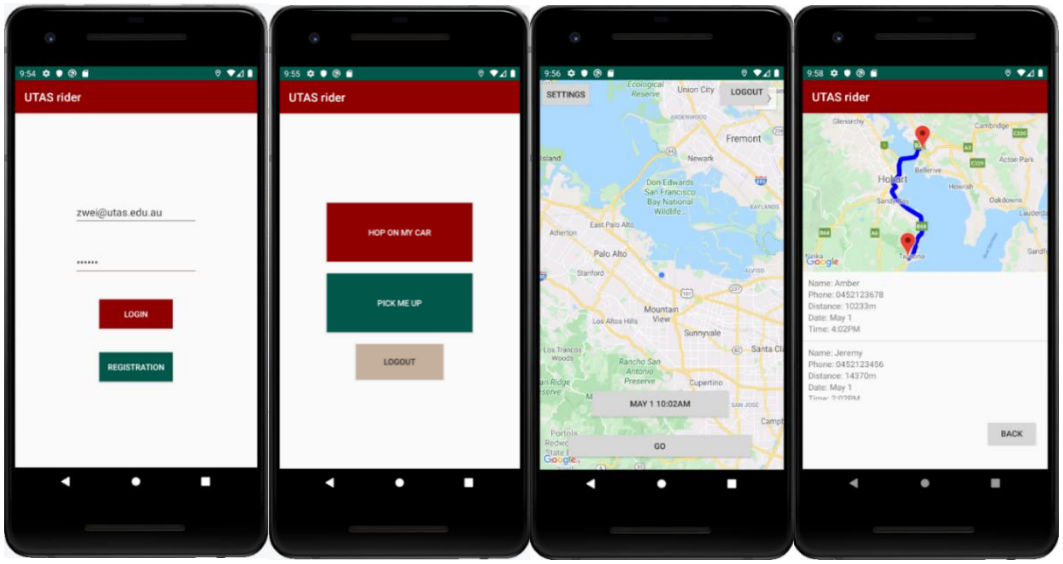

Figure 1: User interfaces of signup, role selection, request submission and ride matching

The interfaces of a typical request for a ride are shown in figure 1. The registered users would go through steps of registration, role selection, editing request and choosing from potential matches. For certified users whose organizations are absent in the system, the users can go to settings to add the name and location of their organizations into the system and wait for the approval from platform administers.

To further demonstrate how the UTAS-Ride works, the following sections will introduce how user's organizational identification is validated, the process of making a request, the data interaction when creating or joining the unique organizational carpool, cost issues and expected updates.

3.1 User inclusion and validation

The UTAS-Ride is designed specifically for workers who want to share their work trips with people with trusted organizational identification. In the organization-based ridesharing system, the assurance of assigning people in the same organization into the same carpool is important. People will obtain a higher-level safety perception when they are with someone within the same organization. To authenticate and identify the organization of the users, the application requires users to register with their official email account ending with the certain organizational domain name, and the verification email with an activation link will be sent to verify the user.

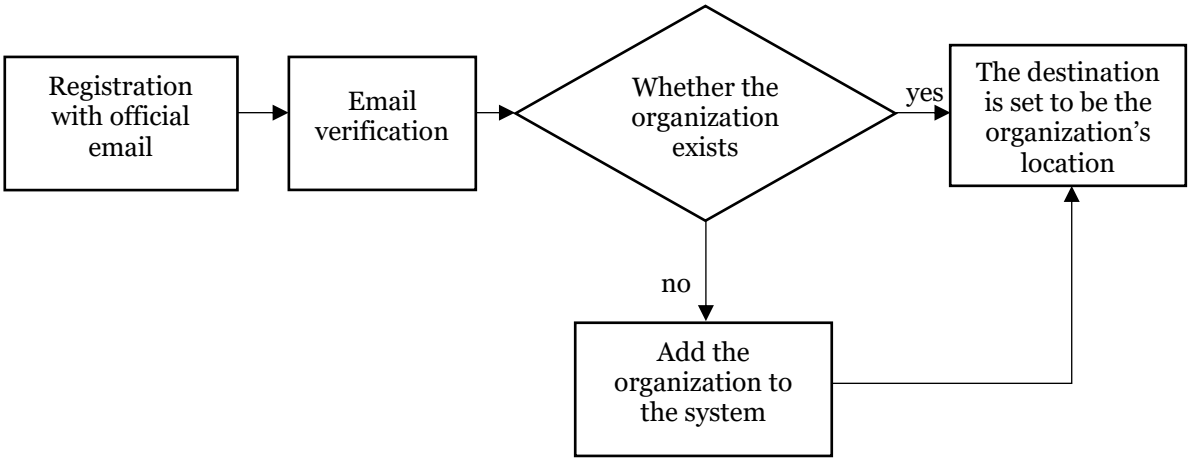

Figure 2: The process of user validation

All users are required to register and be verified with their official email account (Figure 2). The system will check whether the organization exists in the current system. If the organization is in the system, the user's destination will be set to be the location of the organization. Otherwise, the first user from an organization can manually add the organization to the system.

3.2 Journey map of a typical request

Currently, there are 5 main steps in which users interact with the system, and the user journey map is as figure 3 shows.

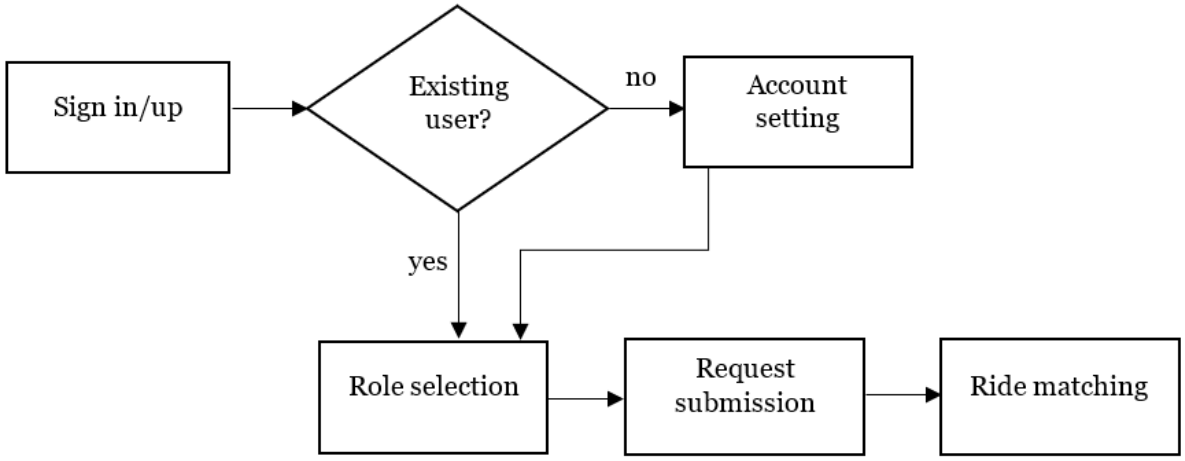

Figure 3: user journey map for the proposed system at the current status

Registration, account setting, role selection, submission and matching are required for a successful pair-up (Figure 3), and each step can be more specifically described as:

- Sign in/up: the authentication process requires an organizational email address to ensure the users in the carpool are from the same organization.
- Account setting: updating user information so that people can contact each other.
- Role selection: the user chooses to be a rider or passenger before sending the request.
- Request submission: the user completes the request with the desired time and location.
- Ride matching: the system will provide all possible matches sorted by distance and time. The user is offered with great flexibility to contact the interested person in private.

3.3 UTAS-Ride database

The system will create a unique carpool for each verified organization, and the members of the organization will only take part in the ride-matching process within the carpool of the organization.

The user entity is a dataset containing user's contact detail. Once the users choose their roles and send requests, the system will place the requests into drivers' or riders' request list correspondingly. Each request consists of the geographical information, departure time and contact details of the request sender. The routes and detour time of the shared rides can be calculated based on the locations of all stops, and such information will be shown to the users when the users click on the person they want to pair up with.

3.4 Cost issues

The system is designed to be a free-for-all and community-based platform. At current stage, there is no user interface related to payment. However, we do realize that monetary incentives are important to motivate drivers to participate. Thus, users are allowed to pay for the rides in private as long as consensus is reached.

3.5 Planned updates for further development

As the application is not fully finalized, a few functionalities that are not yet included are under development. In place of the current function which only allows users to make contacts in private via mobile calling; a built-in messaging system is expected to be added to allow users to conveniently chat with each other while having their personal information such as phone numbers hidden. A number of researchers have addressed the significance of monetary incentives for drivers to perform carpooling activities (Créno 2016; Kelly 2007). Thus, an optional online payment system is expected to be included in the application for users who have agreed on the payment for the rides.

4 Limitation and discussion

We aim to design a platform that can be generalized to any types of organizations. However, one major concern, as identified in the literature review, is the low match rate for small organizations and organizations with flexible work schedule. Small organizations and organizations with flexible work schedule lead to low number of orders in certain time slots. To address this issue, one possible solution for small organizations and organizations with flexible work schedule could be creating affiliation among organizations. Multiple adjacent organizations that are trusted by each other can be assigned into one carpool to increase the number of users per carpool.

Another limitation is the user verification using official email account. A number of small organizations such as local restaurants and shops do not provide business email accounts with certain domain names to employees, which will create difficulties in registration and validation of organizational identification. To address this limitation, we are developing a mechanism learnt from closed social media group, as the person who initially create the carpool will act as an administrator of the carpool. By empowering users as administrator of their own carpools, the cost of maintenance of the platform is reduced, and flexibility is offered to users to manage who they want to share rides with.

5 Conclusion and future work

We have developed a public portal for commuting carpooling at an organizational scale. To enable ridesharing activities to be more secure and approachable, the application provides a platform in which people from any organization can create a unique carpool for their organization and start to share rides with co-workers. Since the users can only join the carpool comprising people within their organizations, the portal provides a stronger sense of safety and community compared to common ridesharing software. To our knowledge, this is the only ridesharing software that allows users to initiate the creation of a carpool for their organization.

We are currently working on adding more features to this application. The built-in messaging system and online payment system are expected to be seen on the next version as enhancements in privacy protection and usability. Limitations regarding small organizations and lack of official email addresses do exist, we intend to solve the issues by creating affiliation among multiple organizations and empowering users who initially create the carpool to manage members in the carpool. To further complete the development lifecycle of the system, test and survey with potential users will be conducted to identify the user's willingness level, estimated success rate, estimated vehicle miles travelled (VMT) savings per user and additional functionality.

6 Reference

Amey, A. 2011. "A proposed methodology for estimating rideshare viability within an organization, applied to the mit community," *TRB Annual Meeting Procediings*, pp. 1-16.

Bruglieri, M., Ciccarelli, D., Colorni, A. and Luè, A. 2011. "PoliUniPool: a carpooling system for universities," *Procedia-Social and Behavioral Sciences* (20), pp.558-567.

Chan, N.D. and Shaheen, S.A. 2012. "Ridesharing in North America: Past, present, and future," *Transport reviews* (32:1), pp.93-112.

Correia, G. and Viegas, J.M. 2005. "Carpooling clubs: solution for the affiliation problem in traditional/dynamic ridesharing systems," *Proceedings of the 16th Mini-EURO Conference and 10th Meeting of EWGT*, pp. 493-498.

Correia, G. and Viegas, J.M. 2011. "Carpooling and carpool clubs: Clarifying concepts and assessing value enhancement possibilities through a Stated Preference web survey in Lisbon, Portugal," *Transportation Research Part A: Policy and Practice* (45:2), pp.81-90.

Coulombel, N., Boutueil, V., Liu, L., Viguié, V. and Yin, B. 2019. "Substantial rebound effects in urban ridesharing: Simulating travel decisions in Paris, France," *Transportation Research Part D: Transport and Environment* (71), pp.110-126.

Créno, L. 2016. "User experience of Dynamic Carpooling: How to encourage drivers and passengers?," *Energy Consumption and Autonomous Driving*, pp. 71-81.

Ferguson, E. 1997. "The rise and fall of the American carpool: 1970–1990," *Transportation* (24:4), pp.349-376.

Habib, K.M.N., Tian, Y. and Zaman, H. 2011. "Modelling commuting mode choice with explicit consideration of carpool in the choice set formation," *Transportation* (38:4), pp.587-604.

Henao, A. and Marshall, W.E. 2019. "The impact of ride-hailing on vehicle miles traveled. Transportation," (46:6), pp.2173-2194.

He, H. 2018. "Didi stops hitching service in China after second murder – and admits it was warned about accused driver." www.scmp.com/news/china/economy/article/2161400/didi-stops-hitching-service-china-after-second-murder-and-admits

Jin, S.T., Kong, H., Wu, R. and Sui, D.Z. 2018. "Ridesourcing, the sharing economy, and the future of cities," *Cities* (76), pp.96-104.

Kelly, K.L. 2007. "Casual carpooling-enhanced," *Journal of Public Transportation* (10:4), pp.119-130.

Li, W., Pu, Z., Li, Y. and Ban, X.J. 2019. "Characterization of ridesplitting based on observed data: a case study of Chengdu, China," *Transportation Research Part C: Emerging Technologies* (100), pp.330-353.

Nielsen, J.R., Hovmøller, H., Blyth, P.L. and Sovacool, B.K. 2015. "Of 'white crows' and 'cash savers:' A qualitative study of travel behavior and perceptions of ridesharing in Denmark," *Transportation Research Part A: Policy and Practice* (78), pp.113-123.

Pratt, A.N., Morris, E.A., Zhou, Y., Khan, S. and Chowdhury, M. 2019. "What do riders tweet about the people that they meet? Analyzing online commentary about UberPool and Lyft Shared/Lyft Line," *Transportation research part F: traffic psychology and behaviour* (62), pp.459-472.

Psaraftis, H.N. 1980. "A dynamic programming solution to the single vehicle many-to-many immediate request dial-a-ride problem," *Transportation Science* (14:2), pp.130-154.

Sarriera, J.M., Álvarez, G.E., Blynn, K., Alesbury, A., Scully, T. and Zhao, J. 2017. "To share or not to share: Investigating the social aspects of dynamic ridesharing," *Transportation Research Record* (2605:1), pp.109-117.

Shaheen, S. and Cohen, A. 2019. "Shared ride services in North America: definitions, impacts, and the future of pooling," *Transport reviews* (39:4), pp.427-442.

Shaheen, S. and Stocker, A. 2015. "Information Brief: Carsharing for Business Zipcar for Business Members Survey," *Transportation Sustainability Research Center-University of California, Berkeley*.

Silpa, K.M. and Mary Priyanka, K.S. 2019. "TOWARDS SOCIAL AWARE RIDESHARING GROUP QUERY SERVICES," *International Research Journal of Engineering and Technology* (6:6), pp. 3816-3823.