
Jerney: A Peer-to-Peer Shared Public Transit on Fixed Routes

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Abstract

This paper introduces a public transit system called Jerney, which is a peer-to-peer shared ride on fixed routes. It takes the advantage of fixed route shared public transit (such as bus and rail systems) in order to keep the fare rate down compared to taxicabs, and provide a convenience of the peer-to-peer ride (such as Uber and Lyft) over the public transit such as bus and rail systems. Jerney system consists of three main components; passenger app, driver app, and dispatch system. Passenger books a shared ride via a mobile app by specifying origin and destination locations. The dispatch system then assigns a driver to the passenger and informs the passenger with pick-up and drop-off stations. Driver location can be monitored by the passenger once the ride has been booked. Jerney system has been evaluated with real users in a user experience study from which there were positive feedbacks from the users, as they felt that the Jerney system was useful and easy to start using.

Author Keywords

Peer-to-peer public transit; on-demand public transit; mobile app; shared public transit system.

ACM Classification Keywords

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

Introduction

Urbanization is rapidly transforming places globally. Urban areas and their populations are projected to experience substantial growth over the years to come. In 2007, the urban global tipping point was reached when for the first time in history over half of the world's population 3.3 billion people were living in urban areas. It is estimated that 60% of the world's population will be urbanized by 2030 and the majority of them will be from developing countries [6].

In an urban area, transportation is an essential mechanism enabling city operation economically and socially. Public transportation is known to reduce traffic congestion and encouraged in urban area. Shared public transit such as bus and rail run on fixed routes and schedules with relatively low fares, which can be suitable mode of transport to many inhabitants. However, passengers can often suffer from rush hour inconvenience, delays, and unreliability of such publication transit.

Another type of public transport is a taxi or a taxicab, which differs from other modes of public transport where the pick-up and drop-off locations are determined by the passengers. Unlike bus and rail systems, the passengers are not restricted by timetables or having to change multiple transits to arrive at the destination, and so on. It can be a quick way to get to destination, but with a high price tag.

Shared taxi is another type of taxi transport service that falls between taxicab and bus. A shared taxi usually takes passengers on a fixed or semi-fixed route without timetables, but instead departing when all seats filled. It may stop anywhere along the route to

pick up or drop off passengers. It offers an inexpensive mode of transport, but it can be slow as it makes several stops along the way. Passengers may need to deal with its unreliable service in terms of operating schedules as it needs to fill up passengers before starting its service.

Recently, the sharing economy [4] has given a rise to the peer-to-peer based sharing of access to goods and services among which is peer-to-peer ride, such as Uber¹, Lyft², GrabCar³, and GrabTaxi⁴. Similar to taxicab transport service, but with this peer-to-peer platform, the passenger can call up a taxicab or private car through a mobile app or website, which provides a convenience over the traditional taxi service. Although its fare tends to be lower than the taxicab's [2], it's still relatively high compared to other public transit modes such as bus and rail.

In this paper, we introduce a new public transit service system that brings together the advantages of fixed route shared public transit (such as bus and rail systems) and IT-driven on-demand transit (peer-to-peer ride). The new system introduced in this paper is called Jerney (it means "meet here" in Thai; Jer means 'meet' while 'Ney' means 'here'). In Jeyney system, transit vehicles run on fixed routes but non-fixed schedules, while pick up and drop off passengers according to the instructions from the main automatic dispatch system via the driver mobile app. Passenger

¹ <https://www.uber.com>

² <https://www.lyft.com>

³ <https://www.grab.com/th/en/car/>

⁴ <https://www.grab.com/th/en/taxi/>

access the Jerney service via a mobile app from which exact arrival time and pick-up location are informed. Passenger can also track the location of the arriving driver via the app. So, unlike bus and rail systems where the passengers are restricted by timetables and not knowing the location of the arrival vehicle. With Jerney, passengers get the advantage of peer-to-peer ride by accessing the service via a mobile app with a fare rate comparable to bus and train. In addition, from the transit driver's point of view, unlike the under-pressure taxicab drivers that need to have effectively driving hours i.e., minimizing non-passenger time [3][5], the Jerney drivers only need to drive according to the instructions given by the Jerney system.

System Overview

Jerney system is composed of three main components; passenger mobile app, driver mobile app, and automatic dispatch system. Overview of the Jerney system is shown in Fig. 1. Jerney links the passengers to the nearest driver who operates in a 'fixed route' with a 'sharable vehicle' (i.e., van), which help keep the fare at a more affordable rate compared to regular taxicabs or peer-to-peer rides. Passenger connects to the Jerney system using the passenger mobile app to request for a shared ride by indicating a pick-up and drop-off locations. Jerney system then locates the nearest Jerney driver and assigns the driver to the passenger who will then be informed with the the pick-up location. The driver is informed by the Jerney automatic dispatch system for where to go pick up and drop off passengers, so it saves time and effort in looking for next customers for the drivers. Once the passenger confirms the ride, a (electronic) ticket is issued through the passenger app. On the approval of the driver at the pick-up location (station), the driver

checks the ticket and confirms to pick up the passenger.

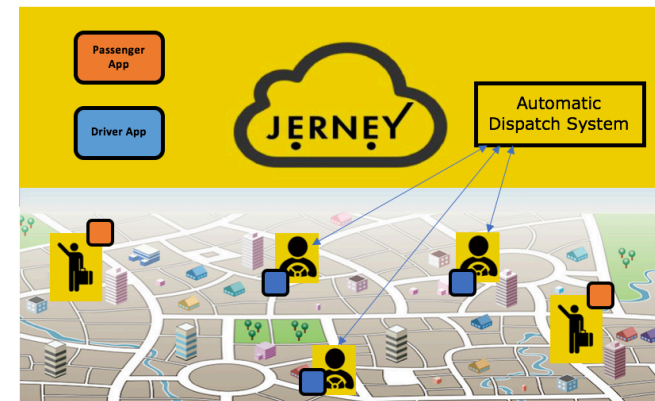


Figure 1: Jerney system consists of three main components; passenger app, driver app, and automatic dispatch system.

Jerney Components

Mainly, Jerney system consists of three components which are synchronously working together. Each component is responsible for a different task enabling the whole Jerney system to fully operate.

Passenger app

For the user who is a passenger, the user installs and uses Jerney passenger mobile app to connect to the system. The app allows the user to book a shared ride. The user first needs login and specify the origin and destination locations (Fig.2a). The system will then inform the user with the pick-up and drop-off stations (Fig.2b). The system shows the driving route along the pick-up and drop-off stations, and asks the user to confirm the booking by clicking on the Ticket button to purchase the ticket (Fig.2c). The user can specify the

number of passengers for this ride with the given fare rate (Fig.2d). Once the user selects the number of passengers and confirms the ticket, a ticket is then issued (Fig.2e). After the ticket is issued, the user can monitor the driver's location on a map (Fig.2f).

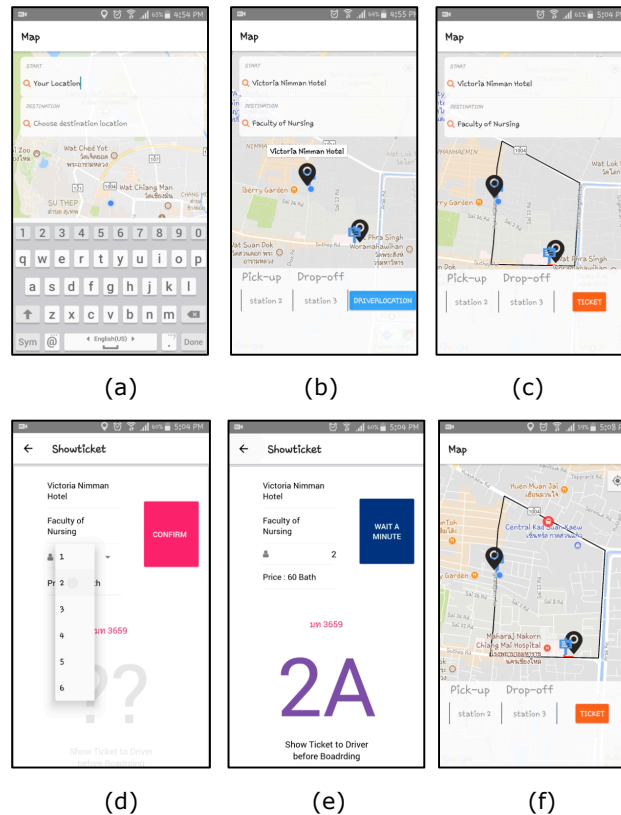


Figure 2: Passenger app; (a) the user specifies the origin and destination locations, (b) the system indicates the pick-up and drop-off stations, (c) the system shows the route and prompts the user to confirm the ticket, (d) the user specifies the

number of passengers and confirms the ticket, (e) ticket is issued and fare rate is confirmed, (f) the user monitors the driver's location on a map.

Driver app

In order for the whole Jerney system to work, we need Jerney drivers who drive according to the instruction given by the automated dispatch system. For example, as shown in Fig. 3a, the system informs the driver that along the fixed route at the up-coming station (Station 2) there will be 1 passenger to pick up and 0 passenger to drop off. The app also shows the current location of the driver. When the driver arrives at the Station 2, the driver clicks on the 'CheckTicket' button once the passenger gets on the ride to inform the system that the passenger has been picked up. The passenger ticket and charged fare is shown on the driver app's screen for the driver to match it with the picked-up passenger (Fig 3b). Along the fixed driving route, the driver can monitor the up-coming station and the number of passengers getting on and off the ride so that the driver is aware of making a stop at the station that requires (Fig. 3c). When the driver arrives at the station where passenger is getting off, the driver clicks on the 'Drop' button on the driver app's screen to inform the system that the passenger has been dropped off at the station (Fig 3d).

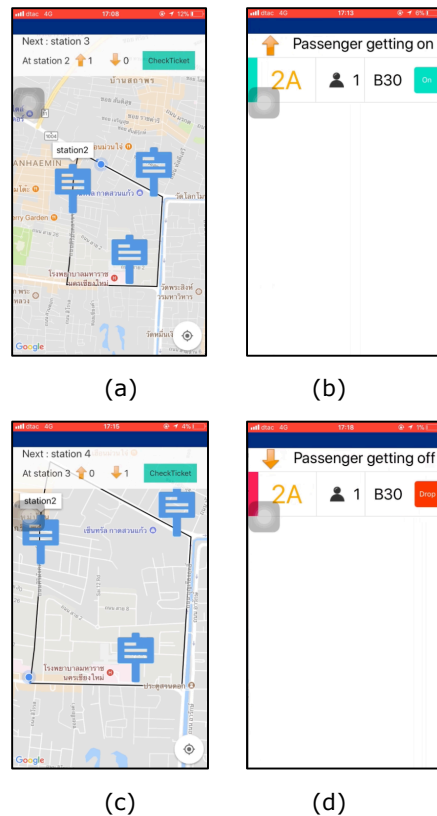


Figure 3: Driver app; (a) driver's location and route are shown on a map while along the route the driver is informed about the number of passenger getting on and off at the upcoming station, (b) driver clicks to confirm that passenger has been picked up, (c) the number of passengers getting on the off the ride in the upcoming station is shown so the driver is aware of making a stop, (d) when the passenger is getting off the ride the driver clicks to confirm and inform the system of dropped-off passenger.

Dispatch system

Each Jerney driver drives along the fixed route and pick up and drop off passengers according to the instruction given by the dispatch system, which allows the drivers to not worry about patrolling for next customers like taxicab drivers. Our first prototype of the automatic dispatch system applies a set of simple rules to driver's pick-up assignment. All drivers drive in the same direction. The requesting passenger will be assigned the driver with available seats and is located nearest (among other drivers) to the passenger, according to the distance required to arrive at the pick-up station. For example, as shown in Fig. 4, the passenger requests a shared ride at the upper right corner station. Since all drivers drives in a counterclockwise direction, so the driver #3 would then be assigned to this passenger. Unless the driver #3 does not have available number of required seats, then the second nearest driver with available seats would be assigned.

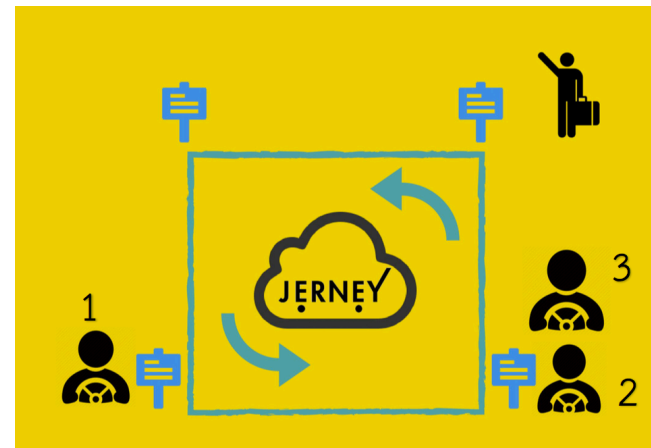


Figure 4: Example of how dispatch system assigns the driver to the requesting passenger.

Demo

For demonstration purposes, a video clip showing how the Jerney system works is available on YouTube at: <https://www.youtube.com/watch?v=qYsjVpkgVFo&t=11s>

User Experience Study

To evaluate the our Jerney system, we put it into the test by the real users by conducting a user experience study. Since this version is still a prototype, which we hope to launch the full service very soon, so the test was done at the experimental level. The study was done in the city of Chiang Mai, Thailand. Two routes were virtually implemented.

For each user, we first explained how the Jerney system works and then asked the user to use both passenger app and driver app. Each user was then asked to answer a questionnaire (shown in Fig. 5) to evaluate the Jerney system from the user experience's point of view. The survey questionnaire was designed base the Theory of Four Elements of User Experience [1], which asks to the user to rate their level of agreement with four different statements concerning the user experience with the system that include:

1. It is useful.
2. It is easy to use.
3. It is easy to start using.
4. It is fun and engaging.

แบบสอบถามเกี่ยวกับประสบการณ์ของผู้ใช้จากการใช้งานระบบ
(User Experience Questionnaire)

เพศ (Gender): () ชาย (Male) () หญิง (Female)
อายุ (Age): () <20 () 20-29 () 30-39 () 40-49 () 50-59 () >60
อาชีพ (Occupation): _____

วัตถุประสงค์ของการวิจัยการใช้นี้จากระบบ (User Experience)
โปรดพิจารณาและตอบคำถามเกี่ยวกับระดับความเห็นด้วย ที่ตรงกับข้อความที่ระบุข้างล่าง (Determine your level of agreement for the following statements, ranging from 1 to 5)
ระดับความเห็นด้วย: 1 = เห็นด้วยน้อยที่สุด 5 = เห็นด้วยมากที่สุด

ข้อความ (Statements)	ระดับความเห็นด้วย (Level of agreement)
1. ระบบนี้มีประโยชน์ (It is useful)	1 2 3 4 5
2. ระบบนี้ใช้งานง่าย (It is easy to use)	1 2 3 4 5
3. ระบบนี้มาง่ายไปใช้ (It is easy to start using)	1 2 3 4 5
4. ระบบนี้มีความสนุก และความเพลิดเพลินในการใช้งาน (It is fun and engaging)	1 2 3 4 5

ข้อเสนอแนะ ความเห็นเพิ่มเติม (Suggestions and comment)

Figure 5: Questionnaire for the user experience study.

There are 50 participants in total that include 30 males and 20 females. Each participant was asked to give a rating of agreement level to the four statement where the rating score is a 5-likert scale where 1 means the lowest level of agreement and 5 means the highest level of agreement.

Overall, the users gave the highest rating (4.76) for the system being easy to start using, followed by being useful (4.72), then being fun and engaging (3.90), and lastly being easy to use (3.08). This suggests that the users felt that the system was useful and interesting (i.e., easy to start using), however not so easy to use nor fun and engaging. According to the comments and conversations with the users, most users had positive feeling towards the Jerney system. One of the comments from the users was "It can be very useful. I can see myself using it right away. I'm tired of the current public transit services that we have in our city

that I either wait for a red car (shared taxi) that I have no idea when it's coming, or get an expensive Uber. This system would definitely address this issue for me." Another comment was "I think it's useful. A lot of people would use it. But I think that the passenger app should be more user-friendly. It would also be great if the app also tells the user about the expected time for the driver to arrive at the pick-up station." Based on these comments and ratings, we will consider improving on the passenger app in the aspect of being easy to use, and adding feature that provides the user (passenger) with expected arrival time of the driver.

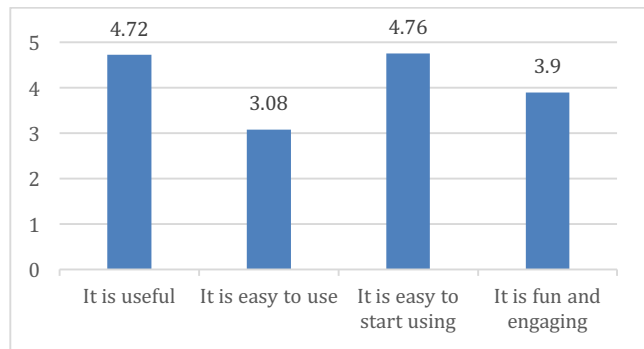


Figure 6: Overall result of the user experience study.

By separated the users by gender, both genders rated the Jerney system similarly with the "being useful" and "being easy to start using" were the top two characteristics, as shown in Fig. 7. While being easy to use was rated the lowest, male users gave a higher rating (3.37) than female users (2.65). One of the comments from female users was "It looks useful but it's not so easy to use, especially the passenger app. You should make the app more attractive and easier to use." Another comment from a male user was "Driver

app is easy to use but the passenger app should improve. It should tell me the estimated time of ride arrival so I'd know when to be at the station. Overall, I think it's a useful transit method." These comments suggest that the passenger app needs to be improved in aspects suggested by the users from both genders.

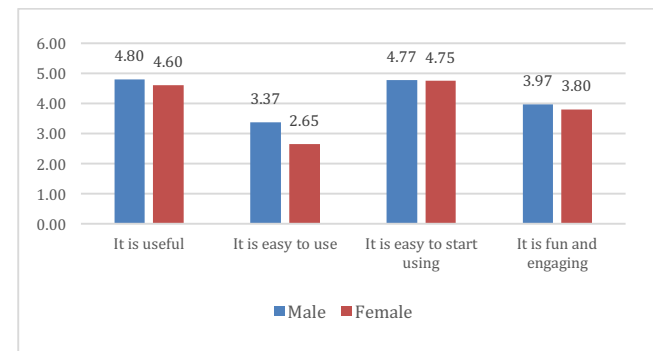


Figure 7: Result of the user experience study when grouped by gender.

When grouped the users by age, there were four users who were under 20 years old, 19 users between 20-29 years old, 12 users between 30-39 years old, 10 users between 40-49 years old, and five users between 50-59 years old. The result is shown in Figure 8. All age groups highly rated Jerney for being useful and easy to start using, equally. For the aspect of being easy to use, the average rating goes from 4.00, 3.53, 3.42, 2.40, to 2.20 given by the youngest to oldest age group, respectively. This may suggest that this aspect, as already being the lowest rated aspect of the system, becomes worse with the age of the users – i.e., older user finds the system more difficult to use, presumably the passenger app. One of the comments from 52 year-old was "The overall goal of the system is great. But

the tool it's a bit confusing. I'm not sure what to do next on the (passenger) app. Some guiding instruction can be useful here." This suggests that we should consider adding some instructions to guide the users in our future system development.

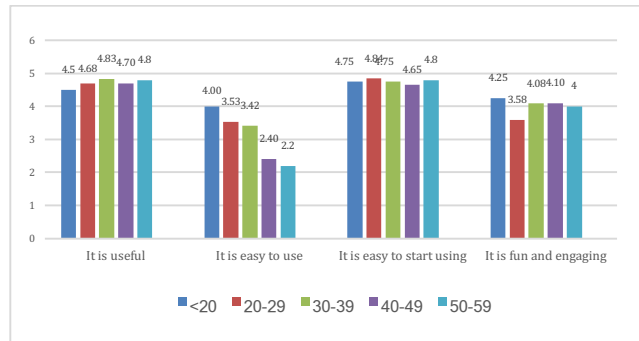


Figure 8: Result of the user experience study when grouped by age.

We further grouped the users by occupation. There were 10 students, 10 academic staff, 10 drivers, 7 office workers, and 13 others (including doctors, merchants, nurses, artists, and freelancers). The result is shown in Fig. 9. Office workers gave the lowest rating to the aspect of system being easy to use at 2.30. One of the comments from office works was "The whole system sounds interesting. But the app shouldn't be this complicated. It could be as simple as the Uber app. With no instruction, it's hard to know what to proceed with the app." Academic staff gave the lowest rating for the aspect of being fun and engaging, which is not very surprising as the Jerney system was developed primarily as a productivity tool but not for entertainment. Another constructive comment from academic staff was "The whole idea is great. But there

is a big risk if you can't attract enough users in the system. There needs to be a careful consideration of contracts with drivers and transaction strategies in the system to keep the system moving, especially in the early stage of deployment."

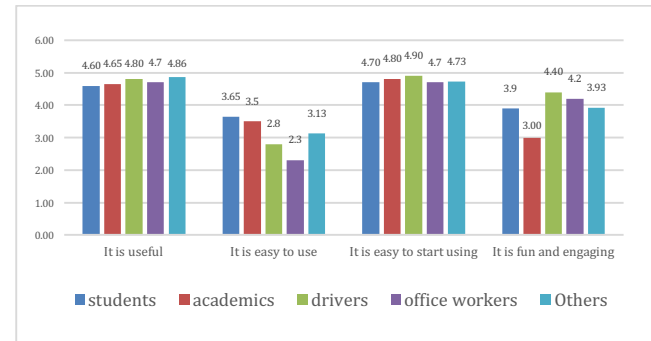


Figure 9: Result of the user experience study when grouped by occupation.

The results from our user experience study help inform our future design and development, which should emphasize on improving the "easy to use" aspect of the system, particularly the passenger app. Guiding instructions, feature for informing the user with the estimated arrival time of the driver, and more attractive appearance of the app are among other planned improvements along the directions of our future development of Jerney system.

Conclusion

Public transit is a very important element of today's cities in order to advance economically and socially. By taking the advantage of both fixed route shared public transit (such as bus and rail systems) and peer-to-peer ride (such as Uber and Lyft), here we introduce a

prototype system called Jerney, which is a peer-to-peer shared public transit on fixed routes. It provides a convenience for the passengers to book a ride with the peer-to-peer system through mobile app (more convenient when compared to bus and rail systems), and it keeps the fare rate low with its fixed routes and shareable ride (when compared to private taxicabs). Jerney system consists of three main components; passenger app for booking a shared ride, driver app for receiving driving instruction from the system, and the automatic dispatch system for managing the drivers in the system. The prototype system was evaluated with real users in a user experience study. Overall, there were positive feedbacks from the users, as they felt that the Jerney system was useful and easy to start using. However, there is still an aspect of being easy to use for the passenger app to improve upon.

Nonetheless, there are some limitations in our current Jerney system and study. Firstly, there is yet a support for handling passengers with large-size baggage. Secondly, there is yet a support for passenger who may wish to change the destination (drop-off station) while already on board. Lastly, the user experience study was done for the whole system but not individual component (passenger app and driver app). These limitations and constructive comments from the user experience study will be the focus points in our future design and development of Jerney.

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