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A Smart Real-Time Ride-Share for Riyadh City

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Abstract

Traffic jam is a growing problem especially in big cities like Riyadh. Wherever, streets are congested with cars and the need of cost-effective system is increasing in order to reduce the traffic jam impact. At the same time, each car's capacity can take up to four persons but this capacity is generally underexploited. If we can take advantage of the free space in each car, this will lead us to its best use with an optimal equation for achieving: fewer cars in the streets with more number of passengers. In this context, our mobile application "Where are you ?" is proposed as a solution that can help solving traffic jam problem. "Where are you ? " is a real-time application, which connects for free people living in the same city and having the same travel needs. Users ride-share their cars, based on the GPS position of the requester, the system searches the nearest and available car on the way of the requester. The system provides feedback and favorite driver's features, so that will help to recommend the best available driver. Our system is developed for android phones. It is considered as a social media since it provides communications between individuals or groups. Our application is based on trusted users. Users are authorized to register as part of a university or a company group or validated by their administrator. A "female only option" is also provided by the system. Our application is environmentally friendly because it provides carpooling service, which reduces carbon emissions, traffic jam, and the need for parking spaces.

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Keywords: ride share, real-time application, carpooling mobile application, GPS

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1. Introduction

Traffic jam is a growing problem especially in big cities like Riyadh. Wherever, streets are congested with cars and the need of cost-effective system is increasing in order to reduce the traffic jam impact. At the same time, each car's capacity can take up to four persons but this capacity is generally underexploited due to a large number of single occupancy vehicles. If we can take advantage of the free space in each car, this will lead us to its best use with an optimal equation for achieving: fewer cars in the streets with more number of passengers. The number of cars has been increasing so fast, thereby, the problem of traffic jam is getting worst every year. Only in the Kingdom of Saudi Arabia, there are more than 13,000,000 cars in 2012 (Alrabiya, 2012). It is expected that the number of cars sold annually reach one million in 2020 (Arab news, 2014). This large number of cars used daily will contribute to a significant air pollution problem. Carpooling helps to reduce this problem. Ride-sharing is a promising approach for reducing car usage in a city, which is beneficial both for individuals, e.g. reducing gasoline, and for the city as a whole e.g. reducing traffic and pollution (Amey, 2010). In recent years, a plethora of web and smartphone-based solutions have emerged for facilitating intelligent traffic management (Thiagarajan &al, 2009) and ride-sharing in particular. The first classic carpool mobile applications were static. The users need to schedule their plans for a trip in advance. The inconvenience of having to search through large carpools or even smaller but fixed choice driver groups, hoping to amongst them find a pre-scheduled and advertised trip adequately consistent with one owns schedule, makes such apps or sites non-practical for relatively short and near immediate on-the-go carpool and ride-sharing trip plans (Dejan &al., 2013). Thus, in the last decade, a new form of dynamic carpool and ride sharing mobile applications is emerging corroborating the fact that dynamic carpooling solutions become compulsory.

Regarding what has been stated; we designed and developed a smart vehicle travel sharing mobile application. This application is a real-time application, which connects people living in the same city and working at the same company or university and having the same travel needs. They rideshare their cars, based on the GPS position of the requester, the system searches instantly the nearest and appropriate driver on the way of the requester. The appropriate driver is chosen considering the profile matching of the requester and the supplier. Our application is environmentally friendly because it provides carpooling service, which reduces traffic jam, carbon emissions and the need for parking spaces. The rest of the paper is organized as follows: section 2 overviews some related works. Section 3 elaborates system design and implementation with subsections focusing on several specifics. Section 4 concludes this paper.

2. Related works

As noted, this section deals with existing carpool related work. The first classic carpool mobile applications were static. The users need to schedule their plans for a trip in advance. However, in the last decade, a new form of dynamic carpool and ride sharing mobile applications is emerging. Amongst some of the well-known and pioneering dynamic carpooling applications, we selected in the table below some applications and we checked if they provide a predetermined list of features.

Table 1. Carpooling apps comparison

Apps / Features	Hopin (Hopin)	Wadeeny (Wadeeny)	Lyft (Lyft)	Carpool (Carpool)
Free	✓	×	✓	✓
Android platform	✓	✓	✓	✓
Uses maps	✓	✓	✓	✓
Detect the current location	✓	✓	✓	✓
Hide user options	✓	×	×	✓
Female only option	×	✓	×	×
Share application link	✓	✓	✓	✓
Display notifications	✓	✓	✓	✓
Needs registration within a group	×	×	×	✓

The reviewing of the selected list of existing apps helps us to set the main features that need to be provided in our application. The next section will detail the system design and implementation.

3. System design and implementation

3.1. System description

"Where are you?" Application has a useful role as a social media transportation application by connecting people and facilitating the ridesharing process between driver and passenger. Our application is proposed as a solution that can help solving traffic jam problem. "Where are you ? " is a dynamic real-time application, which connects people living in the same city and having the same travel needs. Users don't have to pre-schedule their trip a long time in advance. They can decide to request/propose a ride instantly. Users need to ride-share their cars, based on the GPS position of the requester, the system searches the nearest, available and suitable car on the way of the requester. The system provides feedback and favourite driver's features, so that will help to choose the best available driver.

Our application is developed for android phones for two major reasons. First, android apps benefit from an open marketplace for distributing apps. Second, Android powers hundreds of millions of mobile devices in more than 190 countries around the world. It is growing fast every day, more than 1 million new Android devices are activated worldwide (Tiwari & al).

Furthermore, we took into account, when developing the application, all features, discussed in the "related works" section, and more. Indeed Our application is based on trusted users. Users are allowed to register as part of a university or a company group or validated by their administrator. Registration within a group is available to people with email addresses that end with the group affiliation (for example @ksu.edu.sa). A "female only option" is also provided by the system to take into account the specificity of Saudi society. There will be an administrator of the system to validate user's registration and keep track of the reports from the users about illegal using.

A user can be either a driver or a rider. For the driver, the system will locate him/her on the map using GPS and locate the person who has requested to have a ride. Then, the system will allow the driver to display information of the requester and communicate with him/her in order to coordinate the trip. For the rider, the system will display on the map -using GPS- the vehicles offering a ride (Fig. 1.)

For each offered ride, the application shows basic information about each driver such as gender, language and vehicle's type. The drivers that don t match requester's profile will not be shown. The profile matching is based on the preferences of the requester.

a b

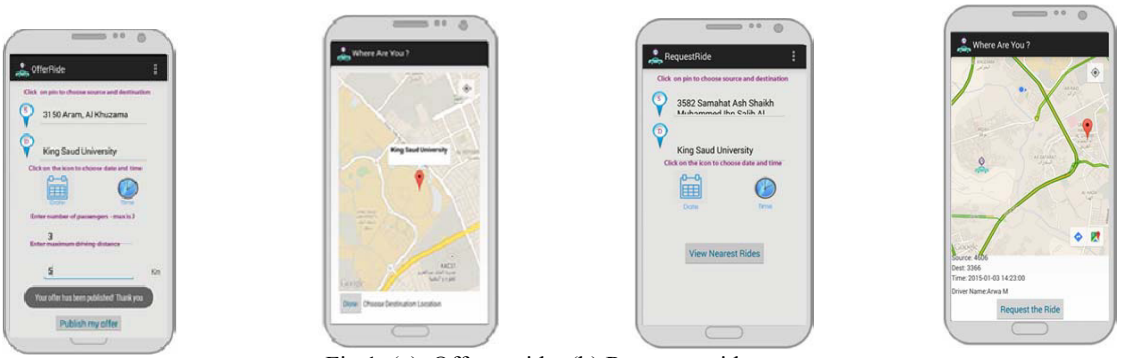

Fig 1. (a) Offer a ride; (b) Request a ride

3.2. Use case diagram

Three types of users transact with "Where are you?" as follows :

- System Administrator: As extended application needs an admin to perform the control tasks such as deleting reported members or fake accounts.
- Organization: an organization such as King Saud University has to register in order to permit the registration of its members. The admin system confirms the organization registration.
- Members can be registered by their organization or by their self with their e-mail organization. The system checks if the organization is already registered. A member can use "Where are you?" as both driver- when he/she is ready to offer a ride for someone- and passenger - when he/she needs a ride.

The figure below shows the use case diagram

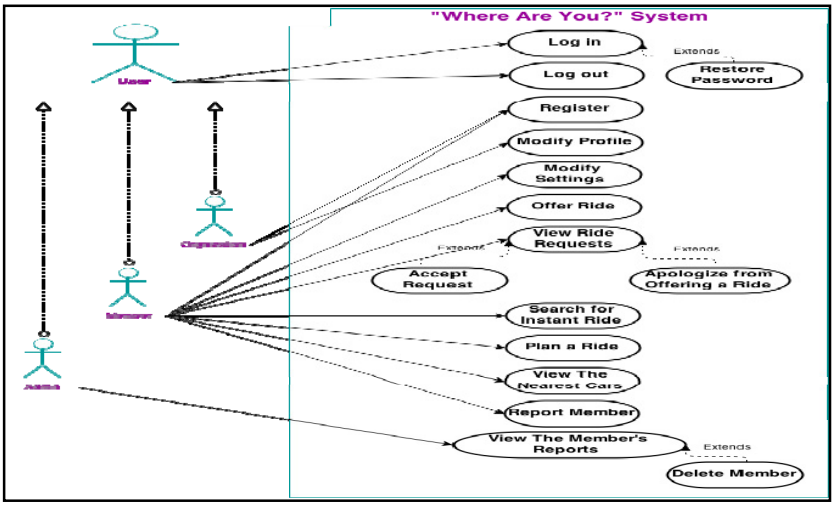

Fig. 2. : use case diagram

3.3. System architecture

The system architecture is based on an M-tier model (Fig. 3). The M-tier model is the best model for the social network applications such as "Where are you?" for many reasons. The first reason is that it allows access to the data from several computers (smart phones) at the same time. The second reason is that we need a set of stand-alone servers that provides specific services such as data management and displaying the desired information. The third reason is that servers can be distributed across the network which allows users to access the servers from any place. Lastly, the data will be saved in a shared database that can be accessed from any location.

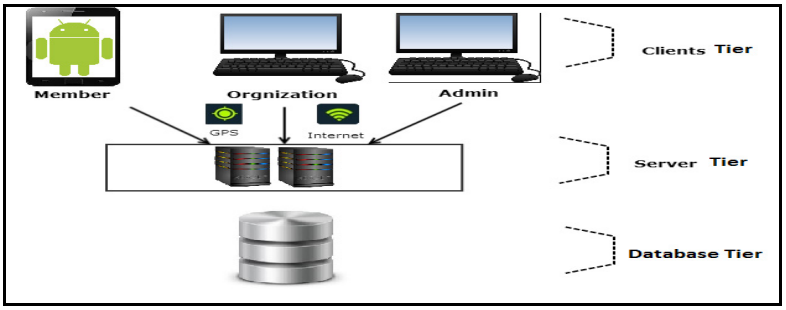

Fig. 3 : System architecture

"Where Are You?" application integrated several components (Fig. 4). We used Google Map APIs that helped in specifying and detecting locations. Also, we utilized Android libraries that were rich in beneficial methods suitable for implementing the application's functions. The figure below shows how the functions have been integrated.

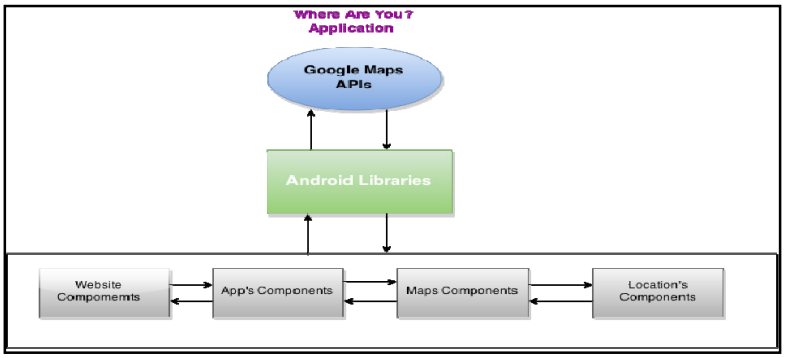

Fig. 4. System integration

3.4. System navigation

The user interface of our system is user friendly. It helps the user in navigating the whole system and performing the available functions in an intuitive and easy way.

Our system has three different views:

- administrator view,
- organization view
- member view.

The Fig. 5. below shows the different views of the system.

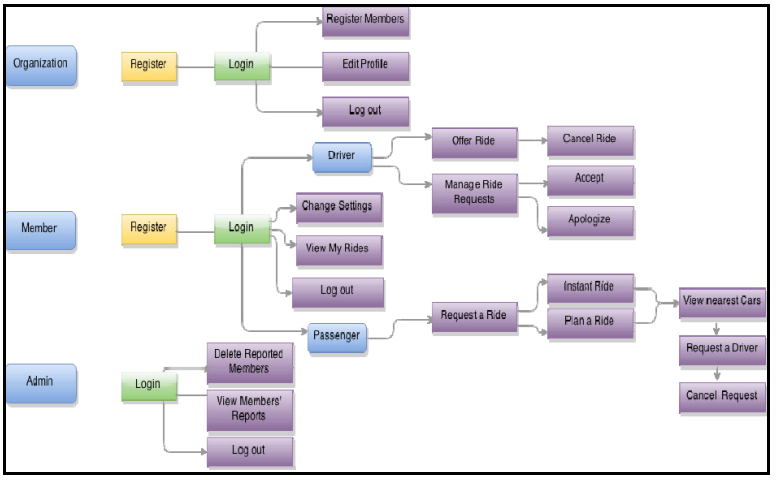

Fig. 5. User interface navigation hierarchy

4. Conclusion

The number of cars has been increasing so fast, thereby, the problem of traffic jam is getting worst every year. At the same time, each car's capacity can take up to four persons but this capacity is generally underexploited due to a

large number of single occupancy vehicles. Carpooling can be a solution for such problem. In this paper, we described the design and the implementation of a smart vehicle travel sharing mobile application, "Where are you?". "Where are you?" presents many advantage related to the existing apps. First, the application is based on trusted users : users are allowed to register as part of a university or a company group or validated by their administrator. Second, the application proposes "female only" feature to take into account the specificity of Saudi society. Third, the application proposes, for the requester, only appropriate drivers who are chosen considering the profile matching of the requester and the supplier. Finally, our application is environmentally friendly because it provides for free a carpooling service, which reduces traffic jam, carbon emissions and the need for parking spaces.

Acknowledgements

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Lyft. www.lyft.com

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