

YolArkadasi: A Carpooling Application for Turkish-speaking Android Smartphone Users

¹Ali Ilhan and^{2*}AlevMutlu

¹Department of Information Technologies, KuveytTürk Participation Bank, Konya, Turkey

²Faculty of Engineering, Department of Computer Engineering, Kocaeli University, Kocaeli, Turkey

Abstract

In this study we present a carpooling application, namely YolArkadasi, which runs on Android smartphones and is developed specifically for Turkish speaking users. Carpooling is the sharing the same vehicle by multiple people that travel the same direction. While carpooling can provide environmental benefits such as fuel saving and gas emission reduction, it can also help people to socialize and reduce their driving stress. When compared to the state of the art applications, YolArkadasi provides powerful mapping services and features that guide users throughout their journeys.

Key words:carpooling, sustainable transportation,smartphone application, android

1. Introduction

Journey sharing is the sharing of the same vehicle by multiple people that travel the same direction. It is a general term that refers to many forms of vehicle sharing such as carpooling, slugging, flexible carpooling, and real-time ridesharing. These formations differ by means of type of the agreement between the participants and the motivation behind the agreement. In carpooling travel costs are shared among the participants while in slugging no money is exchanged. In flexible carpooling there exists meeting points while passengers are picked up from their locations in real-time carpooling. Flexible carpooling and real-time carpooling are generally ad hoc while carpooling is pre-scheduled.

Carpooling gained popularity at various times with different motivations. It popularized during the World War II and in the mid-1970s due to the oil shortages then lost its popularity [1]. Recently it is again in favor mainly due to environmental concerns and personal benefits such as reducing the carbon emission [2] and the driving stress [3], respectively. The wide use of the Internet and the smartphones have also contributed to the popularity of carpooling as they provide several mediums for such journey shares [4]. Search engines return hundreds of thousands of results for “online carpooling service” query and smartphone market searches return hundreds of applications for a similar search. However, very small number of the carpooling web pages have Turkish in their language options, and to the best of our knowledge none of the smartphone applications has. In this paper we introduce a smartphone application for carpooling called *YolArkadasi* that is developed for Turkish speaking users. It is developed for Android smartphones. When compared to the state of the art applications it provides powerful route search options, route planning and route matching mechanisms, and additional features such as showing the route the meeting point, estimated arrival time of the car to the meeting point.

*Corresponding author: Address: Faculty of Engineering, Department of Computer Engineering Kocaeli University, 41380Kocaeli, TURKEY. E-mail address: alev.mutlu@kocaeli.edu.tr, Phone: +90262303-3577

The rest of this paper is organized as follows. In Section 2 we summarize the state of the art web-based and smartphone applications for carpooling. In Section 3 we introduce the architecture and implementation of the application. Section 4 concludes the paper with future directions.

2. Background

Carpooling first appeared in the US policy during the World War II when the country faced oil and rubber shortages and then disappeared until the mid-1970s when the country faced another oil and energy crisis. With the termination of these severe conditions carpooling also fell out of favor. Recently carpooling has once again gained popularity due to environmental and personal concerns. It is estimated that carpooling in San Francisco would save \$3,000,000 in fuel expenses, reduce the CO₂ emission around 8200 tons annually [5]. Researches [3, 6] also report that people prefer carpooling over single occupant vehicle journeys for personal concerns such as meeting new people, reducing the driving stress, and guaranteed parking. Due to its benefits to the environment, governments also encourage carpooling by implementing several infrastructures such as high occupancy vehicle lanes [7].

The Internet and smartphones also contribute to the current popularity of carpooling as they provide web pages and applications, respectively, for people to team up. In Table 1 we list some web pages and smartphone applications and the number of registered users.

Table 1. Online carpooling mediums and the number of registered users as of August 2014

Web site / Application name	Number of registered users
www.carpooling.com	6,000,000
www.carpoolworld.com	284,124
www.erideshare.com	280,000
carpooling.co.uk	5,000 – 10,000
carma carpooling	5,000 – 10,000
direct ridesharing	10,000 – 50,000

www.carpooling.com [8] launched in 2000 and currently operates in seven European countries. Drivers may offer one-time or scheduled carpools. Carpool offerings and searches are done by choosing the originating and the arrival cities from a prepopulated list of cities. A journey that has the originating and the arrival cities of a search as its stopovers is also returned. Searches can further be specified by putting criteria on features such as sexuality, smoking habit of the other party.

www.carpoolworld.com [9] is another internationally operating carpooling website. To offer carpools users need to fill in address text boxes which are later pinned on the map by the Google Geocoding API [10]. If the addresses cannot exactly be decoded into geographical coordinates, approximate locations are suggested. The site also allows users to search carpools at various location granularities such as all offerings within a country, state, and city.

www.erideshare.com[11] is yet another internationally operating carpool website that differs from the two above in the way users post their carpool offerings and do searches. In this web site routes are posted in the form of free texts. To perform a search users are placing the arrival locations and the direction they need to travel through. As an example if the arrival city is set to Ankara and the direction to NW, the search engine will return any carpool offering that starts at the north west of Ankara. Users need to manually go through each result to find out if the offering starts at or passes through the originating city.

carpool.co.uk [12], *carma-carpooling* [13], and *direct-ridesharing*[14] are some of the state of the art smartphone applications developed for carpooling. *carpool.co.uk* is the mobile application of *www.carpooling.com* where carpool offerings and searches are done by selecting the originating and the arrival cities from previously populated list-boxes. *Carma-carpooling* and *direct-ridesharing* are smart phone applications similar to *www.carpoolworld.com* in a sense that users provide the originating and the arrival locations as texts which are geocoded into latitude and longitude and are pinned on the map. If no exact coordinates could be resolved for the addresses approximate locations are provided.

YolArkadasi is similar to the above mentioned applications as it works in integration with the Google Maps, is capable of returning search offerings that exactly or to some extent match with a search query. Its differentiating features are

1. Originating and arrival location are provided by tapping the map instead of providing an exact address.
2. It shows the route to the closest meeting point if the carpool offering does not exactly pass from the location of the user.
3. It calculates the estimated arrival time of the driver to the meeting point.

The first distinguishing feature removes the necessity of providing exact addresses. Benefit of this feature is twofold: a) the user may not know the neighborhood well, and b) the address may not be geocoded. The second feature is beneficial for those that do not know the area well, as it shows them the shortest route to the meeting point from their current location. With the third feature the application aims to minimize the waiting time, both for the passengers and drivers, at the meeting points.

YolArkadasi is developed for smartphones that run on Android mobile operating system. It is integrated with the Google Maps for web mapping services. It uses Google Maps API [15] functions for route planning and route plotting.

3. System Design and Implementation

The system is composed of three main components: the central service provider, the mobile application, and the map server. The communication between the application and the central control unit and the map server is achieved via, respectively, some user defined web services and web services provided by Google Maps Android API. A web service is a software system

designed to support interoperable machine-to-machine interaction over a network[16]. Since 2005 Google has been providing APIs that allow integration of Google Maps into websites and mobile devices applications. These APIs provideservices such as collecting application specific data, visualization at different levels, and route planning. Figure 1 depicts the component level design of the system.

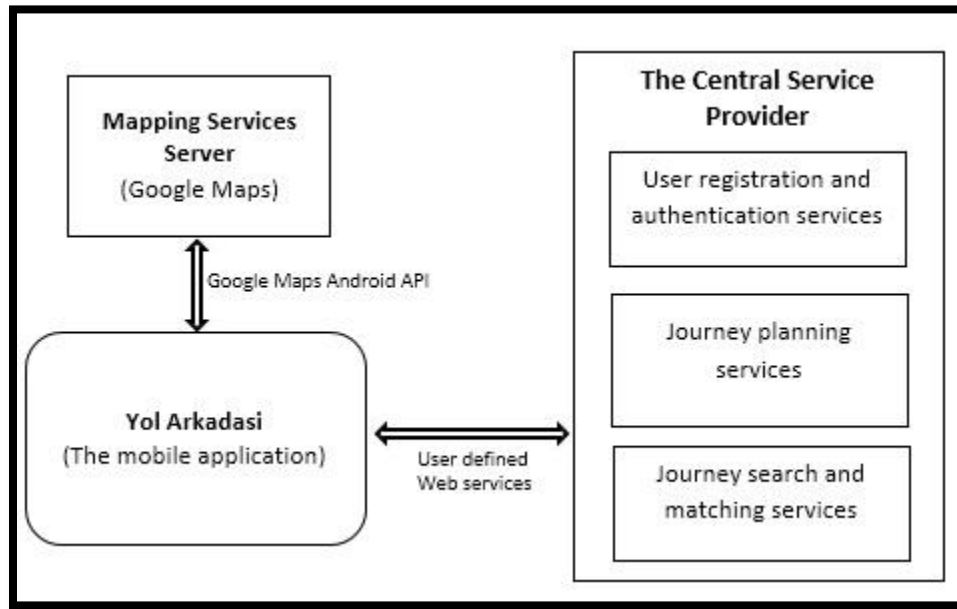


Figure 1. Component level system design

To use the application users need to be registered. *User registration and user authentication* module is responsible for registering new users and authenticate the registered users. To plan a carpool, both parties need to provide their originating and arrival locations and set the type of the carpool either as a regular or a one-time event. Services related to collect such data are provided by the *journey planning* module. Although there may be several carpool offerings, it is rare that a search exactly matches with an offering. *Journey search and matching* module is responsible for matching a search against the search offerings and find out overlapping routes. This module also provides functions such as plotting the route to the closest meeting point and the estimated arrival time of the driver to the meeting point.

Figure 2 shows the use case diagram of the system. Two types of users can use the application: guest users and registered users. The only service available for guest users is the registration service. Registered users, on the other hand, can create a new carpool, search for a carpool, list all of his/her carpool offerings, reply the carpool request sent by other users, or make a request to join a carpool.

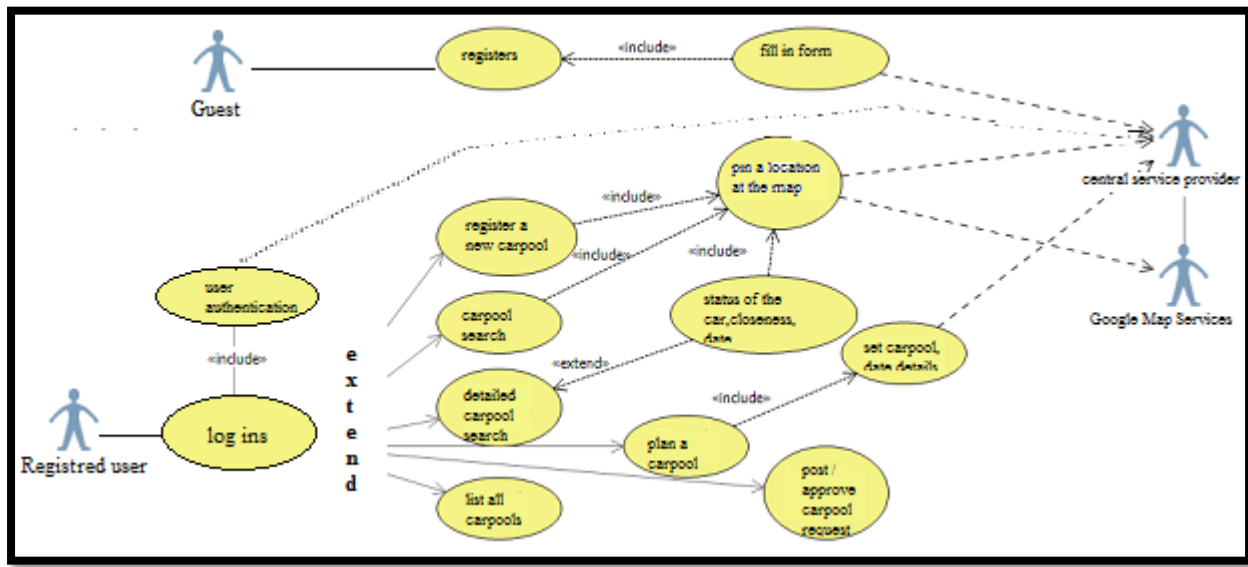


Figure 2. Use case diagram

All the data about the users and carpools are stored in a relational database which resides in the central service provider. The mobile application can access this data via the web services the central service provider publishes.

The application is developed in Java programming language. The mapping services are managed via Google Maps API v2. Web services published by the central service provider are coded in ASP.NET. MySQL is employed as the database management system. The application is developed for devices that run Android OS version 2.3.3 or higher. The central service provider needs to run on a Windows OS with ISS extension.

Figure 3 is a snapshot of the user login and user registration windows. Users are prompted with appropriate error messages when an invalid user name (e-mail address) - password pair is entered

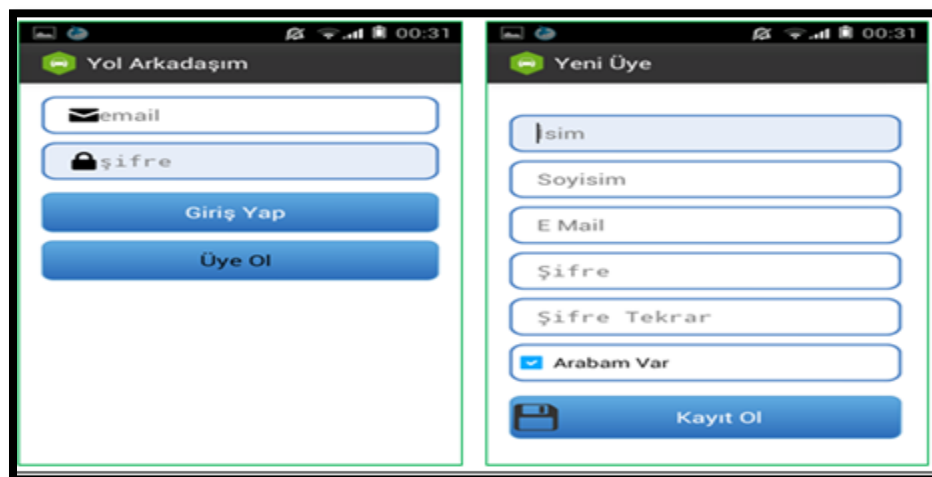


Figure 3. GUIs for user login and registration

at the login screen and different passwords are provided during the registration step. Users also need to provide whether they own a car or nor.

Figure 4 is a snapshot of the main menu window that a registered user faces. Through this window a registered user can create a new carpool with the *YeniKonumBelirle* button, list his/her upcoming carpools with the *Güzergahlarım* button, modify his/her carpools with the *Güzergah Planla* button, and search a carpool with the *Güzergah Ara* button. *Gelen* and *Giden* buttons list the carpool requests the user has made and received, respectively.



Figure 4. GUI for main menu

In figure 5 GUIs for creating a new carpool offer are shown. In the first window, namely *GüzergahKaydet*, the user sets the journey name and the originating and the arrival points by tapping the pins which invoke the map. In the second window, namely *KonumSeçiniz*, default route generated by the Google Direction API is plotted. The user may modify the route by adding stopovers. In this window the user may zoom in/out the map to correctly set the route. When the *Kaydet* button is tapped the third window, *Güzergah Kaydet*, is activated which shows the originating and the arrival address boxes filled – which were initially empty. Tapping the *Kaydet* button in the third window finalizes the journey planning operation. Tapping the *İptal* button in the second window clears the map while the same button in the third window returns to the main menu window.

Carpools that are offered by a user are listed on the *Güzergahlarım* window which is shown on Figure 6. Tapping on a carpool offer activates the *Güzergah Detayları* window where details of the carpool are listed. For each carpool originating and arrival addresses and the distance between them are displayed. *Haritaüzerinde gör* button shows the route on the map.

Users can modify their carpool offerings by tapping the *Güzergah Planla* button. Screenshots for

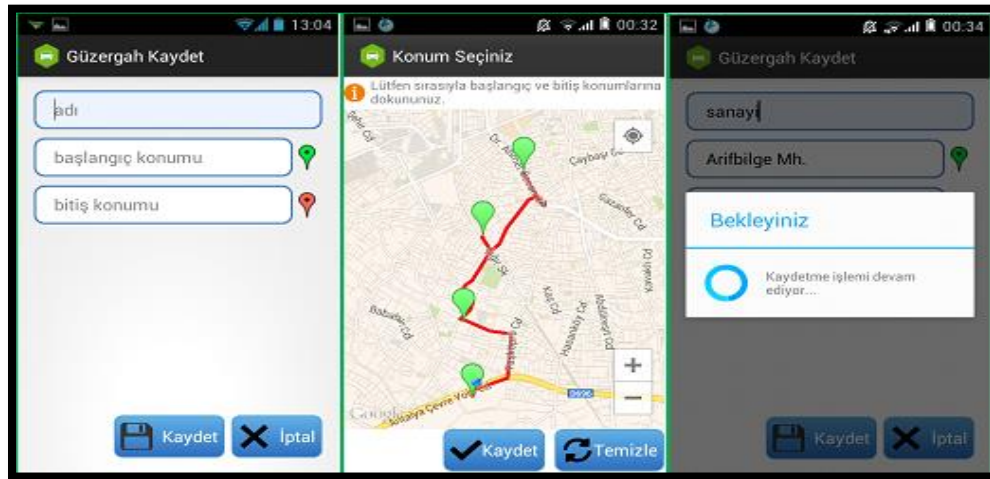


Figure 5. GUIs for creating a new carpool



Figure 6. Carpool details

this operation are shown on Figure 7. To modify a carpool, a user first needs to select the name of the carpool from a list-box and then set whether this is a one-time or a regular carpool. If the carpool is a regular event the user needs to specify its frequency, i.e. once a week, every day, or working days only. The user also needs to set the date, or the start and the end dates of carpool if the selected carpool is a regular event, and the time.

By tapping the *GüzergahAra* button of the main menu a user can search a carpool. The search can be a simple search or a detailed search. In the simple search user simply pins its originating and arrival locations and the application returns the upcoming carpools that have these locations on their route. In the detailed search a user needs to provide the date and the time of journey he/she is looking for, his/her originating and arrival locations and the distance he/she can travel for meeting up. GUIs for searching a trip are shown on Figure 8.



Figure 7. GUIs for scheduling a carpool



Figure 8. GUIs for searching a carpool

Search results are listed as shown on Figure 9. The first window shows those carpools that pass through the user's originating and arrival points. For each result, enlarged in the second GUI, name of the carpool, name of the driver, originating and arrival points of the driver and the driver's total trip distance are provided. When tapped on a carpool, a map that shows both the

sought trip and the found trip is displayed. In the third GUI of Figure 9 the route drawn in red is the driver's route and the one in green is the sought one.

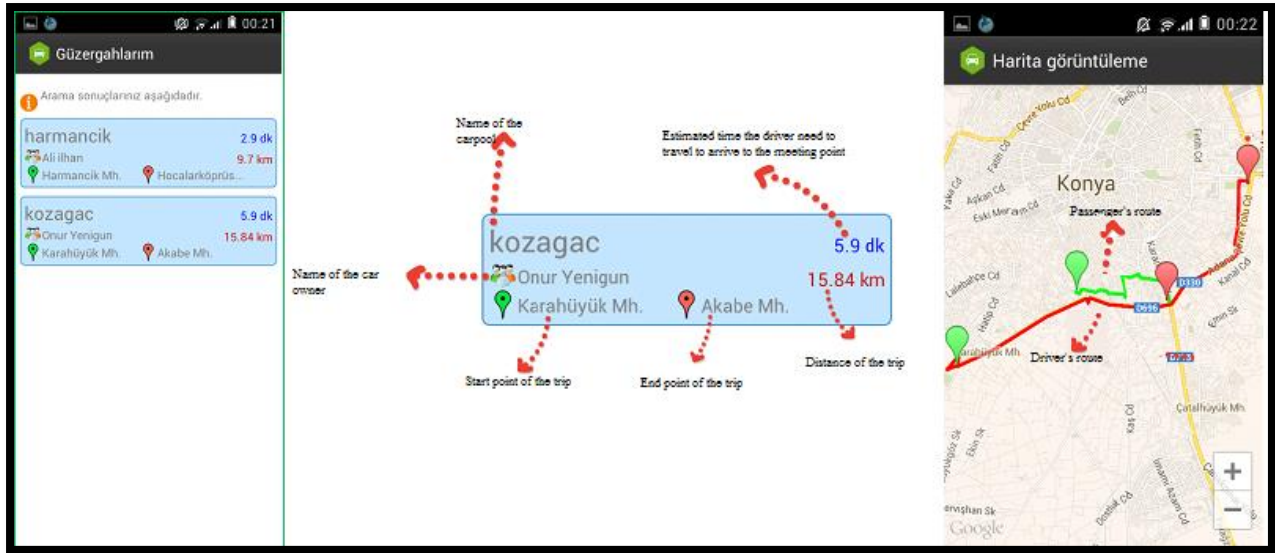


Figure 9. GUIs for listing results of trip searching

The application also provides interfaces for users to communicate, and follow their carpool requests. Figure 10 shows these interfaces. With the *İstekGönder* window a user sends text message to a carpool owner. The second window lists the carpool requests made by other users, and the last window shows the status, i.e. approved, rejected, pending, of carpool join requests made to other users.

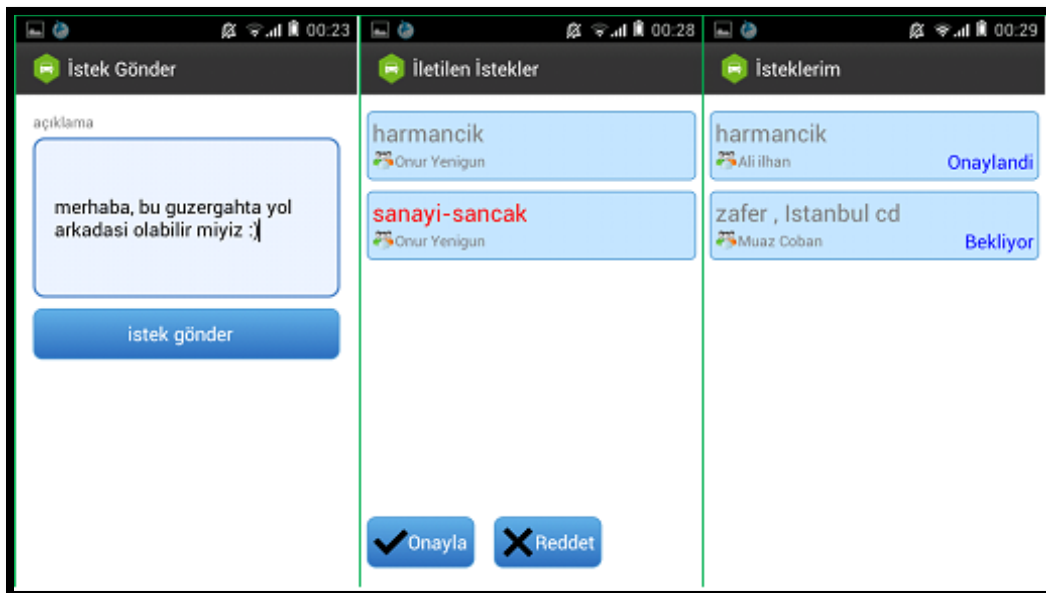


Figure 10. GUIs to set up a carpool and follow requests

5. Discussion and Future Remarks

As far as we know YolArkadasi is the first carpooling application that supports Turkish. When compared to similar studies it has the following distinguishing features:

1. It uses maps to plan the journeys rather than providing originating and arrival addresses.
2. Plots the route passenger need to follow to the meeting point and the route to his/her destination after leaving the car.
3. Calculates the estimated arrival time of the driver to the meeting point.

To further improve the application we plan to store the journey plans in databases that are specifically developed to store geographical data and add mechanism to rate drivers and passengers.

References

- [1] Ferguson, Erik. The rise and fall of the American carpool: 1970–1990. *Transportation* 1997; 24.4: 349-376
- [2] Minett, Paul, and John Pearce. Estimating the energy consumption impact of casual carpooling. *Energies* 2011;4.1: 126-139
- [3] Galovski, Tara E., and Edward B. Blanchard. Road rage: a domain for psychological intervention? *Aggression and Violent Behavior* 2004; 9.2: 105-127.
- [4] Buliung, Ron N., et al. Catching a ride on the information super-highway: toward an understanding of internet-based carpool formation and use. *Transportation* 2010; 37.6: 849-873.
- [5] Minett, Paul, and John Pearce. Estimating the energy consumption impact of casual carpooling. *Energies* 2011; 4.1: 126-139.
- [6] Massaro, Dominic W., et al. Carpoolnow-Just-in-Time Carpooling without Elaborate Preplanning. *WEBIST*. 2009.
- [7] Konishi, Hideo, and Se-il Mun. Carpooling and congestion pricing: HOV and HOT lanes. *Regional Science and Urban Economics* 2010; 40.4: 173-186.
- [8] <http://www.carpooling.com/us/>, last access August 2014
- [9] <http://www.carpoolworld.com/>, last access August 2014
- [10] <https://developers.google.com/maps/documentation/geocoding/>, last access August 2014
- [11] <https://www.erideshare.com/>, last access August 2014
- [12] <https://play.google.com/store/apps/details?id=com.carpooling.android.uk&hl=en>, last access August 2014
- [13] <https://play.google.com/store/apps/details?id=com.avego.avegodriver&hl=en>, last access August 2014
- [14] <https://play.google.com/store/apps/details?id=com.smartroute.free&hl=en>, last access August 2014
- [15] <https://developers.google.com/maps/>, last access August 2014
- [16] Web Services Glossary W3C. February 11, 2004, last access August 2014