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CARPOOLING SYSTEM

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ABSTRACT: **By reviewing ride-sharing studies around the world, this paper aims to map major aspects of ride-sharing, including online platforms, user factors and barriers that affect ride-sharing services, and extract useful insights regarding their successful implementation. This paper describes the design concepts, distribution and cloud computing strategies the authors feel any future global carpool and ride-sharing solution could follow, making it very scalable and ubiquitous enough to successfully reach and serve a global user base. Opportunities exist to improve the quality of existing ride-sharing services and plan successful new ones. Future research efforts should focus towards studying ride-sharing users' trip purpose (i.e., work, university, shopping, etc.), investigating factors associated to ride-sharing before and after implementation of the service, and perform cross-case studies between cities and countries of the same continent to compare finding opportunities exist to improve the quality of existing ride-sharing services and plan successful new ones. Future research efforts should focus towards studying ride-sharing users' trip purpose (i.e., work, university, shopping, etc.), investigating factors associated to ride-sharing before and after implementation of the service, and perform cross-case studies between cities and countries of the same continent to compare finding.**

1. INTRODUCTION:

Ride-sharing aims to minimize negative impacts related to emissions, reduce travelling costs and congestion [1, 2], and increase passenger vehicle occupancy and public transit ridership. During the last decade, innovative mobility solutions were introduced, including on-demand mobility services and Mobility as a Service (MaaS), that focused on daily travel needs to promote sustainable transport [2].The literature uses the term "ride-sharing" to describe various mobility sharing concepts. Ride-sharing refers to the common use of a motor vehicle by a driver and one or several passengers, in order to share the costs (non-profit) or to compensate the driver (i.e. paid service) using billing information provided by the participants (for profit). In this study the term is used to describe the common use of a motor vehicle for cost compensation, in the context of a ride, that the driver performs for its own account (referred also as Carpooling); thus, it is not intended to result in any financial gain [2].

2. RELATED WORK:

As noted, this section deals with existing carpool related work. Subsection A reviews carpool and ride-sharing related solutions currently available and subsection B surveys some of the literature and papers on the subject.

A. Current carpool and ride-sharing solutions- Entering carpool and ride sharing search terms in some of the largest mobile app store and internet search engines returns a great deal of mobile apps and internet websites offering either classic or dynamic carpooling and ridesharing. Classic carpool mobile app or website indicates that its users effectively schedule and advertise their plans for a trip well in advance, effectively via a searchable electronic bulletin board, seeking other users travelling in the same direction at the same time either in part or fully. Although some of those apps and websites, such as carpooling.com [6] and its mobile client apps have their uses and large user bases, the static routing problems they help solve makes those uses fairly limited. A new form of dynamic carpool and ride-sharing mobile apps and websites is emerging, indicated by their use of real-time passenger requests along with real-time vehicle driving users' location data, foregoing the need for well in advance pre-scheduled and advertised trips. Amongst some of the most known and pioneering mobile apps and websites offering dynamic carpooling and ride-sharing are Lyft [21] and SideCar [22], screenshots of their mobile apps are given in Fig. 1.

Both of the listed mobile apps are available for iOS as well as for Android mobile platform, from which screenshots are taken, but neither currently present a web browser user interface. This is probably intentional since both mobile apps are natively written, and by our observations both use TCP sockets to communicate with their respective backend services, so they would both need some changes to make them web-friendly. Unfortunately, those code changes could include some rather tedious transformations because native TCP socket traffic has not been well suited for consumption in web browsers relying dominantly on HTTP, until recently.

B. Current carpool and ride-sharing papers

Because static variety carpool still represents the majority of existing solutions, almost all of the available papers and literature on carpool and ride-sharing mainly tackle the static ridesharing issues, whereby users must pre-schedule their trips, neglecting the dynamic aspect. Despite much of the progress experimented on dynamic carpooling and ridesharing concepts thanks to the current solutions, it still remains in the early stages regarding publicly available works and literature that deal with its real-time automation.

3. DESIGN:

In this section we are building up on those solutions and ideas, proposing some of our own design concepts for a global dynamic real-time carpooling and ride- sharing solution. Subsection A describes some of design concepts we feel are suitable for a real-time dynamic carpooling and ride-sharing solution.

A. Real-time dynamic solution design concepts

As it was noted in section II, real-time dynamic carpooling and ride-sharing solutions are becoming more common amongst the current carpooling and ride-sharing solutions, although it takes more designing effort to achieve real-time dynamic capabilities than for mere static carpooling and ride-sharing. The reason for the recent increase is obviously because real-time dynamic solutions are more convenient, and thus more likely to be used in greater numbers by end users, but also because some technologies previously used for seemingly real-time communication on the web, have only recently matured and have been standardized.

In the begging of the so called Web 2.0, at the time when real-time updating websites were only just starting to appear, most of those websites used Asynchronous JavaScript and XML (AJAX) [10], which is a group of interrelated web development techniques used on the client-side to create asynchronous, seemingly real-time web applications. Most of those techniques relied upon regular HTTP, a simple request-response and stateless protocol. Having to achieve what was usually two-way communication took some effort for websites and web applications, using various workarounds, techniques involving the use of the browser XmlHttpRequest object or some other web browser plugins.

B. User interface architecture design concepts

To make a website or mobile app truly ubiquitous, one needs to support as many different desktop and mobile platforms as possible, ideally all of them. Although client applications can be natively written for each platform, there are some unifying user interface technologies for almost all current desktop and smartphone mobile platforms today.

4. FUTURE WORK:

Early adopters of the online taxi dispatching service will get the benefit of being able to track a few assigned taxis in real-time. Drivers of those taxis will be either issued mobile devices with pre-installed HTML5/CSS3 web clients and/or those client apps will be installed on their own devices. Such real-world tests will hopefully lead to identifying problems not yet foreseen. To reach that point however, some other issues, such as security and privacy, will also need to be tackled. In [5] the solution for the security and privacy issue was implied by use of a 3rd party location based service (LBS), which used OAuth protocol to authenticate and subsequently authorize which exact set of users would be allowed access to the authorizing user's location. Unfortunately, come February 2013 the 3rd party LBS was shut down, and an alternative solution should either be found or developed prior to prototype's launch as a standalone service. Trying to avoid the repeat of having to find alternatives to a 3rd party components not being operational any more, the focus could be on building up own LBS features respective of privacy, but relying on information which can be provided from popular social networks. To aid us in that endeavour, instrumental part of the puzzle could be Windows Azure built-in Access Control Service (ACS), allowing for users to single sign-on to the proposed carpool and ride-sharing service just as if they were signing into the aforementioned social networks. If those users comply, their location data could then only be made accessible to a subset of their social network friends, a widely acceptable solution from a current privacy standpoint.

5. CONCLUSION:

This paper tried to underscore the need for developing dynamic real-time carpool and ride-sharing solutions, instead of already outdated static ones, by employing some novel web technologies and approaches. Since a prototype has been successfully developed following the outlined design concepts, distribution and cloud strategies, it is obviously possible to build other such solutions using the same approaches. The systematic literature review of ride-sharing studies allowed us to have a comprehensive overview of academic publications dealing with ride-sharing platforms, user factors and barriers.

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