NuCarpool - Real-Time Dynamic Carpooling App for Mauritius using Push Service

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ABSTRACT

Following the launch of carpooling.mu, that is a website that provides carpooling services in Mauritius, we decided to add to it by developing a Mobile Application that will reduce the use of personal/public means of transport by favoring the use of carpooling. By adopting the application, users will help reduce high CO2 emission by cars, hence leading to less air pollution. Having a mobile application (anywhere, anytime) enhances the real-time capabilities and makes the carpooling service more dynamic, especially by using the Push Service. The Push Service is a method in which one action triggers a set of other actions. Be it a ride that is being offered or a person looking for a ride, a series of action are undertaken. Though the App provides minimal security, it uses a circle of trust system, to provide a sense of secureness to people looking for a ride.

KEYWORDS

Carpooling, Mobile Application, Android, Trust, Push Service.

1 INTRODUCTION

Mauritius has known a boom in the transport sector over the last 2 decades. Bearing in mind that transportation accounts of 29% of all greenhouse gas emissions – [1], it has a devastating impact on our environment today. Figure 1 show in the increase in the number of buses and other vehicles in Mauritius from the year 1992 to 2012. The number of buses has increased by only 41% compared to the total number of vehicles is nearly 300% - [2]. Public transport is limited to buses and taxis only and crowded buses is daily story. Hence the growing number of cars. However moving to personal means of transport is not solving the transport problem in Mauritius. Since the number of vehicles has grown exponentially, there is a huge congestion issue in the morning and afternoon for vehicles going to and from the capital city, Port-Louis.

Green IT is the latest trend in application development; it is a wise study and practice of using information technologies in such a way that it uses computing resources effectively and at the same time making its contribution to the environment. Taking into consideration the benefits, much research are being done in finding solutions to help save the planet from climatic changes and carpooling is one of them. Carpooling is the term used for the action of sharing car journeys to other person travelling to the same.

Furthermore, carpooling has predictable environmental and social benefits that include:
• Reduction of traffic congestion as number of vehicles on the road can be cut down by more than an third.
• Fuel consumption, miles of travel of a particular vehicle and emission of gases by the vehicles can also be reduced.
• As the system aims at the empty seats it increases vehicle occupancy.
• More efficient land use as parking requirement is reduced. Thus also helps in saving cost of building and maintaining infrastructure.

The remainder of this paper is organized as follows: In Section 2 we discuss about the related work done in this area. In Section 3 we present the Carpooling App, that is, its design and features. In Section 4 we discuss about the issues of the adoption of carpooling and solutions applied. And the paper is finally concluded in Section 5.

2 RELATED WORKS

The main objective of Carpooling is to contribute socially by helping other persons getting to their destination, which is along the same route as the driver’s and environmentally by helping to reduce CO2 gas emissions, traffic congestion, fuel consumption and so on. Carpooling is not a new concept; it started off with hitch-hiking.

The importance and impact of a carpooling application is broadly discussed in [9]. Carpooling Application started off as web-based service in the year 2000 as presented in [3]. It provided the user with a web interface that allowed users to type the address of the departure and destination. The application used a GIS database to establish the coordinates and the distance that will be travelled. Email is used as the mode of communication between the users and application. In [4], a collaborative carpooling system was implemented. The system used a credit mechanism that allowed user of the carpooling system to have parking facilities. CarPoolNow [5] was the first mobile application designed for carpooling. It had a conceptual framework for high precision mapping of rides using web, geo spatially enabled database and java enabled mobile phone. WiSafeCar [6], is another implementation of a carpooling system with the integration of wireless protocol 802.11p (WAVE) for communication between vehicles. However, it has only been simulated and no real life deployment is also planned yet. In [7], the authors implemented a real-time carpooling system using push service. They also investigated social carpooling, which benefits from social groups already formed. However it had only a web-based implementation.

The implementation of NuCarpool goes further by using the push service; Android based mobile application, Google Map V.3 together with GPS, Link to Facebook (social), Security and Trust features.

3 CARPOOLING APP

3.1 Design

The Carpooling System should be able to do the following:

i. User Registration
ii. Submit lifts or Request for lift
iii. Matching of offers to requests
iv. Communication and agreement of the matching.
v. Rating of ride/driver/passanger
vi. Feedback gathering
vii. Provide statistics for individual users and overall system in terms of green contribution.

Figure 1 – Statistics of vehicles in Mauritius
3.1.2 Push Service

The Push Service is basically a set of actions triggered by one action. There are two sets of Push service that have been implemented:

a. **Offer Push Service** – Once an offer is registered, the system needs to match requests to the offer received; any matching would result in the communication of the matching to both parties, and wait for their approval; Once approved, a final round of communication is done.

b. **Request Push Service** – Once a request is registered, the system needs to match offers corresponding to that request. If no match, the request will be put on hold, until new offers are received. If there is one or more matches, the requestor is asked to choose among the list and communication processes are then completed as in the Offer Push Service.

3.1.3 System Architecture

The Carpooling System will be hosted and the Webserver will be in turn connected to a database server (MySQL). On the smartphone, an android based mobile application will access the webserver either through Wi-Fi/GPRS/UMTS/3G. SMS/chat will be used for the dissemination of the matching process.

3.2 NuCarpool App

The NuCarpool App has been built on the Android platform as latest statistics shows an exponential increase in the sales of android based smartphone as described in statistics from IDC Worldwide Mobile Phone Tracker– [8].

3.2.1 Registration

The registration process is done through an interactive form as shown in Figure 3 & 4. Figure 5, is used for entering details about the driver’s car.

![Figure 3](image1.png)  ![Figure 4](image2.png)  ![Figure 5](image3.png)

3.2.2 Rides

Then each time the user has login. Figure 6 shows the form for posting a ride and Figure 7 shows the Google Map integration that provides the best route to reach the destination. Also note that in Figure 6 there is a Facebook posting button, which allows the user to post that activity.

![Figure 6](image4.png)  ![Figure 7](image5.png)
3.2.3 Rating & Feedback

After each, and before any passenger/driver can request for another ride, they are requested to provide rating and feedback on the safeness and friendliness of the ride. The figures 8 and 9 illustrate the different rating and feedback that passengers and drivers provide.

3.2.3 Statistics

NuCarpool system has been designed, having in mind Green IT. That is helping to reduce the increasing amount of gas emission/ fuel consumption by vehicles on our roads. As such, in order to evaluate the success of our application, we need to present statistics. NuCarpool App, displays statistics for individual users (Figure 10 & 11) (both passengers and drivers) such as Number of Rides, Distance Travelled (kms), Amount of Fuel saved and CO\textsubscript{2} gas emission saved. Another global set of statistics (Figure 12) are produced for the application itself. It consists of the number of requests, number of offers, and the number of matching that has been done as well as other statistics in line with the ones presented for passengers/drivers.

4 ADOPTION OF CARPOOLING APP

Though Carpooling seems to be very beneficial environmentally and socially, many implementations faced huge difficulty in attracting potential users. We address this issue by having the following features:

i. Trust (Circle of trust)

Travelling with an unknown person for the first time can be a hurdle. However having reviews and ratings of driver will create a sense of trust. And through the principle that a friend’s friend is a friend, our application creates a circle of trust that helps overcoming that hurdle. Administrator could also remove drivers with bad ratings.

ii. Individual and Application’s green statistic

As each individual users, be it a driver or a passenger, will be presented with a set of green statistics, they will be motivated in being involved with the environment saving mobile application. The global statistics for the whole App will be motivating as well.

iii. Facebook Integration

A Facebook page has been created (www.facebook.com/pages/Nucarpool). And members of the page will receive notifications from the application whenever a lift is offered and the driver accepts to post the information on Facebook. Search implementation will greatly increase the popularity of carpooling App.

5 RESULTS

NuCarpool App is just over 2 months old; however the website (carpooling.mu) has been in use for over a year. So we evaluate the data
gathered and represent it graphically below, as shown in Figure 13.

![Figure 13 – Usage statistics of carpool in Mauritius](image)

Assuming the following data from [9]:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average distance travelled by a car daily</td>
<td>39.78 km</td>
</tr>
<tr>
<td>Average no. of working days in a month</td>
<td>24.06</td>
</tr>
<tr>
<td>Average fuel consumption of cars</td>
<td>15.29 km/lt.</td>
</tr>
</tbody>
</table>

We can calculate the following statistics as illustrated below in Figure 14.

![Figure 14 – Fuel and CO₂ Savings](image)

6 FUTURE WORKS

We intend to continue improving the system and add pertaining features such as real-time traffic information as a criterion for the searching mechanism and move the database on a cloud platform to reap the benefits of that distributed architecture.

8 CONCLUSIONS

In this paper, we have shown that NuCarpool App, which is a mobile application running on Android and using a push service, can bring a significant environmental and social contribution to Mauritius. So as to promote carpooling in Mauritius, we have used motivators such as personal statistics and social networks. Finally our evaluation shows that the NuCarpool has already saved 13000 litres of Fuel and 40,000 Kg of CO₂ gas emission.

9 REFERENCES


