



International Journal of Research Publications

Survey for Traffic Reduction and Management Plan through Carpooling System

Madiha Rasheed^a, Aroosh Fatima^b

^aResearch Centre for Modeling and Simulation (RCMS), National University of Sciences and Technology (NUST), Islamabad, Pakistan

^bResearch Centre for Modeling and Simulation (RCMS), National University of Sciences and Technology (NUST), Islamabad, Pakistan

Abstract

This particular plan is applicable to the transportation project Traffic Reduction and Management Plan through Carpooling (TRMP). It identifies and defines the organization, activities, overall tasks, principles, and objectives of Systems Engineering Management required managing and controlling the project. It provides modern, state-of-the-art, project management requirements for identification of the overall best technical system, and procurement, installation, commissioning and maintenance of the selected equipment. It emphasis on a disciplined integrated systems development approach that is essential for such complex systems. The system that we are implementing for sharing vehicles is also known as Carpooling. It reduces the costs involved in car travel by sharing journey expenses such as fuel, tolls, and car rental between the people travelling. It is one of the best ways to reduce the traffic on the roads, pollution and the need for parking spaces. It can also be described as the most efficient way to achieve sustainable growth with less environmental pollution.

© 2018 Published by IJRP.ORG. Selection and/or peer-review under responsibility of International Journal of Research Publications (IJRP.ORG)

Keywords: Carpooling; Traffic Reduction; Traffic Management

1. Introduction

The development of Traffic Reduction and Management System will help in deployment of system that will solve two major problems of urban areas:

- Traffic problems
- Pollution

By using this system we can reduce the current traffic congestion situation that is mostly face by people doing jobs. Because mostly offices are located in the commercial areas that cause problems to people in busy hours as well as in parking their vehicles. Majority of people comes to job from nearby areas of main cities that is one of the main causes of traffic congestion too. So those people who are willing to share their vehicles with other while going to office as well as by those who are traveling outstations can use this system .This can be done by sharing their information through registration with mobile application or web portal .Additionally registration can also be done through social media account to provide ease to customer. This can also be used for frequent trips for nearby places if informed few hours earlier before traveling time. The system that we are implementing for sharing vehicles is also known as carpooling. It reduces the costs involved in car travel by sharing journey expenses such as fuel, tolls, and car rental between the people traveling. It is one of the best ways to reduce the traffic on the roads, pollution and the need for parking spaces. It can also be described as the most efficient way to achieve sustainable growth with less environmental pollution. It also gives you the opportunity to develop new friendships with co-workers or other commuters. There area number of benefits when two or more people share a ride in one vehicle. This project can be, and should be linked to other mass transit systems that are used for the purpose of solving day to day life problems regarding traffic. We are solving problems of people that are coming to major cities from nearby places. Because Metro Bus Project and Private Vehicles are only facilitating people on specific locations there are still many people who are unable to take advantage from them. While other car services are rental cars that are using as cabs by people by paying huge fairs.

2. Related Work

In major cities, number of people from near-by cities and town come for the sake of job, which can create lot of problems because of limited parking space. Although, many organizations and commercial owners are trying to accommodate people by making underground parking space but due to great usage of same buildings by multiple companies, this problem still becomes nightmare for most of the people. This problem is not only with parking for workplace but also for airports, universities and shopping centers. This can affect life of residents and can cause loss of business because most of the people avoided to go there [1]. This research gives survey for the methods and their shortcoming. Air pollution is one of the majors concerns for environmental list. It can cause serious issues for the people living in cities [2]. Carpooling is a transport system in which people who are going to workplaces or colleges share their private transport with their colleagues. It is beneficial for reducing air pollution and traffic congestion as these are two main issues in populated urban areas [3]. Dynamic carpooling can be used by using smart phones, GPS, and social media but they can raise several privacy issues [4]. Dynamic carpooling is an important solution for reducing traffic especially in peak hours. Matching technique algorithm is used for selecting suitable riders by defining terms and condition [5]. ANDROID based application was proposed that will help people to know that either vehicles are available for carpool on desired path with the help of GPS .This will help people to private

transport without booking cab. It will also increase social connection [6]. Carpooling system can be used by using technology which is supported by memory device and navigation system with algorithm used for calculating distances that could help drivers and riders [7]. One of the major concern for people is the increase prices of petrol and gasoline that can also be solved by sharing rides but after verifying the drivers for security concerns [8]. The proposed way of increasing carpool is on the government for introducing carpooling programs seminars for people and to build carpool lane [9]. This research is carried out for discussing important aspect of carpooling and its importance. It's very disappointing that only few researches are carried out on it.

3. System And User Needs Analysis

This section gives background information about specific requirements of the web based carpool environment to be developed in brief. Although we will not describe every requirement in detail, this section will describe the factors that affect the final product.

System needs are as follows:

- Flexibility - Carpooling can struggle to be flexible enough to accommodate route, stops or changes to working times/patterns.
- To make it reliable because it may be difficult to find a match for certain trips. So it will try to remove such problems.
- To encourage more people to use mass transit. If more people do this, there will be fewer cars on the road, less congestion and less pollution.
- To fully realize this potential, platform operators should implement multi-hop search, assume active control of pricing and booking processes, improve coordination of transfers, enhance data services, and try to expand their market share.

A. Customer Needs

In many cases the acquire may not be fully aware of his needs. It is therefore essential that the needs are expressed as definitive requirements by the systems engineering experts so that the perceived needs are converted into realistic requirements.

B. Mandatory Requirements

Mandatory requirements are those necessary and effective conditions that a minimal system shall have in order to be acceptable. (written with words "shall" and "must"). These are specified in definitive terms and are not susceptible to tradeoffs between requirements. All alternate candidate designs must satisfy the mandatory requirements. Following are the mandatory user requirements for this project:

System handle 1, 00,000 user must register themselves through web portal or mobile App as well as integrate with social media.

- The system main goal is to reduce traffic total traffic travel between Rawalpindi and Islamabad and to facilitate each registered user coming on working days in busy hours.
- The system must be user friendly, must interact with any user located in Rawalpindi/Islamabad and at any time.
- System must be upgraded after every new changes made by user. This will upgrade as per

requirement within seconds.

- User data should be secured to avoid any personal leakage of information through firewall.
- Map picker: for picking the meeting points.
- Carpooling can struggle to be flexible enough to accommodate route, stops or changes to working times/patterns. And update status of user within seconds.

We are taking assumption from data that we collected from Islamabad Capital traffic police as well as from research about cars that are coming from outside areas for sake of work and face problems regarding parking.

Table 1: Traffic Estimation to Workplace during Working Days

No. of cars coming to Islamabad/Rawalpindi on working days	20,000.00
Population of Islamabad	14,300,000.00
No. of cars coming within Islamabad	300,000.00
No. of cars coming to offices within Islamabad	80,000.00
Total Cars	100,000.00
Cars usual capacity excluding Driver	3.00
No. of organization in Islamabad	200.00
Normal Parking of workplace can accommodate maximum	200.00
Total parking capacity	40,000.00
No. of cars coming to Islamabad/Rawalpindi after carpooling	6,666.67
No. of cars travelling within Islamabad after carpooling	26,666.67
Cars cannot accommodate in parking	60,000.00
Cars Reduction after carpooling	66,666.00

Table 2: Fuel Cost Per Car Travelling Outside Islamabad For Average 40km

Distance Covered per liter (km)	12.00
Fuel Cost per Liter (Rs)	66.00
Daily Round Trip Estimated Travelling cost (Rs)	440.00
Travelling cost in working days(Rs)	9,680.00
Cost after Carpooling (Rs)	2,640.00
Total Saving (Rs)	7,040.00

Preferential Requirements

The preferential requirements state conditions that would make the purchaser happier (written with words may” and ”want). These are function of tolerances in the figures of merit and trade offs in these requirements are possible. The preferential requirements in case of this project are:

- Some basic preferences for car travel are i-e Is smoking allowed inside the car?
- Socially enabled: Login using Facebook, Google Plus and share content to social media.
- Pay through the app: The payments for trips go through the application.

4. System Modeling

Models are developed to explore any possible alternative concepts. System models can be in the form of; mathematical models, physical devices, computer simulations, flow diagrams or block diagrams etc. For system design we are using portal website as well as mobile application that can be used for accessing the system. Whenever a new user enters in carpooling system, one must registered oneself with portal website. First of all, he will entered his data which includes his residential and destination address, timings of work, cars model, CNIC number, car license number. According to user requirement, we will look up for suitable matching according to gender and area of work or travelling. If the user requirement satisfied, then members will be added to the cluster. Terms and conditions will be given to him if he agreed; he will pay via debit card or easy paisa. Once payment has been made, cluster information including names and cell number will be given to the user to contact according to his desire. If any user wants to update his profile, then arrangements will be made accordingly to satisfy his needs. Usage includes the following steps:

- Download app
- Fill out personal profile
- Input credit card information
- Start carpooling

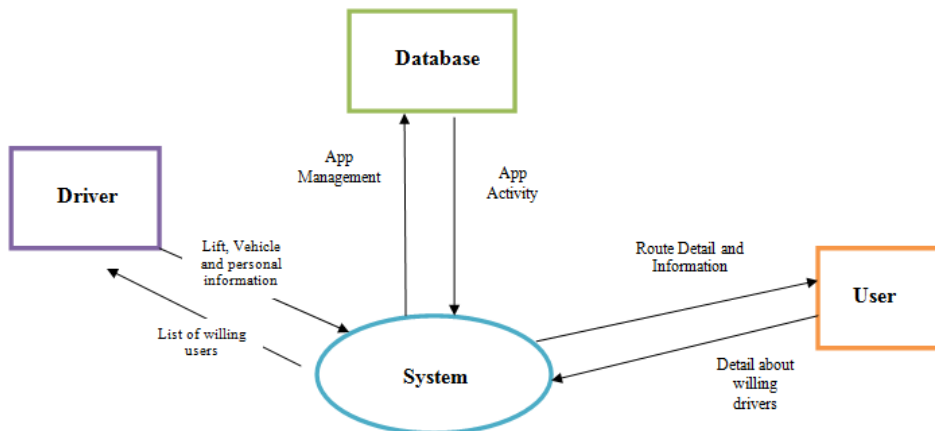


Figure 1: System Model

5. Functional Analysis

System capabilities and the states of the system are progressively identified and analyzed as the basis for identifying alternatives for meeting system performance and design requirements. Other details of functional analysis are discussed below in separate sub-headings.

- **Login/Registration**
Since all the operations that can be done using the application requires both the driver and passenger to be logged in, they can use the login forms of either Google Plus or Facebook. For this matter, the user is prompted to connect the app to his account and then proceed for sign in/up. After the user authorizes the application to access his social media account, the server retrieves his info. If he has never logged to the application before, a new account is created for him.
- **Modify profile information**
All users can modify their profile information. The profile information contain: name, phone number, email, type/color of car if any.
- **Social media sharing**
In order to attract more users to the application and help users find passengers, users should be able to share their activity on the application on social media. A suggestion for sharing trips creation, trips registration or check in should pop-up whenever those previous actions are performed.
- **Rate driver/passenger**
Both the driver and passenger can rate each other in other to gain reputation. The importance of the rating is to encourage users to be helpful and nice during the trip so that they gain popularity in the application.

A. Regular trips

Regular trips include the category of daily basis of sharing vehicles for going to offices or institutions. If anyone is living in the area that is nearby the place of people who are going to offices near by their workplace or institutions can sign up for using the services and if their information match with someone they can share their vehicles on turn-basis.

- **Create new regular trip**
The driver can create a new trip to be displayed when passengers search for trips. The application will prompt the driver or information of the regular trip which consists of destination, origin, meeting point (which can be pointed in a map), departure time/date , estimated arrival time and traveling preferences (number of free spots, price, size of bags, smoking/non-smoking, pets, stops). After providing this information, the user publishes it in order to find passengers.
- **Search for regular trips and reservation**
When a passenger needs to find a driver for a destination, he can use a search form which asks for destination, origin, departure date/time. He can also specify the travelling preferences.

- **Check-in trip**

Whenever the driver or passenger arrives to the meeting point at the time agreed upon, he can check-in the meeting point in order to notify the other user and to show his punctuality. The application will use the devices GPS in order to make sure that the users are in the meeting point. When somebody checks in, a notification is sent to all the carpoolers saying that somebody is in the meeting point.

- **Cluster Information**

When matching is done cluster is defined showing the people name and schedule that who will bring his car on which day and with details of their location of work place or institution.

B. Frequent trip

This category includes the trips that are not daily basis but they are updated as planned by someone who is travelling to outstation and want to share his vehicle with other person who is going to same place. Also by using Google map, route and destination point of the driver can also be fetched and shared with registered member if someone want to share ride then he immediately contact on system and after confirming his seat and payment can reach on way stop by contacting driver.

- **Add frequent trip**

The driver can create a frequent trip where they show the origin and destination, departure and return times in addition to the frequency (daily and weekly).

- **Search frequent trips**

A passenger can search for a frequent that he can join. The passenger should specify the departing neighborhood, destination, departure times and frequency. The application will try to match it with the best trip. If the passenger is satisfied, he can register to the frequent and will be given the contact of the other members.

- **Frequent trips update**

If someone is sharing his/her Facebook or any other social media info, whenever he/she updated location on any day that was not specified earlier, then we will upload information regarding the trip to let people know if they want to go there by sharing vehicle .

6. Life-Cycle Cost Analysis

Life cycle cost analyses are performed periodically to update and include the cost of acquisition and ownership. This effort is an ongoing process that results in identification of the economic consequences of the project. The life cycle cost of every project can be divided into two main categories of fixed cost and recurring cost.

A. Fixed Cost

The fixed cost of this project would include expenses on the following: Cost of Purchasing and installing servers: The tasks your business will need your server to perform as well as the number of users it's expected to serve will largely determine your server's hardware costs. While servers are almost always more expensive than their desktop counterparts, those on a tight budget can find low-cost server options that handle many if not all of the tasks your business will likely need from a server. Cost of interfaces for media connectivity: Few interfaces will be required for interfacing the exchanges and upgrading the media link.

Network Setup within Organization; Internet services should be taken from the Internet suppliers who can offer high speed services with reliable delivery. Network within the organization should be fast to communicate between network and administration department for tracking customers' status and information. Moreover, external communication with the customer via social media and web portal should be quick and reliable to avoid delay and response of their requests and queries.

B. Recurring Cost

The recurring cost of this project would be on the following heads:

- Network Maintenance Cost: The initial estimates have shown that annual cost of this network maintenance including servers would be around Rs. 5,00,000 @ Rs .41000 month.
- Equipment maintenance cost: Only one vendor has quoted an annual maintenance cost of around US \$30,000.00 (US dollars thirty thousand only). The exact cost will be worked out later.
- Office maintenance cost: This will be a variable cost that should be borne by the respective site owners out of their annual maintenance budgets.
- Training for server maintenance: It is recommended that People should be trained by organizing workshop/seminar that gives them knowledge about the functionalities and problems of Servers installed. Moreover hand-on experienced trainings should be organized to upgrade your staff. These people will be responsible for routine O-level maintenance and would be monitoring the equipment installation and commissioning at their respective sites. It is proposed that the cost of training, which is yet to be worked out, be included in the final contract.

7. Risk Management

Optimization takes into consideration the associated risks, technical performance and schedules management over the entire life cycle of a project. The aim of this exercise is to provide the most balanced set of solutions in terms of performance and cost. The risk management plan requires different information to reduce factors that can affect the privacy of system:

- What is the critical information required by dynamic carpooling systems to work.
- How to model the exchange of such information between drivers and passengers in an infrastructure less context. While offering them trust in the information they receive?
- How to protect the privacy of carpooling users from potential attackers? By addressing such issues, this paper aims at integrating the principles of the privacy-by-design for dynamic carpooling systems.

A. Identification

The objective of risk identification is the early and continuous identification of events that, if they occur, will have negative impacts on the project's ability to achieve performance or capability outcome goals. The following four risk areas have been identified and will be identified in the following section:

- 1) **Personal information of customers should be protected:** Customer privacy measures are those taken by commercial organizations to ensure that confidential customer data is not stolen or abused. Since most such organizations have a strong competitive incentive to retain an exclusive access to these data, and since customer trust is usually a high priority, most companies take some engineering measures to protect customer privacy.

- Personnel passwords
 - Public image and reputation
 - Processing availability and continuity of operations
 - Configuration information.
 - Data integrity
 - Confidentiality of information
- 2) **Safety issues during travelling:** The safety of our members is a priority and we have made our web-site as secure as we can. All members' details are stored securely in the database and only the members' intended travel information can be accessed by other members. When it comes to travelling, every member is responsible for his own safety. However, we do recommend that members follow some simple security measures outlined below:
- Avoid exchanging home addresses with your travelling companion before you meet them.
 - Inform a friend or family member of who you will be travelling with, when and to where.
 - If you have any doubts about your travelling companion, for any reason, then you don't have to travel with them.
 - It is your responsibility to check that the person you are sharing with has all the legal driving documents, such as driving license, car insurance and car tax.
- 3) **Liability coverage:** If you are the driver of a vehicle and you are involved in an accident the injuries to those in your car are YOUR responsibility. If you have state minimum limits or just above that, chances are you your coverage will NOT be enough. If the injuries exceed your policy limits your ask risk to be sued and run the risk of losing your personal assets (House, Investments etc.). Increasing your liability insurance coverage and adding an umbrella policy can help protect you from the personal financial liabilities that injured carpoolers or damaged property could bring. Consider higher medical payment coverage: Medical payments coverage makes additional medical payments for your passengers if they are in an accident while you are driving. You may wish to increase this coverage in order to reflect the number of passengers you carpool.

B. Risk Mitigation

- For each risk identified a mitigation strategy should be developed. For the risk areas identified above are the risk mitigation strategies:
- Determine your route and schedule.
- Thoroughly check out your Carpool partners. It is appropriate to discuss driving history and the conditions of the vehicles to be used in the Carpool.
- Ask to review your carpool partners vehicles registration and insurance records.
- Decide on a schedule for driving responsibilities. Lay out who drives when and how often members take their turn driving.
- Be on time. Make sure all members of the Carpool have a way to contact one another in case someone is running late or needs to make alternate plans.
- Establish policies concerning smoking, use of cell phones, music and volume, food and drink.
- Drive carefully and keep vehicles in good working order. There should be an understanding that speeding, recklessness and driving impaired are unacceptable.

C. Risk Monitoring

Personal information of customers should be protected:

1. **Take reviews from the members:** to constantly monitor the performance of this system. The residential address will not be shared with any member, after matching only contact numbers will be shared, further queries will be shared by member with each other. Pick and drop points will be defined so address of members will be confidential. We will also ensure no data will be misused by survey/ questionnaire for survey purpose for judging either customers are satisfied from us and other members and it will increase their trust on this system.
2. **Safety issues during travelling:** This risk can also be monitored if the driver and the passenger can authenticate each other without disclosing their identities. Any carpooler, either the driver or the passenger, cannot be linked to a particular carpooling trip, even the system server and other carpoolers plan.
3. **Liability coverage:** The most important type of insurance you need to consider when carpooling is liability insurance. Accident benefit and liability coverage are mandatory for all vehicle owners that are registering in our system. It provides coverage for medical treatment, income replacement and other coverage if you are injured in an accident. Additionally, it provides protection if someone else takes legal action against you as a result of an accident. Carrying multiple unrelated people in your vehicle poses higher liability risk than driving only yourself and your own family. If driver is involved in auto accident while carpooling, he will be responsible for paying for all injuries to all of his passengers as well as anyone he hit. This can quickly lead very expensive if one does not have sufficient coverage.

8. Configuration Management

Configuration management (CM) is a systems engineering process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design, and operational information throughout its life. To maintain the process of carpooling we should follow following steps:

- Your own distinctive graphical branding and layout .
- staff can easily modify the written content on information pages in the site and load files and images
- agreement to your terms and conditions is enforced in the registration process
- car pool summary statistics (membership breakdown, match-making activity) are available
- a full range of reports from the system are provided:
 - clients
 - travel plans
 - these also available for download to spreadsheet
 - ability to organize car pools for one-off events
- manage clients (add/maintain/delete)
- manage car pool sticker allocation
- client feedback forum can be managed/moderated

9. Verification And Validation Plan

Verification and validation of whether the information content of the system is complete and correct will rely on two reviews of the pertinent information:

- The system will perform a check for completeness and correctness of the needs and requirements. This will ensure that location that a person wants to travel is matching and timings are according to his schedule. This check will be presented to user as part of the technical reviews.
- User will review and comment on the check of needs and requirements performed by the System to ensure that all user needs are defined and that the requirements stated satisfy a particular user need.
- When we analyze our database for matching of registered members according to their requirements, we are considering mandatory requirements first i-e: Gender, Residential Area, Schedule, Work place /Institution, Capacity in Car

If we match requirements in our data base then we made cluster according to the user need and assign them cluster number via their account and after payment list of their cluster is shared with them with detailed schedule and contact information that who will bring vehicle on given day.

10. Conclusion

This plan is prepared to establish the philosophy and strategy for qualifying the System. The organization will prepare the plan with the coordination of technical and management department as well as with the vendors. In this case random data from our employs will be collected and tested by vendor. After verification and validation matching algorithms designed for customers will be run on that data to check correct output and performance of server. This test will show either our algorithms are working correctly or response time of server. Performance analysis of network will also be done by network parameters. In future, we need to create government programs to motivate people for using carpooling. Additionally, we need to design such applications and algorithms that provides perfect matching for riders and drivers.

References

- [1] K. E. Zannat, *et al.*, "Parking Demand and Supply Analysis of Major Shopping Centers in Dhaka—A Case Study of New Market Shopping Center along Mirpur Road," *Journal of Bangladesh Institute of Planners ISSN*, vol. 2075, p. 9363, 2013.
- [2] P. C. Stern, *et al.*, "Value orientations, gender, and environmental concern," *Environment and behavior*, vol. 25, pp. 322-348, 1993.
- [3] M. Bruglieri, *et al.*, "PoliUniPool: a carpooling system for universities," *Procedia-Social and Behavioral Sciences*, vol. 20, pp. 558-567, 2011.
- [4] R. K. Megalingam, *et al.*, "Automated wireless carpooling system for an eco-friendly travel," in *Electronics Computer Technology (ICECT), 2011 3rd International Conference on*, 2011, pp. 325-329.
- [5] A. B. Kothari, "Genghis-a multiagent carpooling system," *B. Sc. Dissertation work, submitted to the University of Bath*, 2004.

- [6] A. Dixit, *et al.*, "Real-Time Carpooling System for Android Platform," *International Journal of Engineering and Innovative Technology (IJEIT)*, vol. 2, pp. 436-437, 2012.
- [7] J. Lehmann, *et al.*, "Process and method for increasing usage for a carpooling system," ed: Google Patents, 2014.
- [8] P. C. Van Buskirk, "Selectively negotiated ridershare system comprising riders, drivers, and vehicles," ed: Google Patents, 2009.
- [9] K. L. Kelly, "Casual carpooling-enhanced," *Journal of Public Transportation*, vol. 10, p. 6, 2007.