

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/354133386>

PROMOTING SUSTAINABLE TRANSPORTATION FOR UNIVERSITY CAMPUS: UM SHARE RIDE

Chapter · February 2021

CITATIONS

0

READS

1,071

8 authors, including:



Umair Munir

University of Central Punjab

4 PUBLICATIONS 49 CITATIONS

SEE PROFILE



Mahi Uddin

University of Malaya

1 PUBLICATION 0 CITATIONS

SEE PROFILE



Mohd Yamani Idna Idris

University of Malaya

212 PUBLICATIONS 7,003 CITATIONS

SEE PROFILE



Rafidah Md. Noor

University of Malaya

194 PUBLICATIONS 3,708 CITATIONS

SEE PROFILE



PROMOTING SUSTAINABLE TRANSPORTATION FOR UNIVERSITY CAMPUS: UM SHARE RIDE

Rafidah Binti Md Noor^{1*}, Muhammad Umair Munir^{2*}, Ismail Bin Ahmedy¹, Nur'ain Alang¹,
Mohd Yamani Idna Bin Idris¹, Mahi Uddin¹ and Nauman Akram³

¹*Faculty of Computer Science and Information Technology, University of Malaya, 50603 Kuala Lumpur.*

²*JPPHB, University of Malaya, 50603 Kuala Lumpur.*

³*Faculty of Information Technology, University of Central Punjab, Lahore, Pakistan.*

**E-mail: fidah@um.edu.my¹, chumair17@gmail.com²*

Abstract: Increased in college/university populations, resulting in insufficient public transportation facilities. Staff members mostly prefer to use their own vehicles to commute to any event or meeting inside the campus rather than an alternative method. This leads to the problem such as an increasing number of vehicles traffic, parking problems, fuel combustion, destruction of natural resources, environmental pollution, health inequalities and global warming etc. To overcome this problem, an application “UM Ride Share” is developed to promote the modes of transportation inside the university campus. The application is targeted to the staff members inside the University of Malaya (UM). This application consists of two parts. First part is Web-Based Application where staff members can initiate any meeting and invite different academic/staff members for the created meeting/event who seek for the vehicle to share or offer his/her vehicle for a ride. On the other side, the staff member will receive an invitation email and corresponds as he/she is sharing the ride to other faculty members, or he needs a ride for any particular meeting. In a second part, a mobile application manages the functionalities such as changing ride sharing status, requesting for ride share to other colleagues, accepting the requests, communication between rider and captain, giving the notification, guiding towards destination through shortest route etc. This application has additional features such as reward points in promoting the effort made. If any member shares his/her ride, some reward points will be added to his profile, and later, it shows the members contribution towards the green environment inside the campus. It is an effective means of reducing traffic congestion, waiting time, wastage of resources and fuel consumption, improving social life, reducing the number of accidents and environmental pollution which in turn results in the green environment, wellbeing and improving the quality of sustainability inside the UM.

Keywords: car pooling, sustainable mobility, green environment, smart system

INTRODUCTION

Many countries, including Malaysia, are facing the problem of growing transportation demand and due to the insufficient capacity of public transportation, many of the people use their private vehicles to go to the destination. Since the last two decades, the population of educational institutions has grown from all around the world and these educational institutes such as schools, colleges and universities are the main sources of traffic generator in urban areas (Finlay & Massey, 2012). These vehicles are responsible for one-fifth of the world's greenhouse gas effects, global warming and air pollution (Global Footprint Network, 2012). In order to moderate the negative effect on society, a significant number of institutions are moving towards a more sustainable. However, unconsciously, some of the campuses neglect the continuous transportation of individuals through their private vehicles, entering or leaving the campus while designing various sustainability models (Norzalwi & Ismail, 2011). Due to which these institutes face difficulties in parking shortages or traffic congestions which indirectly also causes air pollution, the demand on energy supplies such as petrol, and the rise in annual road accidents (A. Shakir & Mohammed, 2013) (Khairul Amri Kamarudin et al., 2018).

There are many older private and public universities which were developed in the limited areas near thriving cities (Sun & Chiou, 2019) (Jonathan Coulson, 2012). In later times, cities expanded to enclave nearby campuses and universities began to spread to neighboring areas. As the population (Students, Faculty and Staff members) of universities increased in numbers, their number of activities such as multiple events, competitions and number of conferences also increased, moreover, universities also have an indirect impact through the importation of products such as food, building equipment, energy and paper which increased in and outgoing of transportation which impacts on multiple factors such as shortage of land for new parking areas, high costs of building new parking facilities, and the need to maintain air quality and campus green spaces also increases and current campuses not able to cope with these emerging problems ("Environmental Effects of Driving Automobiles in the University of Malaya Campus: A Pilot Study," 2009). Historically, plans for educational institutes assume low incoming traffic and high non-auto related trips, but due to the worldwide trend of increased automobile usage and growing population within the limited land area, planning of sustainable transportation infrastructure is necessary to ensure the sustainable movement of people within the campus by which educational institutes can achieve a favorable learning atmosphere. Educational institutes have unique congestion characteristics. Traffic congestion is affected by the different movement of students, staff, faculty and tourists to different campus events. These patterns of movement vary in time and space (HDR Engineering, 2012). The majority of congestion issues in university campuses arise around campus gates or near parking facilities where people hardly found parking space during events or other university operations and class schedules. In order to be more sustainable, greener, and more competitive than the private car, many countries and universities invest heavily in public transportation systems, but still, most of the people prefer to use their own personal vehicles as they feel more comfortable and they do not know about the timing of busses to come, so they feel free while travelling in their own vehicles (Borhan, Hakimi Ibrahim, Syamsunur, & Rahmat, 2019) (Kamba, Rahmat, & Ismail, 2007). Universities are also referred to as "cities within a city," as a result of their area and the size of their populations (Kaplan, 2015). A significant proportion of all urban trips can be added to the traffic created by universities (Kaplan, 2015). This dependence on the private vehicles has adverse social, environmental and economic consequences. Moreover, as per the report of European

Parliament, these vehicles are responsible for the 12% emissions of carbon dioxide (CO₂), the main greenhouse gas and the average emissions of CO₂ from new cars registered in 2019 were 122.4 g CO₂/km (European Parliament and the Council adopted Regulation (EU) 2019/631, n.d.) (“Monitoring of CO₂ emissions from passenger cars – Regulation (EU) 2019/631 — European Environment Agency,” n.d.). The key environmental impacts of transport include air and noise pollution, global warming, resource (such as petrol) usage and waste disposal (Tolley, 1996). Besides these, the major effects on society include lack of access of opportunities, lack of social networking, and while in congestion exposure of stress etc. (Tolley, 1996). Automobile transportation, which is a non-renewable energy resource, relies on the availability of petroleum products. Following the occurrence of global warming and greenhouse gas consequences, many sustainable institutes and individuals begin to realize the detrimental impacts of the automotive industry and, they are now more aware of the environmental crisis, and started looking at the possibilities of building green or sustainable campuses that use fewer vehicles for their transport by providing multiple modes of sustainable transport, such as bicycles, vanpooling, carpooling, public transport buses and the construction of pedestrian-friendly campuses (Kaplan, 2015).

This paper mainly addresses the transportation system challenges facing by the university campuses because universities’ campuses are planned as small cities or communities (Jonathan Coulson, 2012). As a case study, it addresses, the largest and most prominent university in Malaysia, i.e. the University of Malaya (UM). It is situated in the heart of Kuala Lumpur. Although there are different types of public transport (such as MRT busses and university busses) within the city and on campus but still most of the students and faculty/staff members prefer to use their own private vehicles. With the continuous growth of UM facilities, the number of students and faculty members, there is a driving force within the campus to increase the number of parking lots, and still there is no any transportation policies to tackle the increasing problems of campus traffic congestion within the peak hours or when there is some event. Moreover, most of the staff and faculty members drive within the campus due to the limited transportation facilities, and the bus services are not regular, so sometimes they have to wait for more than 30 minutes for public transportation, and they refuse to walk under the hot sun as there is not enough covered walkway. This phenomenon has contributed to traffic congestion, parking problems, insufficient fuel use and unnecessary emissions. Therefore, the biggest challenges for UM staff and faculty members are related to transportation sustainability.

Various case studies for sustainable transport have been suggested by several scholars and institutions. The author in (Azzali & Sabour, 2018) introduced the Sustainable Mobility framework and conducted surveys at Qatar University, concentrating primarily on public transport (Shuttle Buses Within the Campus). On the other hand, researchers in (Waqas, Dong, Ahmad, Zhu, & Nadeem, 2018) conducted a survey in China focusing on their four major cities, including Beijing, Xi'an, Shanghai, and Guangzhou, and examined Chinese attitudes towards sustainable transport such as cycling, public transport, hybrid vehicles, hydrogen, and FCV. In addition, (Dehghanmogabadi & Hoşkara, 2018) primarily suggests various methods for achieving sustainable transport models, including Car Pooling, Parking Management, Bicycle usage promotion and Public Transport. Moreover, though presenting different modes of sustainable transportation (Hsu & Wang, 2001) and (Borén, 2018), proposed various ways and encourages the use of electric buses in conjunction with rapid transit vehicles, which is the most efficient option in terms of energy consumption rather than traditional private cars. Furthermore,

the students of the Business Department at the University of South America surveyed and evaluated students' views on sustainable growth, which enhanced academic awareness of green campus among students (Maria, Moreira, & Günther, 2019); however, students and staff still prefer to use private vehicles because of their privacy, comfort zone and minimum time consumption towards their destination

There are several techniques for supporting the multimodal and productive transportation system, well known as Transportation Demand Management (TDM), TDM was initially proposed in 1990 (Erik Ferguson, 1990). It is an art of changing transport behavior (E. Ferguson, 1998) having abundant advantages such as reduced energy usage, prevention of natural and environmental resources, efficient land usage, decreased road traffic accidents and congestion, decreased emissions, increased transport choices, and overall improvement of livability and social equity (E. Ferguson, 1998) (Berman & Radow, 1997). TDM strategies are widely used in sustainable university campuses which include management, usage of parking, public transit, carpooling and vanpooling, promoting the use of bicycles, and ensuring a pedestrian-friendly campus. As many of the models cannot be implemented without major investment, developing the social solutions, such as carpooling, which stands out as a cost-effective solution, where individual having common route or destination can share their private vehicle, which results in less congestion, and cost-effective public solution.

To achieve transportation sustainability within the campus, it is very essential to provide different modes of transport, which would have a positive impact on the campus as well as on the environment. The average capacity in a private vehicle is of four occupants, and most of the cars are also observed with one occupant. In fact over 87% of people drive to work alone in Klang Valley, Malaysia ("Survey Finds Over 87% Of Klang Valley People Drive To Work Alone," n.d.). Since current public transport systems cannot be adapted in a timely manner or without significant capital investments to fulfil the rising needs of the population, developing social alternatives, such as carpooling, where a person with entirely or partly common routes share a private vehicle with other persons, will be a green and a cost-effective solution. Carpooling is considered as an economical and social solution to utilize the available means of transport, i.e. filling empty seats in private cars which helps people to share a journey with same departure locations.

Keeping in mind the privacy and other policies we developed an application "UM Ride Share" to promote the modes of transportation inside the university campus. This application is mainly targeted to the staff and faculty members inside the University of Malaya. In which staff members can create or initialize any event/meeting, and invite the other faculty members to the specific destination. At the same time, each invited person can respond whether he/she wants to share his/her vehicle or he/she need the ride for specific event. The mobile application provides a complete user interface for the real-time communication and ride-sharing with other faculty members who have the common route or have the same destination. It also works as an event reminder application. Moreover, it shows the list of all committed persons and sorts them in a way that user can pick all of the committed persons within the shortest route. Furthermore, this application also calculates the contribution of each faculty member by adding the total saved distance, which he saved with carpooling and shows the individuals contribution inside the campus. It is an efficient, sustainable solution for reducing the traffic congestion, improving

social life and preserving the parking lots in event destination, which resulting in a green climate, well-being and improving the level of sustainability within the UM.

METHODOLOGY AND DISCUSSION

Carpooling has many advantages. With the rise in carpooling, roads would become significantly less congested, and parking spaces would become more accessible. If four people share one car, the amount of fuel used to transport these individuals will be approximately reduced by a factor of 4. Moreover, carpooling also provides social benefits such as new friendships, less stress while driving. It also increases the sense of obligation for those who appear to be late in events or meetings, as they would become more responsive and accountable to other commuters. While observing these all benefits we observed that the University of Malaya already providing eco-friendly sustainable facilities such as public transportation (where MRT bus came after 30 minutes and University shuttle busses came after every hour), use of bicycles (oBikes / UniRide – which are mostly standing outside of each faculty and students can use them to go within university campuses), and also providing a pedestrian-friendly campus. However, Carpooling was not implemented through which staff and faculty members can share their rides if they have a common destination, and we can reduce more traffic congestion and other gasses emission from campus.

So, for this purpose, “UM ShareRide Application”, which consists of two parts such as Web-based Application and Android-based Application. With the web-based application, faculty members can initiate any event and invite the other staff/faculty members. On the other side, Invited persons receive an invitation email where they respond whether they want to share their vehicle or they need ride. Where as in Android based application, user can see the list of upcoming event in which he/she is invited. Moreover mobile application also manages the functionalities such as real time communication between colleagues, guiding shortest path route towards the destination, requesting other participants to share ride if any user willing to share. Figure 1 illustrates the architectural diagram of UM ShareRide Application.

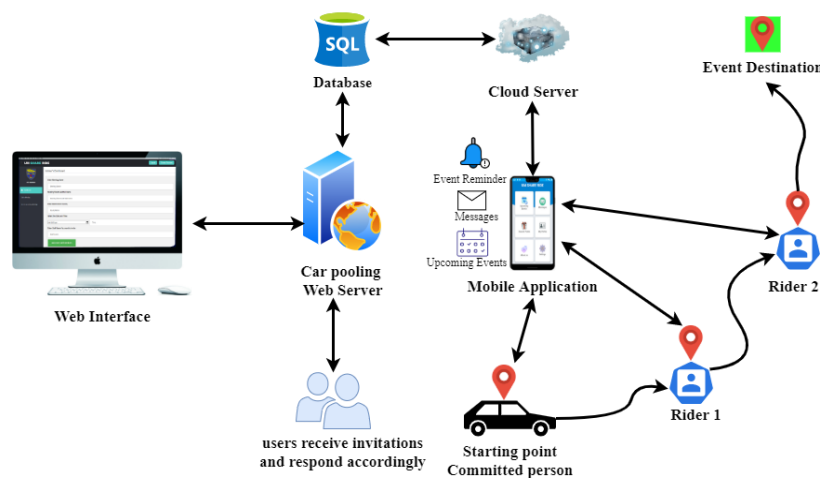


Figure 1: Architectural Diagram of UM ShareRide Application

This mobile application also has additional features such as reward points, which it calculates based on the distance saved of each individual in promoting the effort made. If any faculty

member shares his/her ride, reward points will be added to his/her profile, which shows the individuals contribution inside the campus. Figure 2 shows some of the screenshots of mobile application module. This application is an efficient way to minimize traffic congestion, fuel use, enhance social life, and reduce parking spaces. As a consequence, it leads to a green climate, well-being and strengthening the level of sustainability within the UM.

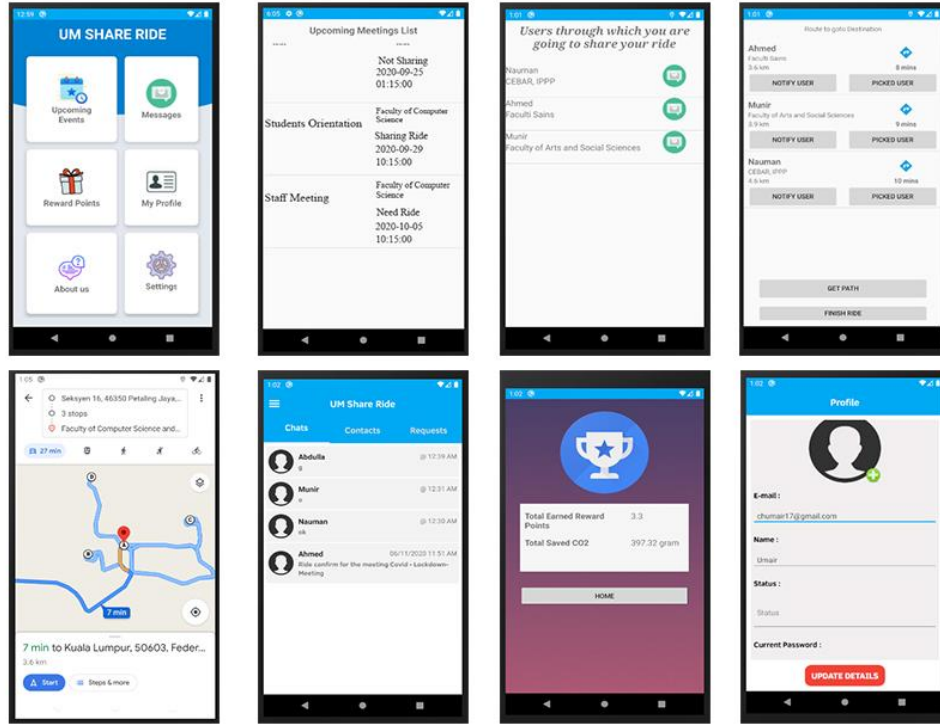


Figure 2: Screenshots of Mobile Application Module

CONCLUSION

It is very important and necessary to create a pleasant and healthy learning environment in university setting to enhance not only the skills and knowledge related to research and teaching, but also the physical sustainable image of the campus. Transport infrastructure is a basic prerequisite in order to meet the needs of the university population for mobility and accessibility. Importantly, the provision of transport facilities should ensure that the movement of vehicles and pedestrians on campus is smooth, convenient and secure. This paper addresses the views of the UM community on the existing situation of sustainability in transportation including provisions for parking consumption, bicycle use, pedestrian and traffic circulation systems. Increased use of motor vehicles inside different campuses also impacted on the level of air quality and emission of excessive CO₂, carpooling which later can be implemented in different universities, is a cost-effective solution to achieve sustainability in transportation, where individuals having common route or destination can share their private vehicle, which results in less congestion, and reduction in emission of gasses. “UM ShareRide” as a carpooling application for the faculty and staff members of University Malaya through which they can share their vehicle along with each other to go to same destination or events. This application is a

smart and efficient transport solution that reduces travel costs, traffic and parking congestion, and emissions while improving the social life of participants.

REFERENCES

A. Shakir, A., & Mohammed, A. A. (2013). Curb parking in Campus and Stimulating Students to use Public Bus within National University of Malaysia (UKM) Campus. *International Journal of Advances in Applied Sciences*. <https://doi.org/10.11591/ijaas.v2i3.1713>

Azzali, S., & Sabour, E. A. (2018). A framework for improving sustainable mobility in higher education campuses: The case study of Qatar University. *Case Studies on Transport Policy*. <https://doi.org/10.1016/j.cstp.2018.07.010>

Berman, W., & Radow, L. (1997). Travel demand management in the USA: context, lessons learned and future directions. *Energy Policy*. [https://doi.org/10.1016/s0301-4215\(97\)00119-5](https://doi.org/10.1016/s0301-4215(97)00119-5)

Borén, S. (2018). *Towards sustainable personal mobility with electric cars and buses*.

Borhan, M. N., Hakimi Ibrahim, A. N., Syamsunur, D., & Rahmat, R. A. (2019). Why public bus is a less attractive mode of transport: A case study of Putrajaya, Malaysia. *Periodica Polytechnica Transportation Engineering*. <https://doi.org/10.3311/PPtr.9228>

Dehghanmongabadi, A., & Hoşkara, S. (2018). Challenges of promoting sustainable mobility on university campuses: The case of Eastern Mediterranean University. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su10124842>

Environmental Effects of Driving Automobiles in the University of Malaya Campus: A Pilot Study. (2009). *Journal of Design and the Built Environment*.

European Parliament and the Council adopted Regulation (EU) 2019/631. (n.d.). Reducing CO2 emissions from passenger cars - before 2020 | Climate Action. Retrieved November 13, 2020, from https://ec.europa.eu/clima/policies/transport/vehicles/cars_en

Ferguson, E. (1998). Transportation demand management. *APA Planning Advisory Service Reports*. <https://doi.org/10.1061/9780784404645.ch15>

Ferguson, Erik. (1990). Transportation demand management planning, development, and implementation. *Journal of the American Planning Association*, 56(4), 442–456. <https://doi.org/10.1080/01944369008975448>

Finlay, J., & Massey, J. (2012). Eco-campus: Applying the ecocity model to develop green university and college campuses. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/14676371211211836>

Global Footprint Network. (2012). *The National Footprint Accounts: 2012 Edition - Working Paper*.

HDR Engineering, I. of the C. (2012). *Campus Mobility Plan Final Report*. (July), 99.

Hsu, C., & Wang, H. (2001). *Strategies for Green Transportation while Preserving Mobility and Accessibility : A Case Study of Taipei City*. [https://doi.org/10.1061/\(ASCE\)UP](https://doi.org/10.1061/(ASCE)UP)

Jonathan Coulson, P. R. & I. T. (2012). University Planning and Architecture: The Search for Perfection. *Book Chapter ISBN: 978 0 415 57110 4*, 53(9), 1689–1699.

Kamba, A. N., Rahmat, R. A. O. K., & Ismail, A. (2007). Why Do People Use Their Cars: A Case Study In Malaysia. *Journal of Social Sciences*. <https://doi.org/10.3844/jssp.2007.117.122>

Kaplan, D. H. (2015). Transportation sustainability on a university campus. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/IJSHE-03-2013-0023>

Khairul Amri Kamarudin, M., Abd Wahab, N., Umar, R., Shakir Mohd Saudi, A., Hafiz Md Saad, M., Rozaireen Nik Rosdi1, Sarah Alisa Abdul Razak, N., ... Mohd Ridzuan, A. (2018). Road Traffic Accident in Malaysia: Trends, Selected Underlying, Determinants and Status Intervention. *International Journal of Engineering & Technology*. <https://doi.org/10.14419/ijet.v7i4.34.23839>

Maria, A., Moreira, M., & Günther, W. M. R. (2019). *Sustainability on University Campuses: Learning, Skills Building and Best Practices*. <https://doi.org/10.1007/978-3-030-15864-4>

Monitoring of CO2 emissions from passenger cars – Regulation (EU) 2019/631 — European Environment Agency. (n.d.). Retrieved November 13, 2020, from <https://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-18>

Norzalwi, N., & Ismail, A. (2011). Public approach towards sustainable transportation in UKM's campus. *Australian Journal of Basic and Applied Sciences*.

Sun, C. J., & Chiou, S. C. (2019). The comparison of campus planning development at the initial stage of school establishment: A study of the two newly instituted private universities of science and technology in Taiwan. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su11061525>

Survey Finds Over 87% Of Klang Valley People Drive To Work Alone. (n.d.). Retrieved November 12, 2020, from <https://says.com/my/news/survey-finds-over-87-of-klang-valley-people-drive-to-work-alone>

Tolley, R. (1996). Green campuses: Cutting the environmental cost of commuting. *Journal of Transport Geography*. [https://doi.org/10.1016/0966-6923\(96\)00022-1](https://doi.org/10.1016/0966-6923(96)00022-1)

Waqas, M., Dong, Q. L., Ahmad, N., Zhu, Y., & Nadeem, M. (2018). Understanding acceptability towards sustainable transportation behavior; A case study of China. *Sustainability (Switzerland)*, 10(10). <https://doi.org/10.3390/su10103686>