RIDE SHARING

Jishnu V Joshy
Dept of Computer Science and Engineering
Mangalam College of Engineering
Ettumanoor,India
jishnujoshy580@gmail.com

Nandhu Kanakarajan
Dept of Computer Science and Engineering
Mangalam College of Engineering
Ettumanoor,India
nadhukanakarajan6041@gmail.com

Neethu Maria John, AP
Dept of Computer Science and Engineering
Mangalam College of Engineering
Ettumanoor,India
neethu.john01@mangalam.in

Nandhu Prasad
Dept of Computer Science and Engineering
Mangalam College of Engineering
Ettumanoor,India
nandhuprasad21@gmail.com

Sidharthpraveen
Dept of Computer Science and Engineering
Mangalam College of Engineering
Ettumanoor,India
sidharthpraveen6@gmail.com

***Abstract*— Over the past decade, problems related to traffic congestion have severely aggravated in city centers across the globe. This has occurred due to a wide variety of factors such as concentration of population in major cities, inadequate public transport facilities, increase in the quantity of private vehicles brought about by an improvement in standard of living, etc. In such densely populated cities, carpooling or ride-sharing serves as the perfect alternative to taking your car out daily. Along with being a relatively cost-effective and frugal way of commuting, carpooling also benefits the environment by reducing the carbon footprint generated by every individual commuter.**

Despite, its numerous benefits, finding people to carpool with often proves to be quite a tedious affair. Due to this, effective execution of carpool proves to be a challenge. This Android carpooling system has been developed to help encourage carpooling by helping users "offer a ride" in their vehicle or "find a ride" with other users.

Keywords—ride-sharing, Vehicle-pooling, cost -sharing machanism

I. INTRODUCTION

Population growth and increasing population density, particularly in metropolitan areas, have brought about an increase in the number of vehicles on the roads, by a few percentage points per year. The cummulative effect of this phenomenon is staggering. This abstract presents the design and implementation of a ride sharing application.

Rideshare help connect people to travel together to the same or similar destinations. Ride sharing is a form of shared vehicle ownership to provide members with vehicles for personal use without the costs and commitment of individual car ownership.

It will enable users to share car and bike rides in an efficient and simple way. Use of this system should reduce significantly the number of private cars on road. The application is designed for web application, thus enabling implementation ofthe sharing in real time, from anywhere, anytime.

II. RELATED WORKS

Research on ride-sharing is included in a sizable corpus of literature. Ride-sharing among commuters or between drivers and passengers can take many different forms. Finding suitable drivers for the requested passengers, or the matching process that matches commuters to share a ride, is one of the crucial elements in ride-sharing. The research in [1], [12] in particular looked at how ride-sharing and vehicle pooling can cut down on delays in transportation. In order to obtain the desired benefits, these articles typically assume that ride-sharing and car-pooling are organized by centralized institutions. The self-interested nature of commuters, who do not always adhere to centralized arrangements, is not taken into account. On the other hand, recent articles [5]–[7] have looked upon stable matching in ride-sharing. . Although it is not always related to cost-sharing of transportation costs, the motivation for stable matching in these papers is related to arbitrary passenger or driver preferences about one another. Although [8]–[11] take into account stable matching between drivers and passengers, they do not take into account the passengers sharing the cost of transportation. These publications also did not compare stable matching with socially optimal ride-sharing arrangements when it came to splitting passengers' transportation costs.

Our research on equitable cost-sharing systems for ride-sharing falls under the umbrella of issues with network cost-sharing and coalition development. The strong price of anarchy for stable matching is a study that is relevant to our findings. Our ride-sharing matching problem belongs to a class of games called coalition formation games [14] that allows arbitrary coalitions with a maximum of two members each. However, unlike earlier studies, our findings are based on the social optimality ratio.

III. METHOD

In particular we highlight three key elements in decentralized ride-sharing arrangement:

A. Fair Cost-Sharing Mechanisms

A widely accepted cost-sharing system for dividing the transportation costs among the ride-sharing partners is essential to decentralised ride-sharing arrangements. The choice of cost-sharing systems should take into account each party's fair contribution, which offers justification for how to fairly divide the expense of a shareable ride.

Particularly, commuters might not share the same sources or destinations. There are numerous equitable cost-sharing options available. One straightforward cost-sharing strategy, for instance, is to divide the expense of transportation equally between the two parties. Another option is to divide equally in accordance with the initial price of standalone rides. One may even think about splitting such that they save equally from solitary rides. Be aware that the choice of cost-sharing techniques will impact an agreement's outcome as well as the preferred ride-sharing options for each commuter.

B. Stable Matching

A decentralised matching mechanism is required to organise ride-sharing based on commuters' preferable rankings of available options. In reality, commuters typically join forces in pairs to share rides because it is simpler to come to an agreement this way. Numerous applications, including dating and college admissions, have been studied in relation to matching mechanisms [2]. Stable matching is a helpful idea that is especially desired in decentralised decision-making procedures since no parties would benefit from deviating from a stable matching conclusion.

Therefore, in a decentralised matching process, stable matching captures the likely outcome of an agreement. But various cost-sharing strategies will result in various stable pairing outcomes. In this study, we compare stable matchresults for several ride-sharing fair cost-sharing systems.

C. Social Optimality

A natural way to compare various cost-sharing mechanisms for ride-sharing arrangements is to set benchmarks against a socially desirable result that lowers the overall cost of transportation for all commuters.

High social optimality is what a good cost-sharing mechanism should achieve. We calculate the cost of a stable matching outcome relative to that of a socially optimum one. Various fair cost-sharing mechanisms have high social optimality, as evidenced by the theoretical bounds we present in this paper on their social optimality ratios. We also give a data analysis on actual taxi sharing in New York City to support our theoretical study. Using the NYC taxi trip dataset, we analyse the empirical social optimality of various fair cost-sharing strategies utilised in taxi sharing.

We assume a public multi-passenger ridesharing system, which has a societal objective to provide a convenient ridesharing service and reduce the total vehicle kilometer traveled (VKT).

In this case, link weights ψm represent the VKT of matching m. The ridesharing matching problem assigns a setof drivers V and a set of passengers R to the driver-passenger combinations M.

The mathematical formulation is defined as follows:

$$\min z = \Psi \cdot \Delta \quad (1)$$

subject to:

$$\sum_{m=1}^{|M|} \omega(j, m) \cdot \delta(m) \leq 1, \forall j \in [1, |R|] \quad (2)$$

$$\sum_{m=1}^{|M|} r(i, m) \cdot \delta(m) \leq 1, \forall i \in [1, |V|] \quad (3)$$

$$\delta(m) \in \{0,1\}, \forall m \in [1, |M|] \quad (4)$$

Where, Ψ is a vector of VKTs of $|M|$ feasible driver-passenger combinations, and vector Δ is the decision variable, in which each element $\delta(m) \in \{0,1\}$. If a driver-passenger combination is matched then $\delta(m) = 1$, otherwise $\delta(m) = 0$. The passenger-combination incident matrix is defined as Ω of size $[|R|, |M|]$, in which element $\omega(j, m)$ is equal to 1 if the passenger j is included in driver-passenger combination m . The driver-combination incident matrix is defined as T of size $[|V|, |M|]$. If driver i is associated with driver-passenger combination m, then $r(i, m) = 1$, otherwise $r(i, m) = 0$.

IV. SYSTEM MODEL

Rider requests a ride: The rider uses a mobile application to request a ride from a nearby driver. The rider inputs the pickup location, destination, and desired vehicle type.

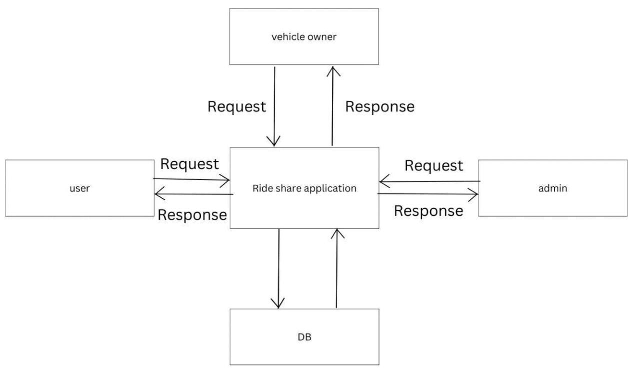

Fig.1. Level 0 DFD

Matching algorithm finds a driver: The ride-sharing platform uses a matching algorithm to identify a nearby driver who can fulfill the rider's request. The driver may choose to accept or decline the request based on factors such as their current location, availability, and destination.

Rider and driver connect: Once a driver accepts the ride request, the rider and driver are connected through the ride-sharing platform's mobile application. The rider can see the driver's location, estimated arrival time, and vehicle information.

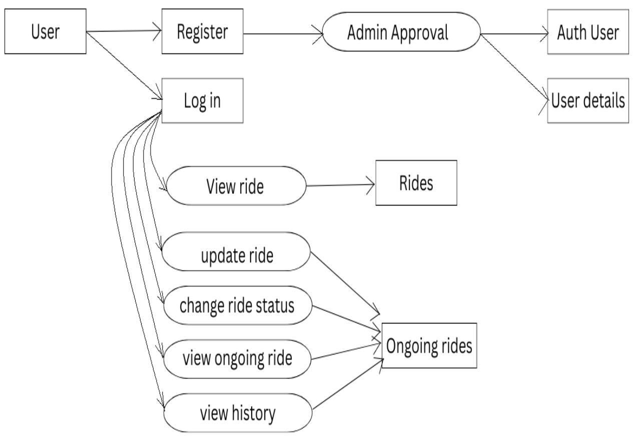

Fig.2. 1st Level User

Ride takes place: The driver picks up the rider at the designated location and drives them to the destination. The ride-sharing platform may provide navigation assistance and route optimization to ensure a smooth ride

An urban region where the concerns highlighted are likely to occur will first be chosen as the study area. A GIS-based ride-sharing application is provided by the suggested methodology, which also incorporates data collecting on current traffic circumstances and an inventory of area conditions. In the study area, an inventory of data including population, land use, vehicle composition, and road network will be gathered.

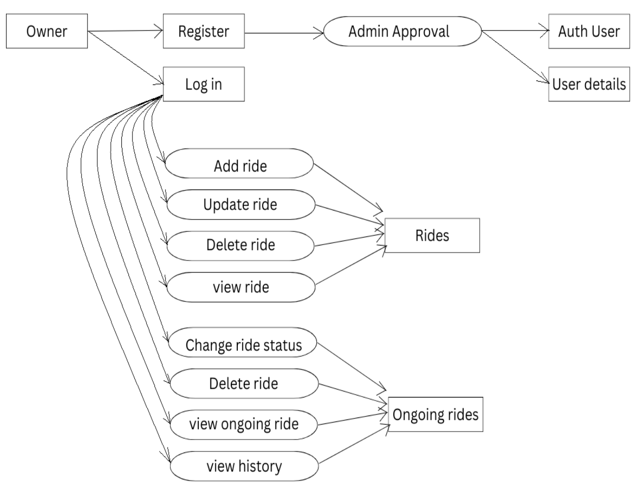

Fig.3. 1st level Vehicle owner DFD

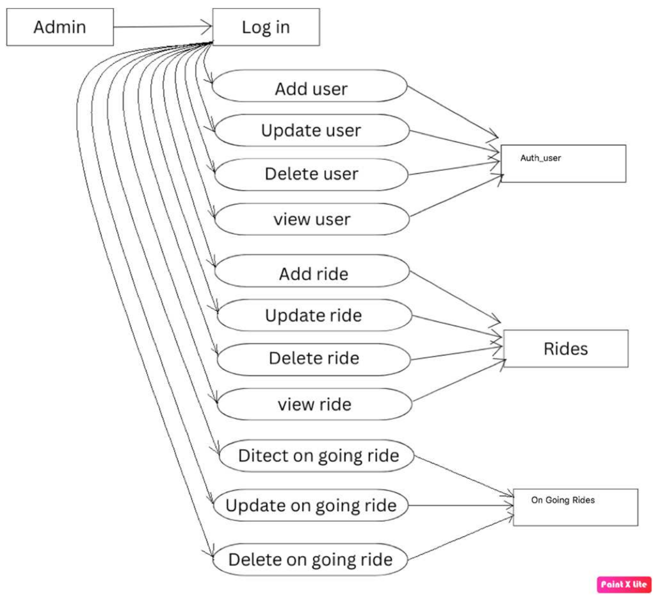

Fig.4. 1st Admin DFD

V. CONCLUSION

In conclusion, ride sharing is an effective method of transportation that offers many benefits. Whether it's carpooling with coworkers, using a ride-hailing app, vanpooling, or taking public transportation, ride sharing helps reduce traffic congestion, saves money, and reduces the carbon footprint. It's a convenient and cost-effective way to travel that can have a positive impact on the environment and our communities. By promoting and encouraging ride sharing, we can work towards creating a more sustainable and efficient transportation system. From above reviews, it can be concluded that, a well-organized ride sharing system can reduce the ill effects made by other mode of transportation.But it would be meaningless to provide traditional ride sharingor carpooling that are quite inflexible and normally takes morewaiting time of passengers. So, a dynamic ride sharing system,which is a well-organized and on-demand service; and can automatically match the rides when a request is made, is necessary to provide, instead of conventional service. Also,the algorithms developed for automated matching function are tedious and time consuming; and they can be applied to similar conditions for which they are developed. Thus, to allow instantaneous ride matching and shortest path, model should be designed using Intelligent transportation system likeGIS.

VI. ACKNOWLEDGEMENT

First and foremost, we would like to express our sincere gratitude and heartful indebtedness to our guide **Neethu Maria John, Assistant Professor**, Department of Computer Science and Engineering for her valuable guidance and encouragement in pursuing this project. We also extend our hearty gratitude to all the teachers of the Department of Computer Science and Engineering and to all my friends for their help and support.

REFERENCES

[1] P. Santi, G. Resta, M. Szell, S. Sobolevsky, S. H. Strogatz, and C. Ratti, “Quantifying the benefits of vehicle pooling with shareability networks,” Proc. Nat. Acad. Sci. USA, vol. 111, no. 37, pp. 13290–13294, Sep. 2014.

[2] D. Gusfield and R. W. Irving, The Stable Marriage Problem: Structure and Algorithms. Cambridge, MA, USA: MIT Press, 1989.

[3] New York City Taxi Trip Dataset, NYC Taxi LimousineCommission, New York, NY, USA, 2019.

[4] M. Nourinejad and M. J. Roorda, “Agent based model for dynamic ridesharing,” Transp. Res. C, Emerg. Technol., vol. 64, pp. 117–132, Mar. 2016.

[5] H. Zhang and J. Zhao, “Mobility sharing as a preference matching prob□lem,” IEEE Trans. Intell. Transp. Syst., vol. 20, no. 7, pp. 2584–2592, Jul. 2019.

[6] D. Pelzer, J. Xiao, D. Zehe, M. H. Lees, A. C. Knoll, and H. Aydt, “A partition-based match making algorithm for dynamic ridesharing,” IEEE Trans. Intell. Transp. Syst., vol. 16, no. 5, pp. 2587–2598, Oct. 2015.

[7] X. Wang, N. Agatz, and A. Erera, “Stable matching for dynamic ride-sharing systems,” Transp. Sci., vol. 52, pp. 739–1034, Aug. 2017.

[8] N. Agatz, A. L. Erera, M. W. Savelsbergh, and X. Wang, “Dynamic ride□sharing: A simulation study in metro Atlanta,” Procedia-Social Behav. Sci., vol. 17, pp. 532–550, Jan. 2011.

[9] X. Wang, N. Agatz, and A. Erera, “Stable matching for dynamic ride-sharing systems,” Transp. Sci., vol. 52, no. 4, pp. 850–867, Aug. 2018.

[10] S. Rasulkhani and J. Y. J. Chow, “Route-cost-assignment with joint user and operator behavior as a many-to-one stable matching assignment game,” Transp. Res. B, Methodol., vol. 124, pp. 60–81, Jun. 2019.

[11] Z. Peng, W. Shan, P. Jia, B. Yu, Y. Jiang, and B. Yao, “Stable ride-sharing matching for the commuters with payment design,” Transportation, vol. 47, no. 1, pp. 1–21, Feb.2020.

[12] J. Alonso-Mora, S. Samaranayake, A. Wallar, E. Frazzoli, and D. Rus, “On-demand high-capacity ride-sharing via dynamic trip-vehicle assign□ment,” Proc. Nat. Acad. Sci. USA, vol. 114, no. 3, pp. 462–467, Jan. 2017.

[13] E. Anshelevich, S. Das, and Y. Naamad, “Anarchy, stability, and utopia: Creating better matchings,” in Proc. Algorithmic Game Theory (SAGT), 2009, pp. 159–170.

[14] H. Aziz and F. Brandl, “Existence of stability in hedoniccoalition formation games,” in Proc. Int. Conf. Auto. AgentsMultiagent Syst. (AAMAS), 2012, pp. 1–16.

[15] C.-K. Chau and K. Elbassioni, “Quantifying inefficiency of fair cost□sharing mechanisms for sharing economy,” IEEE Trans. Control Netw. Syst., vol. 5, no. 4, pp. 1809–1818, Dec. 2018.

[16] S. C.-K. Chau, K. Elbassioni, and Y. Zhou, “Approximately socially□optimal decentralized coalition formation,” Austral. Nat. Univ., Canberra, ACT, Australia, Tech. Rep., 2019.

[17] S. C.-K. Chau, J. Xu, W. Bow, and K. Elbassioni, “Peer-to-peer energy sharing: Effective cost-sharing mechanisms and social efficiency,” in Proc. 10th ACM Int. Conf. Future Energy Syst. (e-Energy), Jun. 2019, pp. 215–225.

[18] C.-M. Tseng, S. C.-K. Chau, and X. Liu, “Improving viability of electric taxis by taxi service strategy optimization: A big data study of New York City,” IEEE Trans. Intell.Transp. Syst., vol. 20, no. 3, pp. 817–829, Mar. 2019