An Application for Load Sharing in Trucks

R. S. Sabeenian, R. Vinod Kumar, G. Ravi, Ashok Pudasaini

Abstract*: *The paradigm of the world has shifted to mobile applications. The services that you need are at your fingertips because of the mobile applications which provide online access to the services you have. Several mobile applications like uber freight, ola are present to facilitate the freight service providers. The existing freight management system depends on the model of separating the users on the basis of fleet provider, normal user and one with the large number of vehicles called as freight provider. For a user to login to the system the user can easily enter his desired destination and send his or her belongings to that destination with the online reservation platform provided by the mobile application. Though the existing system is good but it has one limitation. The limitation of all the existing system is that they don't monitor the load in the vehicle. In order to overcome this limitation, we propose a system which will monitor the load present in the vehicle in real time. We propose a cross platform mobile application which will work on all the available platform. The main aim of the proposed system is to monitor the load present in the truck. The proposed system will use the ultrasonic sensor in the load bearing part of the truck and the total volume as well as the available space in the truck will be continuously monitored and notified to the user who wants to send the load. We will also take into consideration the density of the material so that if the user wants to add a new load the existing load won't be affected. The path of the truck will also be monitored from origin to destination. The proposed method will develop an application for continuous monitoring of the load in the truck. The main application of the system is use in freight management system for monitoring the load of the vehicle and notifying the users whether the space is available for the vehicle to carry their loads.

Keywords*: *Mobile Application, Web Application, Flutter, Android studio, load sharing

I. INTRODUCTION

Load sharing is a common trait in transportation fraternity. Various load sharing mechanisms are used by the freight service providers nowadays.

The popular one is through the development of application whether web or mobile or both. Sharing of load is done on the basis of load bearing capacity of the vehicle. A threshold is fixed taking into account the load bearing capacity of the vehicle.

If the load exceeds the threshold the load is either discarded or charged extra.

Various mobile applications are present in the day to day life to facilitate the users from booking the vehicles online and sharing their load. The mobile applications that are present can be categorized into three types, viz native application, hybrid application and web application. Native application can run in only one specific platform whereas hybrid application is a cross platform application that can run in all the platforms available. Web applications are the responsive version of the website that works on any mobile device. There are various platforms for mobile application development. Amongst them the most popular one is flutter. Flutter is a cross platform application developed by google which helps in the development of mobile application easily and readily. Flutter is an open-source environment developed by google to make various mobile applications such as IOS and Android. It is used to develop applications for web and google itself. A single codebase is used to develop mobile, web and desktop applications. The features of flutter which makes it popular are as follows:

- Fast development because of various built-in customizable widgets.
- Flutter has flexible and dynamic UI.
- Flutter gives the native performance.

The development of application using flutter requires flutter SDK along with the editor like android studio and other according to the preference of the developer. The proposed method uses android studio as editor. An android studio is a development environment for Google's android operating system. It can be used in all the operating systems. With the help of android studio one can edit, analyze, emulate and preview the android application before release. There are various features of android studio which makes is a popular choice amongst all the other editors. Some of the features of android studio are as follows:

- Gradle based build support.
- ProGuard integration and app signing capabilities.
- It has template-based wizards to design the android components.
- Dag and drop of UI components makes it easy to use.
- Integrated support for google cloud platform.

This paper is divided into two sections. The first section provides the abstract and introduction to the proposed method and the second part describes the proposed method along with the results and discussion.

II. LITERATURE REVIEW

Lots of ideas have been proposed for the development of application to share the load in vehicles. Literature review gives the limitations as well as merits of the existing system. It is arranged as per the following. Mohammad et.

al (2018) [1] have proposed an appointment system for trucks which is useful for both the container terminal operators and drayage operators. The system focuses on time management by distributing the truck's arrival time evenly throughout the day as well as giving appointment time to the trucks to avoid heavy traffic and collision.

It helps in reducing the impact of both the operators.

Xinjie et. al (2019) [2] have proposed a quotation booking process by integrating global tank container operation. It emphasis on policy making and controlling inventory. Also, it focuses on integrating job acceptance/rejection decisions in the quotation booking process. The system uses Heuristic algorithm along with adjusted genetic algorithm and various mathematical expressions.

Chenhao et. al (2018) [3] have proposed a system to reduce thcongestion in lighterage terminal by developing a coordinated schedule. Real world terminal is studied and model is developed to determine the coordinated arrival schedule of trucks. Advanced bio-objective simulation optimization is used and the system is delivered using mobile application.

Dong (2016) [4] have proposed a booking control system to solve the revenue management problem for a single station car rental system. Decomposition approach and approximate dynamic program are used to analyze the system.

Determinant of mobile taxi booking application service's continuance by Goi Sai Wang (2018) [5] have proposed a system that predicts the intention of the users to continue the use of mobile application by using technology continuance theory. The data are analyzed by using least square technique.

Teoder (2018) [6] have analyzed the different aspects of car sharing system and introduced a taxonomy for the same. The differences between the operational level and economic aspects along with the business model and customer's perspective is studied.

Vehicle booking system by S. Vidhya (2016) [7] developed an android application for reservation of available space in the parking lots. The system consists of a microcontroller and GSM module that costs less as compared to the other existing systems.

Kangija (2018) [8] have proposed vehicle scheduling methodology to solve online vehicle dispatch problem. An optimization framework is developed and new approach is presented to solve the gap between the big problem size and limited computing time.

Zhigang (2019) [9] have proposed consortium blockchain system-based charging guide technique. Based on consortium blockchain a taxi charging guide architecture is developed and fault tolerance algorithm is used to solve the issue of trust amongst multiple charging station as well as the charging information disconnection. The system minimizes the charging cost of the taxis. Quantum based particle swarm optimization algorithm is used for analyzing the system.

III. PROPOSED WORK

The proposed work is a cross platform application in order to share the load in the truck through a mobile and web application platform. The high-end block diagram of the proposed method is as shown in figure below:
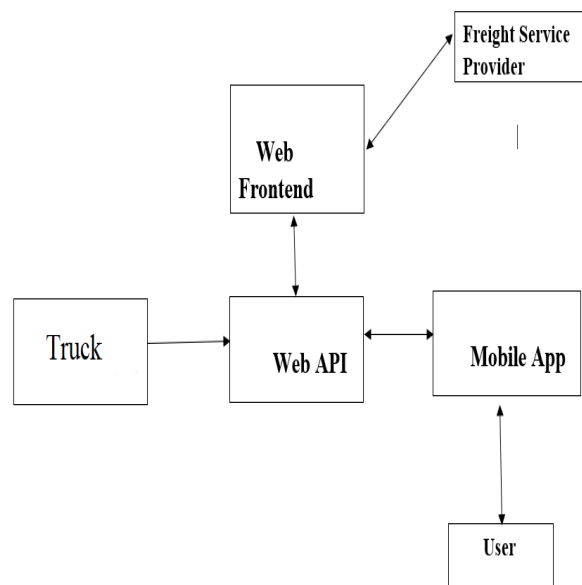

Figure 1 High end block diagram of proposed work

Web API: Web API is an application programming interface for either a web server or a web browser. It is based on web application's client-side. The user interacts with the web application with the help of web API.

Web frontend: User can view and interact with the data using web frontend.

Mobile App: The application in the device of the user through which they can interact and book the service they require.

Freight service provider: Freight service provider is the provider of transportation service to the user or general public.

The flowchart of the proposed system shows that the system starts with the registration of the user. Once the user is registered the user can sign in into the system by using the registered login credentials.

After the sign in is done the user can check the load that is present in the truck. If the load in the truck is less and the space is available the user can book the truck else the user access to book the truck will be denied.

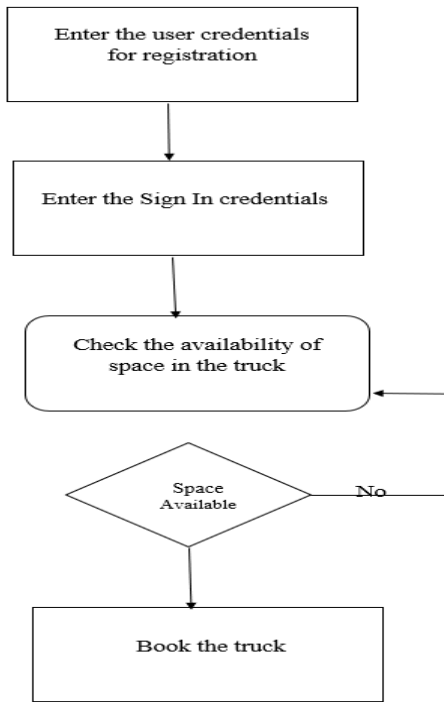The flow chart of the proposed work is as shown in figure below:

Figure 2 Flowchart of the proposed work

The main advantage of the proposed work as compared to other work is that load of the truck will be continuously monitored and displayed. Similarly, the new load won't affect the old load since the density of the new load is already taken into account. This is a robust method in the load sharing mechanism of the freight services.

IV. RESULT AND DISCUSSION

The registration page of the user shows the details to be filled by the user in order to register to the application. In order to register a user has to enter the name, email address and password. The registration page is as shown in figure below:

Figure 3 User registration page

The user needs to enter his credentials. Once the registration is the user can use to sign in to the system.
The sign in page is as shown in figure below:

Figure 4 Sign In page

The user can login to the system using the registered email address and the password. After the successful login the user is redirected to the main page which contains the information of availability of the truck and the status of load present in the truck along with the remaining the space in the truck.
The main page of the system looks like as shown in figure below:
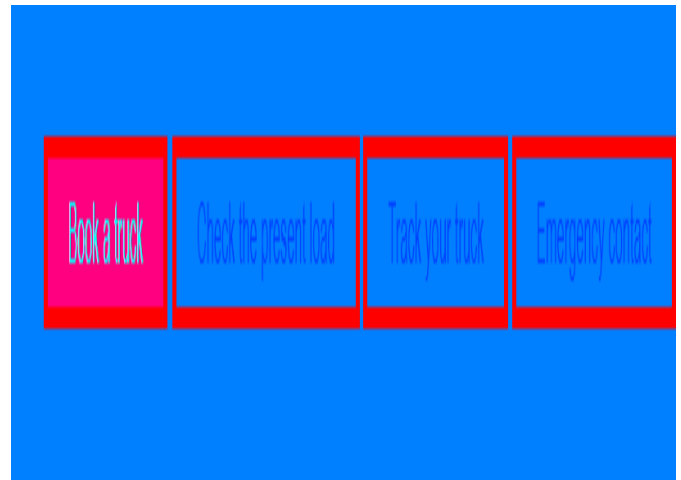

Figure 5 Book the truck

The user can book the truck by clicking the book a truck tab. If the truck is not available the message is displayed as shown in figure below:
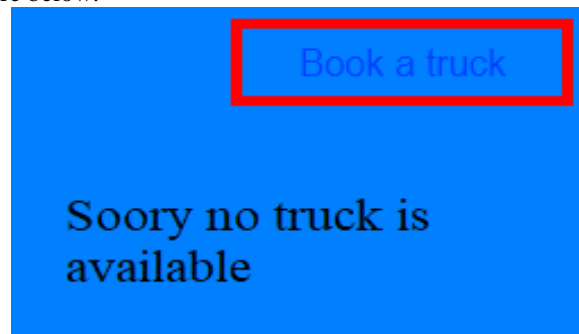

Figure 6 Truck unavailability message

The user can check the load in the truck by clicking the check the present load tab as shown in figure below:
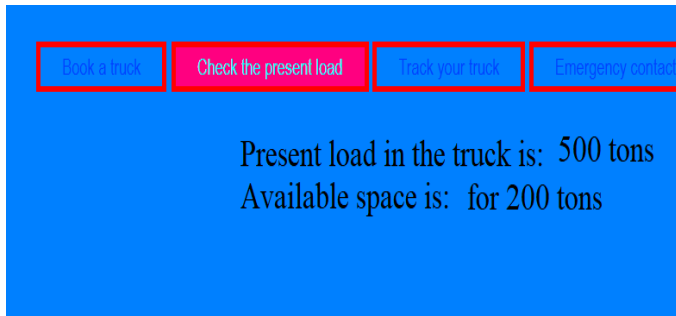
An Application for Load Sharing in Trucks

Figure 7 Check the load of truck

User can see the load present in the truck and then the available space. The user can book the truck only if the space is available in the truck.

In the above used case, the user with the load of 200 tons can book the truck. If the user's load is more than 200 tons then the access is denied. The denial message is as shown in figure below:
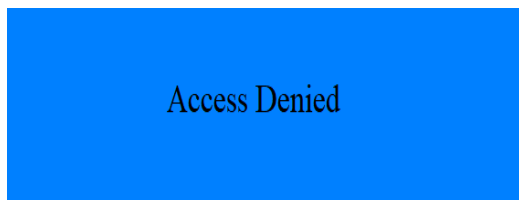

Figure 8 Access Denied message

Thus, the proposed system takes into account the load present in the truck and let the user book the truck based on the availability of space in the truck.

V. CONCLUSION

The proposed system regularly monitors load present in the truck and then notify users the condition of the present load as well as whether new load can be added or not. The proposed method overcomes the limitation of the existing systems by tracking the load continuously. This feature provides new dynamics in the freight service management. The sharing of load also helps users save their money and time.

REFERENCES

1. Mohammad Torkjazi, Nathan Huynh, Samaneh Shiri, "Truck appointment systems considering impact to drayage truck tours", Elsevier, Transportation Research Part E 116 (2018) 208–228.
2. Xinjie Xing, Paul R. Drake, Dongping Song, Yang Zhou, "Tank Container Operators' profit maximization through dynamic operations planning integrated with the quotation-booking process under multiple uncertainties", Elsevier, European Journal of Operational Research 274 (2019) 924–946.
3. Chenhao Zhou, Haobin Li, Byung Kwon Lee, Zhipeng Qiu, "A simulation-based vessel-truck coordination strategy for lighterage terminals", Elsevier, Transportation Research Part C 95 (2018) 149–164.
4. Dong Li, Zhan Pang, "Dynamic Booking Control for Car Rental Revenue Management: A Decomposition Approach", Elsevier, European Journal of Operational Research (2016).
5. Gooi Sai Weng, SuhaizaZailani, Mohammad Iranmanesh, Sunghyup Sean Hyun, "Mobile taxi booking application service's continuance usage intention by users", Elsevier, Transportation Research Part D: Transport and Environment Volume 57, December 2017, Pages 207-216.
6. Teodor Gabriel Crainic, GuidoPerboli, Mariangela Rosano, "Simulation of intermodal freight transportation systems: a taxonomy", Elsevier, European Journal of Operational Research Volume 270, Issue 2, 16 October 2018, Pages 401-418.
7. S.Vidhya Sagar, B.Balakiruthiga, A.Sivanesh Kumar, "Novel Vehicle Booking System Using lOT", IEEE, 2016 Online International Conference on Green Engineering and Technologies (IC-GET).
8. Kangjia Zhao, Wenqing Chen, Kong Wei Lye, "Online Vehicle Dispatch: from Assignment to Scheduling", IEEE, IEEE International Conference on Data Mining Workshops (ICDMW) (2018).
9. ZHIGANG JIN, RUOQIAN WU, XINGYU CHEN, and GEN LI, "Charging Guiding Strategy for Electric Taxis Based on Consortium Blockchain", IEEE Access, volume 7, 02 October 2019.
10. Chen, G., Jiang, L., 2016 "Managing customer arrivals with time windows: a case of truck arrivals at a congested container terminal". Ann. Oper. Res. 244 (2), 349–365.
11. Douma, A., Schutten, M., Schuur, P., 2009. "Waiting profiles: an efficient protocol for enabling distributed planning of container barge rotations along terminals in the port of Rotterdam". Transport. Res. Part C: Emerg. Technol. 17 (2), 133–148.
12. Gracia, M.D., González-Ramírez, R.G., Mar-Ortiz, J., 2017. "The impact of lanes segmentation and booking levels on a container terminal gate congestion." Flexible Serv. Manuf. J. 29 (3–4), 403–432.
13. Zheng, J. F., Sun, Z., & Zhang, F. J. (2016). "Measuring the perceived container leasing prices in liner shipping network design with empty container repositioning" Transportation Research Part E, 94, 123–140.
14. Grand View Research. (2016). "Petrochemicals market analysis by product (Ethylene, Propylene, Butadiene, Benzene, Xylene, Toluene, Vinyls, Styrene, Methanol) by region (North America, Europe, China, Middle East, Africa, Latin America) and segment forecasts", 2014 - 2025. Grand View Research 978-1-68038-560-1. U.S.
15. Song, D. P., & Dong, J. X. (2015). "Empty container repositioning. In C. Y. Lee, & Q. Meng (Eds.), Handbook of ocean container transport logistics- making global supply chain effective" (pp. 163–208). London: Springer.
16. Steadieseifi, M., Dellaert, N. P., Nuijten, W., Van Woensel, T., & Raoufi, R. (2014). "Multimodal freight transportation planning: A literature review". European Journal of Operational Research, 233, 1–15.
17. Shiri, S., Huynh, N., 2016. "Optimization of drayage operations with time-window constraints". Int. J. Prod. Econ. 176, 7–20.
18. Shiri, S., Huynh, N., 2017. "Assessment of US chassis supply models on drayage productivity and air emissions". Transp. Res. Part E: Log. D: Transp. Environ.
19. Eagle Marine Services. http://www.eaglemarineservices.com/ems/ (accessed 11.20.17).
20. Zhang, X., Qingcheng, Z., Wenhao, Ch., 2013." Optimization model for truck appointment in container terminals". Proc. Soc. Behav. Sci. 96, 1938–1947.
21. Zhang, R., Yun, W.Y., Kopfer, H., 2010. "Heuristic-based truck scheduling for inland container transportation". OR Spectrum 32 (3), 787–808.
22. Moon, I., Ngoc, A. D. D., & Hur, Y. S. (2010). "Positioning empty containers among multiple ports with leasing and purchasing considerations". OR Spectrum, 32, 765–786.
23. CM. Tseng, SCK. 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.
24. Z. Tian et al., "Understanding operational and charging patterns of electric vehicle taxis using GPS records," in Proc. IEEE 17th Int. Conf. ITSC.,Qingdao, China, 2014,pp. 2472-2479.
25. J. Liu, J. Ping, and X. Fu,"Research on adistributed public key system based on blockchain,"Netinfo security.,vol. 18, no. 8, pp. 25-33, 2018.
26. Y. Shao, Y. Mu, X. Yu, X. Dong,H. Jia, J. Wu, andY. Zeng, "A spatial temporalcharging load forecast and impact analysis method for distribution network using EVs-traffic-distribution model,"Proc. CSEE,vol. 37, no. 18, pp.5207-5219, 2017.
27. W. Zhang et al., "Application of M/G/k queuing model in queuing system of electric taxi charging station," Power Syst. Technol., vol. 39,no. 3, pp. 724–729, 2015.
28. Z. Yi, J. Smart, and M. Shirk, "Energy impact evaluation for eco-routing and charging of autonomous electric vehicle fleet: ambient temperature consideration," Transp. Res. Pt. C-Emerg. Technol., vol. 89, pp. 344–363, Apr. 2018.

AUTHORS PROFILE

Dr. R. S. Sabeenian is currently working as a **Professor and Head in ECE Department** at Sona College of Technology, Salem, Tamil Nadu, India. He has more than 18 years of teaching experience. He has published more than **100** research papers in various International, National Journals and Conferences. He has received 10 National level awards for his outstanding research contribution and academic excellence from IETE, ISTE, IEEE, Springer, Nehru Groups, INAE, ISTE TP, TNSCST and CICR. He has also received Project Grants of more than 3.5 Crore from AICTE, DST and reputed industry. He also received International funded project worth more than 15 lakhs from Nanolytix, Canada, Consultancy project from Titan worth Rs.10 lakhs. He has produced 10 doctorates (PhD Candidates). He has filed 3 patent and one of his patent granted in the year 2019. He is the Editor of 6 International Research Journals. He is also associated with the Image Processing Payload of the PESIT Pico Satellite Project. He is the Expert Member for Board of Studies of more than five autonomous institutions. He delivered more than 70 guest lectures and chaired more than 25 national and international conferences. He also received **"AICTE Career Award for Young Teacher (CAYT)"** from AICTE for the period of 2015-18.

Dr. R. Vinod Kumar is a senior professor at Sona College of Technology, Salem, Tamil Nadu, India. He completed his PhD in 2015 in Wireless Networks from Anna University in the year 2015. He has published a number of papers in various international journals. His area of interest includes Wireless Sensor Networks, Wireless Networks and new trends in wireless networks. He has a vast experience in teaching fraternity. He is also a lifetime member of ISTE.

Dr. G. Ravi received his Doctoral Degree of Ph.D. in Information and Communication Engineering from Anna University, Chennai, INDIA in the year of 2016. He completed his Master of Engineering in Sona College of Technology (Anna University), Salem and Bachelor of Engineering in V.L.B. Janaki Ammal College of Engineering and Technology (Bharathiyar University), Coimbatore in the years of 2007 and 2002. His research areas are Wireless Communication, Wireless Ad hoc Networks, Wireless Sensor Networks and Optical Communication.

Mr, Ashok Pudasaini completed his under graduate from Khwopa Engineering College, Bhaktapur in the year 2015. He is currently pursuing his master's degree in Communication System from Sona College of Technology, Salem, Tamil Nadu. His area of interest includes wireless sensor networks, digital electronics, mobile application and development.