Scope of On-Demand Public Transit in Rural Area

Md Mahmudur Rahman
Department of Computer Science
University of Massachusetts Lowell
Lowell, MA 01851
mdmahmudur_rahman@student.uml.edu

December 6, 2022

Abstract

Transportation is one of the major source of green house gas emission which causes the global warming. Per capita emission is highest in transportation sector in the North America because of very low transit ridership. Low population density specially in rural area causes very little to none public transit infrastructure in here. This problem can be eliminate by using on demand public transit system where riders can request ride in the app and the app will connect the person who can share the ride. The transit driver will choose the most optimum time and most optimum route to serve the maximum rider at a time. In this work, we study the feasibility of the introduction of an efficient system where maximum rider can be served by minimum resources (Transportation vehicles, drivers).

1 Introduction

Transportation is one of the basic necessity for the people from every level of the society. Lack of good, safe and reliable transportation hurt tremendously specially the marginalized population to look for new job, getting quality education and other basic necessities. Currently, mostly used mode of transportation in most of the sub-urban and rural areas is using a private vehicle. However, as the energy cost is increasing day by day along with the price of new and used vehicle, every family can not afford to maintain a vehicle. Besides, some marginalised population with different disabilities do not have access to a car due to the requirements of having drivers' license.

Currently we are in a climate emergency while we are face more and more extreme weather events due to the increase in emission of carbon dioxide. Cars and other private vehicles emits maximum amount of carbon dioxide per passenger as they are most inefficient of transporting. According to a survey, the average

occupancy of a car in USA is 1.5 persons. Besides, large volume of cars and other private vehicles introduce heavy air and sound pollution.

All these issues can be solved by introducing efficient and reliable public transportation. A standard bus can carry 30 passengers at a time which is not only energy efficient but also can low in producing carbon emission and other pollutants. However, maintaining a public transportation system in the rural area is challenging due to the sparsity of population centers. Because of the sparsity, only few people actually use the predefined route of the transportation. There are also problem with the time table of the bus. If the rides are infrequent, people stop using the the public transportation system due the increased wait time. On the other hand, frequent rides requires more resources for transportation service which is not always possible for the small rural community if the ridership is low.

In this work we conceptualize the idea of on demand public transportation system with the help of modern internet and smartphone technology. We want to develop a framework which addresses the issue of sparse low ridership scenario in the public transportation system and dynamically allocate vehicle and driver for most optimum route with demand for rides.

2 Related Works

There are some existing systems developed to connect multiple person in a ride to similar destination. Uber Pool is one of the commercial solution where one large vehicle is assigned to multiple riders taking similar route to the same destination [1]. However, as it is priced based on demand, it can get expensive for the low income people some time. It also suffer from reliability issue due to the availability of designated drivers. Another existing system is available in many small cities as a para-transit for elderly and disable persons [2]. For example, city of Lowell have a service called "Road Runner" where the seniors and disable persons can book a ride at a certain time of the day by dialling a phone number [3]. Although the cost is very inexpensive and affordable, the service hours is not suitable for all (8 am to 5 pm). Additionally, the riders have to book the ride well ahead of time is inconvenient for most of the people.

3 Methodology

In this section we will discuss about our framework in details in solving the problem of efficient on demand public transportation system. The requirements of designing an effective on demand service is efficient use of the resources and reliability. In case of transportation, we have to design a system which can serve maximum amount of riders with minimum numbers of vehicles and drivers. We also have to ensure the minimum wait time for the riders so that they don't have to wait for the long time to get the ride. One way to ensure minimum waiting time is to process the ride request data real-time and ask the riders to input their desired riding time. Another area of optimization is the route path. In this

case we need to yield the optimal route so that the bus have to travel minimum distance by serving all of the riders along the route.

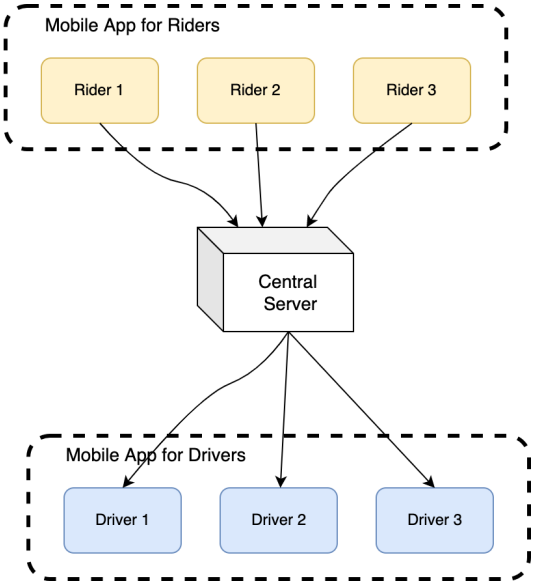

Figure 1: System Diagram of the on demand transportation system using smartphone app

Figure 1 shows the system architecture of our on-demand transportation system. From the diagram, whenever one rider request ride on the mobile app, that ride request will get registered to the server immediately. Ride request from multiple riders will be aggregated in the central server and pick up by the algorithm. First, we cluster all of the routes with the intended time of taking the ride. This way, we can combine all of the ride those are requested with in a similar time window. Then from that time window, we generate a graph with all of the routes requested. From that graph, we pick up the most optimized single or multiple routes. If there are single route got selected by the algorithm, the server will request the corresponding driver with that route and rider details. The corresponding driver will pick up all of the riders listed in the route details from their preferred pick up location and drop them off to their destination.

4 Conclusion

As transportation is one of the basic need for a community to thrive, on demand public transportation can provide an unique opportunity to develop a functional and efficient public transportation with minimum cost. This system will also address the sparsity of inhabitants in the remote rural areas and provide reliable and efficient transportation to marginalized communities.

References

[1] https://www.uber.com/au/en/ride/uberpool/
[2] https://www.mass.gov/doc/ada-paratransit-service-and-the-ride/download
[3] https://lrta.com/fares/dial-a-ride/