Effect of Autonomous Vehicles on Car Rental Services in Sri Lanka

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ABSTRACT

This paper will introduce a special kind of logistics management problem which exists in the car rental industry. In order to get a high degree of customer satisfaction and optimize vehicle fleet utilization, logistics managers in the car rental business have predicted few technologies: namely Autonomous driving and on demanding rentals. These ideas that will be seen in action in the near future approximately 10 years from now on. Optimizing resource deployment and reducing the logistics cost are the targets of logistics management in enterprise. This sort of research is prospective and useful for future development of the car rental industry.

Keywords— Autonomous Driving, Self-Driving, Autonomous Vehicle, Robo-Taxi, Rental

I. INTRODUCTION

The most evident topic in the room is autonomous driving. This will have a massive impact on every vehicle owner and all the other people who will receive this as a service. Self-driving is simply another word for autonomous driving. Fully automated systems are used in these cars. In other words, driving does not require human involvement. These cars are also referred to as robot or driverless cars for this reason. A variety of sensors are used by these cars, including radar, lidar, sonar, GPS, cameras, artificial intelligence, advanced driver assistance systems, software, etc. Whatever your view is on when fully autonomous vehicles will be widely available, it is clear that autonomous vehicles will continue to make 'getting one location(A) to another(B) without any human interference whatsoever. This will be a huge help, especially for people who are not comfortable driving around.

According to a technical report in 2016 by the National Highway Traffic Safety Administration (NHTSA) [1], 94%-96% of road accidents are caused by human errors. Against this backdrop, Automated Driving Systems (ADSs) are being developed with the promise of preventing accidents. This is the first technological advancement we are going to discuss. Autonomous vehicles can be used for rental services. These are referred to as robotic or autonomous taxis. Through this, passengers can communicate with the vehicle on their mobile devices. Recently, autonomous vehicles have been developed and tested. For the first time, Waymo had a completely driverless taxi service in the United States. Uber had also tested autonomous vehicles.

The next big goal is 'on-demand rentals'. "On-demand" is something like this: Imagine arriving at the airport or a railway station or even a huge shopping mall, then opening your app, and clicking a "pick me up" button. Within a few minutes, your rental arrives, and you get in and drive away. No fuss, no paperwork. Just go. It is very much like the technology we have now with PickMe and uber. You pick a location, and the vehicle will be there within a brief time. But here we are suggesting something slightly different. You only need the mobile app for this, no registrations, and no filling forms, just open the app and click the button, and the app will fetch the location itself and send a vehicle to you. But of course, it is only working near airports, busy bus stations, railway stations, etc.

Imagine a dedicated lane on the road for automated driving cars. You get a car like that; you can drive by yourself, or you can just sit back and relax. Either way, when you get to the destination, you get off the vehicle, get your baggage and things, then the car will automatically drive itself to the rental parking lot. When the car comes back to the rental parking lot, it drives itself to a place where it can be cleaned, refuel, check for other things like oil, tires, etc., then it drives back to the parking lot for pickup by the next customer. Also imagine if this rental service was near an airport, when you come back to the airport after the journey you had, when you get out

from the airport a vehicle will be there for you to go to the place where you came earlier.

If you take this method a few steps further, imagine you rent a car today and it will pick you up at the airport and drive you to a hotel in the city. Then the next day you want to go somewhere else, so you just open the app and press a single button, and that same car will come to the place where it last dropped you off. Then you can continue your journey from there. If you are living in the city, then there is no need for you to get a car for yourself. Imagine how different a city could be without parked cars all over the city streets and huge parking lots or garages.[2]

Finding out about the effects of autonomous vehicles on the car rental industry is the main goal of this study.

II. RELATED WORK/LITERATURE REVIEW

Eureka Project PROMETHEUS [3] was held in a few countries in 1995, and it was one of the earliest major automated driving studies. The project was very impressive even today. It succeeded in automatically driving only on highways. Heavily modified Mercedes trucks took the challenge through Germany to Denmark and the journey back to Germany again. It succeeds in maneuvering through real-world traffic at the speed of 175 km/h, under the supervision of a human driver from the Mercedes company. Then late in 2005, there was DARPA (Defense Advanced Research Projects Agency) Grand Challenge. It was the first biggest offroad automated driving test, in which only 5 teams succeeded.[4]

Cruise company CEO Kyle Vogt tweeted a series of tweets on Twitter in September about releasing driverless rides within a few months. He also mentioned at a Technology Conference that his Cruises will work together with Walmart (an American chain of supermarkets like Cargeels and keels in Sri Lanka) and release a delivery service using self-driving cars.[5] Uber is one of the most popular rental services in the world. When it comes to introducing autonomous vehicles to the car rental industry, Uber is at the forefront. In Pennsylvania, Uber debuted its first autonomous vehicle in 2016. And they tested self-driving cars in 2018 but it did not go well as they planned (it killed a pedestrian), so they had to abandon it. It will take a few years to release that service again.[6] More than 1400 self-driving vehicles are being tested by 80 or more companies across the world. So, the concept we are presenting will be available for everyone sooner than we expect.[7]

Tesla succeeded in creating one of the best-automated vehicles ever. The Tesla version 7.1 has the feature to self-park at parking locations without the driver in the car. The Tesla Company is currently working on fully automated vehicles. Right now, we only have semi-automated cars.[8] In 2017 Audi Company managed to release a vehicle model (Audi A8) that could drive 60kmph without any driver assistance. When it comes to taxis and rental cars Waymo rental Company was able to develop their cars to run with passengers under a driver's supervision. Their cars traveled in automated mode for over 16,000,000 km per month. They became the first Company to commercialize a fully autonomous taxi service in the USA.[9]

AutoX is one of the leading robot-taxi providers in China. Since 2020, AutoX has tested completely autonomous vehicles on the streets of Shenzhen. This is the first and only company in China that offers a fully autonomous Robo-taxi service on public roads without a safety driver. These autonomous cars are capable of managing increasingly complex and challenging traffic situations in urban areas on their own. AutoX is the company that obtained the world's second driverless Robo-Taxi permit from California.[10]

III. METHODOLOGY

Automated driving or autonomous vehicles will be introduced to the rental industry in a few separate ways. The first method will be introducing self-driving features and upgrading them from time to time. We already have semi-autonomous vehicles. The second method will be introducing a few fully prepared and fully automated vehicles and giving them to the public for a high price, especially for the people who are willing to have more features and who can afford them easily.
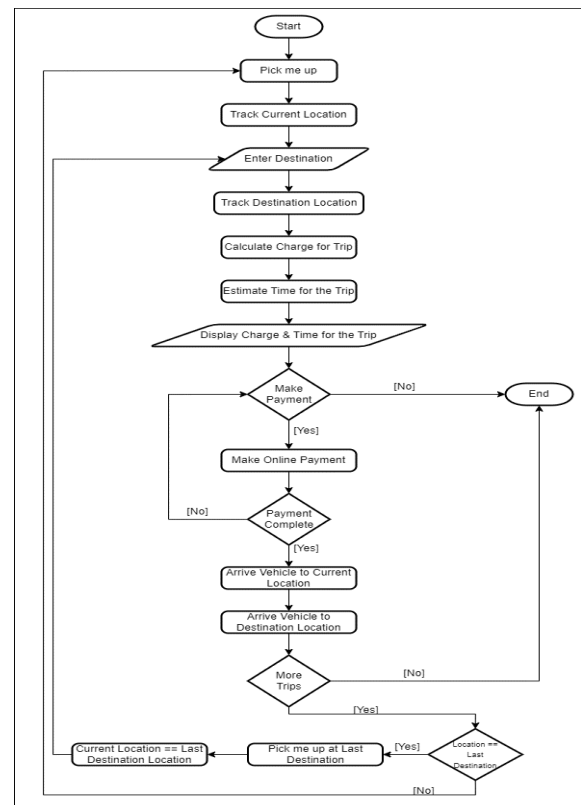

Figure 1: System Flow Chart

The above flow chart can be used to gain a clear concept of how a user can rent a robo taxi utilizing a mobile application. For the application the user uses, or the car has, there are real-time location fetching technologies. So, that the application can get the customer's exact location to send the car there. There are location trackers to keep track of the vehicle and the customer through the application. When the user presses the button "pick me up" the location fetching software will run and get the real-time location and send it to the rental system and allocate a car for that ride. The system of the car will get the date, time, and location and it will make a reservation inside the database. When those times are right, System will send a car automatically. If necessary, customers can connect with a customer service representative while traveling to obtain the information or directions they need. When it comes to payments, the system uses the most secure online payment methods with credit or debit cards. When the customer adds his card details to the app one time, then for every purchase he makes, money will be automatically fetched from the card. Of course, if the customer didn't want to add his card details, he can pay after the ride is done, just by swiping the credit card on the payment machine inside the car.

Artificial intelligence is mostly used in this system. Because they are driverless cars, these vehicles are more sensitive. Consequently, these robot taxis will be able to sense traffic, traffic lights, pedestrians, side passing, etc.

Because there isn't a driver for the vehicle when employing this technique, labor costs can be decreased. Because anybody can utilize these Robo-taxis (people of all abilities, older people, younger people, etc.), it will benefit society as a whole. Additionally, the customer may feel safer as a result of this. Because human error cannot cause an accident, there cannot be any accidents. Customers that use this technique can efficiently use their time. Additionally, these Robo-taxis have additional characteristics including smoother rides and higher speed restrictions.

When the customer selects an autonomous vehicle, it will lead to packages where he can pick fully automated or semi-automated cars according to his budget. According to his choice of vehicle, data will be sent to the allocated vehicles in the rental parking lot.

IV.   PROPOSED SYSTEM

Currently, our team has developed a web application for vehicle rental services, which has employee handling, vehicle handling, rental placement handling, and event handling. Each function completes an important part of this rental service. If you own a car, you can register that car into our system as our rental company property. Then our employees will be the drivers. Customers can see through a list of vehicles, and you can pick a vehicle to rent. You could give a pickup location to get the vehicle to that location. After the due dates are

done you can return the vehicle. This is simply the main functions of the current application.
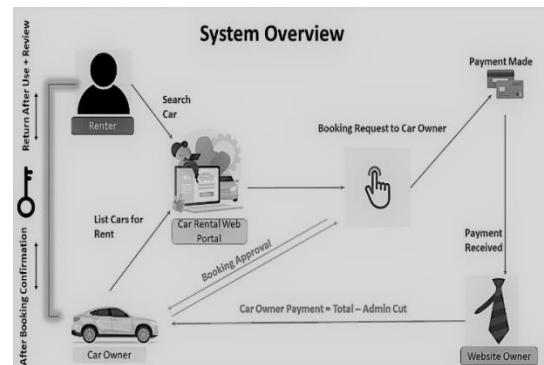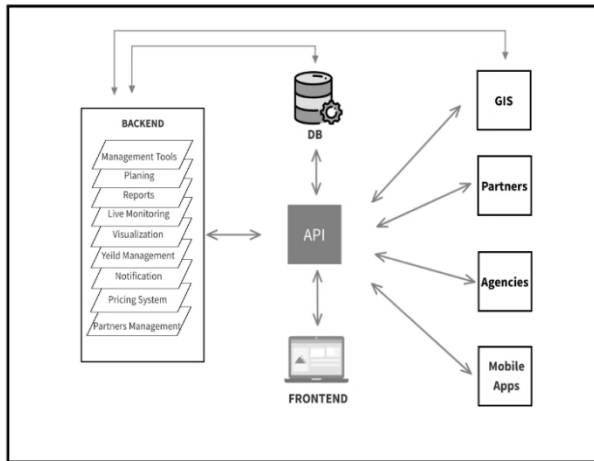

Figure 2: System Overview Diagram

The system overview diagram shown above can be used to gain a comprehensive understanding of the present rental management system.

But we are suggesting a few new methods to improve this application. As for the system we proposed, there are two main functions. The first one is operating autonomous (self-driving) vehicles. The second one is giving easy control over the application, which means you will be able to get a vehicle just by clicking a single button. For the autonomous part, when the user picks the vehicle, he can choose whether it is an autonomous or a regular one. You can choose a normal vehicle and you can drive it by yourself. If you choose an autonomous it will be expensive, and you can choose packages. From package to package the technology of the self-driving vehicle will be different. You must add the pickup address, time, and date for the vehicle to arrive. You could also choose vehicle type. If you are traveling somewhere with lots of baggage you could pick a large vehicle like a truck. If you are moving out, you could rent a huge truck to pack all your furniture. If it is a personal ride to a normal location, you could pick a small electric car. You must pick the destination too. You can do it via the application, or you can do it when the vehicle comes to you. You can always change your mind and pick a different destination while riding. A control panel will be in the passenger seat to give commands to the car. The rental application will allow you to pick the destination on one condition, which is the distance you pick. When the self-driving car leaves its station there will not be any chance to recharge itself while on the ride. If the car can travel 100 km after fully charging its battery, which will be your limitation for your travel. The distance you travel will be calculated while you are on the ride. The system will not allow you to exceed the 100km limit. So, you will not be in a situation where your car died in the middle of nowhere and there is no way to recharge. This is a huge downside, but there is a solution for that. When this technology fully functions in cities, there will be self-driving car parking lots in various places inside a single city. If you are running out of battery the car will indicate it and it will drive to the nearest parking lot to charge

itself. Of course, you can wait until it is fully charged, or you can just simply get another car. All these features will be accessible through the app or the control panel inside the car.

Figure 3: System Overview Diagram

The diagram above represents the overview of the system that we propose.

V. DISCUSSION

Just like in every concept, the autonomous concept also has pros and cons. If we consider the advantages of safety, reduce labor costs, reduce parking spaces, saving energy, and echo-friendly environments. When considering them one by one, there will be a discussion about some advantages. Is this advantage will be an actual benefit? Or is it truly an advantage? Safety is something that everyone questions. How can this system be safe for us the passengers? 94% of vehicle accidents are caused by human error. So, by giving the driving job to a fully prepared AI, the accident count will be reduced. Aggressive driving will be reduced. And speed limits, road signs, and other things won't be violated by the self-driving system. Traffic will be minimum. Energy saving and fuel saving will be highly efficient. There is no doubt about that. This will lead to increased roadway capacities, and everyone can enjoy a smooth ride.

What is the difference between semi-automated cars and fully automated cars in the system? If it is semi-automated the customer must keep an eye on the car when it drives itself. Sometimes it will need some human interference. Of course, semi-automated cars will come to you by themselves, but when you are in heavy traffic on narrow roads, or off roads, the car will need your assistance.

VI. CONCLUSION

The above research was about enhancing a vehicle rental system by using autonomous vehicles and giving more user experience via new technologies. We investigated how autonomous vehicles might impact the car-rental industry in this study. Artificial intelligence and machine learning are the main technological foundations of this system. Implementation of the new tech vehicles and their pros and cons were discussed. Furthermore, we discussed how much easier life will be with these new technologies and how simple it is to operate the relevant web applications and mobile applications. You don't need technical knowledge to operate these applications. It is part of the user experience we were determined to do through this research. Users can operate this system more effectively as a result.

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