TOWARDS A DESIRED TRANSPORT FUTURE: SAFE, SUFFICIENT AND AFFORDABLE

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ABSTRACT

With the development of technology and economy, more and more people desire a better transport service. How to make future transportation safer, more sufficient and affordable is an important issue to discuss. The three aspects were analyzed respectively in this paper. Each aspect is analyzed from three parts: existing problems, solutions to solve the problems, and suggestions for future development. The main methods involved in are developing advanced driver assistance systems, improving and popularizing public transportation and sharing transportation, replacing fuel-powered cars by clean energy cars, and adding intelligent traffic facilities. In a nutshell, to achieve the goal, future transport should develop towards a more intelligent and sharing direction.

Key words: future transportation, safe, sufficient, affordable

1. INTRODUCTION

With the development of technology and economy, more and more people desire a better travel service. How to make future transportation safer, more sufficient and affordable is an important issue to discuss. In this paper, each of the three aspects is analyzed from different perspectives. For safety problems, avoiding potential accidents can be realized by developing advanced driver assistance systems and autonomous cars. To make transport more efficient, we can start from improving transportation systems and developing public transportation, sharing transportation, and electric vehicles. And intelligent traffic facilities can be developed to make transport more sufficient and affordable.

2. SAFETY

To achieve the first goal--Safe, we should try our best to avoid potential accidents. And then we should produce less pollution, which could influence citizens' health conditions.

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2.1 Avoiding Potential Accidents

According to the statistical data from Transport Administration of Public Security Ministry, a total of 165,200 motor vehicle accidents occurred in China in 2016, with 51,800 deaths. Among them, more than 70% of traffic accidents are caused by "human" factors, of which accidents caused by drivers accounted for more than 90% of the total number of accidents. [1] While autonomous cars can use a variety of techniques to detect their surroundings, and advanced control systems can interpret sensory information to identify appropriate navigation paths, as well as obstacles and relevant signage. In this way, autonomous cars can analyze much more information than human drivers, thus avoiding most of potential accidents. For the first aspect, to avoid potential accidents for private cars, I think the most effective way is to develop autonomous vehicles.

However, there are still lots of problems existing:

First, the technology involved in is still to be developed. "In the case of few pedestrians, the driverless car driving in the prescribed lane at a speed of 10 to 15 kilometers per hour, this technology has been achieved years ago." But under the current technical conditions, it is still difficult for driverless cars to cope with the actual road condition, which is complex and always changing. General artificial intelligence systems, such as searching, translating, etc., may allow mistakes, while driverless systems are life-related and do not allow mistakes. Therefore, it is a very difficult challenge to popularize autonomous vehicles into people's lives. [2]

Besides, the legal regulations about autonomous vehicles are far from adequate. The legal issues of driverless cars are quite complicated. They involve not only the multiple legal relationships between designers, producers, users and relatives, but also clarifying the responsibilities of contracts, products and traffic accidents. Without a specific market assessment standard and clear responsibility identification, it will certainly be difficult for autonomous vehicles to be put into commercial use and accepted by the public. [3]

Also, moral problems exist in some cases. For example, when you are in an autonomous car driving on the road, and a truck suddenly burst out right before you, should the car keep on driving and hit the truck, which can make you suffer fatal hurt, or should the car turn to the pedestrian road and hit an innocent pedestrian? How to make a decision for driverless car when facing complex situations is really a tough task to conquer.

So, considering all the limitations, which could take decades to solve, we can start the improvements of transportation from Advanced Driver Assistance Systems. And obtain driverless objective in the end.

"Driver assistance systems do not just include lane keeping assist systems, automatic parking assist systems, brake assist systems, reverse assist systems and driving assistance systems. In addition, some active safety technologies should also be attributed to driving assistance systems, such as collision avoidance systems, fatigue detection, night vision assistance, pedestrian potential crush avoidance, etc. Such driving assistance systems can help people drive safer and develop a healthy driving habit. "said by Xiong Zhiliang, CEO of Xiang Qi Chuang Digital Technology Co., Ltd. [4]

Because driverless cars and driver assistance systems use some similar technologies, and the difference between driverless cars and driver assistance systems is that the results of the analysis are used in different approaches. For driverless cars, information is transmitted to vehicles, while for driver assistance systems, information is transmitted to drivers, who

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make decisions for different situations. Google's driverless car uses a 64-beam infrared head on the roof to capture the real-time conditions around the car. Through the analysis of the image algorithm, a series of reactions are finally made to prevent the car from collision. However, such a technology for driver assistance systems is also achievable by capturing images for analysis. Driver assistance system helps drivers to analyze outside situations, while not making decisions by itself. Thus it covered the shortage of driver's observations.

For example, Tesla's driver assistance system needs to be monitored by drivers, who can't let their hands leave steering wheels. And the switches between different modes are controlled manually. On the other hand, Tesla's driving assistance system needs to collect data through actual driving of millions of miles. And with the collection of data, the system will become more and more intelligent. Actually, it is a derivative process for driverless driving. [5]

Besides, traffic network planning should also be improved. Nowadays, there are still many improper road corridors, such as long steep downslope road connected with a small radius bend, large intersections with no traffic island. These unsafety factors can be eliminated by applying safety facilities.

2.2 Producing Less Pollution

For the second aspect, with the process of urbanization, more and more people crowded in are causing more and more pollution. To reduce pollution, first we need to change energy utilizing forms and use cleaner energy. Second we need to popularize public transportation. (The two aspects will be discussed in 3.2 and 3.1.3.)

3. SUFFICIENCY

For the second goal: Sufficient, I think it includes two aspects: First, the time spent in the road should be reduced. Second, for trips with the same distance, the resources consumed should be as few as possible.

3.1 Reducing Travel Time

For the first aspect, travel time could be shortened by shortening the driving path, reducing waiting time at intersections, toll booths and transitions, keeping congestion part of road as few as possible

3.1.1 Travel path

Better transportation planning based on O-D survey and shortest path algorithm could be made to optimize traffic networks.

3.1.2 Waiting time

And for waiting time, for private cars, green wave traffic can be used to reduce waiting time. As long as drivers drive in design speed of this corridor, they don't need to wait at intersections. In some road parts, pedestrian cross the road in the middle, making drivers slow down to avoid potential crashes. If more overpasses are built in those corridors, passengers will choose to pass the street through overpass instead of passing in the middle of street. It will be easier for drivers to follow design speed.

Besides, the development of expressway intelligence charging system saves time for drivers

and passengers, and increases the efficiency of toll collection. Vehicles can quickly pass through toll booths by means of intelligent payment, which improves the traffic efficiency of single-lane toll booths. It can also help toll booths reduce the configuration of toll lanes, thus saving the land occupation area and reducing the construction cost of expressway operation and management. [6]

For public transportation, transit connection of different modes of transport is quite time-consuming. For example, when you need to go to point D from place A, you should take the subway to place B, then walk to place C, because B and C are very close, so there's no need to take a taxi, then at place C, you can take a bus to place D. But compared with a nonstop travel, it can take much more time, mostly consumed in transition. However, this problem is now being solved by Door-to-Door system, combining two or more different types of transportation into one stop. For example, the Xi'an North station, when you get off the train, you can take the subway or taxi at the same station. (Figure 1 shows the functions and positions of each part of the Xi'an north station)In this way, the transition time can be saved. Besides, many shared bicycles are put beside train stations and bus stops. So passengers can take the bicycle to the next stop after getting off. So what if we put some shared autonomous cars beside train station or airport in the future? It will be much more convenient for passengers to change their trip modes.

Figure1 - Xi'an North station

3.1.3 Public transportation

For big cities with centralized population, public transportation is quite important to relieve traffic pressure. However, public transportation has many disadvantages such as inconvenient, uncomfortable, and too crowded. From the successful example of Singapore, we can obtain three solutions:

(1) Provide a variety of forms of bus service. On the basis of collecting information and analyzing the demand, we should adjust the supply strategy in response to the increasingly individualized travel demand, set up the demand-responsive public transportation market development mode, follow passenger's demand, develop new types of buses, such as Point-

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to-point commuter line, the station Express, non-scheduled bus set, community service minibuses and other lines. To meet requirements of passengers with different age and different travel needs, price of bus tickets can be divided into different prices. Mobile Internet technology has transformed the service model of public transportation from "waiting for people" to "picking cars", respecting passengers' choices and enhancing the customer experience so as to enhance the attractiveness of public transport.

(2) Improve the reliability of bus operation. Residents travel willing survey shows that reliability is one of the most concerned factors. They hope bus travel time could be controllable. At present, due to the aggravating traffic congestion and out of place of bus lanes, the imbalance and unreliability of bus operations are becoming worse. Specifically setting the rewards and penalties for service reliability may be helpful to improve reliability.

(3) Use network intelligence to improve management and operational efficiency. For example, Jinan bus system is trying to use big data method, combined with prediction theory, through the GPS data analysis of the bus line in a year, to forecast relatively accurate turnaround time distribution of the line in different time periods, under different conditions. Turnaround time studies make it possible to plan driving operations more scientifically and accurately, to arrange spare vehicles and personnel appropriately, to make the management of public transport more sophisticated and to provide a higher level of service. According to the test results, the bus punctuality rate can be increased from 52% to 90%.[7]

3.2 Saving Resources

For the second aspect, for private cars, nowadays, more and more cars are transferred into gas-powered, which could improve the utilization ratio of fuel. And In the future, electric vehicles will inevitably develop to replace fuel-driven vehicles to take a major part in market. Because there are various approaches to obtain electricity, including hydroelectric power, wind power and nuclear power, electric vehicles are environmental friendly. And the resultant of electric vehicles is water, which does not pollute the environment. What's more, electric vehicles have higher energy conversion efficiency, about 2-3 times the traditional vehicles. And it also has relatively lower cost, making it more affordable. Although nowadays most people can't accept electric cars and most cities in our country don't have enough charge stations. With policy supporting, electric vehicles will develop quickly.

Except for private cars, some people share cars by posting information on social software. Maybe in the future, when autonomous vehicles are popularized into the public, a new type of car sharing system can be developed: small autonomous buses. When you type in your destination in a car sharing App, the nearby autonomous bus with passengers whose destinations are near yours will come and pick you. In this way, the travel becomes much more convenient, and less energy was wasted compared with self-driving. If public transportation becomes major transport mode in the city, traffic network can be used sufficiently because of less congestion.

4. AFFORDABILITY

For the third goal: affordable, nowadays for common vehicles, it often takes too much to park. Parking lots and garages are expensive, if we could use intelligent parking tower to replace ordinary parking lots, cost of land and human labor can be reduced, and the utilization ratio of land will be improved. So developing intelligent facilities is a good way to make transport more affordable. What's more, as mentioned above, using clean energy vehicles such as electric cars can also reduce lots of cost. And for the autonomous vehicles, which is still developing, the cost of the components (such as radar, laser light, GPS, and advanced control systems) is still very high. As technology develops, the cost may be reduced.
For public transportation, it has been discussed above at 3.1.3

5. SUMMARY

As analyzed above, there are still many problems existing in the way to a safer, more sufficient and affordable transportation system, but some solutions to solve the problems have been found, such as developing advanced driver assistance systems, improving and popularizing public transportation and sharing transportation, replacing fuel-powered cars by clean energy cars, and adding intelligent traffic facilities. Future transport should develop towards a more intelligent and sharing direction. Besides, better public transportation and vehicles powered by clean energy are also essential for future transportation.

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REFERENCES

[1] 刘保奇 2017/08/01 工程院院士：无人驾驶能减少交通事故 零死亡率不可能 界面新闻
Baoqi, Liu, 2017, Academy of Engineering: Driverless Cars Can Reduce Traffic Accidents While Zero Mortality is Impossible. Interface News

[2]姚欣 2018/1/8/ 无人驾驶汽车面临五大挑战 中国青年报/ 012 版科技前沿

Xin, Yao, 2018, Driverless Vehicles are Facing Five Challenges. China Youth Daily.012 [th] Technology Frontier

[3]姚慧雅 2017.01 无人驾驶汽车的风险及其法律应对 Journal of Huaihua University 第 36 卷第一期

Huiya, Yao, 2017, Risk of Driverless Vehicles and Their Legal Response. Journal of Huaihua University 36 [th] Vol. paper No. 1

[4]佳伟 2014-10-22 汽车驾驶辅助为什么不讨中国人喜欢

Wei, Jia, 2014, Why driver assistant system doesn't appeal to Chinese.

[5] Honggang, Wang, 2017, Differences between autonomous vehicles and Advanced Driver Assistance Systems. Chaofen

[6]解亚东 2017 高速公路收费智能化对降低高速公路营运成本的影响 现代经济信息

YaDong, Xie, 2017, Influence of Freeway Intelligent Charging System on reducing the cost of highway operation. Modern economic information

[7]薛兴海 2016-8-25 思辨|互联网+背景下，我们该如何更好地发展公共交通？人民公交

Xinghai, Xue, 2016, speculation | Internet plus background, how can we better develop public transport. People's bus

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