

Comparative Analysis of Chinese New Energy Vehicle Enterprises

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Abstract. As new energy vehicle or specifically electric vehicle has become the popular trend of the automobile market, the competition of more advanced technology that provides more and more advantages to different company. Based on the competitive market of new energy vehicle, the paper mostly focuses on the comparison of Tesla and BYD (Build Your Dream) on field of autopilot, battery life and safety issue within the Chinese automobile market. This paper compares and contrast the status quo and development of Tesla and BYD in Chinese market and predicts possible future development of these companies. This study has important practical significance for the future development of Tesla and BYD enterprises, and has reference value for the future development of China's new energy industry.

Keywords: New energy vehicle; Autopilot/autonomous vehicle; Tesla; BYD.

1. Introduction

1.1. Research Background and Significance

In modern society, the development of various types of new energy vehicle such as electric and hydrogen cars is one of the most popular trends on market. The electric vehicle market in China stands as a dynamic and rapidly evolving landscape, characterized by a fusion of innovation, sustainability, and a drive towards a cleaner automotive future. Within this burgeoning arena, two giants, Tesla and BYD, have taken center stage, each contributing their unique approaches to shape the future of mobility in the world's largest automobile market. This writing will focus on the autopilot system, safeness, and the vehicle battery range of Tesla and BYD. The significance of the paper is to presents the major issues and trends of the new energy vehicle market by comparing Tesla and BYD as the leading role of the field of new energy vehicle. In which providing the important trends in the market that might become the spotlight area of the future of automobile.

1.2. Literature Review

BYD provides passenger car information for multiple models, from K5 to K12, to airports and city governments, with a total of 12 different models [1-4]. Among them, BYD Tang, Atto, and Han all have battery ranges exceeding 400 kilometers, especially Korean batteries with a range exceeding 600 kilometers. Among the three models, Atto3 supports a certain degree of auto drive system technology in the form of driver assistance technology: as far as blind spot detection (BSD) is concerned, when the vehicle quickly approaches in the blind spot of the exterior rear-view mirror, the blind spot detection will remind the driver. In terms of Lane Keeping Assist (LKA): If your attention is not focused, your BYD ATTO 3 can automatically guide you back to the lane. In terms of Intelligent Cruise Control (ICC): The intelligent cruise control system can help the driver automatically follow the path and speed of the vehicle in front at speeds below 60 kilometers per hour. In terms of Rear Cross Traffic Braking (RCTB): When reversing, the rear corner millimeter wave radar monitors other road users approaching the rear of the vehicle in real-time, emits a warning sound, and then applies the brakes in the event of a possible collision [5].

It is a post on BYD's official website about the development and results of blade batteries. This post showcases the efficiency and safety of blade batteries, as they have structural advantages and increase the special utilization rate of batteries compared to traditional lithium batteries; through

multiple safety tests such as nail penetration tests, extreme temperatures, collisions, and overcharging. These series of experiments have demonstrated the stability and safety of blade batteries, while providing additional advantages for structural design in special locations [6]. Shantanu Ingle and Madhuri Phute provide a clear and detailed integration of Tesla's auto drive system from sensors, cameras and radars. These sensors, cameras and radars collect surrounding information and form virtual views or maps, integrating pedestrians, other vehicles, pedestrian lanes, traffic lights, etc. It also helped demonstrate the use and functions of Tesla auto drive system. Such as automatic steering, automatic lane changing, automatic emergency steering, side collision warning, and automatic parking. This article is helpful to explain the principle and principle of Tesla auto drive system, and provide convenience and safety for consumers [7].

1.3. Research content and Framework

The research mostly focuses on the analysis of three areas of new energy vehicle of Tesla and BYD: autopilot system, battery life, and safety concerns. After introduction, the first part of the paper will focus on analyzing these three areas of Tesla and what area that Tesla has advantage or disadvantage compare to other company. On the second part, the paper will focus on BYD with similar description and analyzation of that of Tesla. At the end the paper compares Tesla and BYD on the field of new energy vehicle and makes presumption and prediction of possible trends of future development.

2. Description of Tesla

In a world increasingly concerned about environmental sustainability and technological advancement, Tesla has emerged as a trailblazer in the realm of electric vehicles (EVs). Founded in 2003 by visionary entrepreneur Elon Musk, Tesla's mission transcends traditional automotive manufacturing. With a commitment to accelerating the world's transition to sustainable energy, the company has revolutionized the way we perceive transportation. At the heart of Tesla's allure lies its unwavering pursuit of performance, range, and efficiency. Through relentless research and development, Tesla's engineers have crafted vehicles that not only rival their combustion-engine counterparts in acceleration but also offer exceptional driving ranges, alleviating the concerns that once limited the appeal of electric vehicles. With its sleek design, cutting-edge technology, and unwavering commitment to electric mobility, Tesla has captured the imagination of Chinese consumers seeking high-performance, zero-emission vehicles. Since establishing its presence in China, Tesla has not only introduced its popular Model S, Model 3, Model X, and Model Y but has also constructed a Gigafactory in Shanghai—a testament to its dedication to the local market. Tesla's innovative advancements, like the Autopilot system and over-the-air updates, have revolutionized the driving experience, while its Supercharger network provides convenient access to fast-charging infrastructure across the country.

The definition of the term autonomous vehicle is a vehicle incorporating vehicular automation, that is, a ground vehicle that is capable of sensing its environment and moving safely with little or no human input. In another word, a vehicle that equipped with autopilot system that based on computer program and the data collected on surrounding environment. One of the direct impacts of autopilot system is avoiding traffic accidents. According to the data from the official website of Tesla, which shows that from the third quarter of 2018 to the fourth quarter in 2021 the crash per miles driven while using autopilot technology is all above 3 million miles [8]. The Figure 1 has shown the data collected by Tesla on three types of vehicles: Tesla vehicle using autopilot technology, Tesla vehicle not using autopilot technology, and average data of United States on the million miles per one accident occurs. The data of autopilot vehicle has a significant advantage compares to other two types of vehicles, in which Tesla vehicle using autopilot average around three to four million miles, Tesla vehicle not using autopilot average on about 1.5 million miles, and United States average of about 0.5 million miles before an accident occurs.

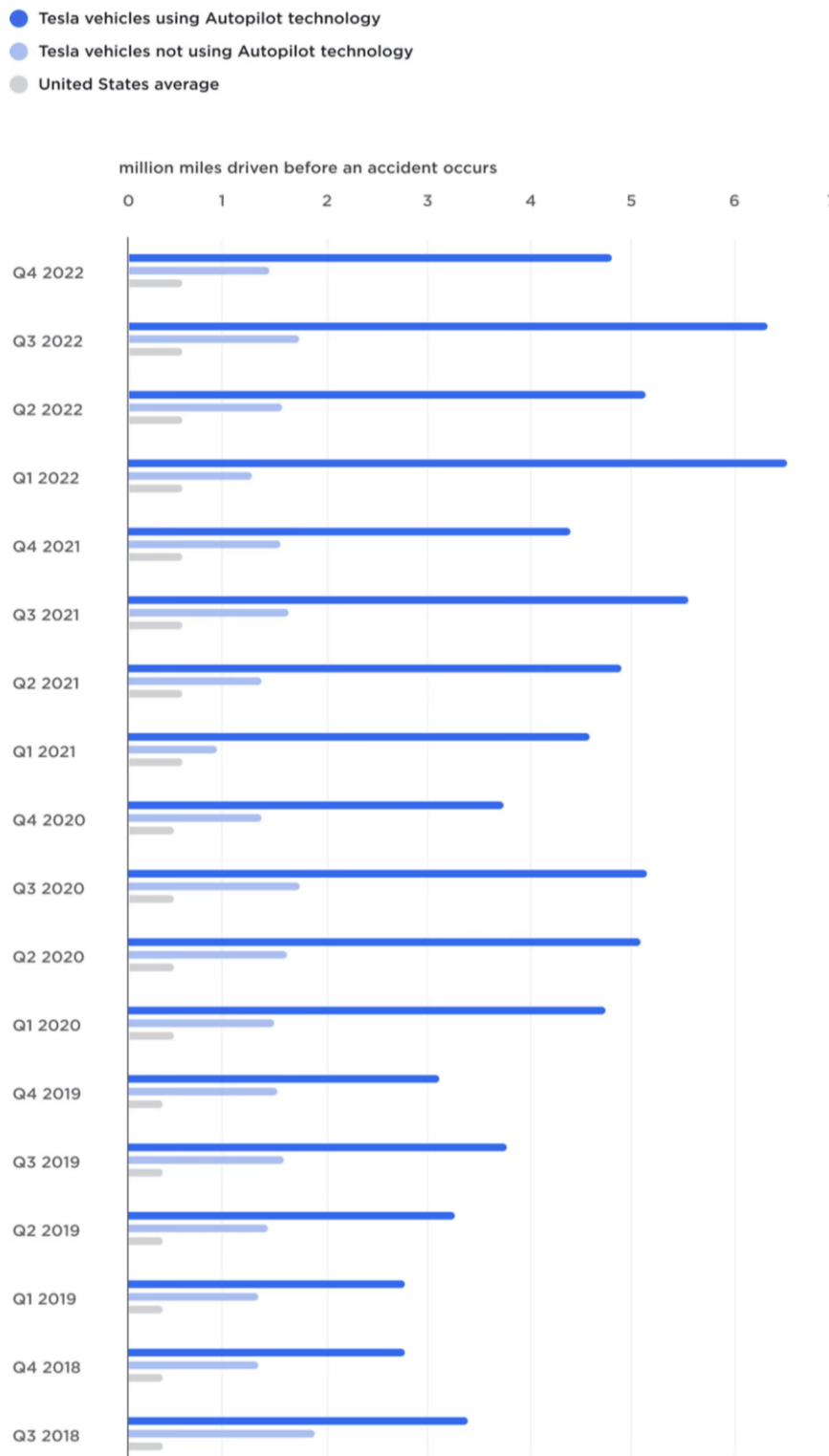


Fig 1. Miles driven per one accident.

Besides from the data of autopilot system on traffic accidents, Tesla autopilot system also enables autosteer and auto-lane change and auto parking ability that uses radar and ultrasonic sensors to detect the surrounding environment to maneuvers the vehicle [9]. The battery life of Tesla electric vehicle is another advantage that has impacts on the automobile market. According to the official website of Tesla, Model S, X, and Y all have battery range of more than 300 miles (480 km) with its Li-ion battery that supports the vehicle and accelerates from 0-100km/h in less than two seconds. Other than the long battery range of Tesla, the recharging of the vehicle is also quick and convenient at the Supercharger station that can charge up to 200 miles or more within 15 minutes [10].

3. Description of BYD

Originating in China, BYD has become a pioneer in electric mobility, particularly in commercial vehicles and public transportation solutions. BYD's commitment to electric buses has established it as a global leader in this segment, providing sustainable transportation solutions for densely populated urban areas. The company's expansive electric vehicle lineup encompasses not only passenger cars but also buses, trucks, and monorails. BYD's integration of renewable energy technologies, such as solar panels on buses, showcases a holistic approach to reducing carbon emissions. BYD's innovative strides and emphasis on practicality have made electric mobility a tangible reality for various sectors in China's diverse transportation ecosystem. There are 12 different models of passenger bus that was released on to the urban areas ranging from K5 to K12 that can take 10 to 40 people while battery life at minimum of 200 kilometers [1]. BYD has also developed multiple types of electric vehicle such as e1, e2, e3, Qin, e9, Han, Yuan, Sone, and Tang [2-4]. Recently at August 9, BYD has rolled off its 5 millionth new energy vehicle [5]. Of all these different types of new energy vehicle, Han EV has the most selling data. For it has excellent battery life of 602 kilometer while recharging 30 to 80% of the battery only takes about half an hour, while having the ability to accelerate from 0-100 km/h in 3.9 seconds. BYD electric vehicle does not uses ordinary Li-ion battery, they invented the new form of blade battery that performs well in both battery life and safety. The blade battery that being tested in form of nail penetration test, crushed, bent, and heated and no sign of fire or explosion. On the other hand, under nail penetration test a ternary lithium battery will exceed 500°C and violently burned; a conventional lithium iron phosphate block battery did not openly emit flames or smoke, but its surface temperature reached dangerous temperatures of 200 to 400°C. These results have shown the stability and safety of such battery placing on Han EV while still providing long battery life of more than 600 kilometers. Also, autopilot system on BYD EV has been developed and put into use. In BYD Atto 3, blind spot detection, lane keep assistance, intelligent cruise control, and rear cross traffic brake are all part of the autopilot system of the vehicle. These functions enable the safety of the passenger while driving, reduce accidental events on highway due to lack of concentration. Besides from BYD Atto 3, Tang EV also have autopilot system that includes 25 state-of-the-art safety features like 360-degree HD surround view camera, 11 outdoor radars and ADAS system.

4. Comparison of Tesla and BYD

Tesla's Autopilot system is known for its advanced capabilities and pioneering the integration of semi-autonomous driving features. The system employs an array of cameras, ultrasonic sensors, and radar to provide features like adaptive cruise control, automated lane-keeping, automatic lane changes, and more. Tesla's approach leans towards a more comprehensive suite of autonomous driving features, with the eventual goal of achieving full self-driving capability. Tesla frequently updates its software to improve and expand the capabilities of its Autopilot system, incorporating data from a vast fleet of vehicles to enhance its performance. On the other hand, BYD's approach to autopilot features is more cautious and focused on driver assistance rather than full autonomy. Their vehicles incorporate features like adaptive cruise control and lane-keeping assistance to enhance safety and convenience for drivers. While not as advanced as Tesla's Autopilot, BYD's system reflects a careful progression towards autonomy, keeping drivers engaged and attentive while benefiting from automated driving aids. On the side of battery life and recharging, Tesla and BYD each have their benefits. Tesla have lesser battery life relative to the BYD EV such as Han and Tang EV, but have significance advantage on the field of recharging for the supercharge station has provides convenience to consumer to be recharge in 15 minutes relative to more than half an hour of charging of Han EV. Unlike Tesla, while having small advantage on the battery life BYD has quite low charging speed comparing to the supercharge station of Tesla that has been spreading and common among urban areas.

In Summary, Tesla and BYD in Chinese automobile market has significant impact and market share while focusing on different strategies of vehicle innovation. Tesla has the significant advantage on the autopilot system of the vehicle through usage of multiple radar, ultrasonic sensor, and cameras

to provide assistance on auto-driving of the vehicle. However, BYD has choose another approach of autopilot system. BYD focus on the assisting the driver through auxiliary system such as blind spot and lane keeping assistance that brings convenience and relax to the driver but not taking control of the vehicle. On the other hand, Tesla and BYD each has their own advantages on battery life. Tesla provides better costumer experience in form of fast recharging speed and convenient access to Supercharge station, and BYD have safer battery in various type of extreme condition or car accidents that might lead to the fire or explosion of the battery.

5. Conclusion

In conclusion, the evolving environment landscape of new energy vehicle in modern society have started and pushes the wave of commitment to a cleaner, sustainable automotive future. Within this dynamic arena, two automotive giants, Tesla and BYD, have played pivotal roles, each contributing distinct approaches to shape the future of mobility in the world's largest automobile market, China. This paper has extensively explored and compared three crucial aspects of Tesla and BYD's new energy vehicles: their autopilot systems, vehicle battery range, and safety concerns. The autopilot system, a cornerstone of autonomous driving, holds immense promise for reducing traffic accidents and improving road safety. Tesla's advanced system, driven by an array of sensors and constant software updates, strives for full self-driving capability, while BYD focus on assistance features, prioritizing driver engagement and safety. In terms of battery range and technology, Tesla has boast long battery range and providing convenience Supercharger network that enables its vehicle travel in long distance with minimal charging downtime. On the other hand, while not providing convenient charging network to reduce downtime for charging, the cutting-edge development of blade battery has provided them the unparallel advantage of vehicle safety compares to another electric vehicle. Both Tesla and BYD have played pivotal roles in promoting the adoption of electric vehicles, albeit with different strategies and strengths. Tesla's focus on innovation and autonomous driving technology has garnered significant attention and consumer interest, while BYD's emphasis on practicality, safety, and public transportation solutions has helped electrify various sectors of China's vast transportation ecosystem.

Under the period of rapid change and development, the analysis and dissection of the Tesla and BYD is crucial for the prediction of future trends of the new energy vehicle markets and the development of advanced technology that will be apply to the new energy vehicle industry. This paper delves into the market of new energy vehicle and compares three different areas of the new energy vehicle: autopilot-system, battery range, and safety concerns. In which these three areas are related to the most concerning issue of future automobile, while connecting to the advanced technology that pushes the development of human civilization. This paper may help assist others to understand better how the market of new energy vehicle was in China, and how may the marketing strategies of Tesla and BYD may led to different future trend and development of the market. However, the resource this paper includes mostly focus on the basic information released based on the official website of Tesla and BYD without real life data that really supports the effectiveness and stability of the vehicle, especially for BYD. There are few large number statistic data of the new energy vehicle of BYD on both areas of autopilot-system and safety concerns. This meant that the data and results of BYD and the comparison with Tesla could be still misleading with minimal evidence in real life to supports the argument.

In future, the author believe that the focus of the new energy vehicle will gradually shift towards the field of autopilot-system or autonomous vehicle. For the battery range and safety concerns of new energy vehicle might have reached a certain limit after time with current human technology, such as reaching similar reading of range compares to modern combustion/fuel engine vehicle and similar or higher safety concerns compares to it. However, the autopilot-system or autonomous vehicle areas have a lot more potential with the prosperous development of the computer technology. With the continuous development of world's computer science, the perfect balance of autopilot-system and

driver could be achieved to reduce both stress of the driver and the accidents and danger of driving vehicle.

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