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China Autonomous Retail Vehicle Industry Report, 2022

June 2022

Research on Autonomous Retail Vehicles: Lower Costs Accelerate Mass Production with Ever-spreading Retail Scenarios

Autonomous retail vehicles integrate technologies such as 5G, artificial intelligence, big data, mobile Internet and autonomous driving. They can move with the changes in the surrounding traffic autonomously. Users can hail such vehicles directly through APPs, and then they will arrive at the designated location accurately to provide convenient services.

At present, the digital economy has become the key engine of China's economic development. According to information from the Ministry of Industry and Information Technology, China has built 1.615 million 5G base stations so far, serving more than 400 million 5G users. China is a global leader in 5G infrastructure, mobile Internet ecology, and e-commerce. Smartphones have become the preferred terminals of the digital economy, smart cars will become the second-ranking terminals, and autonomous retail vehicles act as not only important terminals connecting e-commerce services and smartphones, but also core intelligent terminals that realize the transition from "people looking for services" to "services looking for people" (or "goods looking for people").



Autonomous retail vehicles are widely used in smart scenic spots, AI parks, commercial streets, zones, squares and other places for selling high-demand products such as beverages, breakfast, fast food, fresh products, and even shoes. Mobile new retail lets goods look for people. Users can stop autonomous vending vehicles by scanning QR codes, beckoning, and touching displays, and pay for what they choose by QR code scanning. This mode is time-saving, convenient and easy. For merchants, presenting products in front of customers in crowded areas (subway entrances, business districts, zones, etc.) during rush hours and lunch break when the demand hits the maximum can significantly increase the transaction volume. The service radius of merchants has been expanded from 1-2 kilometers to 5 kilometers.

Mobile Retail Is a Form of Autonomous Delivery

Application scenarios	Services	Timeliness	Coverage
Mobile retail	Sale of food, beverages, fruits and vegetables, etc.	N/A	1- 2km
Food delivery	Instant delivery of takeaways	30-45 minutes	3km
Direct store delivery	Fresh product delivery	1 hour	5km
Express delivery	Parcel delivery	2-3 days	2-5km

Source: ResearchInChina

1. The policies for low-speed autonomous vehicles have been gradually improved

As low-speed autonomous vehicles, autonomous retail vehicles are used in cargo-carrying scenarios that are easier to handle. On May 25, 2021, Beijing High-level Autonomous Driving Demonstration Zone released the "Implementation Rules for the Management of Autonomous Delivery Vehicles", and issued vehicle numbers for autonomous delivery vehicles of JD.com, Meituan and Neolix. Since then, L4 autonomous driving technology has been verified by large-scale testing and on-road operation, which has promoted the vigorous development of China's autonomous delivery industry.

Neolix launched nearly 1,000 autonomous vehicles in 2021, and plans to roll out another 2,000 autonomous delivery vehicles in 2022. Meituan plans to deploy 1,000 autonomous delivery vehicles in Shunyi District within three years, and put a total of 10,000 such vehicles into operation nationwide to achieve multi-city, multi-scenario and all-weather coverage.

Up to now, Beijing High-level Autonomous Driving Demonstration Zone has granted a total of 225 test licenses, including 86 body codes for autonomous delivery vehicles. So far, the demonstration zone has started the third phase of the construction project. In the demonstration zone, 332 digital intelligent intersections have been fully covered by the infrastructure within a range of 60 square kilometers. Scenarios such as autonomous retail, autonomous police patrols, and micro-circulation shuttling have approached citizens.



Neolix's autonomous vehicles provide lunch services for commuters in Yizhuang
新石器无人车为亦庄上班族提供午餐服务

Chinese Standards for Autonomous Delivery

Some Chinese Standards for Autonomous Delivery

Standards	Launch time	Introduction
Implementation Rules for the Management of Autonomous Delivery Vehicles	May 2021	<p>In May 2021, the Beijing High-level Autonomous Driving Demonstration Zone broke through the restrictions of existing laws and regulations in China to release the "Implementation Rules for the Management of Autonomous Delivery Vehicles", and introduced the traffic rules and traffic management models suitable for autonomous delivery vehicles running on roads.</p> <p>At the same time, the demonstration area issued body codes for autonomous delivery vehicles of JD.com, Meituan and Neolix, and gave the corresponding right of way to these vehicles. With reference to the non-motorized vehicle rules, the "Implementation Rules for the Management of Autonomous Delivery Vehicles" manages the right of way for autonomous delivery vehicles, that is, autonomous vehicles can only run on non-motorized vehicle lanes.</p> <p>The "Implementation Rules for the Management of Autonomous Delivery Vehicles" standardizes the size, load, speed, power and other technical and testing indicators of autonomous delivery vehicles. It also requires technology exploration and product insurance models, for which it regulates the insurance types, coverage, insured amount and so on.</p>
Administrative Measures for the Trial Operation of JD's Autonomous Delivery Vehicles in Wuhu City (Trial)	Aug 2021	<p>In August 2021, Wuhu Municipal Transportation Bureau issued "Administrative Measures for Trial Operation of JD's Autonomous Delivery Vehicles in Wuhu City (Trial)" with Municipal Commerce Bureau, Municipal Urban Management Bureau, Municipal Education Bureau and Municipal Traffic Police Detachment. For JD's autonomous delivery vehicles, it stipulates operating entities and vehicles, application process, operation management, safety management, traffic violations and accident handling. This is the first trial regulation for autonomous delivery vehicles in Anhui Province.</p>

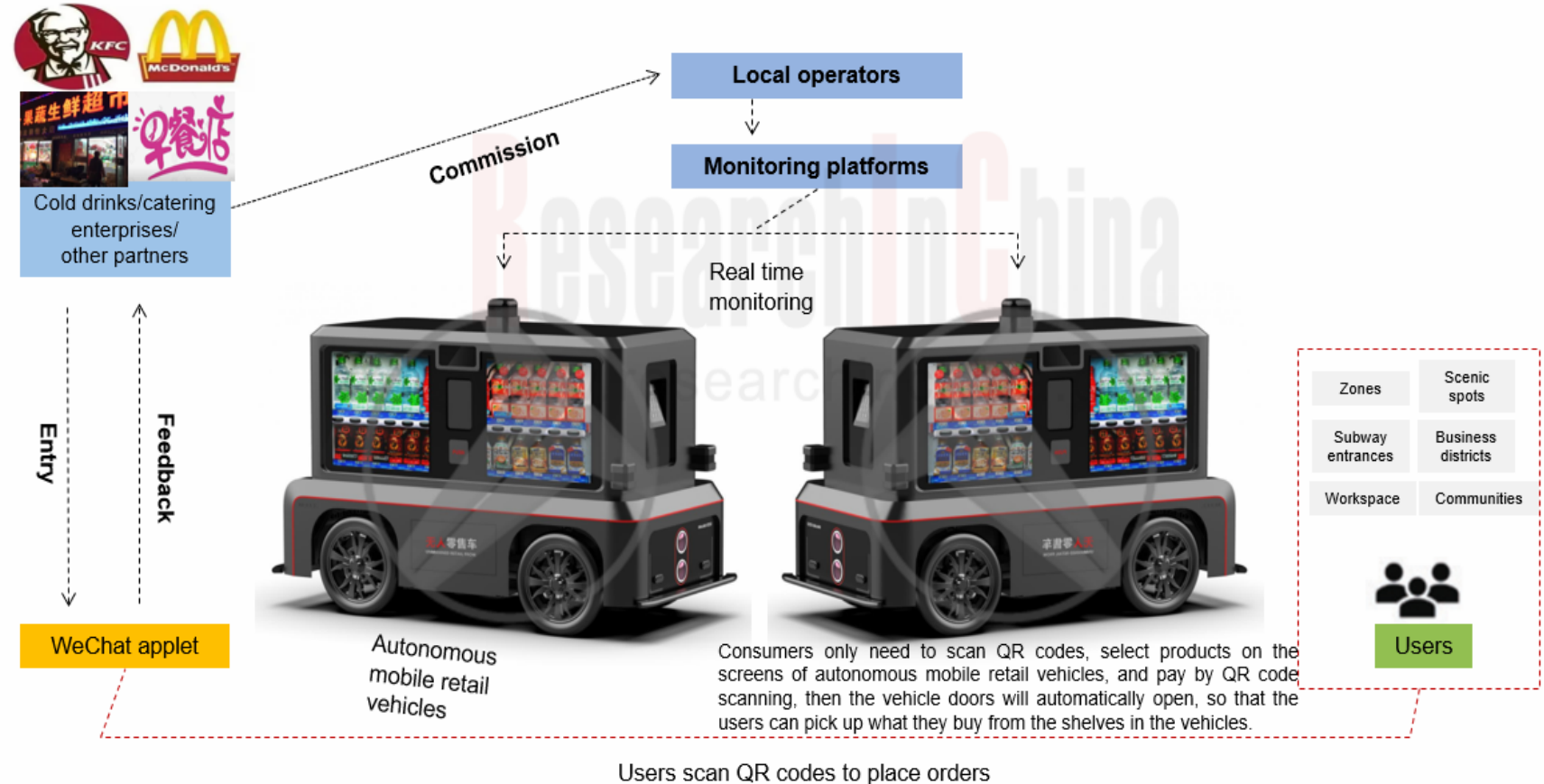
Safety Specification Management for Urban Commercial Operation of Low-speed Autonomous Vehicles	Oct 2021	<p>On October 29, 2021, 2021 Low-speed Autonomous Vehicle Commercial Application Standard Conference was held in Shenzhen. The "Safety Specification Management for Urban Commercial Operation of Low-speed Autonomous Vehicles" compiled by more than 57 units and 112 experts under the organization of Shenzhen Intelligent Transportation Industry Association was officially released. It has been implemented since January 1, 2022.</p> <p>The main drafters include Meituan, Dongfeng Yuexiang, Pudu Robotics, Yuwan Technology, URTRUST Insurance, Ming Chain Technology, etc. Other participants embrace Alibaba DAMO Academy, JD.com, PIX Moving, Go Further AI, Haomo AI, UISEE, Idriverplus, Ecar Tech and other leading enterprises in the industry, as well as Testing Center of the First Research Institute of the Ministry of Public Security of China, China Security Technology Prevention Certification Center, etc.</p> <p>The "Safety Specification Management for Urban Commercial Operation of Low-speed Autonomous Vehicles" requires effective specifications for the city's right-of-way allocation, autonomous driving capability, equipment safety, data communication, safety management system and insurance during the commercial operation of low-speed autonomous vehicles. Also, it puts forward solutions for the inspection and certification of vehicles before entering cities.</p>
Technical Requirements for Safety of Low-speed Autonomous Vehicles	Dec 2021	<p>On December 23, 2021, the opinions on the "Technical Requirements for Safety of Low-speed Autonomous Vehicles" were publicly solicited on the website of China Association for Mechatronics Technology & Application, marking China's upcoming certification standard for low-speed autonomous vehicles.</p> <p>This standard was formulated by China Certification Centre for Automotive Products, China Machinery Huanyu Certification and Inspection (Jiangsu), Lu'an MOVE-X, JD Kunpeng (Jiangsu), Xiangyang Daan Automobile Testing Center and so on. The introduction of this standard fills the gap in China's autonomous vehicle certification. It will play a positive role in providing basis for the driving of autonomous vehicles on roads.</p>
General Technical Conditions for Mobile Chassis of Low-speed Autonomous Vehicles	May 2022 (start)	<p>The formulation of the "General Technical Conditions for Mobile Chassis of Low-speed Autonomous Vehicles" initiated by Hunan Huda Aisheng Automotive Technology Development Co., Ltd. and Shenzhen Unity-Drive Innovation Technology Co., Ltd. was scheduled to start in May 2022.</p>

Source: ResearchInChina

Typical Business Models of Autonomous Retail Vehicles

Typical Business Models of Autonomous Retail Vehicles

At the beginning of March 2022, Shanghai Municipal Transportation Commission announced that a total of 13 solutions for Shanghai Intelligent Connected Vehicle Demonstration Application Innovation Project had been confirmed after companies' voluntary application, on-site evaluation and solution review according to the "Implementation Plan for the Expansion of Demonstration Application Scenarios of Intelligent Connected Vehicles in Shanghai (2021-2023)". Among them, 2 solutions were involved with "smart retail", requiring "no less than 20 smart retail vehicles" in operation.



2. The costs of low-speed autonomous delivery vehicles are gradually sinking, promoting mass production of such vehicles for more scenarios

Depending on models, sensor solutions, etc., an autonomous delivery vehicle generally costs RMB200,000 ~ 500,000, let alone other expenses incurred by insurance, vehicle operation and maintenance, on-site safe operation and maintenance, remote monitoring, labor, cloud platform services, etc. China-based Haomo.AI has launched its first autonomous delivery vehicle, the Little Magic Camel, priced at RMB130,000. It is equipped with 3 mechanical LiDAR sensors worth about RMB40,000, radar, cameras and a computing platform. The total cost is nearly RMB100,000. Among the three basic systems of perception, decision-making and actuation, the computing platform plays a key role in the safe operation of autonomous retail vehicles.

With the gradual penetration of autonomous retail vehicles from fixed scenarios to more complex public road scenarios, extremely high requirements are placed on low-latency processing and multi-sensor information fusion of computing platforms. In the field of computing platforms, typical automotive chip enterprises include Horizon Robotics, Huawei, Idriverplus, Haomo.AI, Neolix, WeDrive.AI, Go Further AI, etc. The current mainstream computing platform is the NVIDIA Jetson AGX Xavier platform which is estimated at around RMB10,000 according to the supplier's price that is expected to further drop in the future.

Typical Chinese Automotive Computing Platforms

Typical Enterprises	Autonomous Driving Computing Platforms	Computing Power
Horizon Robotics	Matrix	40TOPS (Matrix 2)
		192TOPS (Matrix 3)
		1024TOPS (Matrix 5)
Huawei	MDC	352TOPS (MDC600)
Idriverplus	AVCU	3TOPS (2018 version)
		180TOPS (2020 version)
		500TOPS (2022 version)
		1000TOPS (2024 version)
Haomo.AI	ICU3.0 computing platform	360TOPS
Go Further AI	Intelligent Driving Computing Platform	30-60TOPS (zones)
		Above 60TOPS (complex scenarios)
Neolix	NeoWise	96TOPS
WeDrive.AI	Pandora	200TOPS

Source: ResearchInChina

2. The costs of low-speed autonomous delivery vehicles are gradually sinking, promoting mass production of such vehicles for more scenarios

In addition, LiDAR whose cost is on a downward trend plays an extremely critical role in the perception system. Most of the current autonomous delivery vehicles use 16-channel LiDAR. Under the stimulation of demand, Chinese LiDAR vendors, such as LeiShen Intelligent System, RoboSense, HESAI, Livox, Huawei, etc., have sprung up, and they can basically meet the demand of autonomous delivery vehicles.

Chassis-by-wire is one of three core components of an autonomous delivery vehicle. In China, main chassis-by-wire players include PIX, Teemo, UISEE, Skywilling, Neolix, and Haomo.AI. For example, PIX Moving offers chassis-by-wire at the price of RMB80,000 ~ 100,000. With the continuous deployment of autonomous delivery vehicles and autonomous retail vehicles in China, large-scale mass production will further drag down the price of chassis-by-wire.

The chassis of autonomous vehicles is changeable, and a specific service function can be fixed horizontally like autonomous retail vehicles, autonomous media vehicles, etc.



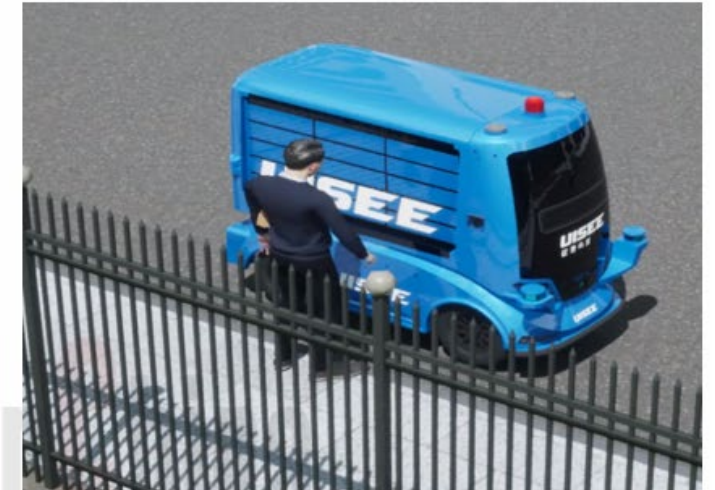
UISEE's autonomous vehicles

UISEE's autonomous vehicles: Different services can be performed at different times of the day with a higher operational efficiency.

UISEE, which is committed to all-scenario strategy, continues to expand application scenarios of its products. On September 25, 2021, it officially released UiBox (an L4 autonomous driving solution for urban services) and UiBox (an autonomous delivery vehicle) to further promote "commercial application of AI drivers" in all scenarios. UiBox can offer different services at different times to improve operational efficiency.



Session 1: Transform into an Autonomous Retail Vehicle



Session 2: Transform into an autonomous delivery vehicle



Session 3: Transform into an autonomous truck



Session 4: Transform into an autonomous patrol car

3. The application scenarios of autonomous retail vehicles have spread from semi-enclosed zones to open roads and then to large communities

In 2021, Jushi Technology deployed an autonomous fleet in Zhangjiang Artificial Intelligence Island in Shanghai where employees can buy a variety of food, office supplies, and daily necessities from autonomous retail vehicles. Autonomous delivery vehicles can provide food delivery services such as pizza delivery to restaurants on the artificial intelligence island. After employees place orders through their mobile phones, autonomous vehicles will automatically deliver the meals prepared by restaurants to employees who only need pick up the meals according to the notification on their mobile phones. In addition, the supporting monitoring platform can surveil the operation of autonomous vehicles around the clock to ensure safety.



Source: Jushi Technology

On June 1, 2022, Shanghai WeDrive.AI officially introduced autonomous retail vehicles to Nanfeng Future Community, Shangyu, Shaoxing, Zhejiang to provide autonomous sales services for the community. Nanfeng Future Community consists of City Star, Liangjiang Home and Community Center Complex, which are home to more than 40,000 residents and more than 12,700 families.

On April 22, 2022, Neolix's autonomous vehicles were also welcomed into the large community of Shanghai Lijing in Pudong District, Shanghai. Autonomous retail companies are covering more application scenarios.



Source: WeDrive.AI

4. OEMs use their advantages in technology and manufacturing to explore new businesses

On April 30, 2021, In-driving Tech was invited to participate in the Science Night of Han Street in Wuhan. The interactive area displayed the Sharing-Box, a high-tech autonomous smart car developed by In-driving Tech and Dongfeng Motor.

Sharing Box is an autonomous intelligent point-to-point transportation platform launched by Dongfeng Motor. It is constructed by integrating TITAN (an autonomous driving domain controller of In-driving Tech) and Athena Software to realize L4 autonomous driving based on HD maps in specific scenarios.

In addition to Dongfeng Motor, Wuling has also explored new businesses with its own technology and manufacturing advantages, and launched "Xiaoling" driverless smart retail vehicle, which has been practically applied.

In Baoding, Haomo.AI, a company backed up by Great Wall Motor, has built the world's first flexible manufacturing base for L4 low-speed autonomous vehicles. It produces a variety of models (including autonomous retail vehicles). After the latest upgrade, the design capacity of the production line can reach 10,000 vehicles per year.



Source: Wuling

5. With the support of capital, major players aggressively enhance resilience, use closed data loop to continuously improve technology and ensure safe operation

Some Autonomous Retail Vehicles Companies and Their Financing

Enterprises	Financing time	Financing amount	Round	Institutions
Neolix	May 2018	Undisclosed	Angel	CHJ Automotive, Suzhou Industrial Park Oriza Yuandian Venture Capital Management, Yintai Group, etc.
	May 2019	Nearly RMB100 mln	A	Yunqi Partners, Clory Ventures, CICC
	Mar 2020	Nearly RMB200 mln	A+	Li Auto, Yunqi Partners, Yunqi Partners, ADDOR Capital
	Aug 2021	Hundreds of millions of yuan	B	SoftBank Group, CICC
Go Further AI	2017	Tens of millions of yuan	Angel	JD.com
	Jan 2018	Tens of millions of yuan	Pre-A	Qianshan Capital, K2VC
	Apr 2021	RMB100 million	A	HONY HORIZON FUND, Yannan Artificial Intelligence Industry Fund, Honghao Capital and UBTECH

Unity Drive	Aug 2018	Undisclosed	Angel	Oriental Capital, Fortune Co-Power, Tsingyuan Ventures
	Feb 2020	Tens of millions of yuan	Pre-A	Lenovo Capital and Incubator Group
	Jul 2021	Undisclosed	Pre-A+	VeriSilicon, Shenzhen Cloud Ventures
Yours	Jun 2018	Millions of yuan	Seed	PNP China led the investment; Beijing HSBC Investment, Beijing Golden Seed Venture Valley Technology Incubator Center, and Shanghai FOSHINE Investment Management participated in the investment
	Jul 2019	Tens of millions of yuan	Angel	Innoangel Fund led the investment, and AISTAR Ventures participated in the investment
	Oct 2020	Tens of millions of yuan	A	Global Brain, Innoangel Fund, AISTAR Ventures, PNP China, FOSHINE Investment Management
	Mar 2019	RMB30 million	Angel	Baidu
Hunan Apollo Intelligent Transportation	Mar 2019	RMB30 million	Angel	Baidu

Source: ResearchInChina

Little Donkey of Alibaba

During the R&D process of Little Donkey, which can run more than 100 kilometers on a charge of 4 kWh, Alibaba DAMO Academy has built its own autonomous driving cloud platform from the very beginning, which uploads massive data (scenario databases, autonomous vehicle data, data from data collection vehicles) to Alibaba Cloud. Carrying out data management, simulation testing and algorithm model training on the cloud has greatly improved the R&D efficiency of autonomous driving algorithms. Based on this autonomous driving cloud platform, Alibaba DAMO Academy has launched the world's first "hybrid simulation test platform" for autonomous driving. The platform uses a combination of virtual and reality simulation technologies, introduces real road test scenarios and cloud trainers. It takes only 30 seconds to simulate an extreme scenario, and the system's daily virtual test mileage can exceed 8 million kilometers, greatly improving the training efficiency of autonomous driving AI models.



Source: Cainiao

From its debut in September 2020 to March 31, 2022, Little Donkey delivered more than 10 million logistics orders.

According to Jie Jinghua, a partner of Neolix, the current commercial scenarios of Neolix's autonomous vehicles include both open roads and closed zones such as campuses. A vehicle can obtain 100T data per day, and it actively captures about 20G/day of valuable data (including the original point cloud of LiDAR, images, intermediate results, logs and so on). The Ocean data system completes the storage, cleaning, labeling and model training of these data before finally forming a closed data loop.

When autonomous vehicles become more sophisticated, the ultimate challenge no longer lies in underlying architectures or technical problems, but fragmented scenarios, special extreme situations and human behaviors that can never be predicted instead which account for 5%.

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Beijing Headquarters

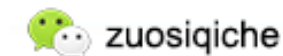
TEL: 010-82601561, 82863481

Mobile: 137 1884 5418

Email: report@researchinchina.com

Website:
www.researchinchina.com

WeChat: [zuosiqiche](#)



[zuosiqiche](#)



Chengdu Branch

TEL: 028-68738514

FAX: 028-86930659