

Mobile Charging Robot Research Report, 2024

May 2024

Research on mobile charging robot: more than 20 companies have come in and have implemented in three major scenarios.

Mobile Charging Robot Research Report, 2024 released by ResearchInChina highlights the following:

- Overview of mobile charging robot (development history, product classification, system structure, key technologies, etc.);
- Characteristics of mobile charging robot market (policy environment, operation scenarios, marketization process, commercial value, main players, competitive edges of players, etc.);
- Mobile charging robot industry chain (market characteristics, technical requirements, main suppliers, etc. of key modules such as energy storage, autonomous driving, mechanical arm and operation platform);
- Mobile charging robot suppliers (product features, application scenarios, commercialization, etc. of over 20 Chinese and foreign mobile charging robot companies);
- Development trends of mobile charging robot (market trends, technology trends, advantages and disadvantages for industry development, etc.).

1. From 2023 to 2024, mobile charging robot companies mushroom in China.

Mobile charging robot is intelligent equipment for mobile charging. After an electric vehicle is parked in the parking space, via APP or other systems, the robot with charging function will automatically move to the vehicle to charge it. As a temporary and fast way to replenish vehicles, mobile charging robots will complement existing fixed charging, battery swap and wireless charging modes in the future to build an improved energy replenishment ecosystem for electric vehicles.

From the perspective of development history, mobile charging robot started around 2015 and was first proposed by Tesla and Volkswagen. Chinese companies began to enter in 2020. By 2024, there will be more than 20 Chinese players, and their products will also become diversified and have function upgrades.

2. Most mobile charging robot players come from OEMs, energy companies, robotics companies, and technology companies.

Mobile charging robots span multiple fields from autonomous driving and energy to robotics. Current players mainly come from OEMs, energy companies, robotics companies, and technology companies.





Source: ResearchInChina



OEMs like Volkswagen and FAW Hongqi develop products around vehicle charging needs.

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?Volkswagen has explored multiple mobile charging solutions, including mobile charging robot and mobile charging station. Its mobile charging robot works by dragging a charging pack. The fully automated robot is fitted with cameras, LiDAR and ultrasonic sensors. It can charge parked cars on its own using a mechanical arm and a 25kWh battery pack. However this solution is still in the prototype phase. One of the reasons why it has yet to be mass-produced is the high cost. This solution is equivalent to using two robots (one of which is a huge battery), and its manufacturing cost may be as high as an electric vehicle.





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FAW Hongqi trial-produced an intelligent mobile charging robot prototype

FAW Hongqi trial-produced an intelligent mobile charging robot prototype in 2022. It integrates a mechanical arm, automation technology and a vision system for complex environments in all scenarios. Combined with robot control technology, it can plug in the gun to an electric vehicle and charge by itself, providing car owners with a more intelligent and more automatic charging experience.





Energy companies like Gotion High-Tech and Envision Group provide diverse energy extension services by virtue of their resource advantages

② Energy companies like Gotion High-Tech and Envision Group provide diverse energy extension services by virtue of their resource advantages.

?Gotion EPLUS intelligent mobile energy storage charging pile is a brand-new product that integrates storage and charging, drives itself freely and moves agilely, providing fast charging services for new energy vehicles anytime and anywhere. It is produced by Anhui Yijianeng Digital Technology Co., Ltd., a subsidiary of Gotion High-Tech. As of April 2024, up to 1,000 EPLUS piles have been put into operation in 30 cities of China including Shanghai, Shenzhen, Hangzhou and Hefei, and it has been exported to the US, Japan, Germany, Singapore, Thailand, the Netherlands, Indonesia and other places.





Envision Group unveiled Mochi in 2021, a charging robot equipped with multiple sensors such as LiDAR, ultrasonic radar array, high-precision wheel speedometer, and inertial measurement unit. It can automatically find the path, drive itself, and accurately get to the parking space where the user summons it. When encountering an obstacle, it can come to a full stop from full speed only in 0.1 seconds, and automatically avoid the obstacle and arrive safely. Using Envision AESC's automotive-grade safe batteries, Mochi can quickly charge a new energy vehicle with a range of about 600km to the full within 2 hours. It is adaptable to almost all mainstream electric models on the market.





Robotics companies enable use of their products in the charging automation market segment relying on their technical strengths such as mechanical arm and control system

③ Robotics companies enable use of their products in the charging automation market segment relying on their technical strengths such as mechanical arm and control system. Typical companies include Xiangyi Automation Technology and Ocean&Macro Intelligent Technology.

?The mobile charging robot jointly developed by Xiangyi Automation Technology and AUBO can charge electric vehicles at any time. This product features a working radius of 1350mm, a repeated positioning accuracy of ±0.03mm, and ±360° rotation of each joint. It can accurately recognize the charging interface and automatically plug in and pull out the charging gun.





Other technology companies integrate technologies and resources around charging scenarios and deploy products in the mobile charging segment

Following the innovation sharing idea of mobile phone power banks, the parking lot mobile power bank solution developed by Ocean&Macro Intelligent Technology combines with the autonomous mobile robot (AMR) to flexibly transport rechargeable batteries. It is the product of the integration of charging piles and mobile robots. In 2023, Ocean&Macro Intelligent Technology's first new energy mobile charging robots came into use, providing a 206kWh battery that can charge 4-6 vehicles. With the maximum charging power up to 80KW, they enable a range of 200km for vehicles with a 20-minute charge.

(4) Other technology companies integrate technologies and resources around charging scenarios and deploy products in the mobile charging segment. Typical companies include SATOR Tech and Zhaozhuang Technology.

?SATOR mobile charging robot with 60kW charging power and a 70kWh CATL battery can achieve 10,000 cycles. In addition, it packs an automotive-grade battery with DC fast charging, allowing for a charge to 80% in half an hour. The power module output voltage range is wide, covering vehicles with 800V systems.







Mobile charging robots have been implemented in three major scenarios: emergency energy replenishment, regular energy replenishment, and accompanying energy replenishment.

3. Mobile charging robots have been implemented in three major scenarios: emergency energy replenishment, regular energy replenishment, and accompanying energy replenishment.

Mobile charging robots are primarily used in energy replenishment scenarios, including emergency energy replenishment, regular energy replenishment, and accompanying energy replenishment.

① Emergency energy replenishment often come into use in scenarios where a vehicle accidentally loses power while travelling. Application case: The mobile charging robot of State Grid Wuhan Power Supply Company can be deployed according to the load of surrounding charging stations, and can also provide emergency rescue for on-road vehicles that need to be charged for the moment: within 2 kilometers, the robot can directly drive itself there; as for temporary support beyond 2 kilometers, it is transported to the scene by a vehicle.

② Regular energy replenishment is applied in the most scenarios including highway service zones, community parking lots, shopping mall underground garages, scenic spot parking lots and industrial campuses, of which it is the most common in highway service zones.

Application case: During the National Day holiday in 2023, Zhejiang, as the venue for the 19th Asian Games, actively proposed and implemented innovative energy replenishment solutions and put into use mobile charging robots in highway service zones. In some service zones such as Jiaxing, Dongyang, Yuyao, Xiaoshan and Changan, SATOR mobile charging robots were deployed. After parking, car owners can summon the mobile charging robot via their mobile phone to charge their car, avoiding many problems caused by waiting in line for charging.

③ Accompanying energy replenishment often acts as an ancillary charging facility for autonomous vehicles or new energy vehicles.

Application case: Fulongma's mobile charging vehicle provides road rescue services along with large charging vehicles.



Mobile charging robot + AVP/ultra-fast charging/commercial vehicle is expected to become the next application trend

4. Mobile charging robot + AVP/ultra-fast charging/commercial vehicle is expected to become the next application trend.

As autonomous driving and ultra-fast charging technologies come into service, mobile charging robots are expected to be applied in new scenarios.

① Mobile charging robot + AVP

After AVP is combined with the charging function, the system will automatically allocate the parking space and charging space according to state of charge. For example, when a vehicle needing a charge enters the site and the system determines that it needs to be charged, the system will automatically guide the vehicle to the charging location. Then the charging device will automatically communicate with the vehicle's charging mechanism and start charging. After charging the vehicle to the set upper limit, the system will move it to a general parking space and then charge the next electric vehicle.

At CES 2024 in January 2024, Bosch and Volkswagen subsidiary Cariad demonstrated how to achieve fully automated charging of electric vehicles in parking lots in the future. This concept is similar to the Automated Valet Parking previously cooperated with Mercedes-Benz. As long as the driver drives a car that supports this function and gets off the car at the drop-off area of the designated parking lot, he/she can activate the automated parking function via the App, and the system will take over all the follow-up steps until the user picks up the car and leave. The user can summon the car to the pick-up area via App.







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2 Mobile charging robot + ultra-fast charging

Since 800V new energy vehicles were unveiled in 2023, multiple brands like BYD, Avatr, Xpeng and Denza have achieve mass production, which then pushes up the demand for ultra-fast charging technology.

In the field of mobile charging, Lotus was the first to apply ultra-fast charging. In August 2023, Lotus Automatic Charging Robot and Solar Storage Supercharging Station settled in Fuyang District, Zhejiang. The supercharging station is equipped with a liquid-cooled supercharging system which supports fully liquid-cooled high-power charging architecture. With the maximum power output of 650kW, it only takes 20 minutes to charge Eletre from 10% to 80%. Differing from conventional mobile charging robots, it cannot move and allow "the pile to find people", in spite of adopting automation technology.

SATOR Tech and DHForce have rolled out mobile charging robots that support highvoltage fast charging. SATOR mobile charging station can cover 800V system vehicles, and is equipped with both liquid cooling and low-temperature heating systems, and automotive-grade batteries that enable a charge to 80% with DC fast charging in half an hour. DHForce's integrated mobile supercharging robot is compatible with 800V platforms and provides 70kWh/80kWh stable and fast charging. The launch of above solutions makes it possible to apply ultra-fast charging in mobile charging robots.





3 Commercial vehicle + application in closed scenarios

Due to large size and inconvenient scheduling, commercial vehicles need mobile charging. In closed scenarios such as campuses, factories and airports, the requirements for the autonomous driving capabilities of charging vehicles are not high, so the demand for mobile energy replenishment in commercial vehicle + closed scenarios is expected to expand.

At this stage, in closed campuses automatic charging services are generally provided in the form of fixed charging station + automatic mechanical arm.

Xiangyi Automation Technology's automatic charging robot with Xiaoyu 2.0, Yutong's new-generation robot bus, entered the Changsha Airport apron for testing. According to the set threshold, when the battery level is lower than a certain SOC value, the vehicle can drive itself to the automatic charging spot. After the autonomous driving system determines that the vehicle is ready for charging, it sends a charging instruction to the automatic charging robot, and the automatic charging robot accurately locates the vehicle charging socket through vision localization and then precisely inserts the charging gun into the vehicle charging socket, without needing to change the charging socket and with strong adaptability.





TELD intelligent flexible charging robot consists of two parts

TELD intelligent flexible charging robot consists of two parts: an intelligent flexible charging robot and an on-board electric base. Based on TELD's two-layer protection and flexible charging, it is a solution that integrates multi-axis movement and accurate recognition to automatically charge electric vehicles. The system has a service life of up to 150,000 times, 15 times that of conventional charging terminals. With smart chip + laser detection, it accurately locates the charging interface, effectively improving autonomous operation in campus scenarios. It is suitable for commercial vehicles, engineering vehicles and special vehicles.

In the future, as battery energy storage efficiency improves, mobile charging robots are expected to be applied in commercial vehicle + closed campus scenarios.





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