

Li Auto will shift from the single extended-range route to the "extended-range + high-voltage battery-electric" route of in 2023.

In the first half of 2022, Li Auto sold 60,801 vehicles, up 99.1% year-on-year. In terms of models, Li ONE still played a main role in the first half of the year. With the launch of L8 in September 2022, Li ONE will be gradually withdrawn from the production line, while L8, L7 and L9 will be the focus of production and marketing in the future.

As for product planning, all the models currently being sold by Li Auto are extendedrange electric vehicles. However, Li Auto plans to launch at least two high-voltage battery-electric vehicles every year from 2023 onward. For the purpose of highvoltage super-fast charging, Li Auto deploys the following four aspects: First, 4C batteries. Second, application of SiC technology. Third, thermal management system. Fourth, 400KW charging network.



Source: ResearchInChina



According to its plan, Li Auto will produce the third-generation semiconductor SiC power chip in 2024. At the same current of the high-voltage platform, this chip is 70% smaller than an IGBT chip, with the comprehensive efficiency being improved by 6%. The layout of Li Auto's 800V high-voltage battery-electric technology reveals that one of the selling points of new cars in the future will be reflected in the charging speed.



Technical layout	Layout mode	Technical progress
4C battery	Joint R&D	As of 2021, Li Auto had completed the test of 4C battery packs on vehicles which can have a range of 400 kilometers after 10 minutes of charging.
SiC technology	Joint R&D with Sanan Optoelectronics	The automotive power semiconductor R&D and production base was set up. In 2022, the equipment installation and commissioning started. The trial production will begin in 2023H1. After the official production in 2024, the annual capacity will gradually jump to 2.4 million SiC half-bridge power modules.
Thermal management system	Joint R&D	Li Auto plans to use carbon dioxide as a refrigerant to further improve the heating and range of new energy vehicles in winter.
400KW charging network	Self-developed and self-built	Li Auto built a closed-loop (vehicle-pile-cloud) service network. Li Auto plans to launch Whale and Shark battery-electric models in 2023, each of which will support 800V fast charging. Li Auto will build a high-power charging network on expressways in key cities.

Li Auto's Technical Layout in High-voltage Fast Charging

Source: ResearchInChina



As for the progress of intelligent driving, Li Auto has developed AEB system by itself as a "latecomer". In the future, Li Auto will provide all open source codes of its AEB system to improve traffic safety.

In addition, Li Auto added NOA to 2021 Li ONE in December 2021, improved the performance of AEB, and optimize the detection and fusion of cameras and radar. Since 2022, all new cars have been equipped with Li Auto's self-developed hardware compatible with L4 autonomous driving as standard. Li Auto plans to make urban NGP functions available in Li L9 through OTA in 2023, and install L4 autonomous driving capability on production vehicles via OTA around 2024.

Progress of Li Auto and Other Emerging Automakers in Pilot Assist

Development of I Assist	Pilot	2018	2019	2020	2021	2022	2023
Li Auto					NOA on highwa	ays	NOA in cities
Tesla	NOA on highways				-		
NIO					NOP on highways		NOP in cities
Xpeng					NGP on highways	NG	P in cities
Source: ResearchInChina							



Regarding the core underlying technology layout of intelligent driving, Li Auto established Sichuan Lixiang Intelligent Technology Co., Ltd. in May 2022 to design chips. In August 2022, Xie Yan, the former vice president of Huawei Software, joined Li Auto as the head of system R&D division. The system R&D division is mainly responsible for R&D of some underlying intelligent technologies, including Li Auto's self-developed operating system and computing platform. Li Auto's computing platform business also includes its self-developed intelligent driving chip project.

For the intelligent driving algorithm, Li Auto uses BEV framework similar to that of Tesla, that is, it utilizes pure vision for motion perception prediction. On the basis of BEV visual information, Li Auto exploits additional LiDAR and HD map information input to implement the **BEV fusion algorithm**, and adds a visual security module and a LiDAR security module which are redundant with BEV framework model for the sake of an extra layer of protection.





The cockpit multi-modal interaction represents development trend of human-machine co-driving era. As per three new cars launched in 2022, Li Auto upgrades the past four-screen 2D interaction in Li ONE to current five-screen 3D interaction, and realizes "voice + gesture" multi-modal interaction.

For example, the five screens of Li L9 include a safe driving interactive screen, a W-HUD with a projected area of 13.35 inches, a 15.7-inch integrated center console screen and co-driver screen, and a 15.7-inch rear entertainment screen. The in-vehicle 3D ToF sensor perceives the cockpit environment in real time. Plus, 6 microphones, 7.3.4 panoramic sound layout, 5G dual-operator automotive communication network, and multi-modal spatial interaction technology developed by Li Auto based on deep learning enable the three-dimensional interaction in the cockpit.

Cockpit Multi-modal Fusion Perception of Li Auto



In terms of **perception**, Li AI, the intelligent cockpit space, imitates the coordination of human ears and eyes to attain the three-dimensional information perception inside the vehicle under the influence of multi-modal attention technology by a distributed hexasilicon microphone, an IR 3D ToF sensor, MIMO-Net six-vocal-range enhancement network and MVS-Net multinocular & multi-view visual fusion network.

As for **understanding and expression**, Li Al restores the multi-source heterogeneous data sensed by fusion perception to concrete events in the network, and fulfills further abstract understanding. Ultimately, knowledge linking, knowledge completion and logical reasoning form an event graph, allowing machines to have their own understanding and decision-making capabilities.



Regarding voice technology, Li Auto defines its voice assistant "Lixiang Tongxue" as the user's housekeeper (current stage) and family (future goal), and plans a three-stage product upgrade. At present, the goals of the first two stages have been achieved through OTA: The first stage: Li Auto's self-developed "Lixiang Tongxue" engine replaces the underlying capabilities with Horizon + Alspeech + Microsoft, etc. The second stage: "what you see is what you can say", four-vocal-range locking and other functions.

In the future, the voice system will offer functions such as "from application-on-demand to network-ondemand", cross-screen multi-person dialogue, and "the front passenger can pick up the conversation after the driver finishes speaking".

May 2021	September 2021	Future
Stage 1: FOTA 2.1	Stage 2: FOTA 2.2	Stage 3: FOTA 2.3
 Li Auto's self-developed "Lixiang Tongxue" engine replaces the underlying capabilities with Horizon + Alspeech + Microsoft, etc. The wake-up interrupt function is added. When "Lixiang Tongxue" is speaking, the user can directly evoke "Lixiang Tongxue" to execute the next instruction by voice. The four-vocal-range locking mode is added. The user can choose the seat position where "Lixiang Tongxue" can be woken up in "Settings>Voice". 13 voice functions for body control and vehicle settings are added (suspension, power, steering, driving mode, road mode, light height, power display, wireless charging, locking tone, automatic locking when the user leaving the car, automatic tilting of rearview mirrors, seat switch, wiper maintenance). 	 Continuous conversation: Conversation can continue for 20 seconds after a wake-up. What you see is what you can say: The user can use voice to control an APP without deliberately memorizing trigger words such as instructions and keywords. The system automatically recognizes and executes the menu items displayed on the screen as spoken by the user. The first batch of supported applications include QQ Music, Ximalaya FM, Bluetooth Phone and Vehicle Center. Four-vocal-range locking: Car owners can choose to turn off the voice function for the co-driver or the second row. Cross-vocal-range contextual dialogue: The user and the system can conduct contextual dialogue according to the content of the previous instruction, and adjust the needs of passengers in other seats. Invalid text rejection 	 Four-vocal-range co driver screen voice system. What you see is what you can say II. Multi-application control and arbitration strategy. Video application access. Vehicle-wide media application access. From application-on demand to network-on demand; Cross-screen multi-person dialogue; The front passenger can pick up the conversation after the driver finisher speaking; People in the front row play songs directly for the children in the back row.

Iteration of "Intelligent Voice System" of Li Auto

Source: ResearchInChina



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