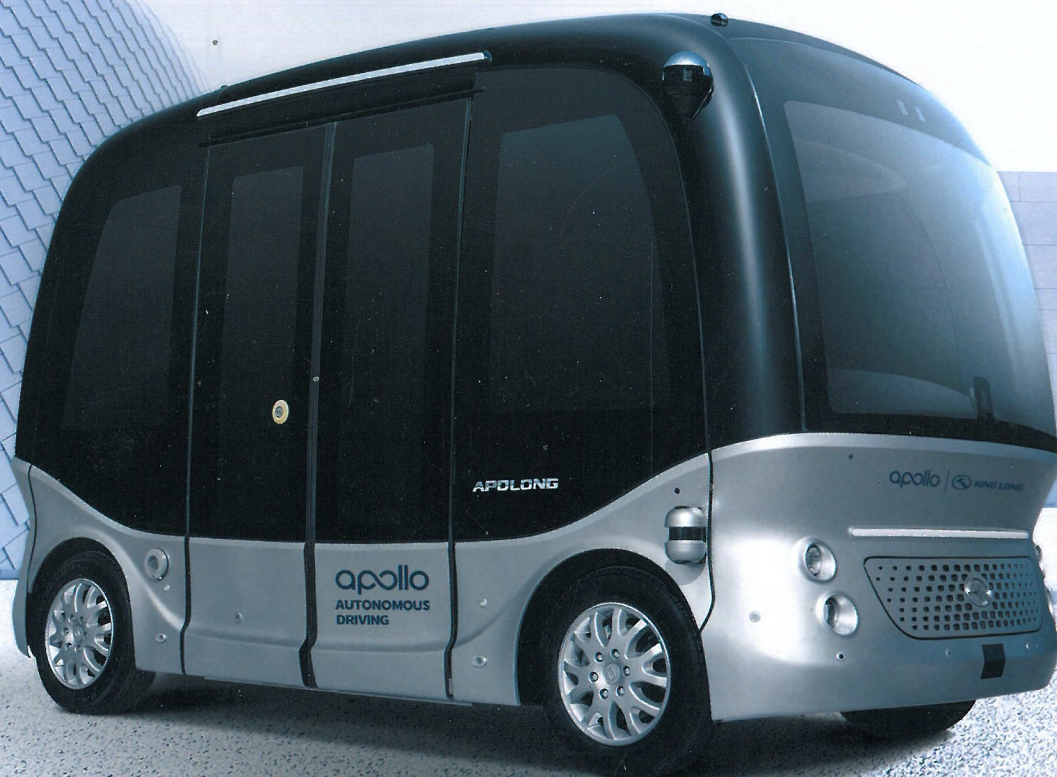




## Apolong Driverless Bus

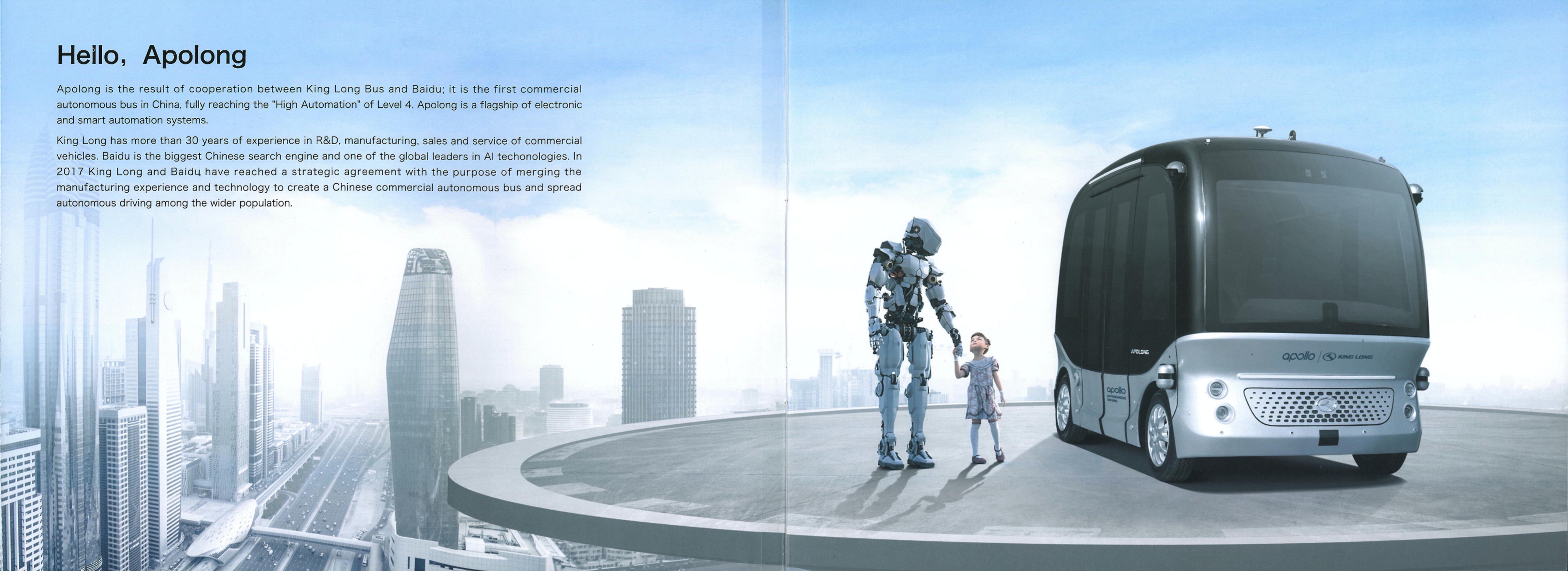


**INNOVATION**  
FOR A BETTER WORLD

# Hello, Apolong

Apolong is the result of cooperation between King Long Bus and Baidu; it is the first commercial autonomous bus in China, fully reaching the "High Automation" of Level 4. Apolong is a flagship of electronic and smart automation systems.

King Long has more than 30 years of experience in R&D, manufacturing, sales and service of commercial vehicles. Baidu is the biggest Chinese search engine and one of the global leaders in AI technologies. In 2017 King Long and Baidu have reached a strategic agreement with the purpose of merging the manufacturing experience and technology to create a Chinese commercial autonomous bus and spread autonomous driving among the wider population.



# Milestones

Since the completion of 100 units mass production in July 2018, as of July 2019, the commercial operation of Apolong has been implemented in more than 20 cities and regions in China, including Beijing, Shanghai, Wuhan, Fuzhou and Foshan. With its futuristic appearance, safe and stable operation capability and intelligent interactive experience, Apolong has started the commercial operation of autonomous driving and promoted the mass transportation into the era of intelligence.



**2018.07**

Completion of the 100th Apolong produced in mass scale



**2018.08**

The trial operation in Xiamen Software Park has officially opened a new era of commercial operation of autonomous driving



**2018.09**

Huizhou Tonghu Country Garden Science and Technology Town



**2018.11**

Apolong in Beijing Haidian Park



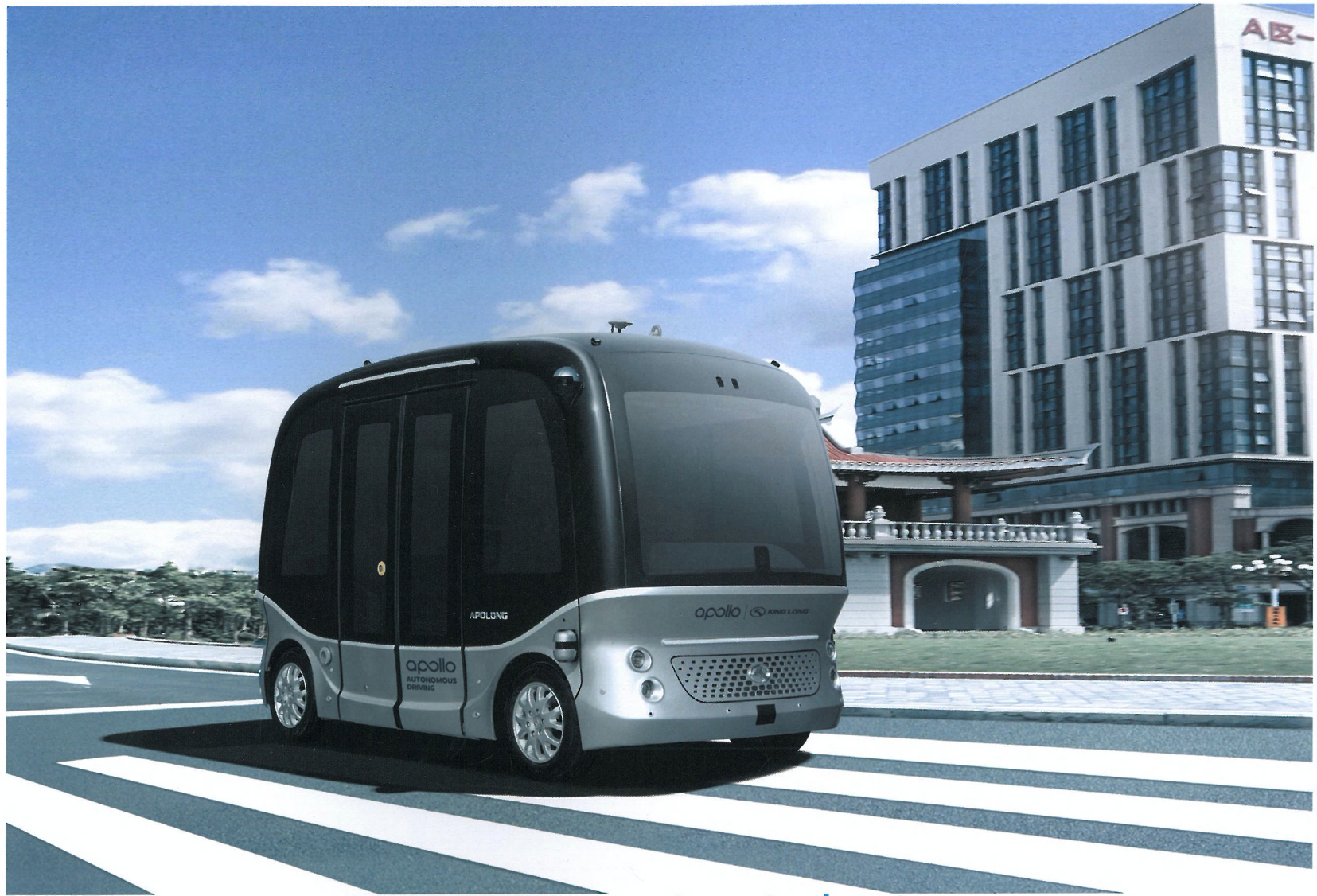
**2019.04**

Apolong "on Duty" in Boao Forum for Asia



**2019.05**

Apolong autonomous driving experience in Feifengshan Intelligent Park



# Friendly Human Machine Interaction-HMI

Pleasant human-vehicle interaction, involving passengers, pedestrians or other vehicles.

## Big Display Screen

Rout information.

Real-time display of the perception and decision-making information of the autonomous driving system provides a full sense of science and technology.

Multimedia content and station navigation are uploaded from the cloud.

## Intelligent on board interface

Real-time voice control system based on Baidu IOV OS is able to show weather forecast and other information.

Voice control multimedia system, including music and video.

Fun entertainment features, such as dynamic introduction of Apolong, photo taking and sharing, etc.

## Safety Specialist Pad

Autonomous driving system management : system shutdown/restart, etc.

Operational management function, e.g., temporary stop/start, door/light control, etc.

Driving assistance display, including features like DV display, reversing radar display, etc.



Thoughtful layout provides enough space for 8 seating and 6 standing passengers



Ceiling lights imitate starry sky



Foldable seats maximize space usage



USB ports for mobile device charging

# Apolong Operating Principles

Compared with non-autonomous vehicles, the most significant difference of Apolong is that it can intelligently perceive the surroundings, promptly response and automatically arrive at the destination. Apolong autonomous driving process includes four elements: precise locating, intelligent perception, decision planning and execution control.

## Precise locating

Real-time analysis sets the location with an accuracy of one centimeter and adds it to the road condition information.

## Intelligent perception

Sensors all over the vehicle body work together to perceive an overall understanding of the surrounding environment and predict its trajectory.

## Decision planning

The next action is the most optimum choice considering the vehicle route intention and current location.

## Execution control

Through a series of dynamic computation, the decision-making target is converted into throttle control, braking and other instructions to complete the vehicle autonomous driving function.



# Autonomous Driving Ability of Apolong

Empowered by Baidu Apollo autonomous driving open platform and King Long IOV big data platform, Apolong can independently complete a series of driving performances such as pulling out of parking space, car following, avoiding obstacles, turning around, stopping and parking, etc. In addition, during the driving process, Apolong can actively collect and report its condition data. After the optimization of the program algorithm is completed in the cloud, the OTA upgrade is used to update the program at the vehicle end, thus realizing the upgrading of the autonomous driving ability.



## Pull out of parking space

Auto pull out of preset parking space



## Direct arrival

From any location on the map to the preset station



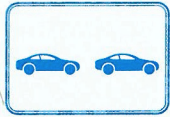
## Stop and park

Stop and park at the preset station automatically after arrival



## Normal driving

Drive at a constant speed along the center of the lane



## Car following

Follow the leading vehicle in the same lane



## Avoidance of obstacles

Auto-avoidance of obstacles in the lane



## Low obstacles

Can perceive obstacles over 30cm



## Pass intersections

Go straight, turn around, turn and pass the intersection



Positioning and digital receiving device



Binocular camera



Monocular camera



Laser radar



Laser radar



Ultrasonic wave radar



Millimeter-wave radar



# Sufficient software and hardware security systems

Sufficient software and hardware security systems guarantee Apolong's self-driving operations are more rigorous and regulated. Its incomparable software/hardware security is provided by the combination of various sensors, monitoring systems for autonomous driving operation, the high-redundancy line control system, and the robust network security scheme. In case of unforeseen circumstances with which AI cannot cope, the in-vehicle safety specialist will timely intervene to provide additional security guarantee for driving.

Collaborative work of various sensors, such as laser radar, millimeter-wave radar, ultrasonic wave radar and camera, grants Apolong more sensitive obstacle identification and road condition perception. It guarantees safe driving in various weather conditions, like sunny day, rainy day and hazy day, and under different road conditions.



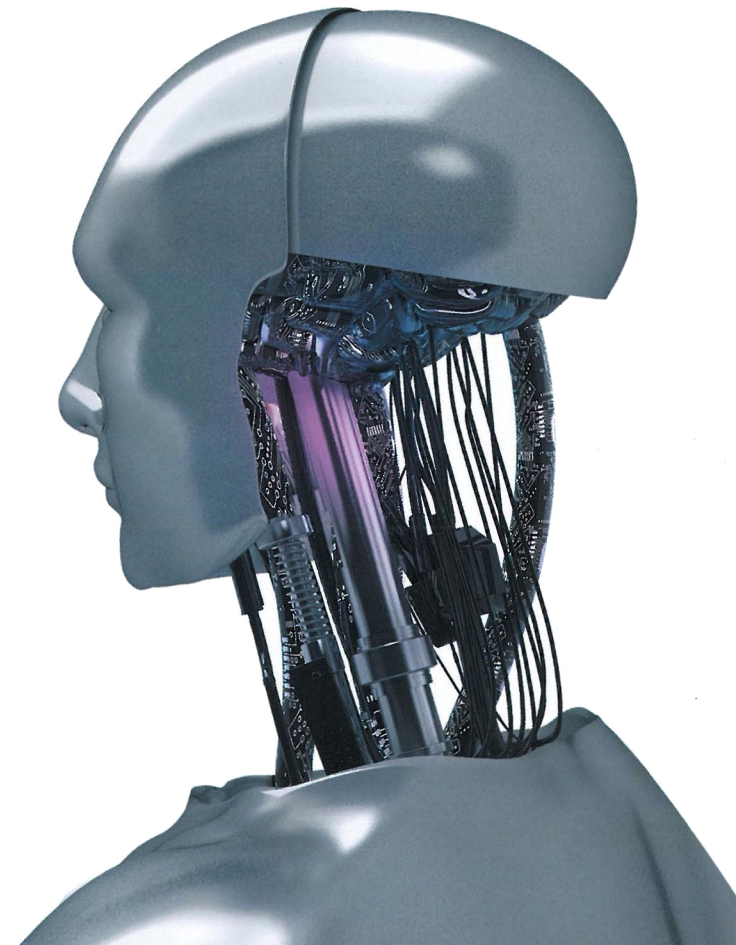
## Network Isolation & Access Control

Isolation and access control are carried out between the on-board network, the Internet and the on-board sub-network. Instructions define abnormal network behaviors. Untrusted operation instructions of the vehicle are sorted out thus ensuring the safety of the on-board network.



## Vehicle ID Verification

Each vehicle has only one ID number. Before any data connection, both ID number and identity information of a vehicle will be checked.



# Diversified Operation Scenarios

At present, Apolong autonomous driving ability is suitable for industrial and science parks, scenic areas, airports, university campuses, large factories and hotels. Apolong's futuristic appearance, safe and stable operation capability, and intelligent interface creates a good image. In the future, with the development of technology and regulation, Apolong will be able to drive on the public roads.



Airport



Road in a scenic area



New town and development area



Industrial/science park



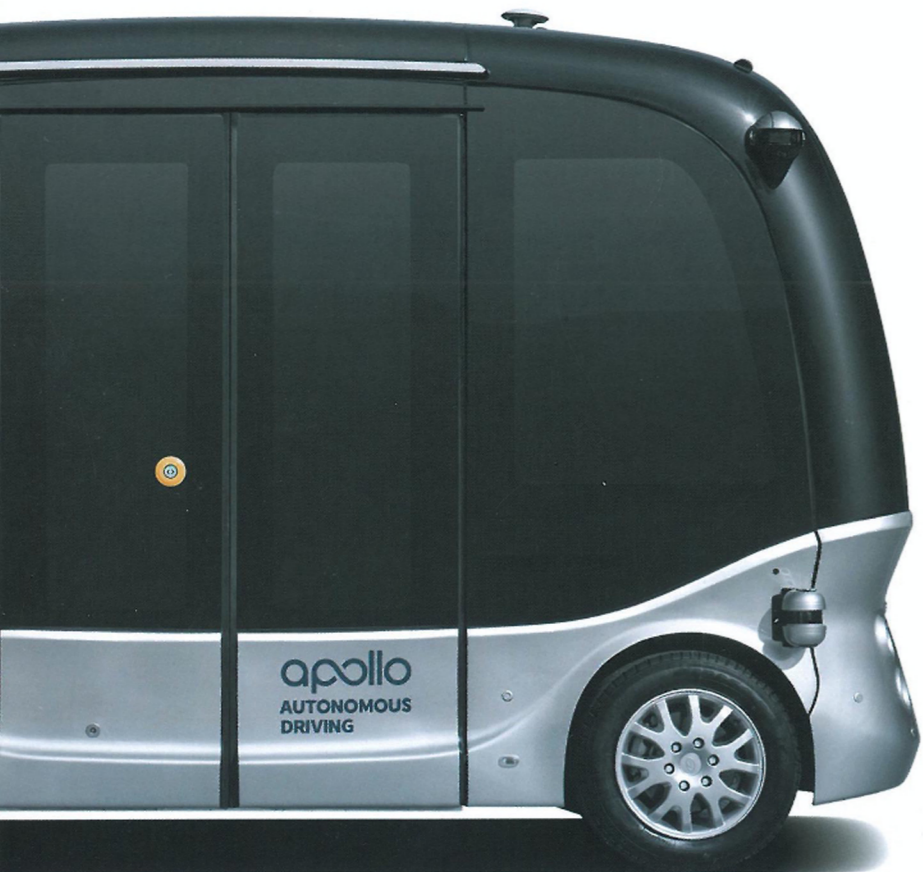
Resort/hotel












University campus



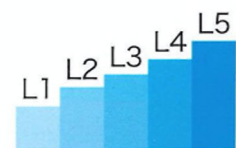




### Apolong Autonomous Bus Parameters

 <b>Overall dimension (including accessories) (mm)</b> 4330×2150×2715	 <b>Curb mass (kg)</b> 2400	 <b>Total mass (kg)</b> 3500
 <b>Passenger capacity (seat + standing)</b> 8+6	 <b>Entrance</b> One-step	 <b>Maximum gradeability (%)</b> 25
 <b>Speed</b> ≤20(km/h)	 <b>Driving mileage (km)</b> 120	 <b>International charging</b> DC 1h AC 10h

### Automobile Driving Automation Grading



#### L1 - Driver Assistance

The driver assistance system of either steering or acceleration/deceleration is provided using information about the driving environment and with the expectation that the human driver performs all remaining aspects of the dynamic driving task.

#### L2 - Partial Automation

Multiple driver assistance systems of both steering and acceleration/deceleration are provided using information about the driving environment and with the expectation that the human driver performs all remaining aspects of the dynamic driving task.

#### L3 - Conditional Automation

The autonomous driving system is used to perform all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene.

#### L4 - High Automation

The autonomous driving system is used to perform all aspects of the dynamic driving task. In the specific environment, the system will request a human driver to give a response, but the human driver doesn't have to respond.

#### L5 - Full Automation

The autonomous driving system can independently perform all aspects of the dynamic driving task under all roadway and environmental conditions without the driver's intervention.

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