ResearchInChina
www.researchinchina.com

Baidu's Intelligent Driving Business Analysis Report, 2022-2023

June 2023

Apollo Platform

Baidu works on three autonomous driving development routes: Apollo Platform, Apollo Go (autonomous driving mobility service platform) and intelligent driving solutions.

Apollo Platform

In July 2017, Baidu announced the Apollo program, and released an open-source autonomous driving platform. In late 2018, Baidu officially opened up its Apollo V2X Solution. At present, Baidu Apollo boasts industry-leading solutions in three major fields: autonomous driving, intelligent vehicle and intelligent transportation. Baidu Apollo's vehicle intelligence solutions have been mass-produced for 134 models under 31 auto brands and mounted on a total of over 7 million vehicles.

Development History of Apollo Platform

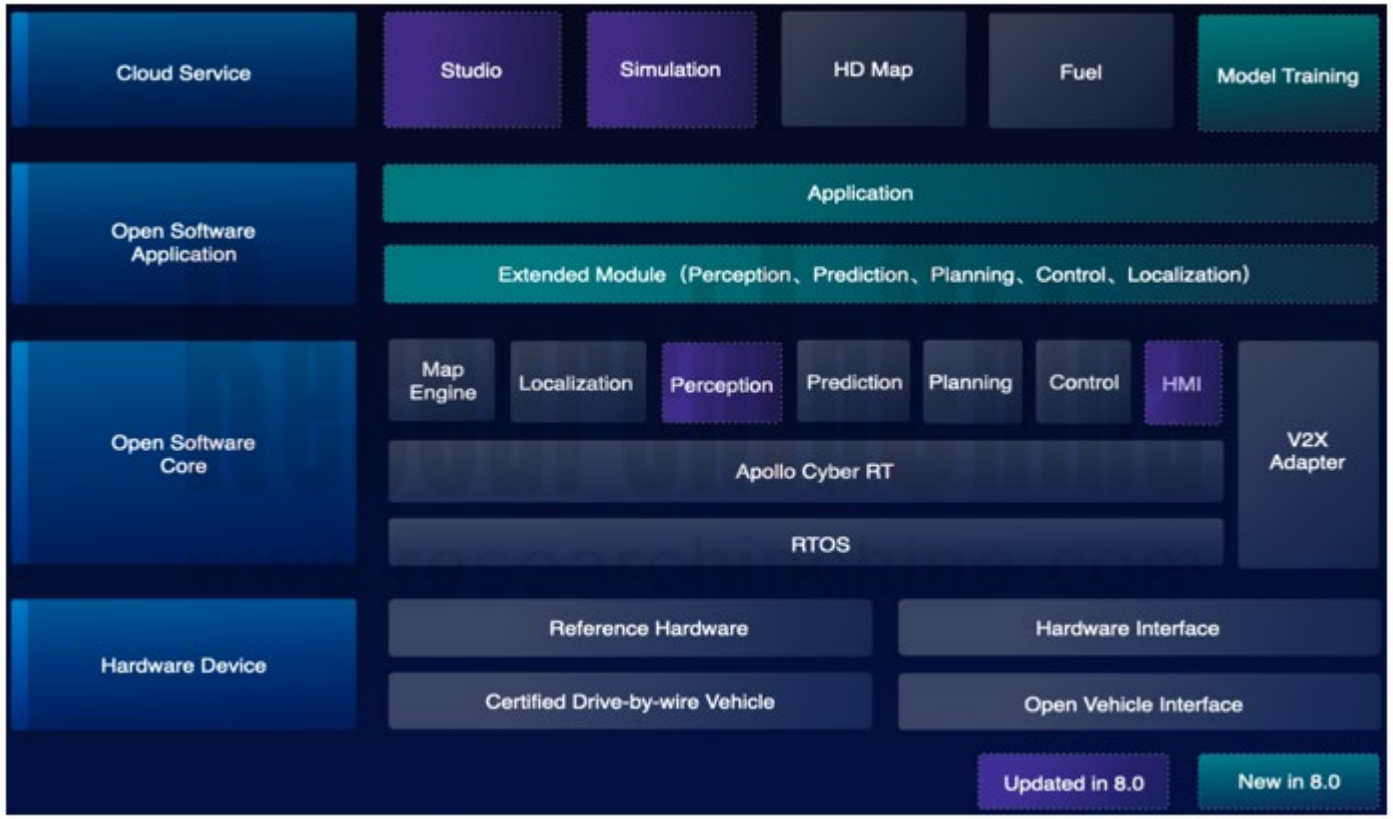
Architecture	Release Date	Characteristic	Details
Apollo 1.0	Jul. 2017	Tracking for autonomous driving in closed sites	Automatic GPS waypoint tracking
Apollo 1.5	Oct. 2017	Autonomous driving in fixed lanes	The addition of LiDAR allows vehicles based on this version platform to better perceive the surroundings and better map its current location and plan its path.
Apollo 2.0	Jan. 2018	Autonomous driving in simple urban road conditions	Rid the vehicle of colliding with obstacles, and allow it to stop at traffic lights and change lanes when necessary to reach the destination.
Apollo 2.5	Apr. 2018	Vision-based highway autonomous driving in limited areas	Allow the vehicle to drive autonomously on the highway with obstacles and detect the obstacles through the camera; keep the vehicle in the lane to avoid a collision with the front vehicle
Apollo 3.0	Jul. 2018	Autonomous driving in production parks	Keep the vehicle in the lane to avoid a collision with the front vehicle
Apollo 3.5	Jan. 2019	Autonomous driving in urban road conditions	Provide navigation in complex driving scenarios, including unprotected bends and narrow streets. The vehicle has 360-degree visibility with upgraded perception algorithms.
Apollo 5.0	Jul. 2019	Mass production of geo-fenced autonomous driving	The vehicle has 360-degree visibility and has upgraded perception & deep learning models, so that it can handle changes in complex road conditions. Scenario-based planning is enhanced to support additional scenarios such as crossing roads and intersections.
Apollo 5.5	Dec. 2019	Point-to-point urban driving	The vehicle has completed 360-degree visibility, upgraded perception & deep learning models and a brand-new prediction model, so that it can cope with changes in complex roads and intersections.
Apollo 6.0	Sept. 2020	Autonomous driving	V2X Solution offers upgrades, and is first used for integration of target-level vehicle-side perception and roadside perception. In algorithm module, three new models based on deep learning are introduced. In perception, the laser point cloud obstacle detection model based on PointPillars is realized. In prediction, a low-speed pedestrian prediction model based on semantic maps is released. In planning, imitation learning based on semantic maps is introduced for the first time.
Apollo 6.0 EDU	Apr. 2021	Integration of production and education empowers education on autonomous driving	Education programs: scientific research programs for school laboratories and scientific research institutions, and teaching programs for school instruction. Cloud service platform: HD maps, simulation services, teaching cloud platforms, Fuel Data Pipeline, etc. Open-source software platform: algorithms for perception, decision, planning, control, V2X, etc. Development kit hardware platform: out-of-the-box Apollo D-KIT.
Apollo 7.0	Dec. 2021	Co-creation of Robocar connection	Upgrade perception and prediction algorithm modules, and introduce three models based on deep learning - MaskPillars, SMOKE and Inter-TNT - to effectively avoid missed detection and jitter.
Apollo 8.0	Dec. 2022	Easy-to-use new architecture for extension	Offer higher usability and make it easier for developers to operate.

Source: ResearchInChina

Apollo 8.0

On December 28, 2022, Baidu officially launched Apollo 8.0 for all developers, which provides higher usability and makes it easier for developers to operate.

Architecture of Apollo 8.0



Source: Baidu Apollo

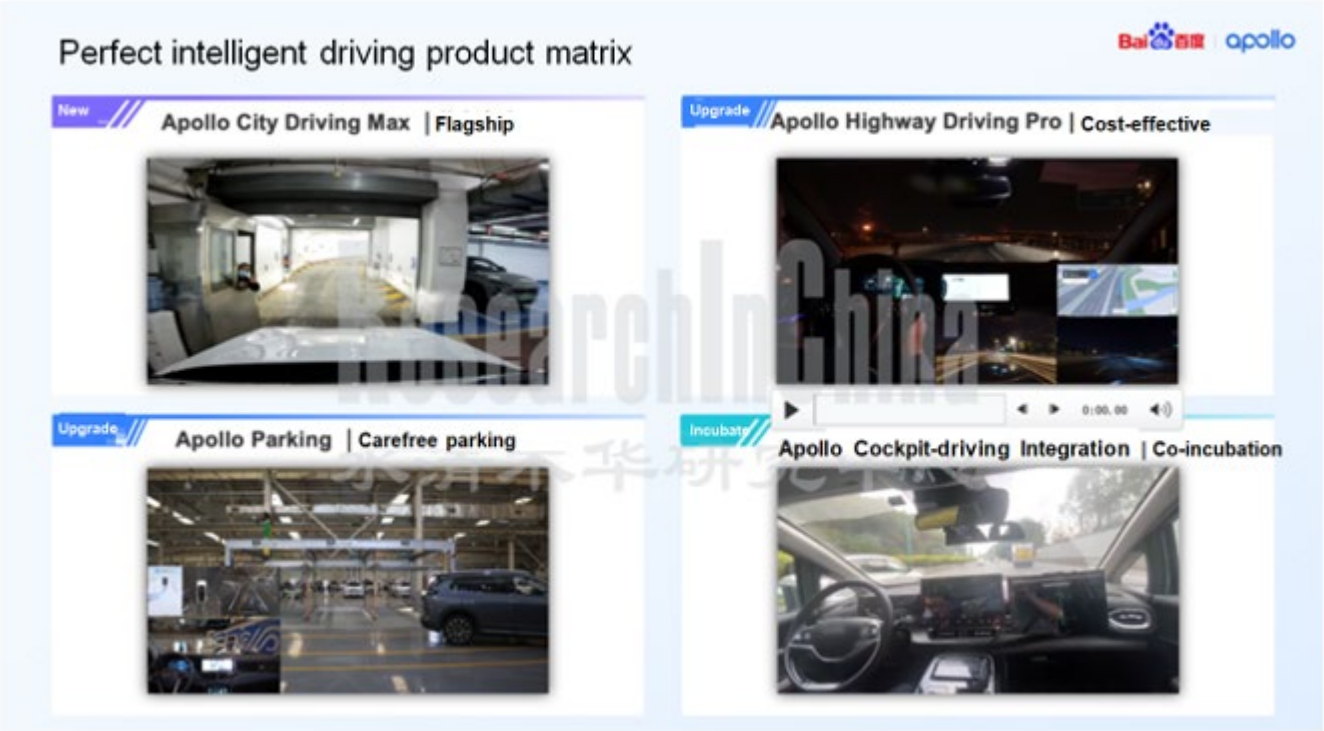
By April 2023, Baidu Apollo had tested a total mileage of more than 50 million kilometers, and its mobility brand "Apollo Go" had gone into normal operation in Beijing, Shanghai, Guangzhou, Shenzhen, Chongqing and Wuhan. Apollo Go is expected to cover up to 65 cities by 2025.

As of July 2022, Baidu had released six generations of production autonomous vehicle products, among which Apollo RT6, the sixth-generation product, is scheduled to be first available to Apollo Go in 2023.

Source: Baidu

Intelligent Driving Solutions

Baidu's intelligent driving product matrix covers: Apollo City Driving Max, Apollo Highway Driving Pro, Apollo Parking, and Apollo Cockpit-driving Integration.



Source: Baidu

Apollo City Driving Max

In April 2023, Apollo introduced its flagship product - Apollo City Driving Max. The "lightweight HD map" used in this system is nearly 80% “lighter” than conventional HD maps in the industry. Apollo City Driving Max packs 2 NVIDIA Orin X SoCs with the computing power of 508 TOPS, 2 high-beam LiDARs with a detection range of 180 meters, 7 8MP cameras, 4 3MP surround view cameras, 5 radars and 12 ultrasonic sensors.

Apollo City Driving Max uses only vision to enable urban navigate on autopilot (NOA). In the production stage, LiDAR will be added as a perceptual redundancy.

The new Voyah FREE, which debuted at the Auto Shanghai 2023, carries Apollo Highway Driving Pro, which offers such driving assistance functions as highway pilot, urban driving assist, and all-scenario efficient parking. The solution can provide accurate environmental perception and decision to enable multiple functions such as automated parking, automatic follow and automatic lane change.

In 2023, Apollo Highway Driving Pro was upgraded, with the computing platform upgraded to a single TDA4-VH platform. Moreover, Baidu teamed up with Black Sesame Technologies to deploy Apollo Highway Driving Pro in the HuaShan-2 A1000 chip platform.

Baidu's first-generation Apollo Cockpit-driving Integration uses Qualcomm 8295 (with the AI compute of 30 TOPS equivalent to NVIDIA Xavier) to enable intelligent cockpit and driving assistance functions.

Domain integration represents an important development trend of the intelligent driving industry in 2023. As a part of domain integration, cockpit-driving integration has begun to be laid out by many ADAS companies. Tier1 suppliers such as Baidu, Huawei and Desay SV have deployed their own product lines in the fields of intelligent driving and intelligent cockpit, making it easy for them to develop cockpit-driving integrated solutions.

For most players that only lay out intelligent driving or intelligent cockpits, it is necessary for them to cooperate with others on cockpit-driving integration. At the Auto Shanghai 2023, Banma Zhixing and HoloMatic Technology forged a strategic partnership to co-develop a cockpit-driving integrated solution. This is a typical cooperation case.

Related Reports:

Ambarella's Intelligent Driving Business Analysis Report, 2022-2023
NXP's Intelligence Business Analysis Report, 2022-2023
Jingwei Hirain's Automotive and Intelligent Driving Business Analysis Report, 2022-2023
Continental's Intelligent Cockpit Business Analysis Report, 2022-2023
Bosch's Intelligent Cockpit Business Analysis Report, 2022-2023
Aptiv's Intelligent Driving Business Analysis Report, 2022-2023
ZF's Intelligent Driving Business Analysis Report, 2022-2023
Continental's Intelligent Driving Business Analysis Report, 2022-2023
Bosch's Intelligent Driving Business Analysis Report, 2022-2023
Horizon Robotics' Business and Products Analysis Report, 2022-2023
Desay SV's Intelligent Driving Business Analysis Report, 2022-2023
Renesas Electronics' Automotive Business Analysis Report, 2023
Infineon's Intelligent Vehicle Business Analysis Report
Haomo.AI's Intelligent Driving Business Analysis Report
SenseTime's Intelligent Vehicle Business Analysis Report

Table of Content (1)

1 Overview of Baidu
1.1 Profile
1.2 Dynamics in Automotive Business

2 Apollo (Autonomous Driving Open Platform)
2.1 Overview of Apollo
2.2 Development History of Apollo
2.3 Business Layout of Apollo
2.4 Intelligent Driving Product Matrix of Apollo
2.4.1 Apollo City Driving Max
2.4.2 Apollo Highway Driving Pro
2.5 Apollo 8.0
2.5.1 Module Structure of Apollo8.0
2.5.2 Perceptual Framework of Apollo 8.0
2.5.3 Toolchain of Apollo 8.0
2.6 Apollo Simulation Platform
2.6.1 Apollo Simulation Platform: Architecture
2.6.2 Apollo Simulation Platform: Scene Library
2.6.3 Apollo Simulation Platform: Evaluation Criteria
2.7 Driving-parking Integrated Solution: ANP
2.7.1 Version Comparison of ANP
2.7.2 Features of ANP 2.0
2.7.3 Driving-parking Integrated Solution: ANP 3.0
2.8 Vision-only Solution: Apollo Lite
2.8.1 Integrated Perception Solution: Apollo Lite++
2.9 Autonomous Driving Perception 1.0
2.9.1 Main Algorithms of Autonomous Driving Perception 1.0
2.9.2 Autonomous Driving Perception 2.0
2.9.3 Autonomous Driving Perception 2.0- Application Challenges
2.10 Perception Algorithms of Apollo
2.10.1 Perception Algorithms of Apollo - Vision Algorithm
2.10.2 Perception Algorithms of Apollo - Traffic Light Algorithm
2.10.3 Perception Algorithms of Apollo – Radar/Ultrasonics Algorithm
2.11 ERNIE Foundation Model
2.11.1 Overview
2.11.2 Application - Long Line-of-sight 3D Perception
2.11.3 Application - Multi-modal End-to-End Perception
2.11.4 Application - Data Mining
2.12 Apollo Cloud
2.12.1 5G Cloud Chauffeur
2.12.2 5G Cloud Chauffeur Solution
2.12.3 Autonomous Vehicle Cloud Security System
2.12.4 Driving-cloud Integration, Data Closed Loop

3 Intelligent Driving Domain Controllers
3.1 Intelligent Driving Domain Controller Product Layout
3.2 Comparison between Intelligent Driving Domain Controllers
3.3 Intelligent Driving Domain Controller - “Wuren”
3.4 Intelligent Driving Domain Controller - “Sixi”
3.5 Intelligent Driving Domain Controller - “Sanxian”

4 Autonomous Shuttle
4.1 Product Layout
4.2 Minibus
4.2.1 Minibus Application Cases
4.3 Robobus
4.3.1 Robobus Application Cases
4.3.2 Robobus Operation

Table of Content (2)

4.4 Intelligent Platform Solutions
4.5 Robotaxi
4.5.1 Apollo RT6
4.5.2 Distribution of Robotaxi by City
4.5.3 Status Quo and Goals of Robotaxi
4.5.4 Customer Feedback of Robotaxi
4.5 Development History of Robotaxi
4.5.6 Robotaxi Cooperation
4.5.7 Robotaxi Is Issued an Autonomous Driving Service License
4.5.8 100 Robotaxies Are Launched in Wuhan.

5 Electronic Maps and Positioning Services
5.1 Electronic Map Product Planning
5.1.1 Electronic Map Product System
5.1.2 ADAS Map Approval by Guangzhou/Shenzhen
5.1.3 Advantages of Electronic Map Products (1)
5.1.4 Advantages of Electronic Map Products (2)
5.1.5 Advantages of Electronic Map Products (3)
5.1.6 Advantages of Electronic Map Products (4)
5.1.7 Advantages of Electronic Map Products (5)
5.1.8 Advantages of Electronic Map Products (6)
5.1.9 Advantages of Electronic Map Products (7)
5.1.10 HD Maps and Intelligent Driving System
5.1.11 Human-machine Co-driving Map/Parking Integrated SDK
5.2 Combined Positioning Technology Solutions
5.2.1 Combined Positioning Technology Solutions (1)
5.2.2 Combined Positioning Technology Solutions (2)
5.2.3 Combined Positioning Technology Engines
5.2.4 Combined Positioning Algorithms (1)
5.2.5 Combined Positioning Algorithms (2)
5.2.6 Evolution of Apollo High-precision Positioning Technology
5.3 "Vehicle-Road-Cloud-Map" Coordinated Development

6 V2X Business
6.1 V2X Solution: Apollo Air
6.2 V2X Open Platform: "KAILU"
6.3 V2X Dataset
6.4 V2X-based Intelligent Highway Solution
6.5 V2X Layout

Contact

Beijing Headquarters

TEL: 010-82601561, 82863481
FAX: 010-82601570

Chengdu Branch

TEL: 028-68738514
FAX: 028-86930659

Website: ResearchInChina

WeChat: Zuosiqiche

zuosiqiche