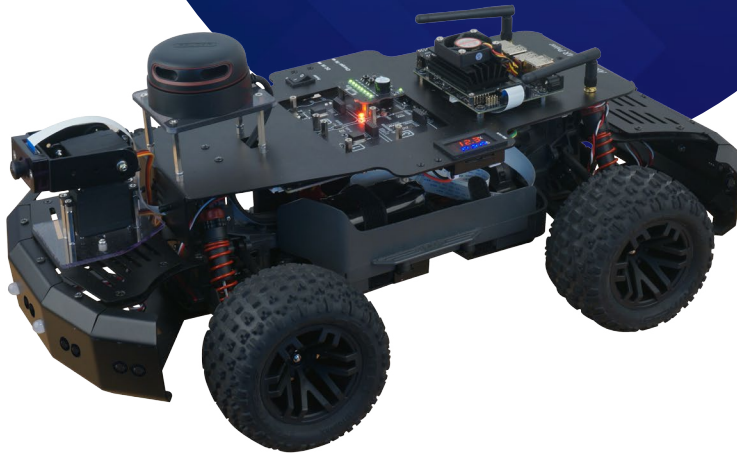


AIoT

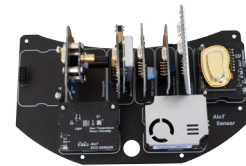
AutoCar Prime

Series

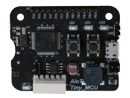
AutoCar Prime • AutoCar PrimeX



Modules provided for AIoT AutoCar PrimeX



Sensor Pack



AIoT Tiny MCU

- AI and IoT convergence training equipment based on autonomous vehicle platform
- GPU-based edge supercomputer platform as main processor
- Integrated modules of Gigabit Ethernet, dual-band Wi-Fi and Bluetooth for connectivity
- Digital microphones and speakers support Speech-to-Text and Text-to-Speech as well as voice command
- 4 dedicated expansion interfaces support various IoT sensor module
- Steering system supports real car-like driving mechanism and deep learning based autonomous driving technology
- High-capacity battery and dedicated charging system enable continuous experiment while charging
- Soda OS and Pop library, the exclusive AIoT operating system
- Interpreter-based C/C++ development environments optimized for beginners to programming, including Python 3
- A dedicated web browser-based learning environment for studying Python 3 and C/C++ simultaneously on PCs and tablets
- mDNS/DNS-SD based distributed name resolution and network service publishing and discovery
- Open integrated development environment based on Visual Studio Code for professional application development
- Educational contents for artificial intelligence and deep learning based autonomous vehicle
- AutoCar PrimeX offers Cortex-M series high performance MCU module and CAN modules
- AutoCar PrimeX's main module contains edge supercomputer up to 21TOPS supporting all popular AI frameworks
- AutoCar PrimeX provides 8 types of IoT sensors that connect to a dedicated expansion interface

Training Contents

Introducing AloT AutoCar Prime

AloT AutoCar Prime Configuration
AloT AutoCar Prime Lab Environment

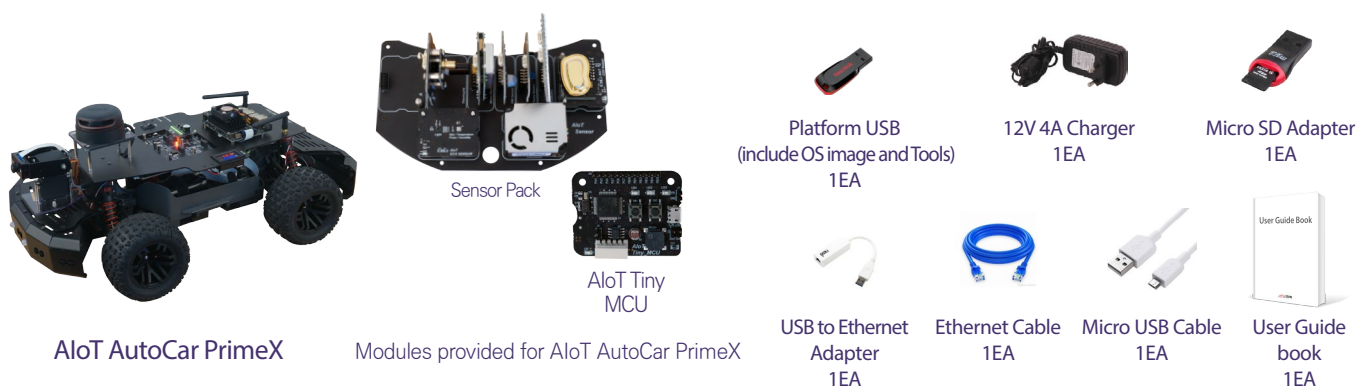
Deep Learning Autonomous Driving Based Technology

Theory and Practice of Pop.AI-Based Linear and Logistic Regression
Theory and Practice of Pop.AI-based Perceptron
Theory and Practice of Pop.AI-based ANN, DNN, and CNN
Theory and Practice of Pop.AI & OpenAI DQN-based Reinforcement Learning
Understanding TensorFlow

Implementing Deep Learning Autonomous Driving

Technology Overview of Deep Learning Autonomous Driving
Basic Driving Practice
Remote Operation Practice
Anti-Collision Practice
Practice Moving Along Object
Transfer Learning
Track Driving Applications

Product Configuration



Software Specifications

	List	Specification
Soda OS	Linux Kernel	4.19
	Desktop	X-Server, Openbox, LightDM, Tint2, blueman, network-manager, conky
	CLI	Zsh, Tmux, Peco, powerlevel9k thema, Powerline fonts
	Tool Chain	GCC 9, JDK, Node JS, Python3, Clang
	IDE	Visual Studio Code, NeoVim, Geany
	Connectivity	Mosquitto(MQTT), Bluez, Samba, Blynk, SSH, Remove Desktop
	Multimedia	portaudio, sox, OpenCV 4, snowboy, Google Assistant
	Data Science & AI	Python3, Numpy, Matplotlib, sympy, Pandas, Seaborn, Scipy, Gym Scikit-learn, Tensorflow, Keras, PyTorch
Pop Library	Output Object (C/C++, Python3)	Led, Laser, Buzzer, Relay, RGBLed, DCMotor, StepMotor, OLed PiezoBuzzer, PixelDisplay, TextLCD, FND, Led Bar
	Input Object (C/C++, Python3)	Switch, Touch, Reed, LimitSwitch, Mercury, Knock, Tilt, Opto, Pir, Flame LineTrace, TempHumi, UltraSonic, Shock, Sound, Potentiometer, CdS SoilMoisture, Thermistor, Temperature, Gas, Dust, Psd. Gesture
	Multimedia (Python3)	AudioPlay, AudioPlayList, AudioRecord, Tone, SoundMeter
	Voice Assistant (Python3)	GAssistant, create_conversation_stream
	AI (Python3)	Linear Regression, Logistic Regression, Perceptron, ANN, DNN, CNN, DQN



Hardware Specifications of AIoT AutoCar Prime

Body Frame

List	Specification
Sound	Stereo Codec With Headphone Amp Interface : I ² C(Control), I ² S(PCM Audio interface) Playback : 100dB SNR and -80 THD+N Recording : 85dB SNR and -73dB THD+N 2ch Microphone Stereo Speaker 2W
Voltage/Current Meter	DC 4~28V measurement Current 0~10A measurement Tolerance +- 1% Operating Temperature -10°C ~ 65°C
LED	Front/Rear LED 2EA
Sensor Module Block 4EA	Sensor Block : +5V, +3.3V, GND, I ² C, SPI, ADC, GPIO Default Module : Tact Switch 2EA, LED 8EA, Passive Buzzer 1EA
6-AXIS	Device : MPU6050N Resolution : 16bit Gyroscope Range: ±250, ±500, ±1000, ±2000°/S Accelerometer Range : ±2, ±4, ±8, ±18g Interface : I ² C Supply Voltage : 3.3V
Illuminance Sensor	Sensor : CdS Operating Voltage : 3.3V Interface : Analog Output
CPU	Quad-Core ARM A57 @ 1.43 GHz
GPU	Maxwell Core 128EA
Memory	4GB 64-bit LPDDR4 25.6 GB/s
Storage	MicroSD (64GB)
Video Encode	4K@30 4x 1080p@30 9x 720p@30 (H.264/H.265)
Video Decoder	4K@60 2x 4K@30 8x 1080p@30 18x 720p@30 (H.264/H.265)
Camera	MIPI CSI-2 DPHY Lanes
Connectivity	Dual Band Wireless Wi-Fi 2GHz/5GHz Band, 867Mbps, 802.11ac Bluetooth 4.2 Gigabit Ethernet
Display	HDMI and Display Port
USB	4x USB 3.0, USB 2.0 Micro-B

Vision Processing & SLAM

List	Specification
Camera	Image Sensor : Sony IMX219 Resolution : 8M Pixel Native Resolution Sensor (3280 x 2464 Pixel Static Images) Video : 1080p30, 720p60 and 640x480p90 Inux Intergration : V4L2 driver available Focal length : 3.04 mm Angle of View : 160 Degrees Focal Ratio (F-Stop) : 2.35
LiDAR	Distance Range : 12m Angular Range : 0 ~ 360Degree Distance Resolution : <0.5(0.15 ~ 1.5Meters) Angular Resolution : 0.9Degree Sample Duration : 0.25 Millisecond Sample Frequency : 4KHz Scan Rate : 10Hz

Body

List	Specification
Battery	11.1V/7000mA
Motor	DC Geared Motor - DC 12V, Max. 12Kg-cm, 1540rpm
Steering	Servo Motor - Stall Torque(6.8V) : 21.5kg/cm - Speed : 0.16 sec/60°(5V), 0.14 sec/60°(6.8V)
Camera PAN/TILT Part	Servo Motor - Stall Torque : 9.4 kgf-cm (4.8 V), 11 kgf-cm (6 V) - Operating Speed : 0.17 s/60°(4.8 V), 0.14 s/60°(6 V) Servo Brackets 2EA Camera Guide
Size	340 X 600 X 220 (mm)
Weight	6kg
Wheels	4Wheels



Hardware Specifications of AIoT AutoCar Prime X

The specifications of AIoT AutoCar Prime is included

Body Frame

List	Specifications
CPU	6-Core NVIDIA Carmel ARM v8.2 64-bit 6MB L2 + 4MB L3 Max Freq : 2-core@1900MHz, 4/6-core@1400Mhz
GPU	384-Core NVIDIA Volta™ GPU with 48 Tensor Cores Max Freq : 1100MHz
Memory	8GB 128-bit LPDDR4x@ 1600MHz
Storage	16GB eMMC 5.1
Video Encoder	2x464MP/sec(HEVC), 2x4k@ 30(HEVC) 6x 1080p@ 60(HEVC), 14x 1080p@ 30(HEVC)
Video Decoder	2x690MP/sec(HEVC), 2x4k@ 60(HEVC), 4x4k@30(HEVC) 12x1080p@ 60(HEVC), 32x 1080p@ 30(HEVC), 16x 1080p@30(H.264)

List	Specifications
CSI Camera	Up to 6 cameras(36 Via Virtual Channels) 12 lanes MIPI CSI-2, D-PHY 1.2(up to 30 Gbps)
Connectivity	Dual Band Wireless Wi-Fi 2GHz/5GHz Band, 867Mbps, 802.11ac Bluetooth 4.2 10/100/1000 Base-T Ethernet
Display	2 multi-mode DP 1.4/eDP 1.4/HDMI 2.0
USB	4x USB 3.0, USB 2.0 Micro-B
Distance Measure Part	Processor : 32bit Cortex-M Processor Ultrasonic : Tx/Rx 10 Pair Interface : UART, CAN
CAN	CAN BUS Transceiver Compatible with ISO11898-2 Standard

MCU & Sensor Pack

List	Specifications
MCU Module	Core: ARM Cortex-M4
	Flash Memory : 1MB
	SRAM : 192+4 Kbyte
	USB : Micro USB (OTG Support)
	Basic Peripheral Device LED 2EA, Switch 2EA, CdS 1EA, Piezo Buzzer 1EA
Flame Module	Interface & Expansion Connector CAN Port 2EA(Expansion 1EA) UART 2EA(TTL 1EA, Serial to USB 1EA) GPIO, SPI, I ² C, ADC, PWM, UART etc.
	Sensing Range : 60 Degree
	I/O Interface : 2 pin Digital Output
	Light Sensor Illuminance to Digital Converter Wide range : 1 ~ 65535(lx)
Eco Sensor Module	Temperature Measure : -40 ~ 85°C
	Humidity Measure : 0 ~ 100%r.H.
	Pressure range : 300 ~ 1100hPa
	VOC Measure : Ethane, Ethanol, Acetone, Carbon Monoxide, Butadiene, Methyl
Carbon Dioxide(CO2) Gas Sensor Module	I/O Interface : I ² C
	Measuring Range : 0 ~ 10000 ppm
	Accuracy : ±7% ±50ppm
Gas Sensor Module	Response Time : 18 ~ 30 sec
	I/O Interface : I ² C

List	Specifications
Pixel Display Module	Color : Pixel RGB
	Pixel : 8x8
Dust Sensor Module	I/O Interface : GPIO(Serial Protocol)
	Measurement Range PM1.0 : 0 ~ 10000ug/m3 PM2.5 : 0 ~ 10000ug/m3 PM10 : 0 ~ 10000ug/m3
	I/Resolution : 1ug/m3
	Response Time : 1sec
	Time to First Reading : ≤8seconds
Digital Thermopile Module Laser(DTPML) Module	I/O Interface : I ² C
	IR Refresh Rate : 50Hz
	Digital Resolution : 0.1°C
	Standard Start-UP Time : 3 sec
Microwave Motion Sensor Module	Accuracy : ±2%
	Stabilization Time : 1 min
	I/O Interface : SPI
PIR Sensor Module	Frequency Setting : 10.525 GHz(Typ)
	Spurious Emission : -7.3 dBm
	Pulse Repetition Frequency : 2KHz
	Setting Time : 3 μsec
PIR Sensor Module	I/O Interface : Pulse Operation
	Sensing Range : 110°
	Spectral Response : 5 ~ 14 um
PIR Sensor Module	I/O Interface : Digital Out