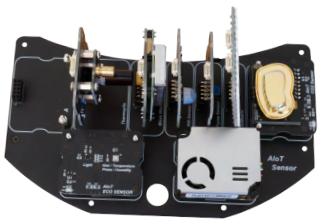
HANBACK ELECTRONICS

# AIoT AutoCar Series

## AutoCar • AutoCar Plus
(Excluding LiDAR)

8 sensor modules provided in AIoT AutoCar Plus



- AI and IoT convergence training equipment based on autonomous vehicle platform
- 128 core GPU supercomputer platform for edge devices as main processor
- Provides freely movable 8M pixel 160 degree wide angle pan-tilt camera module
- Gigabit Ethernet, dual band Wi-Fi (2.4GHz, 5GHz) and Bluetooth 4.2
- Digital microphones and speakers support cloud-based speech recognition and audio playback
- 4 dedicated expansion interfaces support various IoT sensor modules
- Steering system supports real car-like driving mechanism and deep learning based autonomous driving technology
- Adopted 7,000mA battery, and able to continue the practice with separate power connection while charging the battery
- Soda OS, the exclusive AIoT operating system, and Pop library
- Interpreter-based C/C++ development environments optimized for beginners to programming, including Python 3
- A dedicated web browser-based learning environment for learning 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
- AIoT AutoCar Plus provides high-performance 360 degree Lidar and dedicated library
- AIoT AutoCar Plus provides 8 types of IoT sensor modules connected to a dedicated expansion interface

## Training Contents

### Introducing AIoT AutoCar

AIoT AutoCar Configuration
AIoT AutoCar Lab Environment

### AI Technology

Supervised and Unsupervised Learing
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-based Reinforcement Learning
Understanding TensorFlow

### Data Processing Technology

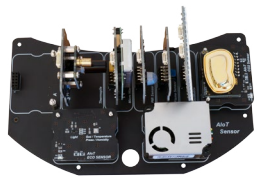
Numpy for Fast Multidimensional Matrix Operations
Pandas for Analyzing Time Series and Tabular Data
Matplotlib for Data Visualization

### Deep Learning Based Autonomous Driving Technology

Overview of Autonomous Driving Technology
Basic Driving Practice
Remote Operation Practice
Collision Avoidance Practice
Driving Practice Along the Objects
Transfer Learning Practice
Advanced Learning for Autonomous Driving

## Product Configuration

AIoT AutoCar Plus



8 sensor modules
provided in AIoT AutoCar Plus

Platform USB
(include OS image and Tools)
1EA

12V 4A Charger
1EA

Micro SD Adapter
1EA

USB to Ethernet Adapter
1EA

Ethernet Cable
1EA

Micro USB Cable
1EA


User Guide book
1EA

## 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, mtr, nmap, iptraf, Samba, Blynk Server, Remove Desktop Server |
| | Multimedia | portaudio. sox, OpenCV 4, snowboy, Google Assistant |
| | Data Science & AI | Python3, Numpy, Matplotlib, sympy, Pandas, Seaborn, Scipy, Gym |
| | | Scikit-learn, Tensorflow, Keras |
| 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

## Main Module

| List | Specification |
|---|---|
| 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<br>Bluetooth 4.2<br>Gigabit Ethernet |
| Display | HDMI and Display Port |
| USB | 4x USB 3.0, USB 2.0 Micro-B |

## Body

| List | Specification |
|---|---|
| Motor | Rear Wheel<br>- RPM 500<br>- Gear Rate 1:30<br>- Max Speed 1.5m/s |
| Steering | Servo Motor<br>- Stall torque : 9.4 kgf·cm (4.8 V ), 11 kgf·cm (6 V)<br>- Operating speed : 0.17 s/60º(4.8 V), 0.14 s/60º(6 V) |
| Camera | Image Sensor : Sony IMX219<br>Resolution : 8M Pixel Native Resolution Sensor (3280 x 2464 Pixel Static Images)<br>Video : 1080p30, 720p60 and 640x480p90<br>Inux IIntergration : V4L2 driver available<br>Focal length : 3.04 mm<br>Angle of View : 160 Degrees<br>Focal Ratio (F-Stop) : 2.35 |
| PAN/TILT Part | Servo Motor<br>- Stall Torque : 9.4 kgf·cm (4.8 V ), 11 kgf·cm (6 V)<br>- Operating Speed : 0.17 s/60º(4.8 V), 0.14 s/60º(6 V)<br>Servo Brackets 2EA<br>Camera Guide |
| Sound | Sound IC : WM8960<br>Interface : $I^2C$, $I^2S$<br>Channel : Input 2ch, Output 2ch<br>Programmable ALC / limiter and Noise Gate<br>On-chip Headphone Driver 40mW Output Power Into 16Ω at 3.3V<br>2CH Microphone<br>Stereo Speaker |
| Voltage/Current Meter | DC 4~28V measurement<br>Current 0~10A measurement<br>Tolerance +- 1%<br>Operating Temperature -10°C ~ 65°C |
| LED | Front/Rear LED 4EA |
| Sensor Module Block | Sensor Block 1 : +5V, +3.3V, GND, $I^2C$, ADC 2EA, GPIO 3EA<br>Sensor Block 2 : +5V, +3.3V, GND, $I^2C$, ADC 2EA, GPIO 3EA<br>Sensor Block 3 : +5V, +3.3V, GND, SPI, GPIO 3EA<br>Sensor Block 4 : +5V, +3.3V, GND, ADC 1EA, GPIO 7EA |
| 6-AXIS | Device : MPU6050N<br>Resolution : 16bit<br>Gyroscope Range : +-250, +-500, +-1000, +-2000°/S<br>Accelerometer Range : +-2, +-4, +-8, +-18g<br>Interface : $I^2C$<br>Supply Voltage : 3.3V |
| OLED | Driver IC : SSD1306<br>Size : 0.91inch<br>Resolution : 128x32<br>Interface : $I^2C$<br>Supply Voltage : 5V<br>Size : 313 X 247mm |
| Battery | 11.1V/7000mA<br>12.6V/4000mA Charger Support |
| Size | 280 X 195 X 160(Exclude Camera Module : 85) (mm) |
| Weight | 2.1Kg |
| Wheels | 4 Wheels |
| Basic Module | Input Device : Tact Switch x 2EA(GPIO)<br>Output Device : LED 8EA($I^2C$)<br>Actuator : Passive Buzzer(GPIO) |

# Hardware Specifications of AIoT AutoCar Plus

The hardware specifications of AIot AutoCar is included

## SLAM

| List | Specifications |
|---|---|
| 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 |

## Sensor Pack

| List | Specifications |
|---|---|
| Flame Module | Sensing Range : 60 Degree |
| | I/O Interface : 2 Pin Digital Output |
| Eco Sensor Module | Light Sensor<br>– Illuminance to Digital Converter<br>– Wide range : 1 ~ 65535(lx) |
| | Temperature Measure : –40 ~ 85℃ |
| | Humidity Measure : 0 ~ 100%r.H. |
| | Pressure Range : 300 ~ 1100hPa |
| | VOC Measure : Ethane, Ethanol, Acetone, Carbon Monoxide, Butadiene, Methyl |
| | I/O Interface : $I^2C$ |
| Carbon Dioxide(CO2) Gas Sensor Module | Measuring Range : 0 ~ 10000 ppm |
| | Accuracy : ±7%~±50ppm |
| | Response Time : 18 ~ 30 sec |
| | I/O Interface : $I^2C$ |
| Pixel Display | Color : Pixel RGB |
| | Pixel : 8X8 |
| | I/O Interface : GPIO(Serial Protocol) |
| Dust Sensor Module | Measurement Range<br>– PM1.0 : 0 ~ 10000ug/m3<br>– PM2.5 : 0 ~ 10000ug/m3<br>– PM10 : 0 ~ 10000ug/m3 |
| | Resolution : 1ug/m3 |
| | Respond Time : 1sec |
| | Time to first Reading : ≤8seconds |
| | I/O Interface : $I^2C$ |
| Digital Thermopile Module Laser(DTPML) | IR refresh Rate : 50Hz |
| | Digital Resolution : 0.1℃ |
| | Standard Start–UP Time : 3 sec |
| | Accuracy : ±2% |
| | Stabilization Time : 1 min |
| | I/O Interface : SPI |
| Microwave Motion Sensor Module | Frequency Setting : 10.525 GHz(Typ) |
| | Spurious Dmission : –7.3 dBm |
| | Pulse Repetition Frequency : 2KHz |
| | Setting Time : 3 μsec |
| | I/O Interface : Pulse Operation |
| PIR Senor Module | Sensing Range : 110° |
| | Spectral Response : 5 ~ 14 um |
| | Operating Voltage : 3.3V |
| | I/O Interface : Digital Out |