

# AIoT AutoCAR II

AI and IoT Convergence Training Equipment based on Self-Driving Vehicle Platform

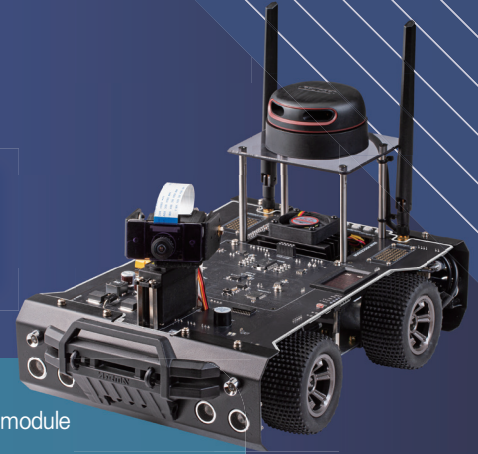


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# AIoT AutoCAR II



- Self-driving platform-based AI and IoT convergence training equipment
- Artificial intelligence development platform consisting of a brain module and a driving module
- Easy programming through block coding, and automatic conversion to Python code
- Satisfies software package and service type required through ROS2-base development environment
- Supports real car-like driving mechanism and deep learning-based self-driving technology by adopting steering system
- Main module is an edge supercomputer that supports all popular AI frameworks
- Provides freely movable 8M pixel 160 degree wide angle pan-tilt camera module
- Provides Gigabit Ethernet and dual-band Wi-Fi and Bluetooth
- Supports Speech to Text and Text to Speech and voice commands via digital microphone and speaker
- Supports various IoT sensor modules through 4 exclusive expansion interfaces
- Adopts high-capacity battery and keeps practicing even while charging
- Supports exclusive AIoT operating system such as Soda OS and Pop library
- Supports interpreter-based C/C++ development environment optimized for introductory programming, including Python 3
- Supports web browser-based learning environment to allow simultaneous learning of Python 3 and C/C++ on PC and tablet
- Confirms the name of mDNS/DNS-SD based dispersion and supports the posting and discovery of network service
- Supports integrated development environment for public use based on Visual Studio Code for professional application development
- Provides artificial intelligence learning contents and deep learning-based self-driving car learning model

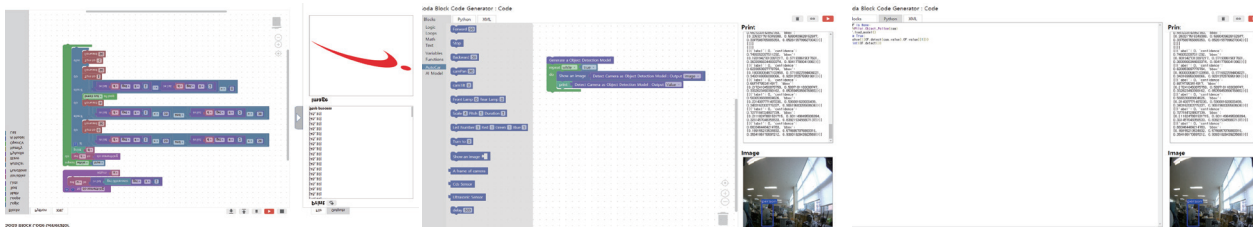
## © Operating Program

| List                                      | Specifications   |
|---|--|
|   | Linux Kernel aarch64 4.x   |
|   | Lightweight Desktop X-Server, Openbox, lxdm, Tint2, blueman, network-manager, conky, pcmanfm, lxterminal   |
|   | CLI Zsh with Oh-My-Zsh, Tmux, Peco, powerlevel10k thema, Powerline fonts   |
|   | Tool Chain GCC (c, c++), JDK, Node JS, Python3, Cling, Clang   |
|   | IDE Visual Studio Code, NeoVim   |
| <b>Soda OS</b>                            | Connectivity SSH Server, Samba Server, Remove Desktop Server, mDNS(avahi), Bluez, MQTT Server(Mosquitto), Blynk Server   |
|   | Multimedia PulseAudio, sox (lame, oggenc), Google Assistant, OpenGL ES, CUDA, OpenCV 4, Qt5  |
|   | Data Science & AI Numpy, Matplotlib, Pandas, Scipy, Seaborn, Scikit-learn, TensorFlow, TensorRT, Keras, PyTorch, TorchVision, OpenAI Gym   |
|   | Middleware ROS2 Eloquent (or Higher), Rviz, DDS, Colcon Build System   |
|   | Output Object Led, Laser, Buzzer, Relay, RGBLed, DCMotor, StepMotor, OLed, PiezoBuzzer, PixelDisplay, TextLCD, FND, Led Bar  |
|   | Input Object Switch, Touch, Reed, LimitSwitch, Mercury, Knock, Tilt, Opto, Pir, Flame LineTrace, TempHumi, UltraSonic, Shock, Sound, Potentiometer, CdS, SoilMoisture, Thermistor, Temperature, Gas, Dust, Psd, Gesture, Co2, Thermopile, Microwave, Lidar |
| <b>Pop Library</b>                        | Multimedia Object AudioPlay, AudioPlayList, AudioRecord, Tone, SoundMeter, Camera(Single&Stereo)   |
|   | Voice Assistant Object GAssistant, create_conversation_stream  |
|   | AI Object Linear Regression, Logistic Regression, Perceptron, ANN, DNN, CNN, DQN, Pilot with AutoCar & SerBot  |
|   | Python3 and Cling support  |
| <b>PC linkage development environment</b> | Jupyter Lab IPython Widgets, Terminal support, Pop Library support   |
|   | Remote SSH   |
|   | Visual Studio Code Python3 and Debugging support, Terminal support, Pop Library support  |
|   | Insiders   |

# Hardware Specifications

| List                           |                         | Specifications   |
|--------------------------------|-------------------------|--|
| Main Module                    | 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 Encoder           | 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 WiFi 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 OTG  |
| Base Board                     | PAN/TILT Part           | Servo Motor 2ea<br>· Stall torque: 9.4 kgf·cm (4.8 V), 11 kgf·cm (6 V)<br>· Operating speed: 0.17 s/60° (4.8 V), 0.14 s/60° (6 V)<br>Servo bracket<br>CAMERA Guide   |
|                                | Driver and Measure Part | 32bit Cortex-M4 Processor<br>Motor Driver 1ea<br>Ultrasonic Tx/Rx 4 pair<br>CAN Communication  |
|                                | Sound                   | 1ch Microphone<br>Omni-directional<br>Sensitivity: -42dBV<br>Stereo Speaker 2W   |
|                                | Voltage/Current Meter   | DC 4~28V measurement<br>Current 0~10A measurement<br>Tolerance ±1%<br>Operation temperature -10°C ~ 65°C   |
|                                | LED                     | Front/Rear LED 4ea   |
|                                | Sensor Module Interface | +5V, +3.3V, GND, I2C, ADC, GPIO, SPI   |
|                                | IMU Sensor              | Gyroscope Range: ±125°/s to ±2000°<br>Accelerometer Range: ±2g/±4g/±8g/±16g<br>Magnetic field range: ±1300uT(X-, Y-axis), ±2500uT(Z-axis)<br>Interface: I2C<br>Supply Voltage: 3.3V  |
|                                | Illuminance Sensor      | Sensor : CdS<br>Operating Voltage : 3.3V<br>Interface : Analog Output  |
|                                | Processing              | Image Sensor: Sony IMX219<br>Resolution: 8M pixel native resolution sensor (3280 x 2464 pixel static images)<br>Video: 1080p30, 720p60 and 640x480p90<br>Linux integration: V4L2 driver available<br>Focal length: 3.04 mm<br>Angle of view: 160 degrees<br>Focal ratio (F-Stop): 2.35 |
|                                | Body                    | Size   |
| Weight                         |                         | 2.3Kg  |
| Battery                        |                         | 14.8V/7000mA   |
| Battery Temperature Monitoring |                         | 200 x 280 x 160mm  |
| Wheels                         |                         | 4 Wheels   |
| Motor (Rear Wheel) 2ea         |                         | 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/60° (4.8 V), 0.14 s/60° (6 V)  |

## [ Block-Based Programming ]



| List   | Specifications  | List        | Specifications   |
|--------|---|-------------|--|
| LiDAR  | Distance Range : 12m<br>Angular Range : 0 ~ 360degree<br>Distance Resolution : <math>(0.5(0.15 \sim 1.5\text{meters})</math><br>Angular Resolution : 0.9degree<br>Sample Duration : 0.25 millisecond<br>Sample Frequency : 4KHz<br>Scan Rate : 10Hz | Sensor Pack | Tiny MCU(Cortex-M4)<br>Basic Module(Switch, LED, Piezo)<br>TPHG Module<br>(Temperature, Pressure, Humidity, Gas)<br>IR Thermometer Module<br>Microwave Motion Sensor Module<br>CAN Communication |
| Option |   |             |  |
| Track  | Tile Size : 500x500 (mm)<br>Rail Height : 30mm<br>Track Layout Size : 4770 x 4280 mm<br>Lane Width: 79mm<br>Component : Mats, Barrier, Joint<br>Traffic light<br>Outbreak : 1ea   |             |  |



## Training Contents

### Introduction to AloT AutoCAR II

AloT AutoCAR II - Configuration  
AloT AutoCAR II - Experimental Environment

### Artificial Intelligence Technology

Supervised Learning and Unsupervised Learning  
Pop.AI-based Linear and Logistic Regression Theory and Practice  
Pop.AI-based Perceptron Theory and practice  
Pop.AI based ANN, DNN, CNN Theory and practice  
Understanding Pop. AI and OpenAI DQN - based Reinforced DQN  
Theory and practice TensorFlow

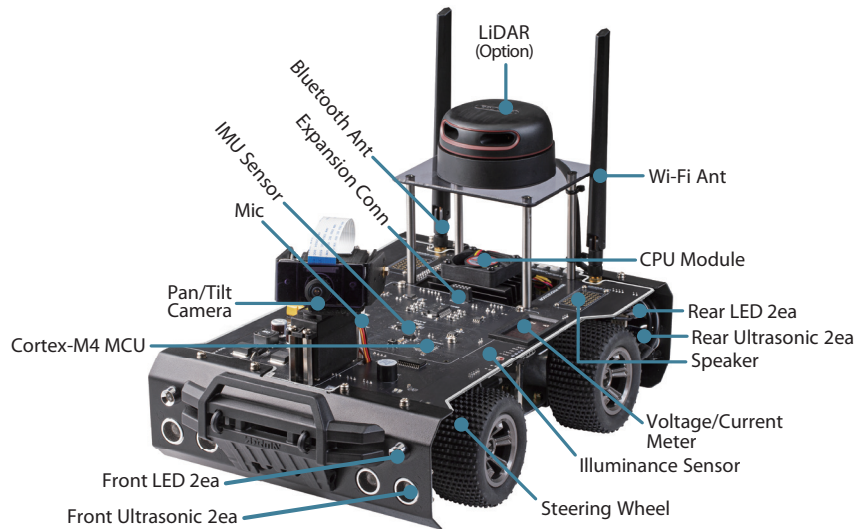
### Data Processing Technology

Numpy for fast Multidimensional Matrix  
Pandas for Operation Time Series and Tabular Data Analysis  
Matplotlib for Data Visualization

### Deep Learning-based Self-Driving Technology

Overview of Self-Driving Technology  
Basic Driving Practice  
Remote Operation Practice  
Collision Avoidance Practice  
Practice moving along an object  
Transition Learning Practice  
Advanced Self-Driving

## Layout



## Components

