

# AIoT SerBot

## Series

SerBot • SerBot Plus • SerBot PrimeX  
(Excluding LiDAR)



- AI and IoT Convergence Training Equipment based on Indoor Service Robot Platform
- Drive part adopts 3-axis omni-wheel to maximize robot's movement efficiency and minimize rotation radius
- The main module is an edge supercomputer that supports all existing AI frameworks
- Provides a 7-inch touch display with 1280x720 resolution and a 160-degree wide-angle camera with 8M pixels
- Provides Gigabit Ethernet, dual-band Wi-Fi and Bluetooth
- Digital microphones and speakers support Speech-to-Text and Text-to-Speech as well as voice command
- Supports various IoT sensor modules through 4 dedicated expansion interfaces
- High-capacity battery and dedicated charging system enable continuous experiment while charging
- Soda OS and Pop library, the exclusive AloT operating system
- Interpreter-based C/C++ development environments optimized for beginners to programming, including Python 3
- A dedicated web browser-based learning environment for training Python 3 and C/C++ simultaneously on PCs and tablets
- mDNS/DNS-SD based distributed name resolution and network service publishing and discovery support
- Open Integrated development environment based on Visual Studio Code for professional application development
- Educational contents for artificial intelligence and deep learning based service robot
- AloT SerBot Plus provides high-performance 360 degree lidar and dedicated library
- AloT SerBot Plus provides 8 types of IoT sensor modules connected to a dedicated expansion interface
- AloT SerBot PrimeX provides 6 ultrasonic sensors and 3 PSD sensors for obstacle detection
- AloT SerBot PrimeX provides Cortex-M series high performance MCU module and CAN module
- AloT SerBot PrimeX's main module contains edge supercomputer up to 21TOPS supporting all popular AI frameworks

## Training Contents

Introduction to AIoT SerBot  
 Structure of AIoT SerBot  
 Practice environment of AIoT SerBot

### AI Technology

Supervised learning and unsupervised learning  
 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 multi-dimensional matrix operations  
 Pandas for analyzing time series and tabular data  
 Matplotlib for data visualization

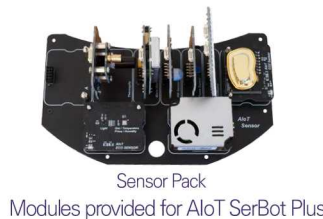
### Service Robot Application Technology

UI Exercise  
 Exercise for TTS (Text to Speech) & STT (Speech to Text)  
 Exercise for audio playback & recording  
 Camera exercise  
 Basic driving exercise  
 Voice command driving exercise  
 Remote control exercise  
 Deep learning-based driving exercise

## Product Configuration



AIoT SerBot PrimeX



Sensor Pack  
 Modules provided for AIoT SerBot Plus



AIoT CAN Transceiver  
 AIoT Tiny MCU

Modules provided for AIoT SerBot PrimeX



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	Specifications
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, Kerast
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 SerBot

### Motor Control Board

List	Specifications
Battery	11.1V / 14000mA
Wheels	3 Omni-Wheels
Motor	DC 12V Motor 3EA Gear Rate 1:50 Speed 6000RPM

### Main Module

List	Specifications
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 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

### Base Board

List	Specifications
Microphone	High Performance Digital Microphone x 4EA - Sensitivity : -26 dBFS(Omnidirectional) - Acoustic Overload Point : 120dB SPL - SNR : 63dB
Speaker	Output : 3W x 2EA - 3.5mm Audio Jack - Frequency Response : 30Hz ~ 20KHz
Sensor Module Interface Block 4EA	+5V, +3.3V, GND, I <sup>2</sup> C, ADC, GPIO, SPI
6-AXIS Sensor	Sensor : MPU6050N Resolution : 16bit Gyroscope Range : +-250, +-500, +-1000, +-2000°/S Accelerometer Range : +-2, +-4, +-8, +-18g
Camera	Image Sensor : Sony IMX219 Resolution : 8M Pixel Native Resolution Sensor (3280 x 2464 Pixel Static Images) Video : 1080p30, 720p60 and 640x480p90 Angle of View: 160 Degrees
LCD	7inch TFT LCD, HDMI Resolution 1024 X 600
Weight	5.2Kg
Size	290 X 290 X 310 (mm)
Basic Module	Input Device : Tact Switch x 2EA(GPIO) Output Device : LED 8EA(I <sup>2</sup> C) Actuator : Passive Buzzer(GPIO)

## Hardware Specifications of AIoT SerBot Plus

The specifications of AIoT SerBot is included

### SLAM & Sensor Pack

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
Flame Module	Scan Rate : 10Hz
	Sensing Range : 60 Degree
Eco Sensor Module	I/O Interface : 2 pin Digital Output
	Light Sensor
	- Illuminance to aDigital Converter
	- Wide range : 1 ~ 65535(lx)
	Temperature Measure : -40 ~ 85°C
	Humidity Measure : 0 ~ 100%r.H.
Carbon Dioxide(CO2) Gas Sensor Module	Pressure Range : 300 ~ 1100hPa
	VOC Measure : Ethane, Ethanol, Acetone, Carbon Monoxide, Butadiene, methyl
	I/O Interface : I <sup>2</sup> C
	Measuring Range : 0 ~ 10000 ppm
	Accuracy : ±7% ~ ±50ppm
	Response Time : 18 ~ 30 sec
Pixel Display	I/O Interface : I <sup>2</sup> C
	Color : Pixel RGB
	Pixel : 8X8
	I/O Interface : GPIO(Serial protocol)

List	Specifications
Dust Sensor Module	Measurement Range
	- PM1.0 : 0 ~ 10000ug/m3
	- PM2.5 : 0 ~ 10000ug/m3
	- PM10 : 0 ~ 10000ug/m3
	Resolution : 1ug/m3
	Respond Time : 1sec
	Time to First Reading : ≤8seconds
	I/O Interface : I <sup>2</sup> C
Digital Thermopile Module Laser(DTPML)	IR refresh Rate : 50Hz
	Digital Resolution : 0.1°C
	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
PIR Sensor Module	I/O Interface : Pulse Operation
	Sensing Range : 110°
	Spectral Response : 5 ~ 14 um
	Operating Voltage : 3.3V
	I/O Interface : Digital Out

## Hardware Specifications of AIoT SerBot PrimeX

The specifications of AIoT SerBot Plus is included

### Body

List	Specifications
Processor	32bit Cortex-M Processor
Distance Measure Part	Ultrasonic Tx/Rx 6 pair
	PSD 3EA
	Interface : UART, CAN

### MCU Module

List	Specifications
Core	ARM Cortex-M4
Flash Memory	1MB
SRAM	192+4 Kbyte
USB	Micro USB AB Type(OTG Support)
Basic Peripheral Device	LED 2EA, Switch 2EA, Cds 1EA, Piezo Buzzer 1EA
Interface & Expansion Connector	CAN Port 2EA (Expansion 1EA)
	UART 2EA(TTL 1EA, Serial to USB 1EA)
	GPIO, SPI, I <sup>2</sup> C, ADC, PWM, UART etc.

### Main Module

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)
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