

Artificial Intelligence-Based Autonomous Driving Service Robot Training Equipment

AIoT SerBot II



SerBot II



- AI application practice equipment based on indoor service robot platform
- NVIDIA high-performance on-device AI platform is adopted for Brain board
- Touch display and high-resolution wide-angle camera for GUI-based user interface and deep learning are provided
- Gigabit Ethernet, dual-band Wi-Fi, and Bluetooth are provided
- Voice recognition and audio playback through digital microphone and speaker are possible
- Various IoT sensor modules through 4 dedicated expansion interfaces are supported
- The driving part adopts a 3-axis omni wheel to maximize the robot's movement efficiency and minimize the turning radius
- For precise control of the driving part, controller equipped with a high-performance MCU controls omni wheel motor, encoder and sensor
- Connected via highly reliable CAN FD communication for collaboration between brain board and controller
- Built-in power path management circuit to make it possible to continue practicing even while the battery is charging
- Service robot development is supported through ROS2, robot standard middleware
- High-level Pop libraries enabling to focus on application implementation is provided
- CUDA-based PyTorch and Tensorflow artificial intelligence framework are supported
- Web browser-based Google block coding platform (Blockly) is supported
- Pre-set integrated development environment based on Visual Studio Code for professional application development is supported
- Deep learning-based service robot learning contents are provided
- On-device AI self-driving car training equipment

Operating Program

| List | Specifications |
|-------------|--|
| Linux OS | Desktop X-Server, Openbox, LightDM, Tint2, blueman, network-manager, conky |
| | CLI Zsh, Oh-My-Zsh with powerlevel9k thema and nerd fonts, Tmux, fzf, bat, lsd |
| | Tool Chain Python3, NodeJS, Java, Clang, GCC, LLVM |
| | IDE Visual Studio Code, Jupyter Lab, NeoVim |
| | Connectivity Remote Desktop Server with NoMachine, MQTT Broker with mosquitto, Jupyter Lab Server Bluez, paho-mqtt |
| | Multimedia portaudio, sox, OpenCV, Google Assistant |
| | Data Science & AI Python3, Numpy, Matplotlib, sympy, Pandas, Seaborn, Scipy, Gym Scikit-learn, Tensorflow, Keras |
| Middleware | ROS2 Rviz2, RQt, ament, RTPS, Fast DDS, TF2 |
| Pop Library | 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 |
| | Multimedia AudioPlay, AudioPlayList, AudioRecord, Tone, SoundMeter |
| | Voice Assistant GAssistant, create_conversation_stream |
| | AI Linear Regression, Logistic Regression, Perceptron, ANN, DNN, CNN, DQN |

Hardware Specification

| List | Specifications |
|------------------------|--|
| Body | Size 290x290x310mm Weight 5.2Kg(About) Battery 14.8V/7000mA 2ea Wheels 3 Wheels |
| | Motor: 3ea RPM 500, Encoder Gear Rate 1:30 Max Speed 1.5m/s |
| | UltraSonic Sensor 6ea Effectual Angle < 15° Ranging Distance : 2cm ~ 400cm Resolution : 0.3cm Measuring Angle : 30° Trigger Input Pulse width : 10us |
| | PSD 3ea Effectual Angle < 15° Ranging Distance : 2cm ~ 400cm Resolution : 0.3cm Measuring Angle : 30° Trigger Input Pulse width : 10us |
| | CPU Quad-core ARM Cortex-A57 MPCore processor |
| Brain Module (Default) | GPU NVIDIA Maxwell architecture with 128 NVIDIA CUDA® cores |
| | Memory 4 GB 64-bit LPDDR4, 1600MHz 25.6 GB/s Storage MicroSD 64GB |
| | Video Encoder 4Kp30 4x 1080p30 9x 720p30 (H.264/H.265) |
| | Video Decoder 4Kp60 2x 4Kp30 8x 1080p30 18x 720p30 (H.264/H.265) Camera MIPI CSI-2 lanes |
| | Connectivity Dual Band Wireless WiFi 2GHz/5GHz Band, 867Mbps, 802.11ac Bluetooth 4.2 1x Gigabit Ethernet |
| | Connector 1x HDMI 4x USB 3.0 Type-A, 1x Micro-USB (device mode) |

Software Specification

| List | Specifications | |
|--------------------------|--|--|
| Brain Module (Option 1) | CPU | 6-core ARM v8.2 64-bit 6MB L2 + 4MB L3 Max Freq: 6-core@1900MHz |
| | GPU | 384-core NVIDIA Volta™ GPU with 48 Tensor Cores Max Freq: 1100MHz |
| | Memory | 8 GB 128-bit LPDDR4x 59.7GB/s Storage 16GB eMMC 5.1, NVMe 256GB SSD 1ea(M.2) |
| | Video Encoder | 2x 4K60 4x 4K30 10x 1080p60 22x 1080p30 H.265 |
| | Video Decoder | 2x 8K30 6x 4K60 12x 4K30 22x 1080p60 H.265 |
| | Connector | 1x HDMI 4x USB 3.0 Type-A, 1x Micro-USB (device mode) |
| Brain Module (Option 2) | CPU | 8-core Arm® Cortex®-A78AE v8.2 64-bit CPU 2MB L2 + 4MB L3 |
| | GPU | NVIDIA Ampere architecture with 1024 NVIDIA® CUDA® cores and 32 tensor cores |
| | Memory | 16GB 128-bit LPDDR5 102.4 GB/s Storage NVMe SSD 256GB |
| | Video Encoder | 1x 4K60 3x 4K60 6x 1080p60 12x 1080p30 (H.265) H.264, AV1 |
| | Video Decoder | 1x 8K30 2x 4K60 4x 4K30 9x 1080p60 18x 1080p30 (H.265) H.264, VP9, AV1 |
| | Connector | 1x HDMI 2.1 4x USB 3.2 Type-A (10Gbps), 1x USB2.0 Type-C (Device Mode) |
| Top Board | Information | Power Voltage Display (3 Digit FND) LED : Low Battery, Normal Battery Piezo : Alarm Low Battery or Booting |
| | Application Controller | Arm® 32-bit Cortex®-M4 CPU with FPU 210 DMIPS 1.25 DMIPS MHz (Dhrystone 2.1), and DSP instructions CAN FD Communication App. Sensor Control IMU Sensor Control Power Check |
| | CAN FD | CAN FD Controller CAN FD Transmitter x 2ea |
| | IMU Sensor | Pitch Roll Yaw (X Y Z axis) Accelerometer + Angular Velocity + Angle +Magnet Field I2C Interface |
| | CAMERA | Image Sensor: Sony IMX219 Resolution: 8M pixel native resolution sensor (3280 x 2464 pixel static images) Video: 1080p30, 720p60 and 640x480p90 Linux intergration: V4L2 driver available Focal length: 3.04 mm Angle of view: 160 degrees Focal ratio (F-Stop): 2.35 Tilt : 0° ~ 100° Tilt |
| | Microphone | High performance Digital Microphone x 4ea Sensitivity : -26 dBFS(Omnidirectional) Acoustic Overload Point : 120dB SPL SNR : 63dB |
| | Light Sensor | Illuminance to digital converter Wide range : 1 ~ 65535(lx) Interface: I2C |
| | App. Sensor Module Block x 7ea | Power: +5V, +3.3V, GND Interface: I2C, ADC, GPIO, SPI |
| | Power Block | Battery Charger Controller Block INFET Low Loss Ideal Diode PowerPath Control Indicator State : DC Adapter, Charging, Complete, Current Limiting +5V, +12V Switching Power Block +3.3V Power Block |
| | Motor Board | Arm® 32-bit Cortex®-M4 CPU with FPU 210 DMIPS 1.25 DMIPS MHz (Dhrystone 2.1), and DSP instructions CAN FD Communication Motor Driving Control UltraSonic Sensor Control PSD Sensor Control Battery Temperature |
| Motor Driver 3ea | Double H bridge drive Drive current 3.4A(MAX single bridge) Direction, PWM Control | |
| TFT LCD | 7inch 1024 x 600 Interface HDMI Touch Screen Speaker 2ea | |
| Base Components | LiDAR(option1) | Distance Range : White object: 12 meters Black object: 10 meters Minimum Operating ranging : 0.2m Angular Range : 0 ~ 360degree Sample Frequency : 16KHz Scan Frequency: 10Hz Angular Resolution : 0.225° |
| | LiDAR(option2) | Both outdoor and indoor environments with reliable resistance to daylight (≥80Klux) Distance Range : White object: 0.05-40 meters (under 70% reflection) Angular Range : 0 ~ 360degree Sample Frequency : 32KHz Scan Frequency: Typ. 10Hz, 10-20Hz Angular Resolution : Typ. 0.1125°, 0.1125°~0.225° Resolution : 10mm |
| | Switch Module | Power : +3.3V, GND Input Device : Tact Switch x 4ea(GPIO 4) |
| Expansion Module(Option) | RGB LED Module | Power : +3.3V, GND output device : RGB LED 4ea(GPIO 12) |
| | Analog Module | Power : +3.3V, GND output device : CdS, NTC, VR(Analog 3) |
| | TPHG Sensor Module | Power : +3.3V, GND I/O Interface : I2C Temperature Measure : -40 ~ 85°C Pressure range : 300 ~ 1100hPa Humidity Measure : 0 ~ 100%.H. VOC Measure : Ethane, Ethanol, Acetone, Carbon Monoxide, Butadiene, methyl |
| | Thermopile Sensor Module | Power : +3.3V, GND I/O Interface : I2C Factory calibrated in wide temperature range:-40~+125°C for sensor temperature and -70~+380°C for object temperature High accuracy of 0.5°C over wide temperature range (0~+50°C for both Ta and To) High (medical) accuracy calibration Measurement resolution of 0.02°C |
| | TOF Sensor Module | Power : +3.3V, GND I/O Interface : I2C 940 nm laser VCSEL Measures absolute range up to 2 m Eye Safe : Class 1 laser device compliant with latest standard IEC 60825-1:2014 - 3rd edition |
| | PGCA Sensor Module | Power : +3.3V, GND I/O Interface : I2C, GPIO Proximity Sensing Gesture Detection RGB Color Sensing & Ambient Light Operating Range: 4-8in (10-20cm) White BackLight LED 4ea(GPIO Control) |

Training Contents

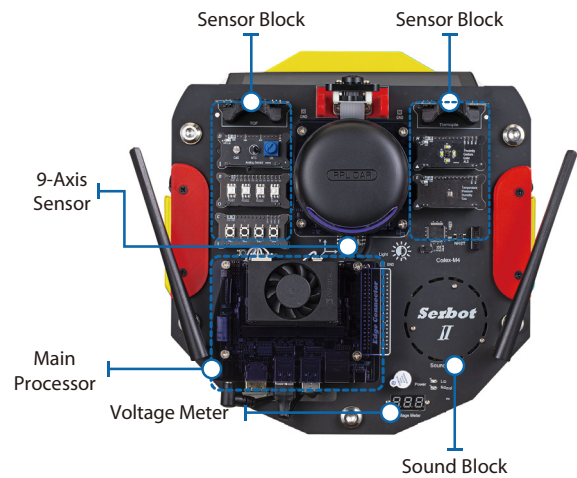
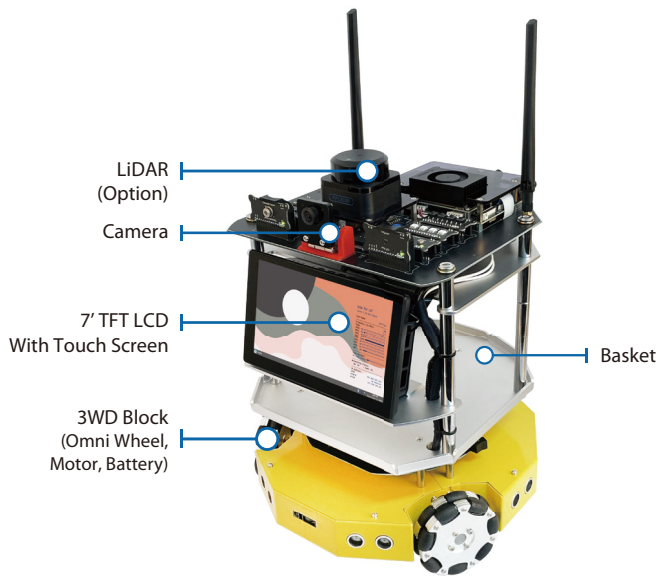
DDS/RTSPS network-based autonomous vehicle control in ROS2 environment

WSL2-based Linux development environment
Understanding Python core syntax for ROS2
Understanding network programming for ROS2
ROS2 installation and environment configuration
Understanding node, topic, service, and parameter action
ROS2 build environment
Publisher node and subscriber node
Services and user defined interface
Action and multi-node
Launch and multi-execution
Advanced ROS2

Deep learning-based autonomous driving technology

WSL2-based Linux development environment
Supervised learning and unsupervised learning
Linear Regression and Logistic Regression
ANN, DNN, CNN basics
Understanding machine learning framework
Fast multidimensional matrix library
Time series, table data analysis library
Data visualization library
Overview of autonomous driving technology
Basic driving and remote operation
Avoid collision and move along object
Transfer learning
Advanced autonomous driving

Layout



Component



SerBot II



Platform USB
(include OS image and Tools)
1EA



19V 4.6A DC Adapter
1EA



USB to Ethernet
Adapter
1EA



Ethernet Cable
1EA



User Guide book
1EA