

AI Autonomous Driving Vehicle

Educational Equipment

AutoCar Prime II



AutoCar Prime II



Operation Program		HANBACK ELECTRONICS
List	Specifications	
OS	Desktop	X-Server, Openbox, LightDM, Tint2, blueman, network-manager, conky
	CLI	Zsh, Tmux, Peco, powerlevel9k thema, Powerline fonts, Powerline fonts
	Tool Chain	GCC 9, JDK, Node JS, Python3, Clang
	IDE	Visual Studio Code, NeoVim
	Connectivity	Mosquitto(MQTT), Bluez, mtr, nmap, iptraf, Samba, Blynk Server, Remote Desktop Server
	Multimedia	portaudio, sox, OpenCV 4, Google Assistant
	Data Science & AI	Python3, Numpy, Matplotlib, sympy, Pandas, Seaborn, Scipy, Gym Scikit-learn, Tensorflow, Keras
Middleware	ROS2 Foxy	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
Development Environment Linked with PC	Jupyter Lab	Python3 and Cling support IPython Widgets Terminal support Pop Library support
	Visual Studio Code Insiders	Remote SSH Python3 and Debugging support Terminal support Pop Library support

Hardware Specification

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List	Specifications
Main Module	CPU 6-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 8GB 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
	Camera MIPI CSI-2 lanes
	Connectivity Dual Band Wireless WiFi 2GHz/5GHz Band, 867Mbps, 802.11ac Bluetooth 4.2 1x Gigabit Ethernet 1x CAN
	Display 1x HDMI 2.1 4x USB 3.2 Type-A (10Gbps), 1x USB2.0 Type-C (Device Mode)
Base Board	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 Power Voltage Display(3 Digit FND) LED : Low Battery, Normal Battery Piezo : Alarm Low Battery or Booting
	Main Controller Arm® 32-bit Cortex®-M4 CPU with FPU Power Check 210 DMIPS/1.25 DMIPS/MHz (Dhrystone 2.1), and DSP instructions CAN Communication Motor Driving Control, Steering Control UltraSonic Sensor Control 9-AXIS Sensor Control
	Motor Driver 1ea Double H bridge drive Drive current 3.4A(MAX single bridge) Direction, PWM Control
	Sound 1ch Microphone Omni-directional Sensitivity: -42dBV Stereo Speaker 2W
	9-Axis Sensor an advaced triaxial 16bit gyroscope, a versatile, leading edge triaxial 14bit accelerometer and a full performance geomagnetic sensor Gyroscope Range switchable $\pm 125^\circ/\text{s}$ to $\pm 2000^\circ/\text{s}$, Low-Pass filter bandwidth 523Hz ~ 12Hz Accelerometer Range: ± 2 , ± 4 , ± 8 , $\pm 18g$, Low-Pass filter bandwidth 1kHz ~ 8Hz Magnetic field rage typical $\pm 1300\mu\text{T}$ (x-,y-axis), $\pm 2500\mu\text{T}$ (z-axis), Magenetic field resolution of ~0.3uT
	CAMERA Video Output : → 2K at 15 FPS with Output resolution side-by-side of 2x(2208x1242) → 1080p at 30 FPS, 720p at 60 FPS, WVGA at 100 FPS Depth Perception : → Range: 0.3m to 20m → Accuracy: <1% up to 3m, <5% up to 15m Field of View: Max. 110°(H) x 70°(V) x 120°(D) Sensors: IMU, Barometer, Magnetometer
Body	Dimension 340 x 600 x 220 (mm) Weight: 6kg Battery: 14.8V/7000mA Wheels: 4 Wheels
	TFT LCD Screen : IPS 7 inch Resolution: 1024 x 600 pixels Touch: 5-Points, Capacitive Interface: HDMI
	Motor DC Geared Motor with Encoder : RPM 500, Encoder Gear Rate 1:30 Max Speed 1.5m/s
	Steering Serial Bus Servo Motor High-precision potentiometer for more stable operation Torque :35kg.cm Servo accuracy 0.2° Gear : Metal Protect : avoid stalling and overheat
	UltraSonic Sensor 5ea Front 3ea, Rear 2ea Effectual Angle < 15° Ranging Distance : 2cm ~ 400cm Resolution : 0.3cm Measuring Angle : 30 degree Trigger Input Pulse width : 10us
	LED Front White 2ea Rear Red 2ea
	Voltage Meter DC 4~28V measurement Tolerance +- 1% Operation temperature -10°C ~ 65°C
	ILLUMINANCE SENSOR Sensor : CdS Operating Voltage : 3.3V Interface : Analog Output
Expansion Module(Optional)	Tiny Bread-F405 Module Bread Board: 470 Tie-point (Terminal Strip, Distribution Strips) +5V, +3.3V, GND, I/O Connector ARM®32-bit Cortex®-M4 CPU CAN, ADC, I2C, SPI, GPIO etc USB OTG Port 1ea SPI CAN FD Controller and Transmitter Mixed CAN 2.0B and CAN FD Conforms to ISO 11898-1:2015
	Switch Module Power : +3.3V, GND Input Device : Tact Switch x 4ea(GPIO 4)
	RGB LED Module Power : +3.3V, GND output device : RGB LED 4ea(GPIO 12)
	Analog Module 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%r.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)



- On-Device AI Autonomous Driving Vehicle Educational Equipment
- Brain Board Adopts NVIDIA High-Performance On-Device AI Platform
- High-Resolution Wide-Angle Camera for Deep Learning-Based Autonomous Driving Practice is Built-in
- 9-Axis High-Precision IMU Sensor for Path Tracking and Vehicle Position Control is Built-in
- High-Precision Serial Servo Motor for Accurate Steering Control is Built-in
- Control Motor, Encoder, and Sensor with Controller with High Performance MCU for Precise Control of Driving Part
- Connect Brain Board and Controller through CAN FD Communication
- Gigabit Ethernet, Dual-Band Wi-Fi, and Bluetooth for IOT Connectivity Application are Built-in
- Digital Microphone and Speaker for Voice Recognition and Audio Playback are Built-in
- Power Path Management Circuit Enabling Practice Even While Battery Charging is Built-in
- Selectable Indoor or Indoor/Outdoor DToF Lidar for SLAM and Path Planning Applications
- Selectable Sensor Pack with Built-In Breadboard to Utilize Various IoT Sensor Modules
- Selectable Touch Display for GUI-Based User Interface Implementation
- High-Level Pop Library to Focus on Autonomous Driving Implementation is Provided
- Supports Autonomous Driving Applications Based on ROS2, Robot Standard Middleware, and Pop library
- Supports CUDA-Based PyTorch and Tensorflow Artificial Intelligence Framework
- Supports Web Browser-Based Google Block Coding Platform, Blockly
- Supports Pre-Set Integrated Development Environment Based on Visual Studio Code for Professional Application Development
- Provides Learning Content for Autonomous Driving Vehicle Based on Deep Learning

Learning Content

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Artificial Intelligence and Autonomous Driving

LiDAR Application

Environment for Experiment

Image Processing

AutoCar Prime II Control

Understanding Machine Learning
for Autonomous Driving

CAN Protocol

Convolutional Neural Network and Resnet Structure

Positioning Method for Vehicle Location
and Surrounding Environment

Object Detection and Vehicle Control using YOLO

Driving by Calculation Algorithm

Sensor Fusion

Component

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AutoCar Prime II



Platform USB
(include OS image and Tools)
1EA



19V 4.7A Adapter
1EA



USB to Ethernet Adapter
1EA



Ethernet Cable
1EA



User Guide book
1EA