LEETOP ALP-ALP-606 Embedded Artificial Intelligence Computer User Guide

Contents

LEETOP ALP-ALP-606 Embedded Artificial Intelligence Computer

Product Information

The Leetop_ALP_606 is an embedded artificial intelligence computer that provides high computing power for various terminal devices. It features a fast active cooling design, meeting industrial standards for shock resistance and anti-static. With rich interfaces and high-cost performance, the Leetop_ALP_606 is a versatile and powerful product.

Specifications

- **Processor:** Jetson Orin Nano 4GB / Jetson Orin Nano 8GB / Jetson Orin NX 8GB / Jetson Orin NX 16GB
- **AI Performance:** 20 TOPS / 40 TOPS / 70 TOPS / 100 TOPS
- **GPU:** NVIDIA Ampere architecture GPU with Tensor Cores
- **CPU:** Varies depending on the processor
- **Memory:** Varies depending on the processor
- **Storage:** Supports external NVMe
- **Power:** Varies depending on the processor
- **PCIe:** Varies depending on the processor
- **CSI Camera:** Up to 4 cameras (8 via virtual channels), MIPI CSI-2 D-PHY 2.1
- **Video Encode:** Varies depending on the processor
- **Video Decode:** Varies depending on the processor
- **Display:** Varies depending on the processor
- **Networking:** 10/100/1000 BASE-T Ethernet
- **Mechanical:** 69.6mm x 45mm, 260-pin SODIMM connector

Product Usage Instructions

To use the Leetop_ALP_606, follow these steps:

1. Ensure that the Leetop_ALP_606 is properly connected to a power source using the provided power adapter and power cord.
2. If required, connect external devices such as cameras to the available interfaces based on the specifications of your processor.
3. For AI computing tasks, make sure to utilize the appropriate GPU and CPU capabilities of your specific processor.
4. When using the Leetop_ALP_606 for video encoding or decoding, refer to the specifications of your processor to determine the supported resolutions and formats.
5. If you need to display the output, connect a compatible display device to the designated ports based on the specifications of your processor.
6. Ensure that the Leetop_ALP_606 is connected to a network using the provided Ethernet port for networking functionality.
7. Handle the Leetop_ALP_606 with care, considering its mechanical dimensions and connectors.

If you have any questions or need technical support, you can contact Leetop's customer service by sending an email to **service@leetop.top**.

Notice
Please read manual carefully before install, operate, or transport the Leetop device. Ensure that the correct power range is being used before powering the device. Avoid hot plugging. To properly turn off the power, please shut down the Ubuntu system first, and then cut off the power. Due to the particularity of the Ubuntu system, on the Nvidia developer kit, if the power is turned off when the startup is not completed, there will be a 0.03% probability of abnormality, which will cause the device to fail to start. Due to the use of the Ubuntu system, the same problem also exists on the Leetop device. Do not use cables or connectors other than described in this manual. Do not use Leetop device near strong magnetic fields. Backup your data before transportation or Leetop device is idle. Recommend to transport Leetop device in its original packaging. Warn! This is a Class A product, in a living environment this product may cause radio interference. In this case, the user may be required to take practicable measures against the interference.

Service and Support

Technical Support
Leetop is glad to help you with any questions you may have about our product, or about the use of the technology for your application. The fastest way is sending us an email: service@leetop.top
Warranties
Warranty period: One year from the date of delivery.
Warranty content: Leetop warrants the product manufactured by us to be free from defects in material and workmanship during warranty period. Please contact service@leetop.top for return material authorization (RMA) prior to returning any items for repair or exchange. The product must be returned in its original packaging to prevent damage during shipping. Before returning any product for repair, it is recommended to back up your data and delete any confidential or personal data.

Packing List

- Leetop_ALP_606 x 1
- Non-standard equipment
- Power adapter x 1
- Power cord x 1

DOCUMENT CHANGE HISTORY

Document	Version	date
Leetop_ALP_606	V1.0.1	20230425

product description

Brief

Leetop_ALP_606 is an embedded artificial intelligence computer that can provide up to 20/40 |70/100 TOPS computing power for many terminal devices. Leetop_ALP_606 provides a fast active cooling design, which can meet industrial standards such as shock resistance and anti-static. At the same time, Leetop_ALP_606 has rich interfaces and high cost performance.

Specifications

Processor

Processor	Jetson Orin Nano 4GB	Jetson Orin Nano 8GB
AI Performance	20 TOPS	40 TOPS
GPU	512-core NVIDIA Ampere architecture GPU with 16 Tensor Cores	1024-core NVIDIA Ampere architecture GPU with 32 Tensor Cores
CPU	6-core Arm® Cortex®-A78AE v8.2 64-bit CPU 1.5MB L2 + 4MB L3	6-core Arm® Cortex®-A78AE v8.2 64-bit CPU 1.5MB L2 + 4MB L3
Memory	4GB 64-bit LPDDR5 34 GB/s	8GB 128-bit LPDDR5 68 GB/s
Storage	(Supports external NVMe)	(Supports external NVMe)
Power	5W – 10W	7W – 15W
PCIe	1 x4 + 3 x1 (PCIe Gen3, Root Port, & Endpoint)	1 x4 + 3 x1 (PCIe Gen3, Root Port, & Endpoint)
CSI Camera	Up to 4 cameras (8 via virtual channels***) 8 lanes MIPI CSI-2 D-PHY 2.1 (up to 20Gbps)	Up to 4 cameras (8 via virtual channels***) 8 lanes MIPI CSI-2 D-PHY 2.1 (up to 20Gbps)
Video Encode	1080p30 supported by 1-2 CPU cores	1080p30 supported by 1-2 CPU cores
Video Decode	1x 4K60 (H.265) 2x 4K30 (H.265) 5x 1080p60 (H.265) 11x 1080p30 (H.265)	1x 4K60 (H.265) 2x 4K30 (H.265) 5x 1080p60 (H.265) 11x 1080p30 (H.265)
Display	1x 4K30 multi-mode DP 1.2 (+MST)/eDP 1.4/HDMI 1.4**	1x 4K30 multi-mode DP 1.2 (+MST)/eDP 1.4/HDMI 1.4**
Networking	10/100/1000 BASE-T Ethernet	10/100/1000 BASE-T Ethernet
Mechanical	69.6mm x 45mm 260-pin SO- DIMM connector	69.6mm x 45mm260-pin SO-DIMM connector

Processor	Jetson Orin NX 8GB	Jetson Orin NX 16GB

AI Performance	70 TOPS	100 TOPS
GPU	1024-core NVIDIA Ampere GPU with 32 Tensor Cores	1024-core NVIDIA Ampere GPU with32 Tensor Cores
CPU	6-core NVIDIA Arm® Cortex A78AE v8.2 64-bit CPU 1.5MB L2 + 4MB L3	8-core NVIDIA Arm® Cortex A78AE v8.2 64-bit CPU2MB L2 + 4MB L3
Memory	8 GB 128-bit LPDDR5 102.4 GB/s	16 GB 128-bit LPDDR5102.4 GB/s
Storage	(Supports external NVMe)	(Supports external NVMe)
Power	10W – 20W	10W – 25W
PCIe	1 x4 + 3 x1 (PCIe Gen4, Root Port & Endpoint)	1 x4 + 3 x1 (PCIe Gen4, Root Port & Endpoint)
CSI Camera	Up to 4 cameras (8 via virtual channels***) 8 lanes MIPI CSI-2 D-PHY 2.1 (up to 20Gbps)	Up to 4 cameras(8 via virtual channels***) 8 lanes MIPI CSI-2D-PHY 2.1 (up to 20Gbps)
Video Encode	1x4K60 | 3x4K30 | 6x1080p60 | 12x1080p30(H.265) 1x4K60 | 2x4K30 | 5x1080p30 | 11x1080p30(H.264)	1x 4K60 | 3x 4K30 | 6x 1080p60 | 12x 1080p30 (H.265) 1x 4K60 | 2x 4K30 | 5x 1080p60 | 11x 1080p30 (H.264)

Video Decode	1x8K30 |2X4K60 | 4X4K30| 9x1080p60 | 18x1080p30(H.265) 1x4K60|2x4K30| 5x1080P60 | 11X1080P30(H.264)	1x 8K30 | 2x 4K60 | 4x 4K30 | 9x 1080p60| 18x 1080p30 (H.265) 1x 4K60 | 2x 4K30 | 5x 1080p60 | 11x 1080p30 (H.264)
Display	1x 8K60 multi-mode DP 1.4a (+MST)/eDP1.4a/HDMI 2.1	1x 8K60 multi-mode DP 1.4a (+MST)/eDP1.4a/HDMI 2.1
Networking	10/100/1000 BASE-T Ethernet	10/100/1000 BASE-T Ethernet
Mechanical	69.6mm x 45mm 260-pin SO-DIMM connector	69.6mm x 45mm260-pin SO-DIMM conne ctor

I/O

Interface	**Specification**
PCB Size / Overall Size	100mm x 78mm
Display	1x HDMI
Ethernet	1x Gigabit Ethernet (10/100/1000)
USB	4x USB 3.0 Type A (Integrated USB 2.0) 1x USB 2.0 +3.0Type C
M.2 KEY E	1x M.2 KEY E Interface
M.2 KEY M	1x M.2 KEY M Interface
Camera	CSI 2 line
FAN	1 x FAN (5V PWM)
CAN	1x CAN
Power Requirements	+9—+20V DC Input @ 7A

Power Supply

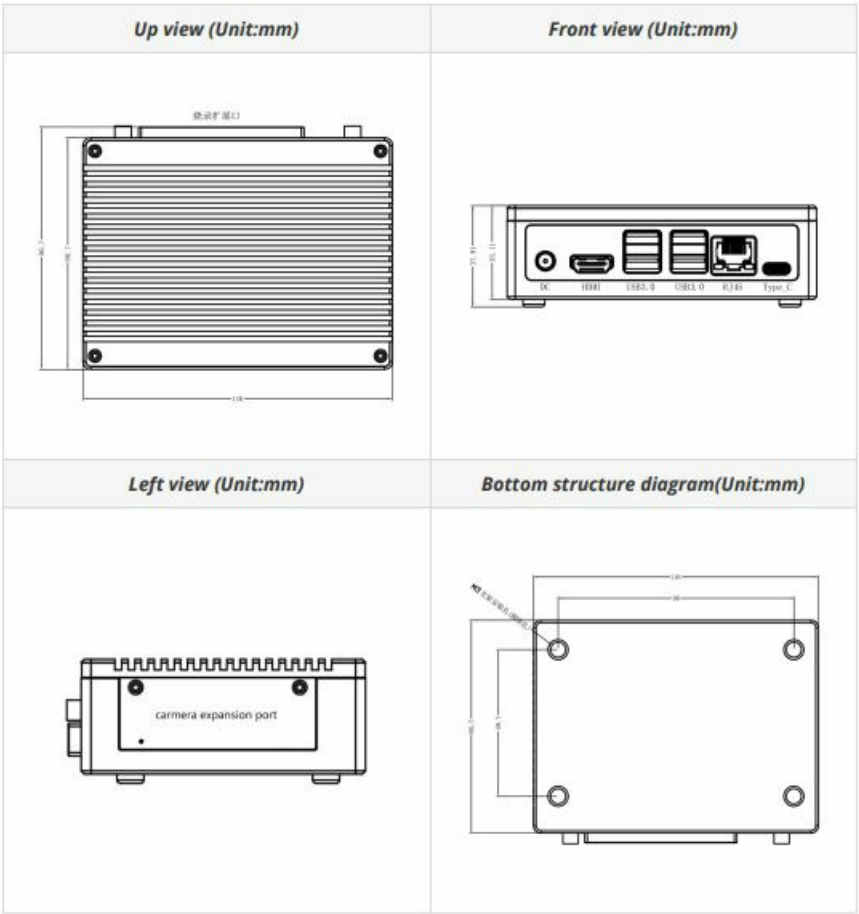
Power Supply	Specification
Input Type	DC
Input Voltage	+9—+20V DC Input @ 7A

Environmental

Environmental	Specification
Operating Temperature	-25 C to +75C
Storage Humidity	10%-90% Non-condensing environment

Install Dimension

Leetop_ALP_606 Dimensions as below:



Interface Description

Front interface

Leetop_ALP_606_Schematic diagram of front interface

Interface	Interface name	Interface description
Type-C	Type-C interface	1 way Type-C interface
HDMI	HDMI	1 channel HDMI interface
USB 3.0	USB 3.0 interface	4-way USB3.0 Type-A interface (compatible with USB2.0) 1-way USB 2.0+3.0Type A
RJ45	Ethernet Gigabit port	1 independent Gigabit Ethernet port
POWER	DC power interface	+9—+20V DC @ 7A power interface

Note: This product starts automatically when plugged in

Back side interface

Leetop_ALP_606_Interface diagram on the back

Interface	Interface name	Interface description
12Pin	12pin multi-function	Debug serial port

PIN	Signal Name	PIN	Signal Name
1	PC_LED-	2	VDD_5V
3	UART2_RXD_LS	4	UART2_TXD_LS
5	BMCU_ACOK	6	AUTO_ON_DIS
7	GND	8	SYS_RST
9	GND	10	FORCE_RECOVERY
11	GND	12	PWR_BTN

Note:

- **PWR_BTN-**—system boot positive;

- A short circuit between 5PIN and 6PIN can turn off the automatic power-on function;
- Short circuit between SYS_RST_IN and GND—-system reset; short circuit between
- FORCE_RECOVERY and GND to enter the flashing mode;

Description of the carrier board interface

Carrier plate specification

Interface	Specification
PCB Size / Overall Size	100mm x 78mm
Display	1x HDMI
Ethernet	1x Gigabit Ethernet (10/100/1000)
USB	4x USB 3.0 Type A (Integrated USB 2.0) 1x USB 2.0 +3.0Type C
M.2 KEY E	1x M.2 KEY E Interface
M.2 KEY M	1x M.2 KEY M Interface
Camera	CSI 2 line
FAN	1 x FAN (5V PWM)
CAN	1x CAN
Power Requirements	+9—+20V DC Input @ 7A

Features

Operating system setup

Hardware Preparation

- **Ubuntu** 18.04 PC x1
- **Type** c data cable x1

Environment requirements

- Download the system image package to the PC host of the Ubuntu18.04 system:

Burn-in steps

- Use a USB cable to connect the USB Type-A of the PC of the Ubuntu18.04 system to the
- Type c of the Leetop_ALP_606 Development System;
- Power on the Leetop_ALP_606 Development System and enter Recovery mode;
- Open the Nvidia-SDK-Manager on your PC, as shown below, and select Jetson Orin NX/ Orin Nano to

download the Jetpack5xxx system image package and development tools.

- From **https://developer.nvidia.com/embedded/downloads** or download the latest
- Jetson Linux distribution package and Jetson development kit sample file system. (Jetson Linux Driver Package (L4T))
- **Download the matching driver:** orin nx link: **https://pan.baidu.com/s/1RSDUkcKd9AFhKLG8CazZxA**
- **Extraction code:** 521m orin nano: link: **https://pan.baidu.com/s/1y-MjwAuz8jGhzVgIU6seaQ**
- **Extraction code:** kl36


```
#If you can't find the version using the latest sdk, you can use this command to get it
sdkmanager --archivedeversions
```

- Please contact us for the rest of the information at **service@leetop.top**
- Unzip the downloaded image package and enter the Linux for Tegra(L4T) directory

```
tar xf ${L4T_RELEASE_PACKAGE}
cd Linux_for_tegra/rootfs
sudo tar xpf ${SAMPLE_FS_PACKAGE}
cd ..
sudo ./tools/l4t_flash_prerequisites.sh
sudo ./apply_binaries.sh
#Replace driver packages
sudo cp -r 606_xxx/Linux_for_tegra /Linux_for_tegra
```

- Enter the Linux_for_tegra directory and use the flash command(flash to NVMe))

```
#flash to nvme
#orin nano
sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c tools/kernel_flash/flash_l4t_external.xml -p "-c bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-orin-nano-devkit internal
#orin nx
sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c tools/kernel_flash/flash_l4t_external.xml -p "-c bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-a02+p3767-0000 internal
```

- Enter the Linux_for_tegra directory and use the flash command(flash to USB))

```
#flash to USB:
#orin nano
sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device sda1 -c tools/kernel_flash/flash_l4t_external.xml -p "-c bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-orin-nano-devkit internal
#orin nx
sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device sda1 -c tools/kernel_flash/flash_l4t_external.xml -p "-c bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-a02+p3767-0000 internal
```

- Enter the Linux_for_tegra directory and use the command flash to SD

```
#flash to SD
#orin nano
sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device mmcblk1p1  -c tools/kernel_flash/flash_l4t_external.xml -p "-c bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-orin-nano-devkit internal
```

Recovery mode

Leetop_ALP_606 can use USB to update the system. You need to enter USB Recovery mode to update the system. In USB Recovery mode, you can update the file system, kernel, boot loader, and BCT. Steps to enter recovery mode:

1. Turn off the system power, make sure that the power is turned off instead of in standby mode.
2. Use the USB Type C to USB Type A link cable to link the carrier and the host
3. Power on the device and enter Recovery mode. This product starts from power on and enters rec mode. If there is a system, you can use the following instructions to enter rec mode.

```
sudo reboot --force forced-recovery
```

Note:

Please follow the steps of the update manual for system update. when entering USB recovery mode, the system will not start, and the serial port will not have debugging information output`.

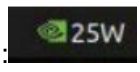
Install system image

- **a)** Connect USB type-A of Ubuntu 18.04 Host to Type-c of Leetop_ALP_606;
- **b)** Power up Leetop_ALP_606 and enter Recovery mode(RCM);
- c) The PC Host enters the L4T directory and executes the flashing instruction

```
cd Linux_for_tegra
#flash to nvme
#orin nano
sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c tools/kernel_flash/flash_l4t_external.xml -p "-c bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-orin-nano-devkit internal
#orin nx
sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c tools/kernel_flash/flash_l4t_external.xml -p "-c bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-a02+p3767-0000 internal
```

- **d)** After flashing, power on Leetop_ALP_606 again and log in to the system.

Switching working modes

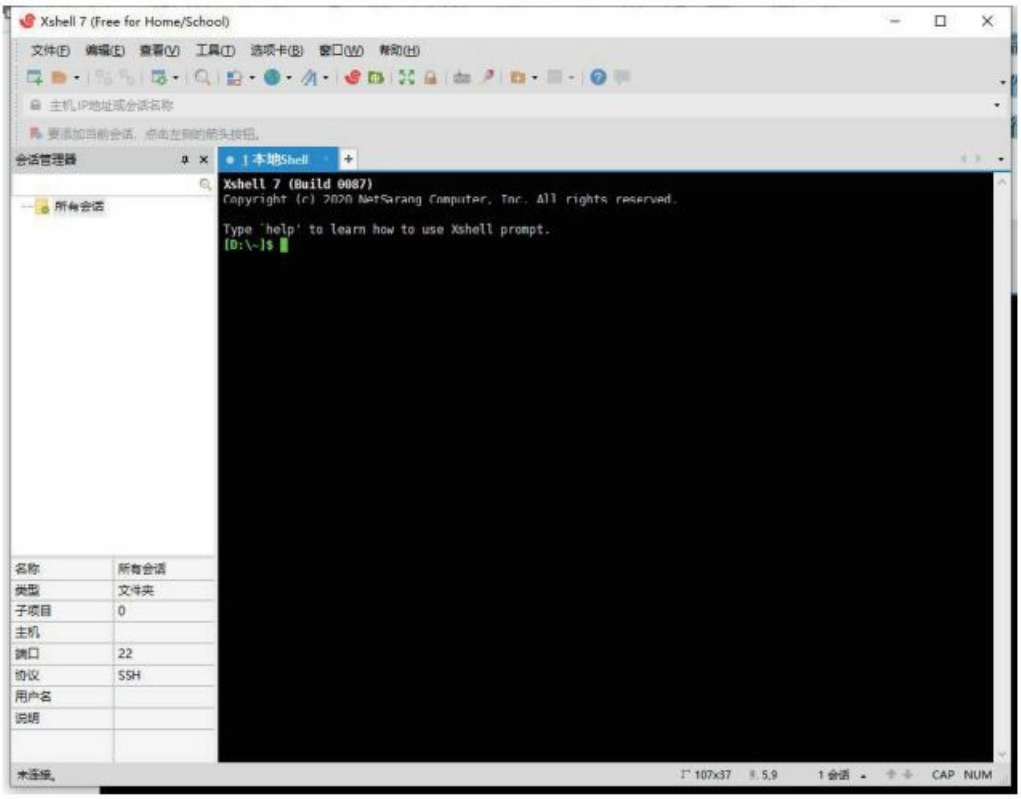
- After logging in to the system, you can click on the operation modification in the upper right corner of the system interface, as shown in the figure: 

- Or, enter the command in the terminal to switch:

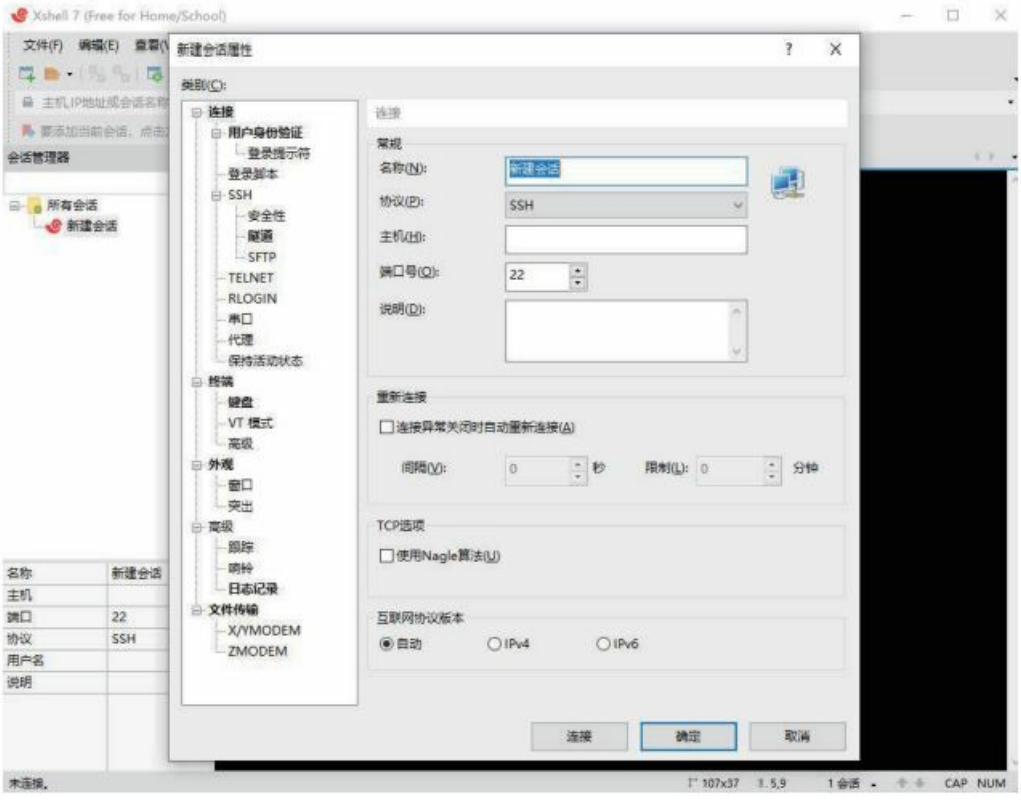
```
#Switch to mode 0, use the -q parameter to view the current mode
sudo nvpmodel -m 0
```

Use of shell

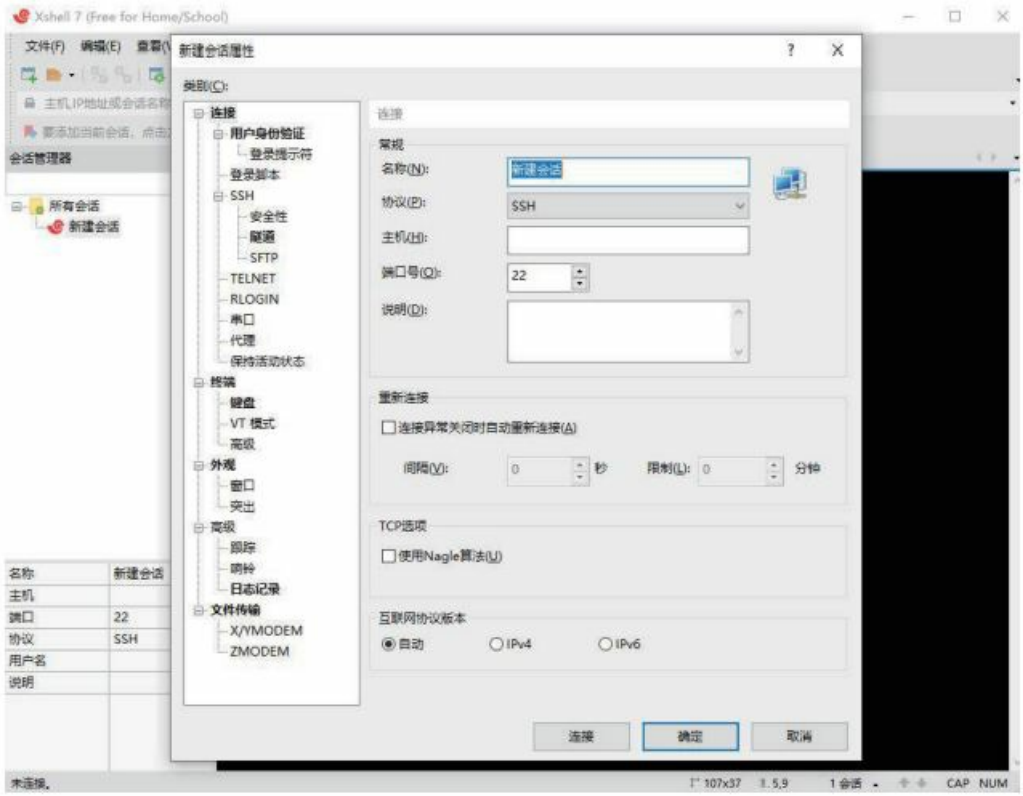
- Xshell is a powerful security terminal emulation software, it supports SSH1, SSH2, and TELNET protocol of Microsoft Windows platform. Xshell's secure connection to remote hosts through the Internet and its innovative design and features help users enjoy their work in complex network environments. Xshell can be used to access servers under different remote systems under the Windows interface, so as to better achieve the purpose of remote control of the terminal. xshell is not necessary, but it can better assist us in using the equipment. It can link your Windows system with your Ubuntu system, allowing you to operate your Linux system under Windows system. To install xshell, you can download and install it by searching Baidu on the Internet. (When the product cannot enter the desktop system, you can also use xshell to perform remote control and modify configuration errors).



- Newly bulit

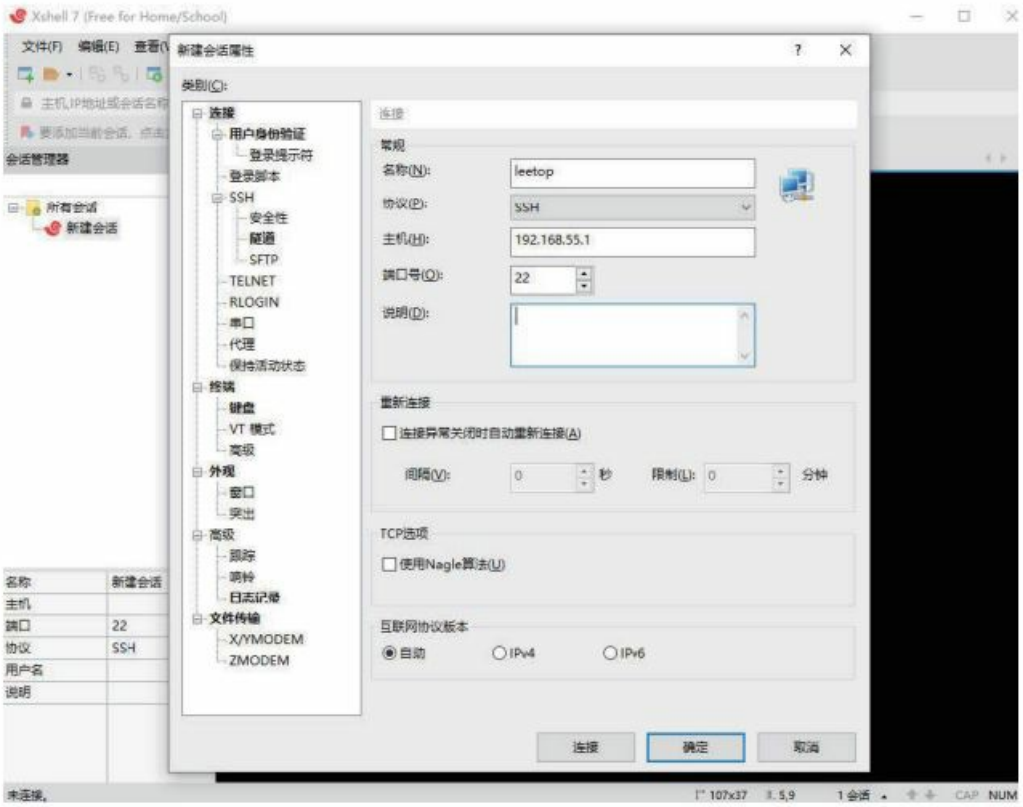


- Fill in the name and host ip(normally you can connect through the network ip, if you do not know the ip, you can connect the computer and the OTG port of the device through the usb data cable, fill in the fixed ip to connect)

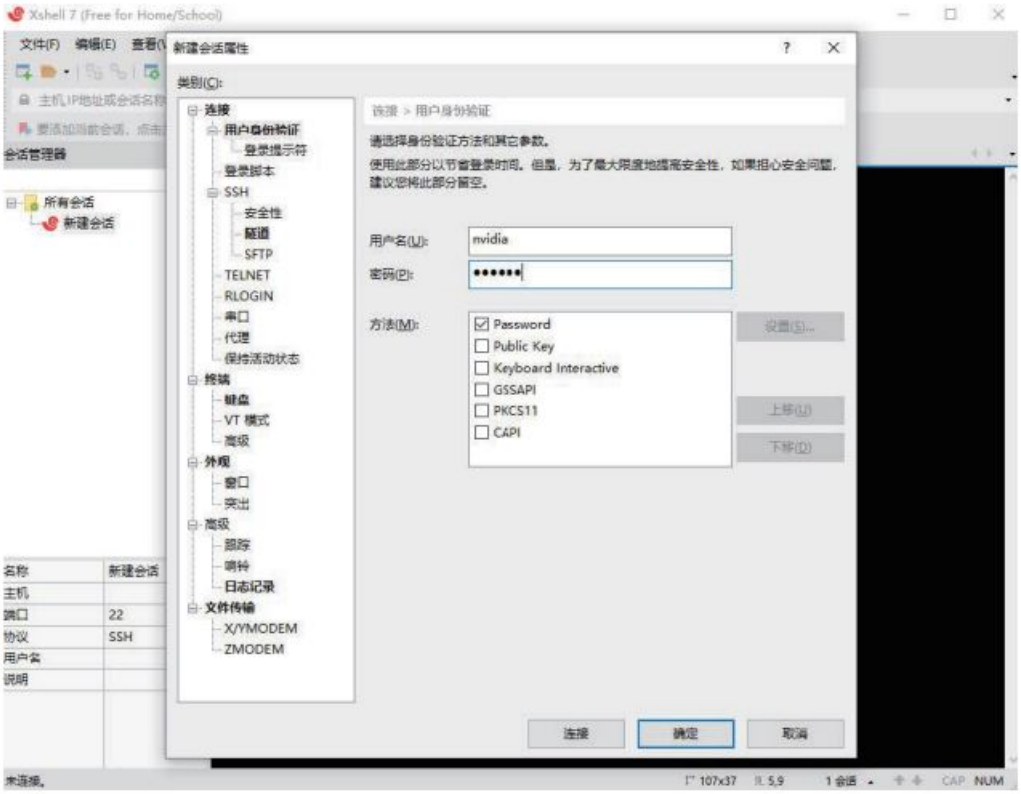


- Enter user and password

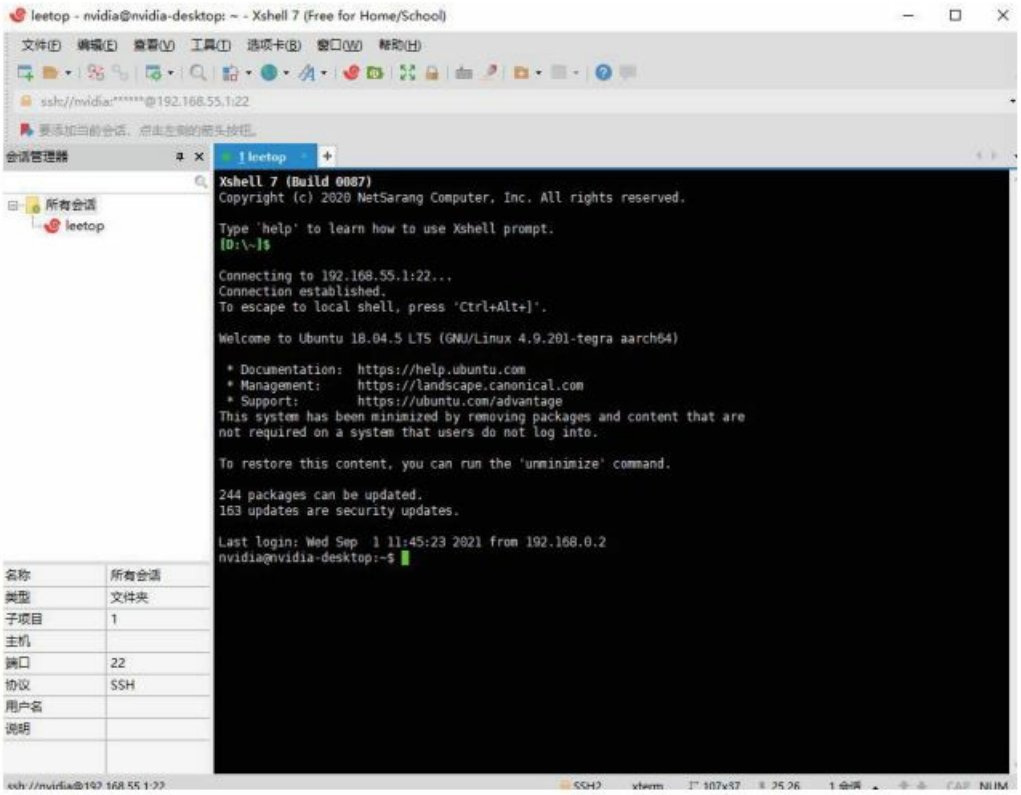
```
192.168.55.1
```



- Click Connect to enter the command line interface



- Operate jetson devices remotely through xshell



System configuration

Default username: Nvidia Password: Nvidia

NVIDIA Linux For Tegra (L4T)

- The load board supports native NVIDIA Linux For Tegra (L4T) Builds. HDMI, Gigabit Ethernet, USB3.0, USB OTG, serial port, GPIO, SD card, and I2C bus can be supported
- Detailed instructions and tools download links: https://developer.nvidia.com/embedded/jets on-Linux-r3521 /

https://developer.nvidia.com/embedded/jetson-linux-r3531

- **Note:** The native system does not support PWM fan control. If the native system is used, IPCall-BSP must be deployed

NVIDIA Jetpack for L4T

- Jetpack is a software package released by NVIDIA that contains all of the software tools needed for Orin NX/Orin Nano development using Leetop_ALP_606. It includes both host and target tools, including OS images, middleware, sample applications, documentation, and more. The newly released JetPack runs on Ubuntu 18.04 Linux 64-bit hosts.
- It can be downloaded from the following link: **https://developer.nvidia.com/embedded/jetpack**
- Default configuration system
- Leetop_ALP_606 uses Ubuntu 20.04 system, default username: nvidia password: nvidia Development MATERIALS and forums
- L4T development data: **https://developer.nvidia.com/embedded/linux-tegra**
- Developer forum: **https://forums.developer.nvidia.com/**

View System Version

View the installed system package version

```
cat /etc/nv_tegra_release
```

View information about the installed JetPack

```
sudo apt show nvidia-jetpack
```

Make a backup image

Making a backup image needs to be done in the environment of command line flashing, only the system. img file is backed up

1. Use A USB cable to connect USB Type-A of the Ubuntu18.04 PC to Type c of the Leetop_ALP_606.
2. Power on the Leetop_ALP_606 and enter the Recovery mode;
3. Enter the Linux_for_tegra directory, and refer to README_backup_restore.txt in backup_restore for backup. Instructions for backing up the Jetson Orin Nano/Orin NX system:

```
cd Linux_for_Tegra/tools/backup_restore
#Replace mmcblk0 with nvme0n1 in the following files.
sudo sed -i 's/mmcblk0/nvme0n1/g' l4t_backup_restore.sh
sudo sed -i 's/mmcblk0/nvme0n1/g' l4t_backup_restore.func
sudo sed -i 's/mmcblk0/nvme0n1/g' nvbackup_partitions.sh
sudo sed -i 's/mmcblk0/nvme0n1/g' nvrestore_partitions.sh
cd ../../
#Automount backup restore for new external storage devices must be temporarily disabled.
systemctl stop udisks2.service
sudo tools/l4t_flash_prerequisites.sh # For Debian-based Linux
sudo service nfs-kernel-server start
sudo ./tools/backup_restore/l4t_backup_restore.sh -b <board-name>
#Backup image, after the backup is successful, an image file will be generated under Linux_for_Tegra/tools/backup_restore.
sudo ./tools/backup_restore/l4t_backup_restore.sh -r <board-name>
#Backup image restoration.
```

4. Use the backup image to flash:

```
sudo ./tools/backup_restore/l4t_backup_restore.sh -r <board-name>
#Backup image restoration.
```

If the backup image can be used normally, it indicates that the backup image is available.

Installation of Jtop tools

Jtop is a system monitoring utility for Jetson that can be run on a terminal to view and control the status of NVIDIA Jetson in real time.
Installation steps

1. Installing the pip3 tool

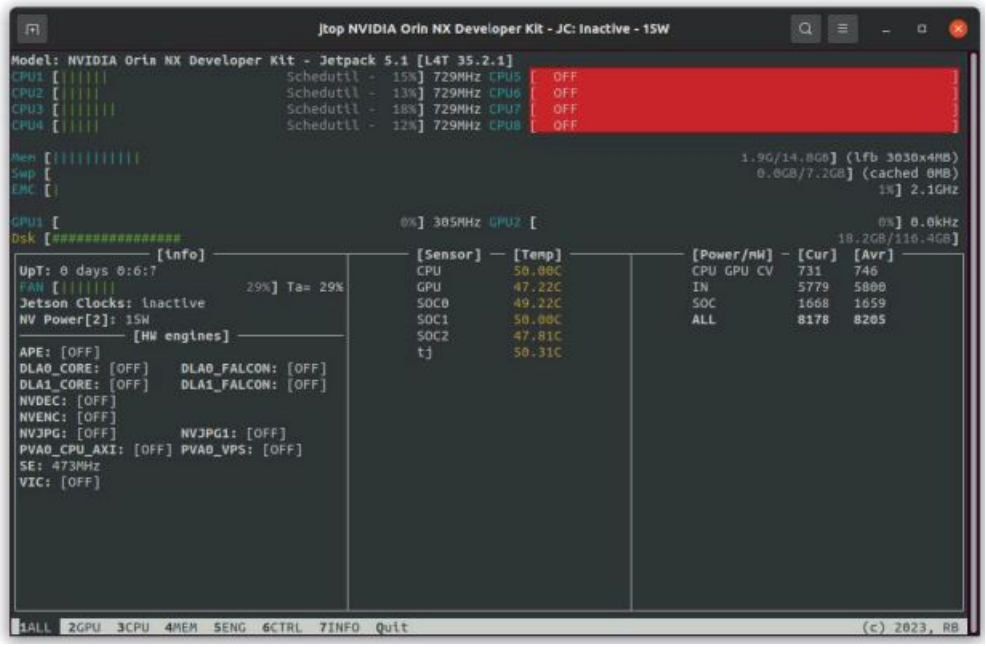
```
sudo apt-get install python3-pip
```

2. Installing top packages with pip3

```
sudo -H pip3 install -U jetson-stats
```

3. Restart to run top

After running, as shown in the figure below:



Developer Tools

JetPack
NVIDIA JetPack SDK is the most comprehensive solution for building AI applications. It bundles Jetson platform software including TensorRT, cuDNN, CUDA Toolkit, VisionWorks, GStreamer, and OpenCV, all built on top of L4T with LTS Linux kernel.
JetPack includes NVIDIA container runtime, enabling cloud-native technologies and workflows at the edge.
JetPack SDK Cloud-Native on Jetson L4T

- NVIDIA L4T provides the Linux kernel, bootloader, NVIDIA drivers, flashing utilities, sample filesystem, and more for the Jetson platform.
- You can customize L4T software to fit the needs of your project. By following the platform adaptation and bring-up guide, you can optimize your use of the complete Jetson product feature set. Follow the links below for details about the latest software libraries, frameworks, and source packages.
- DeepStream SDK on Jetson
- NVIDIA’s DeepStream SDK delivers a complete streaming analytics toolkit for AI-based multi-sensor processing, video and image understanding. DeepStream is an integral part of NVIDIA Metropolis, the platform for building end-to-end services and solutions that transform pixel and sensor data to actionable insights. Learn about the latest 5.1developer preview features in our developer news article.

Isaac SDK

- The NVIDIA Isaac SDK makes it easy for developers to create and deploy AI-powered robotics. The SDK includes the Isaac Engine (application framework), Isaac GEMs (packages with high-performance robotics algorithms), Isaac Apps (reference applications) and Isaac Sim for Navigation (a powerful simulation platform). These tools and APIs accelerate robot development by making it easier to add artificial intelligence (AI) for perception and navigation into robots.

Key Features of Jetpack

OS	NVIDIA Jetson Linux 35.3.1 provides the Linux Kernel 5.10, UEFI based bootloader, Ubuntu 20.04 based root file system, NVIDIA drivers, necessary firmwares, toolchain and more.JetPack 5.1.1 includes Jetson Linux 35.3.1 which adds following highlights: (Please refer to release notes for additional details)Adds support for Jetson AGX Orin 64GB, Jetson Orin NX 8GB, Jetson Orin Nano 8GB and Jetson Orin Nano 4GB production modules Security: Over The Air Updates: Image Based OTA tools supported to upgrade Xavier or Orin based modules running JetPack 5 in the field1 Camera: Support for Multi Point Lens Shading Correction (LSC) on Orin. Enhanced resilience of Argus SyncStereo app to maintain synchronization between stereo camera pairs. Multimedia: Support for dynamic frame rate in AV1 encoding New argus_camera_sw_encode sample for demonstrating software encoding on CPU cores Updated nvgstcapture-1.0 with option of software encoding on CPU cores 1Previous releases supported upgrading Xavier based modules in the field running JetPack 4.
TensorRT	TensorRT is a high performance deep learning inference runtime for image classification, segmentation, and object detection neural networks. TensorRT is built on CUDA, NVIDIA's parallel programming model, and enables you to optimize inference for all deep learning frameworks. It includes a deep learning inference optimizer and runtime that delivers low latency and high- throughput for deep learning inference applications.**JetPack 5.1.1 includes TensorRT 8.5.2**
cuDNN	CUDA Deep Neural Network library provides high-performance primitives for deep learning frameworks. It provides highly tuned implementations for standard routines such as forward and backward convolution, pooling, normalization, and activation layers.**JetPack 5.1.1 includes cuDNN 8.6.0**
CUDA	CUDA Toolkit provides a comprehensive development environment for C and C++ developers building GPU-accelerated applications. The toolkit includes a compiler for NVIDIA GPUs, math libraries, and tools for debugging and optimizing the performance of your applications.**JetPack 5.1.1 includes CUDA 11.4.19** Starting with JetPack 5.0.2, upgrade to latest and greatest CUDA releases from CUDA 11.8 onwards without the need to update Jetson Linux other JetPack components. Refer to instructions in the CUDA documentation on how to get the latest CUDA on JetPack.

Multimedia API	The Jetson Multimedia API package provides low level APIs for flexible application development.Camera application API: libargus offers a low-level frame-synchronous API for camera applications, with per frame camera parameter control, multiple (including synchronized) camera support, and EGL stream outputs. RAW output CSI cameras needing ISP can be used with either libargus or GStreamer plugin. In either case, the V4L2 media- controller sensor driver API is used.Sensor driver API: V4L2 API enables video decode, encode, format conversion and scaling functionality. V4L2 for encode opens up many features like bit rate control, quality presets, low latency encode, temporal tradeoff, motion vector maps, and more.**JetPack** **5.1.1 Camera highlights include:** Support for Multi Point Lens Shading Correction (LSC) on Orin. Enhanced resilience of Argus SyncStereo app to maintain synchronization between stereo camera pairs.**JetPack 5.1.1 Multimedia highlights include:**Support for dynamic frame rate in AV1 encoding New argus_camera_sw_encode sample for demonstrating software encoding on CPU cores Updated nvgstcapture-1.0 with option of software encoding on CPU cores
Computer Vision	VPI (Vision Programing Interface) is a software library that provides Computer Vision / Image Processing algorithms implemented on multiple hardware accelerators found on Jetson such as PVA (Programmable Vision Accelerator), GPU, NVDEC(NVIDIA Decoder), NVENC (NVIDIA Encoder), VIC (Video Image Compositor) and so on.OpenCV is an open source library for computer vision, image processing and machine learning.**JetPack 5.1.1 includes a minor update to VPI 2.2 with bug fixes** JetPack 5.1.1 includes OpenCV 4.5.4
Graphics	JetPack 5.1.1 includes the following graphics libraries:Vulkan® 1.3 (including the Roadmap 2022 Profile).Vulkan 1.3 Announcement Vulkan® SC 1.0 Vulkan SC is a low-level, deterministic, robust API that is based on Vulkan 1.2. This API enables state-of-the-art GPU-accelerated graphics and computation that can be deployed in safety-critical systems and that are certified to meet industry functional safety standards. Refer to **https://www.khronos.org/vulka** nsc/ for more information. Vulkan SC can also be invaluable for real-time non safety critical embedded applications. Vulkan SC increases determinism and reduces application size by shifting preparation of the run-time application environment either offline, or into application setup, as much as possible. This includes offline compilation of graphics pipelines that define how the GPU processes data, together with static memory allocation, that together enable detailed GPU control that can be rigorously specified and tested. Vulkan SC 1.0 is evolved from Vulkan 1.2 and includes: the removal of runtime functionality that is not needed in safety-critical markets, an updated design to provide predictable execution times and results, and clarifications to remove potential ambiguity in its operation. For more details see **https://www.khronos.org/blog/vulkan-sc-overview** **Note**: Jetson support for Vulkan SC is **not** safety certified. OpenWF™ Display 1.0 OpenWF Display is a Khronos API for low overhead interaction with the native display driver on Jetson and allows interaction with Vulkan SC to display images. **Note**: Jetson support for OpenWF Display is **not** safety certified.

Developer Tools	CUDA Toolkit provides a comprehensive development environment for C and C++ developers building high-performance GPU-accelerated applications with CUDA libraries. The toolkit includes Nsight Visual Studio Code Edition, Nsight Eclipse Plugins, debugging and profiling tools including Nsight Compute, and a toolchain for cross-compiling applications NVIDIA Nsight Systems is a low overhead system-wide profiling tool, providing the insights developers need to analyze and optimize software performance.NVIDIA Nsight Graphics is a standalone application for debugging and profiling graphics applications. NVIDIA Nsight Deep Learning Designer is an integrated development environment that helps developers efficiently design and develop deep neural networks for in-app inference. Nsight System, Nsight Graphics, and Nsight Compute are all supported on Jetson Orin modules to assist development for autonomous machines. **JetPack 5.1.1 includes NVIDIA Nsight Systems v2022.5 JetPack 5.1.1 includes NVIDIA Nsight Graphics 2022.6 JetPack 5.1.1 includes NVIDIA Nsight Deep Learning Designer 2022.2** Refer to release notes for more details.
Supported SDKs and Tools	NVIDIA DeepStream SDK is a complete analytics toolkit for AI-based multi- sensor processing and video and audio understanding.**DeepStream 6.2 release supports JetPack 5.1.1** NVIDIA Triton™ Inference Server simplifies deployment of AI models at scale. Triton Inference Server is open source and supports deployment of trained AI models from NVIDIA TensorRT, TensorFlow and ONNX Runtime on Jetson. On Jetson, Triton Inference Server is provided as a shared library for direct integration with C API. PowerEstimator is a webapp that simplifies creation of custom power mode profiles and estimates Jetson module power consumption. **et Pack 5.1.1 supports PowerEstimator for Jetson AGX Orin and Jetson Xavier NX modules** NVIDIA Isaac™ ROS is a collection of hardware-accelerated packages that make it easier for ROS developers to build high-performance solutions on NVIDIA hardware including NVIDIA Jetson. **Isaac ROS DP3 release supports JetPack 5.1.1**
Cloud Native	Jetson brings Cloud-Native to the edge and enables technologies like containers and container orchestration. NVIDIA JetPack includes NVIDIA Container Runtime with Docker integration, enabling GPU accelerated containerized applications on Jetson platform. NVIDIA hosts several container images for Jetson on NVIDIA NGC. Some are suitable for software development with samples and documentation and others are suitable for production software deployment, containing only runtime components. Find more information and a list of all container images at the Cloud-Native on Jetson page.
Security	NVIDIA Jetson modules include various security features including Hardware Root of Trust, Secure Boot, Hardware Cryptographic Acceleration, Trusted Execution Environment, Disk and Memory Encryption, Physical Attack Protection and more. Learn about the security features by jumping to the security section of the Jetson Linux Developer guide.

Sample Applications
JetPack includes several samples which demonstrate the use of JetPack components. These are stored in the reference filesystem and can be compiled on the developer kit.

JetPack component	Sample locations on reference filesystem
TensorRT	/usr/src/tensor/samples/
cuDNN	/usr/src/cudnn_samples_/
CUDA	/usr/local/cuda-/samples/
Multimedia API	/usr/src/tegra_multimedia_api/
Visionworks	/usr/share/Visionworks/sources/samples/ /usr/share/vision works-tracking/sources/samples/ /usr/share/vision works-sfm/sources/samples/
OpenCV	/usr/share/OpenCV/samples/
VPI	/opt/Nvidia/vpi/vpi-/samples

Developer Tools

JetPack includes the following developer tools. Some are used directly on a Jetson system, and others run on a Linux host computer connected to a Jetson system.

- Tools for application development and debugging:
- NSight Eclipse Edition for development of GPU accelerated applications: Runs on Linux host computer. Supports all Jetson products.
- CUDA-GDB for application debugging: Runs on the Jetson system or the Linux host computer. Supports all Jetson products.
- CUDA-MEMCHECK for debugging application memory errors: Runs on the Jetson system. Supports all Jetson products.

Tools for application profiling and optimization:

- NSight Systems for application multi-core CPU profiling: Runs on the Linux host computer. Helps you improve application performance by identifying slow parts of code. Supports all Jetson products.
- NVIDIA® Nsight™ Compute kernel profiler: An interactive profiling tool for CUDA applications. It provides detailed performance metrics and API debugging via a user interface and command line tool.
- NSight Graphics for graphics application debugging and profiling: A console-grade tool for debugging and optimizing OpenGL and OpenGL ES programs. Runs on the Linux host computer. Supports all Jetson products.

FCC Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference e to radio or television reception, which can be determined by turning the equipmentoff

and on, the user is encouraged to try to correct the interference by one or more of thefollowing measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications to this device not explicitly approved by the manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference
2. this device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.

Leetop Technology (Shenzhen) Co., Ltd. http://www.leetop.top

Documents / Resources

	LEETOP ALP-ALP-606 Embedded Artificial Intelligence Computer [pdf] User Guide ALP-606, ALP-ALP-606 Embedded Artificial Intelligence Computer, Embedded Artificial Intelligence Computer, Artificial Intelligence Computer, Intelligence Computer, Computer

References

- Jetson Download Center | NVIDIA Developer
- JetPack SDK | NVIDIA Developer
- Jetson Linux 35.3.1 | NVIDIA Developer
- Jetson Linux | NVIDIA Developer
- NVIDIA Developer Forums - NVIDIA Developer Forums
- ____
- ____
- Khronos Blog - The Khronos Group Inc