Introduction to Jetson Nano

Installation Set up, Configuration and Deployment.

INTERNATIONAL MELAKA ARTIFICIAL INTELLIGENCE OF THINGS (MAIoT) CHALLENGE 2021

By: Dr Wira Hidayat bin Mohd Saad

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Samsung IoT Academy
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International MAIoT Challenge 2021
Melaka Artificial Intelligence of Things

Important Dates:

Proposal submission	: 15th Oct 2021
Top 30 announcement	: 25th Oct 2021
Video/Poster submission	: 25th Nov 2021
Final presentation (virtual)	: 9th Dec 2021

PRIZE	Prototype Video	Business Idea Poster
	1st Place: RM1000	1st Place: RM500
	2nd Place: RM700	2nd Place: RM300
	3rd Place: RM500	3rd Place: RM200
	4th to 10th Place: RM100	4th to 10th Place: RM100

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Homepage - Wira Hidayat bin M

blog.utem.edu.my/wira_yugi/

Wira Hidayat bin Mohd Saad, PhD

Senior Lecturer, FKEKK, UTeM, Melaka, Malaysia

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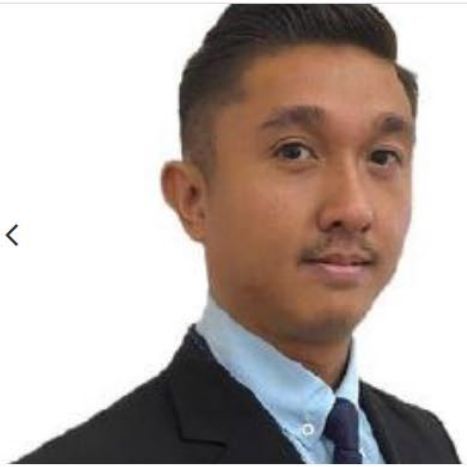

Wira Hidayat bin Mohd Saad, PhD

Senior Lecturer, FKEKK, UTeM, Melaka, Malaysia

FKEKK

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

Faculty of Electronic and Computer Engineering (FKEKK) started its operation in 2001 after the formation of Kolej Universiti Teknikal Kebangsaan Malaysia (KUTKM). KUTKM is rebranded to Universiti Teknikal Malaysia Melaka (UTeM) in 2007.

FKEKK is located at main campus UTeM in Melaka, Malaysia.

FKEKK support teaching and learning in Electronics, Computer and Telecommunication Engineering field.

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VISION OF CeTRI

To be the center of excellence for the advancement in telecommunication engineering

MISSION OF CeTRI

To lead in the research and innovation of telecommunication engineering by actively incorporating experts in the fields of computer, electronics and telecommunications with smart university-industry partnership in line with national aspirations

Key takeaway

- Understanding the concept of AIoT element on product development
- Get to know the key features of NVIDIA Jetson Nano Developer Kit
- Configuration steps on how to get started on using the NVIDIA Jetson Nano Developer Kit
- NVIDIA Jetson Nano Developer Kit device deployment and application

Outline

- What is AI, IoT and AIoT?
- Development kit for AIoT
- Jetson nano device
  - Feature
  - Required additional item
  - Jetson Nano Jetpack Set up
  - Test the jetson nano with camera

People-oriented IoT

AI + **IoT** = **AIoT**

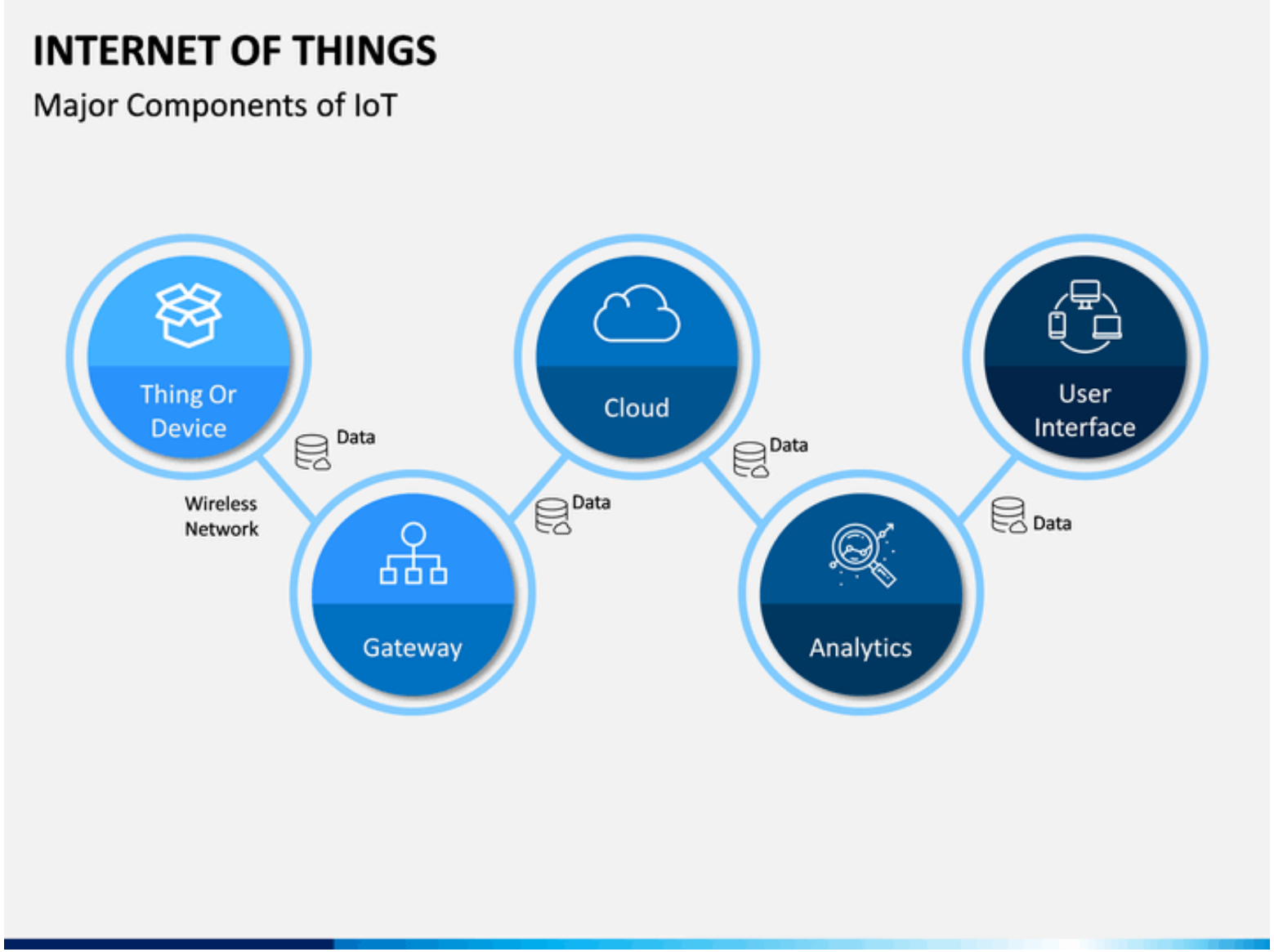
Artifical Intelligence

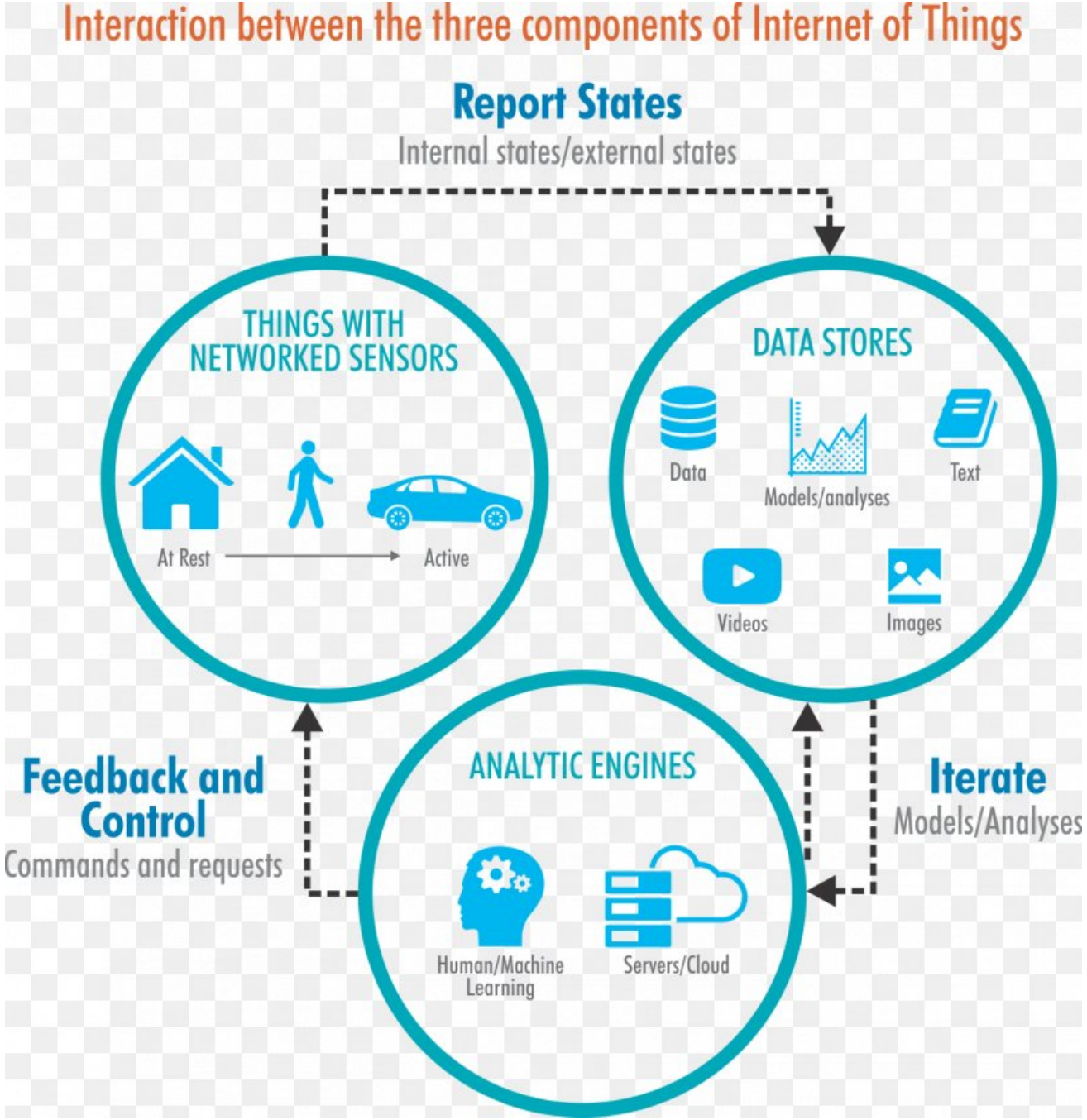
Internet of Things

Artifical Intelligence of Things

IoT

- IoT devices use the internet to communicate, collect, and exchange information about our online activities.

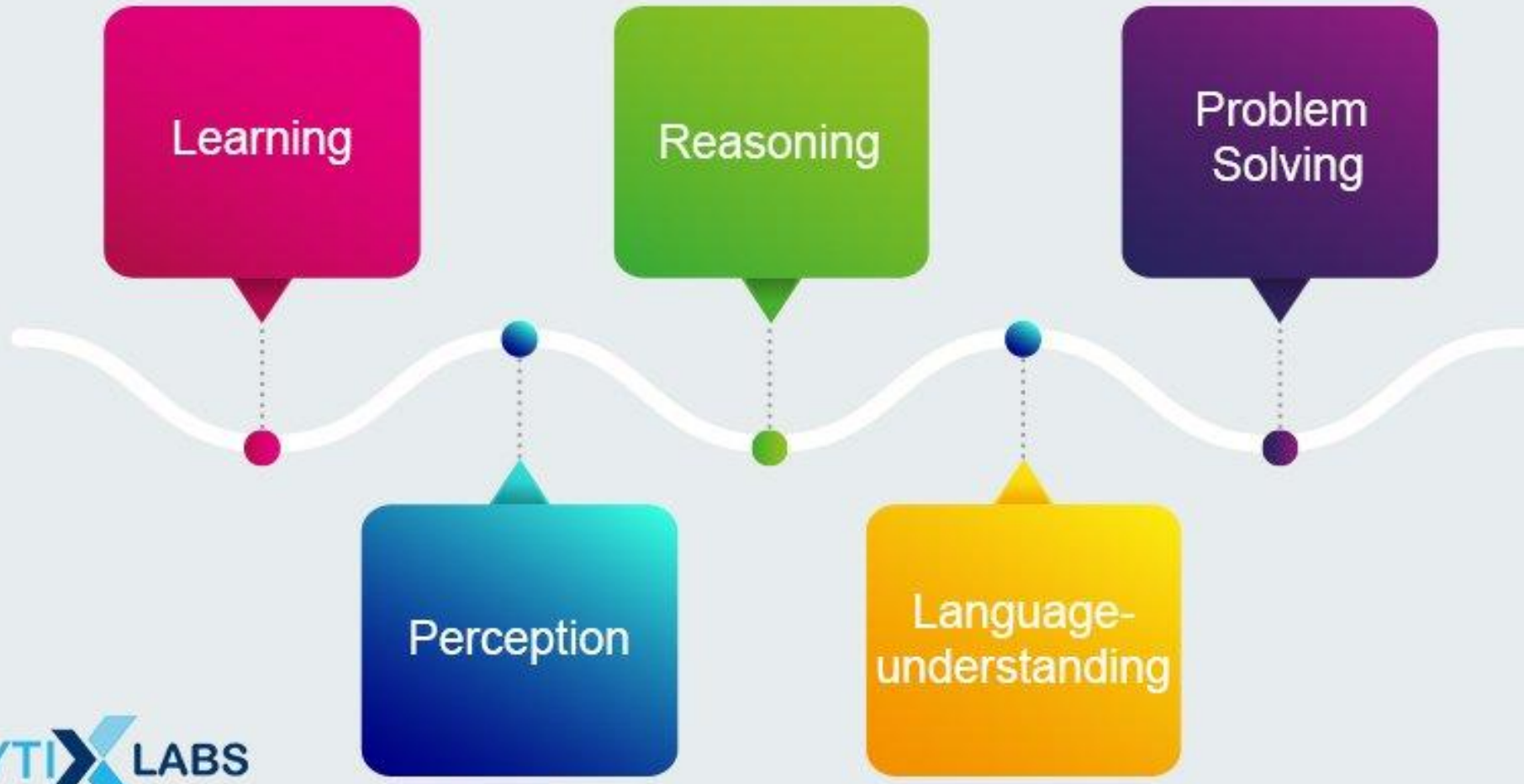



Interaction between the three components of Internet of Things
Report States
Internal states/external states
THINGS WITH NETWORKED SENSORS
At Rest
Active
DATA STORES
Data
Models/analyses
Text
Videos
Images
ANALYTIC ENGINES
Human/Machine Learning
Servers/Cloud
Feedback and Control
Commands and requests
Iterate
Models/Analyses

AI- Artificial intelligent

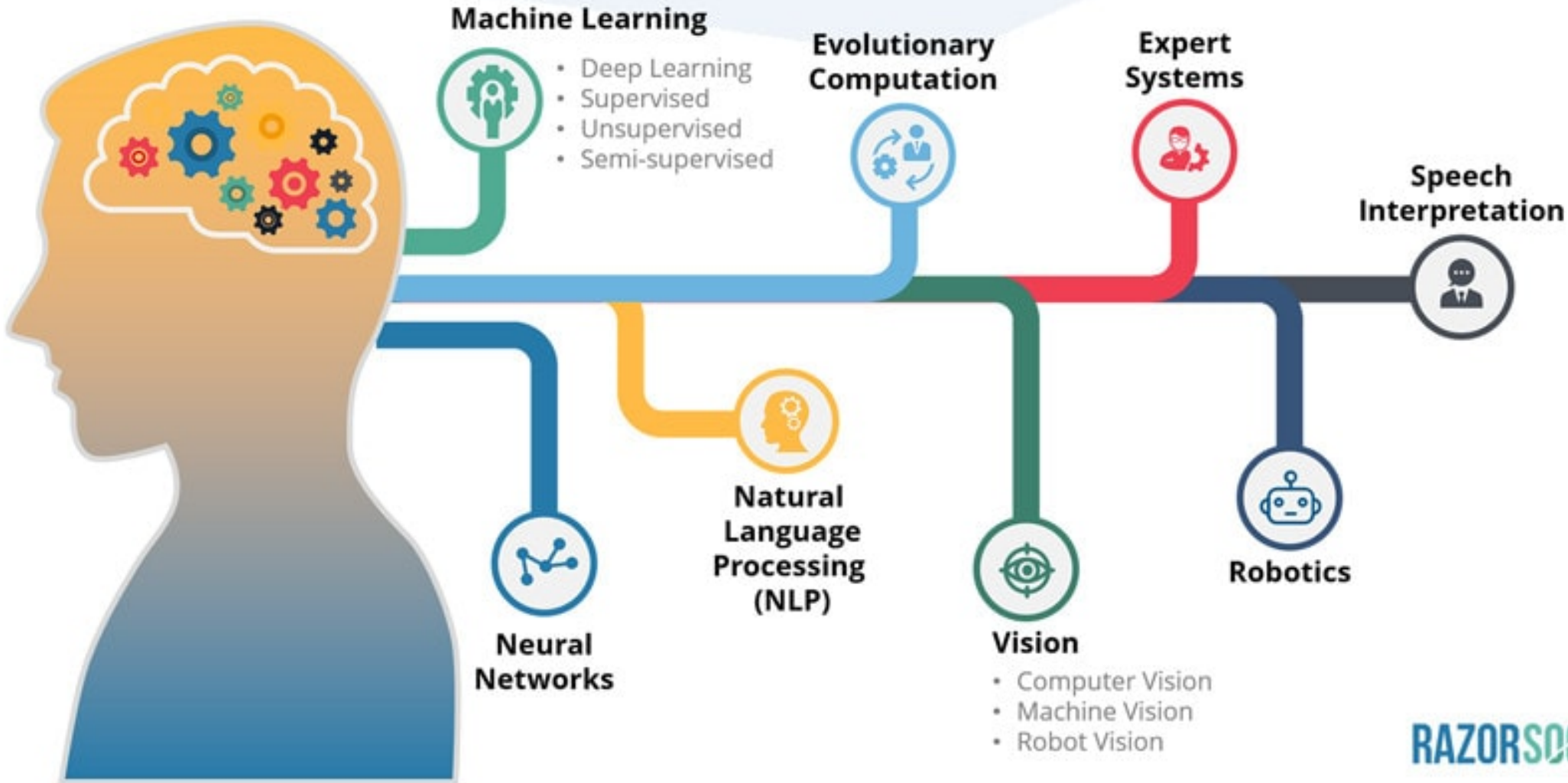
- Artificial Intelligence (AI) is a Programmable functions and systems that enable devices to learn, reason, and process information like humans. It can be divided by two type:
  - **narrow AI**-which addresses single-task applications, including playing strategic games, language translation, self-driving vehicles and image recognition.
  - **artificial general intelligence (AGI)**, refers to a “future AI system that exhibits apparently intelligent behavior at least as advanced as a person across the full range of cognitive tasks.”

COMPONENTS OF ARTIFICIAL INTELLIGENCE



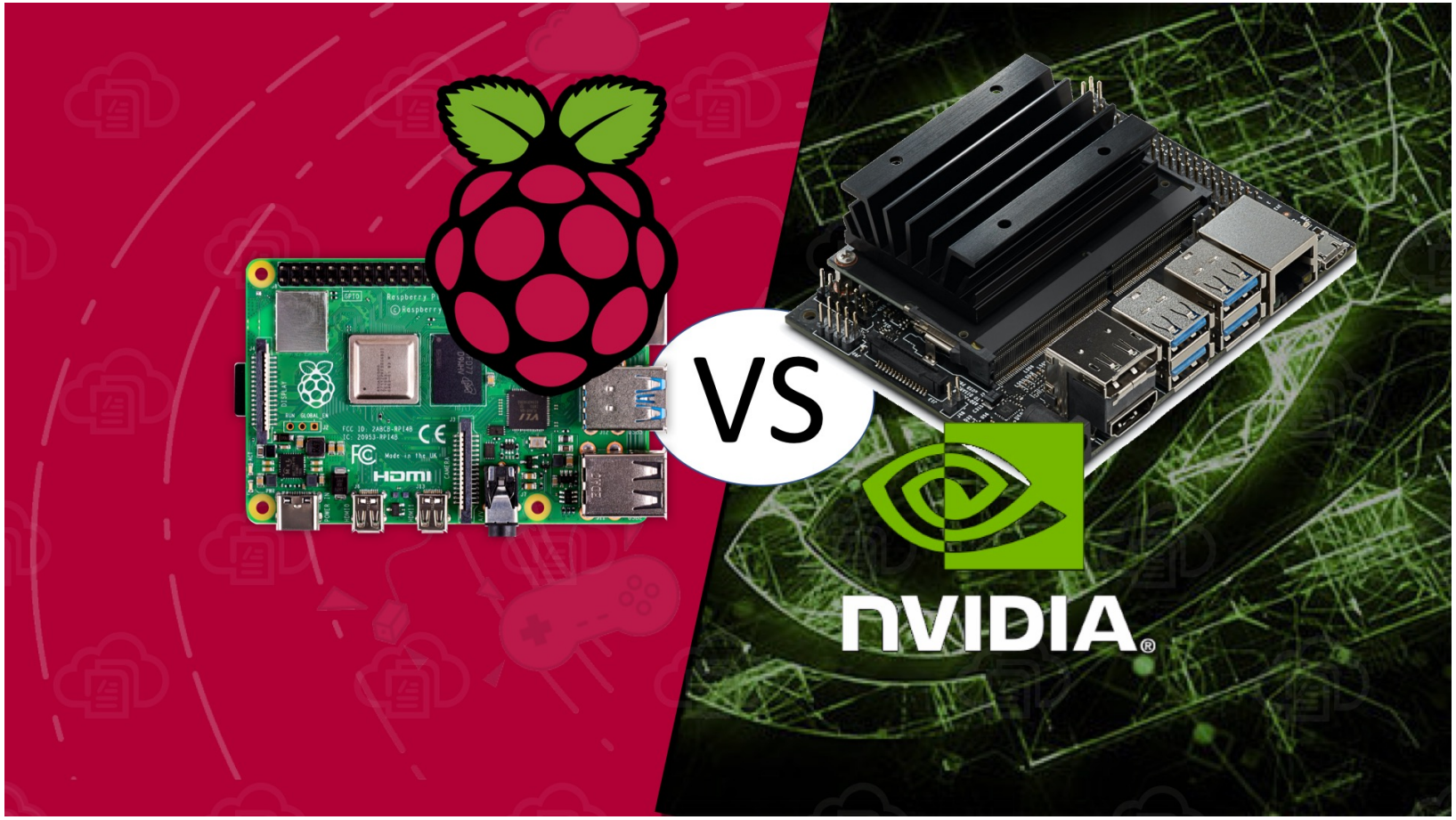
ANALYTIX LABS

Elements of AI



RAZORSOCIAL

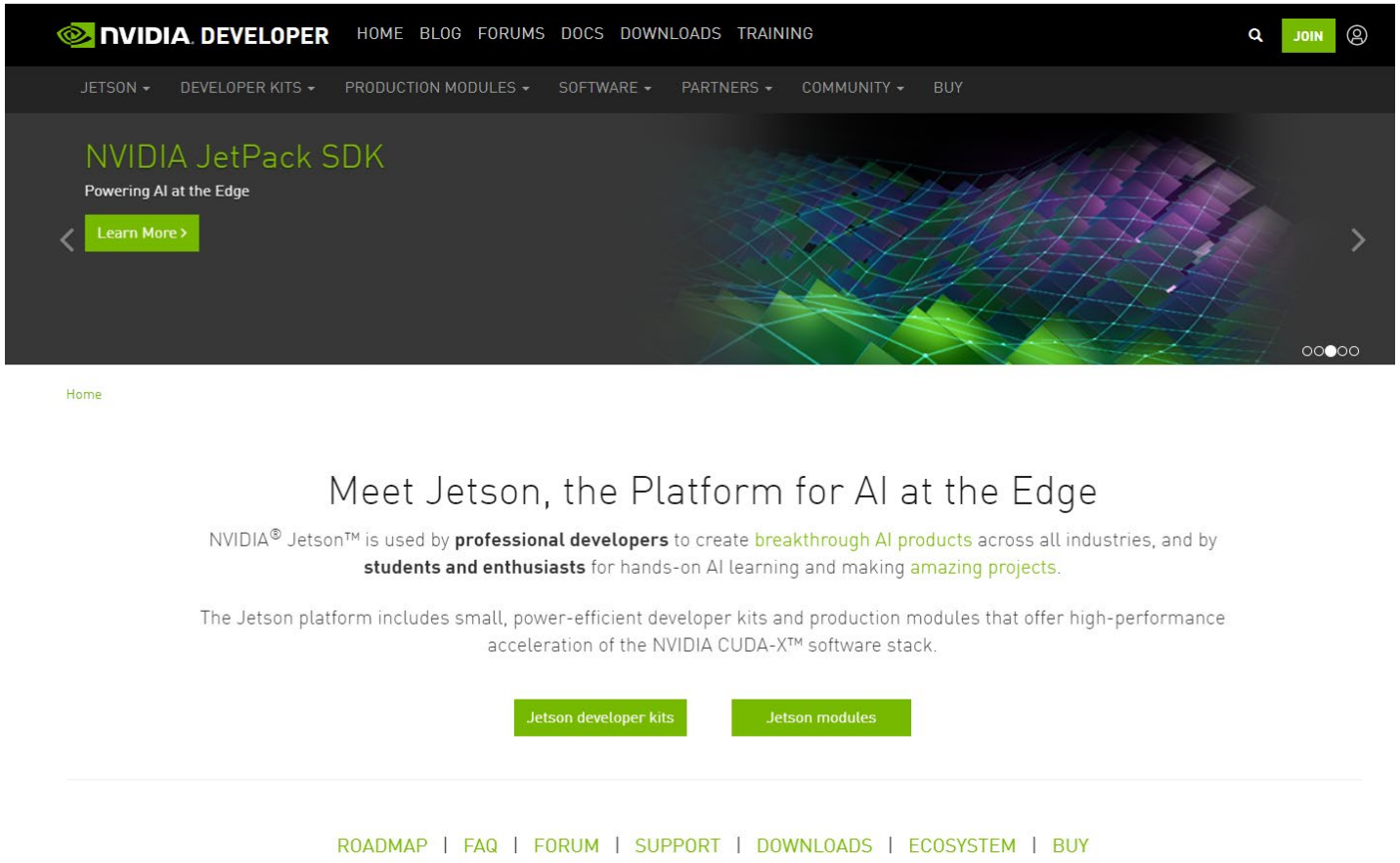
Suitable Development kit for AIoT



As you can see, the primary features of the Raspberry Pi 4 and NVIDIA Jetson Nano are similar. But there is one unique distinction. The biggest difference lies in the graphics capabilities between the two boards, specifically their graphical processing units (GPU).

NVIDIA Jetson Nano

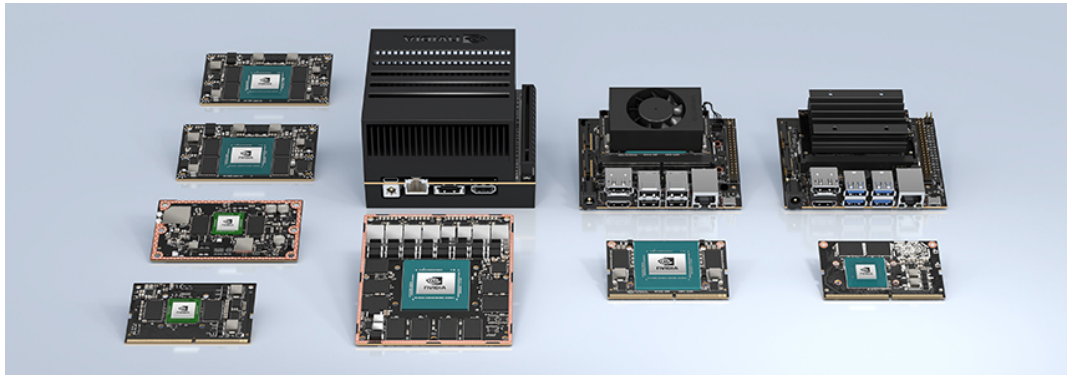
- https://developer.nvidia.com/embedded-computing



Development vs Deployment

Jetson Developer Kits

- NVIDIA® Jetson™ developer kits are used by professionals to develop and test software for products based on Jetson modules, and by students and enthusiasts for projects and learning. Each developer kit includes a non-production specification **Jetson module** attached to a reference **carrier board** with standard hardware interfaces for flexible development and rapid prototyping.



Jetson Modules

- NVIDIA® Jetson™ brings accelerated AI performance to the Edge in a power-efficient and compact form factor. Together with NVIDIA JetPack™ SDK, these Jetson modules open the door for you to develop and deploy innovative products across all industries.
- The Jetson family of modules all use the same NVIDIA CUDA-X™ software, and support cloud-native technologies like containerization and orchestration to build, deploy, and manage AI at the edge.
- With Jetson, customers can accelerate all modern AI networks, easily roll out new features, and leverage the same software for different products and applications.

NVIDIA JETSON NANO DEVELOPER KIT
TECHNICAL SPECIFICATIONS

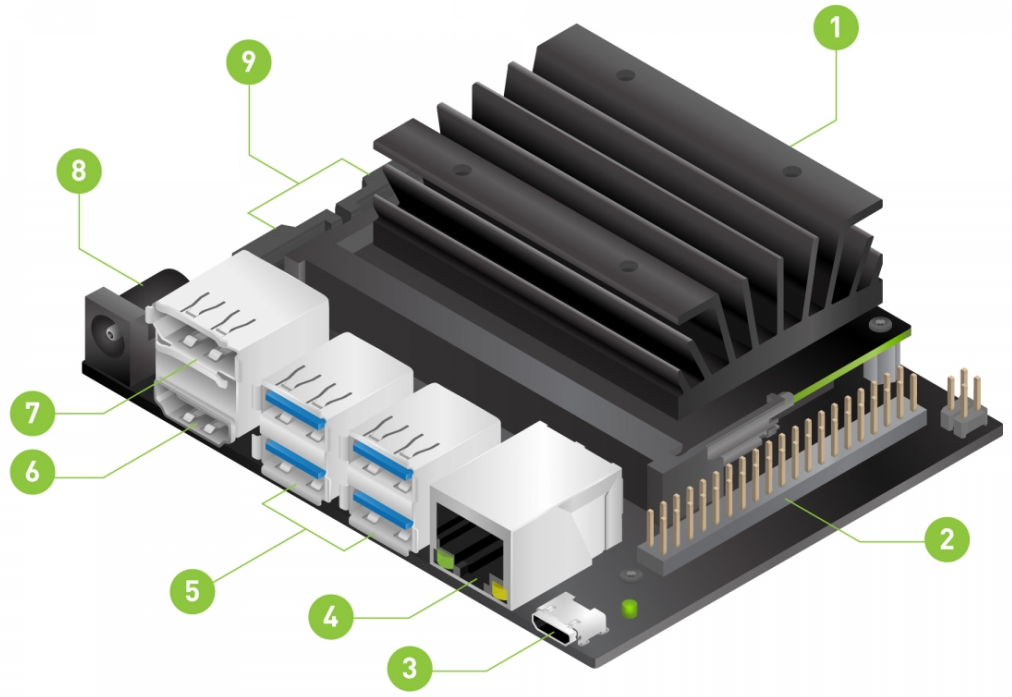
DEVELOPER KIT

GPU	**128-core Maxwell**
CPU	**Quad-core ARM A57 @ 1.43 GHz**
Memory	**4 GB 64-bit LPDDR4 25.6 GB/s**
Storage	**microSD (not included)**
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	**1x MIPI CSI-2 DPHY lanes**
Connectivity	**Gigabit Ethernet, M.2 Key E**
Display	**HDMI 2.0 and eDP 1.4**
USB	**4x USB 3.0, USB 2.0 Micro-B**
Others	**GPIO, I²C, I²S, SPI, UART**
Mechanical	**100 mm x 80 mm x 29 mm**

*Please refer to NVIDIA documentation for what is currently supported.

Get to know NVIDIA® Jetson Nano™ Developer Kit

1. microSD card slot for main storage
2. 40-pin expansion header
3. Micro-USB port for 5V power input, or for Device Mode
4. Gigabit Ethernet port
5. USB 3.0 ports (x4)
6. HDMI output port
7. DisplayPort connector
8. DC Barrel jack for 5V power input
9. MIPI CSI-2 camera connectors



Required additional item (not include in the box)

1. microSD card (32GB UHS-1 minimum recommended) and card reader
2. USB keyboard and mouse
3. Computer display (HDMI or DP)
4. Micro-USB power supply or 5V/4A OD 5.5mm ID 2.1mm”
5. Wifi adapter/ ethernet cable
6. LCD Monitor or video adaptor with PC

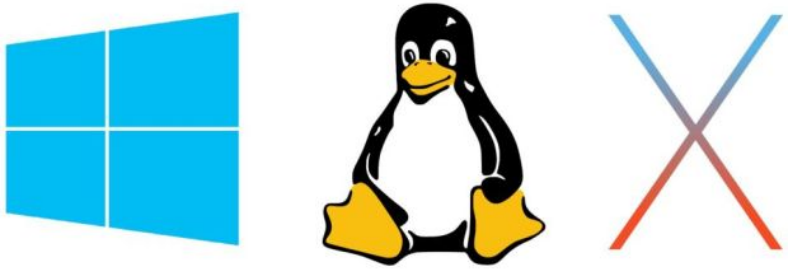
*Input: AC 100-240V 50/60Hz
*Output: 5V/3A
*USB type: Micro

Jetson Nano Jetpack Set up

Operating System-Ubuntu 18.04

1) Download the Jetpack for SD card image

- Download the Jetson Nano Developer Kit SD Card Image and note where it was saved on the computer often known as Jetpack.
- Write the image to your microSD card by following the instructions according to your computer's operating system: Windows, macOS, or Linux.
- For this tutorial, we will proceed with window instruction



2) Format microSD card

- Download, install, and launch the SD Memory Card Formatter for Windows.
- Select the drive where your SD card reader is.
- Select “Quick format”.
- Leave “Volume label” blank.
- Click “Format” to start formatting, and “Yes” on the warning dialog.

3) Write the download image into the microSD card

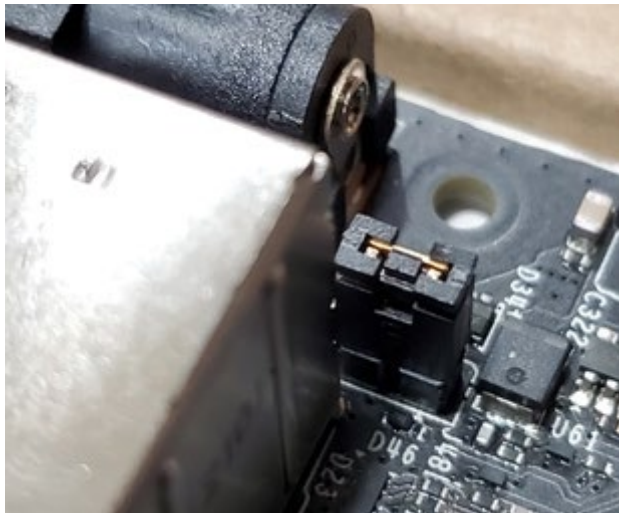
- Download, install, and launch Etcher software .
- Click “Flash from file” and choose the zipped Nano Jetson image file you downloaded earlier. Select “Quick format”.
- Click “Select target” and choose the SD card’s drive. Remember the drive letter and it is different from one PC to another.
- Click “Flash!”

After Etcher finishes, Windows may let you know it doesn’t know how to read the SD Card. Just click Cancel all those screens and remove the microSD card.

Setup and First Boot

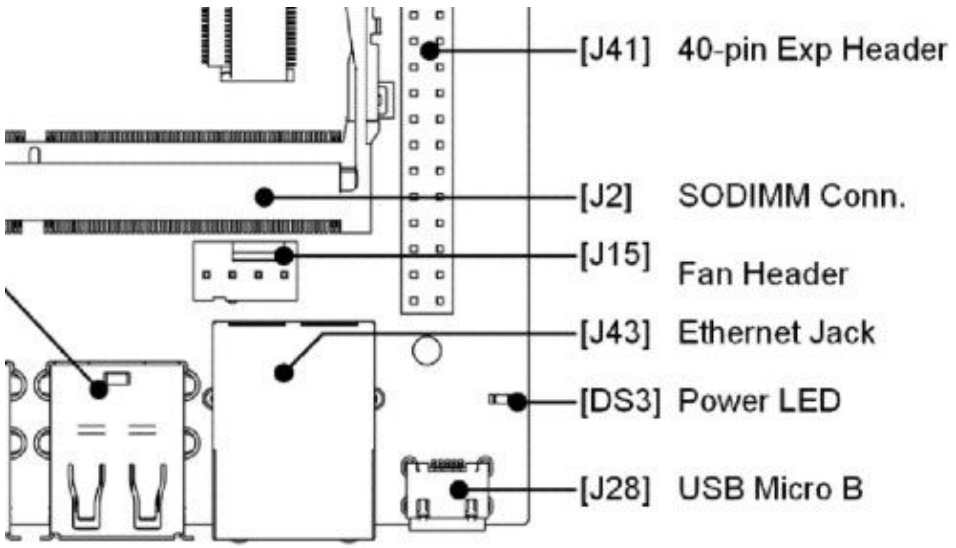
1) Hardware set up

- Unfold the paper stand and place the Nano Jetson inside the developer kit box.
- Set the developer kit on top of the paper stand.
- Insert the microSD card (with system image already written to it) into the slot on the underside of the Jetson Nano module.
- Make sure the jumper is pushed into the J48 Power Select Header pins if you are using 5V/4A OD 5.5mm ID 2.1mm power supply
- Connect the Jetson Nano into your monitor. You can select to use HDMI or display port. You can connect direct to stand alone monitor or if you have a USB video adaptor, you can connect to another PC and use a video capture software such as OBS studio to view your Jetson display



1) Hardware set up cont.

- Connect your keyboard and mouse into Jetson Nano USB port
- Connect the power supply. The developer kit will power on automatically. Allow 1 minute for the developer kit to boot.
- A green LED next to the Micro-USB connector will light as soon as the developer kit powers on. When you boot the first time, the developer kit will take you through some initial setup



2) OS initial set up for first time user

- Review and accept NVIDIA Jetson software End User License Agreement.
- Select the system language.
- Select the keyboard layout.
- Select the time zone.
- Create a username, password, and computer name. Be sure to select “Log in automatically.”
- Select APP partition size. NVIDIA recommends to use the maximum size.

2) OS initial set up for first time user cont.

- Update QSPI process and click Continue.
- Keep the default setting for the Nvpmodel Mode and click Continue.
- Your Nvidia will automatically reboot to the Ubuntu desktop.
- Click the Terminal icon in the bottom-left and Restart the computer again.

  > sudo reboot

Set Up WiFi

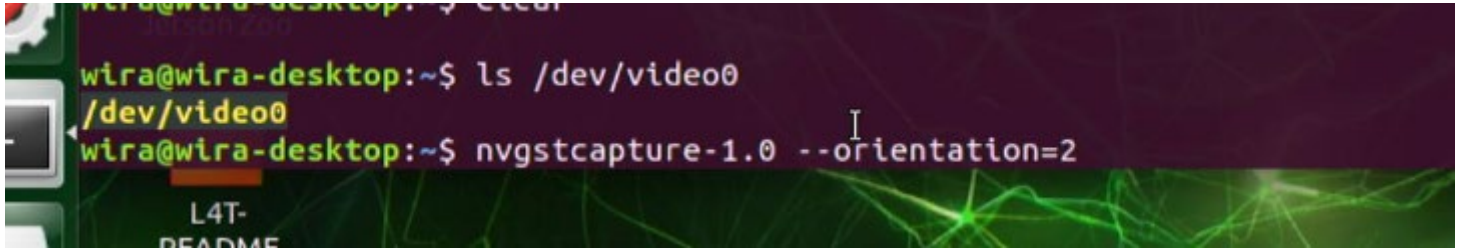
- Grab your WiFi adapter and plug it into one of the USB ports on the Jetson Nano.
- Type the code on terminal to set up the wifi
  - sudo nmtui
- Check if your WiFi setup is fine by typing this on terminal
  - ping google.com
- Turn off the power save mode to get stability. Type this on terminal
  - sudo iw dev wlan0 set power_save off
- Then reboot your system
  - sudo reboot

Run Updates

- On the new terminal, enter
  - sudo apt-get update
  - sudo apt-get upgrade
- After the update is complete, reboot your system

Test the jetson nano with camera

- Open a new terminal window, and type:
  - ls /dev/video0
- If your window shows as below, it mean that the camera is set up properly



- Then you may type
  - nvgstcapture-1.0 --orientation=2
- This will pop up the camera view window.
- Ctrl+C to close the window