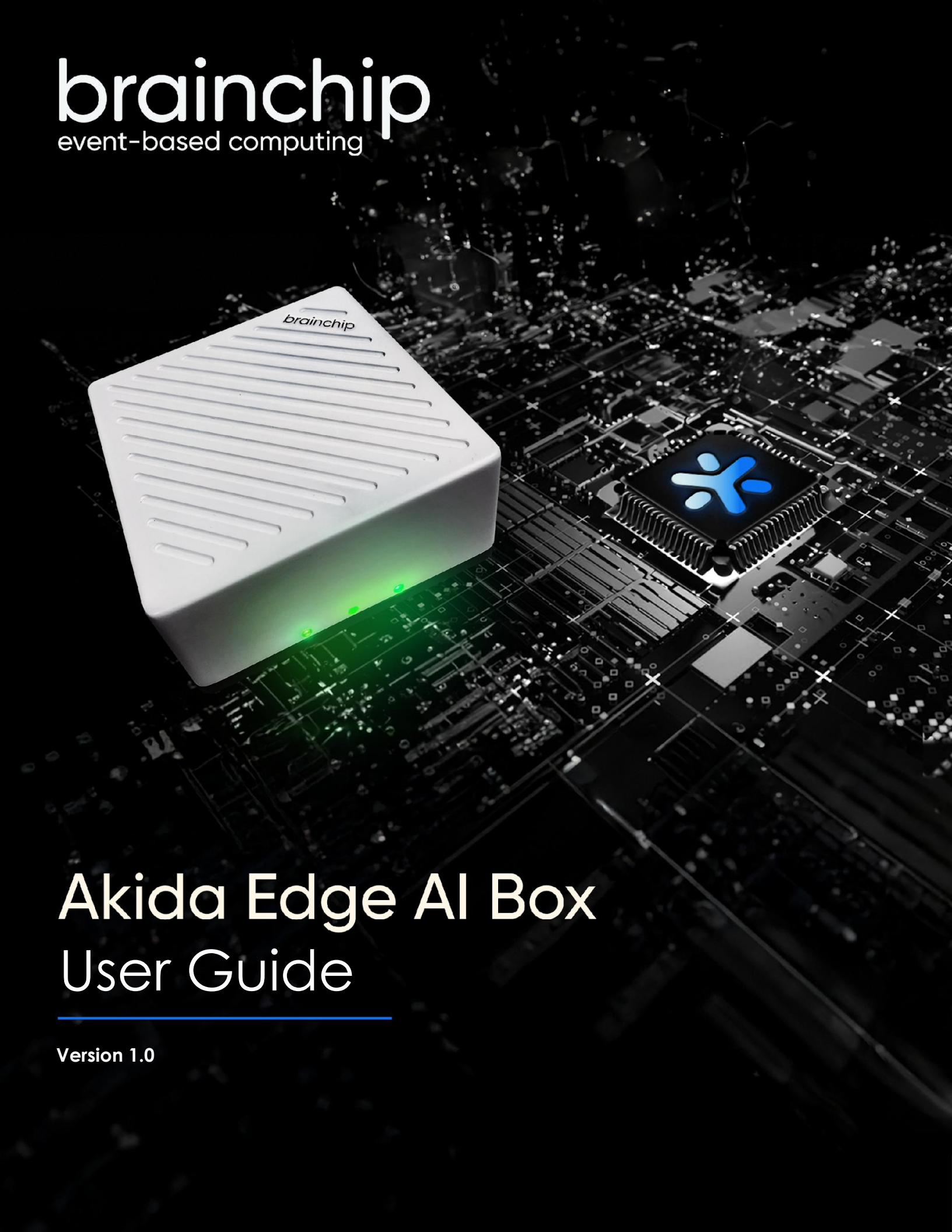
brainchip
event-based computing



Akida Edge AI Box
User Guide

Version 1.0

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1. Introduction

Welcome to the Akida Edge AI Box user guide. The Akida Edge AI Box is a powerful edge computing device designed for AI applications such as video analytics, face recognition, and object detection. This guide will walk you through the setup process and help you get the most out of your device.

2. What's Included

Your Akida Edge AI Box package should contain:

- Akida Edge AI Box
  - OS: Embedded Linux for i.MX Applications Processors
- 12V DC Power Adapter

Additional Equipment Needed

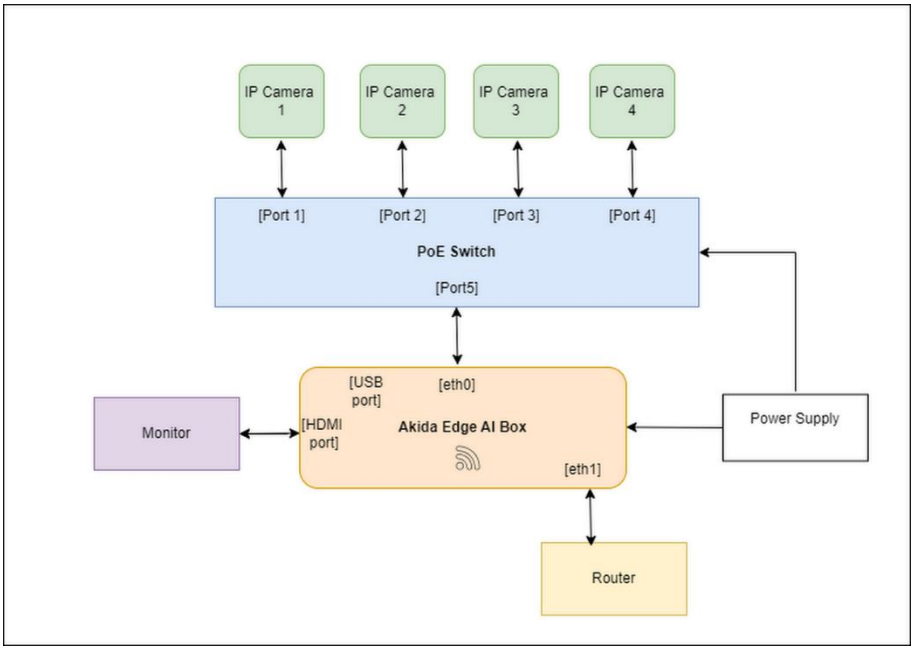
To effectively set up and use the Akida Edge AI Box, you'll need the following items (not included in the package). Although not required, 4 x cameras are recommended if you desire to leverage the 4-camera demonstration.

Note: If using power over ethernet (POE) cameras, ensure that this switch is POE enabled.

- Ethernet cables (CAT5e or better)
- 1 to 4 IP Cameras (minimum 720p resolution, 25FPS, with RTSP support)
    - Although not required, 4 x cameras are recommended if you desire to leverage the 4-camera demonstration.
- 1 Power over Ethernet Network Switch (minimum 5 ports)
    - PoE not necessary if cameras are AC powered
- Ethernet cables (CAT5e or better)
- A laptop or desktop computer with an Ethernet port
- HDMI monitor (minimum 720p resolution, 1280x720)
- HDMI cable
- Keyboard
- Mouse
- USB hub (for connecting keyboard, mouse and other peripherals)

3. Setting Up Your Akida Edge AI Box

Connecting the Hardware



1) Connect your IP cameras to the ethernet switch using Ethernet cables.

2) Connect the Akida Edge AI Box to an available port on the ethernet switch using an Ethernet cable.
3) Connect your laptop to a port on the switch using an Ethernet cable.
4) Connect the HDMI monitor to the Akida Edge AI Box using an HDMI cable.
5) (Optional) Connect a USB keyboard and mouse to the Akida Edge AI Box, using a USB hub if necessary.
6) Power on the PoE switch, cameras, and monitor.
7) Connect the 12V DC power adapter to the Akida Edge AI Box and plug it into a power outlet.

Configuring Your Network

1) On your laptop, open your network settings.
2) Set a static IP address for your Ethernet connection. For example:

- IP Address: 172.18.10.100
- Subnet Mask: 255.255.255.0
- Gateway: Leave blank

Configuring the IP Cameras

1) Open a web browser on your laptop.
2) Enter the default IP address of one of your cameras (refer to your camera's documentation).
3) Log in using the default username and password (refer to your camera's documentation).
4) Navigate to the network settings in the camera's web interface.
5) Set a static IP address for the camera within the same subnet as your laptop. For example, if using 4-cameras:
    - Camera 1: 172.18.10.20
    - Camera 2: 172.18.10.21
    - Camera 3: 172.18.10.22
    - Camera 4: 172.18.10.23
6) Save the settings and repeat for all cameras.

Verifying Camera Connectivity

1) Open a command prompt or terminal on your laptop.
2) Ping each camera to ensure they're accessible:

```
ping 172.18.10.20
ping 172.18.10.21
ping 172.18.10.22
```

```
ping 172.18.10.23
```

3) If all pings are successful, your network is set up correctly.

Finding the RTSP URLs

1) Access each camera's web interface using its IP address.
2) Navigate to the RTSP or streaming settings.
3) Note down the RTSP URL for each camera. It typically looks like:

```
rtsp://172.18.10.20/Stream0
```

4) If your cameras require authentication, the URL will be in this format:

```
rtsp://username:password@172.18.10.20/Stream0
```

Setting Up the Akida Edge AI Box

The Akida Edge AI Box can be set up using two methods: via Wi-Fi AP mode or via an Ethernet connection to a router.

Method 1: Wi-Fi AP Mode

1) On your laptop, connect to the Wi-Fi network broadcasted by the Akida Edge AI Box.
   - SSID: ap_<Akida_Edge_AI_Box_Serial_Number>
   - Password: 12345678
2) Open a terminal on your laptop and run the ConfigManager utility:

```
./ConfigManager
```

3) Follow the prompts to:
   a. Set a static IP for the Akida Edge AI Box (e.g., 172.18.10.11)
   b. Configure the RTSP URLs for each camera
   c. Set the IP addresses for each camera

Method 2: Ethernet Connection via Router

1) Connect the Akida Edge AI Box to your router using an Ethernet cable.
2) Connect your laptop to the same router (via Wi-Fi or Ethernet).
3) Open a terminal on your laptop and run the ConfigManager utility:

```
./ConfigManager
```

4) Follow the prompts to:
   a. Set a static IP for the Akida Edge AI Box (e.g., 172.18.10.11)
   b. Configure the RTSP URLs for each camera
   c. Set the IP addresses for each camera

Verifying the Setup

1) Reboot the Akida Edge AI Box by unplugging the power supply and plugging it back into the Edge AI Box.
2) After rebooting, check that all LEDs on the Akida Edge AI Box turn green.
3) After successful setup, the monitor connected to the Akida Edge AI Box will display the demo interface.

4. Using the Akida Edge AI Box

Understanding the LED Status

The Akida Edge AI Box has three LEDs that indicate its status:

LED	Color	Description
Akida	**Green**	Akida 1000 Accelerator is online and functional.
	Red	There is a problem connecting to the Akida 1000 Accelerator.
Power	**Green**	The Akida Edge AI Box is powered on and operational.
	Red	Power supply or system error.
Wi-Fi/Ethernet	**Green**	Connected to Wi-Fi or Ethernet
	Red	Not connected to Wi-Fi or Ethernet is not configured.

Accessing the Demo Interface

After successful setup, the monitor connected to the Akida Edge AI Box will display the demo interface:

Demos: Launch pre-loaded artificial intelligence demos that showcase the capabilities of your Akida Edge AI Box.

Community: Connect to Edge Impulse's online platform where you can collaborate, share projects, and access resources from other AI developers.

Terminal: Access the Linux command line interface to directly interact with and control your device using text commands.

Documentation: Access comprehensive guides, tutorials, and technical specifications for your Akida Edge AI Box through your web browser.

AI Demo Overview

Your Akida Edge AI Box comes with five pre-installed demonstrations. These demonstrations are only meant for demonstration purposes. See the Akida Edge AI Box Model Deployment Guide for more information regarding creating your own models for the Edge AI Box. For other production uses of the Akida Edge AI Box, contact VVDN Technologies (https://www.vvdntech.com/vision/akida-edge-ai-box).

1. Face Detection (FOMO)
    a. FOMO is an object detection algorithm developed by Edge Impulse, optimized for constrained devices. This model is trained to detect faces.
2. Vitamin Classification (FOMO)

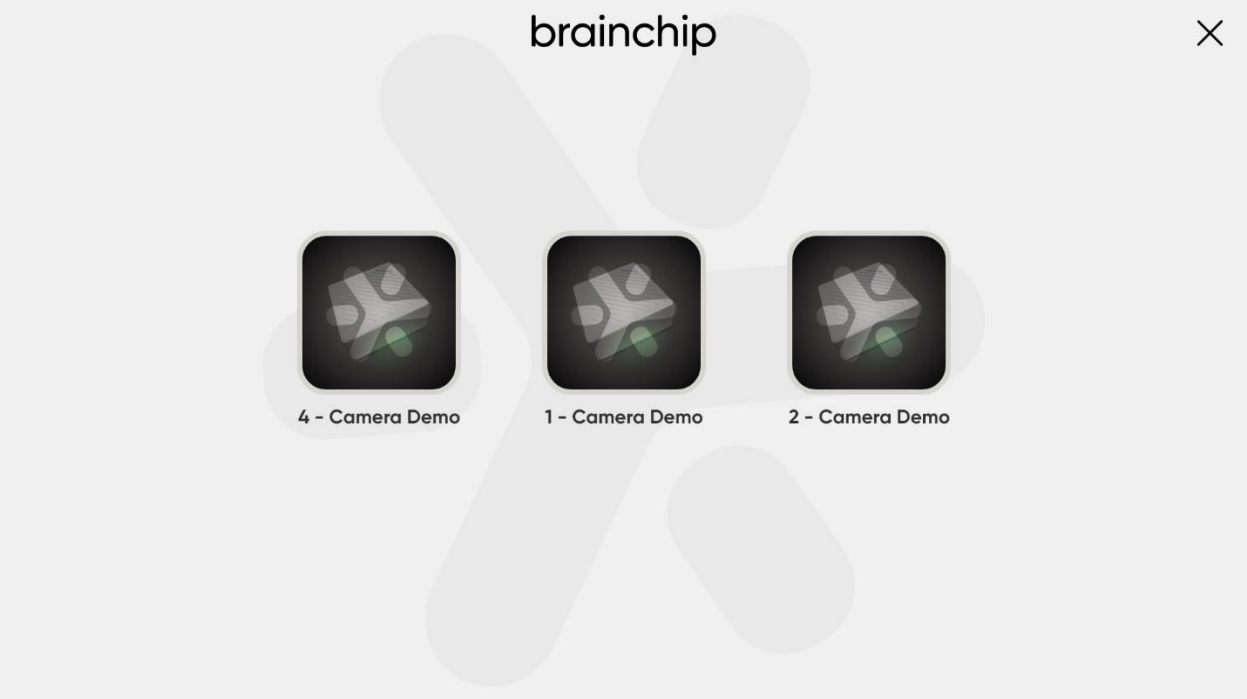
    a. A FOMO object detection algorithm that is trained to detect and classify different types of vitamins.
3. Person/Car Detection (YOLOv2)
    a. This model uses the YOLO (You Only Look Once) architecture to detect people and cars in images.
4. Face Detection (YOLOv2)
    a. A YOLO algorithm that is trained for face detection.
5. Visual Wake Word (AkidaNet)
    a. This model uses BrainChip's AkidaNet model architecture to detect the presence of a person in an image.

Advanced configuration instructions for the AI models can be found in the Akida Edge AI Box Model Deployment Guide.

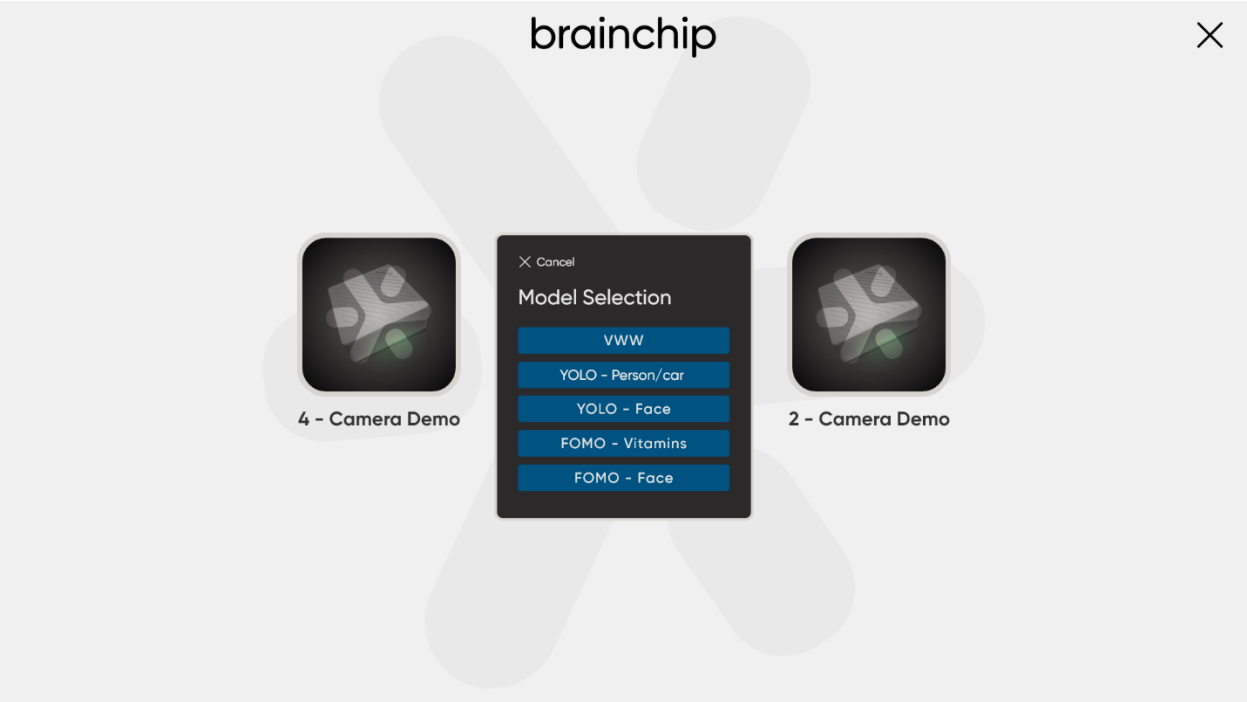
5. Graphical User Interface Workflow Example

The following steps will walk you through the process of starting the 1-Camera Demonstration.

1) From the home screen, select the "Demos" icon.



2) Select "1-Camera Demo"



3) Select the “VWW” demonstration (Visual Wake Word).
4) The Person/No-Person demonstration will launch.

6. Advanced Configuration

Changing the Demo Layout

1) You can change the layout of the demo output displayed on the screen by modifying the configuration file: /etc/akida/akidemo.com
2) SSH into the Akida Edge AI Box:

```
ssh root@172.18.10.11
```

3) Open the configuration file:

```
nano /etc/akida/akidademo.conf
```

4) Find the "composite_layout" setting and change it to one of the following options:
   - "2x2" (default, displays all 4 cameras)
   - "1x3L" (3 cameras in a line)
   - "1x3B" (3 cameras stacked)

- "1x2" (2 cameras side by side)
- "1x1" (single camera full screen)

5) Save the file and exit the editor.
6) Reboot the Akida Edge AI Box for changes to take effect:

```
reboot
```

7. Updating the Firmware

Updating the firmware is only necessary when a new set of software features are released for the Akida Edge AI Box. The method described below applies to version 1.0 of this document.

SD Card Preparation Methods

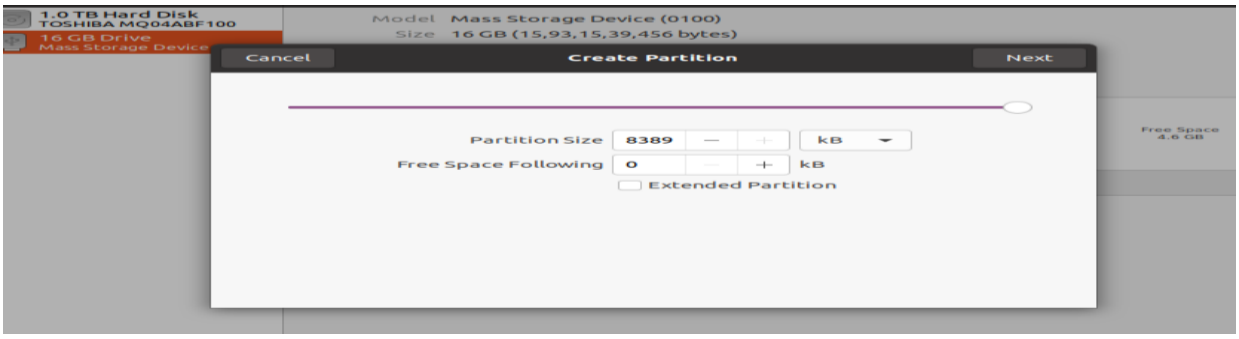
There are two methods for preparing an SD card for the Akida Edge AI Box: via the Linux Command Line or via belenaEtcher. Both methods will create the necessary boot and root partitions on your SD card.

Using Linux Command Line

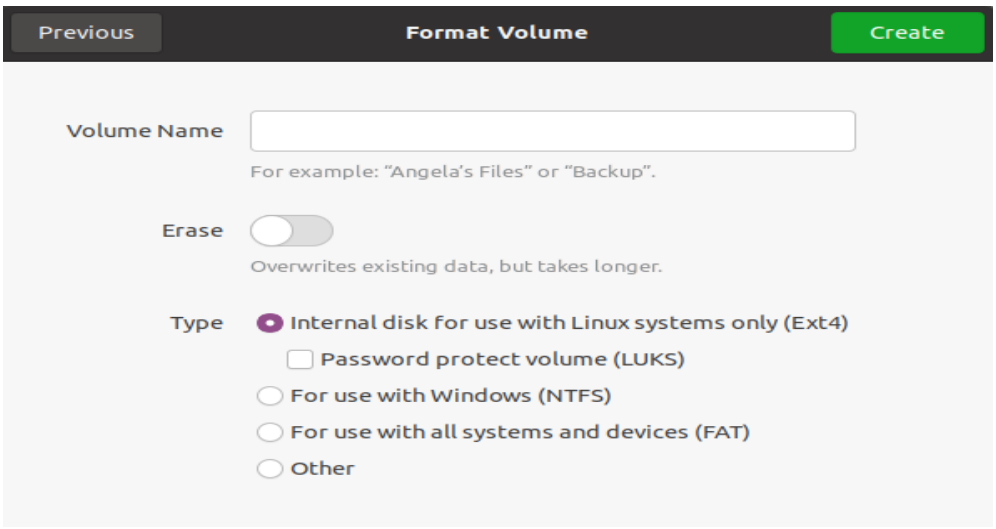
1) Insert the SD Card into the Linux machine's SD Card slot

2) Format the SD Card to ext4 format with a single partition with “Disks” Linux application

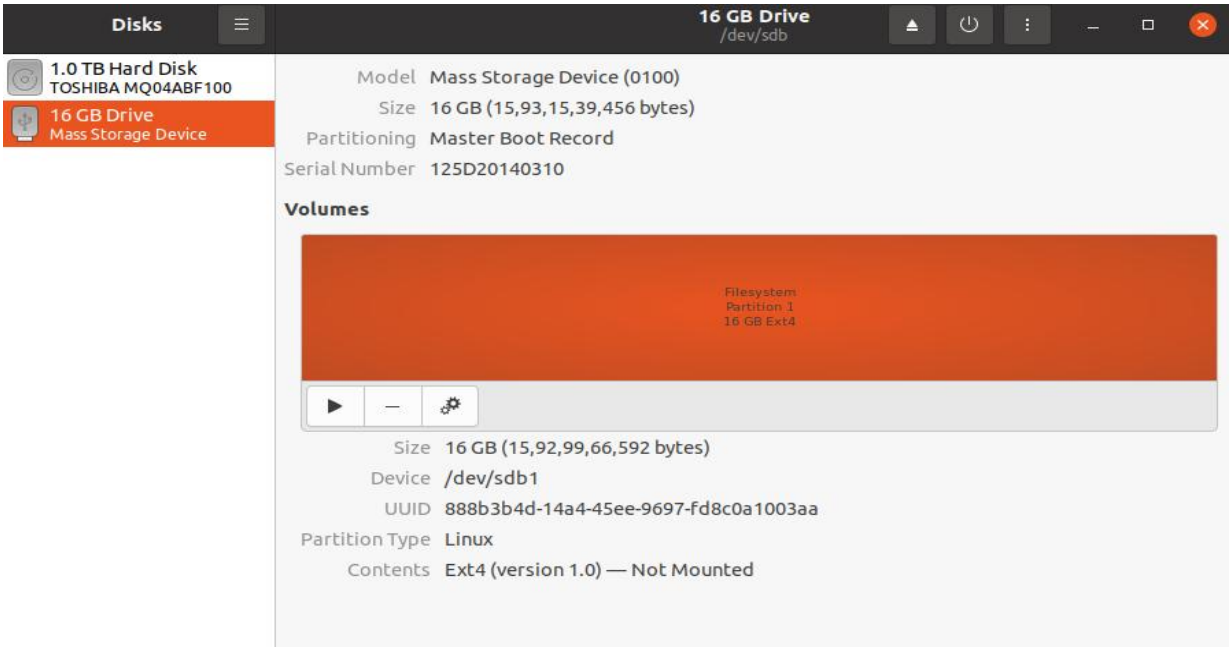
   - You can launch ‘Disks’ utility either from application menu or by using the command in the terminal *#gnome-disks.*
   - In the ‘Disks’ interface, choose your SD card from the list of storage devices on the left side.
   - Then, click the ‘**+**’ icon below the volume to create a new partition. Choose the ‘**ext4**’ file system format and configure the SD card to have a single partition.



3) Click ‘Next’, then select the ‘ext4’ format and finally click ‘Create’ to proceed.



- After the format is successful, you will get the screen below:



4) Run the command below to confirm that the format is ext4 and has only one partition:

```
# sudo fdisk -l
```

```
Device     Boot Start      End  Sectors  Size Id Type
/dev/sdb1        2048 31115263 31113216 14.9G 83 Linux
root@25722--VISN--CHN:/home/vvdn#
```

- As shown in the image above, if there is only a single partition listed, such as **/dev/sdb1**, it indicates that the SD card has been successfully partitioned into a single partition. If more than one partition is displayed, it means the SD card has multiple partitions.

5) Download the SD Card Boot image package **BCHU_AIBX_240724.x.x.x.x_d** to a Linux machine.

To ensure that the package contains the necessary files and tools listed please refer the steps below:

```
user:~$ cd BCHU_AIBX_070624.x.x.x.x_d /* To Enter the Package */
user:~/BCHU_AIBX_070624.x.x.x.x_d$ ls /* To List the Package*/
Documentation  firmware  tools

user:~/BCHU_AIBX_070624.x.x.x.x_d$cd Documentation /* To Enter Documentation Folder */
user:~/BCHU_AIBX_070624.x.x.x.x_d/Documentation$ ls /* To List Documentation Folder */
```

```
'BCHU_AIBX_Hardware Booting Configurations_A5.pdf'   BCHU_AIBX_Software_Release_Notes_A6.pdf

user:~/BCHU_AIBX_070624.x.x.x.x_d$ cd firmware /* To Enter firmware Folder */
user:~/BCHU_AIBX_070624.x.x.x.x_d/firmware$ ls /* To List firmware Folder */
BCHU_AIBX_070624.x.x.x.x_d.wic  BCHU_AIBX_070624.x.x.x.x_d.wic.zst

user:~/BCHU_AIBX_070624.x.x.x.x_d$ cd tools /* To Enter tools Folder */

user:~/BCHU_AIBX_070624.x.x.x.x_d/tools$ ls /* To List tools Folder */
ConfigManager  eeprom_flasher
```

6) Enter the package folder:

```
# cd BCHU_AIBX_240724.x.x.x.x_d/firmware/
```

7) To decompress the wic.zst image, you need to install the Zstandard ('zstd') compression tool using the commands below.

```
# sudo apt update
# sudo apt install zstd
```

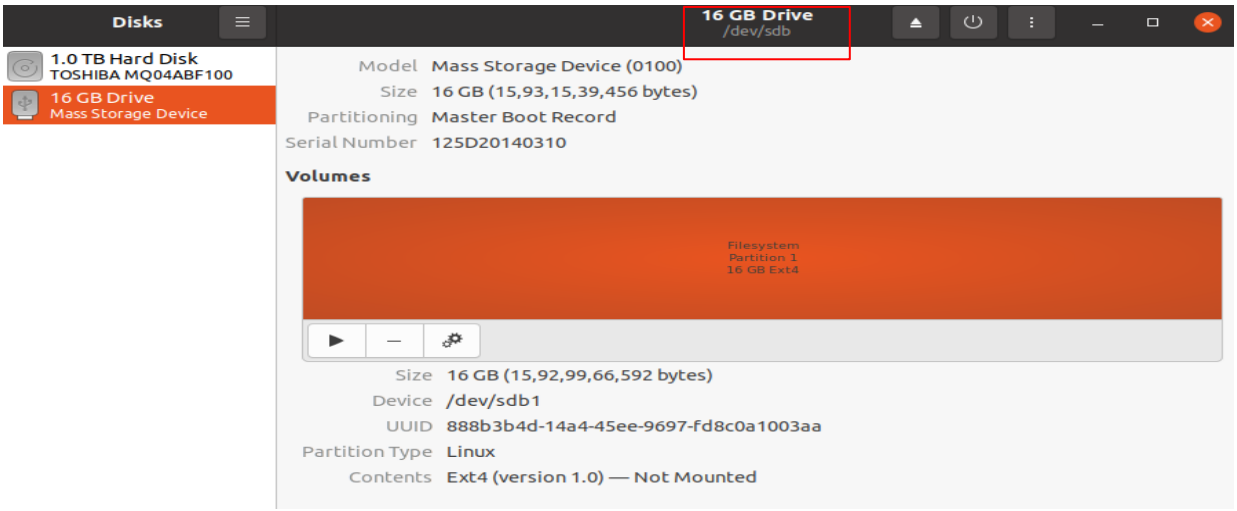
Now, you can use the command below to decompress the image:

```
# zstd --decompress BCHU_AIBX_240724.x.x.x.x_d.wic.zst
```

8) Run the command below to write this '.wic' file to the SD card. Note that the SD card mount point, used in the "of=" argument to the dd command, may vary depending on the host Linux machine.

```
# sudo dd if=BCHU_AIBX_240724.x.x.x.x_d.wic of=/dev/sdb bs=1M && sync
```

9) To find the SD card mount point, open the 'Disks' application via the GUI menu or the *gnome-disks command* . The mount point is displayed at the top of the application window as shown in the red box in the image below.



- The Figure above shows sdb as the mount point of the SD Card. If the mount point varies, please change "of=" argument of the "dd" the command accordingly.
- For example, the command line below shows the proper command to write the '.wic' file to the SD card when the mount point of the SD Card is mmcblk0.

```
# sudo dd if=BCHU_AIBX_240724.x.x.x.x_d.wic of=/dev/mmcblk0 bs=1M && sync
```

```
root@25722--VISN--CHN:/home/vvdn/Project/BCHU_AIBX_240724.1.0.0.52_d/firmware# sudo dd if=BCHU_AIBX_240724.1.0.0
.52_d.wic of=/dev/sdb bs=1M && sync
10834+1 records in
10834+1 records out
11361289216 bytes (11 GB, 11 GiB) copied, 1365.51 s, 8.3 MB/s
```

- Please note that flashing the SD card can take some time, depending on the speed of the SD card. Ensure you do not interrupt the process and wait for it to finish.

10) After the the write is successful, you may remove the SD card and reinsert to the Linux laptop

11) Please make sure the SD card has become bootable by using the "fdisk" command as below:

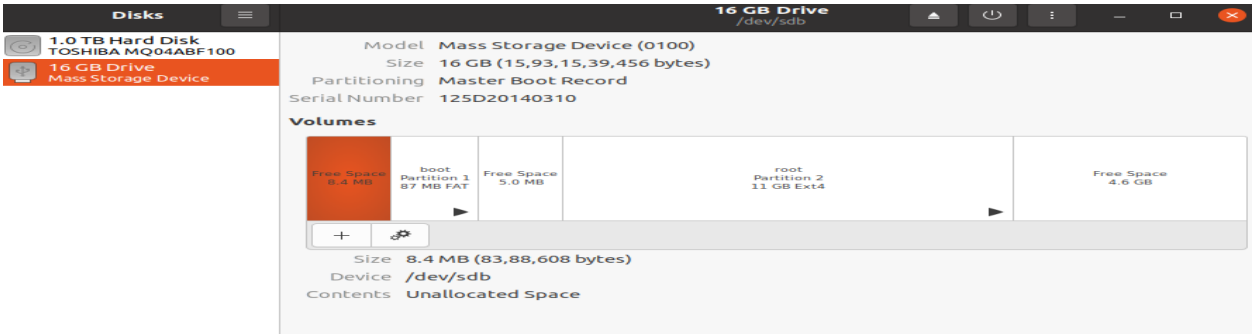
```
# sudo fdisk –l
```

```
Device     Boot  Start      End  Sectors  Size Id Type
/dev/sdb1  *     16384   186775   170392 83.2M  c W95 FAT32 (LBA)
/dev/sdb2       196608 22190017 21993410 10.5G 83 Linux
```

- A bootable SD card will have two partitions:

- /dev/sdb1 - boot partition (as indicated by the '*' in the "Boot" column in Figure 10 above)
- /dev/sdb2 - root partition

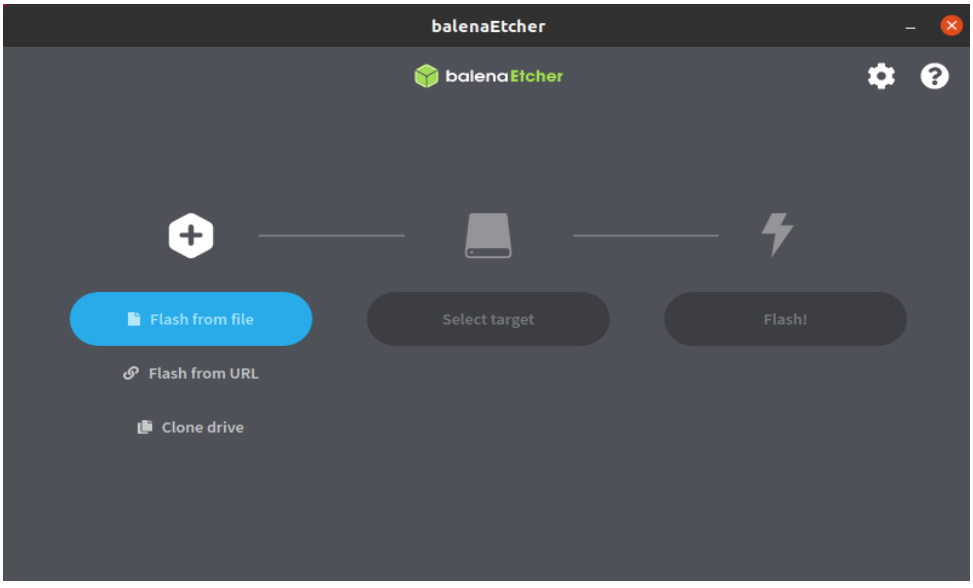
- Additionally, one may verify the SD card partitions using the Disks application. Figure below shows the partitions created on the SD card.

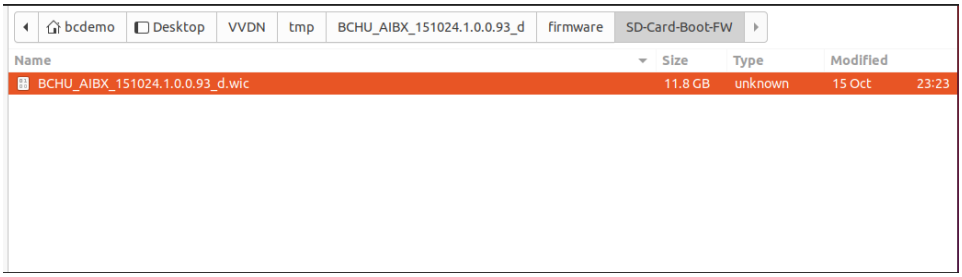


12) Remove the SD card from the Linux machine.
13) Insert the SD card into the designated slot on the Akida Edge AI Box.
14) Power on the Akida Edge AI Box to begin the boot-up process.

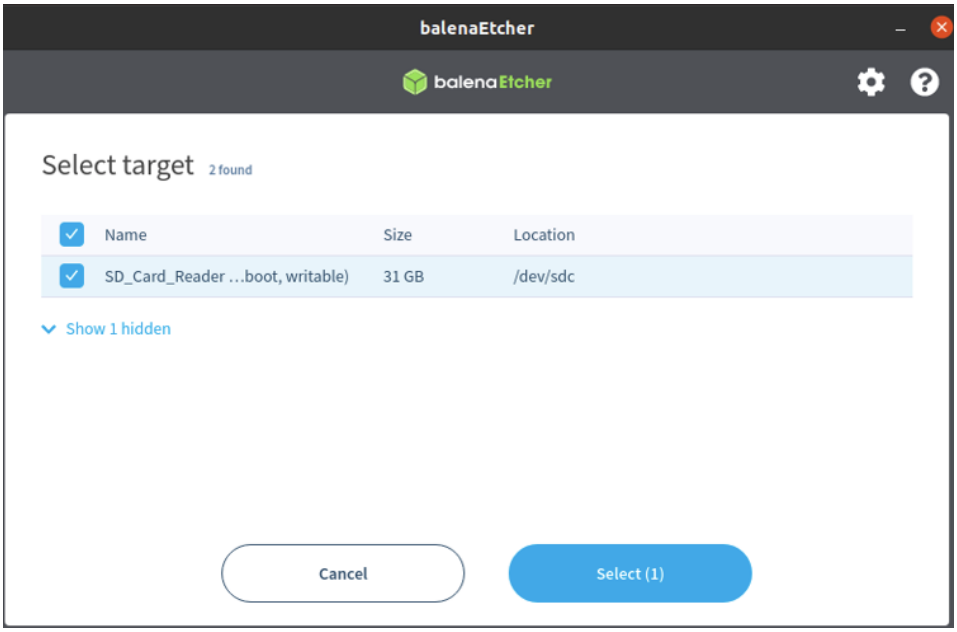
Using balenaEtcher (Windows or Linux)

1) Download and install balenaEtcher from https://etcher.balena.io/
2) Download the SD Card Boot image package (BCHU_AIBX_240724.x.x.x.x_d.wic.zst)
3) Decompress the .zst file and retrieve the .wic file from the folder.
4) Launch balenaEtcher
5) Click "Flash from file" and select the .wic image file

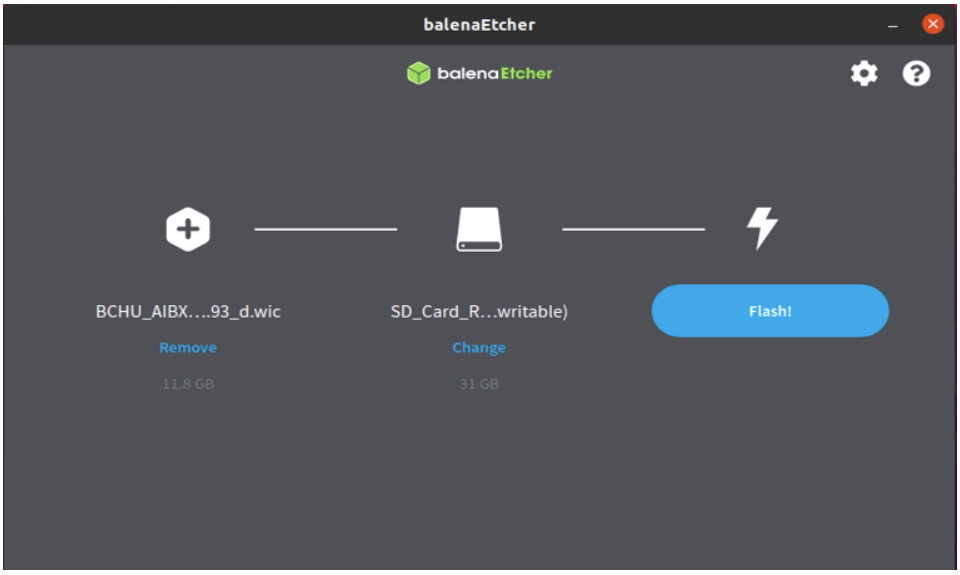




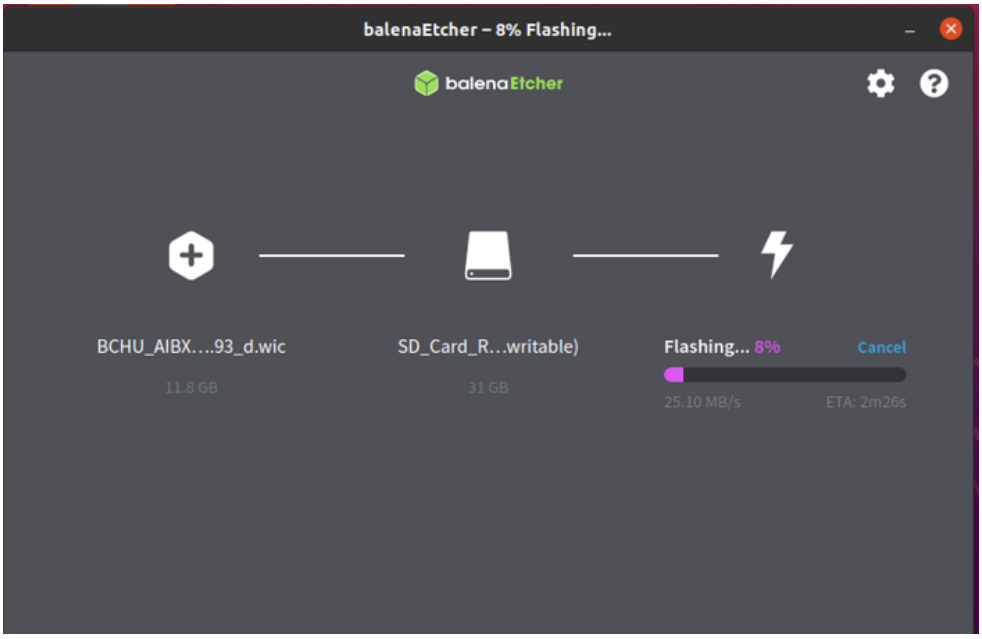
6) Click "Select target" and choose your SD card



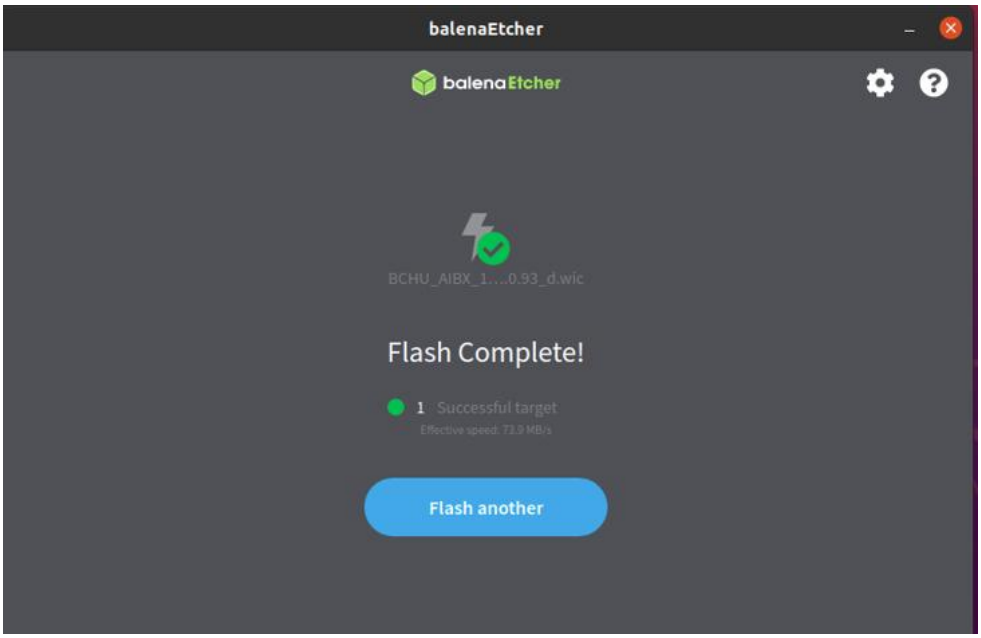
7) Click "Flash!" to begin the process



8) Wait for the verification process to complete



9) Remove the SD card when prompted



Initial Boot

1) Insert the SD card into the Akida Edge AI Box
2) Power on the device
3) Verify boot success via LED indicators

8. Troubleshooting

If you encounter issues:

- Check all physical connections, ensuring cables are securely plugged in.
- Verify IP addresses and network settings for both the cameras and the Akida Edge AI Box.
- Ensure the SD card is properly formatted and contains the correct firmware image.
- Check the LED status on the Akida Edge AI Box.
- If cameras are not displaying, verify their RTSP URLs and authentication settings.
- For persistent issues, try power cycling the Akida Edge AI Box and the PoE switch.

9. Tested Components

The following components have been tested and verified:

- HDMI Monitor: PHILIPS 22 inch Class Thin Full HD (1920 x 1080) Monitor
    - [Product Link](https://a.co/d/2Ep5BTj)
- IP Cameras: 4MP PoE IP Bullet Outdoor Camera
    - [Product Link](https://a.co/d/1aln4KH)
- PoE Switch: MokerLink 10 Port PoE Switch
    - [Product Link](https://a.co/d/bPp0xtN)
- USB Keyboard and Mouse Combo: Logitech MK270 Wireless Keyboard And Mouse Combo
    - [Product Link](https://a.co/d/b1uacfA)
- USB Camera: Logitech C920x HD Pro Webcam
    - [Product Link](https://a.co/d/fPlD6Oo)