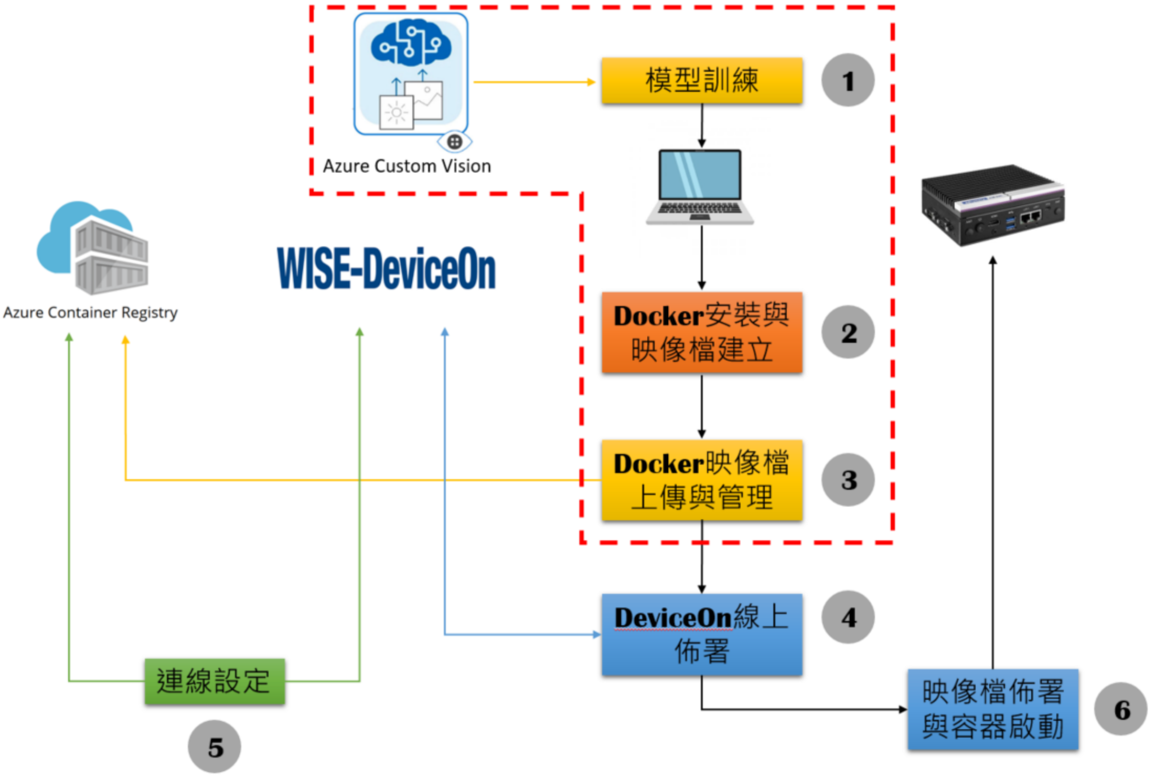
流程圖



1. 模型訓練

- 模型應用：物件分類
- 訓練資料上傳
- 模型訓練
- 模型下載

2. Docker安裝與映像檔建立

> - Linux x86
> - Linux arm64

1. 確保系統已更新至最新版本

```
$ sudo apt-get update
$ sudo apt-get upgrade
```

2. 透過以下命令先將 Docker 移除 (若是已經安裝過 Docker 的)

```
$ sudo apt-get remove docker docker-engine docker.io containerd runc
```

3. 安裝相依套件

```
$ sudo apt-get update
$ sudo apt-get install -y ca-certificates curl gnupg lsb-release
```

4. 添加Docker的官方GPG密鑰與APT的下載庫位置

```
$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg

$ echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
```

5. 再次更新APT庫並安裝Docker

```
$ sudo apt-get update
$ sudo apt-get install -y docker-ce docker-ce-cli containerd.io
```

6. 確認Docker以正確安裝並啟動

```
$ sudo docker run hello-world
```

3. 建立客製化的Docker映象檔

- 下載適當的映象檔，
  - arm 64 映像檔連結在此

```
$ sudo docker pull nvcr.io/nvidia/l4t-tensorflow:r32.5.0-tf2.3-py3
```

> 要確認本機端安裝的cuda版本與base image的tensorflow版本是否一致，才能順利啟用gpu

- 設定xhost

```
$ xhost +[HostName]
```

> 只須設定一次

- 啟動容器

```
$ sudo docker run -it --rm -v <diretory path on pc>:<diretory path on container> --workdir <diretory path on container> -e DISPLAY=:0 -e QT_X11_NO_MITSHM=1 --device="/dev/video0:/dev/video0" -v /tmp/.X11-unix/:/tmp/.X11-unix/ --runtime=nvidia tf2.3-gpu-arm64:v0.0 /bin/bash
```

- 啟動容器後，在該容器內安裝必要的函式庫

```
$ sh setup_opencv.sh
```

- 修改.bashrc檔

```
$ nano ~/.bashrc
```

  - 開啟檔案後，在最後一行加入`export LD_PRELOAD=/usr/lib/aarch64-linux-gnu/libgomp.so.1:$LD_PRELOAD`，儲存後退出，並執行

    ```
    $ source ~/.bashrc
    ```

> `安裝完後，請勿關閉容器`

- 執行辨識程式，確認容器功能正常

```
$ python3 savedmodel_classification.py
```

> 若跑出辨識視窗則表示容器功能正常，可以進行打包

- 開啟新的終端介面，並輸入下列語法，將其打包成Docker映象檔

```
$ sudo docker commit <CONTAINER ID> <your own new image name>
```

- 儲存成壓縮檔，以利使用

```
$ sudo docker save -o <tar file name> <IMAGE ID>
```

- 載入Docker映像壓縮檔，確認該壓縮檔內的映像檔是否正常

```
$ sudo docker load -i <tar file name>
```

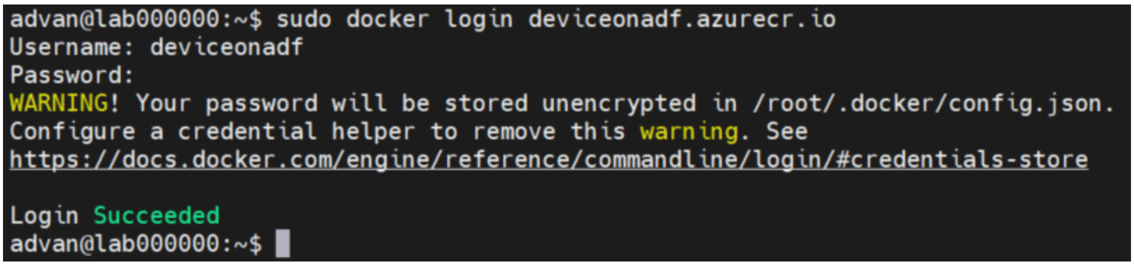
> 這裡提供另一種自製映像檔的方法，`Dockerfile`。可以參考此網站

Docker映像檔上傳與管理@Azure Container Registry (ACR)

> - ACR可以用來儲存您的容器映像及其他項目，詳見官方網站
> - 細節可以參考ADVANTECH-Corp/DeviceOn-x86_Edge_AI_Solution，自行建立ACR service

- 建立ACR並取得密鑰
- 透過Docker登入ACR，並輸入帳密

```
$ sudo docker login <URL>
```

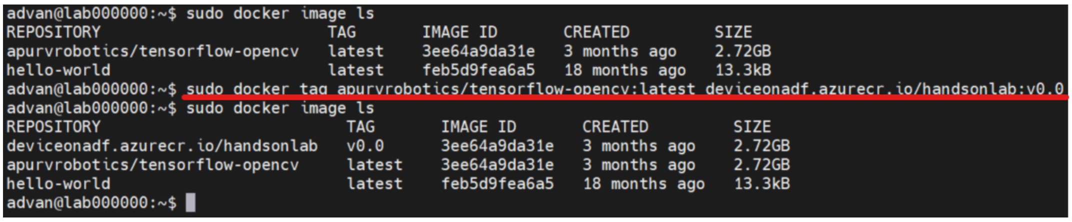


```
advan@lab000000:~$ sudo docker login deviceonadf.azurecr.io
Username: deviceonadf
Password:
WARNING! Your password will be stored unencrypted in /root/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
advan@lab000000:~$
```

- 上傳映像檔至ACR
  - image名稱必須加上前綴 -> `deviceonadf.azurecr.io`

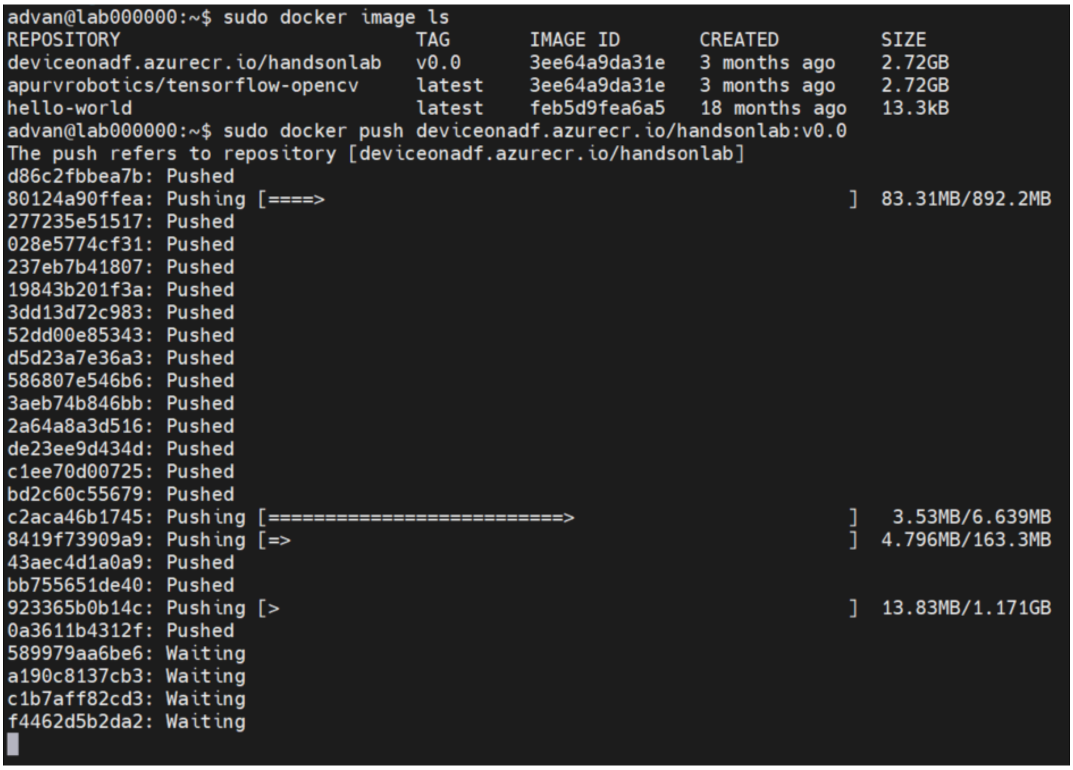
```
$ sudo docker tag <SOURCE_IMAGE:TAG> deviceonadf.azurecr.io/<TARGET:TAG>
```



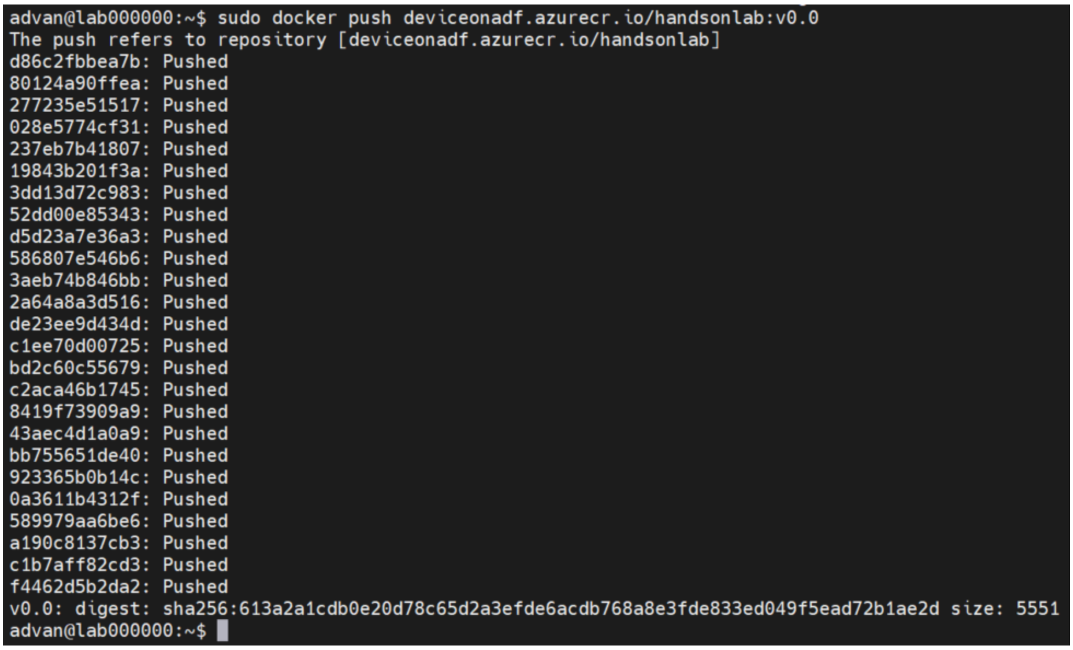
```
advan@lab000000:~$ sudo docker image ls
REPOSITORY                      TAG       IMAGE ID       CREATED         SIZE
apurvrobotics/tensorflow-opencv latest    3ee64a9da31e   3 months ago    2.72GB
hello-world                     latest    feb5d9fea6a5   18 months ago   13.3kB
advan@lab000000:~$ sudo docker tag apurvrobotics/tensorflow-opencv:latest deviceonadf.azurecr.io/handsonlab:v0.0
advan@lab000000:~$ sudo docker image ls
REPOSITORY                        TAG       IMAGE ID       CREATED         SIZE
deviceonadf.azurecr.io/handsonlab v0.0      3ee64a9da31e   3 months ago    2.72GB
apurvrobotics/tensorflow-opencv   latest    3ee64a9da31e   3 months ago    2.72GB
hello-world                       latest    feb5d9fea6a5   18 months ago   13.3kB
advan@lab000000:~$
```

  - 上傳以加前綴的映像檔

```
$ sudo docker push deviceonadf.azurecr.io/<TARGET:TAG>
```



```
advan@lab000000:~$ sudo docker image ls
REPOSITORY                        TAG       IMAGE ID       CREATED         SIZE
deviceonadf.azurecr.io/handsonlab v0.0      3ee64a9da31e   3 months ago    2.72GB
apurvrobotics/tensorflow-opencv   latest    3ee64a9da31e   3 months ago    2.72GB
hello-world                       latest    feb5d9fea6a5   18 months ago   13.3kB
advan@lab000000:~$ sudo docker push deviceonadf.azurecr.io/handsonlab:v0.0
The push refers to repository [deviceonadf.azurecr.io/handsonlab]
d86c2fbbea7b: Pushed
80124a90ffea: Pushing [====>                                          ]  83.31MB/892.2MB
277235e51517: Pushed
028e5774cf31: Pushed
237eb7b41807: Pushed
19843b201f3a: Pushed
3dd13d72c983: Pushed
52dd00e85343: Pushed
d5d23a7e36a3: Pushed
586807e546b6: Pushed
3aeb74b846bb: Pushed
2a64a8a3d516: Pushed
de23ee9d434d: Pushed
c1ee70d00725: Pushed
bd2c60c55679: Pushed
c2aca46b1745: Pushing [==========================>                    ]   3.53MB/6.639MB
8419f73909a9: Pushing [=>                                             ]  4.796MB/163.3MB
43aec4d1a0a9: Pushed
bb755651de40: Pushed
923365b0b14c: Pushing [>                                              ]  13.83MB/1.171GB
0a3611b4312f: Pushed
589979aa6be6: Waiting
a190c8137cb3: Waiting
c1b7aff82cd3: Waiting
f4462d5b2da2: Waiting
```

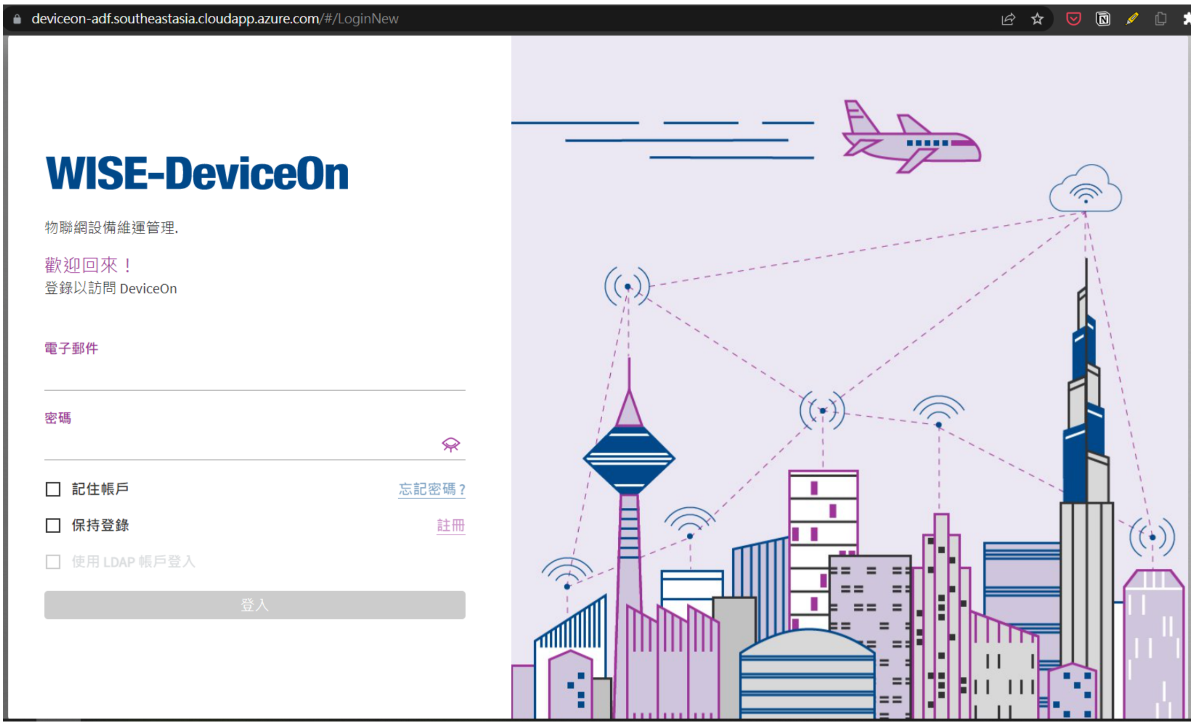


```
advan@lab000000:~$ sudo docker push deviceonadf.azurecr.io/handsonlab:v0.0
The push refers to repository [deviceonadf.azurecr.io/handsonlab]
d86c2fbbea7b: Pushed
80124a90ffea: Pushed
277235e51517: Pushed
028e5774cf31: Pushed
237eb7b41807: Pushed
19843b201f3a: Pushed
3dd13d72c983: Pushed
52dd00e85343: Pushed
d5d23a7e36a3: Pushed
586807e546b6: Pushed
3aeb74b846bb: Pushed
2a64a8a3d516: Pushed
de23ee9d434d: Pushed
c1ee70d00725: Pushed
bd2c60c55679: Pushed
c2aca46b1745: Pushed
8419f73909a9: Pushed
43aec4d1a0a9: Pushed
bb755651de40: Pushed
923365b0b14c: Pushed
0a3611b4312f: Pushed
589979aa6be6: Pushed
a190c8137cb3: Pushed
c1b7aff82cd3: Pushed
f4462d5b2da2: Pushed
v0.0: digest: sha256:613a2a1cdb0e20d78c65d2a3efde6acdb768a8e3fde833ed049f5ead72b1ae2d size: 5551
advan@lab000000:~$ 
```

4. DeviceOn線上佈署

> DeviceOn提供一個便於將ACR中的映像檔佈署至edge端的操作介面

註冊WISE-DeviceOn帳號



deviceon-adf.southeastasia.cloudapp.azure.com/#/LoginNew

WISE-DeviceOn

物聯網設備維運管理.

歡迎回來！

登錄以訪問 DeviceOn

電子郵件

密碼

☐ 記住帳戶

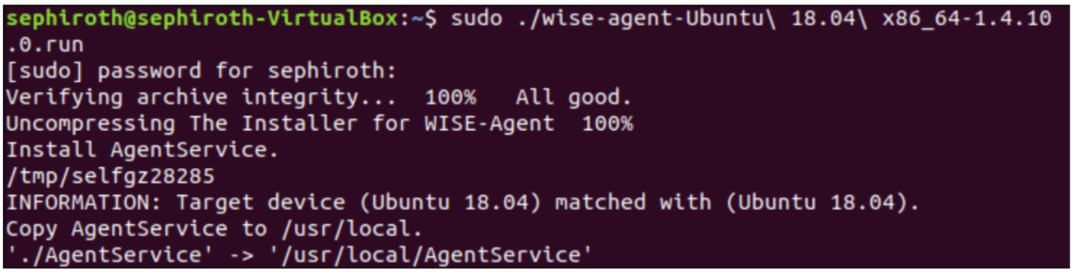
☐ 保持登錄

☐ 使用 LDAP 帳戶登入

在edge端安裝WISE-DeviceOn

- 安裝的執行檔
  - x86的部分挑選符合本機系統的即可，本次工作坊是以`wise-agent-Ubuntu_20.04-x86_64-1.4.45.0.run`為主
  - arm64的部分則是針對Nvidia Jetson，所以安裝`wise-agent-Ubuntu_18.04-jetson-1.4.45.0.run`

```
$ chmod 0755 wise-agent-Ubuntu_18.04-jetson-1.4.45.0.run
$ sudo ./wise-agent-Ubuntu_18.04-jetson-1.4.45.0.run
```

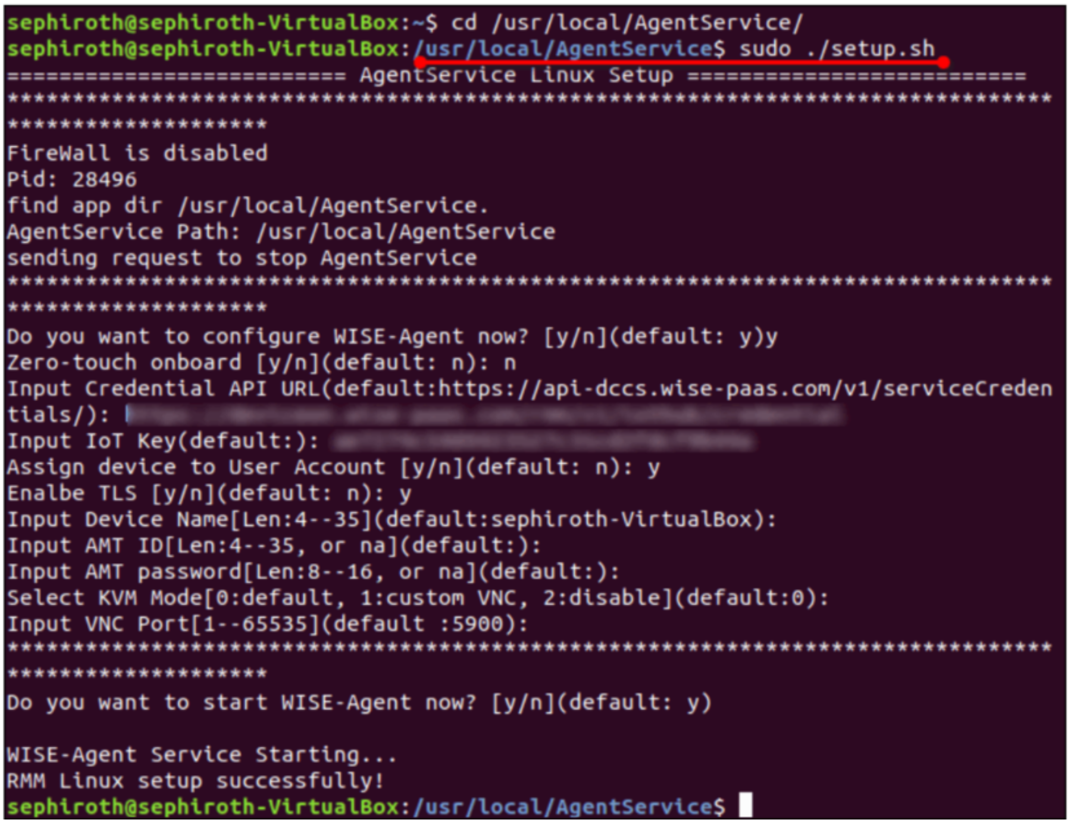


```
sephiroth@sephiroth-VirtualBox:~$ sudo ./wise-agent-Ubuntu\ 18.04\ x86_64-1.4.10
.0.run
[sudo] password for sephiroth:
Verifying archive integrity...  100%   All good.
Uncompressing The Installer for WISE-Agent  100%
Install AgentService.
/tmp/selfgz28285
INFORMATION: Target device (Ubuntu 18.04) matched with (Ubuntu 18.04).
Copy AgentService to /usr/local.
'./AgentService' -> '/usr/local/AgentService'
```

- 移動到`/usr/local/AgentService`，並執行

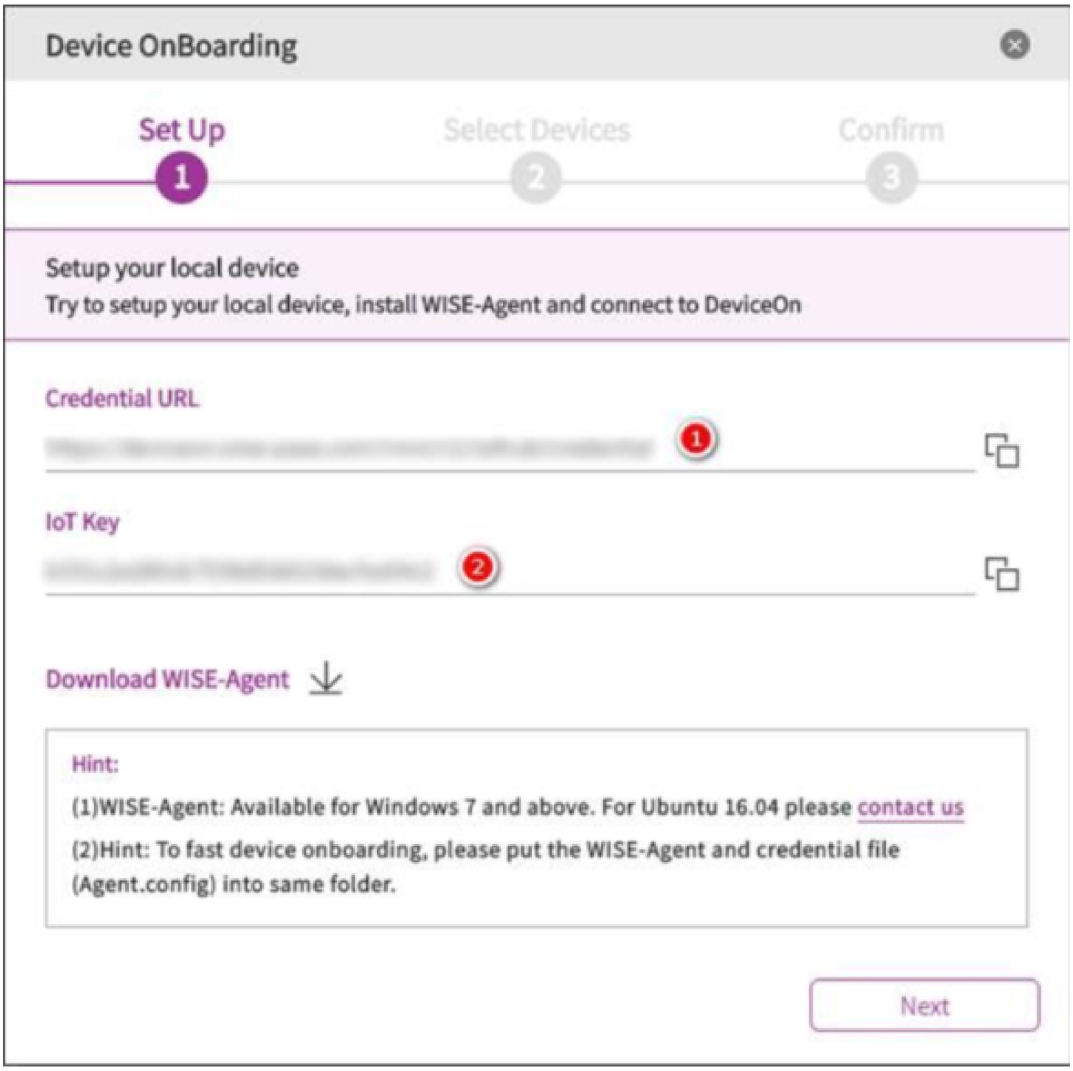
```
$ sudo ./setup.sh
```

> `Credential URL`跟`IoT Key`可從DeviceOn網頁取得



```
sephiroth@sephiroth-VirtualBox:~$ cd /usr/local/AgentService/
sephiroth@sephiroth-VirtualBox:/usr/local/AgentService$ sudo ./setup.sh
========================== AgentService Linux Setup ==========================
********************************************************************************
********************
FireWall is disabled
Pid: 28496
find app dir /usr/local/AgentService.
AgentService Path: /usr/local/AgentService
sending request to stop AgentService
********************************************************************************
********************
Do you want to configure WISE-Agent now? [y/n](default: y)y
Zero-touch onboard [y/n](default: n): n
Input Credential API URL(default:https://api-dccs.wise-paas.com/v1/serviceCreden
tials/): [redacted]
Input IoT Key(default:): [redacted]
Assign device to User Account [y/n](default: n): y
Enalbe TLS [y/n](default: n): y
Input Device Name[Len:4--35](default:sephiroth-VirtualBox):
Input AMT ID[Len:4--35, or na](default:):
Input AMT password[Len:8--16, or na](default:):
Select KVM Mode[0:default, 1:custom VNC, 2:disable](default:0):
Input VNC Port[1--65535](default :5900):
********************************************************************************
********************
Do you want to start WISE-Agent now? [y/n](default: y)

WISE-Agent Service Starting...
RMM Linux setup successfully!
sephiroth@sephiroth-VirtualBox:/usr/local/AgentService$
```



Setup your local device

Try to setup your local device, install WISE-Agent and connect to DeviceOn

Credential URL

[redacted] 1

IoT Key

[redacted] 2

Download WISE-Agent

Hint:

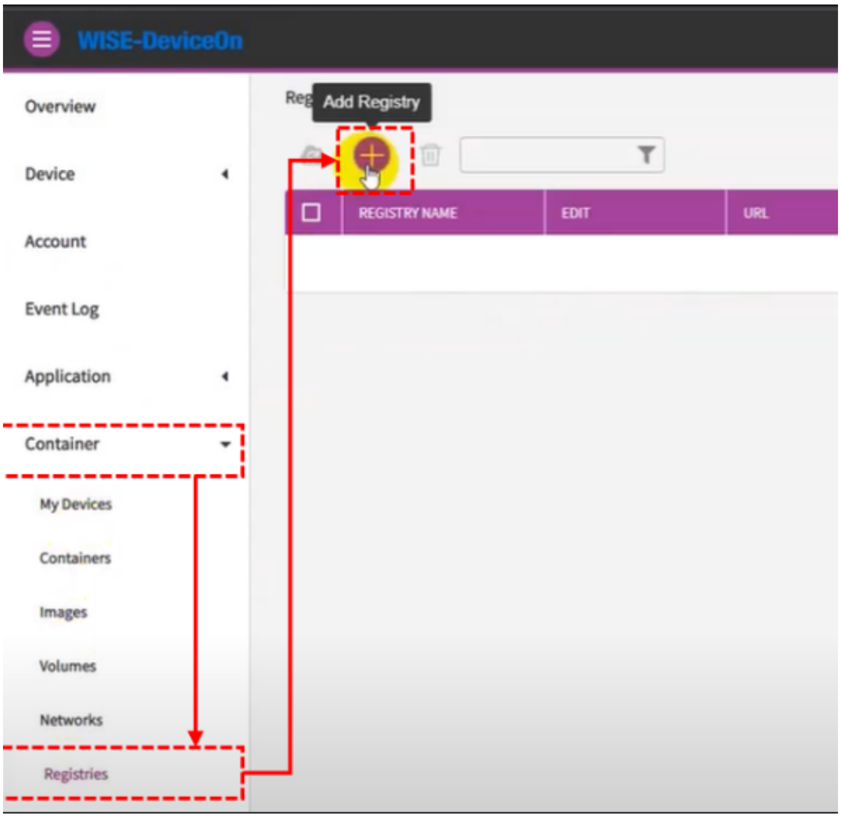
(1)WISE-Agent: Available for Windows 7 and above. For Ubuntu 16.04 please contact us

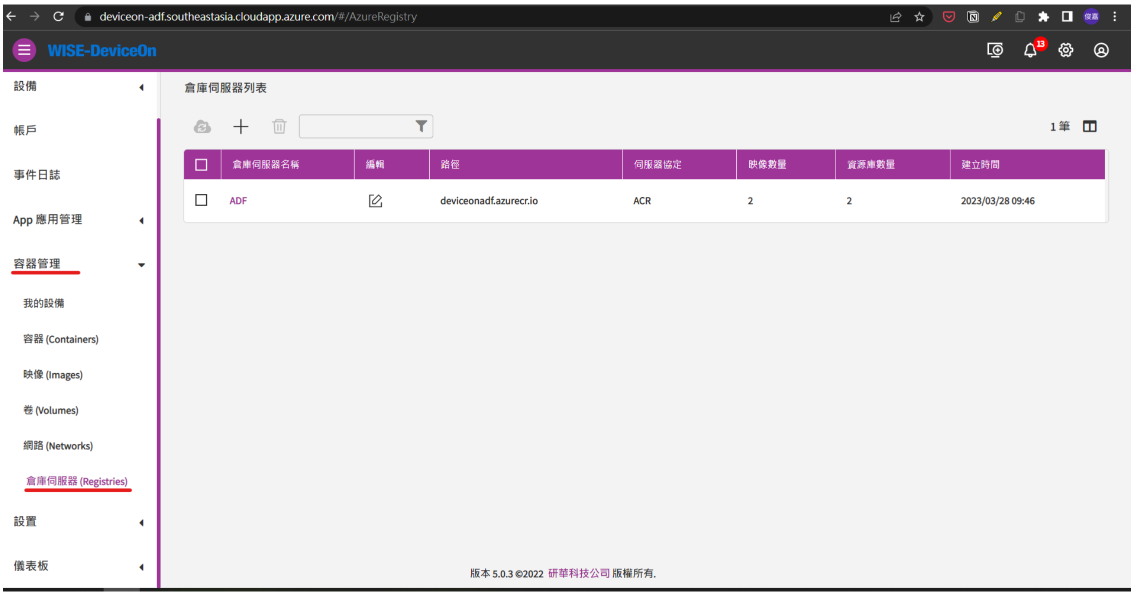
(2)Hint: To fast device onboarding, please put the WISE-Agent and credential file (Agent.config) into same folder.

5. DeviceOn與ACR的連結設定

> - 此部分細節可以參考ADVANTECH-Corp/DeviceOn-x86_Edge_AI_Solution

- 新增Registry



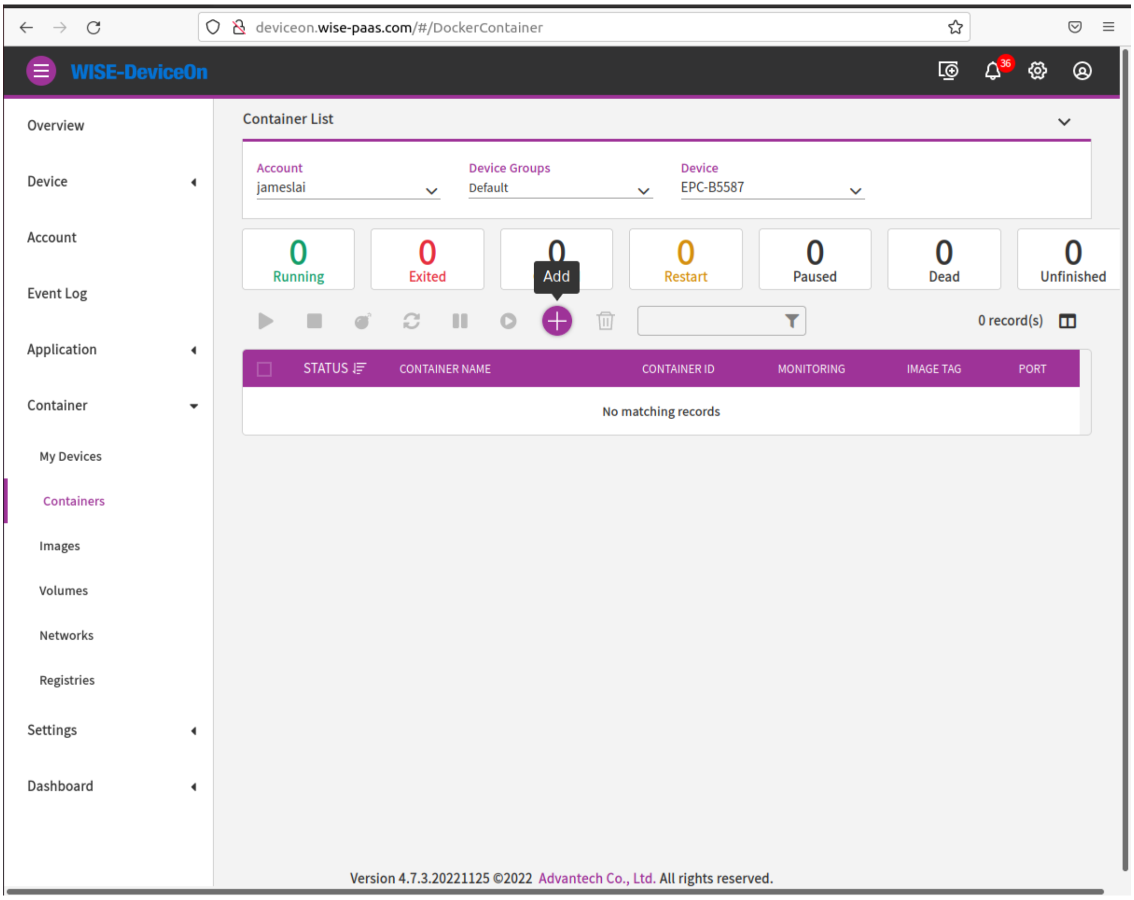


倉庫伺服器列表

□	倉庫伺服器名稱	編輯	路徑	伺服器協定	映像數量	資源庫數量	建立時間
□	ADF		deviceonadf.azurecr.io	ACR	2	2	2023/03/28 09:46

6. 映像檔佈署與容器啟動

- 透過DeviceOn介面將ACR中的映像檔佈署到edge端設備



deviceon.wise-paas.com/#/DockerContainer

WISE-DeviceOn

Overview
Device
Account
Event Log
Application
Container
My Devices
Containers
Images
Volumes
Networks
Registries
Settings
Dashboard

Container List

Account: jameslai
Device Groups: Default
Device: EPC-B5587

0	0	0	0	0	0	0
Running	Exited	Add	Restart	Paused	Dead	Unfinished

0 record(s)

□	STATUS	CONTAINER NAME	CONTAINER ID	MONITORING	IMAGE TAG	PORT
No matching records						

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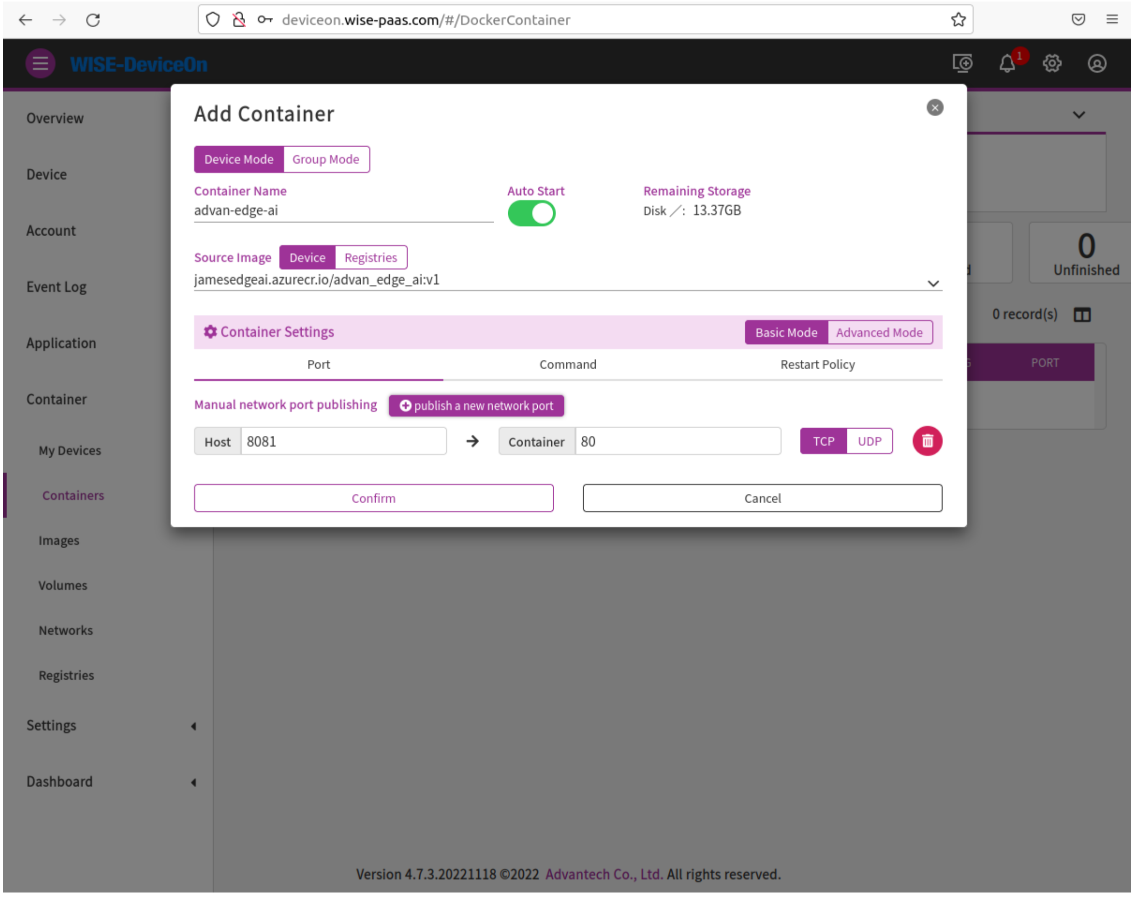

deviceon.wise-paas.com/#/DockerContainer

Add Container

Device Mode | Group Mode

Container Name: advan-edge-ai
Auto Start: ●
Remaining Storage: Disk /: 13.37GB

Source Image: Device | Registries
jamesedgeai.azurecr.io/advan_edge_ai:v1

Container Settings — Basic Mode | Advanced Mode

Port | Command | Restart Policy

Manual network port publishing — publish a new network port

Host 8081 → Container 80 — TCP | UDP

Confirm | Cancel

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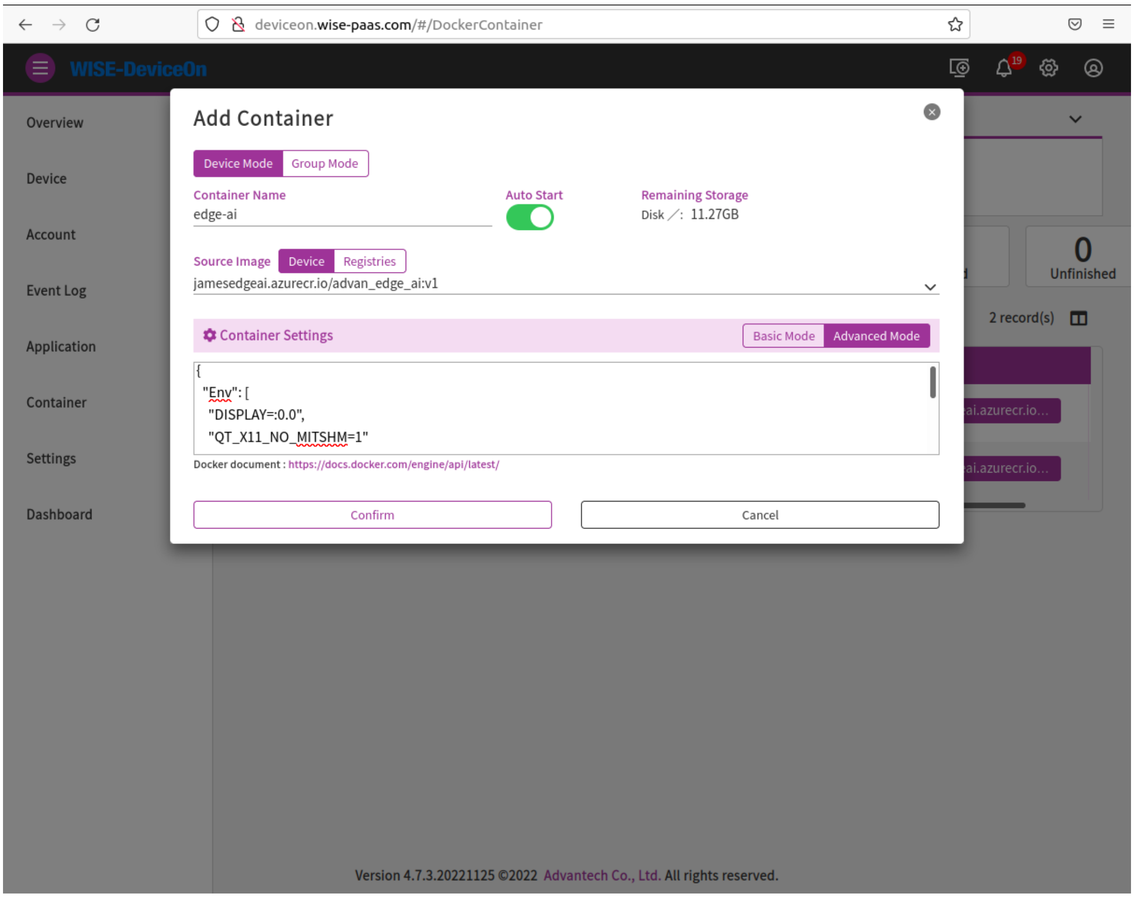

Add Container

Container Name: edge-ai

Auto Start: on

Remaining Storage: Disk ／: 11.27GB

Source Image: Device | Registries

jamesedgeai.azurecr.io/advan_edge_ai:v1

Container Settings: Basic Mode | Advanced Mode

```
{
 "Env": [
  "DISPLAY=:0.0",
  "QT_X11_NO_MITSHM=1"
```

Docker document : https://docs.docker.com/engine/api/latest/

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- 參數設定

```
{
  "Env": [
    "DISPLAY=:0.0",
    "QT_X11_NO_MITSHM=1"
  ],
  "Image": "deviceonadf.azurecr.io/handsonlab/jetson-tx2:latest",
  "Volumes":{
    "/tmp/.X11-unix":{},
    "/home/a":{}
  },
  "WorkingDir": "/ws",
  "Cmd": ["date"],
  "HostConfig": {
    "Binds":[
      "/tmp/.X11-unix/:/tmp/.X11-unix",
      "/home/a:/ws"
    ],
    "Devices":[
        {
            "PathOnHost": "/dev/video0",
            "PathInContainer": "/dev/video0",
            "CgroupPermissions": "rwm"
        }
    ]
  }
}
```