Microsoft

PROJECT AI CARE 技術白皮書

AI Box Hands-on Lab Guide

Building Your Own Device for
AI Care with Azure AI & IoT Services

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目錄

1 Background and Challenge –

- Increased chance of people contact for 1st line security guards
- Increased labor time and cost: 8~10 hours per day standing there
- Efficiency on peak hours will be challenging
-

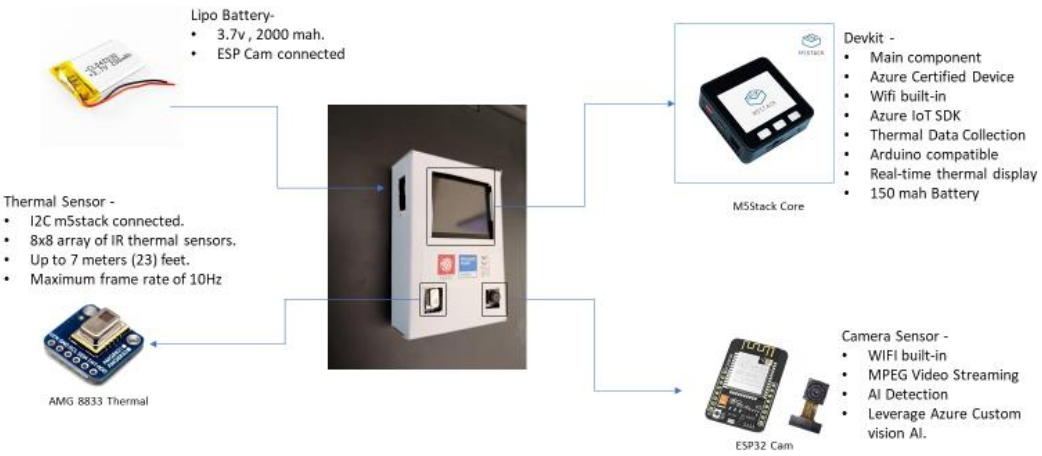
2 Solution Overview –

Idea - An easy-to-adopt AIoT Technology to help real estate building management companies save labor and decrease chance of contact for 1st line security guard in difficult time

- Client Device – Azure Certified Device and Sensors (Thermal/Camera)
- Backend – Azure AI and IoT Services
  - Azure Custom Vision
  - Azure IoT Central
  - Azure IoT Edge
  - Azure Event Hub
  - Power BI
  - Cosmos DB (Optional)
  - Azure Stream Analytics (Optional)

3 AI CARE Device Hardware Architecture –

Hardware Architecture

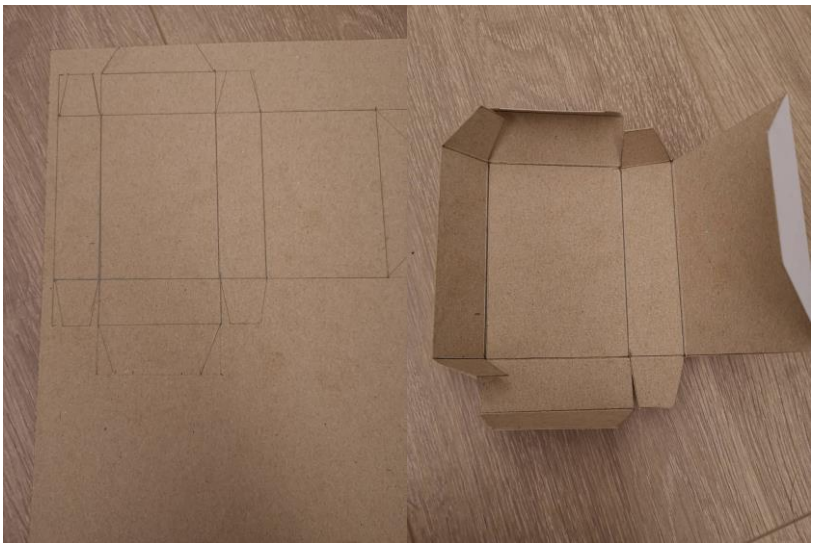


- Main Controller – M5Stack Core –
  - Azure Certified Device
  - Wifi built-in
  - Azure IoT SDK
  - Thermal Data Collection
  - Arduino compatible
  - Real-time thermal display
  - 150 mah Battery

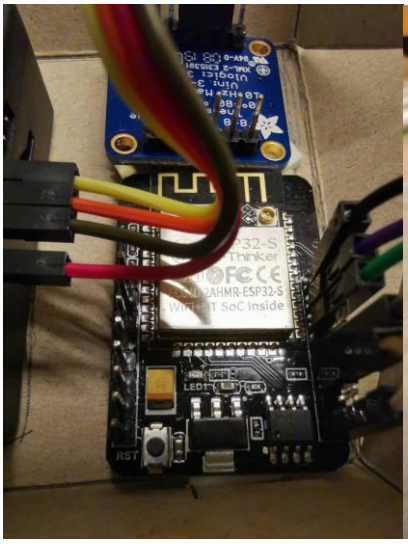
- Sensors –
  - Thermal Camera (AMG 8833) –
    - I2C m5stack connected.
    - 8x8 array of IR thermal sensors.
    - Up to 7 meters (23) feet.
    - Maximum frame rate of 10Hz

  - Camera (ESP 32 Cam)–
    - WIFI built-in
    - MPEG Video Streaming
    - AI Detection
    - Leverage Azure Custom vision AI.

- Battery – Extra 3.7v 2000 mah
- Card Box Layout –

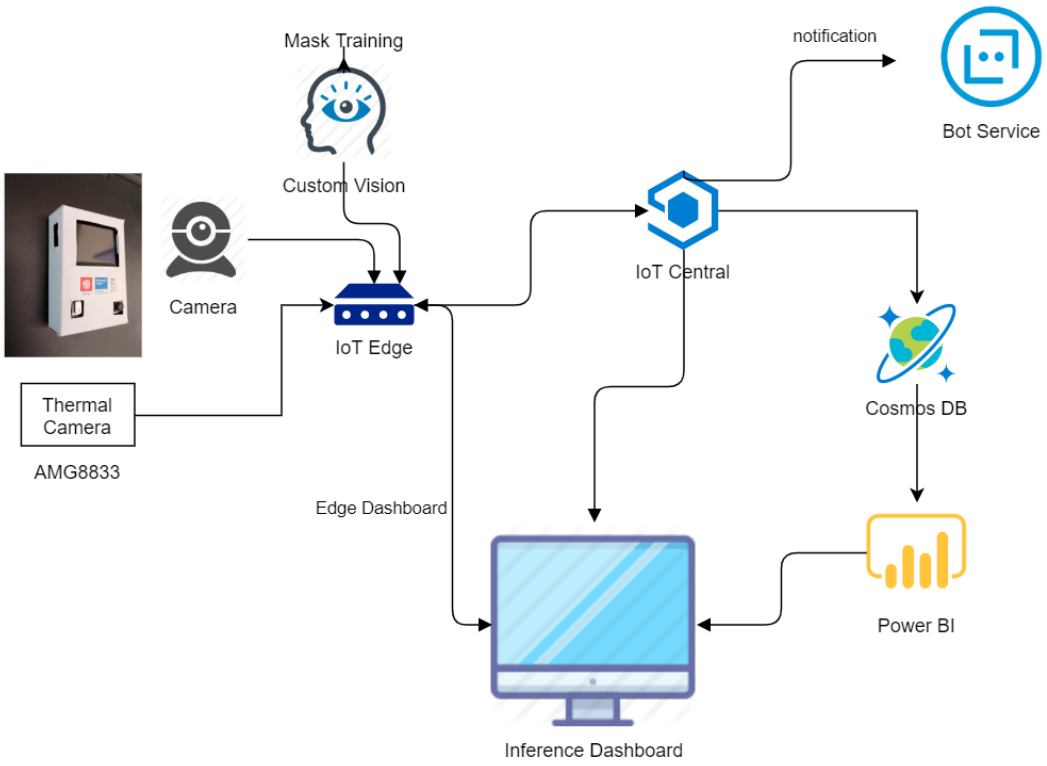


Internal Wired -



4 AI CARE System Architecture –

System Overview



1 Mask Training –
   1. Leverage Azure Custom Vision for mask training in 5 minutes !
   2. Re-train your own dataset to improve your enterprise accuracy.
   3. Deploy AI model as IoT Edge module for quick deployment & distribution.

2 IoT Edge –
   1. AI on Edge for inference performance and data consolidation.
   2. Edge dashboard module for real-time result display.
   3. Large Scale AI Module deployment efficiency.

3 IoT Central –
   1. Overall Coronavirus Epidemic prevention dashboard
   2. Create Your Cross multi-region Summary in 5 mins
   3. Control Sensor device settings and monitoring easily
   4. Notification built-in and quick customization.

4 BoT Service –
   1. Connect to social media notification (Line/Facebook/SMS..etc)
   2. Create your own logic for notification dispatching

5 Power BI + CosmosDB –

1. Enterprise Dashboard for your deep customization UI requirement.
2. Develop your enterprise level dashboard based on IoT Central dataset
3. Quick widgets and drag&drop mode to mash up your complex UI and reporting.

5 Hands-On Guide Tutorial -

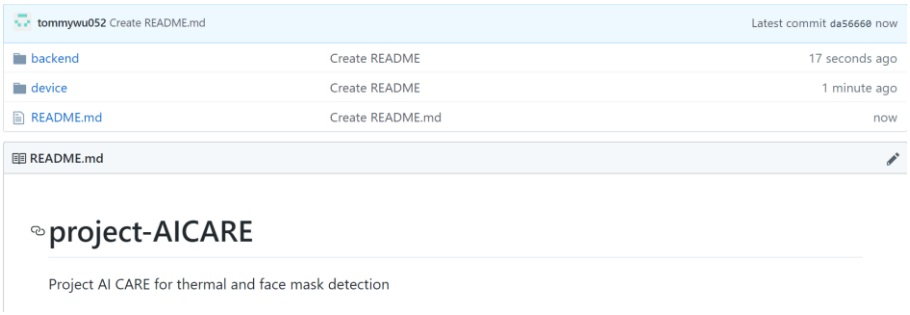
- **Device Side** –

5.1 M5StackCore –

5.1.1 Development & Pinout Reference –

https://docs.m5stack.com/#/en/quick_start/m5core/m5stack_core_get_started_Arduino_Windows

5.1.2 Git clone from - https://github.com/tommywu052/project-AICARE.git

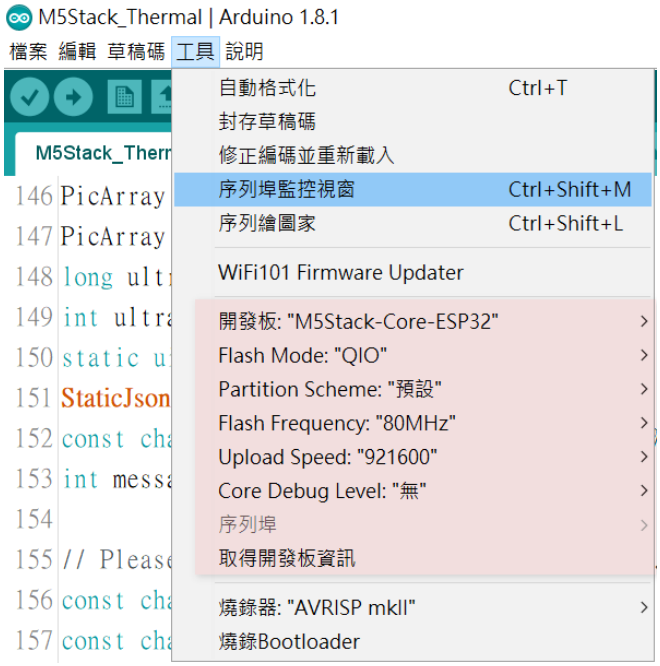


5.1.3 Go to project-AICARE/device/**M5Stack_Thermal**/, modify the code as below for your own wifi ssid / password and Azure IoT Central device connection string.

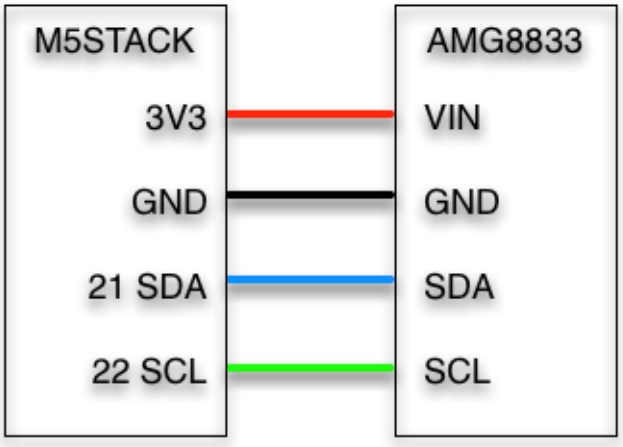
```
// Please input the SSID and password of WiFi.
const char* ssid     = "YourWiFISSID";
const char* password = "YourWiFIPassword";

// Please input connection string of the form "HostName=<host_name>;DeviceId=<device_id>;SharedAccessKey=<device_key>" from IoT Central
static const char* connection_string = "Your Connection String from IoT Central Connect Settings";
```

5.1.4 Flash the modified .ino file into your m5stack core . make sure you have import the related library as m5stack core reference document as step 1.



5.1.5 Port Connection map



5.2 ESP32 CAM –

- Development & Pinout Reference – https://www.instructables.com/id/ESP-32-Camera-Streaming-Video-Over-WiFi-Getting-St/
- ESP32 CAM connect M5stack map –

5.3 Battery –

5.3.1 External Battery Pinout map –

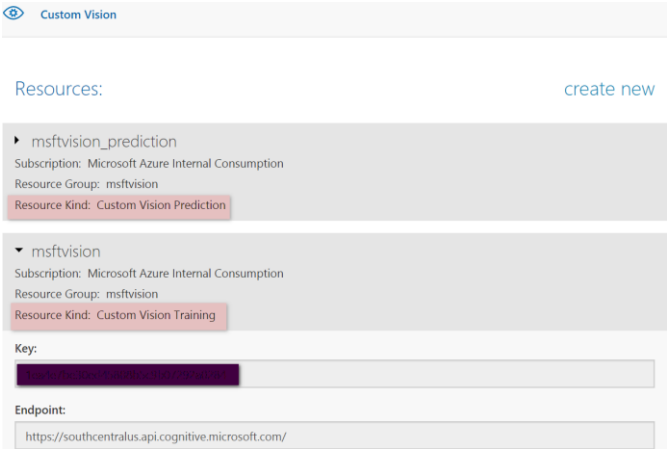
- **Backend Side** –

5.4 Mask Training with Azure Custom Vision –

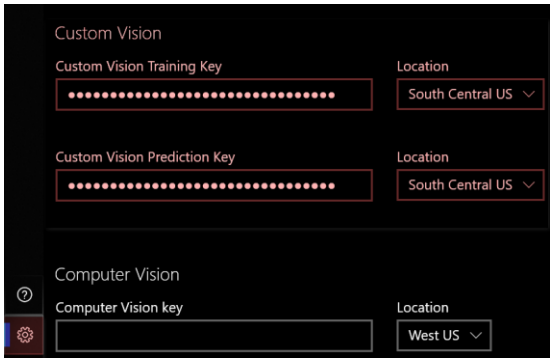
5.4.1 Download Kiosk App : http://aka.ms/kioskapp

5.4.2 Setting your training & prediction key in kiosk app from https://www.customvision.ai/ website.

In Custom Vision Website Keys -



In Kiosk App Settings –

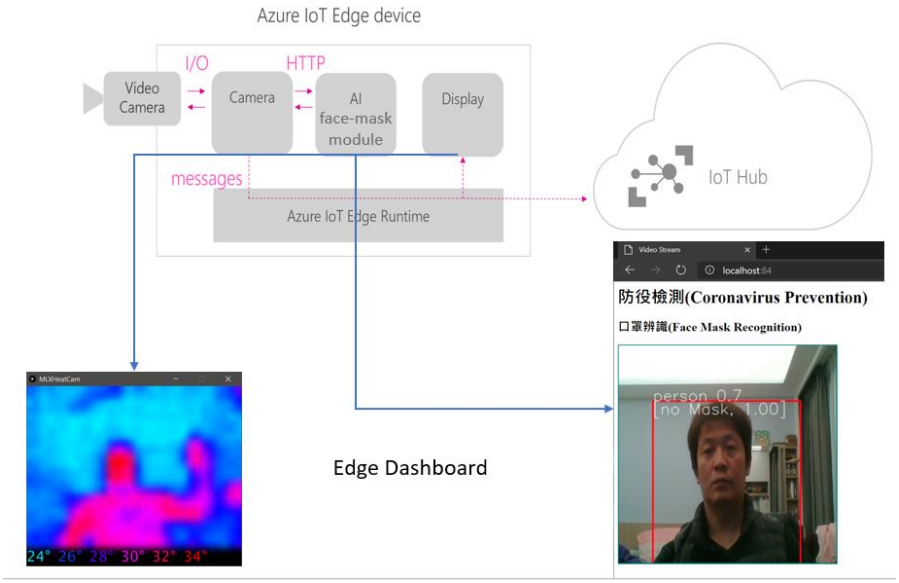


5.4.3 Mask Training Steps with Custom Vision AI –

- Leverage Azure Custom Vision for mask training in 5 minutes !
- Add Common Images by Bing Search Engine.
- Add Your own mask training images with camera or local images to improve accuracy.
- One-click training and export AI model for real-time testing
- Deploy as IoT Edge module for scale deployment.

5.5 Edge Computing with Azure IoT Edge -

- Web service over HTTP running locally that takes in images and classifies them based on a custom model built via the Custom Vision
- Can be deployed and configured via Cloud
- Can leverage Edge device like GPU/VPU/FPGA to improve the inference
- Adapt to different acceleration framework like OpenVINO, CUDA , DeepStream, ONNXRT and etc.

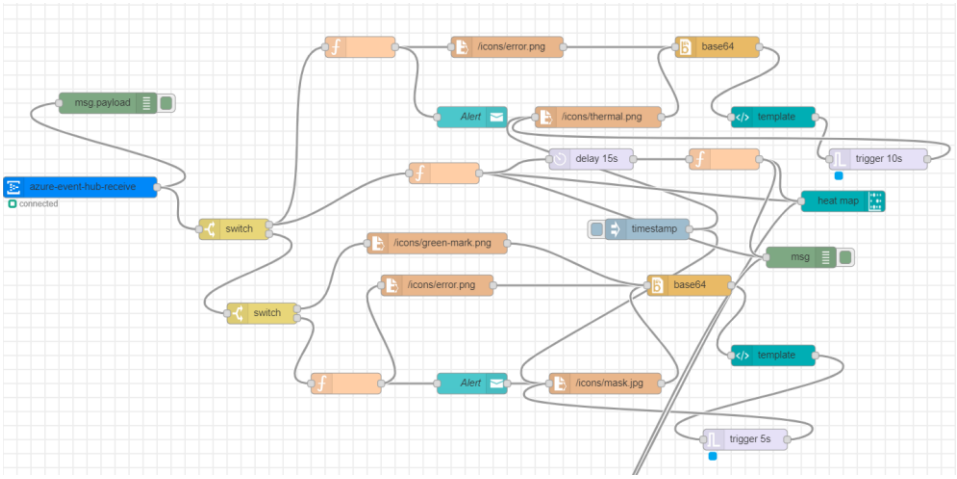


5.5.1 Refer the document https://github.com/Azure-Samples/Custom-vision-service-iot-edge-raspberry-pi/tree/master/ for IoT Edge setup, remember to choose amd64 for x64 platform.

5.5.2 Install the node-red IoT Edge module as - https://github.com/iotblackbelt/noderededgemodule

5.5.3 Import the code from https://github.com/tommywu052/project-AICARE/blob/master/backe

nd/IoTEdge/AICare-nodered-flows.json into your node-red edge.



Review Your UI widget as http://localhost:yourport/ui

5.5.4 Export Custom vision model as IoT Edge and copy **model.pb** and **labels.txt** from the zip file into docker images via docker cp.

docker images

REPOSITORY TAG

IMAGE ID CREATED SIZE

a9publicregistry.azurecr.io/imageclassification 0.3.8-maskai

0be0b6d56941 2 days ago 1.57GB

docker cp model.pb 0be0b6d56941:/app/model/model.pb

docker cp labels.txt 0be0b6d56941:/app/model/labels.txt

5.5.5 Get the inference code from - https://github.com/tommywu052/project-AICARE/blob/master/backend/IoTEdge/yolocv-public.py

Modify the code - line 22-24 as your device key on IoT Central :

```
21  #iot central initalize
22  deviceId = "your device id on iot central"
23  scopeId = "iot central scope id"
24  mkey = "SAS Key on IoT Central"
```

Modify the code – line 63 as your image inference host at 5.5.1 step

```
63    IMAGE_PROCESSING_ENDPOINT = 'http://localhost:8081/classify/helmets'
```

Modify the code – line 261 as your ESP32 CAM streaming IP (ex:192.168.43.138, port 81 is default MJPEG streaming)

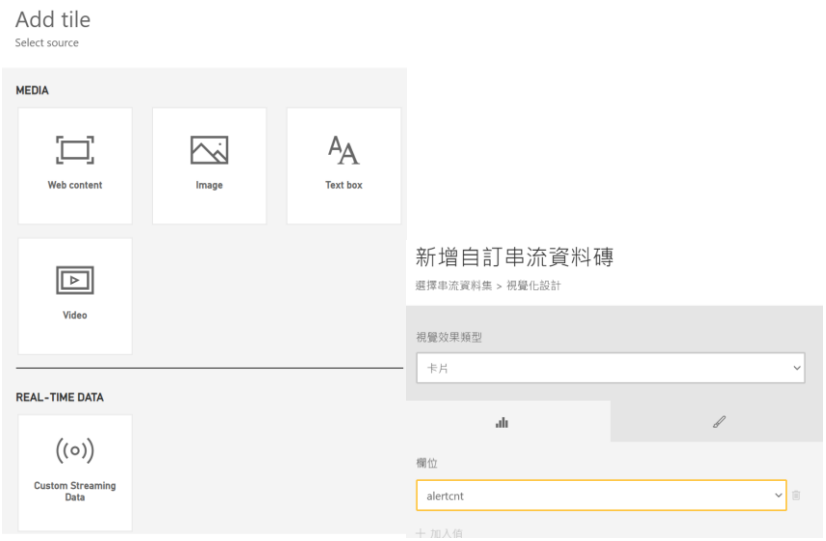
```
261    url="http://192.168.43.138:81/stream"
```

5.6 Power BI Dashboard -

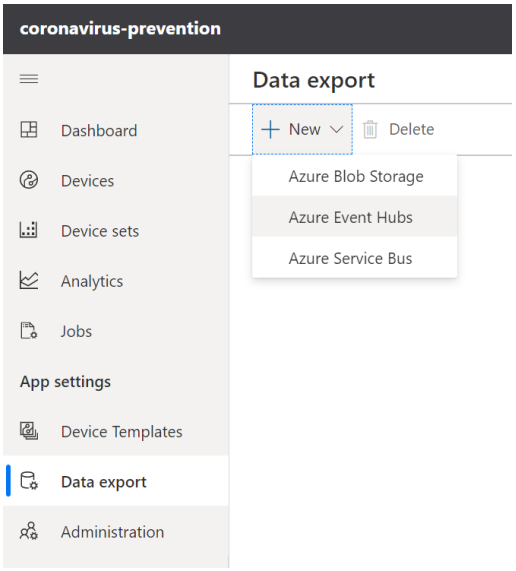
- In few clicks, you can set up an end-to-end solution that pulls exported Edge measurements, devices, and device templates data from IoT Central
- Power BI Solution for creates the data pipeline in your IoT Central that brings data from your Azure Event Hub

5.6.1 Refer the document for Real-Time Streaming – https://docs.microsoft.com/zh-tw/power-bi/service-real-time-streaming

5.6.2 Add Real-Time widget with Web Content and Streaming data set - https://docs.microsoft.com/zh-tw/power-bi/service-dashboard-add-widget



5.6.3 Note – Data on real-time dashboard is coming from IoT Central export as Azure Event Hubs-



5.7 IoT Device Control and Monitoring on IoT Central -

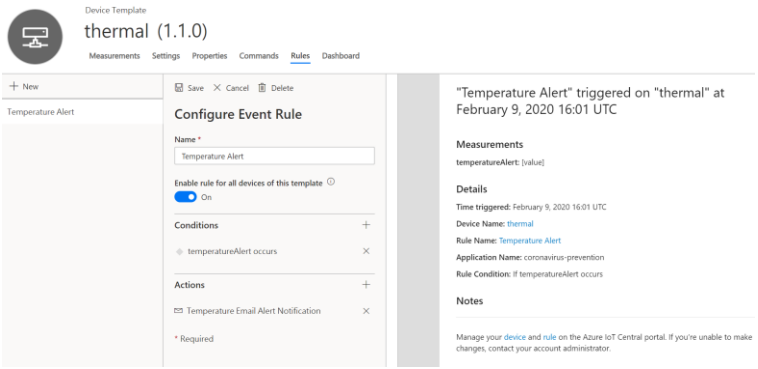
- Summary Dashboard - Data from Thermal/Camera Sensors and Alert Notification Triggered
- Device Control & Monitoring through command/settings pages

5.7.1 Refer the document to Create Your IoT Central Dashboard Application - https://docs.microsoft.com/zh-tw/azure/iot-central/core/quick-deploy-iot-central

5.7.2 Device Configuration –

Configure your device telemetry/settings/command/triggers on the device template (mapping the code on the device side Arduino and python code)

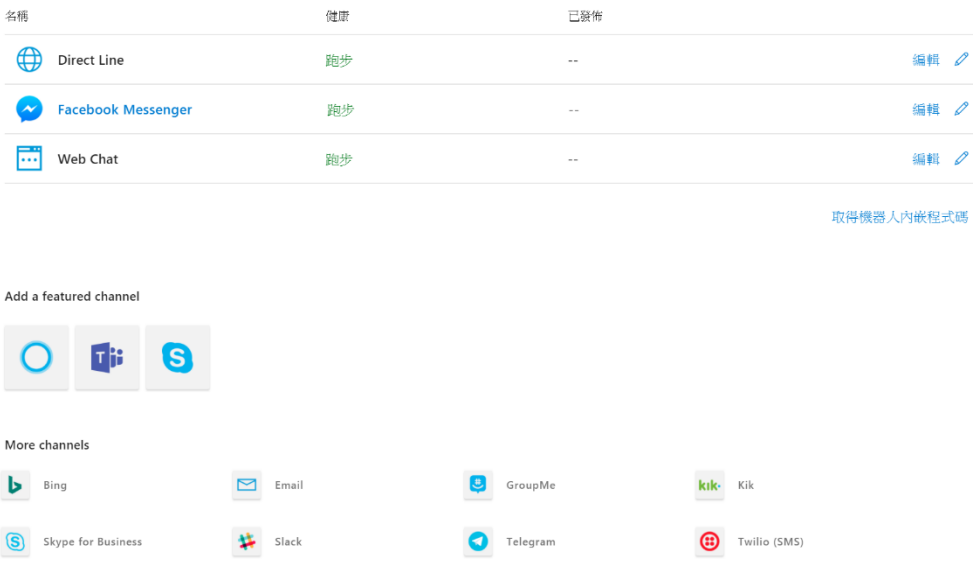
5.7.3 Enable Alert Notification – https://docs.microsoft.com/zh-tw/azure/iot-central/core/quick-configure-rules



5.7.4 If you just want to copy my existing application template quickly , Please create your application based my share template, click the below - https://apps.azureiotcentral.com/build/new/7490af0a-4e9c-4b54-b7a6-bd0c6092e522

5.8 (To-Do) Azure BOT service integration –

- Real-time notification for multiple social media channels (LINE/FB/..).
- Integrate speech service for interactive notification.
- No-Code for channels integration.
- Flexible and Extensible



Check this for more detail notification - https://docs.microsoft.com/zh-tw/azure/bot-service/bot-builder-tutorial-basic-deploy?view=azure-bot-service-4.0&tabs=csharp

LINE Integration - https://docs.microsoft.com/zh-tw/azure/bot-service/bot-service-channel-connect-line?view=azure-bot-service-4.0

6 Demo Video Reference –

6.1 AI Care Edge Demo - https://youtu.be/Wh_21go4Thg

6.2 AI Care Device hands-on - https://youtu.be/d4HqonLCNmM

6.3 Mask Training by Custom Vision - https://youtu.be/eEb9vfvgW0g

6.4 Mask Inference Demo with Custom Vision on IoT Edge - https://youtu.be/dXDriffeE6Q

7 Feedback -

Welcome and Improve the code based on your advanced requirement .Please contact towu@microsoft.com or submit request on the github. Thanks !