



Azure Intelligent Edge Brief

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Agenda

- Azure Intelligent Edge Overview and News
- Today's Focus Area:
 - **Detecting safety violations using Azure Data Box Edge and Cognitive Services – Marvin Garcia, CSA**
- Q&A

But First - What is the AIEB?

30-minute briefing open to everyone to discuss a specific area within our 'Intelligent Edge' offerings

Not a forum to share NDA information

Using 'regular' Teams for now for easier collaboration (Q&A, discussion, etc.)

Calls will be recorded and posted here: <https://aka.ms/aieb-channel>

Some quick news...

- Azure Stack Update 1.1907.0.20 released
 - <https://docs.microsoft.com/en-us/azure-stack/operator/azure-stack-release-notes-1907>
 - Enhancements to the diagnostic log collection service
 - Improvements to time it takes to start and stop Azure Stack.
- Deploying Cognitive Services to Azure Stack:
<https://docs.microsoft.com/en-us/azure-stack/user/azure-stack-solution-template-cognitive-services>
- Azure Data Box Heavy now available: <https://azure.microsoft.com/en-us/blog/azure-data-box-heavy-is-now-generally-available/>

Detecting safety violations using Azure Data Box Edge and Cognitive Services – Marvin Garcia, CSA

Business Justification

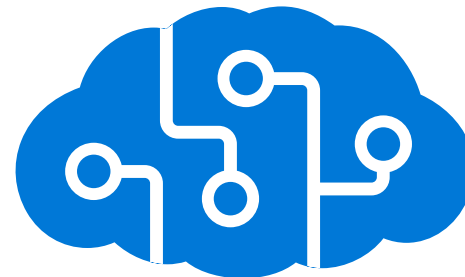
- 35+ worldwide plants and factories for production of fuel tanks and fuel cells.
- High product quality; but concerning scrap levels.
- Floor employees place defective and suspicious tanks on the floor due to lack of rack space or laziness.
- Tanks deform themselves when placed on the floor for too long, leading to increased scrap and objects in the way of work:
safety concern.
- Floor employees using their cell phone or not wearing safety glasses while on the factory floor: safety code violations.

Business Requirements

- Use a POC to implement an automated, cost-effective and scalable system to identify certain situations on the factory floor.
- Provide notifications to floor managers when safety violations take place.
- Provide insights to leadership about safety code compliance.



Data Box Edge

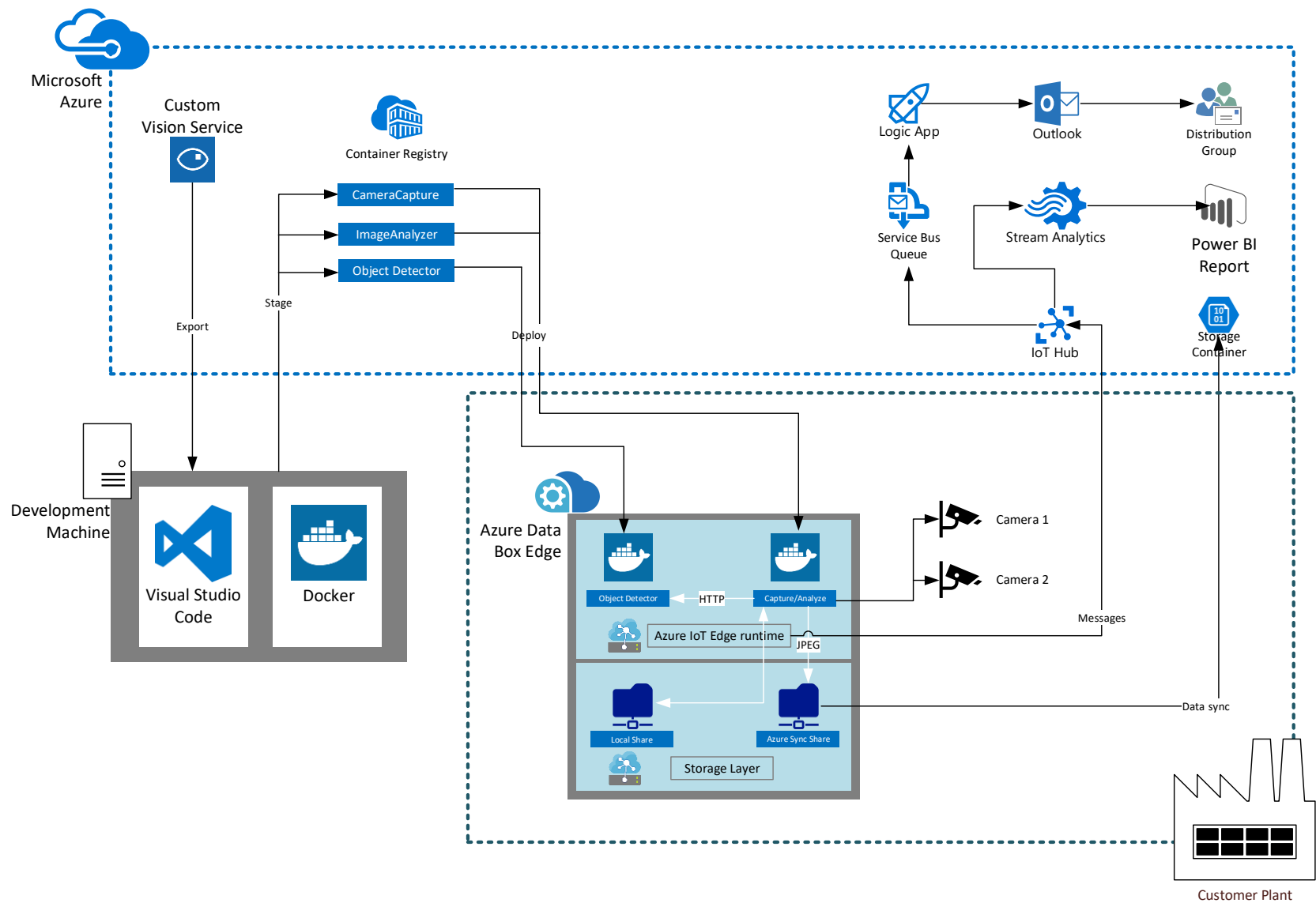


Cognitive Services
Computer Vision

POC scope

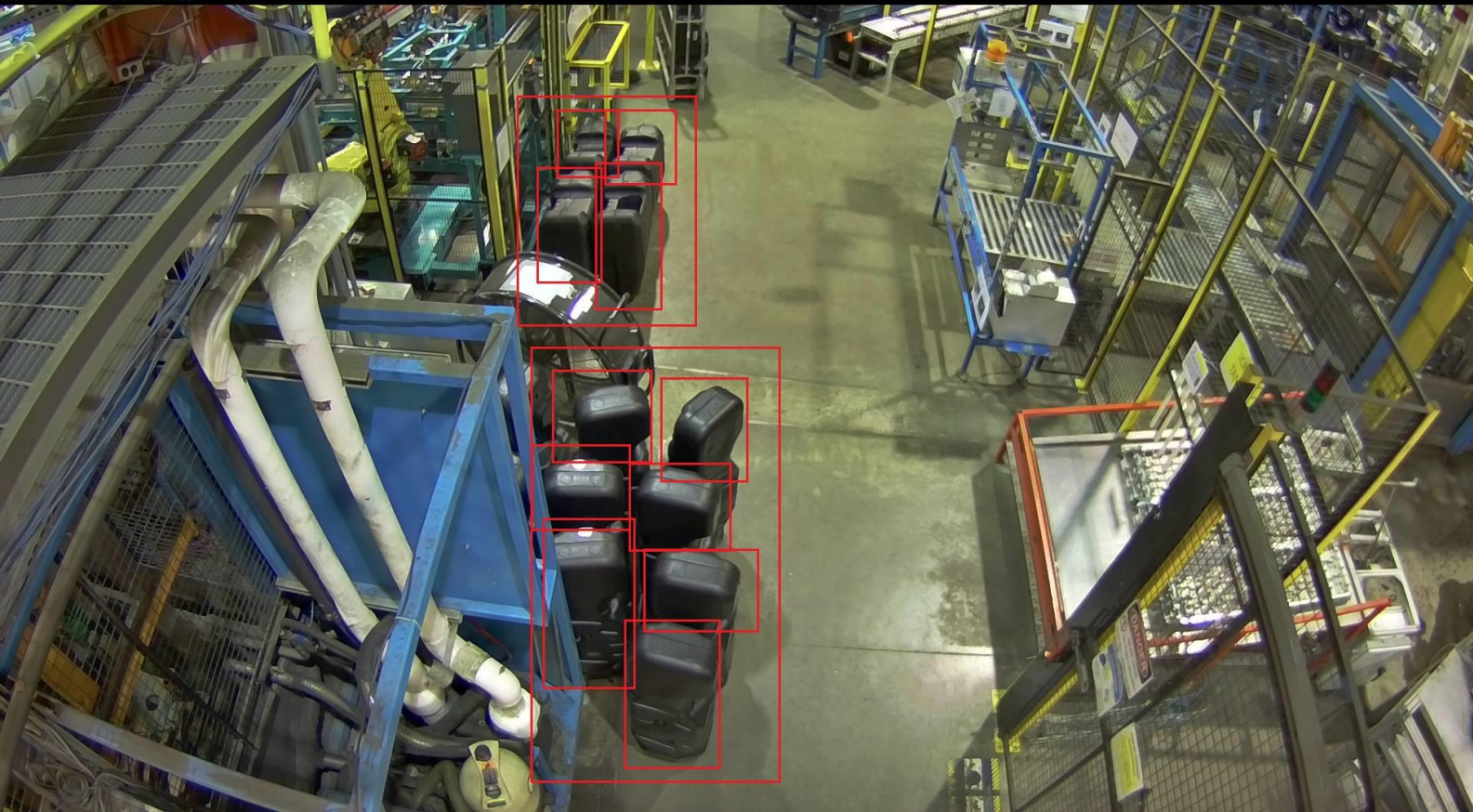
- Capture images from 2 IP cameras to identify safety violations.
- Send notifications to floor managers through different channels.
- Provide reporting and insights over safety violations.
- Every situation can have its own verification frequency. E.g. System must check for people using their phones or not wearing googles every 5 minutes, but tanks on the floor must be checked every hour.
- Provide easy and repeatable way to improve the accuracy of the AI model.

POC Architecture Diagram



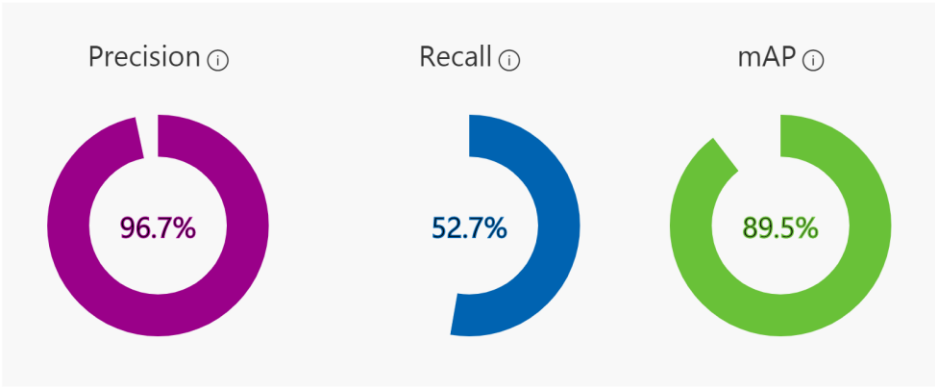
Custom Vision

Object detection tagging strategy



Iteration 3

Finished training on 6/25/2019, 8:12:40 PM using General (compact) domain
Iteration id: d4b0c186-2cc6-4f95-bca5-a2de730dd3cb



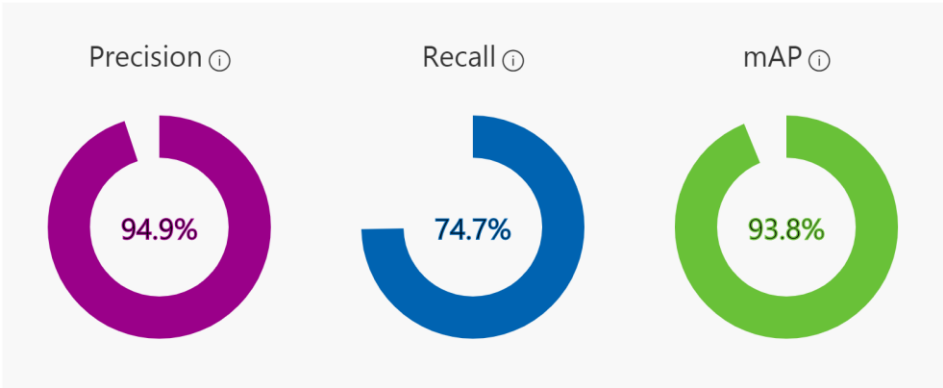
Performance Per Tag

Tag	Precision ^	Recall	A.P.	Image count ^
person_with_phone	100.0%	33.3%	100.0%	15
tank_on_floor	100.0%	39.4%	75.3%	81
person	93.8%	78.9%	93.3%	54



Iteration 6

Finished training on 6/26/2019, 7:10:43 AM using **General (compact)** domain
Iteration id: 5dbf6560-1a99-4e50-bb81-8b9e7b3b19cd



Performance Per Tag

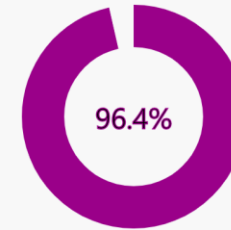
Tag	Precision ^	Recall	A.P.	Image count ⚠
person_with_phone	100.0%	100.0%	100.0%	15 <div></div>
tank_on_floor	94.7%	73.5%	90.3%	150 <div></div>
person	94.4%	73.9%	91.0%	93 <div></div>



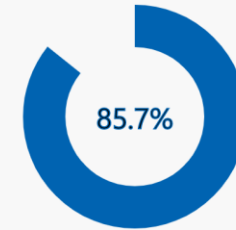
Iteration 10

Finished training on 6/27/2019, 1:57:14 PM using **General (compact)** domain
Iteration id: 46bf70db-5821-4a0d-aa47-3adae1efa124

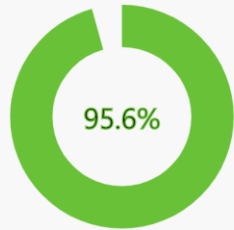
Precision ⓘ



Recall ⓘ



mAP ⓘ



Performance Per Tag

Tag	Precision ^	Recall	A.P.	Image count ⚠
person_with_phone	100.0%	87.5%	100.0%	41 <div><div style="width: 100%;"></div></div>
tank_on_floor	97.4%	89.4%	93.6%	290 <div><div style="width: 100%;"></div></div>
person	92.6%	75.8%	93.2%	123 <div><div style="width: 100%;"></div></div>

Azure IoT Edge Solution

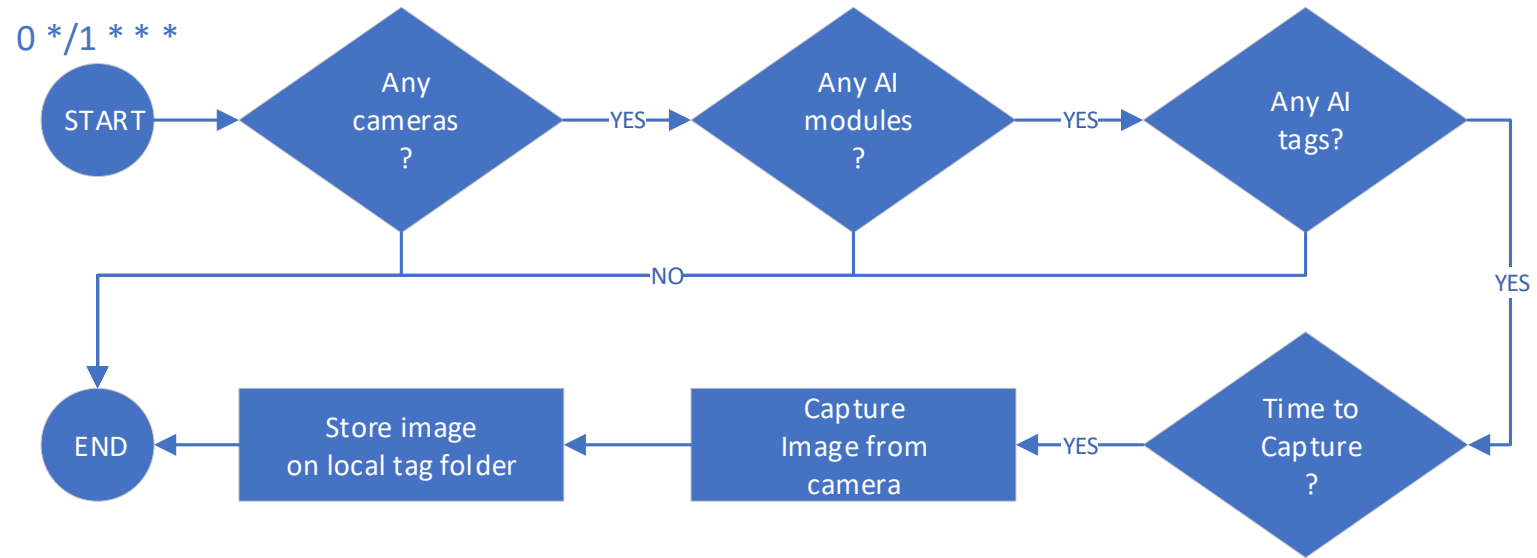
Check source code at

<https://github.com/marvin-garcia/edgesafetyviolationsdetection>

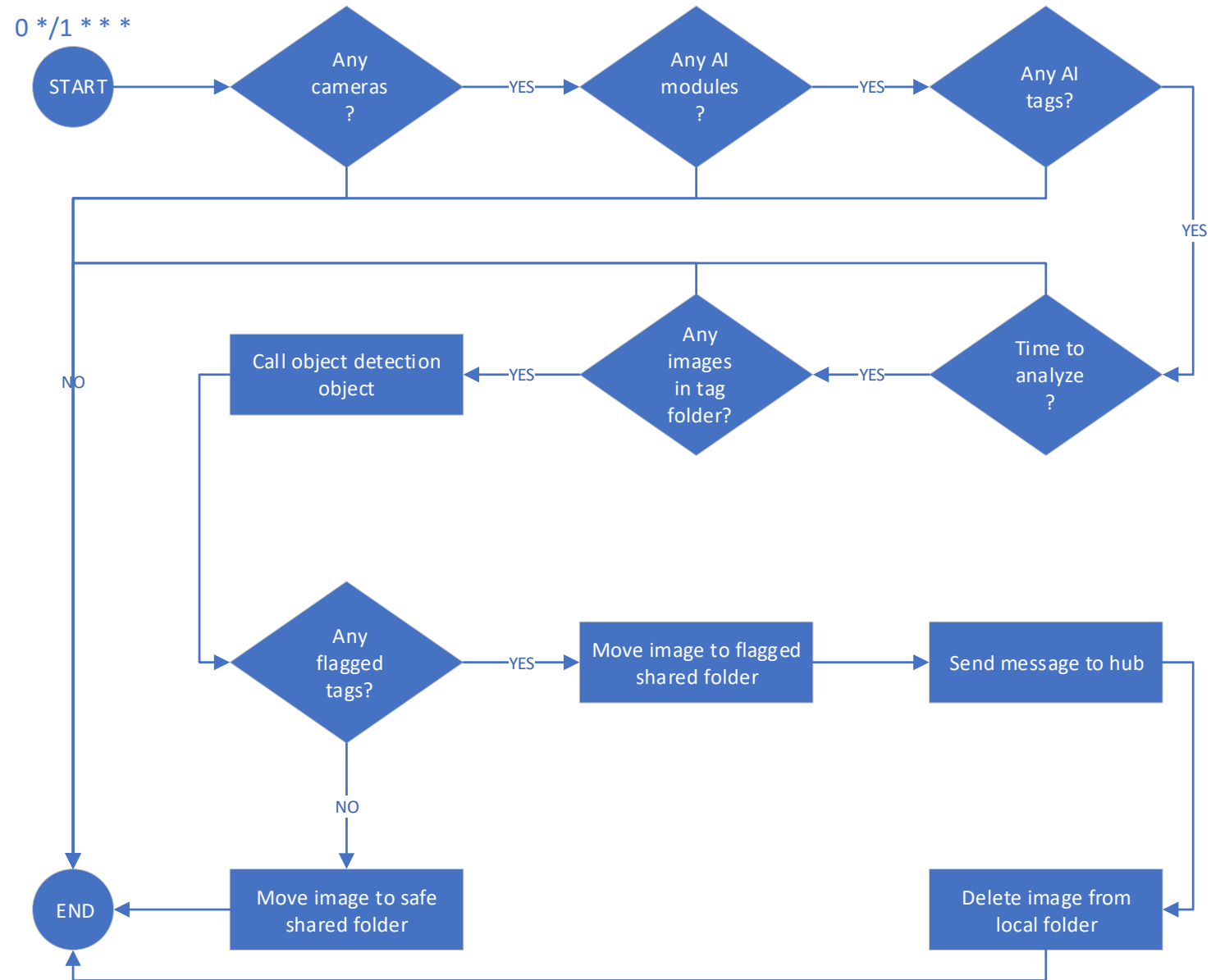
Env Settings Template

```
env_settings.template.json ▸ ...
1  {
2    "CameraDevices": [
3      {
4        "Id": "camera1",
5        "ImageEndpoint": "http://<camera-ip>",
6        "Username": "<user>",
7        "Password": "<password>",
8        "LocalFolder": "/home/local/camera1",
9        "OutputFolder": "/home/output/camera1",
10       "CaptureTimeInterval": 5,
11       "AIModules": [
12         {
13           "Name": "camera1",
14           "ScoringEndpoint": "http://camera1objectdetection/image",
15           "Tags": [
16             {
17               "Name": "tag1",
18               "Probability": 0.5,
19               "AnalyzeTimeInterval": 60
20             },
21             {
22               "Name": "tag2",
23               "Probability": 0.5,
24               "AnalyzeTimeInterval": 5
25             }
26           ]
27         }
28       ]
29     }
30   ],
31   "Properties": [
32     {
33       "Name": "StorageAccountName",
34       "Value": "<storage-acct-name>"
35     },
36     {
37       "Name": "DBEShareContainerName",
38       "Value": "<share-container-name>"
39     },
40     {
41       "Name": "TimerIntervalInSeconds",
42       "Value": 60
43     },
44     {
45       "Name": "LogLevel",
46       "Value": "Debug"
47     }
48   ]
49 }
```

Store Image module flow



Analyze Image module flow



Lessons learned during the POC

Lessons learned

- Data Box Edge
 - May take 10-12 days to arrive to its destination.
 - With a 30Mbps Internet connection, the Data Box Edge device can take 3-10 hours to apply updates. Update 1905 is needed in order to push FPGA-compatible modules.
 - When configuring the compute layer of the Data Box Edge, it is recommended to do the advanced configuration because it allows the use of different IoT Hub tiers and enables pushing modules and more complex deployments through the hub.
 - Debugging the device is complicated, and it requires access to the same network.
 - It has a timer trigger which works great for tasks like cleaning shares folders, but it's not recommended for recurring code invokes. It's better to handle a timer inside the code.

Lessons learned

- Azure IoT Edge module development
 - Visual Studio Code is the preferred developer platform for IoT Edge solutions.
 - Name modules and paths all lower-case to be consistent with the Linux platform.
 - Do not use the built-in **Build and Push IoT Edge module** functionality from Visual Studio Code, it does not automatically increase the docker image tag, therefore there is not traceability of changes.
 - Establish a DevOps pipeline to build and push docker images whenever code changes take place, and then push the deployment updates to the IoT Hub.
 - There is trade-off between creating a module to analyze each camera or one to analyze them all. The key is in how to provide settings and the amount of duplicated code to maintain.
 - Use async methods as much as possible to enable concurrency and parallel tasking.
 - Log everything! Use log levels to easily gather/ignore messages in dev and production.

Lessons learned

- Cognitive Services Custom Vision
 - Some situations may need a high precision, others high recall, and sometimes both. This POC valued recall over precision.
 - Can't stress this enough: **the larger the dataset, the better the training results.**
 - Don't use the **Fast Training** option for complex POCs or production.
 - Try different tagging strategies until you reach acceptable results.
- IP cameras
 - Pay attention to the authentication type that is set up in the cameras.
 - Choose the right compression algorithm to prevent maxing out the shared storage capacity.



**Next AIEB Call will be 8/16 @ 11AM US
Central Standard Time**