# Predictive Maintenance (with a Thermal Imaging Camera, vibration sensors, etc.)

need to fill out these templates: Documentation Sub-committee

PTL- Vladimir Suvorov - 17 September 2020 through 17 September 2021

## Use Case Details:

<add in the taxonomy image from the white paper>


### Use Case - Predictive Maintenance using a Thermal Imaging Camera

| Attributes | Description | Informational |
|---|---|---|
| Type | New | New |
| Industry Sector | IoT Device Edge | |
| Business driver | Predictive Maintenance | |

| | | |
|---|---|---|
| Business use cases | Many devices give off hints that they will need to have maintenance earlier than their scheduled maintenance. Through Machine Learning (ML), we can create models that will allow us to know that a device will soon need maintenance. For many machines, we can gain a great deal of information on the health of the device by looking at the temperature of the device. This requires collecting the data and then sending it to a Historian or similar device. These data points can be sent to the cloud to be modeled.<br><br>Other requirements<br><br>• Need to take the current temperature of the device and react in near real-time to rising temperature<br>  ○ Example: If over 150 C- send out a warning to an email list, show warning on a UI<br>  if over 180 C trigger light or horn<br>  if over 200 C trigger shutdown process<br><br>Other variations:<br><br>Monitoring restricted spaces<br><br>• If a human enters in a space,<br>  ○ first level of restriction- sound an alarm and turn on lights<br>  ○ second level- start the shutdown process | Predictive maintenance: There are many different types of models. For example, many models do not need to be done in real-time. Thus, the data can be sent to the Cloud and processed. The data is not time critical, so if there is a delay in sending/receiving data, the data will need to be stored and then sent when the network is available.<br><br>Yet, there are many scenarios, where real-time or near real-time is required. An example of this would be a machine reaching a maximum temperature. As it approaches this, we would want to send out a warning and then if it reached this critical temperature, the device needs to be shut down.<br><br>For this type of scenario, there needs to be a server or space on the IoT gateway that can process the data in real-time. |
| Business Cost - Initial Build Cost Target Objective | Cost is only for the hardware- | |
| Business Cost – Target Operational Objective | varies widely depending on accessories. The IoT Gateway can be under $500 to over $5,000 | |
| Security need | Because of the remoteness of the devices, need the ability to control ports (turn on /off) | |
| Regulations | Varies depending on local regulations | |
| Other restrictions | | |
| Additional details | | |

## Family- IoT Device Edge-

| Use Case Attributes | Description | Informational |
|---|---|---|
| Type | New | |
| Blueprint Family - Proposed Name | IoT-Device Edge | There are many possible UCs that would be IIoT, so these only are designed to handle Predictive Maintenance UCs |
| Use Case | Predictive Maintenance using a FLIR Camera | See below |

| | | |
|---|---|---|
| Blueprint proposed | Predictive Maintenance- Using FLIR Camera | |
| Initial POD Cost (capex) | Varies widely depending on the Blueprint | |
| Scale of Servers | one at the User Edge | this is the IoT Gateway |
| Applications (Edge Virtual Network Functions) | EVE | |
| Power Restrictions | None/Varies | ▪ none for the FLIR, but another blueprint might need it |
| Preferred Infrastructure orchestration | Docker/K8 - Container Orchestration<br><br>OS - Linux | |
| Additional Details | | |

## BluePrint (Species) - Predictive Maintenance- with a Thermal Imaging Camera

| Case Attributes | Description | Informational |
|---|---|---|
| Type | New | |
| Blueprint Family - Proposed Name | IoT Device Edge | IIoT == Industrial Internet of Things<br><br>PM == Predictive Maintenance |
| Use Case | Any Predictive Maintenance UC that is on the shop floor | With a few modifications, it is possible to change this blueprint to meet many similar Use Cases |
| Blueprint proposed Name | Predictive Maintenance using a FLIR Camera | |
| Initial POD Cost (capex) | Under $20k<br><br>FLIR Camera-<br><br>IoT Gateway- Advantech- Model UNO<br><br>LFEdge's Adam or similar<br><br>Fledge | This is the set up for the FLIR Fledge/EVE demo<br><br>▪ the demo uses ZEDEDA instead of LF Edge's Adam |
| Scale & Type of Server | 1 IoT Gateway, a server on the edge is not needed | This is on the customer edge, thus there is no server. The IoT Gateway will handle the connection to the internet. |
| Applications | Fledge, Ubuntu, code for the demo | |
| Power Restrictions | NA | none of the devices require power that is outside of a normal wall socket |
| Infrastructure orchestration | EVE<br><br>VM- Ubuntu | EVE acts as the OS and will have a containerized version of Ubuntu and Fledge on it |
| SDN (Software Defined Networking) | None | |
| Workload Type | • Containers (Tensoflow, Keras containers)<br>• VM- Ubuntu | |
| Additional Details | | |

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