How Machine Learning, IoT and Artificial Intelligence Will Change Your Business

Sam Lakkundi - OSIsoft

OSIsoft - 37 years of helping metals/mining/power companies achieve excellence

For 37 years OSIsoft has provided solutions

19,200 +

PI Installations

OSIsoft PI Peruvian Mining, Oil and Gas & Power Customers

MM&M

O&G

Power

The Digital Mine

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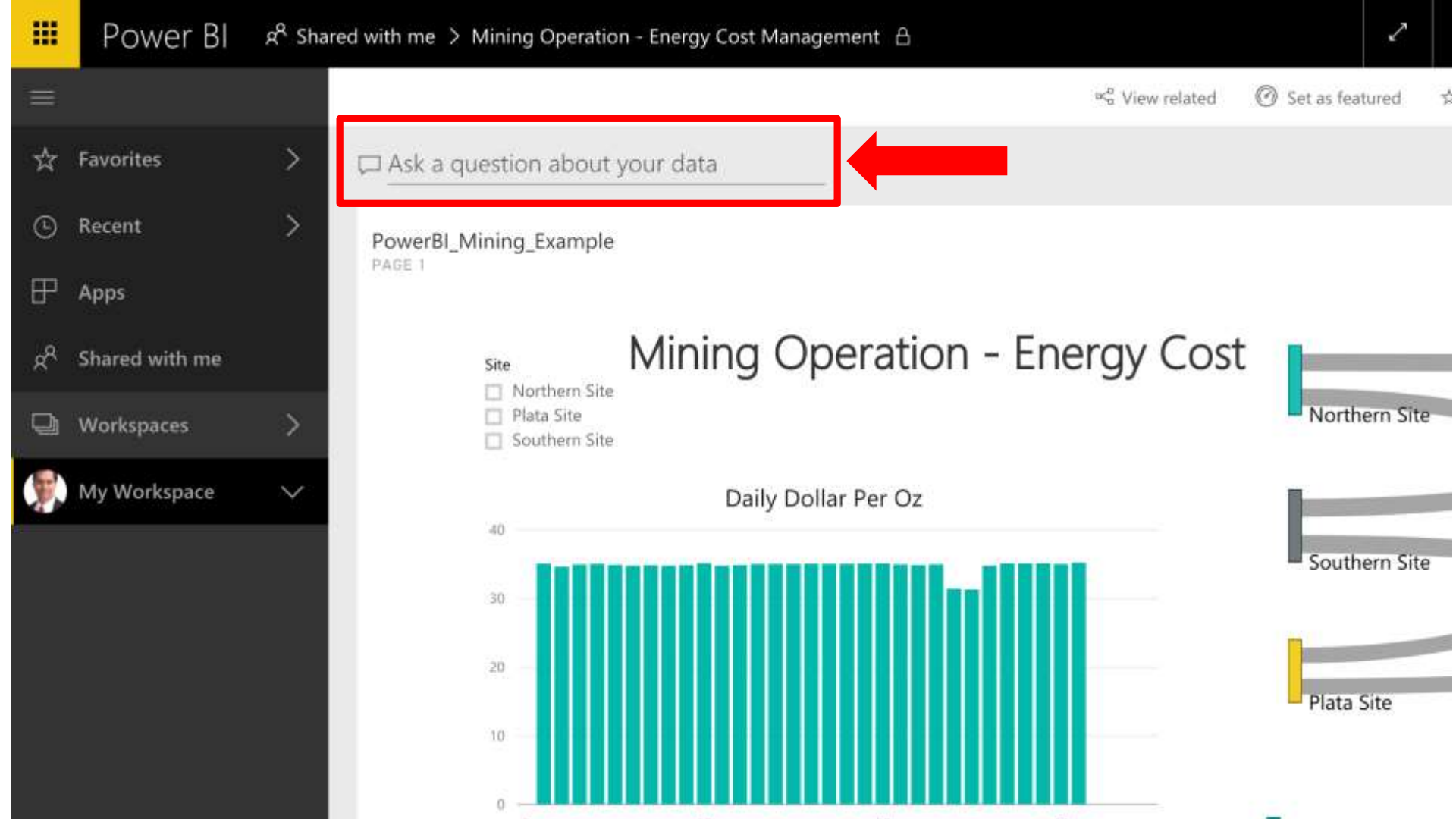
Iot/Machine
Learning/AI
Enters Mines?

Machine Learning (ML)

- Machine-learning algorithms are considered the next step for digital mine transformation.
  - Use real-time PI data to automatically warn operators and maintenance crews of downtime hours in advance
  - Predict pump pressure spikes 24 hours before they happen
  - ML assessment of ore fragmentation in underground and open-pit operations.
  - Machine learning can be used to answer the question: “where to explore?”


Power BI
Shared with me > Mining Operation - Energy Cost Management
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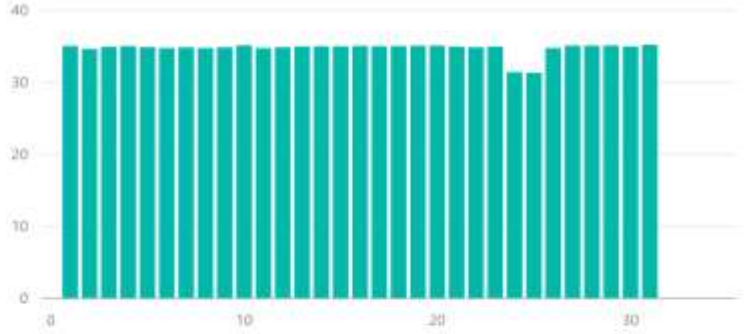
Ask a question about your data
PowerBI_Mining_Example
PAGE 1
Mining Operation - Energy Cost
Site
Northern Site
Plata Site
Southern Site
Daily Dollar Per Oz
40
30
20
10
0
Northern Site
Southern Site
Plata Site

Ask a question about your data

Mining Operation - Energy Cost

Site
- Northern Site
- Plata Site
- Southern Site

Daily Dollar Per Oz

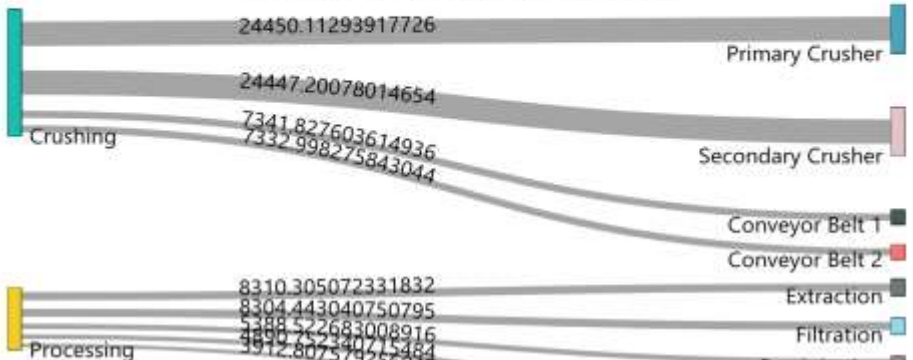


Daily Ore Specific Energy

Daily Platinum Production

Average Hourly Ore Throughput

Average Hourly Energy Consumption



Internet Of Things (IoT) & OSIsoft Edge Computing

- **Edge computing** may also help miners deploy machine-learning algorithms more quickly and without the need for high-speed internet.
- **Edge computing and the internet of things (IoT)** enable algorithms to be processed where the things are. Accordingly, edge computing enables machine-learning processing on the mine site.
- With IoT you can **automate vehicles using sensors** (laser range- finders, radar, electromagnetic antennae, ultrasound, cameras)
- **Monitor** and automate heavy fixed assets
- **Connect dispersed,** diverse and remote operations

Data From Sensors

32 Sensors

120 Sensors

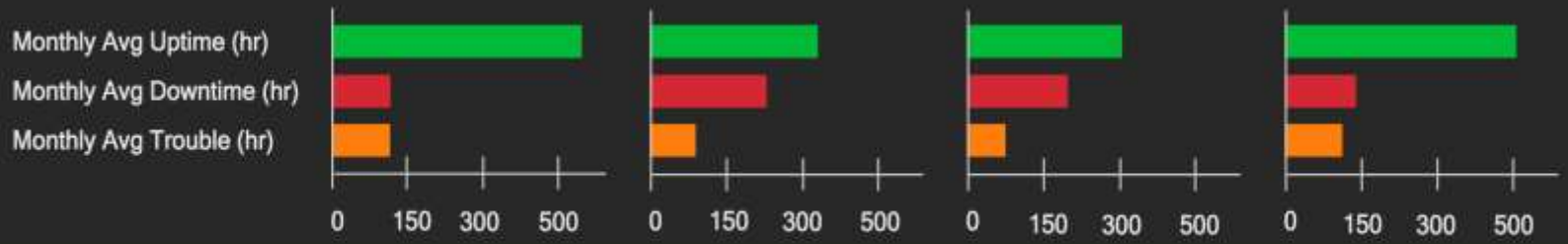
40 Sensors

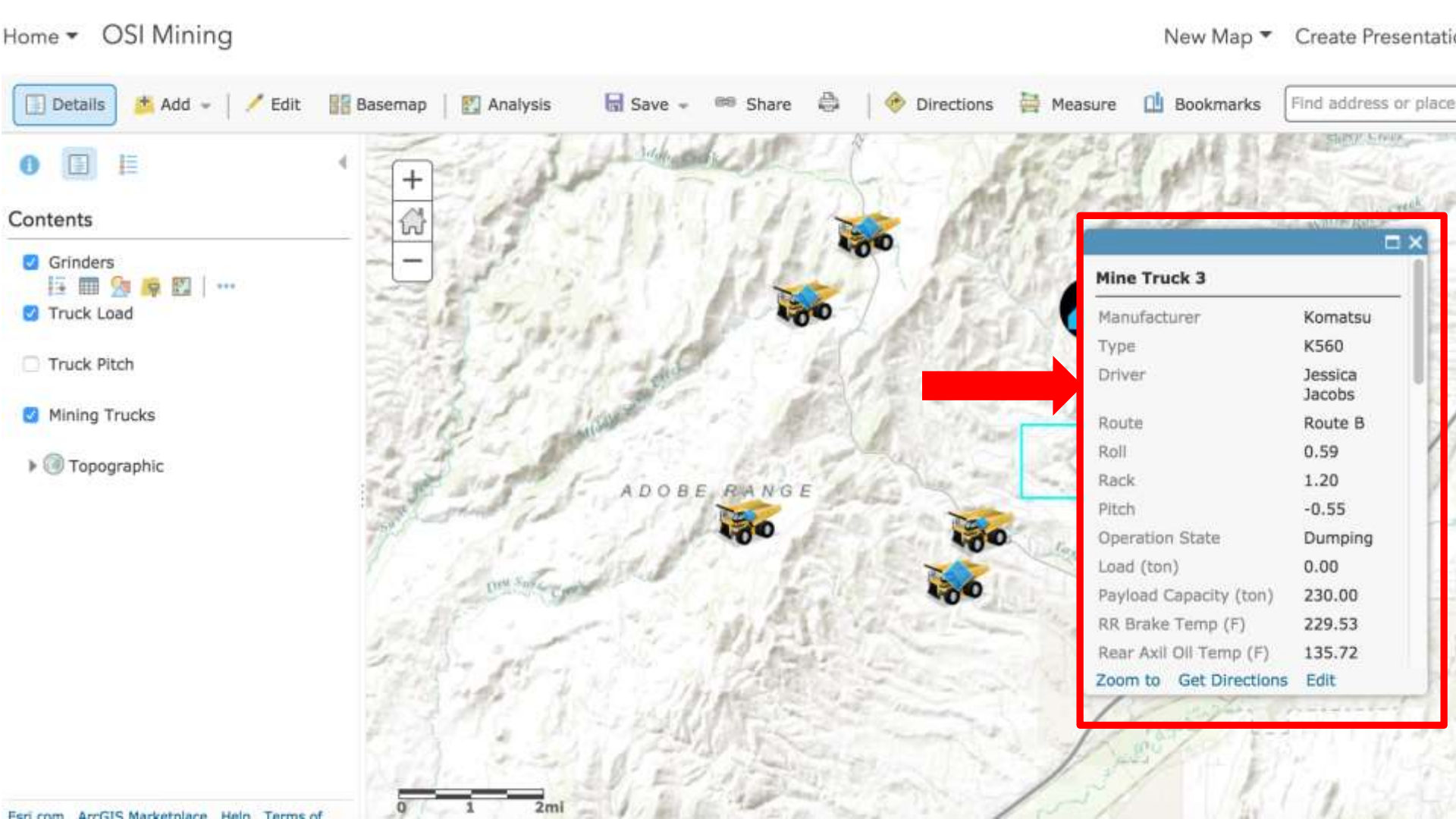
https://edgegateway.osisoft.int/#/ar/Asset%201/ga...
2
Asset Dashboard
Bars
Table
Chart
Assets
Getting Started
Proximity Sensor
Light Sensor
Z
Alpha
Phone
X
Beta
Gamma
Y
A-β-Γ Orientation Sensors
X-Y-Z Acceleration Sensors
JS chart by amCharts
351.0
8.7
-54.7
5.0 ft-c
26.2 cm
-7.8 m/s2
-1.4 m/s2
-5.6 m/s2
Alpha spin
Beta spin
Gamma spin
Light
Proximity
X-axis
Y-axis
Z-axis

https://edgegateway.osisoft.int/#
2
Asset Dashboard
Getting Started
JS chart by amCharts
Average Beta Spin: 24.643
Average Proximity: 34.886 cm
Max Z-Axis Acceleration: 4.710 m/s2
Minimum Light Level: 3.240 ft-c
0
20
40
60
80
100
View Assets

OSI Mining Asset Health Dashboard

Compressors	Blowers	Pumps	Grinders
3 out of 4 are running	1 out of 5 are running	3 out of 5 are running	5 out of 7 are running
Avg Run Hours Since Last Maintenance	9,999.62 h	8,704.25 h	7,177.00 h	1,300.00 h



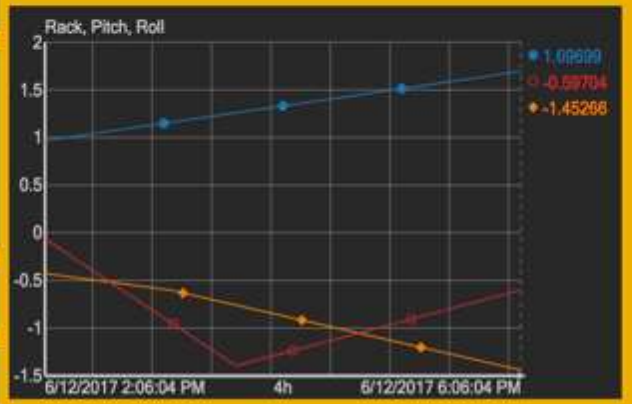

Home
OSI Mining
New Map
Create Presentati
Details
Add
Edit
Basemap
Analysis
Save
Share
Directions
Measure
Bookmarks
Find address or place
Contents
Grinders
Truck Load
Truck Pitch
Mining Trucks
Topographic
ADOBE RANGE
Mine Truck 3
Manufacturer Komatsu
Type K560
Driver Jessica Jacobs
Route Route B
Roll 0.59
Rack 1.20
Pitch -0.55
Operation State Dumping
Load (ton) 0.00
Payload Capacity (ton) 230.00
RR Brake Temp (F) 229.53
Rear Axil Oil Temp (F) 135.72
Zoom to
Get Directions
Edit
0
1
2mi
Esri.com
ArcGIS Marketplace
Help
Terms of

Main Truck Monitoring Display

Tire Pressures	
Left Front	301.4 psi
Right Front	295.5 psi
Left Rear Outside	289.5 psi
Left Rear Inside	291.5 psi
Right Rear Outside	301.1 psi
Right Rear Inside	299.1 psi

Brake Temperatures	
Left Front	223.9 °F
Right Front	236.5 °F
Left Rear	226.5 °F
Right Rear	229.9 °F

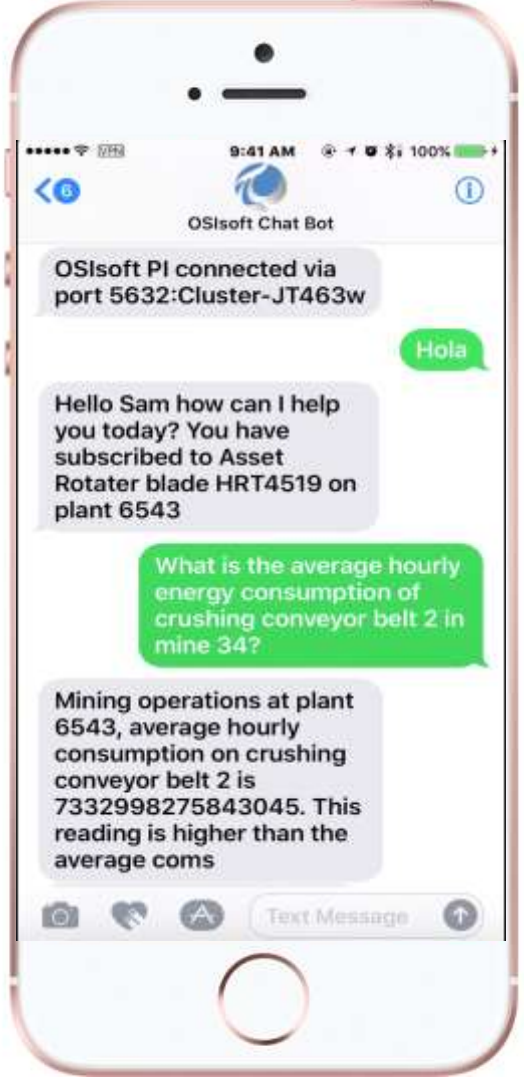
Payload	.0 ton
Ground Speed	.0 mi/h

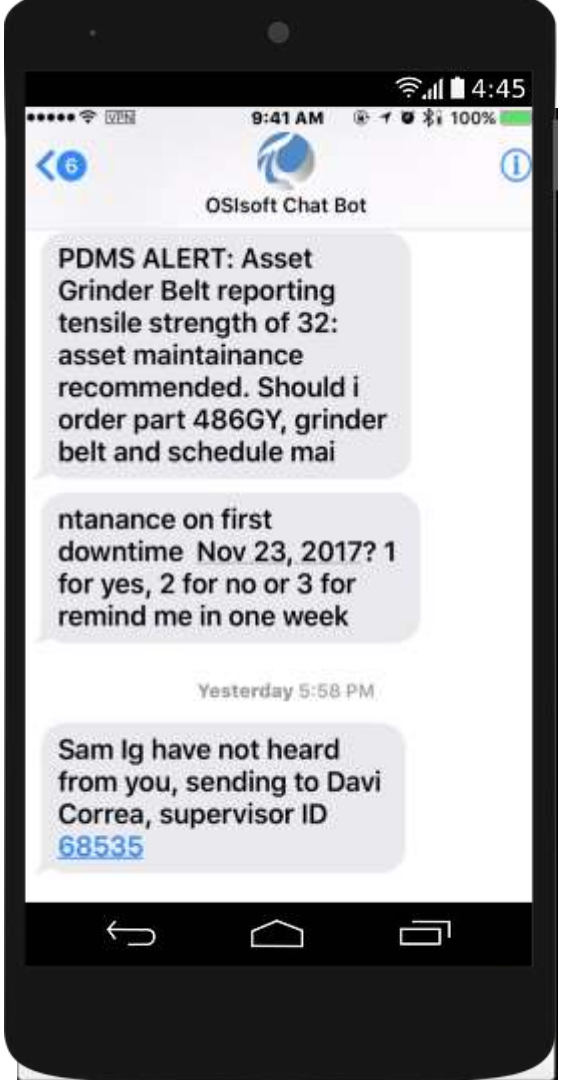


Demo – PI Vison

Artificial Intelligence

- To support humans in the processes of problem solving, machines must analyze massive amounts of data from various input sources such as mining hardware, worker equipment and databases.
  - Artificial Intelligence’s main them will be not how to think like an engineer, but teach them the system how to think like thousands of engineers.” that’s AI’s real power..


9:41 AM
100%
OSIsoft Chat Bot
OSIsoft PI connected via port 5632:Cluster-JT463w
Hola
Hello Sam how can I help you today? You have subscribed to Asset Rotater blade HRT4519 on plant 6543
What is the average hourly energy consumption of crushing conveyor belt 2 in mine 34?
Mining operations at plant 6543, average hourly consumption on crushing conveyor belt 2 is 7332998275843045. This reading is higher than the average coms
Text Message


4:45
9:41 AM
100%
OSIsoft Chat Bot
PDMS ALERT: Asset Grinder Belt reporting tensile strength of 32: asset maintainance recommended. Should i order part 486GY, grinder belt and schedule mai
ntanance on first downtime Nov 23, 2017? 1 for yes, 2 for no or 3 for remind me in one week
Yesterday 5:58 PM
Sam Ig have not heard from you, sending to Davi Correa, supervisor ID 68535

THE DIGITAL MINE

Digitalization will transform the way every mining company operates

The Digital Mining Network

With increased access to more sensors and data – whether on crushers and conveyor systems or load haul devices – there are significant opportunities for mining companies to improve their operational efficiency through better analysis and understanding of their asset management efforts

How do I leverage these technologies?

The best way to leverage these technologies and data is to build stronger connections between information technology (IT) and operational technology (OT), at both the technology and organizational levels.

Muchas Gracias