ENSURING CRITICAL ASSET OPTIMIZATION AND UPTIME USING ARTIFICIAL INTELLIGENCE

NYWEA Spring Technical Conference 2022

Agenda

- Introductions
- Water Industry Challenges and Opportunities
- What do we mean by AI?
- Solution overview
- Real examples
- Conclusions

Speakers Today

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Senior Practice/Solutions Architect, Xylem Vue

Water Industry Challenges and Opportunities

Automation

Connection

Cloud computing

IOT

Big Data

System integration

Water Industry Challenges and Opportunities

Asset Management

Water treatment and distribution are complex systems with multiple individual processes, each containing many assets

PROCESSES

- Intake
- Chemical treatment
- Clarification
- Filtration
- Sludge treatment
- Distribution

ELECTRICAL ASSETS

- Pumps
- Blowers/Compressors
- Mixers
- Conveyors
- Centrifuges

POTENTIAL ISSUES

- Pump cavitation
- Shaft misalignment
- Component wear
- Clogging
- Design/duty mismatch
- Foot looseness

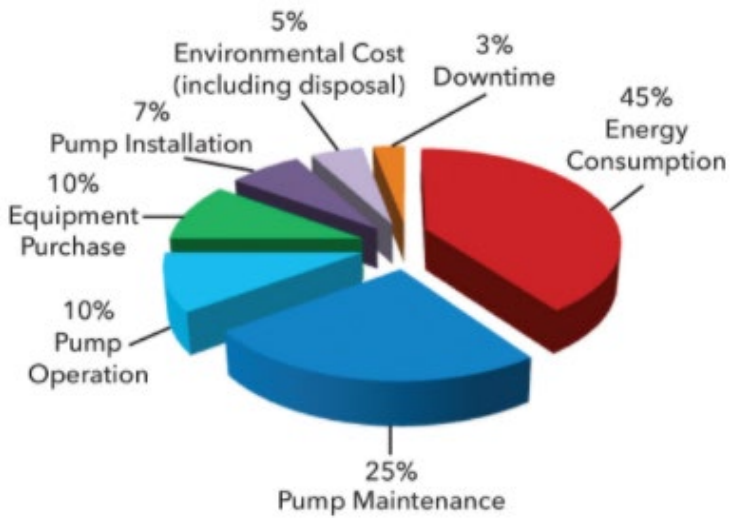


Figure 1
Typical pump life cost profile

World Pumps 2017

Water Industry Challenges and Opportunities

Asset Management Metrics

Considering Pumps

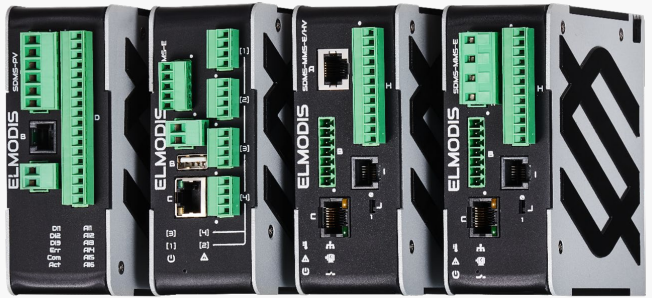
- Operation & Maintenance = approx. 80% of Life-Cycle costs
- 3% downtime considers asset not process
- OPEX management most likely to control costs

Water Industry Challenges and Opportunities

Asset Management Metrics

Estimate of annual O&M cost for a 100 hp (75kW) pump with VFD in a water system

- Assume: 75% load and 50% duty
- Energy = 246 MWhr/year
- Maintenance cost = $41,820*
- Energy cost = $31,980**
- Total annual O&M cost = **$73,800**



* Hunter Water Corp, New South Wales, rev2 2013
** electricrate.com average commercial electricity tariff for NY

What do we mean by AI?

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What do we mean by AI?

A much used term

ar·ti·fi·cial in·tel·li·gence
noun

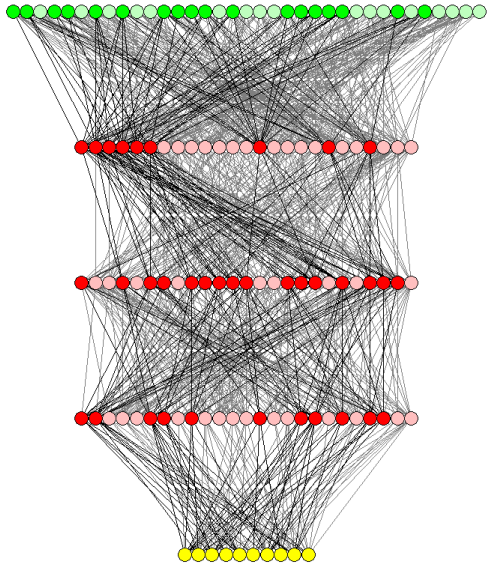
the theory and development of computer systems able to perform tasks that normally require human intelligence

Examples :

- Face recognition
- Auto translation
- Alexa/Siri
- Self-driving cars
- Proactive healthcare management

What do we mean by AI?

Machine learning

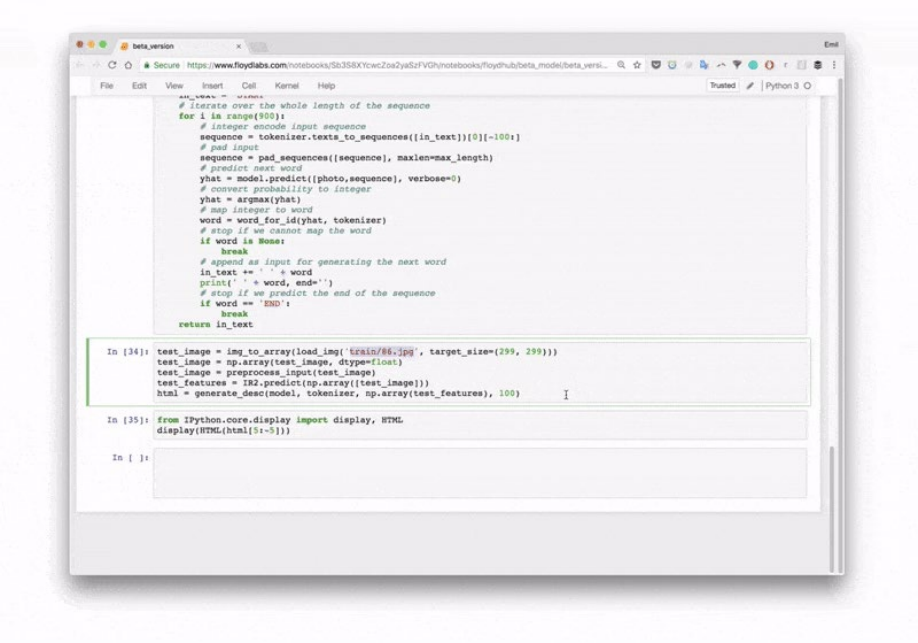


Machine Learning is a Subset of AI

The use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data. Through becoming familiar with a given machine, the system is able produce specific KPIs relating to the future performance and reliability of that machine.

What do we mean by AI?

Deep learning



Deep Learning is a Subset of Machine Learning:

KPIs from the ML phase are fed to the cloud based deep learning system. The system then analyzes that data, without specific rules or features preprogrammed into it. Once the system makes its predictions, they are checked against a separate set of data for accuracy. The system then adapts, based on the accuracy of its initial predictions. Using huge datasets of operational data linked to specific machine sizes and types the system provides insights to operators to enact changes that bring about reliability and performance improvements

Solution Overview

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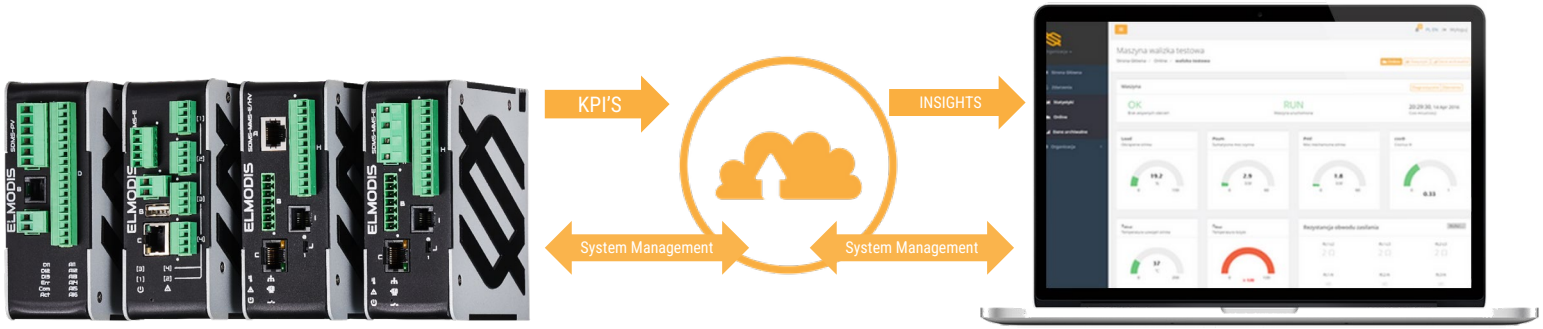
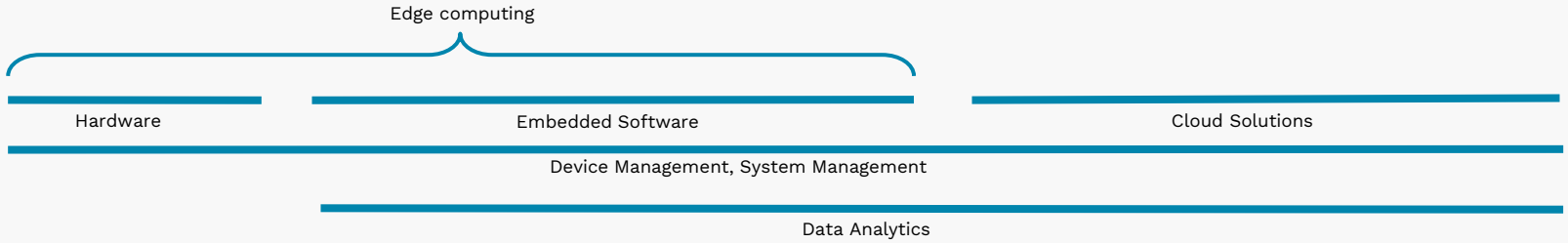
How it works?



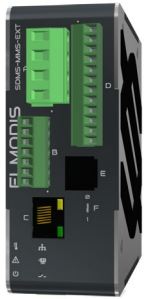
Edge
Machine Learning

Cloud/ On Premises
Deep Learning

User Interface/ Reports
Operator Insights

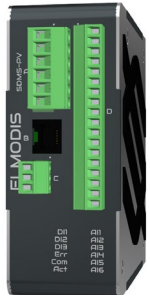


Smart ADEC Edge devices



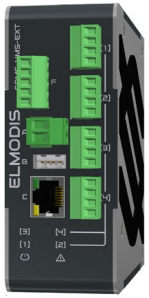
Electro Module

Proprietary electric motor with current, voltage measurements and built-in analytics



Process Module

Proprietary machinery process parameters measurements like pressure, flow, temperature with built-in analytics



Vibration Module

Proprietary electric motor and machinery components vibration and temperature measurements with built-in analytics

Secure Gateway

Cyber Secure and mobile virtual network operated solution to implement final SAM PRO Intelligent cloud architecture - MVNO

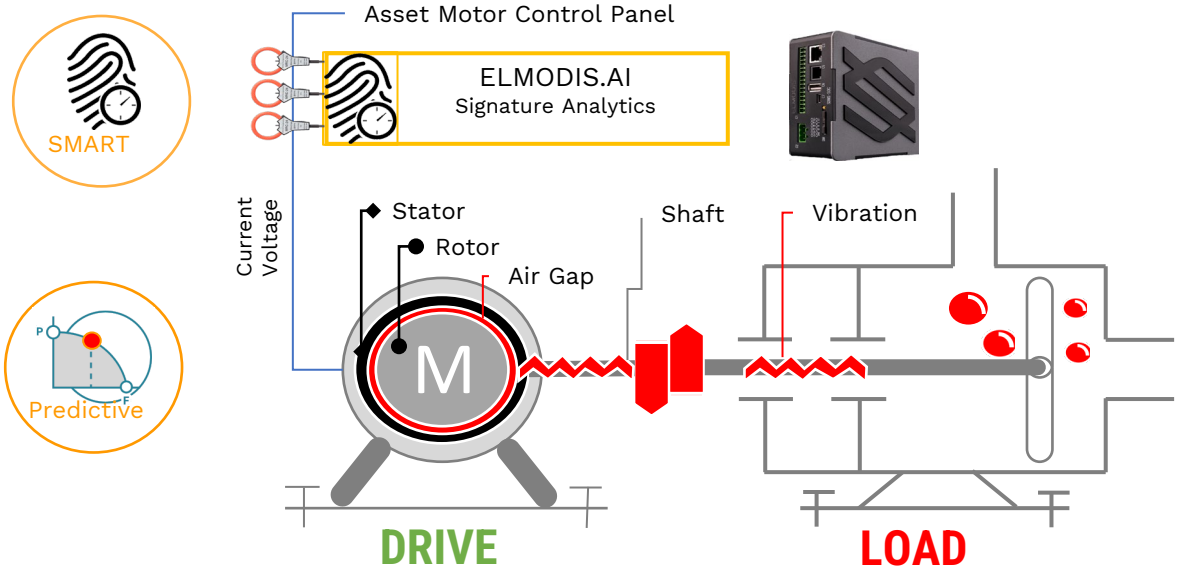
OPTION

OPTION

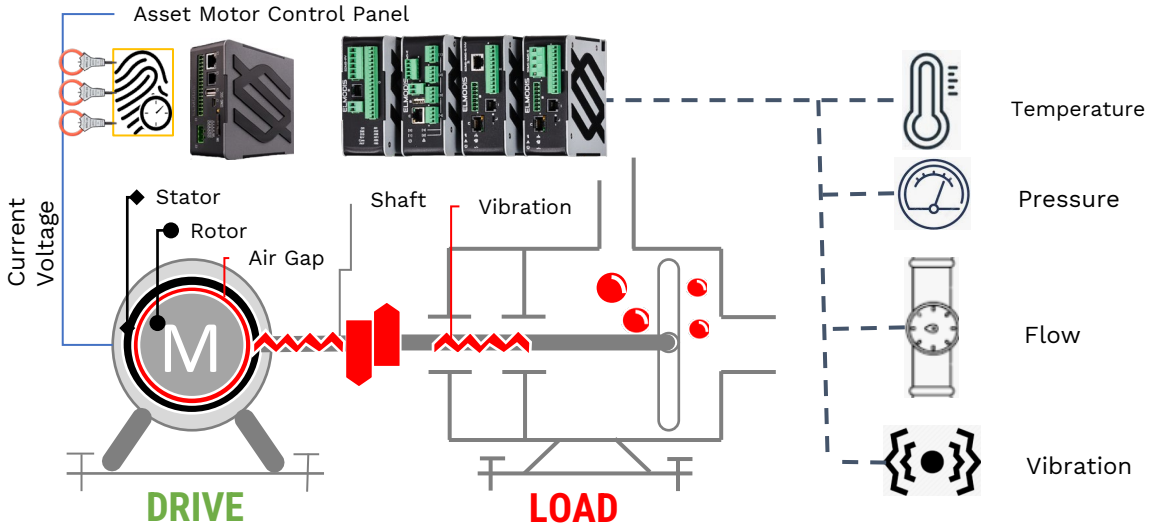
On Prem Module

Intel technology based, 3rd party solution to implement optional proprietary on premises computing architecture

How it works - energy flow signature and analysis



How it works - additional data inputs and analysis



How it Works - Data needed to build a complete picture

Insights	ESA	EFA Power	Vibration	Temperature	Noise & Ultrasound	Thermogr-aphy	Process Parameters	SAM-PRO
	(Current only)	(Current & Voltage)		(Ambient, bearing)			(Pressure, flow, etc.)	(EFA + other parameters)
Ambient Temperature								
Motor bearing condition								
Machine bearing condition								
Foundation Condition								
Power supply quality								
Process performance								
Machine efficiency/performance								
Machine operational history								
Electrical issues (rotor/stator problems)								
Mechanical issues (imbalance, misalignment)								

Green = Clear Picture Yellow = Partial Picture Grey = No Insight

Real Examples

Automation

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City of Den Bosch, NL

Sewer pumping station
- 3 pumps

- Different performance from each pump
- Control valve issues
- Design/actual performance variation

Insights/ Outcomes

- Real pump curve different from design
- Different speed required for one pump
- Pump speed generally needs to be higher
- Operating efficiency optimized

Customer comments

SAM PRO ‘switched on the light’ for operators who are subject matter experts, enabling a new level of understanding and operational performance to be achieved.

Knoxville Utility Board, TN, USA

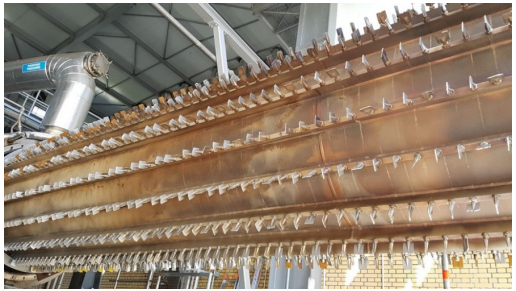
Sewer pumping station
- 4 pumps.

- Inconsistent pump performance
- Performance baseline project
- Operating cost reduction goal

Insights/ Outcomes

- Pumps all behaving differently
- Optimized BEP management for each pump – energy reduction
- Planning expansion to other assets

City of Wroclaw, Poland



Sludge drying facility

- Plant operating at only 60% design capacity
- Maintenance interval 3000 hours (design = 6000)
- High energy consumption

Insights

- Heat source temperature unstable
- Dryer rotor rotation not properly regulated
- Alignment of rotor blades not optimal

Outcomes/Economics

- Plant capacity increased to 133% of design (one line remains in standby)
- Improved energy performance giving savings of $328k/year
- Maintenance interval of 8000 hours giving savings of $378k/year

Conclusions

Automation

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Economics

Asset Management Metrics

Estimate of annual cost for a 100 hp (75kW) pump with VFD in a water system

- Assume 75% load and 50% duty
- Energy = 246 MWhr/year
- Maintenance cost = $41820*
- Energy cost = $31980**
- Total annual O&M cost = **$73,800**
- Average cost of SAM PRO solution = $2000/asset/year for 1st 3 years
- After 3 years = $1200/asset/year
- Average reduction in O&M cost = 5%***
- ROI less than **12 months** in most cases

* Hunter Water Corp, New South Wales, rev2 2013
** electricrate.com average commercial electricity tariff for NY
*** See article 'Data Analytics Deliver Results' published by WE&T December 2021

Summary

- Asset management in the water industry comes with many challenges that impact operational, maintenance and overall process efficiency and cost.
- Machine Learning backed systems can provide insights to operators that enable significant reliability and performance improvement.
- These solutions can and should pay for themselves quickly, usually in less than 12 months.
- Operators will enjoy year on year savings and smoother operations, to the lasting benefit of their customers.

Thank you
Questions?