

CEE19035 – Predictive Maintenance of Filtration Units Unlocking the Value of Industry 4.0

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Corrective Maintenance Preventative Maintenance Predictive Maintenance

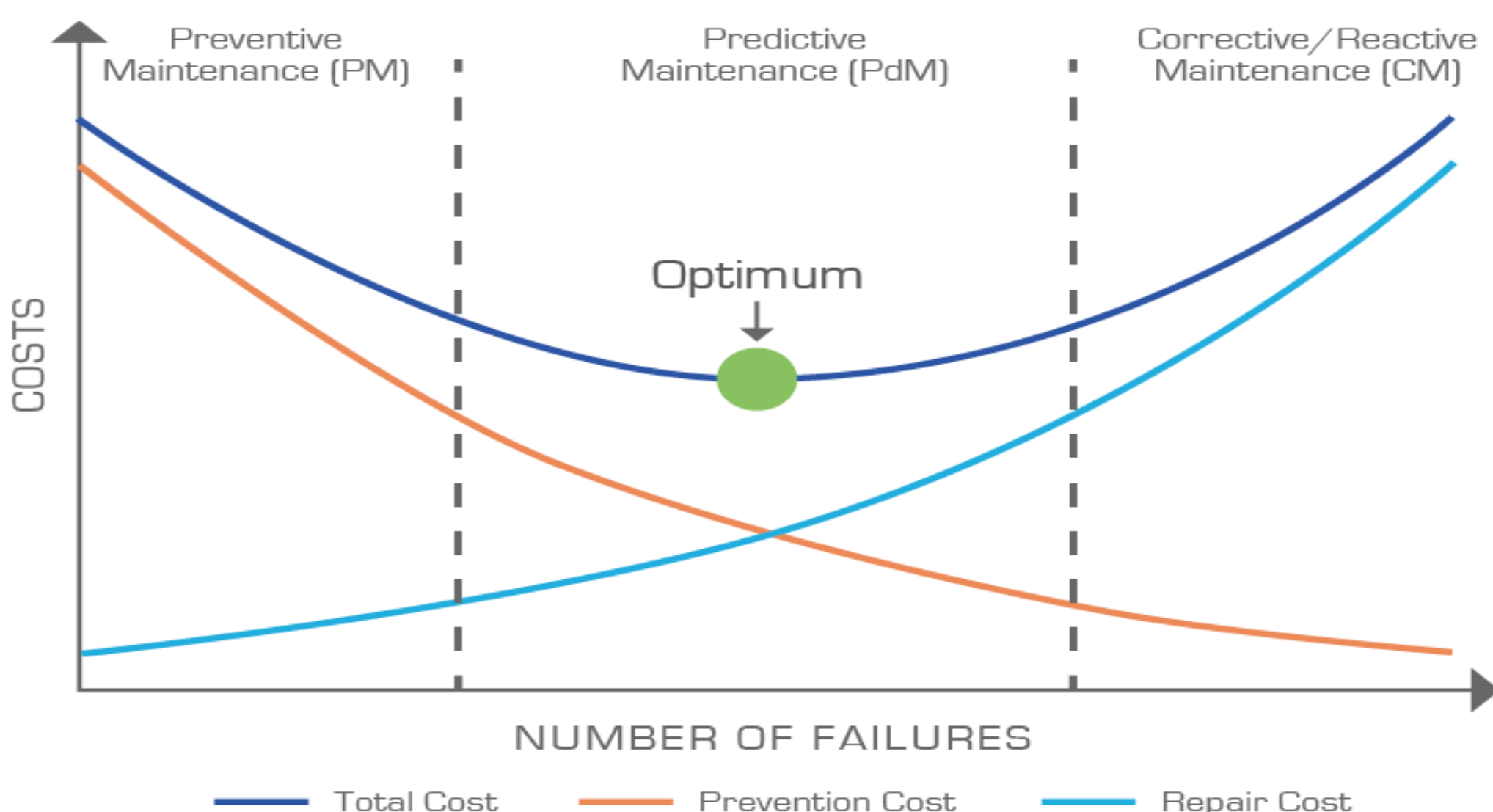


BACKGROUND

Currently, **preventive maintenance** is the **standard practice** in the **water industry**. However, the main flaw of a fixed schedule strategy is that all equipment are maintained at the same time interval regardless of their specific operating conditions. This has resulted in unnecessary maintenance or failure to detect unanticipated breakdown. With the advent of **Industry 4.0**, IoT enabled sensors can enable **real-time remote monitoring** of filtration units in the water industry.

KEY RESEARCH QUESTION

Is it **economically feasible** to adopt machine learning and data analytics to forecast the maintenance timing of filtration units in the water industry?



Cost comparison between different maintenance strategies

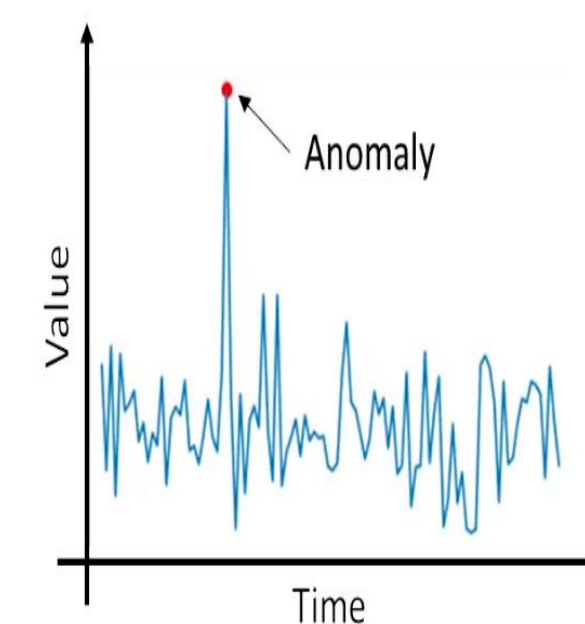
METHODOLOGY

Proof of Concept Approach

- Data Source: Secure Water Treatment (SWaT) Dataset from iTrust SUTD
- Machine Learning Type: Anomaly detection
- Business Feasibility: Incremental analysis with Monte Carlo simulation



SWaT testbed



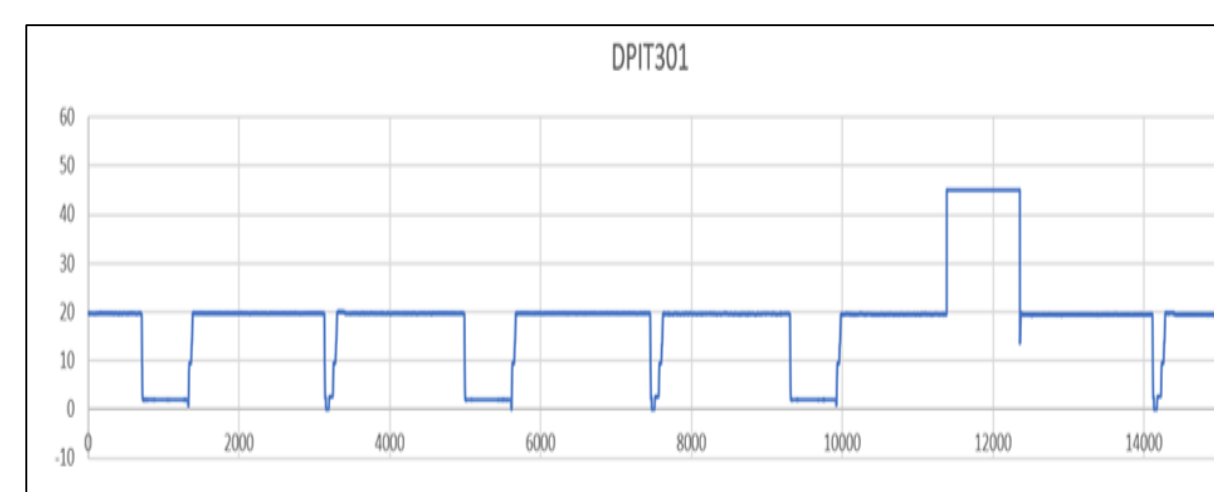
Anomaly detection

Cost Category	Cost of Implementation		
	Variable Cost (VC)	Fixed Cost (FC)	Total Cost (TC = VC + FC)
Cost A: Equipment			
Sensors	0	0	0
Actuators	0	0	0
Data center	0	0	0
Mainframe/Computers	0	0	0
Cost B: Supplies			
Chemicals	0	0	0
Resin	0	0	0
Cost C: Labor			
Database administrator	0	0	0
IT personnel	0	0	0
Data analysts	0	0	0
Data scientists	0	0	0
Upgrading and training	0	0	0
Cost D: Other			
Indirect labor	0	0	0
Indirect materials	0	0	0
Utilities	0	0	0
Office expenses	0	0	0
Administrative expenses	0	0	0
Total cost of implementation	0	0	0

Incremental analysis template subsection

PRELIMINARY FINDINGS

Based on the dataset obtained from iTrust SUTD, a **high margin of safety** is currently being practiced by the industry. This means that the time interval between each maintenance cycle is shorter than necessary and **higher costs** will be incurred.



Differential pressure indicating transmitter readings in Kilopascals (kPa)

Differential Pressure Indicating Transmitter	Range: 0-2 Bar
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Differential pressure indicating transmitter design specifications (100 kPa = 1 Bar)

Predictive Maintenance
a marathon, not a sprint

IMAGE REFERENCES

Free Predictive Maintenance Cliparts, Download Free Clip Art on Clipart Library. (2020). Retrieved 25 January 2020, from <http://clipart-library.com/predictive-maintenance-cliparts.html>
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