DATA-DRIVEN ARTIFICIAL INTELLIGENCE FOR PREDICTIVE MAINTENANCE OF INDUSTRIAL EQUIPMENT

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I. Title of presentation	Data-Driven Artificial Intelligence for Predictive Maintenance of Industrial Equipment
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III. Organization(s)	1. MIMOS Berhad, MALAYSIA 2. Universiti Sains Islam Malaysia, MALAYSIA 3. Universiti Putra Malaysia, MALAYSIA
1) IV. Topic selection (Please check the box for selected topic)	ICT related Technologies and Applications
Duration	24 months

Maintenance Procedure for Industrial Equipment

With the scale and need for industrial operations increasing, industrial systems are becoming far more complex than they had ever been.
As a consequence, traditional maintenance strategies are not only failing to prevent downtime, they introduce additional costs due to over-maintenance.

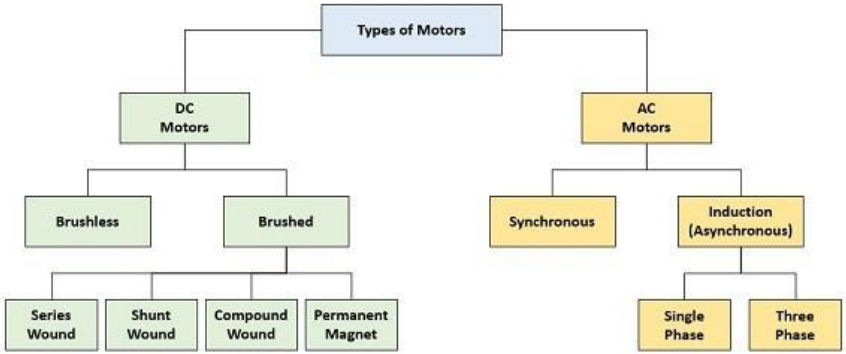
Motor to move the conveyor belt

Rotating Motor to Move Lift

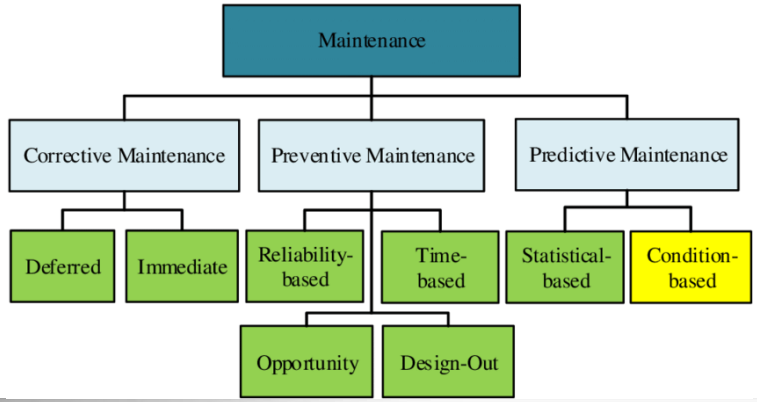
The prognostic and health management (PHM) for smart manufacturing

The prognostic and health management (PHM) concept has become the inevitable tendency in the context of smart manufacturing and industrial big data, and it provides a reliable solution for managing the health status of equipment.

Types of Motors



Maintenance Classification



Predictive Maintenance of Industrial Equipment

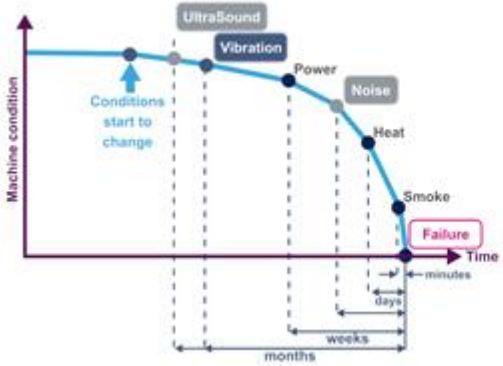
- Predictive maintenance (PdM) aims to address this problem by delivering on the promise of an optimal maintenance policy that allows maintenance to be delayed until the risk of failure is not critical and the performance of the equipment remains unaffected.
- In order to effectively implement Predictive Maintenance, one must first perform prognostics with minimal error and uncertainty.
  - Unfortunately, due to the limited data availability for prognostics in industrial scenarios, effective implementation of PdM remains a vision rather than a reality for industrial organisations.

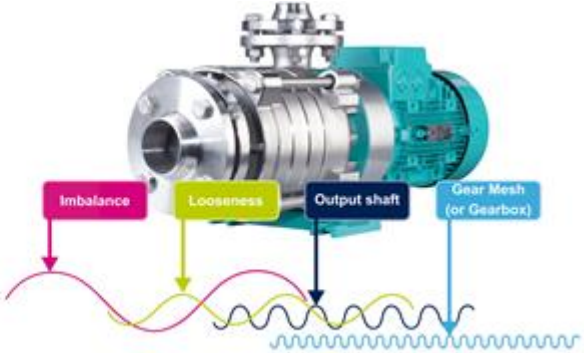
Project: Data Driven Artificial Intelligence of Predictive Maintenance for the Industrial Machine

- In recent years, industrial wireless sensor networks (IWSNs) and industrial cyber physical systems have become an emerging data acquisition technology in the complex industrial environment, and electrical and mechanical data can be collected using various types of sensors with high reliability and in a real-time manner.
- Obviously, because of the continuous improvement of data acquisition ability, as well as the exponential growth of data volume [14], data-driven methods for health monitoring have achieved great success and received widespread attention regarding the PdM of industrial equipment.
- Therefore, since artificial intelligence (AI) algorithms have achieved important progress during the past five years, we considered the relevance of performing a summary study on guiding the selection of algorithms in specific applications, particularly the corresponding significance of AI to PdM.
- In this project, *we are proposing to study on the data-driven approach through artificial intelligence for assessing the asset performance and quality of the industrial equipment, in particular the induction electric motors.*

Objectives

- The purposes of this project is to improve the ability to effectively plan and schedule PdM tasks under the conditions of limited data availability for prognostics, whilst maximizing the value of the equipment.
- More specifically, the research focuses on addressing the following research questions:
  - how to predict equipment failure under the conditions of limited data availability;
  - how can such improved prediction of equipment failure be exploited to develop an optimal maintenance policy.





Scope of Work for the Data Driven Artificial Intelligence Predictive Maintenance for Industrial Equipment

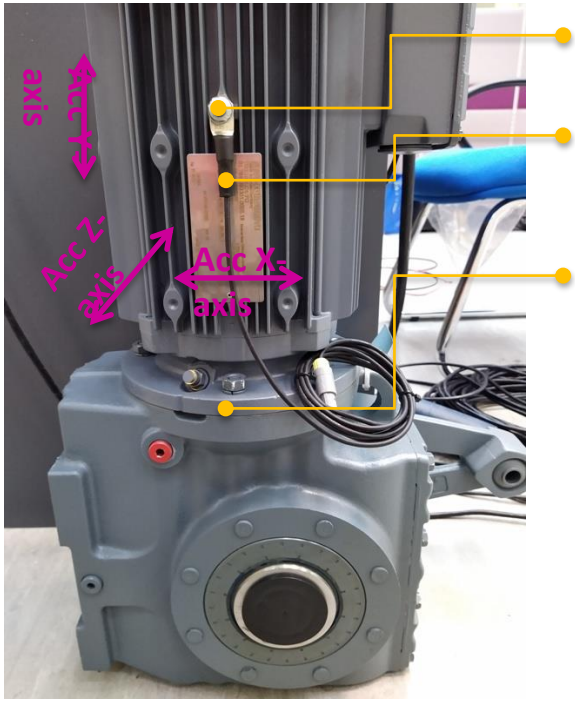
1. Development of the internet of things solution for the continuous health monitoring of the industrial equipment. This includes the solution of sensors, gateways and the solution in the industrial environment setting.
2. Development of the Back-end Data Processing and Analysis. Process of data design and implementation of data warehouse, data integration, data modelling. Design of Analytics solution for alert triggering based on condition monitoring
3. Development of the data driven artificial intelligence (AI) algorithms to perform the corresponding PdM exercise for the industrial motor
4. Development of Data Visualization for the near real-time dashboard to display the condition based monitoring and predictive modelling outpus.
5. Conduct the proof-of-concept deployment of the developed AI based algorithms to perform the predictive maintenance of the industrial motor
6. Development of the Machine Learning Models can be classified based on two approach
   - Condition Based Monitoring Approach (Anomaly detection)
   - Predictive Maintenance Algorithms

Expected Outcomes

1. Internet of Things solution for the continuous machine health monitoring and data collections (environment, mechanicals and electricals data)
2. Machine Learning Models and Algorithms
3. Near-real time dashboard monitoring solution to visualize the output of the machine condition based monitoring and predictive modelling outputs
4. Proof-of-Concept Deployment of the above solutions at the complex machine environment
5. Intellectual Properties & Joint Publications

Proposed Machine Health Monitoring Solution

Class 1 Three-Phase Motor



M8 screw thread

Temperature, Vibration sensor tip

Sensor Node connector

AI Based Predictive Maintenance

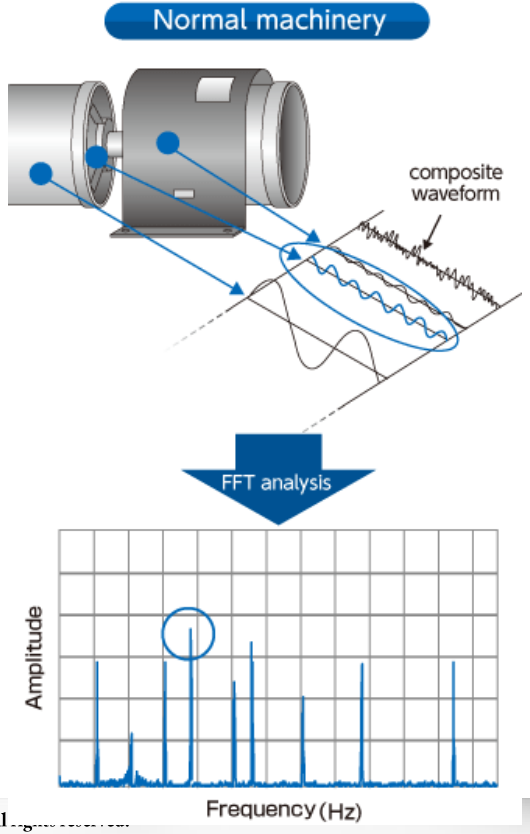
IoT Platform

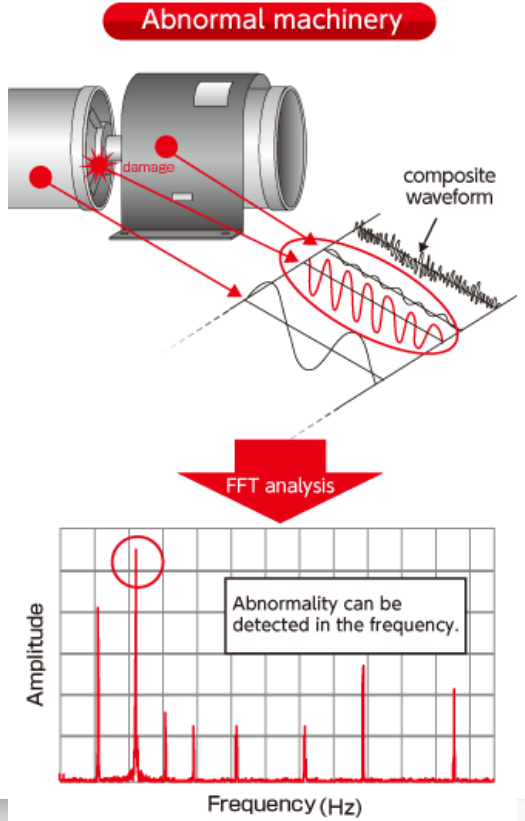
Notification & Alert

Dashboard Visualization

Measuring Motor Vibration (Method of Analysis)

Method of Analysis:
Machine that function abnormally (due to imbalance or bearing damages) will produce different vibration that can be detected using FFT.





Invitation to the Research Partnership & Collaboration

- Welcome researchers within ASEAN IVO members to participate in this project
- Discuss on the machine learning algorithms development from difference type of electric motors
- Deploy and implement the develop algorithms to the motor based on difference use cases of the members at each country
- Joint publications and knowledge sharing

National Applied R&D Centre

MIMOS

THANK YOU

Any Questions?

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