Introduction to Predictive Maintenance

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Introduction

Predictive maintenance is a method of detecting irregularities in the operation and potential faults in equipment and processes using data analysis methods and techniques, so you can repair them before they fail. Predictive maintenance, in theory, allows for the lowest possible maintenance frequency to avoid unplanned reactive maintenance while avoiding the costs associated with doing too much preventive maintenance.

Predictive maintenance (PdM) is a kind of condition-based maintenance that continually monitors the performance and condition of assets using sensor devices. These devices supply data in real-time, to predict and prevent any imminent failures. The ultimate purpose of predictive maintenance is to predict when the equipment might break down, followed by preventing the failure through regularly scheduled and corrective maintenance. This ensures that the maintenance frequency is as low as possible, without incurring high maintenance costs.

How does predictive maintenance work?

Predictive maintenance anticipates problems by combining historical and real-time data from different parts of the service. Predictive maintenance is influenced by three key areas of your business:

1. The real time monitoring of asset condition and performance
2. The analysis of work order data
3. Benchmarking MRO inventory usage

Predictive maintenance is made up of many primary components, with technology and software being one of them. Different assets and systems can link, work together, exchange, analyze, and act on data thanks to the Internet of Things (IoT), artificial intelligence, and integrated systems.

Predictive maintenance sensors, industrial controls, and business systems are all used in these tools to collect data (like EAM software and ERP software). They decipher it and use it to pinpoint any areas that need care. Vibration analysis, oil analysis, thermal imaging, and equipment observation are some examples of using predictive maintenance and predictive maintenance sensors. Choosing the right methodology for condition monitoring is a crucial decision that should be made in collaboration with equipment suppliers and experts in the field.

Benefits of predictive maintenance

When predictive maintenance is used effectively as a maintenance technique, machines are only serviced when they are required. That is, just when failure is about to happen. This results in a number of cost savings:

- Reducing the time spent maintaining machinery
- Reducing the number of production hours missed due to repairs
- Reducing the cost of replacement parts and supplies

Predictive maintenance systems have been shown to result in a tenfold rise in ROI, a 25% -30% reduction in maintenance costs, a 70%-75 percent reduction in breakdowns, and a 35%-45% reduction in downtime. However, these cost savings come at a cost. Some condition monitoring methods are costly, and successful data analysis necessitates the use of specialized and skilled personnel.

Manufacturers profit from predictive maintenance by decreasing maintenance costs, extending the lifecycle of legacy equipment, and reducing downtime to boost output. Unexpected mechanical failures on a production line can be extremely costly. Manufacturing facilities benefit from more advanced big data analytics for more reliable predictions and lower costs as predictive maintenance is used in conjunction with machine learning. Predictive maintenance involves inspecting and repairing components, oil adjustments, partial overhauls, washing, and lubrication of industrial machinery and machines on a daily basis.

Advantages

Some of the most prominent benefits of predictive maintenance are the following:

- **Reduced downtime and longer life**
  Asset failures are both frustrating and costly. Predictive maintenance can help you avoid problems and save money by reducing downtime. According to a PWC survey, PdM increases uptime by 9% and extends the lifespan of aging assets by 20%.

- **Reduced maintenance costs**
  Since scheduled maintenance is performed according to a timetable, it is possible that maintenance will be performed even if it is not necessary. Such inefficiencies are eliminated with predictive maintenance. Technicians may concentrate on only the correct equipment based on the symptoms interpreted from the data, saving money and time.

- **Improved safety**
  Predictive maintenance can help prevent workplace injuries by alerting maintenance teams to impending equipment failures. Predictive maintenance in manufacturing, according to PWC, can reduce protection, health, and environmental risks by 14%.

- **Increased efficiency**
  When equipment fails during a vital procedure, the entire workflow is thrown off. The interruption in operations, as well as the upcoming repairs, will eat up valuable time and money. Predictive maintenance guarantees operational stability and smooth workflows by avoiding any unexpected equipment breakdowns.

Disadvantages

Despite its numerous benefits, which can significantly increase a company's net throughput, predictive maintenance has its own set of challenges. Some of the issues that make it unsuitable for some businesses include:

- **Scheduling takes time**
  A PdM schedule requires a significant amount of time to prepare and execute.

- **Additional expenses**
  Plant staff must be instructed on how to use the equipment and view the analytics due to the complexity of predictive maintenance. It also necessitates the purchase of repair equipment and systems. Condition tracking, on the other hand, has a high upfront expense.

Applications of Predictive Maintenance

Predictive maintenance can be used in any industry where machines generate large volumes of data and where data analysis can help with maintenance and fine-tuning. The following are some of the sectors where PdM is already applied.

- **Automotive**
  In an industry that is highly reliant on manufacturing and assembly, equipment failure may cause significant disruption and cost the business millions of dollars. PdM technology, which eliminates downtime and ensures continuous and reliable workflows, is expected to be adopted by the automotive industry.

- **Transportation**
  Sensor data from the complicated devices on airplanes must be closely monitored by airlines on a regular basis. The proper operation of equipment is critical to ensuring the safety of passengers. Trains have complex equipment that can benefit from predictive maintenance.
- **Manufacturing**
  In the manufacturing sector, early fault identification and diagnosis. Manufacturers are gradually collecting big data from Internet of Things (IoT) sensors in their factories and goods, and then using various algorithms to predict warning signs of costly failures before they happen.

- **Oil and Gas**
  In the extraction and processing processes, the oil and gas industry employs expensive machinery that, if it fails, can pose health and environmental risks.

- **Ports**
  Since port equipment is constantly exposed to harsh environments, it easily deteriorates. Cranes, for example, are critical instruments that are vulnerable to failure. Crane downtime will result in longer ship wait times and lower port throughput. Reducing downtime is essential for improving service quality and reducing waste.

Implementation

Some critical steps to be followed before implementing predictive maintenance are:

- Analyzing the need and ROI cases are two important steps to take before introducing predictive maintenance.
- Defining terms, setting practical goals, and making a case for PdM.
- Educating key stakeholders and providing maintenance and machine operator experience.
- Take an inventory of your equipment and determine the current state.
- Attach appropriate sensors and IIoT devices to the asset in question.
- Create a computerized maintenance management system (CMMS) to which IIoT devices can be connected.
- Create appropriate maintenance plans.

Impact of predictive maintenance

Predictive maintenance seeks to define the best time to do work on an asset so maintenance frequency is as low as possible and reliability is as high as possible without unnecessary costs.

Utilizing the Internet of Things is key for implementing a successful predictive maintenance program, as is the use of predictive maintenance sensors and techniques, such as vibration analysis, oil analysis, thermal imaging, and equipment observation.

Although there are some disadvantages to predictive maintenance (high start-up costs, the need for specialized skills, the limitations of some equipment), it allows maintenance to be performed only when required, helping facilities cut costs, save time and maximize resources. Consultation with equipment manufacturers and condition monitoring experts should be undertaken before deciding if predictive maintenance is best for particular assets.

Conclusion

Predictive maintenance shows you the best time to work on an asset such that maintenance frequency is kept to a minimum and reliability is maximized while unnecessary costs are avoided. Predictive maintenance, on the other hand, has a few drawbacks, including high start-up costs and the need for specialized staff. Predictive maintenance is clearly not appropriate for every business, especially those that have yet to implement planned maintenance activities. Larger companies, on the other hand, that have outgrown traditional maintenance activities and have extra budgets, should use predictive maintenance.