**IOT-based Pre & Post Machine Diagnosis, Fault Analysis & Prognosis**

In recent times, there has been significant interest in condition-based maintenance systems that utilize machine fault diagnostic and prognostic techniques. These techniques have the potential to reduce downtime, lower maintenance costs, and increase machine availability. Research in machine fault diagnosis and prognosis has been rapidly evolving, covering a wide range of statistical and model-based approaches. This paper aims to summarize and classify recent published techniques for diagnosing and prognosing rotating machinery, with the goal of providing information to the research community. Additionally, it discusses the opportunities and challenges in conducting advanced research in the field of machine prognosis.

Industrial equipment failures can cause disruptions in productivity, customer service delays, safety and environmental concerns. This highlights the importance of maintenance in manufacturing operations for organizations. Maintenance plays a crucial role in maintaining the availability and reliability of production facilities, as well as ensuring product quality. However, in the past, maintenance has received less attention compared to production and manufacturing issues, which may have contributed to the current low efficiency in maintenance practices in the industry.

Approximately one-third of maintenance costs are wasted due to unnecessary or improper maintenance activities. Maintenance costs are a significant expense and can range from 15-40% of production costs, depending on the industry. For example, in 1989, over $600 billion was estimated to have been spent on maintenance in a selected group of companies. Maintenance costs as a percentage of total value-added costs can vary, with ranges of 20-50% for mining, 15-25% for primary metal, and 3-15% for processing and manufacturing industries. Moreover, the adoption of mechanization and automation in modern plants, with flexible computer-controlled automatic and unmanned equipment, has substantially increased maintenance costs. As a result, maintenance has often been viewed as a necessary evil by various management functions.

In this project, we propose a multi-channel Internet of Things (IoT)-based industrial wireless sensor system (IWS) for machine condition monitoring and fault diagnosis using accelerometer, gyroscope, vibration sensor, and temperature sensor data for pre- and post-diagnosis and analysis. We investigate ensemble feature extraction and fault diagnosis using a classifier to address the system requirements of IWS. We also explore a two-step classifier fusion approach using Dempster-Shafer theory to improve diagnosis results. We monitor four types of machine faults and evaluate the proposed system. The final fault diagnosis results using the proposed classifier fusion approach show a high level of certainty, indicating the feasibility of the proposed method for identifying fault patterns. This project provides new insights into the design of a high-accuracy IoT-based fault diagnosis algorithm and serves as a valuable reference for other IWS scenarios. Additionally, we plan to plot a graph to visually display the differences in pre- and post-diagnosis using the collected sensor data.

In the process industry, complex equipment is crucial for generating profits, and proper management and maintenance of these assets are essential for protecting a company's investments. Online monitoring and fault diagnosis of equipment have become imperative in today's information-intensive environment. Stress wave monitoring technology can provide direct insights into the working condition, expected faults, and lifecycle of continuously operating mechanical equipment. Additionally, process monitoring parameters such as pressure, temperature, and current can also be used for fault diagnosis. Currently, there are three categories of fault diagnosis methods: analysis model-based, empirical knowledge-based, and data-driven methods. Analysis model-based methods combine mathematical models with equipment's current operating status for accurate results, but establishing accurate models can be challenging. Empirical knowledge-based methods rely on the experience of domain experts and actual equipment operation, with expert systems being a typical example. Data-driven methods use historical monitoring data for diagnosis and avoid complex mathematical models and expert experience, but the completeness and comprehensiveness of monitoring data affect the credibility of diagnostic results.

The IOT-based equipment online monitoring and fault diagnosis platform emphasizes equipment focuses on multiple condition perception of equipment, real-time online data monitoring, and intelligent fault diagnosis. It provides technical support for proactive maintenance of various complex equipment in the process industry.