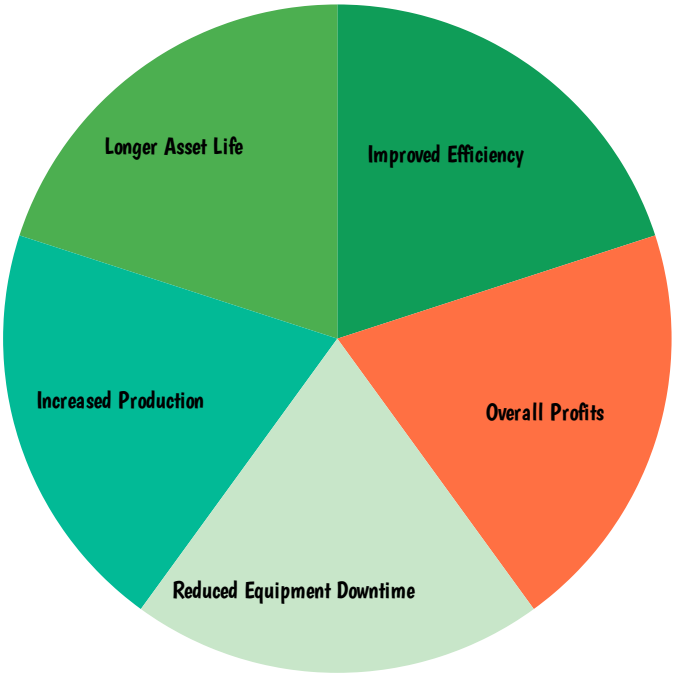
Predicitive Maintainence

Overview

Major Benefits of Predictive Maintenance



Predictive maintenance is a technique that is designed to evaluate the present condition of machines or devices.

Usually, achieved via analytical methods. There are several benefits of predictive maintenance, with an increase in **overall profits** as the ultimate effect.

A Typical Predictive Maintenance Process

STEP 1

Data Acquisition

Real time data collection from sensor devices.

STEP 2

Data Processing

Data transformation and storage.

STEP 3

On-time Monitoring

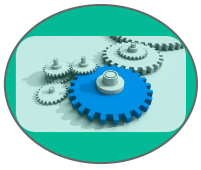
Real time visualization of processed data on dashboards.

STEP 4

Predictive Analysis

Using Machine learning algorithm to forecast the probability of next faults.

STEP 5



Connectivity and Alerts

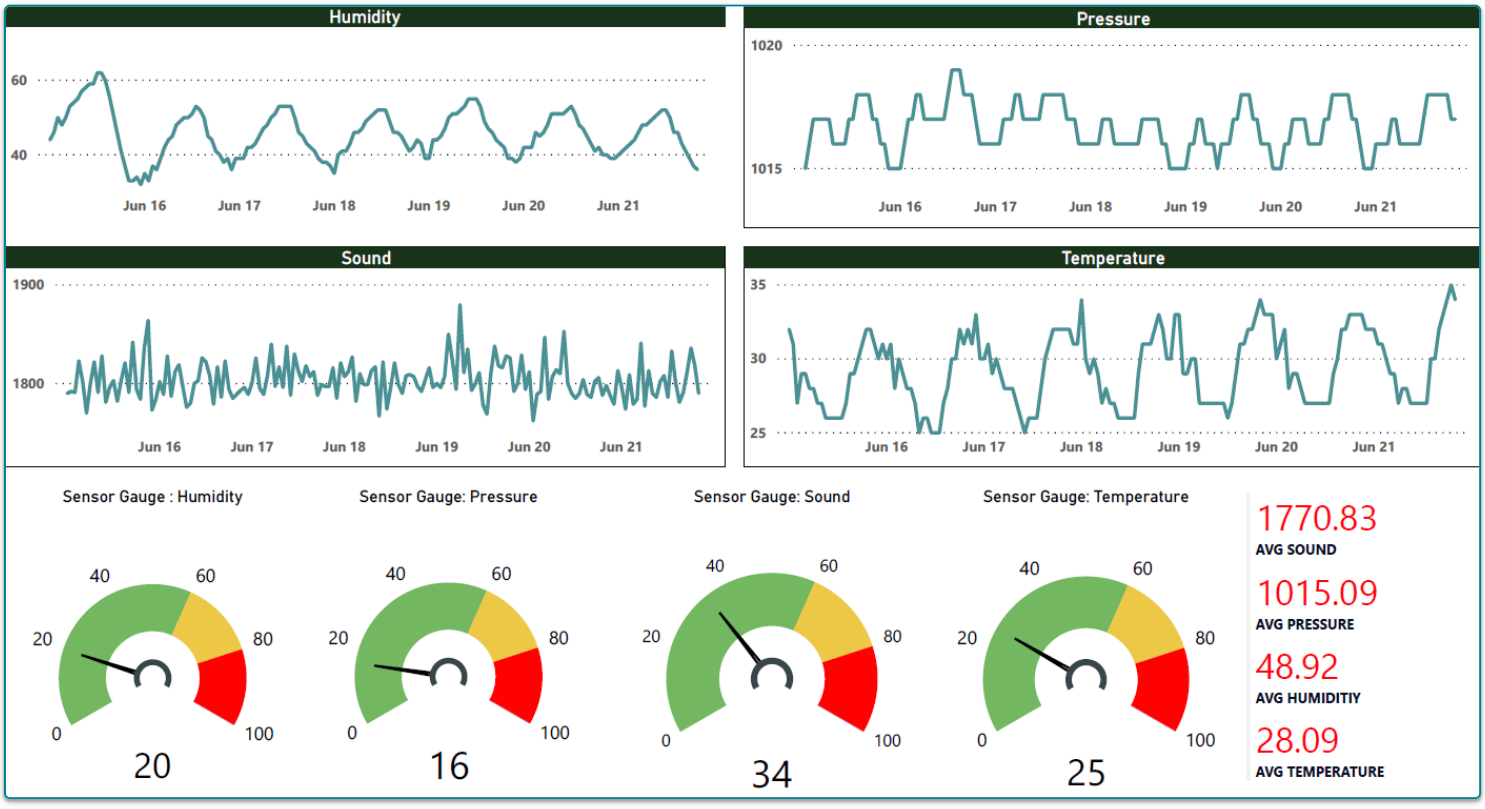
Deploy on set systems and send alerts to human operators for necessary actions.

Scenario 1: Stable Condition in Predictive Maintenance

Importance of stable conditions

A piece of equipment is said to be stable if its output is under control; that is, the values or readings obtained while it is working are within a set boundary. Otherwise, it is said to be unstable. In predictive analysis, especially with time-series prediction, Feeding stable records to feed the model helps the algorithm to differentiate normal patterns from abnormal patterns. Also, stable equipment produces a bounded output for a given bounded input.

Dashboard Sample for Stable Conditions



The dashboard represents an on-time monitoring scenario from four different sensors measuring different parameters; Pressure, Humidity, Sound, and Temperature. The charts, gauges, and scorecards visualize devices with **clean installation records that are running flawlessly**. Thus, in a stable condition, the values of its output generate data points that fall within a median range.

Advantages of Predictive Maintenance in Stable System

With Use Cases

In Car Servicing

It shows the real condition of a car. A stable installation record of a car is solid proof that the had been working for months or years without breakdowns or incidents.

In Real Estate

In the case of a house purchase, a stable installation record of all house appliances gives the buyer a high level of assurance and peace of mind. It also minimizes the risk of future system failure for the new buyer.

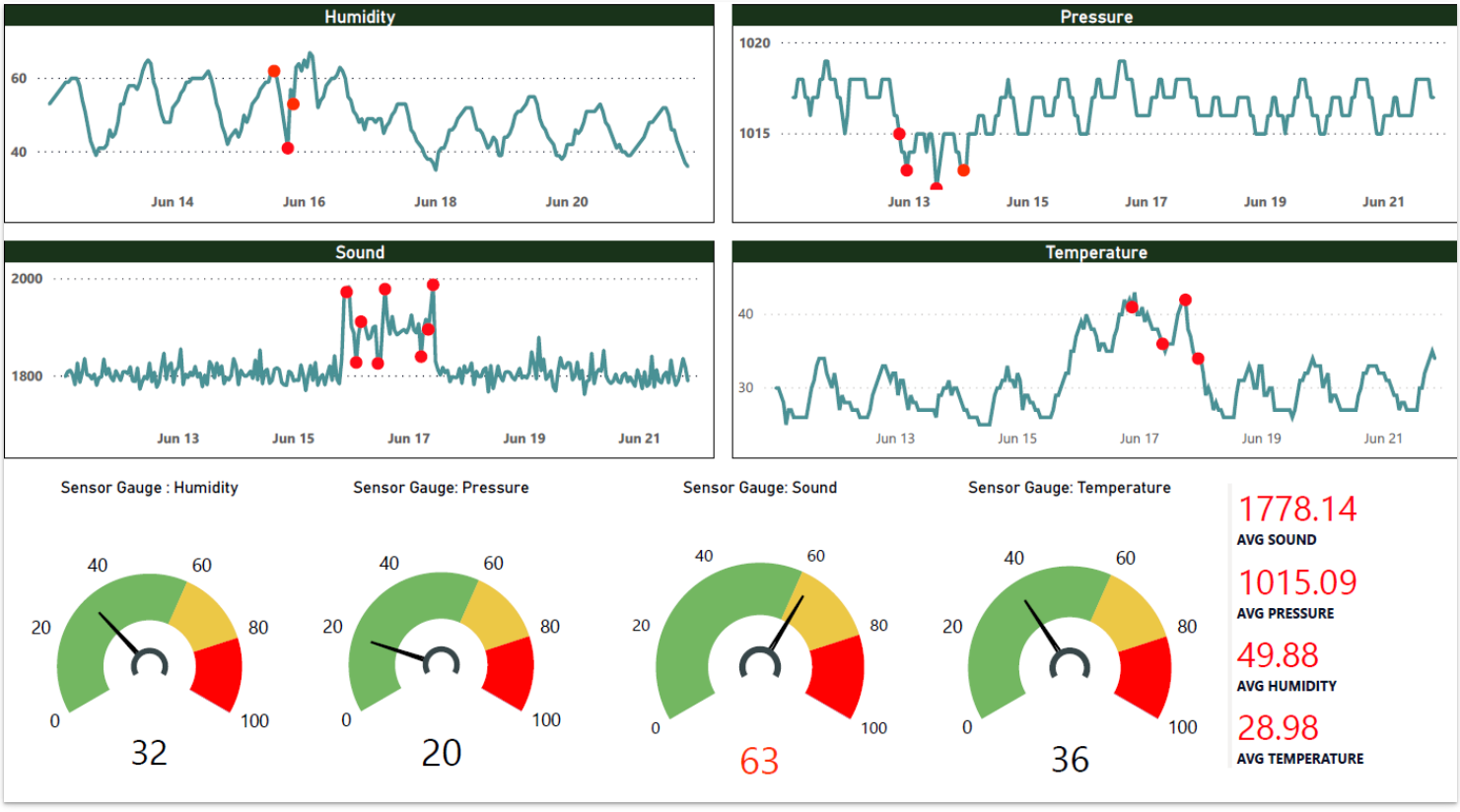
Finally, many installation records are not entirely homogeneous but are patched together bit by bit from various sources over the years. The installation record system provides a check and a record of the balance in the operation of the system. Furthermore, many problems would result in fluctuations in the 'heart rhythm' of installations. In contrast, a stable installation record indicates that the system is healthy and unlikely to develop complications in the near future.

Scenario 2: Unstable Condition in Predictive Maintenance

Fault Detection

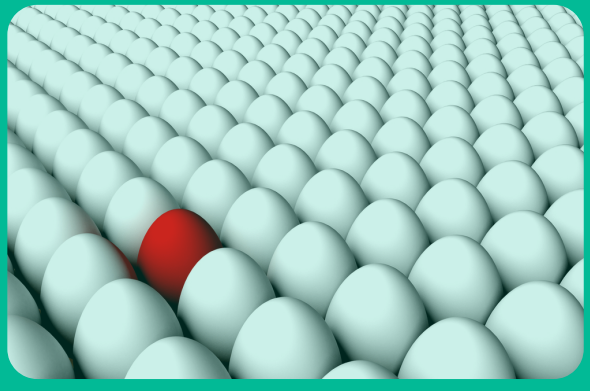
Fault Detection is a core method in predictive maintenance that provides a real-time warning indication of an impending breakdown. Fault detection methods, such as anomaly detection, typically log the time that the error occurred and either trigger alarms for manual intervention or initiate automatic recovery. Hence, the algorithms in a fault detection system estimate what an unstable condition is from a stable condition in predictive maintenance.

Dashboard Sample for Unstable Conditions



In an unstable condition, the sensor from the machine yields irregular readings, as shown by the red dots in the dashboard above. These red dots are referred to as points of **an anomaly**, which are points of deviation from the regular readings of a stable condition. Importantly, these points serve as warning signals that are sent to a human operator to respond appropriately.

Conclusion

Remarks

Conclusively, anomaly detection is applicable in various domains, such as intrusion detection, fraud detection, fault detection, health system monitoring, event detection in sensor networks, and detecting ecosystem disturbances. For this study, anomaly detection was used as a predictive maintenance technique for fault detection through real-time data monitoring.