

# **Hydro Pumping Ltd. -** **Sensor Data Analysis**

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## **1. Introduction**

This report delves into an in-depth examination of sensor data, with a special focus on pinpointing any outliers, evaluating the variation in sensor readings via standard deviation, and computing the MAD for each sensor. This approach aims to uncover any unusual patterns and understand the consistency of the sensor measurements.

## **2. Agenda**

### **2.1 Objective**

The primary objective of this project is to analyze the sensor data collected from the water pump systems to identify patterns, anomalies, and potential predictors of system failures. By understanding these aspects, the company aims to move towards a predictive maintenance, reducing downtime and enhancing service.

### **2.2 Methodology**

We utilized a comprehensive data analysis approach, focusing on 52 sensors. The analysis involves data cleaning and preparation, followed by statistical examination of sensor readings. Outliers are identified and interpreted to understand their impact on the system. Graphical representations are used to visualize patterns and anomalies in the data.

### **2.3 Data Overview**

The dataset consists of raw values from 52 sensors over a specified period.

## **3. Findings**

### **3.1 Standard Deviation**

Varied standard deviations were observed across sensors.

- High Standard Deviation: sensor\_23, sensor\_28, sensor\_21, indicating significant variability.
- Low Standard Deviation: sensor\_00, sensor\_06, sensor\_07, suggesting more consistent readings

### **3.2 Mean Absolute Deviation (MAD)**

MAD values also varied, reflecting the typical deviation in sensor readings:

- Higher MAD Values: Notably in sensor\_21, sensor\_23, sensor\_28, and sensor\_31.
- Lower MAD Values: In sensors like sensor\_00, sensor\_06, and sensor\_07.

## **4. Insights**

### **4.1 Variability in Sensor Readings**

Observation: There is a notable variation in sensor readings across different sensors. Some sensors exhibit more stable readings (lower standard deviation), while others show significant fluctuations.

Implication: Sensors with high variability might be more sensitive to environmental changes or could be indicative of potential malfunctions. These should be monitored closely for maintenance or calibration.

### **4.2 Outliers in Sensor Data**

Observation: A substantial number of outliers were detected in several sensors. These outliers are data points that significantly deviate from the majority of readings.

Implication: Outliers could indicate transient or abrupt changes in the system, sensor malfunctions, or environmental anomalies. Identifying the causes of these outliers is crucial for maintaining system reliability.

### **4.3 Mean Absolute Deviation in Sensor Data**

Observation: The MAD values varied across sensors, indicating differences in the consistency of readings.

Implication: Sensors with high MAD values might require more frequent monitoring or maintenance to ensure accurate readings.

## **5. Recommendations**

Close Monitoring of High-Variability Sensors: Sensors with high variability and MAD should be prioritized for regular checks and calibration.

Investigation of Outliers: Conduct a thorough investigation into the causes of outliers to ensure they are not indicative of underlying system issues.

## **6. Conclusions**

The comprehensive analysis of the sensor data from Hydro Pumping Ltd reveals crucial insights into the functioning and health of the water pump system. Key observations include variability in sensor readings, the presence of outliers, and identifiable trends in time series data. These findings are instrumental in understanding the system's current state and predicting potential issues.