AI Based Operator Guidance System

And

Silicon Prediction in Hot Metal Tapped from Blast Furnace

Bhilai Steel Plant

Bhilai Steel Plant (BSP), situated in Bhilai, Chhattisgarh, has 5 working Blast Furnaces with annual capacity of producing 7.5 Mt of hot metal.

Considering the complexity of Blast Furnace process and vastness of process data, the following challenges are faced by the Blast Operation Operator:

1. Difficulty in drawing insights from real-time changes in the Blast Furnace

2. To establish correlation between process data & its derivatives with quality & productivity.

Team Introduction

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AI/ML based Operator Guidance System(OGS)

OGS enables operators of Blast Furnace

1. To interpret key insights in real time

2. Control critical quality parameters, especially silicon content in hot metal.

3. Provides insights which helps in boosting productivity, increasing the level of integration

4. Saves energy and costs.

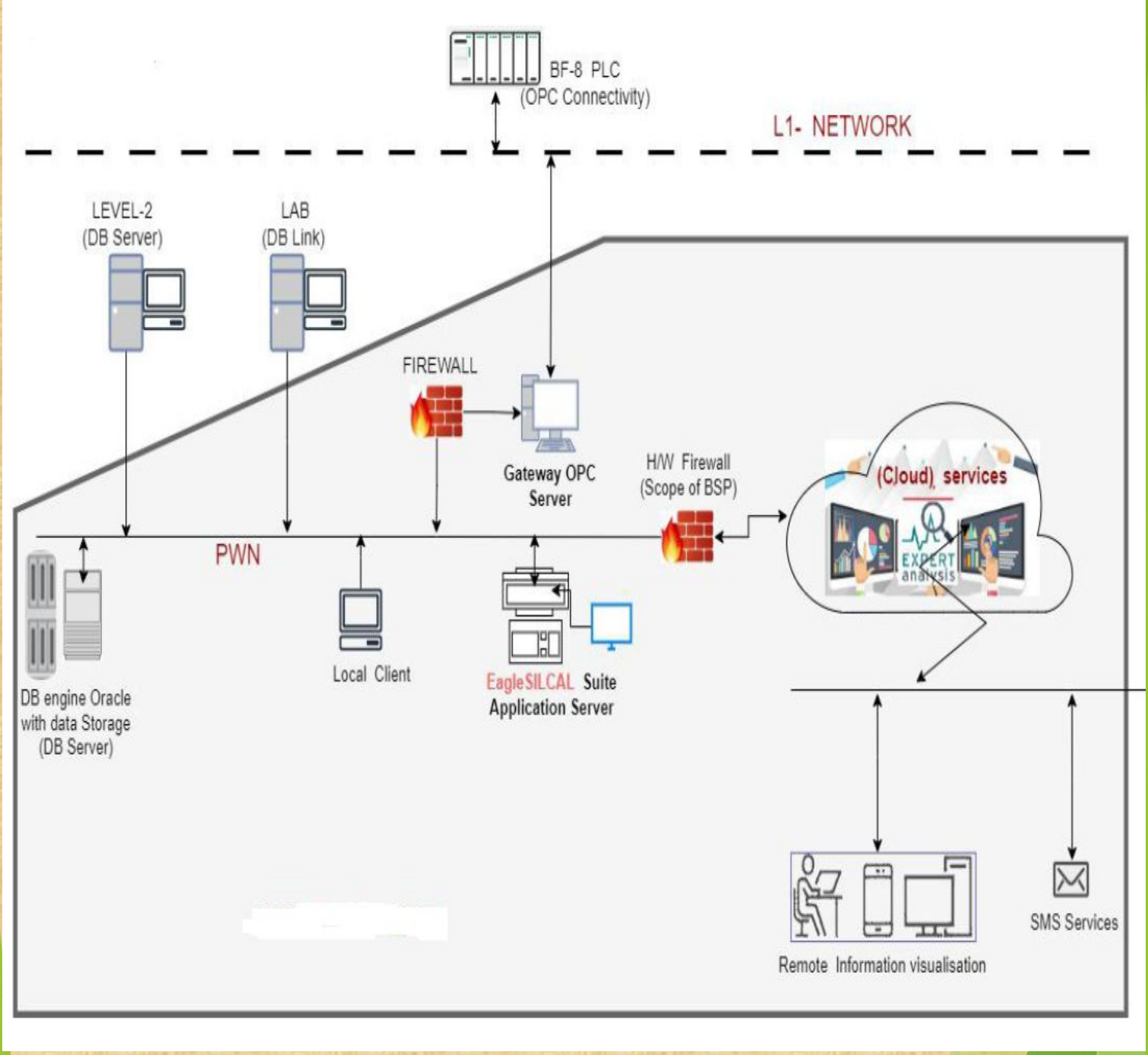
Working of OGS

Around 100 different signals and data points are captured in real time

Source of data:

1. **Laboratory Information Management System (LIMS)**
2. **Blast Furnace Level-1 & Level-2 systems.**

System Architecture



Data Used in Model

1. **LIMS data**
   - **Slag chemical analysis**
   - **Coal Analysis**
   - **CDI chemical analysis**
   - **Hot metal analysis**
2. **Process Data**
   - **BF Gen Data**
   - **BF Gen Gas Data**
   - **BF Hearth Temperature & Stave Temperature**

Process of Data Analytics

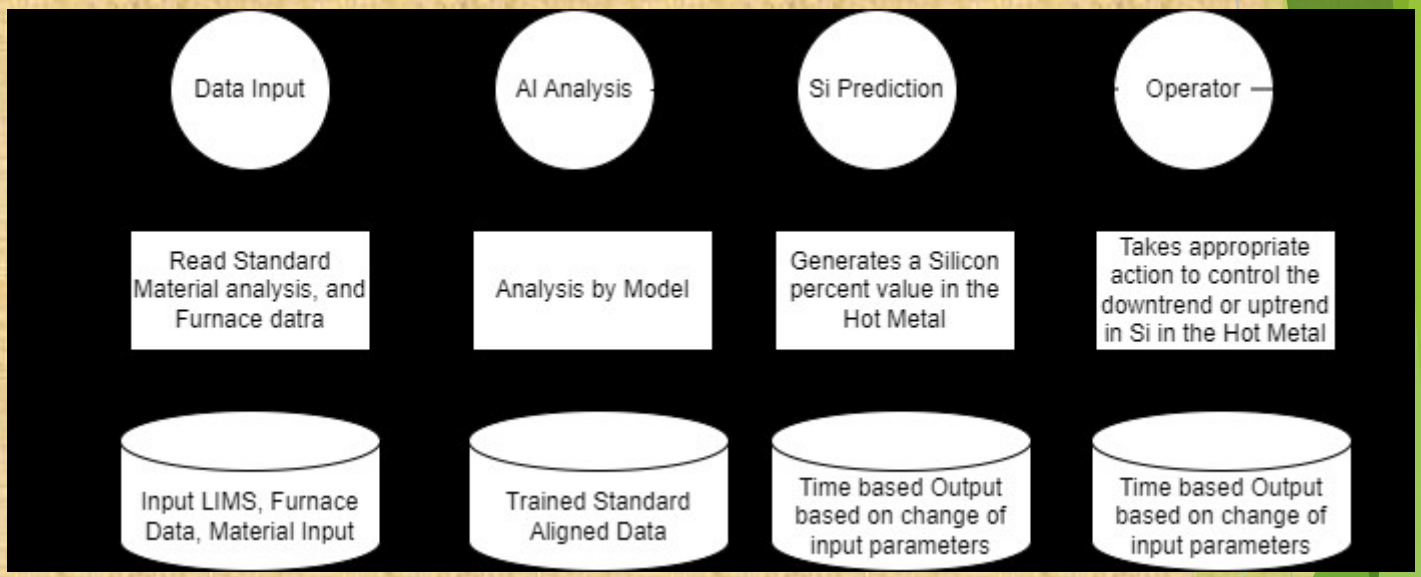
1. **Analysis of Dataset based on the following identification criteria:**
   I. **Criticality**
   II. **Key performance parameters (KPP).**

   Based on Process of Data cleaning and featured engineering

   ANN and Random Forest Machine learning models used to develop correlation between key performance parameters (KPP) and the silicon percent in the hot metal tapped.

Purpose and Strategy of Predictive Model

1. **Developed Using different correlations**
2. **To generate alerts for operators such that preventive and / or corrective actions**
3. **Based on alerts , action can be taken in time to control the silicon percentage in hot metal and other KPP.**
4. **The corrective actions to be taken is also suggested by the model.**

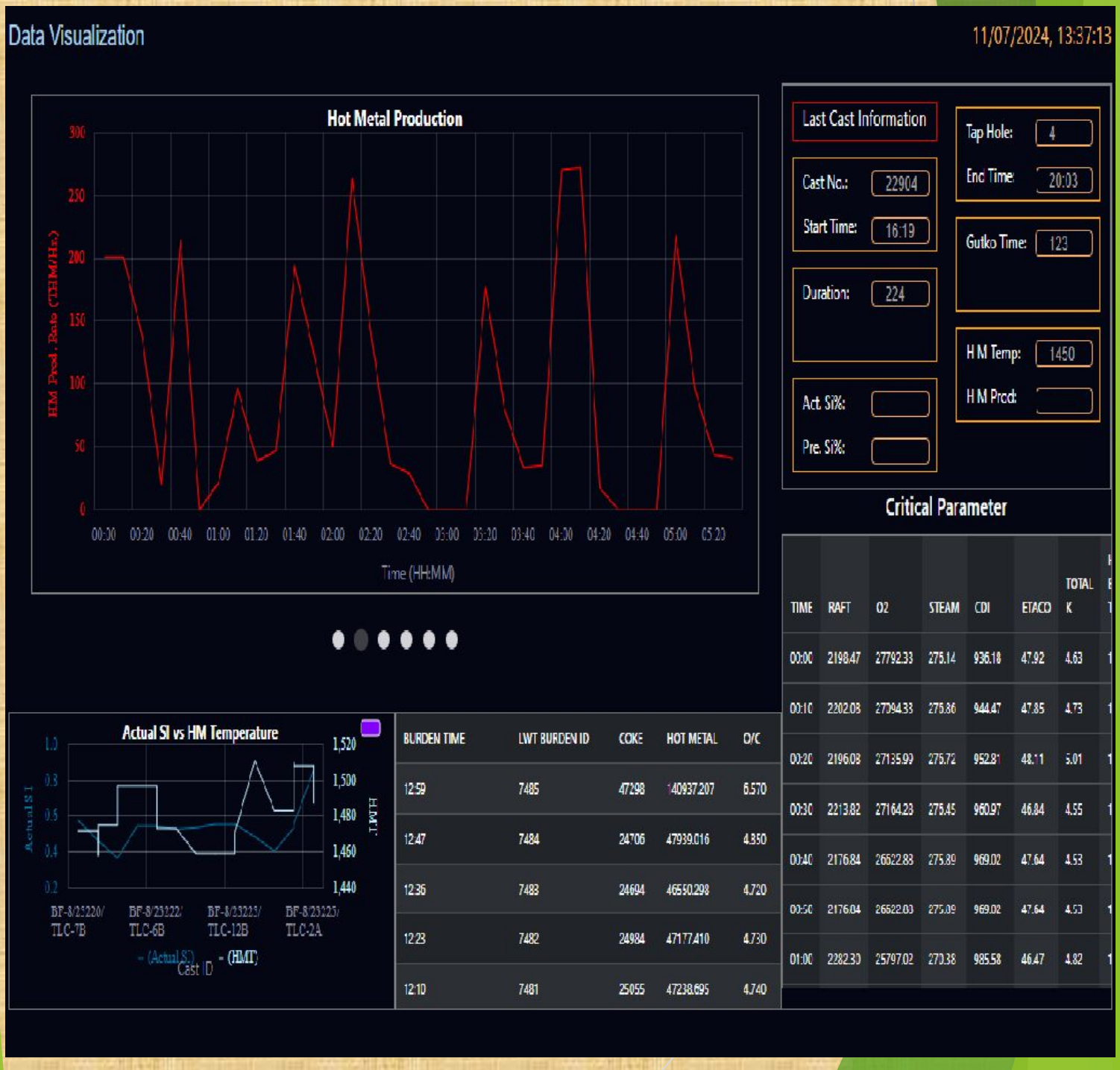


Dashboard- Operator Guidance System (OGS)

1. This screen is designed to suggest actions to operators in response to relevant alarms and highlight deviations between predicted silicon values.
2. Additionally, it provides visualizations illustrating the relationship between fuel consumption and Hot Metal production

Data Visualization

1. This screen is designed to visualize the input parameters and their impact on both the actual Silicon and Hot Metal Temperature.
2. Additionally, it provides visual representations of the details related to the casting data.

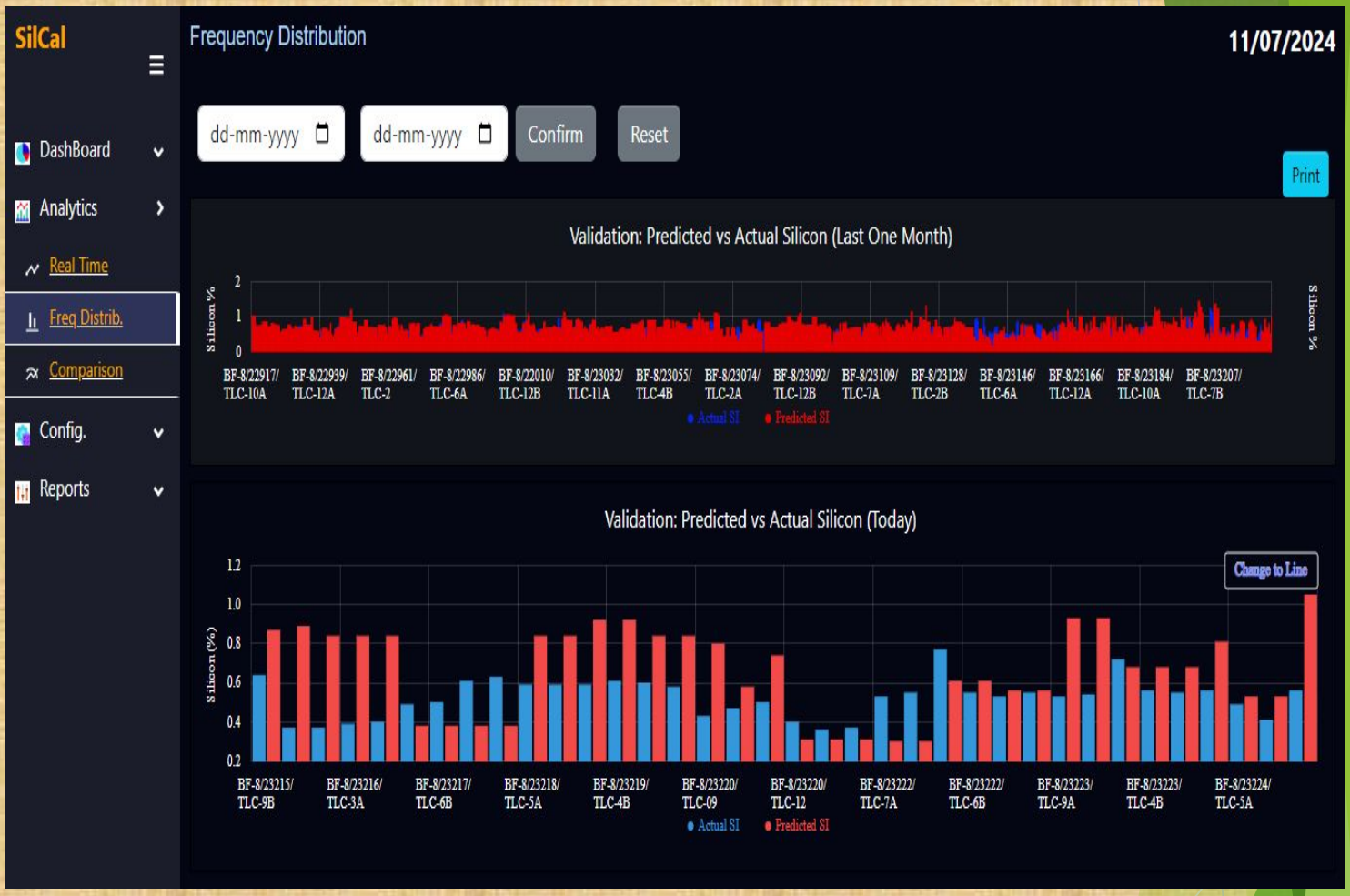


Analytics -Comparative Time Series Data Trending

1. **This screen is used for comparing the different parameters of same time scale. This will help for analysing and extracting the co-relation between the different screens.**

Frequency Distribution Of Actual Si And Predicted Si

1. **This screen is used for comparing the actual Si and predicted Si value with Hot Metal sample id. This will help for analysing the ANN model output with actual Si value.**



Combination Trend

1. **This screen is utilized to compare the Actual Si value with other laboratory data such as hot metal and slag analysis data.**

Outcome of the System

Since its commissioning at BF-8, the system has achieved the following :

1. **Accuracy of over 90% in KPP alert generation**
2. **Over 85% accuracy in silicon content prediction in hot metal tapped from Blast Furnace.**

QUESTION AND ANSWER