AVEVAWORLD

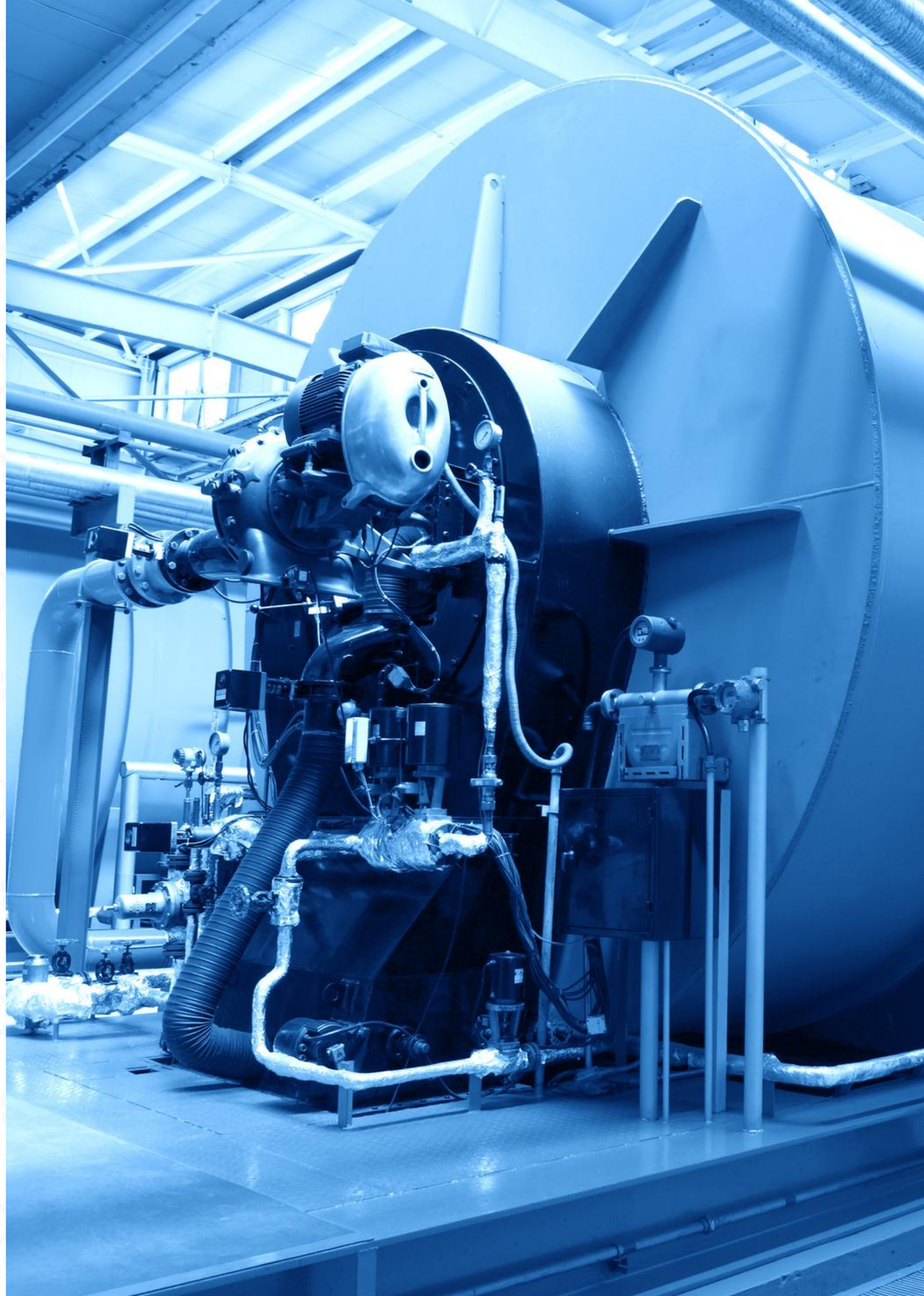
Fueling Efficiency:
Nalco's AI-Driven Solutions for Smarter Boiler Operations

Santosh Kumar
NALCO

Jimesh Gajera
Cerebulb India Pvt. Ltd.

Divyesh Dhorajiya
Cerebulb India Pvt. Ltd.

नालको NALCO | CEREBULB



About CEREBULB

CereBulb is a global company that helps organizations navigate the ever-evolving world of digital transformation. Our mission is to act as a catalyst, empowering businesses to leverage technology and data to achieve their goals

Start-Up of the Year

Entrepreneur of the Year

GLOBAL ENERGY DIGITALISATION CONCLAVE

3

Global Locations

USA IND AUS

75+

Technology Portfolio

Open Source & Licensed

140+

Team of

Global Experts

Project Management | Software Development | IoT | Analytics |Strategy Building

450+

Years Combined Industrial Experience

AVEVA Solution Provider

Technology Portfolio

aws, salesforce, tableau, mongoDB, React, PostgreSQL, Microsoft Azure, Power BI, D3, Grafana, python, R, Angular, Google Cloud

Schneider Electric

SI Partner

databricks

Partner


नालको NALCO

Challenges

1

Data Silos & Limited Accessibility

2

Limited Predictive Insights & Corrective Measures

3

Unplanned Boiler Shutdowns and Increased Downtime

4

Heat Balance and incomplete Combustion monitoring

5

Reactive Maintenance Leading to Higher Costs

6

Lack of Real-time Monitoring and Decision Support

Asset Information - Coal fired Boiler

Boiler 5

Information About Boilers:

Make	:	BHEL
Model	:	VU40
Capacity	:	200TPH, Top supported bi-drum tangential Coal fired boiler
Steam Temperature	:	485 Degree C.
Year of Commissioning	:	2011
System	:	maxDNA
Protocol	:	OPC UA

Project Objectives

01 Optimized Combustion Process

02 Digitalization of Manual Processes

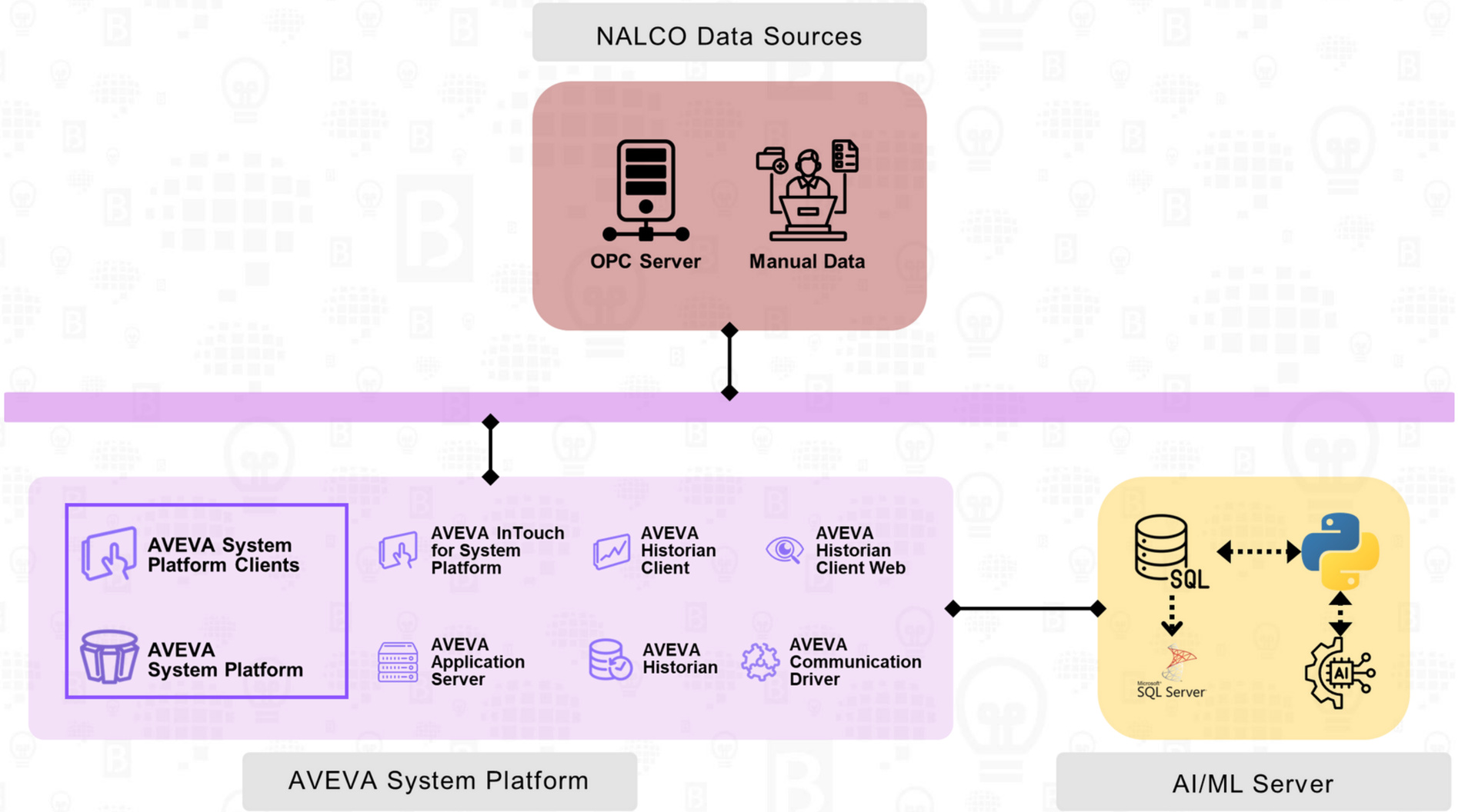
03 Parameter Deviation Detection

04 Automated Root Cause Analysis (RCA)

05 Deviation Identification & Guidance

06 Dynamic Optimization Instructions

System Architecture



Building Blocks of The Project

1. Centralized Data Collection & Historian

2. Advanced Analytics & Statistical Modeling

3. Process Deviation Detection & Root Cause Analysis

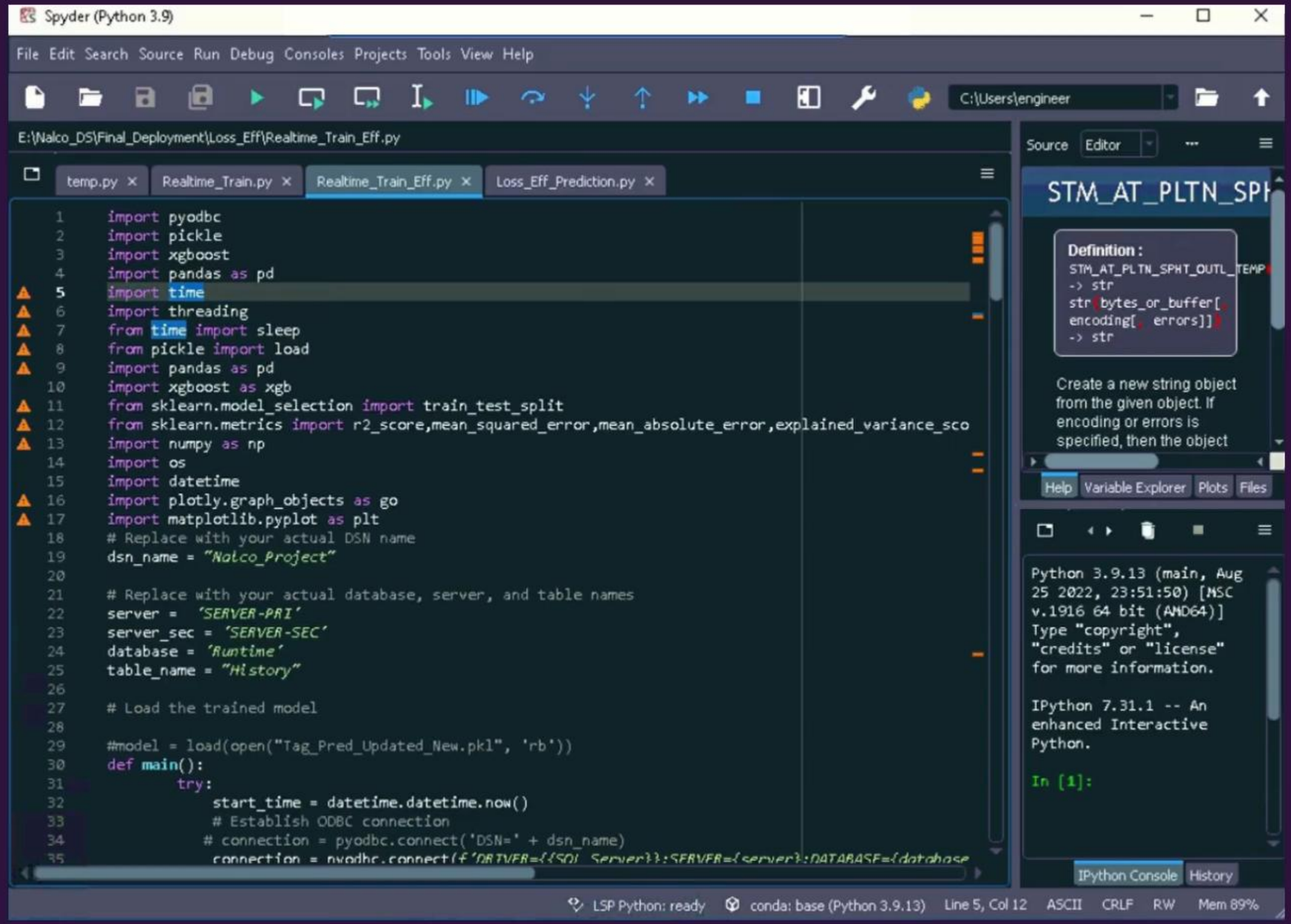
4. AI-Driven Corrective Action & Optimization

5. Real-Time Visualization & Remote Accessibility

6. Comprehensive Reporting & Historical Insights

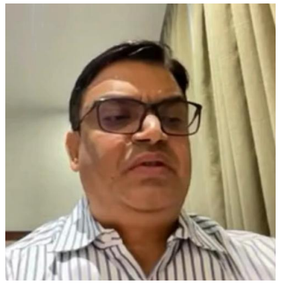
High Level AIML Project Approach

1. Raw Data
2. Data Pre-processing
3. Model Building
4. Model Validation
5. Model Tuning
6. Model Deployment
7. SSRS Reports
8. Visualization/Dashboard


Spyder (Python 3.9)
File Edit Search Source Run Debug Consoles Projects Tools View Help
C:\Users\engineer
E:\Nalco_DS\Final_Deployment\Loss_Eff\Realtime_Train_Eff.py
temp.py
Realtime_Train.py
Realtime_Train_Eff.py
Loss_Eff_Prediction.py
import pyodbc
import pickle
import xgboost
import pandas as pd
import time
import threading
from time import sleep
from pickle import load
import pandas as pd
import xgboost as xgb
from sklearn.model_selection import train_test_split
from sklearn.metrics import r2_score,mean_squared_error,mean_absolute_error,explained_variance_sco
import numpy as np
import os
import datetime
import plotly.graph_objects as go
import matplotlib.pyplot as plt
# Replace with your actual DSN name
dsn_name = "Nalco_Project"
# Replace with your actual database, server, and table names
server = 'SERVER-PRI'
server_sec = 'SERVER-SEC'
database = 'Runtime'
table_name = "History"
# Load the trained model
#model = load(open("Tag_Pred_Updated_New.pkl", 'rb'))
def main():
try:
start_time = datetime.datetime.now()
# Establish ODBC connection
# connection = pyodbc.connect('DSN=' + dsn_name)
Source Editor
STM_AT_PLTN_SPH
Definition :
STM_AT_PLTN_SPHT_OUTL_TEMP
-> str
str(bytes_or_buffer[,
encoding[, errors]])
-> str
Create a new string object from the given object. If encoding or errors is specified, then the object
Help
Variable Explorer
Plots
Files
Python 3.9.13 (main, Aug 25 2022, 23:51:50) [MSC v.1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.
IPython 7.31.1 -- An enhanced Interactive Python.
In [1]:
IPython Console
History
LSP Python: ready
conda: base (Python 3.9.13)
Line 5, Col 12
ASCII
CRLF
RW
Mem 89%

NALCO POWER PLANT | INDIA

नालको NALCO



NALCO reduces energy costs through AI-driven optimization

Challenge

- Data is scattered across multiple platforms, limiting real-time monitoring and decision-making, while restricted remote access reduces operational visibility.
- Operators rely on reactive maintenance, leading to frequent breakdowns, increased downtime, and high maintenance costs.
- Inefficient combustion and uncontrolled heat losses result in excessive fuel consumption, high emissions, and reduced boiler efficiency.

Solution

- AI-driven optimization integrates AVEVA with Python-based models to enable real-time monitoring, predictive analytics, automated root cause analysis, and KPI-driven decision-making.

Results

- AI-driven optimization enhances boiler efficiency and reduces coal consumption, leading to significant cost savings.
- Predictive monitoring helps minimize unplanned downtime and lowers maintenance costs, ensuring more reliable operations.
- Optimized combustion contributes to lower CO_2 emissions, supporting ESG compliance and sustainable industrial practices.

Thank You

नालको NALCO | CEREBULB