
CYCLO-TECH

Cyclo-tech

Presentation Product Launch

OPTIMIZING BIKE INFRASTRUCTURE, FLEET MANAGEMENT & URBAN PLANNING WITH BIG DATA

MOBILITY & RESOURCE OPTIMIZATION IN MODERN CITIES

01. Cycling is growing rapidly, but **infrastructure planning** lags behind demand.

02. Cities, bike-sharing companies, and e-scooters fleets struggle to **optimize station locations and charging points.**

03. Governments & businesses **lack real-time insights on traffic trends.** (Bikes, Taxis, e-scooter)

04. **Airports & Transit Hubs:** Trolley & cart placement inefficiencies lead to passenger inconvenience.

05. Taxi & ride-hailing companies lack data on high-demand **pickup zones.**

OUR SOLUTION: A DATA-DRIVEN APPROACH

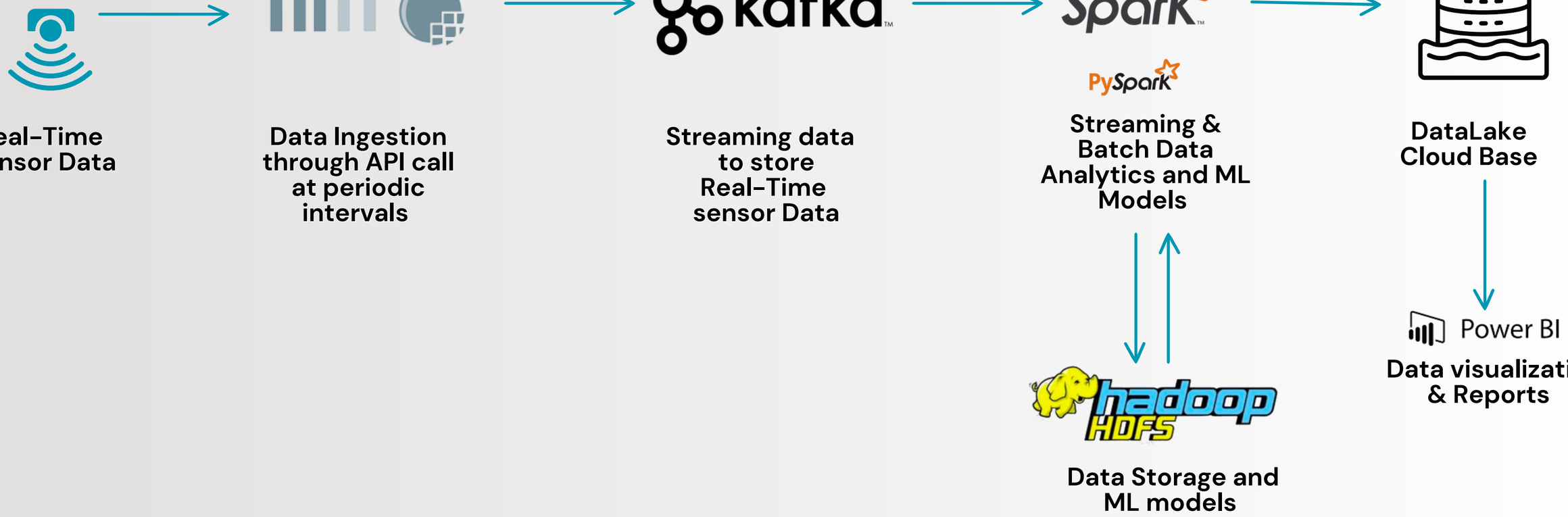
01. Real-time & historical data collected from induction loop sensors.

02. Big Data analytics to identify trends, predict demand & optimize operations.

03. Business Intelligence insights to support cities, startups & mobility providers.

TECH-STACK

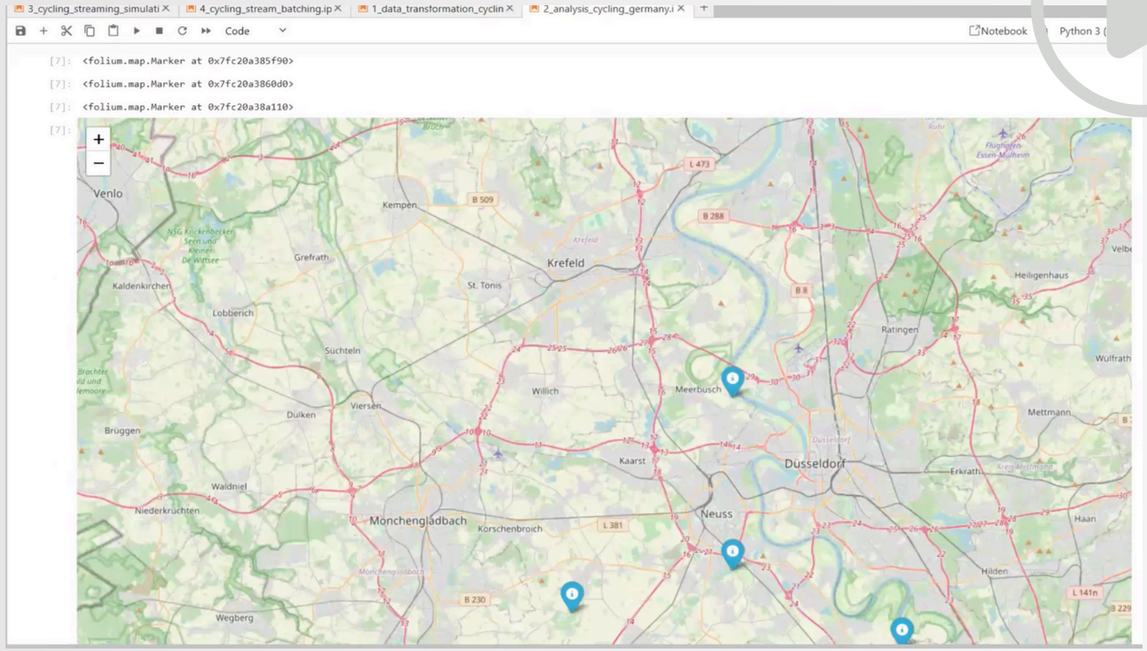
Big Data Pipeline



DEMO

Client: A Bike - Sharing App in Germany

Case Study of Cycle Paths in Rhine-Kreis Neuss



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Big Data Pipeline

Real-Time sensor Data

Data Ingestion through API call at periodic intervals

Streaming data to store Real-Time sensor Data

PySpark

Streaming & Batch Data Analytics and ML Models

DataLake Cloud Base

Power BI

Data visualization & Reports

Data Storage and ML models

OSBDET v2024r1 | 3_cycling_st... (4) - JupyterLab

localhost:28888/lab/tree/3_cycling_streaming_simulation.ipynb

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Code | Notebook | Python 3 (ipykernel)

Cycling in numbers - A Case Study of Cycle Paths in Rhine-Kreis Neuss

Description

Five Counting stations have been permanently documenting cycling traffic on central roads since 2016 in Cycle paths in the Rhine-Kreis Neuss. The daily measurement of cycling traffic is done with the help of induction loops laid in the ground. With the permanent collection of data can gain insights on the daily, weekly and annual cycles and on it building long-term cycling developments over several years.

More details on the data source here: https://data.europa.eu/data/datasets/eco-counter-data-rhein-kreis-neuss?locale=en

Streaming Simulation - Data Ingestion

To simulate real-time data ingestion, Apache Kafka is used to stream bicycle count data continuously. A Kafka producer reads records from the dataset and publishes them as JSON messages to a designated topic, replicating live data collection scenarios. The simulation introduces controlled time delays, mimicking the hourly arrival of new data.

Each message follows a predefined schema to maintain data integrity. Logging and monitoring mechanisms track message flow, ensuring successful ingestion and identifying potential issues. This simulation validates the system's ability to handle real-time data, laying the groundwork for further streaming analytics and dynamic monitoring applications.

[1]:
```
from kafka import KafkaProducer
import pandas as pd
import time
import json
from datetime import datetime
from pyspark.sql.session import SparkSession
import findspark


findspark.init()

import os

os.environ['PYSPARK_SUBMIT_ARGS'] = '--packages "org.apache.spark:spark-sql-kafka-0-10_2.12:3.5.2" pyspark-shell'
```

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USE-CASES

CycloTech a data-driven platform applies across multiple industries, helping businesses and governments make smarter decisions.

Urban Mobility & Smart Cities

Optimizing Bike & Scooter Station Placement:

- Identify high-demand locations to balance availability & reduce wait times.
- Improve bike fleet distribution

City Planning & Infrastructure Development

- Design better cycling lanes & reduce congestion.

Airports & Transit Hubs

Optimizing Passenger Mobility & Last-Mile Transport

- Identify key drop-off & pickup zones
- Optimize trolley placements based on passenger movement patterns.

Micromobility e-bikes

Predicting Optimal Charging & Battery Swap Times

- Use real-time data to schedule e-bike battery swaps at the right times.
- Reduce operational costs by optimizing energy efficiency.

Fleet Rebalancing & Demand Forecasting

- Prevent bike shortages in high-traffic areas with AI-driven demand prediction.

Cyclo-tech

BUSINESS IMPACT

01. Improve City Planning

02. Optimize Bike-Sharing Operations

03. Improve station/facility placement efficiency.

04. Drive Cost Efficiency

05. Identify Optimal locations for new transport hubs & facilities.

06. Increase Customer Satisfaction

FUTURE APPLICATIONS AND USE CASES

01. Predict EV charging demand and optimize station placement with real-time data.

02. Optimize delivery fleets using real-time traffic data and historical demand

03. Use data to predict parking demand and optimize space allocation in real-time

04. Use of graph algorithms to optimize cycling routes based on real-time data and user preferences


MAXIMIZE OPERATIONS FLEET EFFICIENCY &
CUSTOMER SATISFACTION.
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