AI-Driven Workflow Optimization & Delay Prediction Platform

Technical Case Study

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Executive Summary

This document presents an enterprise-grade analytics platform designed to diagnose operational bottlenecks, optimize resource utilization, and predict delivery risks for large-scale IT service organizations. The system integrates SQL-based data warehousing, machine learning models, and Power BI visualization, wrapped in a minimalist web interface for executive and operational decision-making.

Business Problems Addressed

- Unidentified workflow bottlenecks leading to schedule overruns and cost escalation.
- Inefficient resource allocation causing employee overutilization or underutilization.
- Lack of predictive visibility into task delays and project risk.
- Absence of a unified analytics view combining operations, resources, and forecasting.

Solution Overview

- Centralized SQL data model integrating Projects, Tasks, Employees, Delays, and Resource Allocation.
- Workflow analytics to measure cycle time variance, delay drivers, and bottleneck intensity.
- Resource optimization layer analyzing utilization %, skill-task alignment, and overload risk.
- Machine learning models to predict delay probability and forecast future workload demand.
- Power BI dashboards embedded in a web interface for interactive exploration and executive reporting.

Key Analytics Modules

- **Workflow Bottleneck Analysis:** Task delay distribution, project-task heatmaps, estimated vs actual cycle time.
- **Resource Optimization:** Utilization tracking, overload identification, skill mismatch detection.
- **Predictive Analytics:** Delay probability scoring, risk classification (High/Medium/Low), workload forecasting.

Technology Stack

- Data Layer: MySQL (Relational schema with referential integrity and fact-dimension modeling).
- Analytics & Modeling: Python (Regression, Classification, Time Series Forecasting).
- Visualization: Power BI (Interactive dashboards and KPIs).
- Web Layer: HTML, CSS (Apple-style minimalist presentation).

Enterprise Relevance

The architecture and analytical approach are aligned with real-world operational intelligence systems used by large IT service providers such as TCS and Infosys. The platform demonstrates the ability to translate raw operational data into actionable insights for project managers, resource planners, and delivery leadership.

Expected Business Outcomes

- Early identification of high-risk tasks and projects.
- Improved resource utilization and reduced employee burnout.
- Data-driven decision support for delivery planning and capacity forecasting.
- Enhanced transparency and accountability across project workflows.

— End of Case Study —