Downtime Shield Project Documentation

1. Project Proposal

Overview

This project analyzes **production downtime trends** and **operator performance** using four core datasets from a manufacturing facility:

- **Manufacturing Data**: Records of batches produced, duration, shifts, and operator IDs.
- **Operator Data**: Shift assignments and identity of each operator.
- **Batch Timing Data**: Minimum and maximum expected times for each product batch.
- **Downtime Logs**: Root causes and durations of downtime incidents by batch.

Goal: Identify downtime patterns, operator-related inefficiencies, and potential process bottlenecks to optimize manufacturing throughput and reduce production halts.

Objectives

- **Analyze** root causes of downtime by batch and operator.
- **Compare** actual production time with expected batch time standards.
- **Evaluate** operator performance across shifts and product lines.
- **Design** an interactive dashboard for real-time downtime tracking and root cause analysis.

Scope

- Merge manufacturing, operator, batch_time, and downtime sheets using Batch and Operator ID.
- Clean and standardize data (remove unused columns, validate joins).
- Perform Exploratory Data Analysis (EDA) on downtime distributions, shift patterns, and operator performance.
- Develop visualizations: downtime by reason, shift, and operator; deviations from standard batch times.
- Build an interactive dashboard to monitor KPIs and support operational decision-making.

2. Project Plan (Timeline & Milestones)

Phase	Tasks	Team Members	Deadline
Data Preprocessing	Clean, merge all datasets	Olivia Ashraf	12/05/2025
EDA	Explore downtime trends and batch duration gaps	Carol Nader	15/05/2025
Analysis	Identify key operators, shifts, products	John Mamdooh , Ziad Abdullah	18/05/2025
Modeling & Correlation	Link downtime causes to shifts, operators, etc.	Kenzy Ashraf , Meraa Amr	22/05/2025
Visualization	Create plots by downtime reason and operator	John , Kenzy , Meraa, Ziad , Carol ,Olivia	25/05/2025
Dashboard Development	Build real-time monitoring tool (Power BI/Tableau)	John , Kenzy Ziad, Mera	28/05/2025

3. Task Assignment & Roles

- **Olivia Ashraf:** Data preprocessing (merge, clean, structure).
- **Carol & Mera:** EDA and root cause modeling.
- **John & Ziad & Kenzy:** Visualizations (e.g., downtime distribution, batch deviation).
- **John & Kenzy & Ziad & Mera:** Dashboard implementation and filter integration.

4. Risk Assessment & Mitigation Plan

Risk	Potential Impact	Mitigation Strategy
Incomplete merges	Missing operator/batch associations	Verify joins using consistent batch/operator IDs
Irregular data	Unexpected nulls or duplicate entries	Perform rigorous cleaning and deduplication
Time mismatch	Inaccurate comparisons of actual vs. standard	Validate unit consistency (e.g., minutes vs. hours)

5. Key Performance Indicators (KPIs)

- **Downtime Rate:** Total downtime (hours) per shift or operator
- **Root Cause Frequency:** Most common causes (e.g., emergency stop, labeling error)
- **Batch Efficiency:** Deviation between actual and standard batch durations
- **Operator Performance:** Downtime caused per operator normalized by hours worked
- **Dashboard Usage:** Interaction metrics on filters, views, and alerts