Low Level Design Document

Introduction

This Low Level Design (LLD) document outlines the implementation details for **EcoWatt - Energy Consumption Dashboard**. The project aims to deliver a Tableau dashboard for a utility provider to monitor energy usage, peak demand times, and cost breakdowns, featuring interactive charts and time filters.

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1. System Components

Component	Description	Key Responsibilities
Data Source	Raw energy usage and cost data (CSV/DB/API)	Provide structured data for analysis
Data Pipeline	ETL scripts/processes	Clean, transform, and load data to Tableau
Tableau Dashboard	Interactive visualization layer	Display charts, filters, and breakdowns
User Interface	Tableau dashboard UI	Enable user interaction and filtering

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2. Class/Interface Overview

Class/Interface	Description	Key Methods/Attributes
DataExtractor	Extracts raw data	`extract()`, `source_path`
DataTransformer	Cleans/transforms data	`transform(data)`, `validate(data)`
DataLoader	Loads data into Tableau	`load(data)`, `target_tableau_source`
TableauWorkbook	Tableau dashboard configuration	`charts`, `filters`, `data_source`

Relationships:

- `DataExtractor` → `DataTransformer` → `DataLoader` → `TableauWorkbook`

Key Methods Example:

```
class DataTransformer:
    def transform(self, data):
        # Clean and aggregate data for dashboard
        return transformed_data
```

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3. Data Structure Overview

Model	Fields/Attributes	Description
EnergyUsage	timestamp, meter_id, usage_kwh	Raw energy usage records
CostBreakdown	timestamp, meter_id, cost_type, amount	Cost per type (e.g., peak, off-peak)
AggregatedMetrics	date, total_usage, peak_time, total_cost	Daily/periodic summary for dashboard

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4. Algorithms/Logic

Data Processing Flow:

```
For each data file/source:
    Extract raw data
    Validate and clean data
    Aggregate usage and cost by time period
    Identify peak demand times
    Output to Tableau data source
```

Dashboard Logic:

- Use Tableau calculated fields for dynamic cost/usage breakdowns.
- Implement time filters (date range, granularity).
- Configure interactive charts (usage trends, peak times, cost pie chart).

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5. Error Handling

Scenario	Handling Approach
Data extraction failure	Log error, alert admin, skip file
Data validation error	Log invalid records, continue processing
Tableau data source update fail	Retry, log error, notify admin
User filter input error	Show user-friendly error in dashboard

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