

# Milestone 2 Comprehensive Description

## Real-Time Traffic Anomaly Detection System – Cairo

Digital Egypt Pioneers Initiative – Real-Time Traffic Analytics

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### Overview

A complete real-time anomaly detection pipeline that processes live traffic data every 5 minutes, identifies abnormal patterns using rule-based logic, and persists **only anomalous events** — achieving **90–95% data reduction** during normal conditions.

### Architecture

Event Hubs / IoT Hub → Azure Stream Analytics → Azure SQL Database (Anomalies Table)

### Key Deliverables

#### 1. 7 Cairo Hotspots Fully Configured

Real GPS coordinates and capacity limits for Tahrir Square, Ramses, 6th October Bridge, Nasr City, Heliopolis, Maadi Corniche, and Ahmed Orabi.

#### 2. Reference Data Foundation (Ready for ML Phase)

`dbo.IncidentReference`: Speed impact factors (e.g., Major Accident → 55% reduction)

`dbo.WeatherReference`: Weather impact factors (e.g., Sandstorm → 45% reduction)

#### 3. Optimized Anomalies Table (`dbo.Anomalies`)

Stores only anomalous 5-minute windows with denormalized fields and indexes for instant Power BI querying.

#### 4. Production Azure Stream Analytics Job

Tumbling 5-minute windows

Rule-based anomaly detection with priority logic (most severe condition wins)

Detects 6 anomaly types:

`critical_incident` (Major Accident)

`severe_congestion` (AvgSpeed < 15 km/h)

`high_congestion` (>100%)

`high_speed` (>90 km/h)

`volatile_traffic` (speed swing >30 km/h)

`minor_incident`

Severity levels: `critical` / `high` / `medium` / `low`

Normal traffic filtered out at source

5. **Smart EventID Format**

EVT\_LOC001\_103000 → enables perfect time-location alignment

## Results Achieved

Successfully detects all synthetic anomalies from Milestone 1 simulator

Anomaly table remains small and actionable

End-to-end latency < 10 seconds

90–95% storage savings by discarding normal traffic

Fully tested and production-deployed