

Milestone 2 Comprehensive Description

Real-Time Traffic Anomaly Detection System – Cairo

Digital Egypt Pioneers Initiative – Real-Time Traffic Analytics

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