Project Design Phase

Solution Architecture

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Project Name:Traffictelligence:Advanced Traffice Volume Estimation With Machine

Maximum Marks:4 Marks

Solution Architecture: Solution architecture is a complex process

– with many sub-processes

– that bridges the gap between business problems and technology solutions. Its goals are to:

● Find the best tech solution to solve existing business problems.

● Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.

● Define features, development phases, and solution requirements.

● Provide specifications according to which the solution is defined, managed, and delivered

🚦 Scenario 1: Smart City Real-Time Traffic Management

Use Case: City municipality needs real-time traffic insights for dynamic signal control and congestion mitigation.

Solution Architecture Fit:

Data Sources: CCTV cameras, inductive loops, GPS data.

Edge Processing: Edge AI devices run object detection (YOLOv8) to count vehicles in real time.

Ingestion: Kafka streams send data to central servers.

Storage & Processing: Real-time analytics using Apache Flink + InfluxDB.

ML layer: Predictive model (LSTM) forecasts congestion 15 mins ahead.

Output: Live dashboards for traffic control centers; APIs to adjust traffic signals dynamically.

Deployment: On-premise + Cloud hybrid with Kubernetes for scalability.

🚗 Scenario 2: Highway Authority Volume Forecasting for Infrastructure Planning

Use Case: National highway authority wants historical analysis and future traffic projection to plan expansions.

Solution Architecture Fit:

Data Sources: Roadside radar sensors, GPS from commercial fleets.

Ingestion: Batch uploads daily via SFTP + API feeds.

Storage: Cloud-based Data Lake (AWS S3) + PostgreSQL for processed data.

Processing: Apache Spark ETL jobs for data cleansing and aggregation.

ML Layer: Time series forecasting using Prophet or XGBoost.

Output: Weekly/monthly traffic volume reports, interactive BI dashboards.

Deployment: Cloud-native (AWS) for elasticity and cost control.

🏙 Scenario 3: Smart Parking & Urban Mobility Insights for a Metro Area

Use Case: A metro city wants to analyze parking occupancy trends and micro-traffic flow to optimize urban planning.

Solution Architecture Fit:

Data Sources: IoT-based parking sensors, GPS from e-scooters and ride-share.

Ingestion: MQTT protocol for IoT feeds + Mobile App data via REST APIs.

Storage: NoSQL DB (MongoDB) for flexible location-based queries.

Processing: Real-time occupancy updates with rule-based processing.

ML Layer: Anomaly detection to identify unusual congestion or illegal parking zones.

Output: App-based insights for citizens + City dashboard with zone heatmaps.

Deployment: Edge-heavy architecture for parking, centralized cloud for analytics.