A basic architecture that serves as a launchpad for feature enhancements and service upgrades will integrate the following components:

- ***Sensors*** for collecting data and sending it to a centralized cloud platform
- ***Actuators*** for physical devices to make necessary adjustments like – restricting the water supply in pipelines with leakages or dimming & brightening streetlights based on weather conditions.
- ***Field gateways*** to collect & compress data before moving it to a cloud platform.
- ***Cloud gateways*** enable secure data transfer between field gateways & the cloud storage of the traffic management system
- ***A data lake*** to store the raw, unstructured information before it is cleansed, processed, transformed & moved to a data warehouse for extracting actionable insights
- ***Data warehouse*** stores contextual information about connected objects and devices installed with sensors and actuators.
- ***Data analytics*** for analyzing the data from streetlight sensors on a centralized dashboard to adjust the intensity of lights
- ***ML algorithms*** to analyze traffic patterns & trends from historical data – stored in the data warehouse. The identified trends are then used to build predictive models for control apps. These apps modify the average vehicle speed to avoid congestion.
- ***Rules*** to enable actuators to automate the functioning & control of smart city objects and devices. These rules are manually defined to tell actuators what needs to be done to solve a specific problem.
- ***User applications*** that allow citizens to receive instant notifications in case of traffic jams and congested routes. Desktop user apps for control rooms send commands to actuators for altering traffic signals. It helps to relieve congestion and optimize routes.
- ***Cross-solution integrations*** with traffic lights or streetlight management systems. Control apps apply ML models or predefined rules to prompt appropriate output action if the air quality is poor.

Cities of all sizes can leverage this approach. Depending on the budgetary and procurement constraints, they can start small. It would be with solutions like – a littering offense ticketing system or a smart parking app. Later they can expand the range of services.

Key Features of a Smart Traffic Management System

The key features are listed below depending on the city's size and the scope of the governmental policies. It can be integrated into an intelligent traffic management system. They include

- Traffic Jam Detection: With cloud connectivity, sensors, and CCTV cameras tracking intersections 24x7, technicians can remotely monitor all the streets in real-time from the city's traffic control room.
- Connected Vehicles: A smart traffic system using loT technology can connect with roadside tracking devices to enable direct communication between intelligent vehicles & intersections.
- Modular Control: Real-time detection of congestion triggers dynamic adjustments in the systems meant for controlling traffic lights, express lanes, and entry alarms
- Emergency Navigation: A system with edge data processing & programmatic alerting capabilities can alert response units (police, ambulance & tow trucks) in case of a car crash or collision. It reduces the crucial time an injured driver or passenger remains unattended
- Road Safety Analytics: Systems with pattern detection capabilities can immediately flag high cruising speeds and reckless driver or inappropriate pedestrian behavior
- Digital Payments: Commercial traffic management systems enable quick and convenient electronic transactions in real time while ensuring financial data safety

Case Study: IoT-based Litter Fine Ticket Mobile App

Our client is a prominent service provider of cleaning & hygiene supplies. To ensure a clean & greener community, they cover all littering offenses. They turned to us to modernize their existing littering violation system with a fine-ticket mobile app.

Challenges:

Poor visibility into operations with the Fixed Penalty Notice being issued based on employee number, location & details of the offender

No mechanism for issuing receipts on the move for field officers

No encryption in the payment gateway

Our Approach:

- Our team designed an Android app that allows officials to record, submit & manage offenses
- It integrates the payment gateway and allows corrections on a unified system
- We optimized the user interface for their online portal and enabled online and offline synchronization
- We helped optimize & secure employee logins & authentication for extracting the details of offenses & penalties

Benefits Delivered:

- Data-driven analytics for on-demand reporting
- End-to-end encryption of data
- Easy access to online & offline data

Technologies Used:

- Android, Microsoft .NET, SQLite, Bluetooth 4.0