



Smart AI-Powered Traffic Management System

Presented at NEXHACK 1.0

👥 **Team Name:** Codify

👨‍💻 **Team Members (4):**

- **Astha Singh** → *Team Lead & Junior ML Engineer*
- **Avni Yadav** → *Frontend Developer & UI/UX Designer*
- **Avni Tyagi** → *Backend Developer*
- **Abhinav Bahadur Singh** → *AI & ML Engineer & Blockchain Developer*



Traffic Congestion: A Growing Problem

Delays & Frustration

Millions of hours lost in traffic, impacting productivity and quality of life.

Environmental Impact

Increased fuel consumption and CO₂ emissions contribute to air pollution.

Safety Concerns

Slow emergency response times and a higher risk of accidents due to gridlock.

Inefficient Systems

Fixed-timer traffic lights fail to adapt to real-time traffic dynamics.

💡 Our Innovative Solution

AI-Powered Adaptive Traffic Control

Our system leverages advanced AI and real-time data to revolutionize urban traffic management.

🔑 Key Features

- **Live Camera Feeds** – HD cameras monitor intersections, tracking vehicles, pedestrians, and unusual activity.
- **Real-time Detection** – AI instantly identifies vehicles, pedestrians, accidents, and emergencies.
- **Dynamic Signal Adjustment** – Smart traffic lights adapt timings based on live traffic flow.
- **Emergency Vehicle Priority** – Automatic green passage for ambulances, fire trucks, and police.
- **Accident & Anomaly Alerts** – Quick detection of crashes or violations with instant alerts.
- **Predictive Traffic Management** – ML forecasts congestion patterns and peak hours.
- **Blockchain Security** – Ensures safe, transparent, and tamper-proof traffic data.





Driving Towards a Smarter Future



Key Objectives & Goals

Optimize Traffic Flow

Significantly reduce average waiting times at intersections.

Optimize Traffic Flow

Ensure rapid and unimpeded passage for emergency vehicles.

Enhance Safety

Instant accident detection and notification to authorities.

Scalable Integration

Lay the groundwork for broader smart city infrastructure.

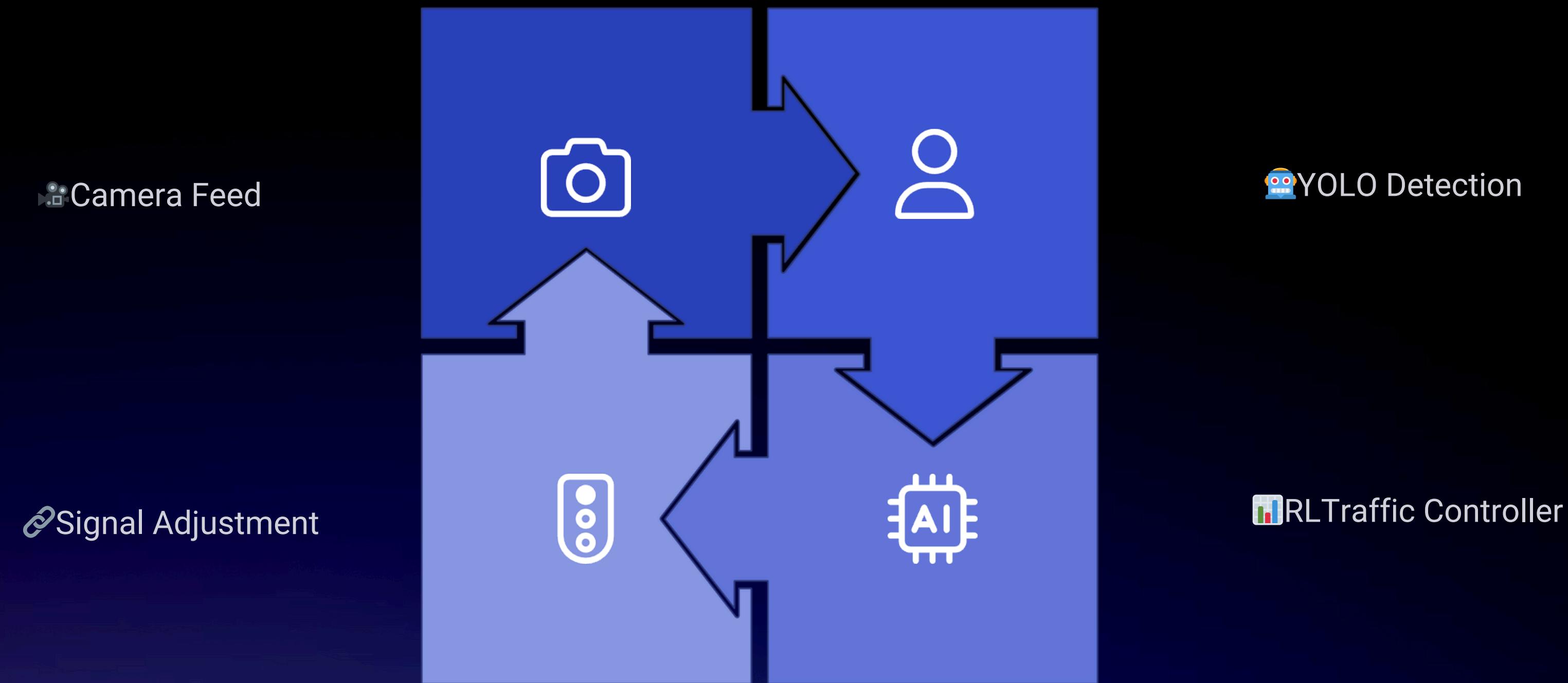
 The Foundation of Our System Robust Technology Stack

 Languages	Python
 AI/ML Frameworks	RL, PyTorch, OpenCV, YOLO (You Only Look Once)
 Simulation	SUMO (Simulation of Urban MObility)
 Database	Firebase (real-time data synchronization)
 User Interface	Tkinter (desktop visualization), Web (future scalability)

This combination provides a powerful, flexible, and scalable platform for intelligent traffic management.

⚙️ How It Works

⌚ System Workflow & Architecture



Our architecture ensures seamless data flow from detection to real-time action, supported by continuous learning from simulation.

🔑 Key Features & Innovations



AI-Driven Adaptability

A truly intelligent and responsive traffic ecosystem.



Pedestrian Safety

Prioritizes pedestrian crossing times based on real-time detection.



Emergency Response

Automated accident detection and expedited emergency vehicle routes.



Edge Device Compatibility

Enables low-cost, decentralized deployment at intersections.



Implementation Plan

→ Phase 1: Concept & Research

Defining the problem, exploring solutions, and initial design.

→ Phase 2: SUMO Prototype

Developing and testing the core AI logic within a simulated environment.

→ Phase 3: Integration

Connecting YOLO/OpenCV for real-time vision and Firebase for data management.

→ Phase 4: Real-World Pilot

Deployment and testing in a controlled urban environment.



Prototype

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⚠️ Anticipating Obstacles

🛡 Challenges & Risk Management

📹 Processing Lag in Video Feeds

Mitigation: Utilizing lightweight AI models and optimizing code for efficiency on edge devices.

🏗 Integration with Existing Infrastructure

Mitigation: Designing a modular system with flexible APIs for easy adaptation.

🌐 Network Failure & Data Loss

Mitigation: Implementing a local fallback mode to maintain basic functionality during outages.

🔒 Data Privacy & Security

Mitigation: Anonymizing data and ensuring robust encryption protocols.



The Road Ahead

★ Impact & Conclusion



Reduced Congestion

Smoother traffic flow, less idling, and significant fuel savings.



Enhanced Safety

Fewer accidents, quicker emergency response, and pedestrian protection.



Smart City Ready

Scalable and adaptable for integration into broader urban ecosystems.



AI + IoT + Smart Governance = The Future of Urban Mobility.