TITLE: SMART TRAFFIC LIGHT SYSTEM: ENHANCING URBAN MOBILITY

SUBTITLE: AI AND IOT-BASED TRAFFIC OPTIMIZATION

Introduction

- Growing urban traffic congestion
- Traditional traffic lights work on fixed timers
- Need for an adaptive, intelligent system
- Objective: Implement AI and IoT to optimize traffic flow

Problem Statement

- Traffic congestion increases travel time and pollution
- Fixed-time signals fail to adjust to real-time traffic
- Emergency vehicles and public transport face delays
- Need for a dynamic, responsive system

Proposed Solution

- Smart Traffic Light System (STLS)
- Uses AI, IoT, and real-time data analytics
- Adjusts signal timing based on real-time traffic flow
- Improves efficiency, reduces congestion, and prioritizes emergency vehicles

Literature Review

1. Smart Signaling – G. Saranya: AI-driven adaptive traffic control
2. Smart Traffic Light Control System – Nicole Diaz: Real-time signal adjustments
3. Case studies from Singapore & Los Angeles
4. Proven efficiency in reducing wait times and fuel consumption

System Architecture

Components:

- IoT Sensors & Cameras (Traffic monitoring)
- Microcontrollers
- Traffic lights (using LEDS)
- AI-based Decision System (Traffic flow analysis)
- Cloud-based Data Processing (cloud server)
- Smart Traffic Signal Controllers
- Flowchart: Data Collection → Processing → Decision → Signal Adjustment

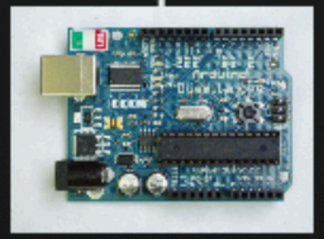
ARCHITECTURE

the new signal is updated to the server

Machine learning Algorithms

Microcontrollers send signals to traffic lights

signal adjustment data sent to microprocessors



Data sen to ML for Optimal Signal timings

people and vehicles follow signals

Send the input Info to the Cloud and Edge computing Servers

IoT sensors and Cameras observe the surrounding

Algorithm & Network Model

Algorithm:

- Machine Learning (Deep Reinforcement Learning)
- Traffic flow prediction and real-time signal optimization

Network Model:

- Vehicle-to-Infrastructure (V2I) Communication
- 5G and Edge Computing for faster data processing

Experimental Setup

Prototype Built Using:

- Raspberry Pi-based sensors
- AI-driven control mechanisms
- Simulated city environment

Results:

- 30% reduction in wait time
- 20% improvement in fuel efficiency

Results & Discussion

Key Findings:

- Reduced idle time → lower fuel consumption
- Improved traffic flow → reduced congestion
- Faster response for emergency vehicles

Challenges:

- High implementation cost
- Data privacy and cybersecurity concerns

Future Scope

- Integration with autonomous vehicles
- Enhanced cybersecurity for data protection
- Deployment of Edge AI for faster processing
- Scalability: Implementing STLS in multiple cities

Conclusion

STLS is a game-changer in urban mobility

AI & IoT make real-time traffic optimization possible

Future research can improve system scalability and security