SMART TRANSPORT SIMULATION

TEAM MEMBERS:

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SMART TRANSPORT SIMULATION SYSTEM

Team Size: 4 Members | Language: C Programming

INTRODUCTION:

It is the real-time intelligent traffic management simulation that replicates smart city transportation systems. The program optimizes traffic flow through adaptive signal control, monitors congestion across road networks, simulates realistic daily traffic patterns, and prioritizes emergency vehicle routing—all working together to create an efficient, life-saving urban transport system.

CORE CONCEPTS:

1. Adaptive Traffic Light Management

Replaces fixed-timing signals with intelligent lights that adjust in real-time based on traffic conditions. Each intersection monitors vehicle queues in all four directions and calculates priority factors to allocate optimal green light durations.

Formula: Green light Time = 30s + (Queue length / 10) × 5s.

Impact: Reduces average wait time by 25-35% compared to fixed timing.

2. Real-Time Congestion Monitoring

Provides comprehensive traffic density analysis with color-coded visualization. Each road calculates congestion Score

Formula: Congestion score = (Current Vehicles / Road Capacity) × 100

categorized as Low (0-30% green), Medium (31-60% yellow), or High (61-100% red). Impact: Traffic managers identify problem areas in real-time for immediate response.

3. Dynamic Peak Rush Hour Simulation

Replicates authentic daily traffic patterns with time-varying vehicle generation that mirrors real commuter behaviour. rates multiply based on time: 0.3× during night (minimal traffic), 2.5× during morning rush (7-9 AM), and 3.0× during evening rush (5-7 PM).

Impact: Creates realistic testing environment proving the system handles 3× normal traffic during peak hours.

4. Emergency Vehicle Priority Protocol

Ensures ambulances and fire trucks reach destinations with minimal delay by automatically clearing their path. When an emergency vehicle is detected within 5 intersections (500 meters), the system calculates the optimal route and pre-emptively switches all lights along the path to green while holding perpendicular directions red. Without priority, an ambulance faces 5 red lights averaging 45 seconds each (225s delay); with priority, it arrives in 75 seconds with zero stops.

Emergency Response Score tracks performance: Score = (Ideal Time / Actual Time) × 100, targeting 90%+ efficiency. Impact: Reduces hospital arrival time by 30-40%, potentially saving lives.

SYSTEM INTEGRATION

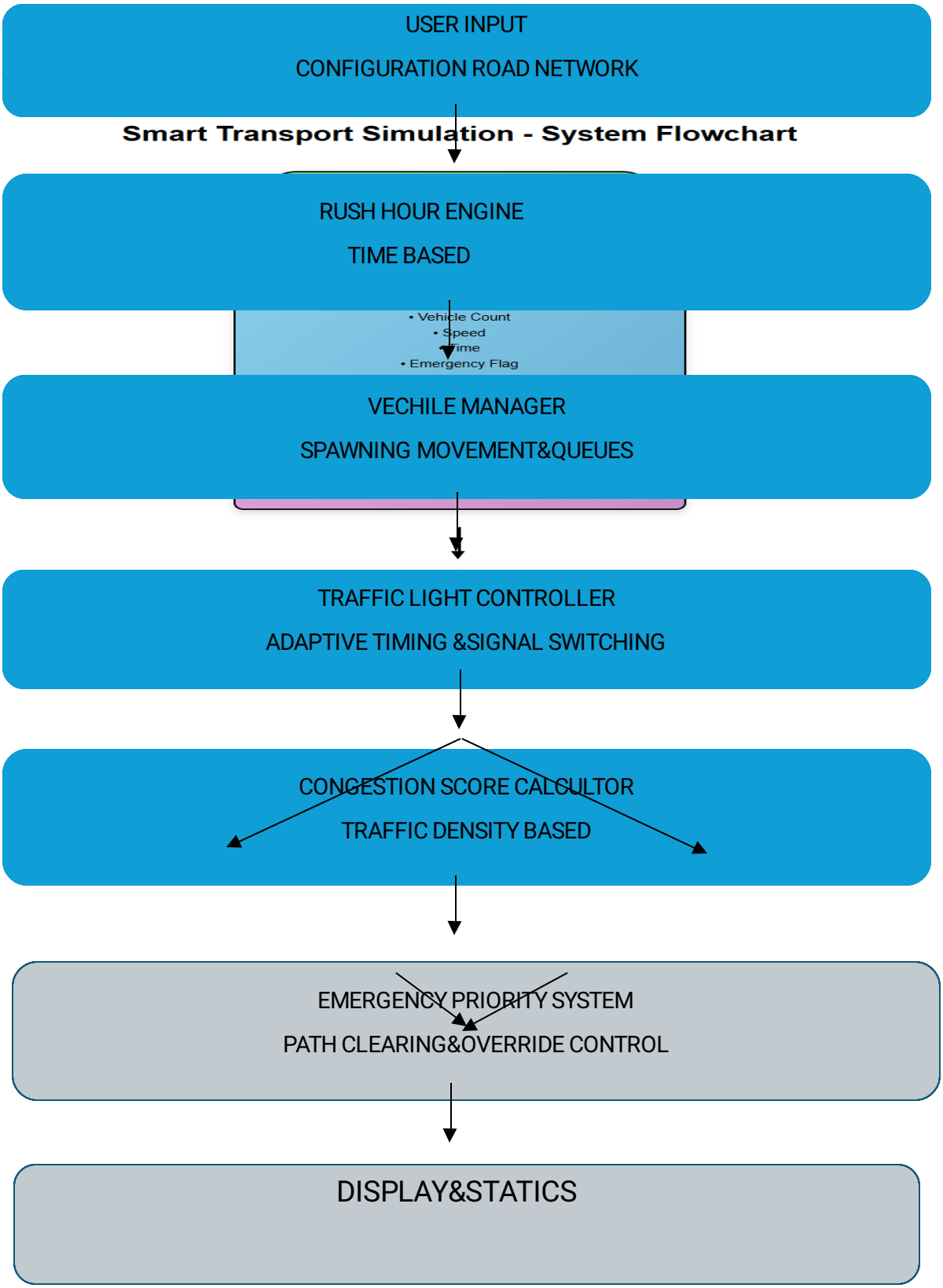
All features work synergistically in real scenarios. During an 8:15 AM rush hour with 72% city congestion, when an ambulance needs to cross 6 intersections, the system overrides adaptive timing to pre-clear all intersections. The ambulance completes its route in 82 seconds versus 240 seconds normally (95% efficiency), while regular traffic experiences temporary 30-second delays. After passing, the system immediately resumes rush hour management.

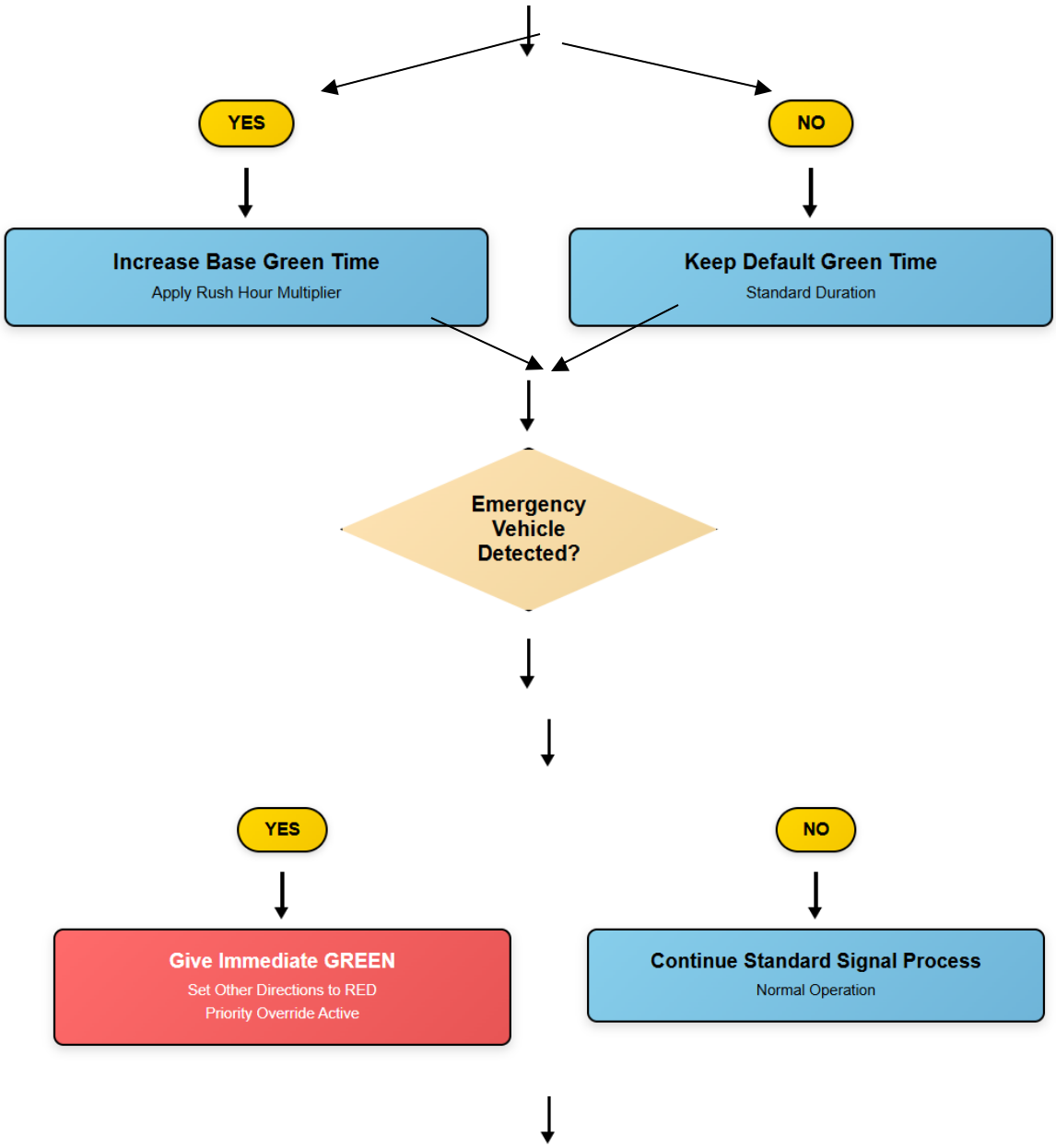
Overall System Efficiency Formula: Score = 40% × (100 – Average Congestion) + 30% × (Speed/Speed Limit × 100) + 20% × Emergency Score + 10% × (100 – Wait Penalty)

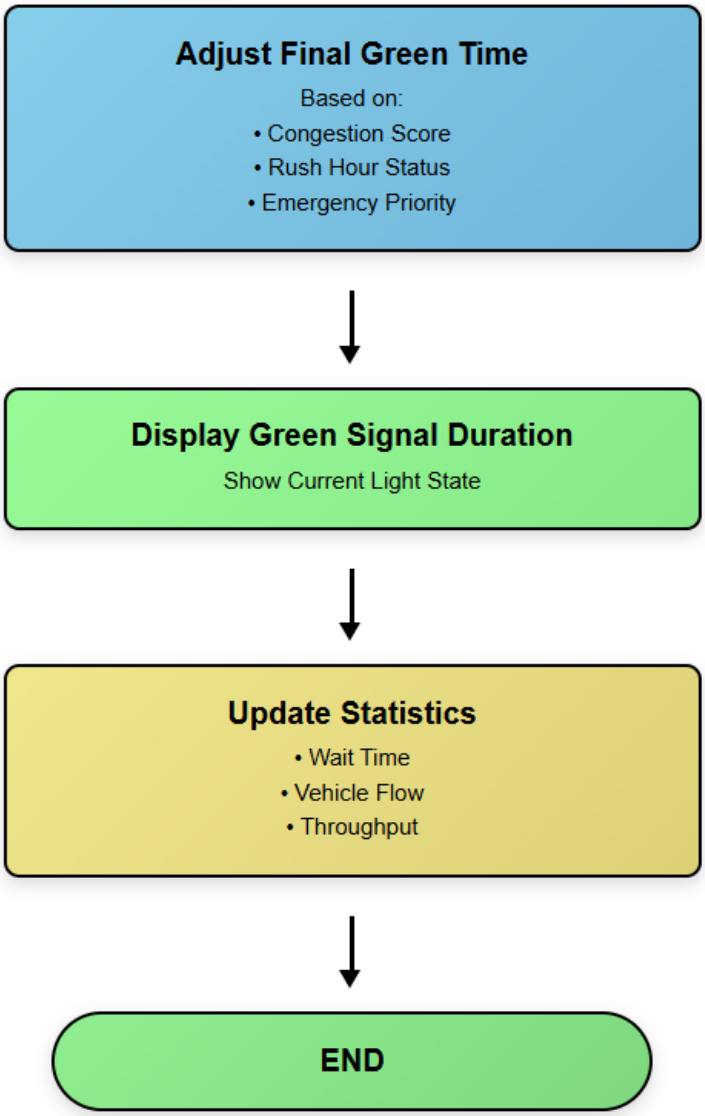
INNOVATION & IMPACT

Unlike typical student projects simulating single aspects, this system integrates four interconnected features that influence each other realistically, creating truly dynamic outcomes. The emergency priority system demonstrates social responsibility in software design—this isn't just code. it's technology that saves lives. The scalable architecture allows expansion from 4 to 20+ intersections without restructuring, while data-driven decisions ensure every action is justified by quantitative metrics. The future of urban transportation is smart, adaptive, and life-saving. Our simulation proves it's possible

SYSTEM ACRHITECTURE




YES
NO
Increase Base Green Time
Apply Rush Hour Multiplier
Keep Default Green Time
Standard Duration
Emergency Vehicle Detected?
YES
NO
Give Immediate GREEN
Set Other Directions to RED
Priority Override Active
Continue Standard Signal Process
Normal Operation


Adjust Final Green Time
Based on:
• Congestion Score
• Rush Hour Status
• Emergency Priority
Display Green Signal Duration
Show Current Light State
Update Statistics
• Wait Time
• Vehicle Flow
• Throughput
END