VAC Project Report

# Project Title:

Adaptive Traffic Light Controller using Computer Vision

# Technologies Used:

- Python  
- OpenCV  
- Research References:  
 - IIT Bombay research papers on traffic signal optimization  
 - Hyderabad Traffic Police — Reference green light timing data

# Objective:

The goal of this project is to design an intelligent traffic light controller that dynamically adjusts the green light duration based on real-time traffic conditions, optimizing road usage and reducing congestion.

# Introduction:

Traffic congestion is a growing problem in urban cities. Traditional traffic light systems operate on fixed timers, which do not adapt to actual traffic density. To solve this, we propose a vision-based adaptive controller (VAC) system that uses computer vision techniques to monitor vehicle density and adjust green light timings accordingly.

# Methodology:

1. Traffic Monitoring with Computer Vision:

* - OpenCV is used to process live video feeds from traffic intersections.  
  - Vehicles are detected and counted using background subtraction and contour detection techniques.

2. Green Light Time Adjustment:

* - Reference minimum and maximum green light durations were obtained from Hyderabad Traffic Police data.  
  - Adaptive logic based on IIT Bombay research papers was implemented, setting:  
   - Minimum green light time to ensure basic clearance even under low traffic.  
   - Maximum green light time to prevent any one side from hogging the intersection.

3. Decision Algorithm:

* - If vehicle count is high, green light duration is extended towards the maximum limit.  
  - If vehicle count is low, green light is shortened but not less than the minimum limit.  
  - This dynamic adjustment happens in real-time, ensuring smoother traffic flow.

# References:

- IIT Bombay Research on Adaptive Traffic Systems  
- Hyderabad Traffic Police Traffic Signal Timings  
- OpenCV Documentation

# Future Improvements:

* - Integrating AI-based vehicle classification (cars, buses, bikes).  
  - Predictive modeling using historical traffic data.  
  - Deploying the system on embedded hardware for real-world testing.