Adaptive Traffic Lights for Intelligent Traffic Systems

Project Overview

This project presents an innovative approach to traffic management through adaptive traffic lights that change based on real-time vehicle detection from video input. By using computer vision techniques to detect and count vehicles, the system can adjust traffic light timings at intersections, reducing congestion and waiting times. The system prioritizes the lanes with the most vehicles, allowing for smoother traffic flow.

Team Information

Team Members

1.Komali Kanumarla

2.Hema Sree Thota

Problem Statement

Traditional traffic lights operate on fixed timers, which can lead to inefficiencies and increased congestion, especially during peak hours. By adapting traffic lights based on real-time vehicle counts from video, this project aims to address these inefficiencies and improve traffic flow at intersections.

Proposed Solution

The proposed solution uses computer vision to detect vehicles from live video feeds. By processing the video to count vehicles in each lane, the system can dynamically adjust traffic lights, prioritizing lanes with more traffic. This adaptive approach reduces congestion and wait times, making intersections more efficient.

Key Features

- **Real-Time Vehicle Detection**: Using computer vision techniques, the system detects and counts vehicles in real-time from video input.
- **Adaptive Traffic Light Control**: Traffic lights are adjusted based on vehicle counts, giving priority to lanes with more vehicles.
- **Reduced Congestion and Wait Times**: By adapting traffic lights to real-time vehicle counts, the system reduces congestion and idle times at intersections.

Technical Implementation

Here's an overview of the software components used to implement the adaptive traffic light system based on real-time video detection.

Software Components

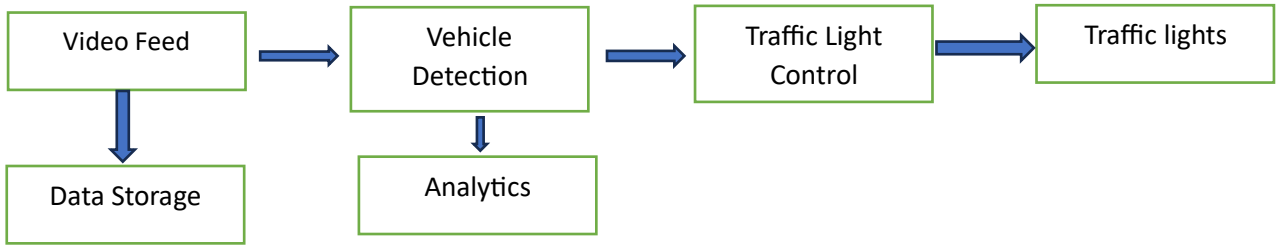
Computer Vision for Vehicle Detection: Python code utilizing libraries like OpenCV to detect and count vehicles from live video feeds.

Traffic Light Control Logic: Software logic that adjusts traffic light timings based on the vehicle counts obtained from video analysis.

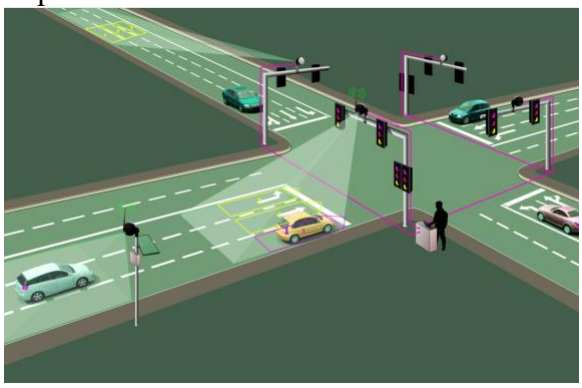
Data Processing and Storage: Module for processing vehicle count data and storing it for analysis and future traffic pattern predictions.

System Architecture

The system architecture shows how the different software components interact to achieve adaptive traffic light control.



- The video feed is processed to detect vehicles.
- The vehicle detection module sends the vehicle count data to the traffic light control module.
- The traffic light control module adjusts the traffic lights based on vehicle counts.
- The data storage module retains vehicle count data for future analysis and improvements.



Test Results

Vehicle Detection Accuracy: The computer vision-based approach successfully detected and counted vehicles from video feeds.

Traffic Light Adaptation: The system adjusted traffic light timings based on real-time vehicle counts, prioritizing lanes with more vehicles.

Reduced Wait Times: Tests showed that the adaptive system reduced waiting times at intersections, leading to smoother traffic flow.

Impact on Traffic Management

The adaptive traffic light system based on real-time vehicle detection can significantly reduce traffic congestion by adapting to current traffic conditions. By giving green lights to lanes with higher vehicle counts, the system reduces wait times and congestion, contributing to more efficient traffic flow and reduced emissions due to less idling.

Future Development and Improvements

Outline your plans for future advancements and improvements.

- **Integration with Smart City Infrastructure**: Explore integration with broader smart city systems to improve traffic management on a larger scale.
- **Machine Learning for Enhanced Detection**: Implement machine learning techniques to improve vehicle detection accuracy and traffic pattern prediction.
- **Mobile Application for Drivers**: Develop a mobile app to inform drivers of real-time traffic conditions and suggest optimal routes based on adaptive traffic light patterns.

Conclusion

The adaptive traffic light system based on real-time vehicle detection offers a practical solution to traffic congestion at intersections. By dynamically adjusting traffic light timings based on real-time vehicle counts, the system can reduce congestion and wait times, contributing to a more efficient traffic management system. Future developments aim to enhance the system's capabilities and integrate it with broader smart city initiatives.