CS531- Python Applications Programming

Traffic Governance System

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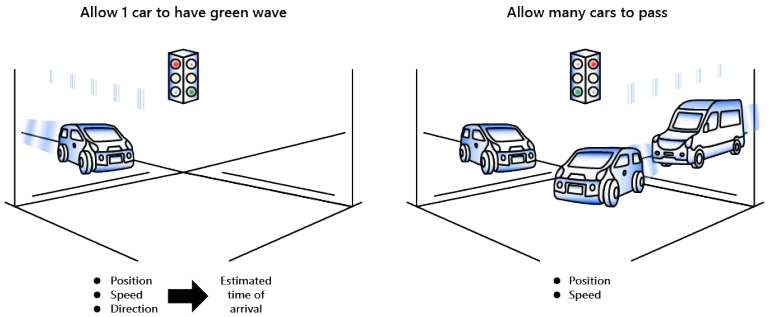
Problems:Inefficient Traffic Management

- **Inefficient Signal Timing:** Fixed signal cycles don't account for changing traffic patterns.
- **Traffic Imbalance:** Congestion builds in high-volume lanes while other directions have long green lights despite low traffic.
- **Long Wait Times:** Drivers experience excessive delays, especially during peak hours.
- **Environmental Impact:** Stop-and-go traffic increases emissions and pollution.

Problems



- **Illogical Signal Switching:** Lanes with greater traffic volume receive shorter green signals.
- **Limited Data:** Traditional systems lack real-time data on traffic density, making them unresponsive.
- **Inability to Adapt:** Traditional traffic signals cannot adjust to dynamic traffic conditions.

Problems

Studies have shown that the implementation of Intelligent Traffic Management Systems can reduce travel times by up to 25% and decrease fuel consumption by 10-20%.

The concept of a "Smart City" is becoming increasingly prevalent in the 21st century.

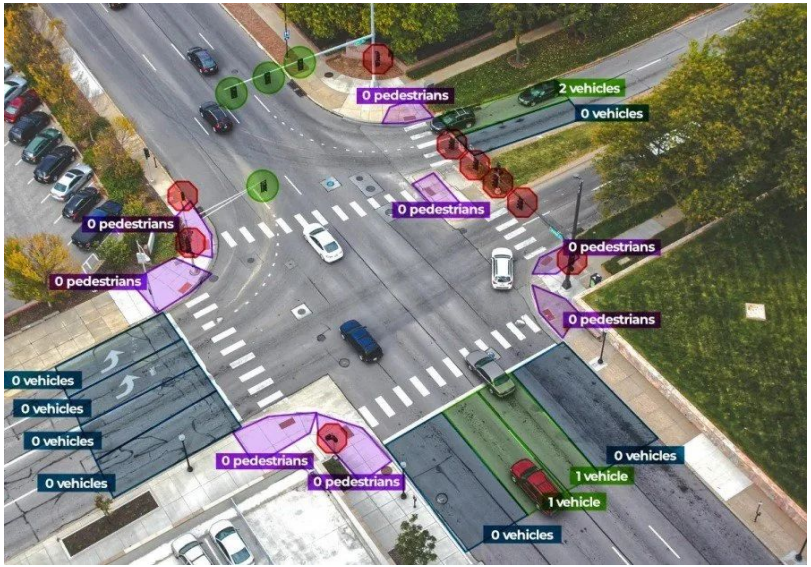
There are some intelligence traffic management system in Bay Area, but in a lot of countries and cities, they do not have the intelligence traffic management system, and they are being affected by traffic congestion and traffic accidents.

Proposed Solution: Dynamic, Sensor-Driven Control

Our solution: A software simulation environment enables us to design, test, and refine adaptive control policies.

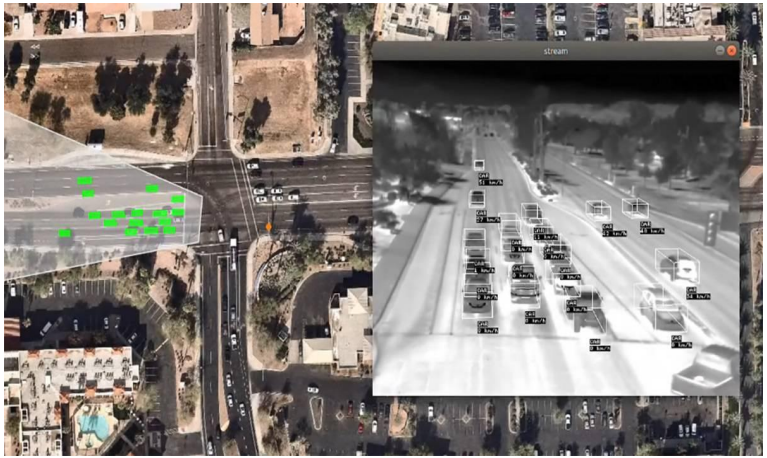
Key Elements:

- **Realistic Traffic Signals:** Our simulation accurately models the behavior of physical traffic lights, including their timing patterns and impact on traffic flow.
- **Diverse Sensor Simulation:** We replicate various sensor types (loop detectors, cameras) to provide the same rich data that real-world systems rely on.
- **Adjustable Control Policies:** Within the simulation, we can create and test diverse traffic management strategies. This allows us to rapidly pinpoint the most efficient ways to optimize flow and minimize congestion.



Key Features and Technologies

- Advanced technologies: image processing, computer vision, AI, intelligent controls
- Real-time data collection via sensors and communication systems
- Priority-based decisions and dynamic signal timing adjustments
- Algorithms for traffic routing and optimization based on current conditions



Potential Alternative Approaches

- **Fixed Timers:** Rigid schedules, can't adapt to unexpected events or traffic fluctuations.
- **Adaptive Traffic Control Systems (ATCS):** Adjust signals based on current traffic, but rely on historical patterns. Best for predictable congestion.
- **Traffic Prediction & Routing:** Uses real-time and historical data to suggest alternative routes. Effectiveness depends on driver compliance.
- **Intelligent Transportation Systems (ITS):** Integrates traffic signals with sensors, connected vehicles, etc., for broader optimization. Requires careful planning.
- **Physical Upgrades (lanes, intersections):** Costly, time-consuming, and may not solve demand-related congestion.

Our Simulation-Driven Model (Advantages)

- **Real-time Optimization:** Adapts signals based on traffic, reducing congestion and improving flow.
- **Prioritizes Busy Lanes:** Gives more green time to congested lanes, reducing wait times.
- **Less Congestion, Faster Travel:** Minimizes congestion and optimizes signals for faster travel times.
- **Cleaner City, Safer Roads:** Reduces pollution and improves safety by smoothing traffic flow.

Future Expansion and Differentiation

- **Networked Control:** Coordinate simulations of multiple intersections across a city grid to optimize regional traffic flow. This enables intelligent traffic routing to reduce bottlenecks and improve overall efficiency.
- **AI-Driven Prediction:** Harness historical traffic data and machine learning to accurately forecast congestion hotspots. This allows for proactive traffic signal adjustments, preventing problems before they arise.
- **Unique Advantage:** Our simulator's adaptability allows rapid testing and integration of new technologies (advanced sensors, vehicle-to-infrastructure communication, etc.). This positions us at the forefront of traffic control innovation.

System Features

User: User can view notifications sent by the admin and take necessary actions.

Admin: The admin can detect traffic at crossroads by video analysis.

Database: Database stores the data and performs analysis on the data to generate the required result.

WebPage: Upload Video and get the timing of the signal for the each video

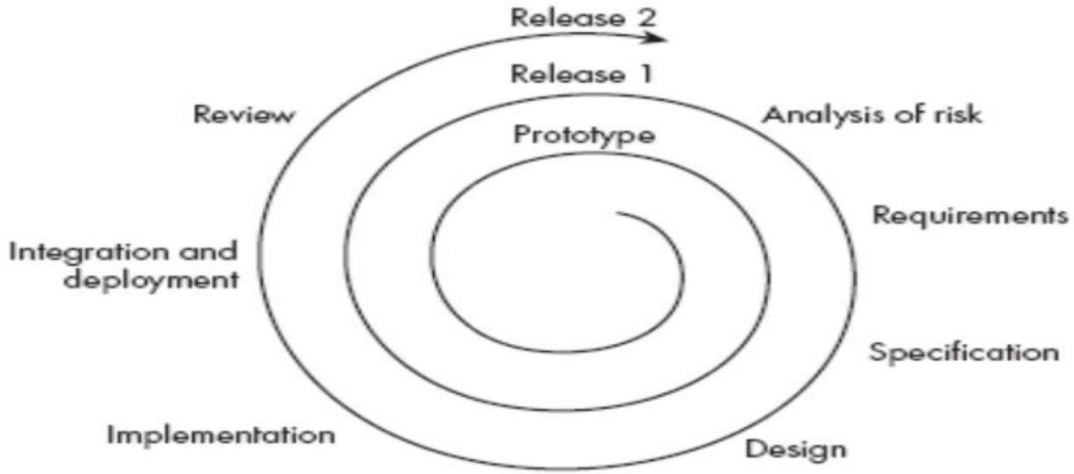
Design and Implementation

The language that is used for coding is Python, HTML, CSS For working on coding phase.

We will make use of Pycharm for working. Also, we will make use of the online references.

We will make use of the existing Python libraries such as numpy, imutils, dlib, OpenCV and Flask.

Development Approach



SPIRAL MODEL

User Interface

Road Side	Green Signal (Seconds)	Red Signal (Seconds)
Side 1	10	70
Side 2	20	60
Side 3	10	60
Side 4	30	50

Delving into behind-the-scenes

MySQL

- Performance, reliability and ease of use.
- Best choice for the web based applications.
- A popular choice for embedded database and distributed among ISVs and OEMs.

Delving into behind-the-scenes

API : Flask

- Python flask for API design as flask supports extensions that can add application features as if they were implemented in the flask itself and doesn't require complicated boilerplate code
- Simple to use and easy to understand
- Ease of deployment on various platforms such as cloud and web servers

Delving into behind-the-scenes

Application Server : WSGI (Web Server Gateway Interface)

- Speedy and reliable server for running Python web applications
- Able to handle high traffic loads
- To forward requests from web server to python web application.

References

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Thank You