SHAPING MOBILITY ON ROADS USING DYNAMIC PRIORITY SCHEDULING

Under the Mentorship of **Dr. Tarunpreet Bhatia**
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PROBLEM DEFINITION

- Existing traffic management systems are **primitive and have drawbacks**
- **Manual controlling system** requires an **outsized amount of manpower**
- **Static traffic controlling doesn't adapt** to the real-time traffic variabilities
- If system uses **proximity sensors or loop detectors** to get high-quality information, **expensive technologies are required**
- **Sensors** face the drawback of **limited area of coverage**
- No **special priority** to the **emergency vehicles** such as **ambulance, firetruck** etc

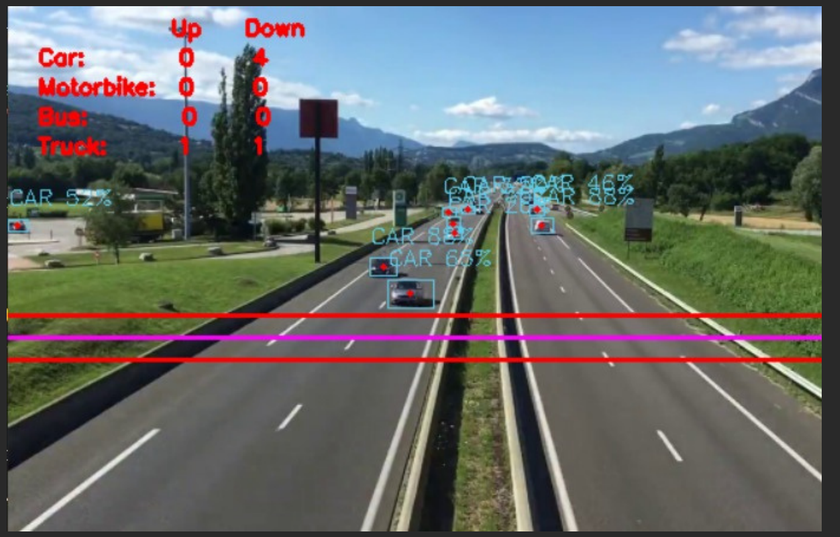
TRAFFIC CONGESTION

PROJECT SCOPE

- Introduction of **efficiency in the traffic management** domain
- System achieves efficient management by performing **vehicle detection via image processing**
- Using the results to **calculate the traffic occupancy** of each lane
- Using these **traffic occupancy values to set the priority** and corresponding **timings** for each lane
- **Prevent delay** of various **emergency vehicles** in critical life-death situations, via **allotting special priority to that lane**

OBJECTIVES

- To **identify and classify** various vehicles using **object detection algorithms.**
- To develop a **scheduling algorithm** which controls the traffic light **timings based on traffic density** and **prioritization of emergency vehicles** on each lane.
- To create a **simulated environment** of a smart traffic control system.

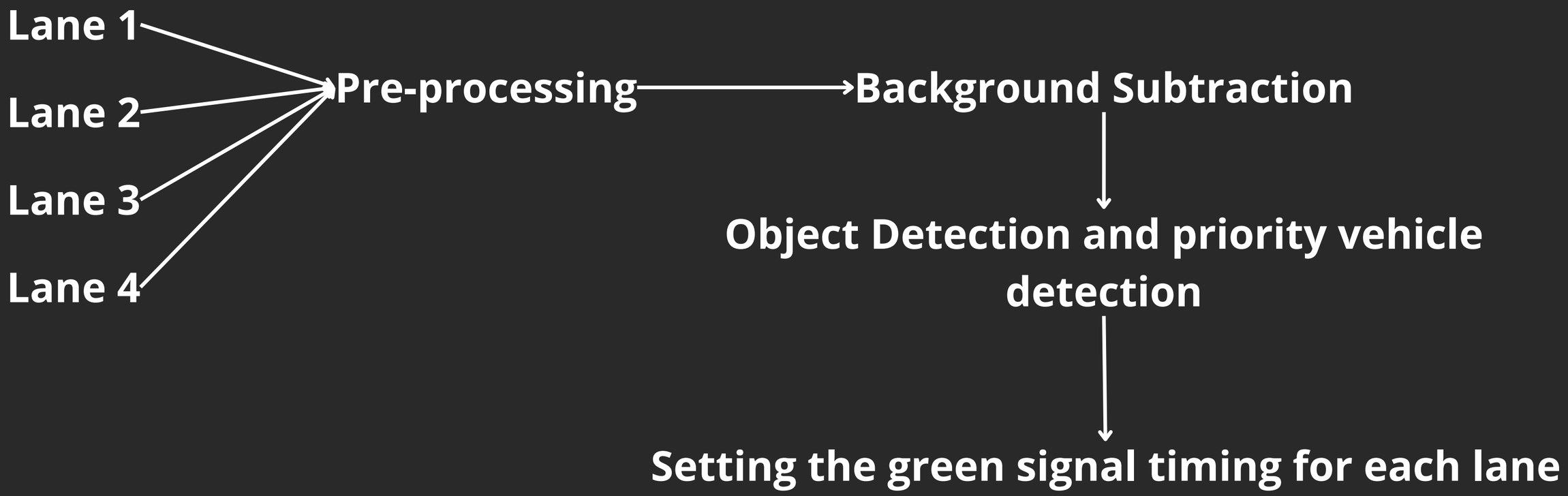


LITERATURE SURVEY

S.NO.	CITATION	TOOLS / TECHNOLOGIES	FINDINGS
1	Smart Control of Traffic Light System using Image Processing [1]	MATLAB, arduino, camera module	It is used to calculate traffic count and traffic density and accordingly changes the time of signals. It uses image processing using MATLAB. Overall, it gives accuracy of 70-80% in traffic estimation
2	Traffic Light Control and Violation Detection Using Image Processing [2]	OpenCV, SVM	OpenCV was used to process the videos, which were then transformed to grayscale images before SVM was used. Not only does this technology assess traffic density, but it also looks for red light violations
3	AI Powered Smart Traffic Control System for Emergency Vehicles [3]	GPS, Raspberry Pi module Cloud storage,	GPS tracking was used to detect emergency vehicles and give way to them by knowing their location retrieved from the cloud.
4	Smart traffic lights switching and traffic density calculation using video processing [4]	MATLAB, C++ compiler, video and image processing	It takes live video feed from the cameras at traffic junctions for real time traffic density calculation using video and image processing. The system doesn't work upto the expectations in improper light conditions, so it switches the system to hard coded algorithm during night time.
5	Smart Control of Traffic Light Using Artificial Intelligence [5]	Image processing and Artificial intelligence.	The system aims to utilize live images from the cameras at traffic junctions for traffic density calculation using image processing and AI. It also focuses on the algorithm for switching the traffic lights based on the vehicle density to reduce congestion.
6	Improving Traffic Light Control by Means of Fuzzy Logic [6]	VISSIM, MATLAB, fuzzy controller	It uses a fuzzy logic- controlled traffic light to tailor the traffic scenarios. For major and secondary driveway sit needs two fuzzy controllers with three inputs and one output each. The controllers take information about the current traffic conditions and make appropriate decisions for the next phase in the signalswitching algorithm

7	A distributed algorithm for adaptive traffic lights control [7]	Simulation & sensors.	They address the problem of controlling traffic lights at an intersection with a spatially distributed sensor network. In this architecture, we define and evaluate through simulations an adaptive traffic light control algorithm.
8	Smart controlling for traffic light time [8]	Algorithm development , Image processing	This paper develops an automatic algorithm to control traffic light time based on artificial intelligent techniques and image for cars on traffic lights, this algorithm is validated by compare its results with manual results.
9	Lightweight PVIDNet: A Priority Vehicles Detection Network Model Based on Deep Learning for Intelligent Traffic Lights [9]	Deep Learning and OpenCV	This work proposes (1) a novel vehicle detection model named Priority Vehicle Image Detection Network (PVIDNet), based on YOLOV3, (2) a lightweight design strategy for the PVIDNet model using an activation function to decrease the execution time of the proposed model
10	Research on Urban Road Traffic Congestion Charging Based on Sustainable Development [10]	GPS, GSM (global system for mobile communication)	Urban road traffic congestion charge refers that motor vehicles which enter into some region or certain road section in certain time interval will be charged special fare.
11	Traffic Congestion Prediction Using Machine Learning Techniques [11]	ML, Signal Processing, Random Forest Regressor, Gradient Boosting Regressor.	Model for traffic congestion that can predict congestion based on day, time and several weather data (e.g., temperature, humidity).algorithm
12	Analysis of Traffic Congestion Impacts of Urban Road Network under Indian Condition [12]	Video graphic survey, license plate matching techniques.	Impact of traffic congestion was studied in various sectors like health, economy, environment and mitigation measures were also discussed.

ARCHITECTURE OF THE PROJECT

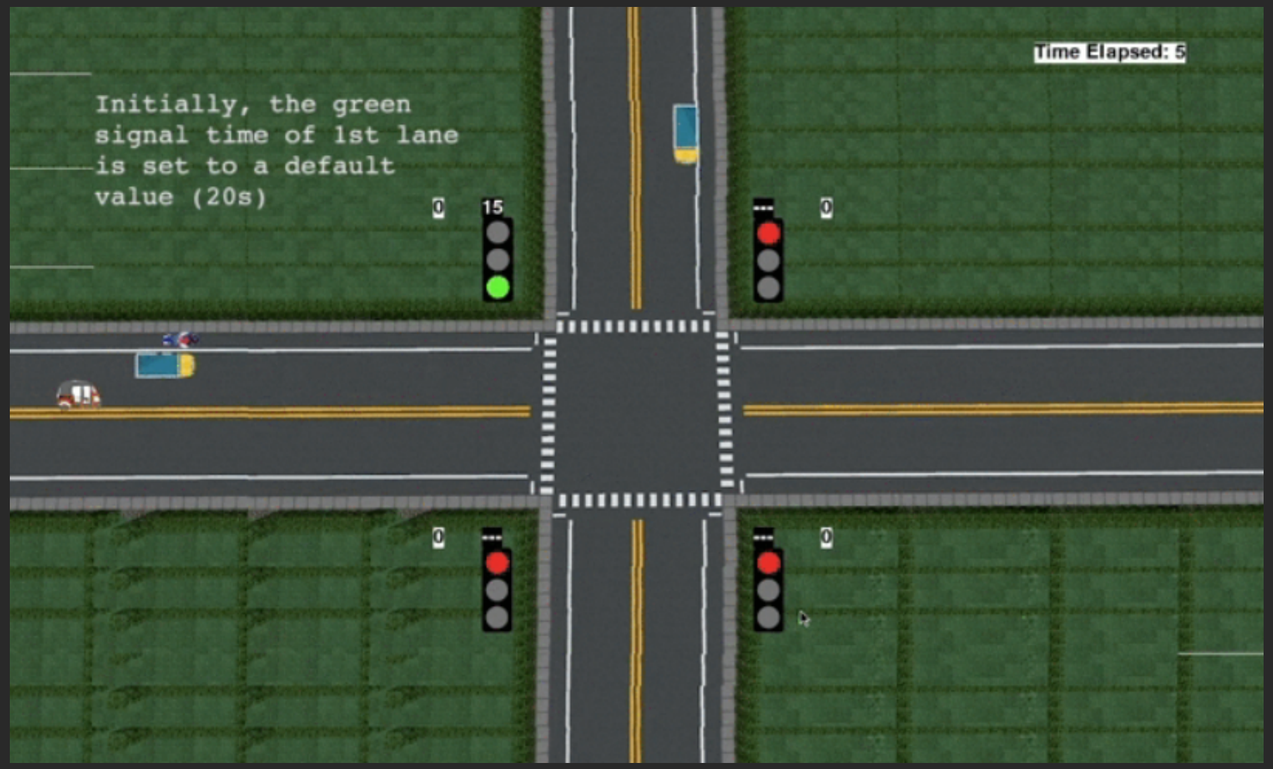


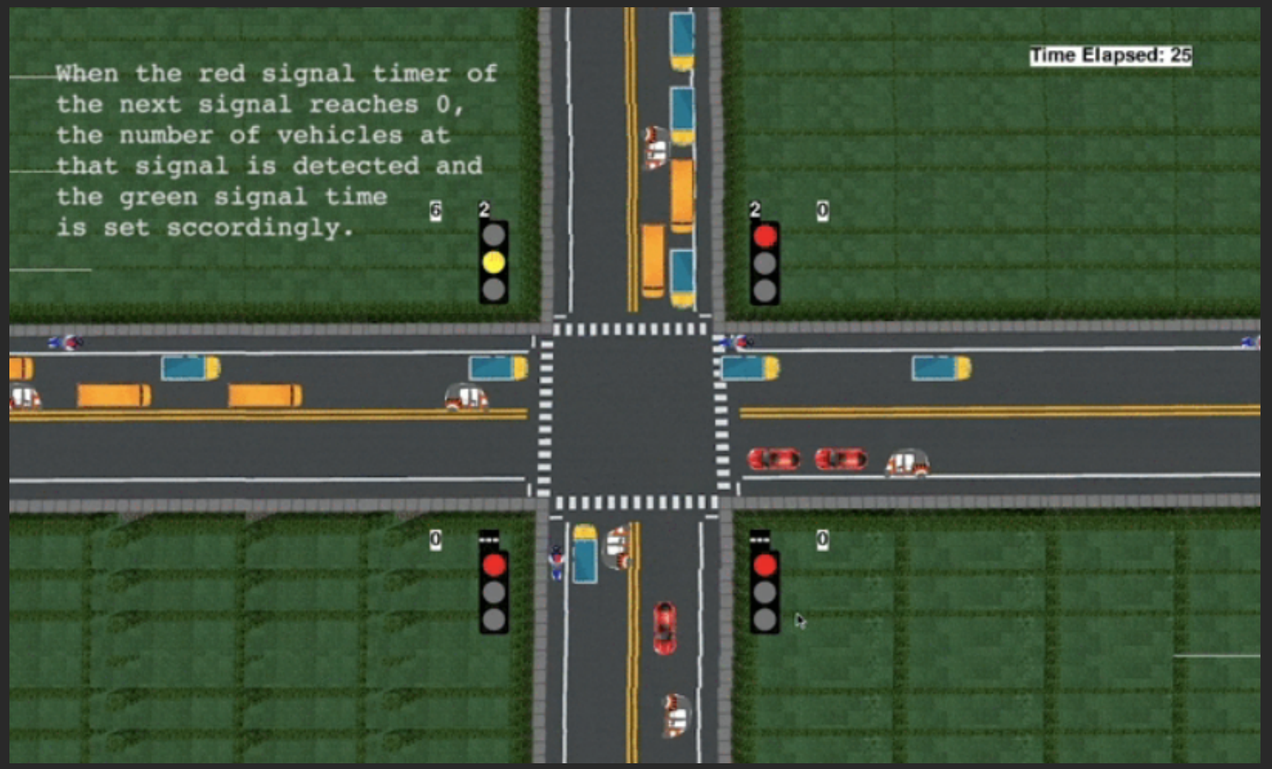
PLATFORMS & TECHNIQUES USED

- **Open CV**
- **Pygame**
- **Visual Studio Code**
- **Artificial Intelligence**
- **Machine Learning**
- **Cuda Computing**

WORKING PROTOTYPE

SIMULATION



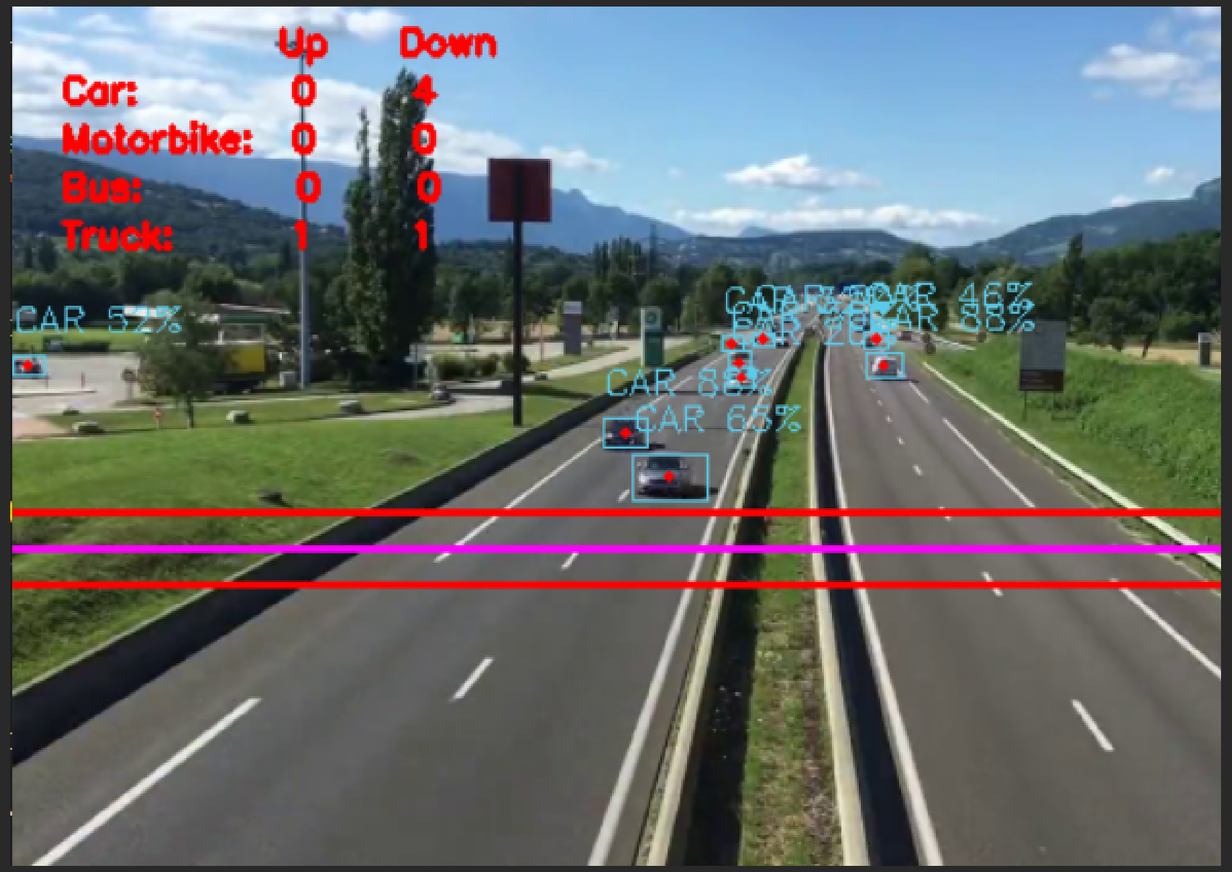


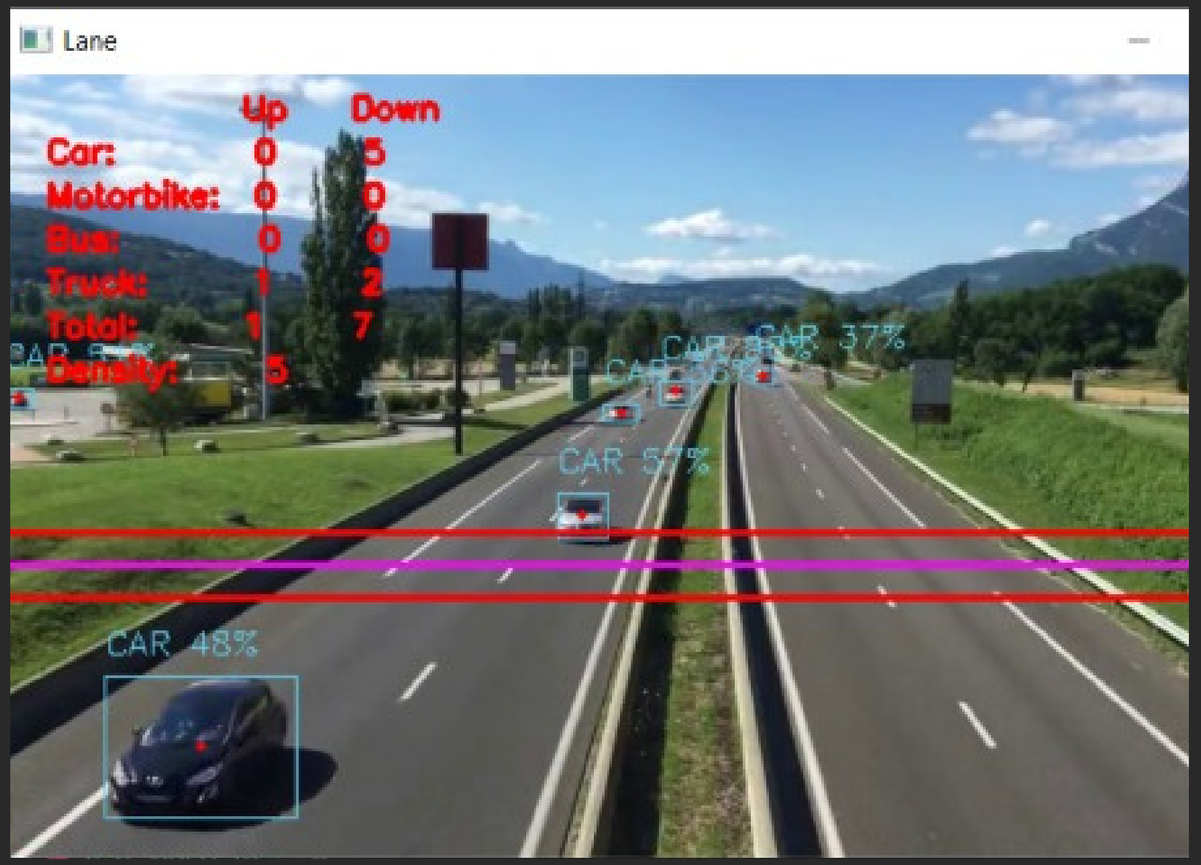
WORKING PROTOTYPE

SIMULATION

WORKING PROTOTYPE

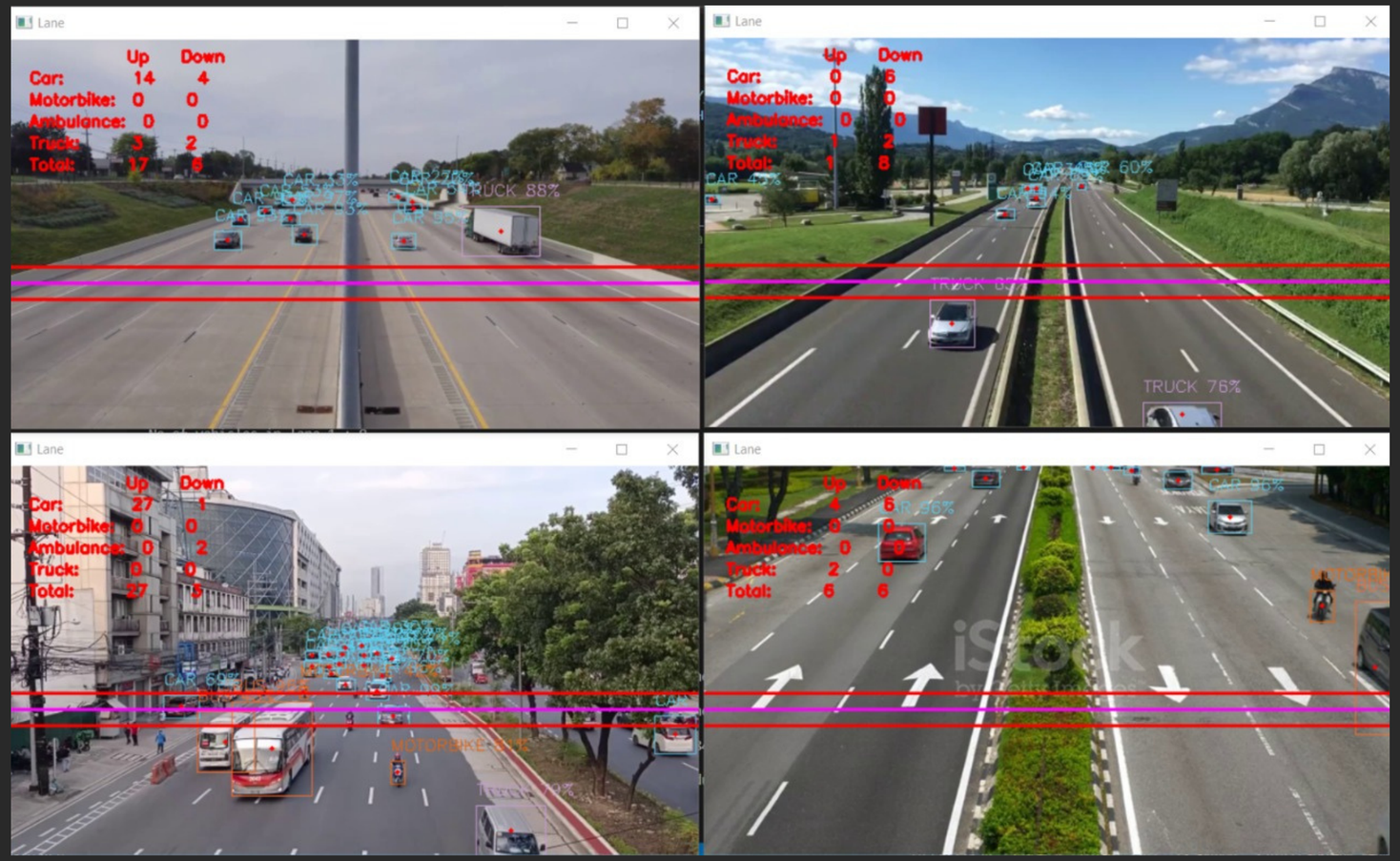
VEHICLE DETECTION AND DENSITY MODULE





WORKING PROTOTYPE

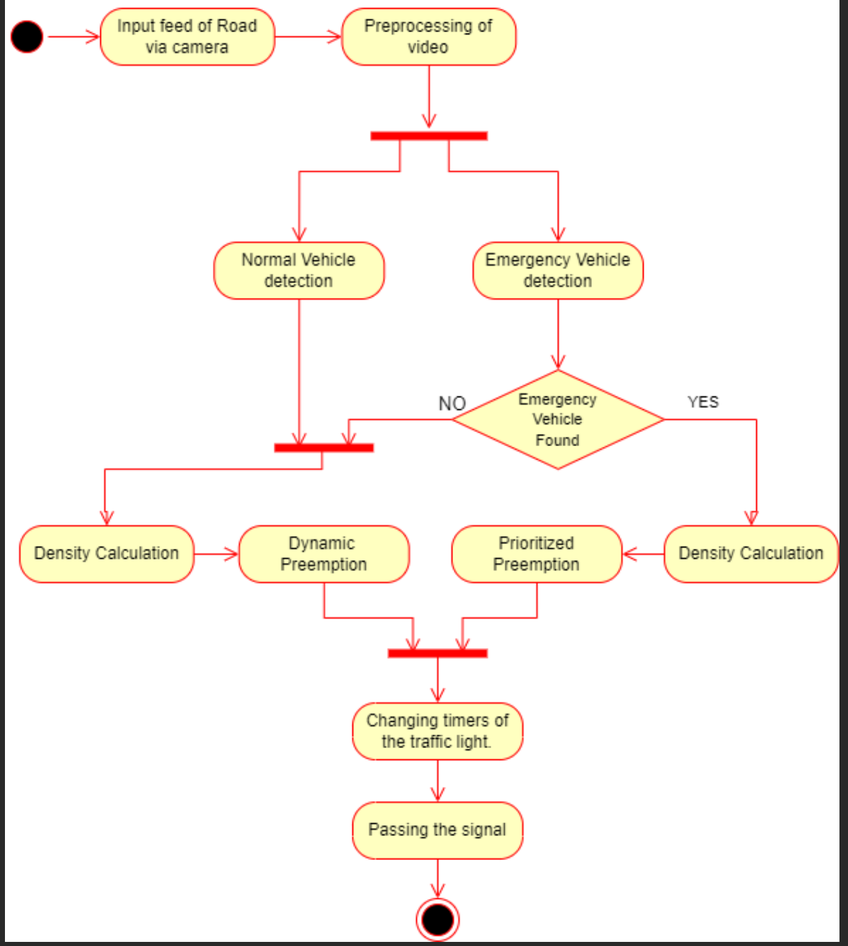
SCHEDULING MODULE



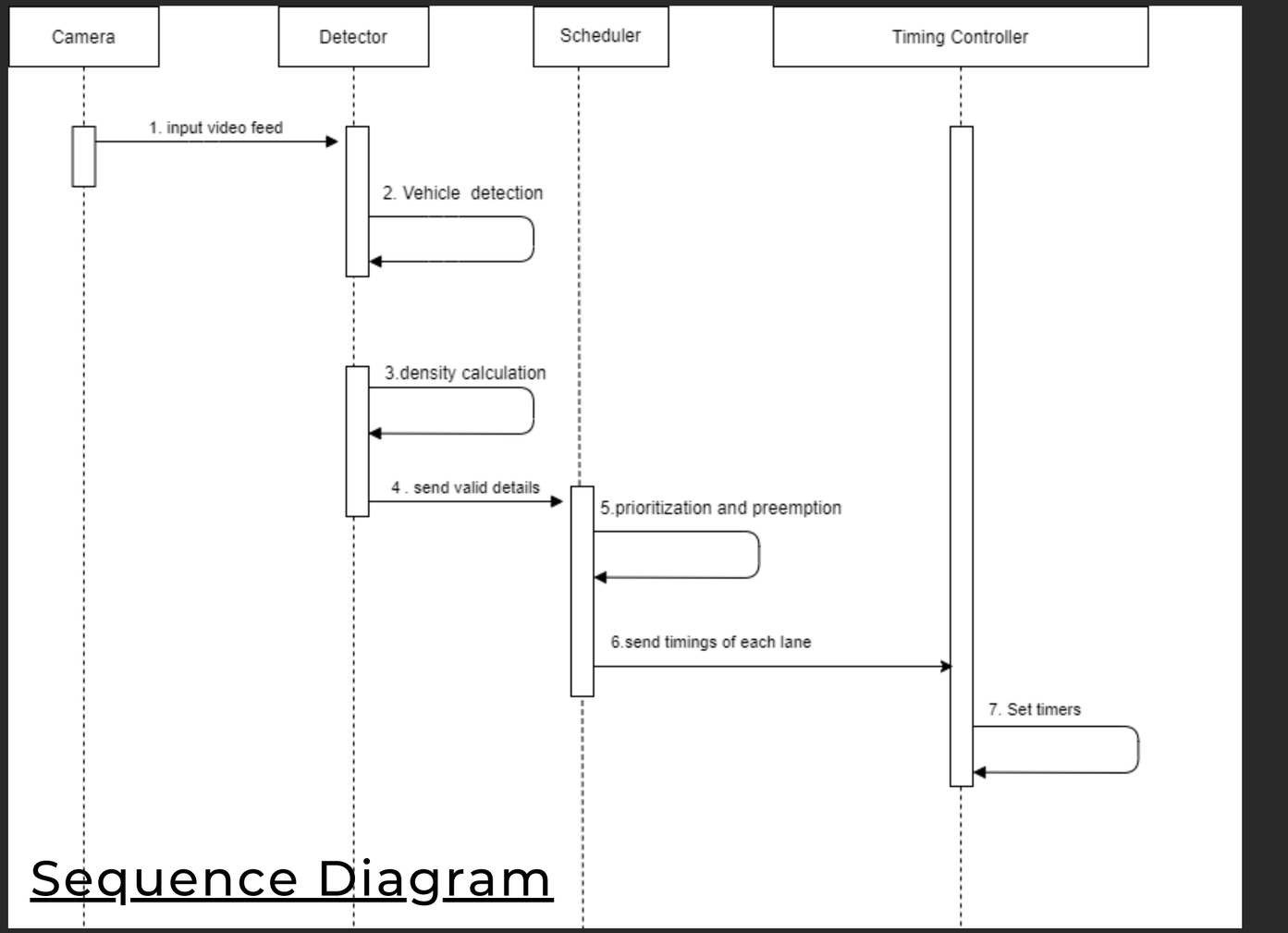

```
No of vehicles in lane 1 : 8
No of vehicles in lane 2 : 6
No of vehicles in lane 3 : 6
No of vehicles in lane 4 : 3
Signals for all lanes
Signal for lane 1 Red
Signal for lane 2 Green   and   Green Timer =  5
Signal for lane 3 Red
Signal for lane 4 Red
For current Green 1
```

DETAILED DESIGN

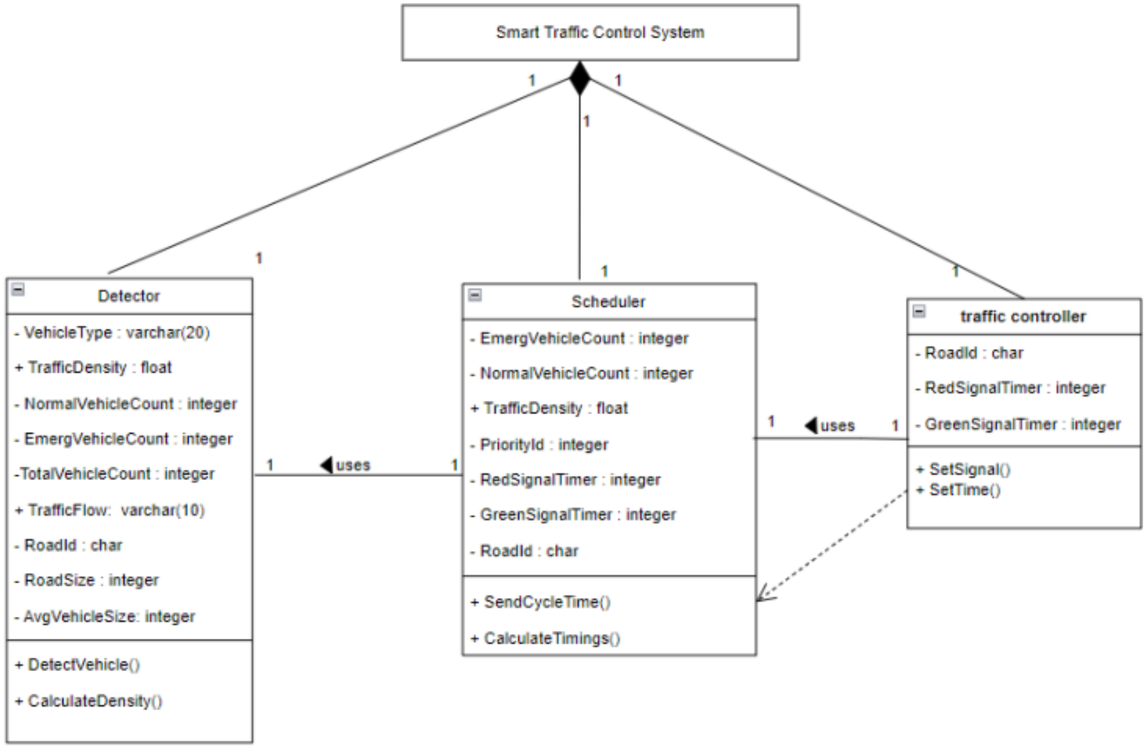
Activity Diagram



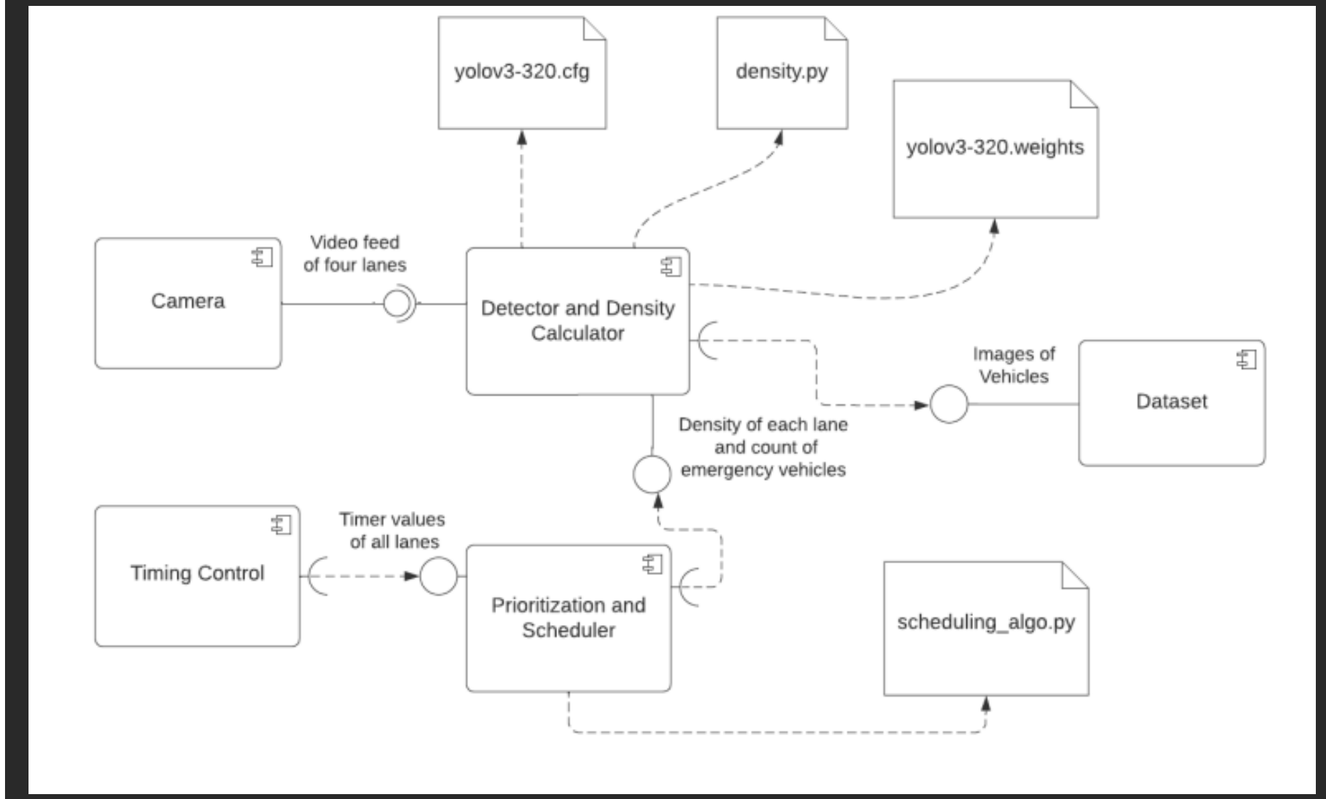
Sequence Diagram



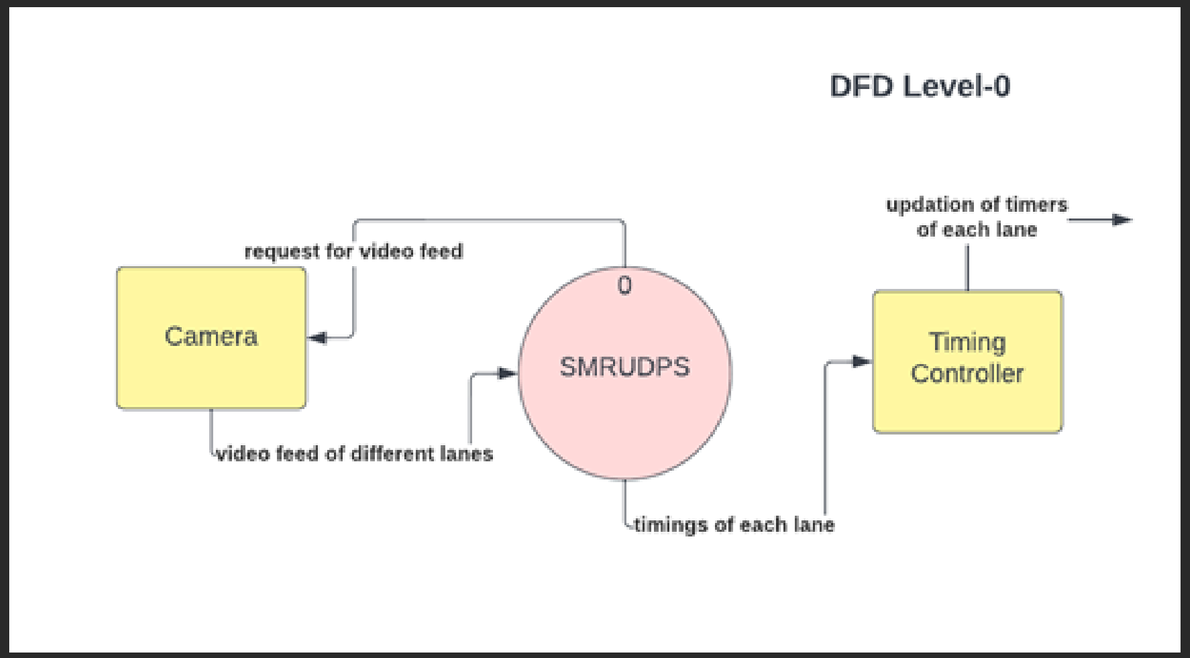
Class Diagram



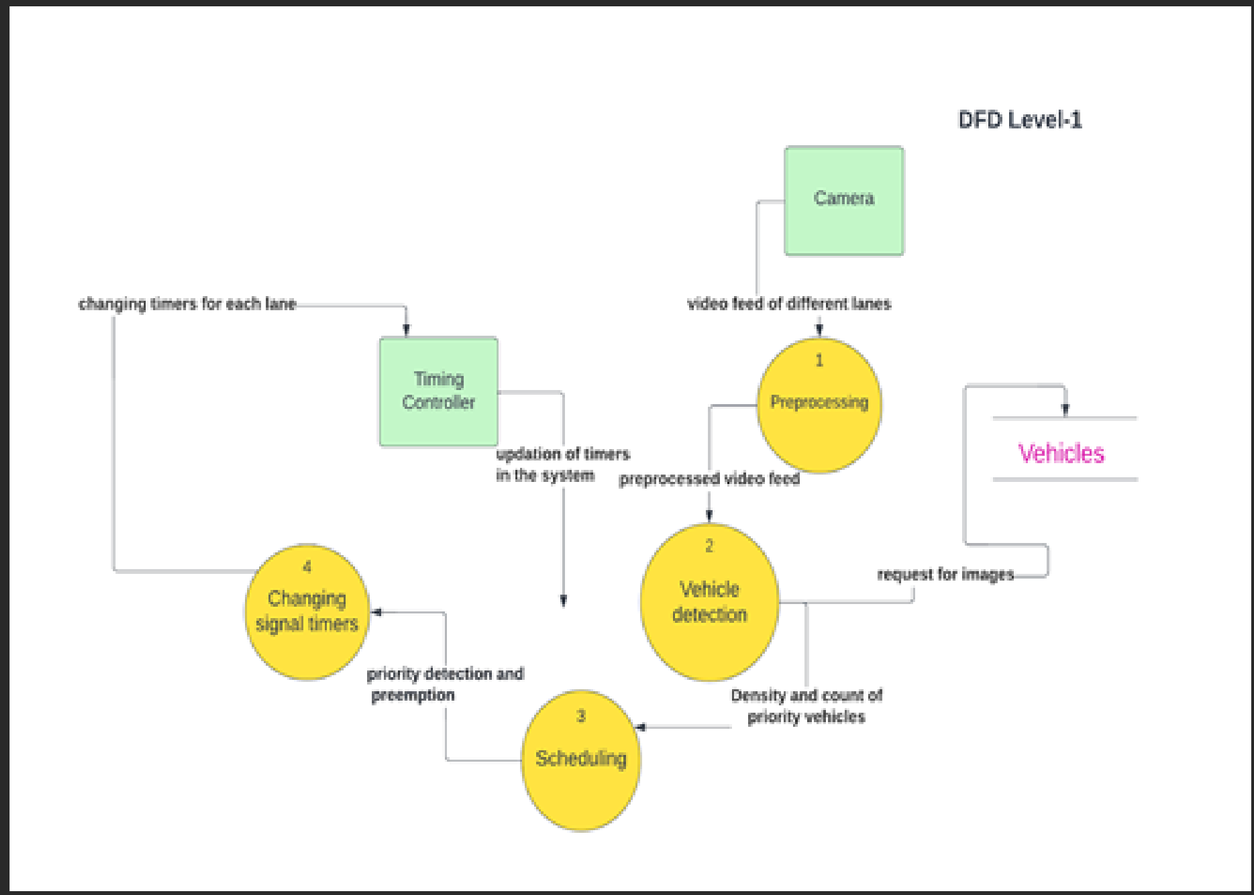
Component Diagram



DFD LEVEL-0



DFD LEVEL-1



KEY HIGHLIGHTS

- Unlike the traditional traffic control system, **this model provides results according to the traffic density** and hence is traffic dependent.
- **Prioritization of emergency vehicles** irrespective of the congestion of a particular lane.
- in order to enhance the performance of the system, **GPU computing** was used.
- **Pygame simulation was done for prototyping** and later the model was implemented on real-time video feed.

ROLES AND CONTRIBUTION

Tasks	Individuals Assigned
Study of YOLO library used for object detection	Japleen, Shaurya
Applying object detection algorithm on vehicles and testing	Pramit, Shaurya
Simulating the traffic junction through pygame based on density	Apurvi, Japleen
Simulating the project using video feed as an input	Pramit, Apurvi
Incorporating emergency vehicles prioritization in the algorithm	Shaurya, Apurvi
Designing signal switching algorithm based on the traffic density	Pramit, Japleen
Incorporating emergency vehicles prioritization in the algorithm	Pramit, Apurvi
Design Optimisation	Shaurya, Japleen
Documentation	Pramit, Apurvi, Shaurya, Japleen

PROJECT OUTCOMES

- The system would **manage the traffic efficiently** based on **real time conditions.**
- **Reduced waiting time** for **emergency vehicles** like ambulances,etc.
- Help **control environment pollution** which is a **major current** issue.
- It'd **comfort people** and help them **fight distress** caused by long waiting times.

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THANK YOU