SOMAIYA VIDYAVIHAR UNIVERSITY
K J Somaiya College of Engineering

Somaiya TRUST

TY MINI-PROJECT
TY EXTC
2019-2023

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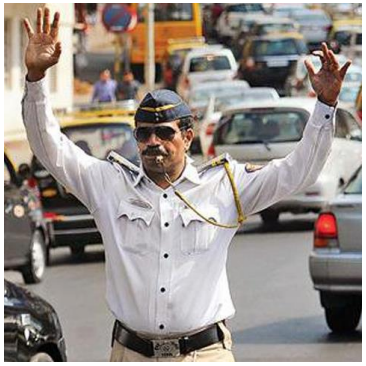
Topic

Adaptive Traffic Signal Timer Based On Traffic Density

Motivation

- The core drawback of conventional signals is their inability to adjust the time of Red and Green signal in a single or multiple traffic signal cycles for the changing patterns of traffic flow.
- A conventional traffic signal, with constant time setting for Red and Green signal, may not cater to these dynamics of the Traffic flow. Judging from the simplicity of the conventional traffic signals, it is safe for us to assume that, these conventional traffic signals are unequipped to adapt to the dynamics of traffic flow. We can simply validate this by our own experience of traffic jams caused in the presence of traffic signals.



Problem Statement

- Efficient regulation of Traffic at traffic signals by taking into consideration the traffic density at every intersection of signals to provide appropriate green signal time (according to the density of vehicles) to corresponding intersections of signals.

Proposed Model

Detection

The detection of vehicles using OpenCV technology to calculate traffic density.

Algorithm

Feeding data to a mathematical algorithm based on Bayes theorem.

Green Signal Time

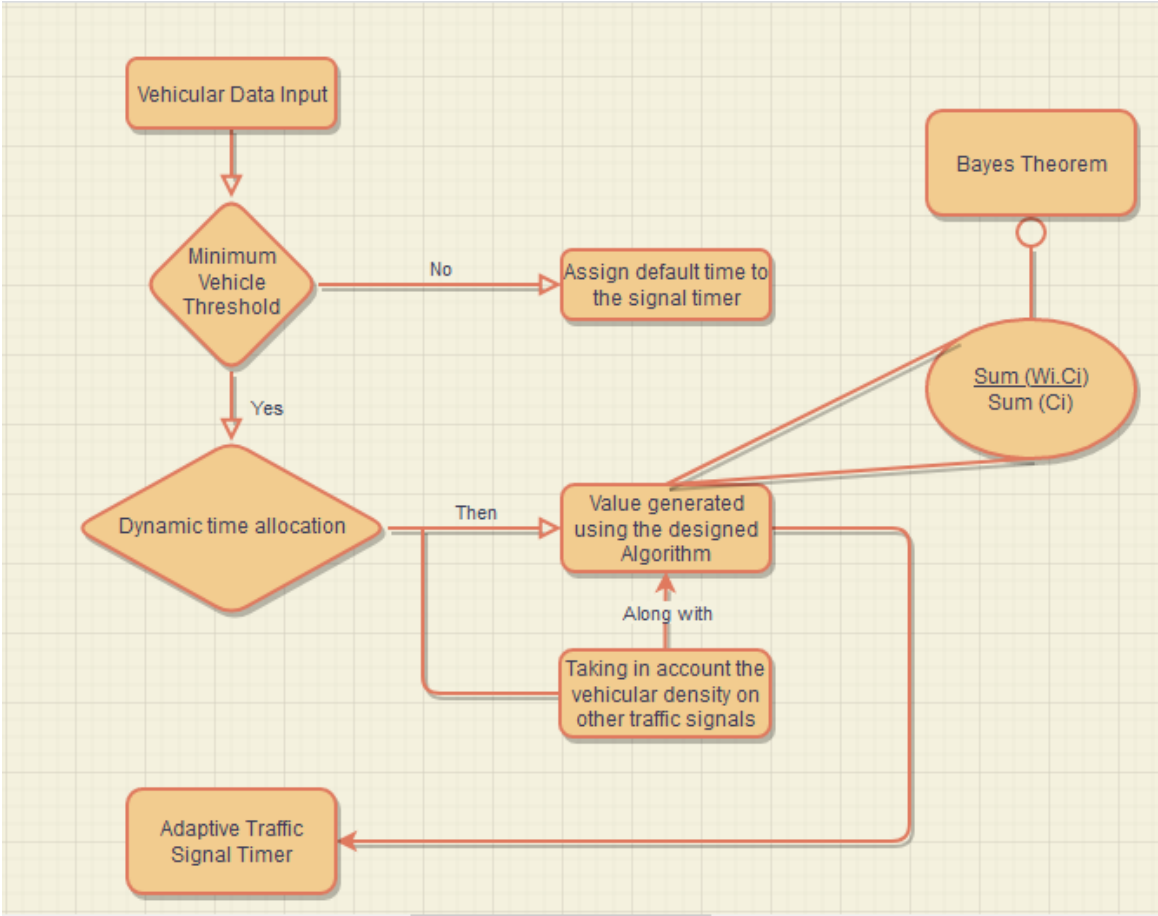
The output of the algorithm gives the dynamic real-time value of green signal time.

Implementation

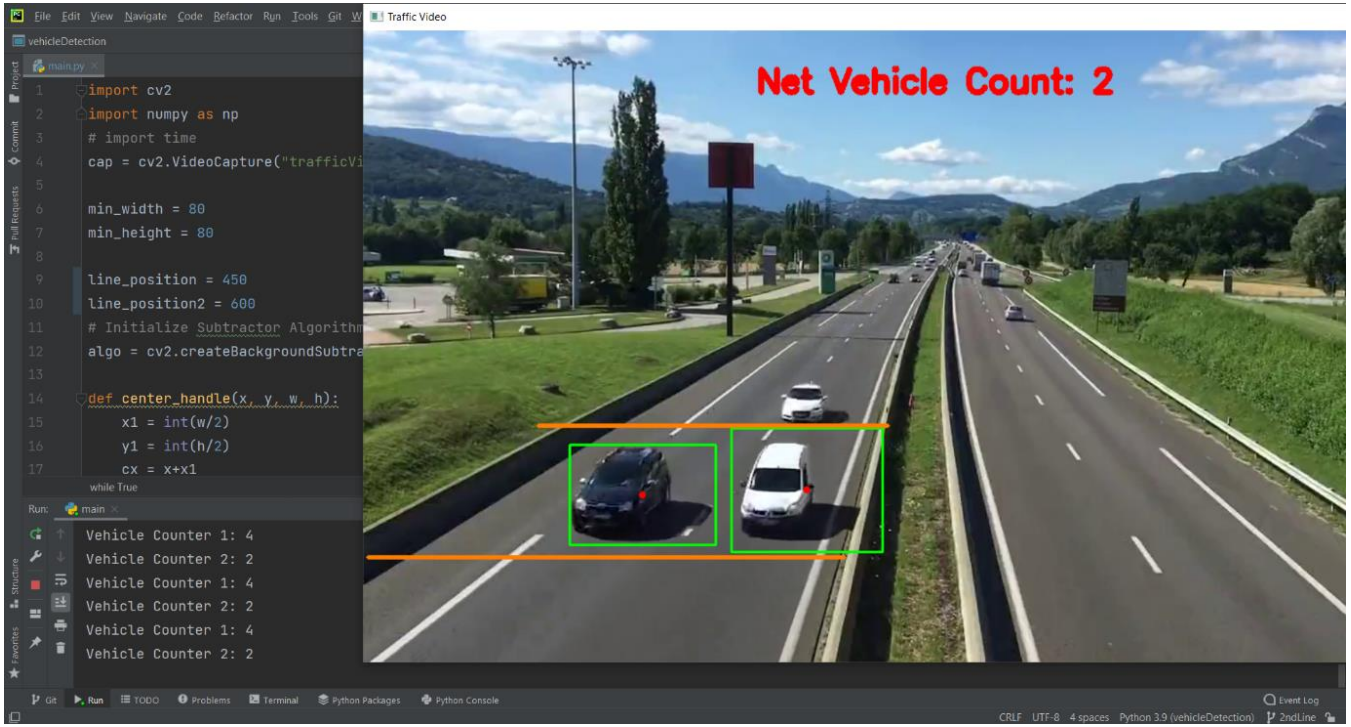
The implementation of this problem statement is divided into three parts:

1. OpenCV Implementation
2. Mathematical Algorithm
3. Pygame Simulation

Building Block Diagram

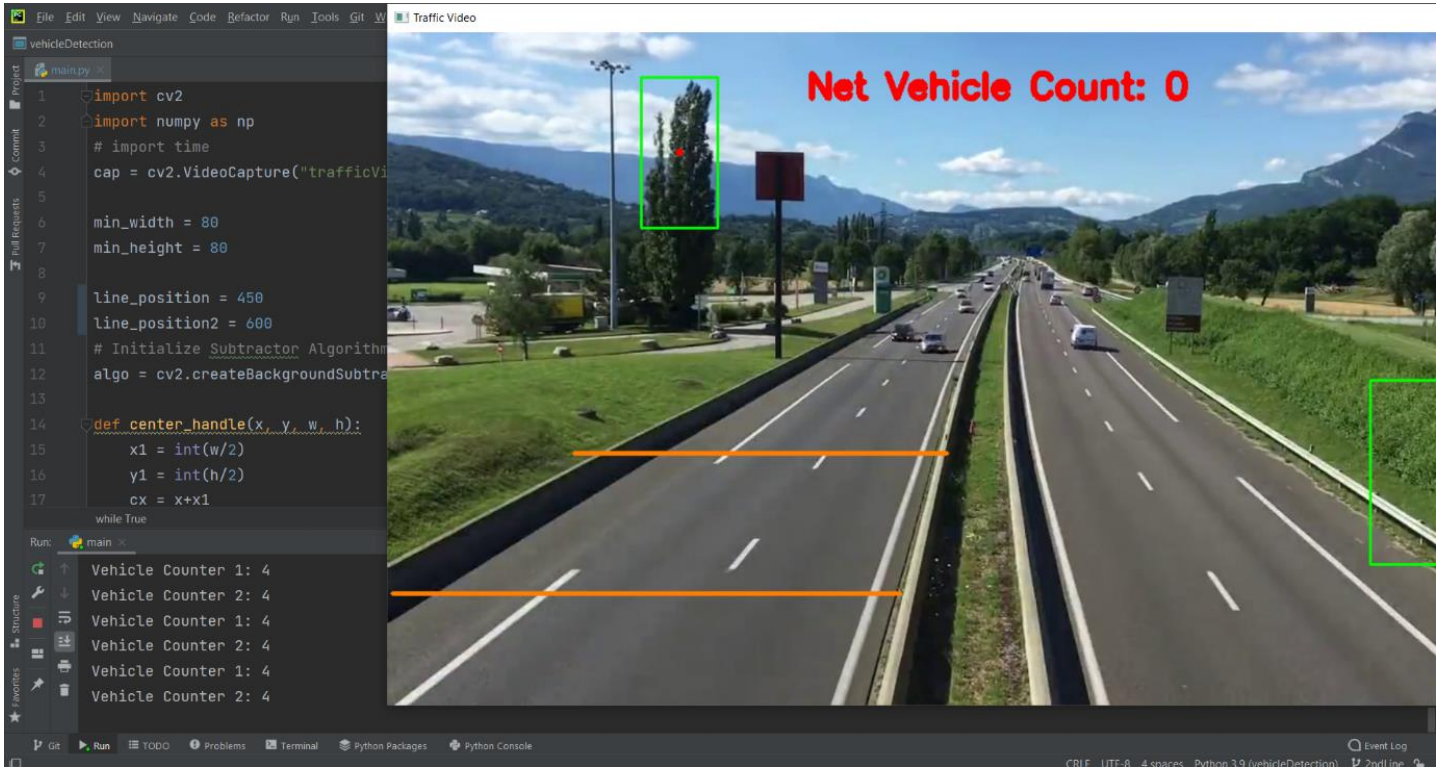


OpenCV Implementation



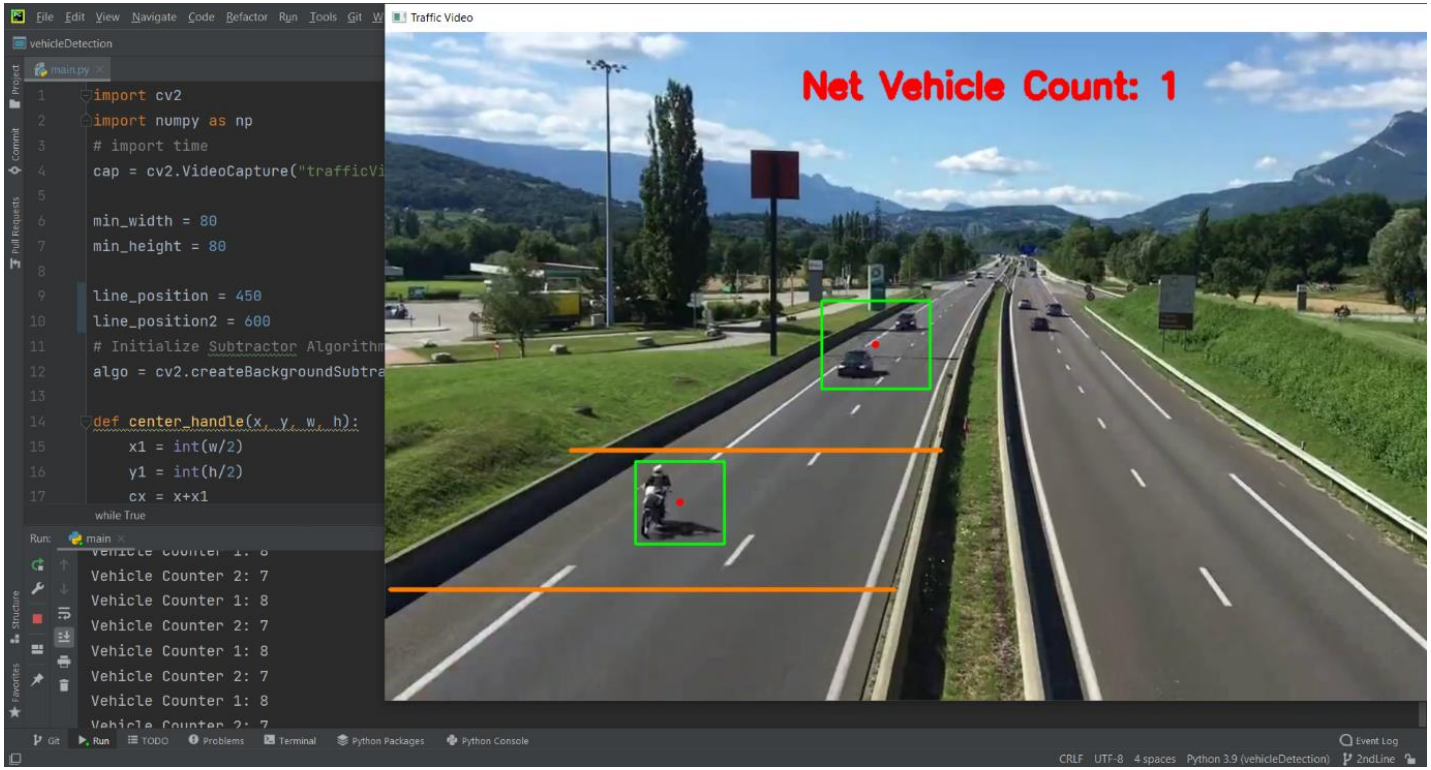
When there are two vehicles between 2 lines

OpenCV Implementation



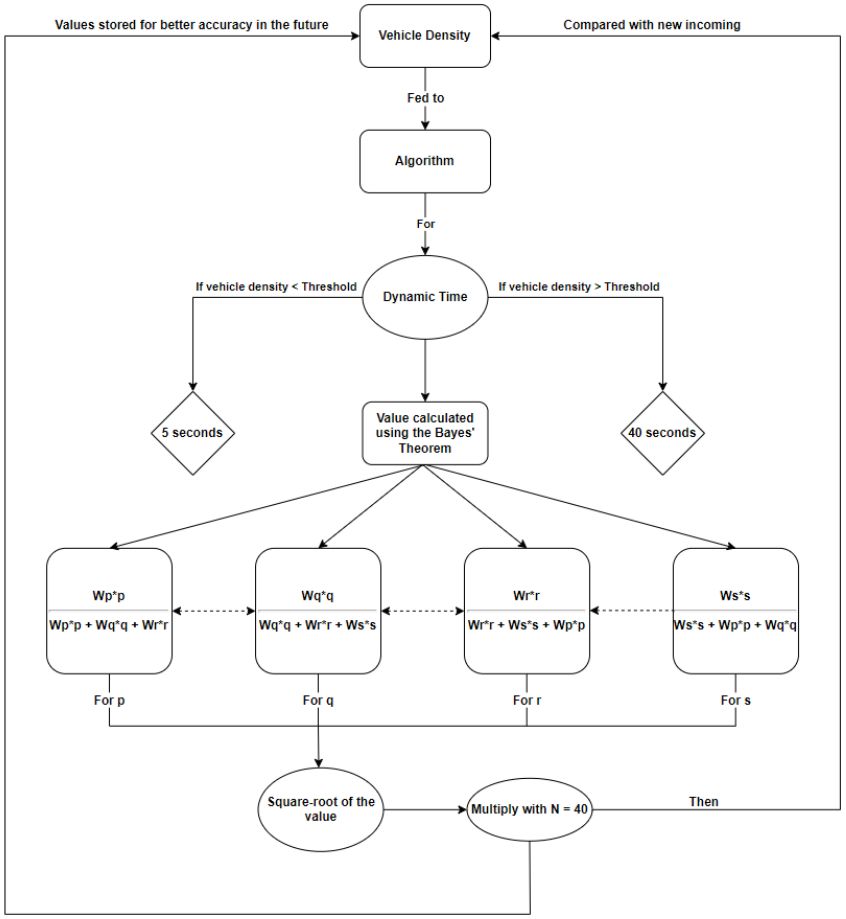
When there are 0 vehicles between 2 lines

OpenCV Implementation



When there is one vehicle between 2 lines

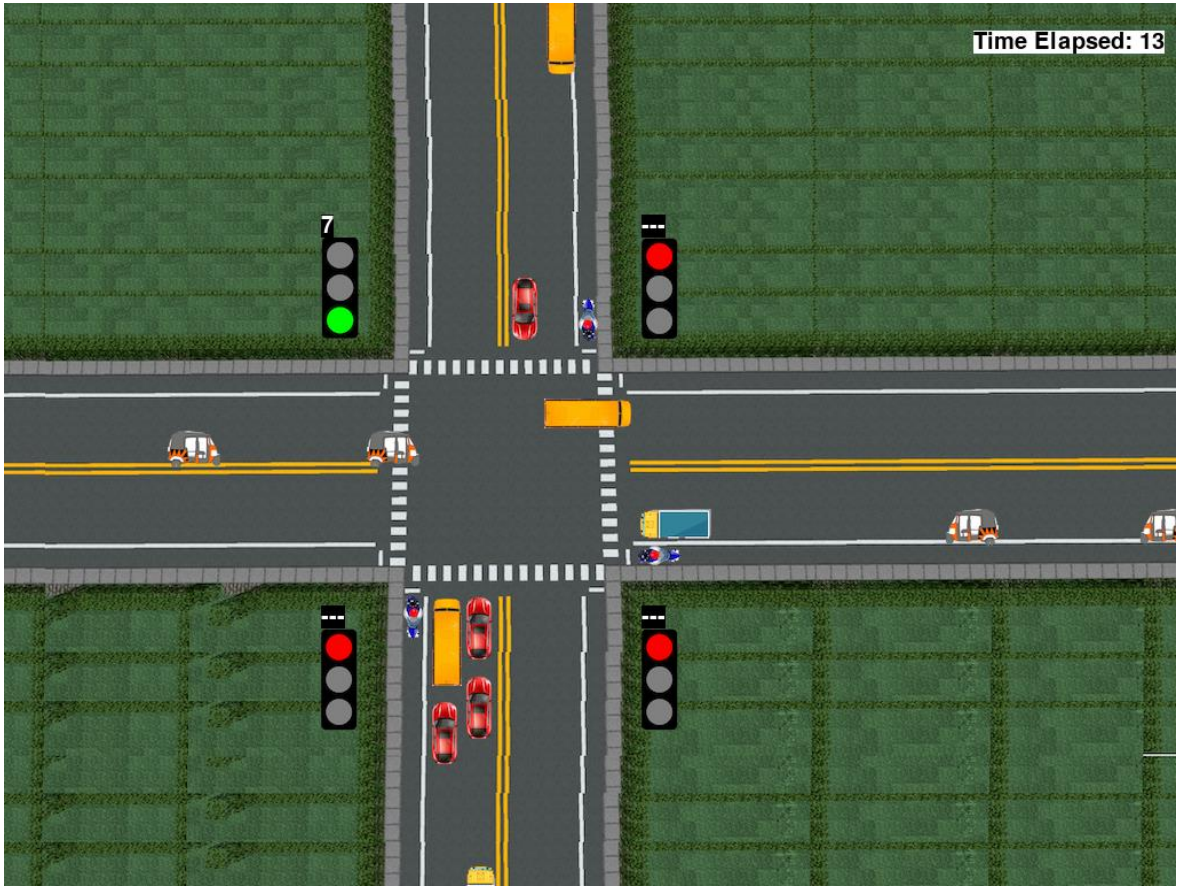
Algorithm Flowchart



Algorithm Output

```
D:\PARAS\3rd year\TY MiniProject\Git_TrafficSignal>c.exe

For intersection P:
Enter the count of vehicles on P intersection:14
Enter the count of vehicles on Q intersection:23
Enter the count of vehicles on R intersection:15

The GreenSignalTime is :19

For intersection Q:
Enter the count of vehicles on Q intersection:34
Enter the count of vehicles on R intersection:23
Enter the count of vehicles on S intersection:5

The GreenSignalTime is :33

For intersection R:
Enter the count of vehicles on R intersection:45
Enter the count of vehicles on S intersection:32
Enter the count of vehicles on P intersection:12

The GreenSignalTime is :32

For intersection S:
Enter the count of vehicles on S intersection:4
Enter the count of vehicles on P intersection:45
Enter the count of vehicles on Q intersection:23

The GreenSignalTime is :4


The Total GreenSignalTime for entire cycle is: 87
```

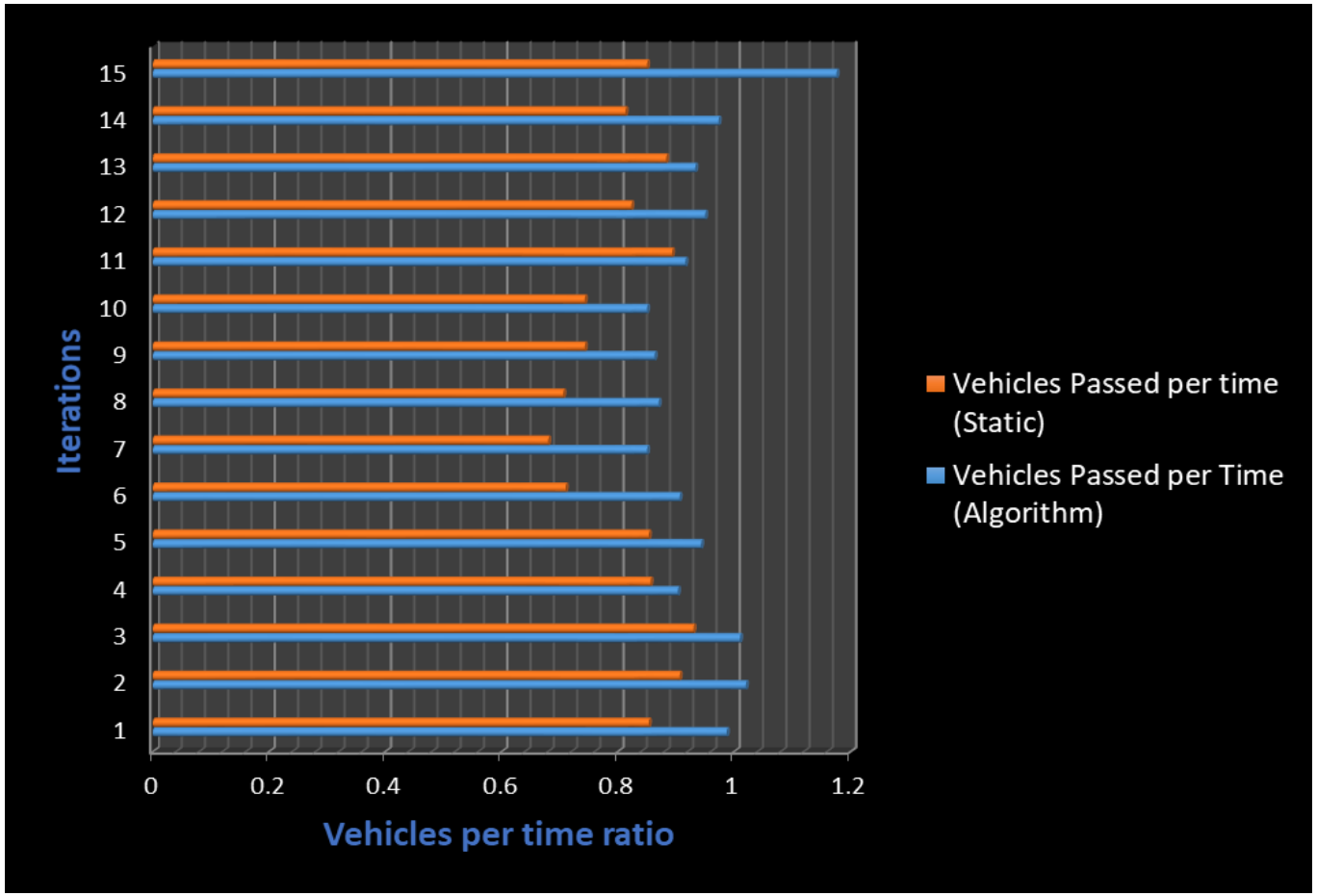
Pygame Simulation

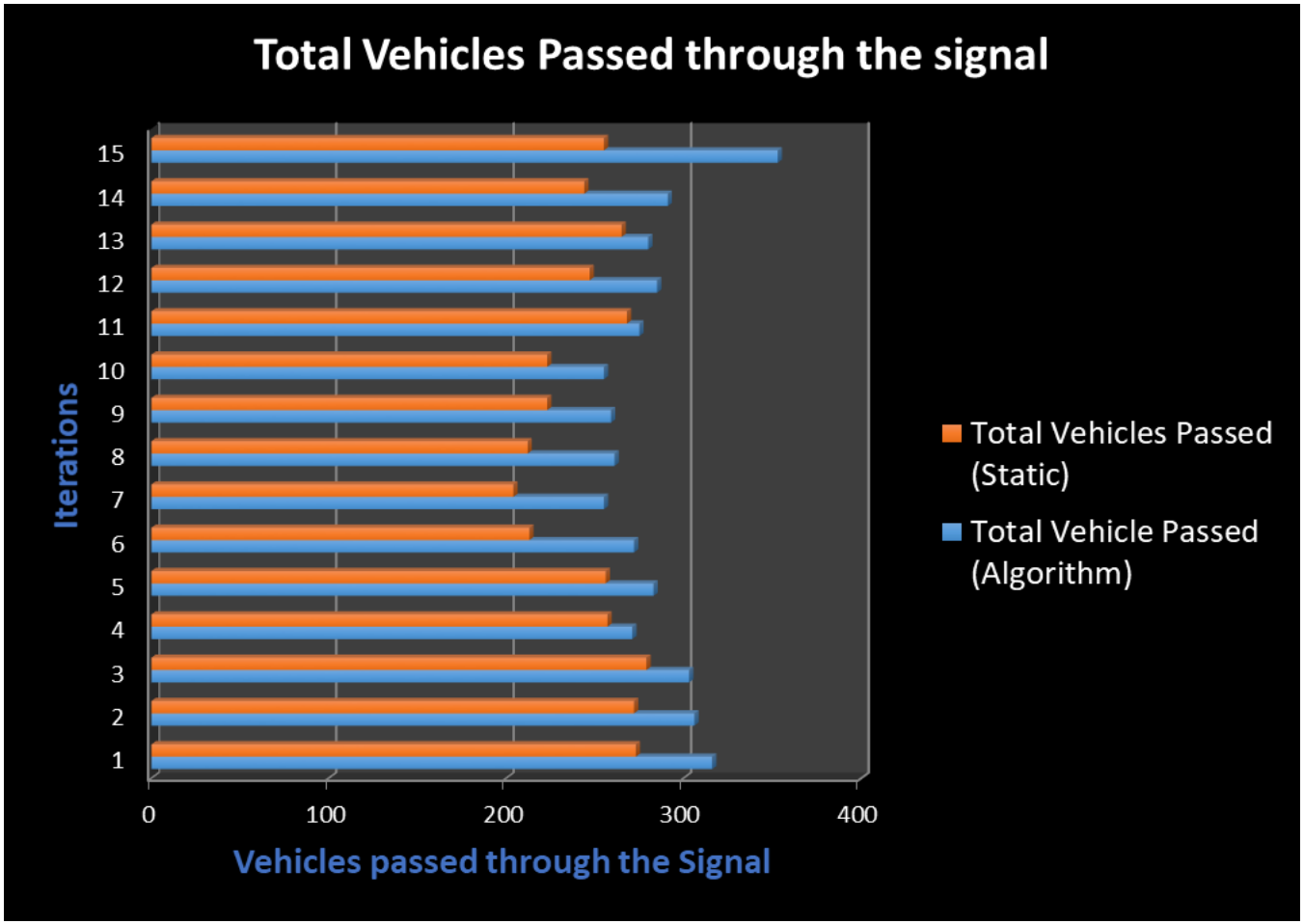


Pygame Simulation

Results and Analysis

Iterations	Vehicles Passed per Time (Algorithm)	Vehicles Passed per time (Static)	Total Time	Total Vehicle Passed (Algorithm)	Total Vehicles Passed (Static)
1	0.987	0.853	300	316	273
2	1.02	0.906	300	306	272
3	1.01	0.93	300	303	279
4	0.903	0.856	300	271	257
5	0.943	0.853	300	283	256
6	0.906	0.71	300	272	213
7	0.85	0.68	300	255	204
8	0.87	0.706	300	261	212
9	0.863	0.743	300	259	223
10	0.85	0.743	300	255	223
11	0.916	0.893	300	275	268
12	0.95	0.823	300	285	247
13	0.933	0.883	300	280	265
14	0.973	0.813	300	291	244
15	1.176	0.85	300	353	255


Iterations
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.2
0.4
0.6
0.8
1
1.2
Vehicles per time ratio
Vehicles Passed per time (Static)
Vehicles Passed per Time (Algorithm)


Total Vehicles Passed through the signal
Iterations
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
100
200
300
400
Vehicles passed through the Signal
Total Vehicles Passed (Static)
Total Vehicle Passed (Algorithm)

Future Scope

1. Identification of vehicles violating traffic rules:
2. Accident or breakdown detection:
3. Synchronization of traffic signals across multiple intersections:
4. Adapting to emergency vehicles:

Conclusion

- In conclusion, the proposed system sets the green signal time adaptively according to the traffic density at the signal and ensures that the direction with more traffic is allotted a green signal for a longer duration of time as compared to the direction with lesser traffic.

- This will lower the unwanted delays and reduce congestion and waiting time, which in turn will reduce fuel consumption and pollution.

- According to simulation results, the system shows about 20% improvement over the current system in terms of the number of vehicles crossing the intersection, which is a significant improvement.

- Thus, the proposed system can thus be integrated with the CCTV cameras in major cities in order to facilitate better management of traffic.