IOSR Journal of Engineering (IOSRJEN)
ISSN: 2250-3021 Volume 2, Issue 7(July 2012), PP 148-151
www.iosrjen.org

A Strategy to reduce air pollution for Homogeneous lane following traffic system – An Indian Scenario

[1]Yogesh Singh Rathore, [2]Jaya Sharma,[3]Shilpi Gupta
Amity University

***Abstract:* -** *Traffic flow accounts for as much as one-third of global energy consumption. In India congestion and air pollution are two big problems for cities today. A general traffic control idea is to allow traffic to pass on the basis of fixed time controller. In this paper we have presented a novel approach to reduce average waiting time on signals thereby reducing air pollution. By placing sensors at every entry and exit of a junction and monitoring the number of cars present at the junction, it is possible to get an idea of load on the lanes. Traffic management can be efficiently carried out by applying proposed scheduling algorithm.*
Keywords: *Scheduling, Traffic,* *Waiting time*

I. INTRODUCTION

Due to increasing number of vehicles and the poor state of highways developments have led to traffic congestion problem especially in metro cities. Travel time, environment quality, life quality, and road safety are all adversely affected as a result of traffic congestions. In metro cities large presence of 2 stroke vehicles and 4 wheelers are the major source of Carbon Mono oxide and Lead Aerosol. Both gasoline and diesel based vehicles are also the main source of toxic air contaminants. In addition, delays due to traffic congestions also indirectly affect productivity, efficiency, and energy losses. Due to the large number of variables or parameters involved and their unexpected variations, traffic management becomes much more complex. [1]

To control the ever increasing traffic, traffic signals are installed at road intersections, pedestrian crossing and other locations. But the problem is most of the traffic signal controllers installed across the country are fixed time controllers that do not regulate traffic efficiently. Therefore to upgrade the traffic light, first step is to fully understand the problem. The flow of the vehicle stream can be measured by appropriate detectors (or sensors). Vehicle presence can be detected and occupancy can be measured. The unmeasured inputs and outputs introduce non deterministic factors. The flow splits can be measured or estimated but cannot be controlled in an acceptable manner [1-8]. So in this paper we have proposed a different approach to reduce waiting time of vehicles by introducing 'shortest job first scheduling' with the existing method of traffic movement.

II. RELATED WORK

A lot of research is being done in area of effective traffic control system. Better traffic control leads to improved safety for all road users, shorter travelling times through the controlled part of the traffic system and it also reduces negative environmental impact [1]. One of the important issues is the optimization of traffic lights in urban road networks [6], especially the coordination of vehicle flows and traffic lights. A typical goal is to minimize travel times, to find optimal cycle times [5, 6] and to study the corresponding spatio-temporal patterns of traffic flow [7]–[9].

Urban vehicle traffic control can be actuated or non-actuated. Control can be non-coordinated (implemented for isolated intersections) or coordinated. The actuated urban vehicle traffic control can be performed on the following approaches: controlling the flows (i.e. the volume control), density control, queue length control, singular event reaction, phase time extension until a minimum gap out, and phase time extension until timeout [1]. Most of the research focus was put on traffic, which requires studying the situations, where traffic flows merge or intersect. These models can explain how jam fronts propagate backwards over network nodes [3], which might eventually result in breakdowns of traffic [9]–[11]. Papageorgiou, et al. present some methods for local, centralized or distributed control of vehicle urban traffic [1]. Bazan presents a coordination method based on multiagent system that uses game theory to get the crossing times and the synchronization of intersection signaling [1]. Liu and Tate propose an intelligent adaptation speed system that uses in- vehicle electronic devices to enable the speed of vehicle to be regulated automatically [1]. This offers a flexible method for speed management and control in urban area. Lammer *et al* [12] proposed to represent the traffic lights by locally coupled phase oscillators, whose frequencies adapt to the minimum cycle of all nodes in the network.

III. CONVENTIONAL SYSTEM AND ITS LIMITATIONS

In conventional system fixed cycle time is assigned, the order of green light and is duration shifts between neighboring traffic lights. This system has following limitations –

- Green light duration is often longer than needed to serve the average number of arriving vehicles. This causes long waiting time in neighboring lights.
- Longer cycle time causes avoidable delay in case of light traffic. In such case accident also takes place
- This unnecessary waiting time results in decrease in efficiency and energy loss. It also increases air pollution.

IV. PROPOSED APPROACH

Every little move helps in improving traffic flow. Regarding urban road networks, our approach is to have optimal use of traffic lights, the goal being to minimize the time spent by vehicles in the road networks. To effectively manage traffic we need to determine the number and constitution of stages at intersections during which a set of traffic streams has the green light for each stage; time taken for a complete cycle of signals to take place at an intersection. As discussed in previous section a lot of work has been done in this area. However, further improvement of the traffic flow requires more flexible strategies to be applied rather than fixed-time controls [17]–[20].

Traffic light system is a time-sharing system. To decide the flow of vehicles at intersection effective scheduling is required to make best use of time. In the existing approach traffic lights follow a fixed time scheduling approach. In this a small unit of time is defined and vehicles are allowed to move according to this fixed time quantum. But the average waiting time under this policy is often long. Setting this time quantum too short causes too many switches and lowers the system efficiency , and setting it too long causes poor response At times it is required to switch to manual mode where the lane having largest

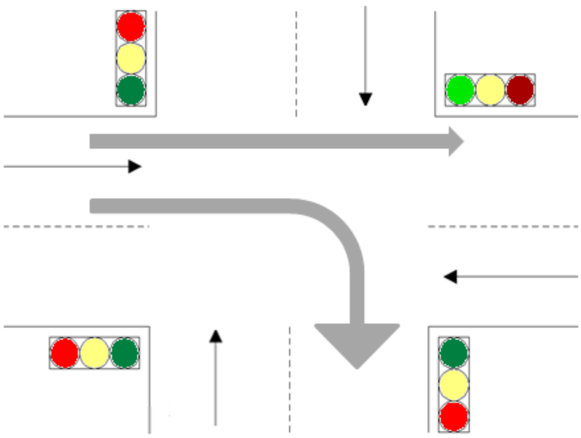

Figure 1: Road Intersection Layout

load is allowed to pass first but this results in more waiting time for vehicles in other lane.

We have defined a different approach called shortest load first (SLF), in which the lane having the smallest queue of waiting vehicles are allowed to move first. The process is then repeated for next lane in increasing order of their traffic length. The SLF scheduling algorithm gives the minimum average waiting time for a given set of vehicles because moving a short queue before a long one decrease the waiting time of the short queue lane more than it increases the waiting time of the long queue lanes. Consequently, the average waiting time of vehicles decreases resulting in more green time. But it has the potential for starvation i.e. if we keep on repeating the process the longer queue of waiting vehicles may keep on waiting endlessly. So, only after one cycle is over we again return to SLF scheduling to clear any waiting queues of vehicles. We have used 2 parameters: Crossing Time ($\mathbf{C_{Ti}}$) & Waiting time ($\mathbf{W_{Ti}}$) for calculating average waiting time ($\mathbf{AW_T}$). Before starting the calculation we have sorted the crossing time ($\mathbf{C_{Ti}}$) of all the lanes in ascending order. In the table below, we have assumed that $C_{T1} < C_{T2} < C_{T3} < C_{T4}$

Table no 1: Calculation of Average Waiting Time

Lane No. L_i	Crossing Time C_{Ti}	Waiting Time W_{Ti}	Average Waiting Time AW_T
L_1	C_{T1}	$W_{T1} = 0$	$AW_T = (\sum W_{Ti}) / 4$ i= 1 to 4
L_2	C_{T2}	$W_{T2} = C_{T1}$	
L_3	C_{T3}	$W_{T3} = C_{T1} + C_{T2}$	
L_4	C_{T4}	$W_{T4} = C_{T1} + C_{T2} + C_{T3}$	

V. RESULTS & DISCUSSIONS

To collect actual data we have considered 5 busy traffic intersections in Noida region, and then we have tested our approach on this data. The following figures show the result obtained. It is clear from the graphs that the average waiting time in case of SLF is always less than the existing approach.

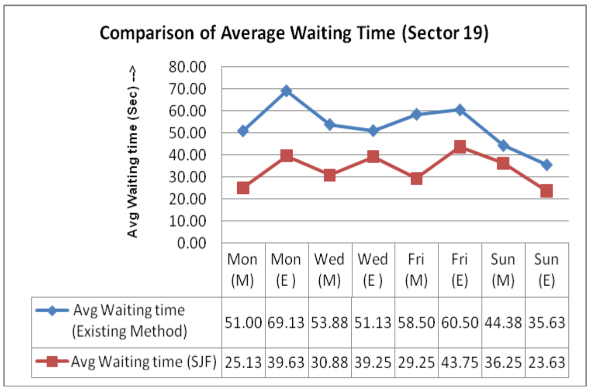

Figure 2: Comparison of Average waiting time (Sector 19)

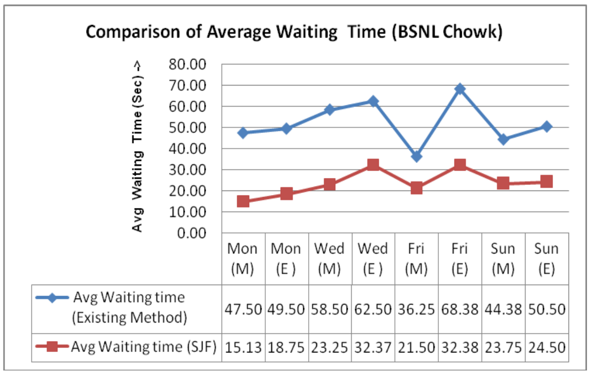

Figure 3: Comparison of Average waiting time (BSNL howk)

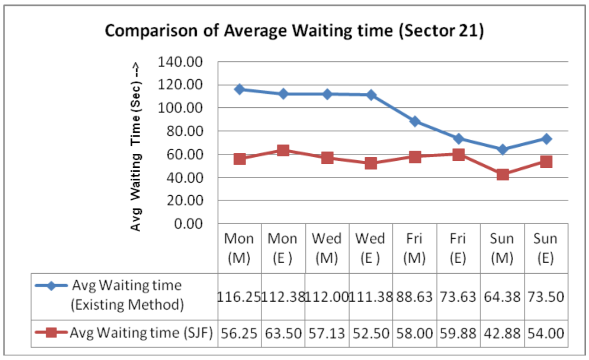

Figure 4: Comparison of Average waiting time (Sector 21)

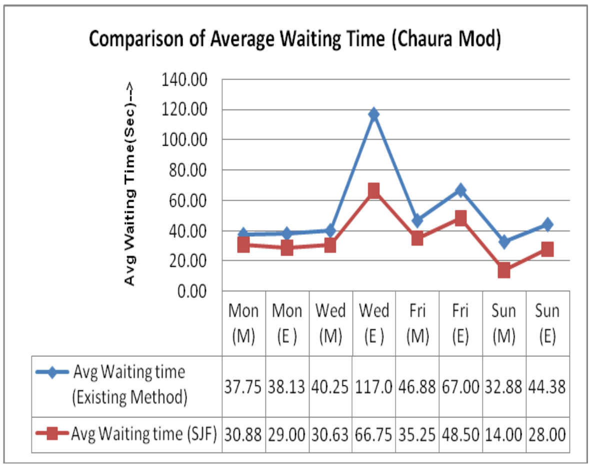

Figure 5: Comparison of Average waiting time (Chaura Mod)

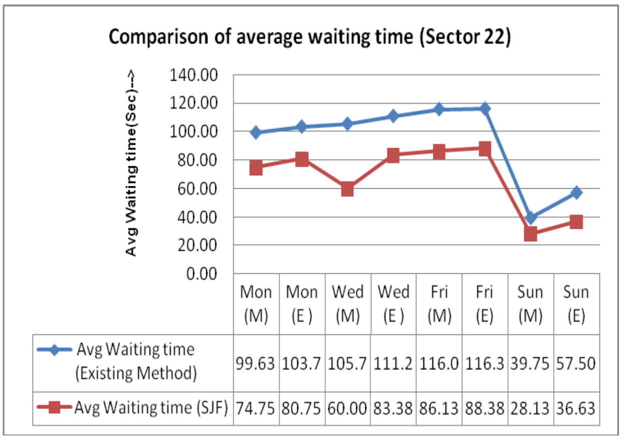

Figure 6: Comparison of Average waiting time (Sector 22)

VI. CONCLUSION & FUTURE SCOPE

Environmental pollution due to vehicle is a severe and growing problem. In our approach we have managed to reduce the average waiting time that ultimately results to less fuel consumption & lower emissions. This leads to a better environment. At later time, we will try to simulate these results for larger area and in cloud architecture.

REFERENCES

[1] Tiberiu Letia, Sergiu Barbu and Florin Dinga," Using Preemption ForDependable Urban Vehicle Traffic", Proceedings of the International Multiconference on Computer Science and Information Technology pp. 923–932
[2] Helbing D, Jiang R and Treiber M, "Analytical investigation of oscillations in intersecting flows of pedestrian and vehicle traffic", 2005 Phys. Rev. E **72** 022113
[3] Wastavino L A, Toledo B A, Rogan J, Zarama R, noza V M and Valdivia J A, "Modeling traffic on crossroads", 2007 Phys. Stat. Mech. Appl.
[4] Zheng J-F, Gao Z-Y and Zhao X-M, "Modeling cascading failures in congested traffic and transportation networks", 2007 Phys. Stat. Mech. Appl
[5] Brockfeld E, Barlovic R, Schadschneider A and Schreckenberg M, "Optimizing traffic lights in a cellular automaton model for city traffic", 2001 Phys. Rev. E
[6] Fouladvand M and Nematollahi M, "Optimization of green-times at an isolated urban crossroads", 2001
[7] Chowdhury D and Schadschneider A, "Self-organization of traffic jams in cities: effects of stochastic dynamics and signal periods", 1999 Phys.
[8] Huang D and Huang W, "Traffic signal synchronization", 2003 Phys.
[9] Sasaki M and Nagatani T, "Transition and saturation of traffic flow controlled by traffic lights", 2003 Phys. Stat. Mech.
[10] Sekiyama K, Nakanishi J, Takagawa I, Higashi T and Fukuda T, "Self-organizing control of urban traffic signal network", 2001 IEEE Int. Conf. Syst. Man. Cybern.
[11] Fouladvand M E, Shaebani M R and Sadjadi Z, "simulation of intelligent controlling of traffic flow at a small city network", 2004 J. Phys. Soc. Japan
[12] L¨ammer S, Kori H, Peters K and Helbing D, "Decentralised control of material or traffic flows in networks using phase-synchronisation", 2006