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A NOVEL ALGORITHM FOR CONTROLLING TRAFFIC CONGESTION

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ABSTRACT

Efficient traffic management is a vital component in the growth of the Nation. Traffic congestion is a prominent issue in the metro cities where travelers are spending the maximum commutation time in the traffic jam which is serious hazard. To find the solution of such problem a new algorithm is developed which efficiently control the traffic congestion problem by diverting the vehicles to different lanes in shortest possible the time. Different Traffic control systems have also been reviewed in this paper by investigating the upsides and downsides of each in cost, dependability, exactness, effectiveness, and upkeep upward.

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KEY WORDS
raffic Congestion; Computer Vision; Threshold frequency; junction points

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INTRODUCTION

Traffic Congestion word which is clouded with unexplained fear and stress. Many researchers are working on this particular problem still there is more scope and improvement in this area. Traffic congestion is directly proportional to the efficiency of the daily commuter. If the start of the day is the well due to unexplained and uncontrolled problems leads to the full day of stress and anxiety. Researchers have discovered that ants just like commuters, they also analyze the traffic issues from their end and if they found themselves to be stuck suddenly they change their routes to some alternate and best possible shortest path. The major issue is that the majority of users are using GPS app to find the best possible path for a chosen destination. This GPS gives the information in close integration with multiple servers connected through IOT (Internet of Things) and that information is stored in cloud. The traffic could be managed if we could identify at a particular junction on stated time how many vehicles pass though which could analyze the trend at that particular junction what is the statistics so that if that junction is overloaded with vehicles an alternate route can be suggested on the basis of threshold frequency. The proposed system is developed considering the scenario wherein there are multiple lanes at a particular junction. The ideology behind the development of this novel algorithm is that the number of vehicles passing through a particular lane at a particular junction is calculated with the help of threshold frequency. Once that limit that is the number of vehicles passing through that lane gets exhausted the algorithm will redirect to the next lane to the round robin manner. Once the limit on all the lanes is exhausted the new algorithm will redirect to the alternate path.

LITERATURE REVIEW

An extensive literature review has been carried out in the existing literature.
Kirschfink et al. in 2000[22] propose new algorithm which were able control traffic [1]. Papageorgiou et al. [35] give outline of problem faced in traffic control and method to resolve such problems [2]. H. Ceylan et al. in 2004[14] studied the road reserve capacity network under seedtime traffic control [3]. Hong & Lo [16] developed a algorithm that study the Phase Clearance Reliability (PCR) and improve the performance of traffic signal. Han & Zhang [4] proposed an approach to detect and count vehicles at an intersection in real- time to increase efficiency on traffic control. Some of the author’s works have been encapsulated in [Table 1].

Table 1: Literature survey(Source:Self)

Name of Paper	Author Name	Approach	Description
A genetic algorithm for the vehicle routing problem	Baker, B. M. and Ayechew, M. (2003)	Genetic Algorithm	This study construe genetic algorithm (GA) operation to the basic vehicle routing problem (VRP), in which customers of known demand are supplied from a single depot.[2]
Vehicle Routing Problem With Time Windows, Part II: Metaheuristics	Br¨aysy, O. and Gendreau, M. (2005)	Metaheuristic Approach	This paper is about the surveys on the research of the metaheuristics approach for the Vehicle Routing Problem with Time Windows (VRPTW). The VRPTW can be depict the problem of drafting lowest cost routes from one signal point to a set of geographically scattered points.[3]
Applying the ANT System to the Vehicle Routing	Bullnheimer, B., Hartl, R. F., and Strauss, C. (1999)	ANT colony	In this paper Ant System has been used to solve the Vehicle Routing Problem

Problem			w.r.t capacity and distance from one central depot.[4]
Analysis of Noisy Evolutionary Optimization When Sampling Fails	Chao Qian et al.(2018)	Evolutionary Algorithm	This paper includes a description about the effect of sample size from a theoretical perspective. By analyzing the the noisy Leading Ones problem, it has been shown that as the sample size increases, the run time can also become reduced exponentially [5]
The Truck Dispatching Problem	G. B. Dantzig and J. H. Ramser	Linear Programming Formulation	The shortest paths have been found between any two points in the system and a demand for one or several products is specified for a number of stations within the distribution system. [6]

PROPOSED SYSTEM

Since the traffic management system in India has been designed technically but still there is a need for the improvement. A new algorithm has been designed which evaluate the how many traffic vehicles can be allowed to pass through the one lane at the particular junction point and redirect the traffic to another path accordingly.
This dataset used comprise of collection of numbers of vehicles at four junctions points at an hourly frequency.

- Date and Time
- lane points
- No. of Vehicles
- Distance covered by the junction point

The data has been collected by the sensors functional in different junctions in different interval of time.

The current Traffic Management system is designed technically but usually fails to provide an optimum[7-9] throughput of vehicles. Providing effective real time traffic signal control for a large complex traffic network is an extremely challenging distributed control problem. We aim to develop an efficient traffic adaptive control strategy that identifies the real time traffic scenario in small steps (surveillance interval), and gives appropriate green time extensions to minimize time function consisting of linear combination of performance indexes of all the four lanes [10-12] .

The key idea behind the Developed algorithm is to calculate the threshold frequency according to the distance covered by the lane point [13-17]. The threshold frequency indicate the number of vehicles pass through the one point and beyond that frequency automatically redirect towards another lane, if all the lane threshold limit exhausted then redirected to the best possible route.

Threshold value=area covered by junction point/no. of lanes*no. vehicles covered in 1 lane

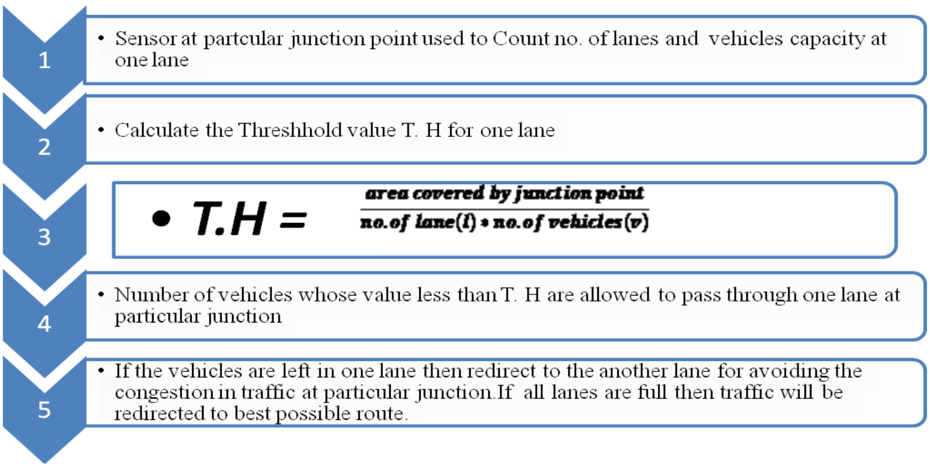

Fig. 1: Flow chart of Proposed Methodology (Source: Self).

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The steps of the developed algorithm are as follows:

Algorithm 1: Algorithm for evaluating the frequency of vehicles in lane points.
Input: no. of vehicles, junction point, date and time
Output: Frequency of each variable (vehicles and junction points) and if deadlock occur redirect for the most suitable junction point(route)

Algorithm
{
1. for i (1 to n) do (#where i is time)
2. for j (1 to m) do (#where j loop for lane)
3. Count [] =0
4. Scan (j) (#where j is the lane point)
5. Count l and v (# of lanes and vehicles capacity at one lane)
6. Calculate T.H = $\frac{area\ covered\ by\ junction\ point}{no.of\ lane(l) * no.of\ vehicles(v)}$
7. V= (1 to p)
8. Do while (V<T.H)
9. Scan (V) at j^{th} *lane point*
10. Count+=V
11. if sensor[j] $\Longleftarrow$ *(true) added to (V to war []) and count added to var [i][j])*
12. V++
End loop
/ If still no. of vehicles left greater than T.H then redirect to the another junction* /*
13. If (j≠m) Go to step 2 for another junction
14. Else redirect j=1;
End loop
End loop
End loop

The above algorithm evaluates the Threshold frequency so that it can calculate the capacity of vehicles that can pass through the one lane after that all the vehicles whose value are greater than the T. H value can automatically redirect to the another lane point to avoid the congestion[18][19]. If deadlock occur all the traffic will pass to another possible path [20-22].

RESULTS

The data has been taken for an arbitrary location. The proposed algorithm has been implemented in Python. The IDE used for the implementation is Jupyter. The results after executing the algorithm threshold frequency of each four lane points are calculated which are as follows:
[50, 30, 100, 29].
The threshold frequency indicates the number of vehicles that pass through one lane.
The above array indicates the 50 vehicles can pass through one lane 30 can pass through 2nd lane and so on. Below is the result which calculates the T.H value of every lane point.
Parameters of junction 1
[1, 2, 3, 4] [50, 30, 100, 29]
Distance 2252
Lanes 1 Threshold Frequency 15
In the above parameters Ist array denote the number of lanes, 2nd array denote the vehicles waiting to pass respectively. Distance can be calculated by sensor at each junction point. Threshold frequency can be calculated by
T.H =
In the similar manner the below T. H value has been calculated
Parameters of lane 2
[1, 2, 3, 4] [50, 30, 100, 29]
Distance 2602
Lanes 2 Threshold Frequency 17
Parameters of lane 3
[1, 2, 3, 4] [50, 30, 100, 29]
Distance 3949
Lanes 3 Threshold Frequency 20
Parameters of lane 4
[1, 2, 3, 4] [50, 30, 100, 29]
Distance 3494
lanes 4 Threshold Frequency 60
[15, 17, 20, 60]
Since after calculating the threshold frequency now it's a time to pass the vehicles from the particular lane and rest has been redirected towards the next lane.
[50, 30, 100, 29] [15, 17, 20, 60]

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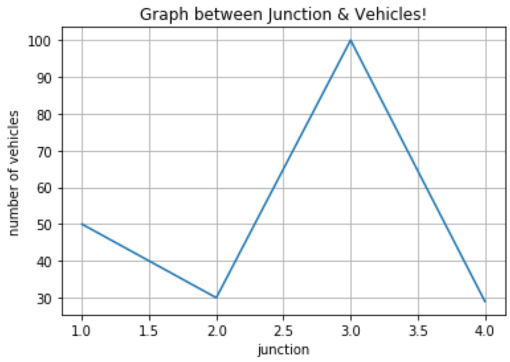
The first array indicated the no. of vehicles waiting to pass through lanes and 2nd array indicated the T. H value respectively.
Vehicles can pass through junction 0
15
According to T. H value only since only 15 can pass through first lane. So rest vehicles i.e 35 will be directed towards 2nd lane. At 2nd junction already 30 vehicles have been waiting so the total will be 65. But at that point only 17 that pass through the 2nd lane so the rest will directed to 3rd lane and so on.
Vehicles at lane 1
65
Vehicles can pass through lane 1
17
Vehicles at lane 2
148
The above results
Vehicles can pass through lane 2
20
Vehicles at lane 3
157
Vehicles can pass through lane 3
60
No. of vehicles left 97 and they will redirect towards another junction
The above 97 vehicles are left after covering up the entire junction, so they redirect to another junction. This loop will be continued till all the vehicles passed. The time consumption will be so small to avoid the traffic congestion.



CONCLUSION

Since the traffic jam is the matter of serious concern which leads to the many complications like missing the fight, train, exams, and patients could not reach on time. To avoid such situation, a new algorithm have been generated which can eradicate the problem of traffic congestion. This algorithm has been tested on particular location and has seen that the results are efficient and it can be implemented in real time. Since shortest path (optimal)routes has not taken into consideration when the deadlock occur, so in the next paper optimal path will be selected for choosing the next junction point

CONFLICT OF INTEREST
None

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