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Traffic Estimation and Least Congested Alternate Route Finding Using GPS and Non GPS Vehicles through Real Time Data on Indian Roads

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ABSTRACT: Traffic becomes major problem on Indian urban roads as well as on highways. Traffic state estimation is a fundamental work in intelligent transportation systems (ITS). So, we need to find out a systematic solution to efficiently estimate the traffic state of large-scale urban road networks. We can predict the traffic state of road by using GPS devices mounted on vehicles. Through GPS we can analyze number of vehicles and their spatiotemporal location through real time traffic data set which updates continuously. After the prediction of traffic state through GPS, system suggests the alternate route to the user by using various algorithms. Alternate route must be least congested, shortest distance, minimal delay path. It is a possibility that some vehicles on Indian road may not have GPS mounted on it. So, we can count those vehicles on total traffic through here.com web service or through network. So we will be able to provide alternate route which contain less traffic as well as shortest distance and less time delay. All operations are going to perform on real time traffic dataset through GPS application.

KEYWORDS: GPS, Traffic signal, ITS.

I.INTRODUCTION

Real traffic state information is obtained by analyzing data from various traffic detectors or from GPS probed devices. Advanced Traffic Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS)depends significantly on the capability to perform accurate prediction of the current traffic. Traffic data collection techniques such as Automated Vehicle Identification systems, video cameras, inductive loops, radar based sensors, floating cars using GPS receiver and GSM/GPRS transmitter, act as moving sensors traveling in a traffic stream. In this paper, we propose an algorithm for efficient route estimation according to real traffic state on roads. This algorithm provides least-congested, shortest, minimum delay route from source to destination to the driver before or after he leaves from the source. The concept presented is based on the servers which receive precise coordinates of the GPS vehicles through GPS simulator which might be utilized in personal computers for computation. Each server receives coordinates of every GPS vehicle. With every route we are attaching a server and a database which will be updated continuously by real time route segments through GPS application and internet. Traffic of non GPS Vehicles can be measured through internet. The algorithm used for measuring non GPS Probe vehicles is multiscale correlation-averaging algorithm which is novel approach to measure gross Traffic on Indian Roads. Many Indian vehicles are Less configured. In Survey, It has been seen that only 40 percent vehicles on Indian road are highly configured. We must consider those less configured vehicles in gross traffic.

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II. LITERATURE SURVEY AND RELATED WORK

Various techniques has been proposed and research is done in the area of Advanced Traffic Management System (ATMS). Also many advanced methods have been introduced for real time traffic state estimation. Some research work in the area of ATMS is illustrated below:

Pueboobpaphan and Nakatsuji et al. [10] applied the unscented Kalman filter to make the real-time traffic state estimation; Jia et al. [11] implemented the urban traffic state prediction by considering resident travel characteristics and road network capacity. Using the city of Stockholm, Sweden, as a case study, Rahmani et al. [9] made a preliminary investigation on the requirement and potential of GPS-probe-vehicle data for traffic management, particularly on the aspect of data coverage.

Qing-Jie Kong et al. [1] introduced the network traffic flow model and the approaches employed to traffic state prediction.

Q.-J. Kong, Z. Li, Y. Chen, and Y. Liu et al. [2] introduced an information-fusion-based way for the prediction of urban traffic states. The approach obtains traffic data from dissident loop detectors and global positioning system (GPS)-equipped vehicles. In this approach, three parts of the algorithms are developed for fusion computing and the data processing of loop detectors and GPS probe vehicles. First, a fusion algorithm, which integrates the merged Kalman filter and evidence theory (ET) .

M. P. Hunter, S. K. Wu, H. K. Kim, and W. Suh et al. [3] introduced a probe-vehicle-based evaluation of adaptive traffic signal control. Travel time data were gathered using Global-Positioning-System (GPS)-equipped test vehicles. Shi et al. [7] built a GPS and GIS-integrated system for urban traffic flow analysis, and in this system, they proposed a curve-fitting method to analyze GPS data for the mean-speed estimation in the urban road network.

H.Y. Cheng and S.H. Hsu et al. [4] introduced self-diagnosing intelligent highway surveillance system and design effective resolutions for both daytime and nighttime traffic observation. For daytime observation, vehicles are detected via background modeling. For nighttime videos, headlights of vehicles need to be located and paired for vehicle detection.

III. PROBLEM STATEMENT

Estimation of traffic using real time data and find out most convenient alternate path from source to Destination for normal as well as Time critical User through GPS probe devices and non GPS devices. Alternate route must be least congested, Shortest distance path and Minimal time delay.

IV. PROPOSED SYSTEM

The proposed method provide a shortest least-congested, minimum delay path to the driver when he starts from the source. The inputs are source location (from where he leaves) and the destination location entered into GPS receiver. We provide source location and destinition location in form of addresses or land mark ,but this form is not acceptable for processing. So ,We convert this landmark addresses into latitude and longitude through Google Geocoding. Based on these inputs, the system estimates the traffic on the route and suggests alternate route to the user which is shortest, least congested and minimum delay path. This combined approach improves the performance of proposed system in terms of efficiency and robustness. The solution includes three parts:

1) Shortest distance path.

2) Finding least congested route.
3) Minimum delay path.

Here, we will use GPS device to track vehicles location in form of latitude and longitude. This approach will make system dynamic as well as accurate. System is easy to install and less costly.

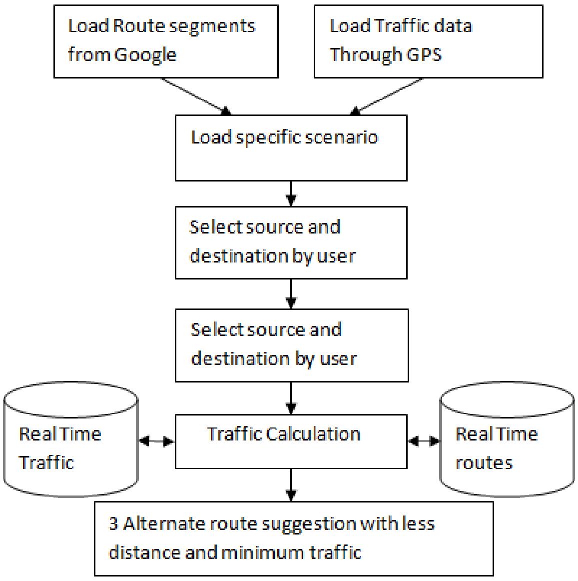

Figure1: System Architecture.

IV. ALGORITHM FOR TRAFFIC STATE PREDICTION

1) Input I=traffic dataset through GPS servers I2=Real time route segments in between source location and destinition

2) Forming dynamic route *Dm* = *Y,R,G,O*
a) Yellow path *Y* = *Less crowded area*
b) Red path *R* = *Blocked road*
c) Green path *G* = *Free road*
d) Orange path *O* = *Crowded road*

3) Find out optimal tracking path from source to destination through *A** heuristic search algorithm.

$$F^k(N) = G^k(N)+H^k(N)\ldots\ldots(1)$$

4) Shortest distance calculation through euclideans distance.

$$G^k(N) = D^k(N) + \propto^k . C^k(N)\ldots\ldots(2)$$

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4)Traffic Calculation

a)Record last 5 locations of vehicle in form of latitude and longitude with their respective times through GPS. $R=\{(l1, t1, v1); (l2, t2, v2)\ldots.. (l5, t5, v5)\}$

b) Apply haversine formula to calculate speed of vehicle.

c) Vehicles that don't have GPS mounted on it, their data can obtain through here.com web service or network.
d) Calculate average velocity V^k of road link k ($k = 1,2,3\ldots..m$) by:

$$V^k = (\sum_{r=1}^{n} d_r^k)/(t_{end}^k - t_{start}^k) \qquad (3)$$

5) Total Traffic=GPS vehicles+ non GPS vehicles
6) Suggest proficient alternate route.

VIII. IMPLEMENTATION STRATEGY

I. Location Based Distance Calculation

This uses the haversine formula to calculate the circle distance between two points that is, the shortest distance over the earth's surface.

$$a = \sin^2(\triangle\emptyset/2) + \cos(\emptyset1)\cdot\cos(\emptyset2)\cdot\sin^2(\triangle\lambda/2)$$
$$c = 2.a\tan 2(\sqrt{a}, \sqrt{(1-a)})$$
$$d = R.c$$

Where, $\emptyset$ is latitude,
λ is longitude,
R is earth's radius (mean radius = 6,371km)

II. Vehicle Tracking Method:

The vehicle tracking method is another popular way of predicting traffic states. In this section, the proposed tracking based method consists of the following several algorithms. First, we employ the A* Heuristic search algorithm to determine the optimal tracking route and then calculate the average velocities along these tracks. Then, the average velocity of each road section is obtained by combining the velocities of the tracks that pass through the road section, depending on their corresponding credibility factors. Because GPS equipped probe vehicles discontinuously send sampling data (usually once every tens of seconds), we have to determine the driving path according to the locations of the vehicle at two adjacent moments. In general, the vehicle location at the current moment is not far away from the location at the previous moment, because the interval is very short.

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III. A* Heuristic Search Algorithm:

The A* heuristic search algorithm is optimal upon the searcning time and can balance multiple optimum criteria by adjusting the factors of its evaluation function. Therefore, in this method, the A* algorithm is selected to judge the optimal tracking path. The evaluation function for track k is defined by

$$F^k(N) = G^k(N) + H^k(N)$$

where $G^k(N)$ is the cost of the path from the start location to crossroad N, and $H^k(N)$ is the heuristic function that estimates the cost of the shortest path, which is the Euclidean distance from crossroad N to the end location.

$$G^k(N) = D^k(N) + \propto^k . C^k(N)$$

where $D^k(N)$ is the total journey from the start location to crossroad N, $C^k(N)$ is the number of the crossings through which the path has already passed, and $\propto^k$ is the scale factor between them.
After ascertaining the tracking path, we can calculate the spatiotemporal average velocity of every road section in the path. Taking road section r as an example, we first obtain the total distance of each vehicle track by summing up its driving distances in every road section. In addition, the travel time can be obtained from the GPS data. Therefore, the average velocity along track k (k = 1, 2,….,m). V^k can be obtained by

$$V^k = (\sum_{r-1}^{n} d_r^k)/(t_{end}^k - t_{start}^k) \qquad (3)$$

where $d_r^k\ (r = 1, 2, \ldots, n)$ is the driving distance in road section *r*, t_{end}^k and t_{start}^k are the time stamps, *m* represents the total number of the tracks, and n represents the total number of the road sections through which track *k* passes. And for measuring traffic of non GPS Vehicles, here.com traffic provision service is used.

IX. EXPERIMENTAL RESULTS

Proposed methodology of traffic state estimation is combination of various approaches.The System Provides efficient solution to user without disregarding the performance. Time required for estimating traffic state and suggesting alternate route is less as compare to existing system. As we are fetching real time traffic data through GPS simulator, the suggested alternate route will be more accurate. Suggested route is draw on map with different colors which will be helpful to user.

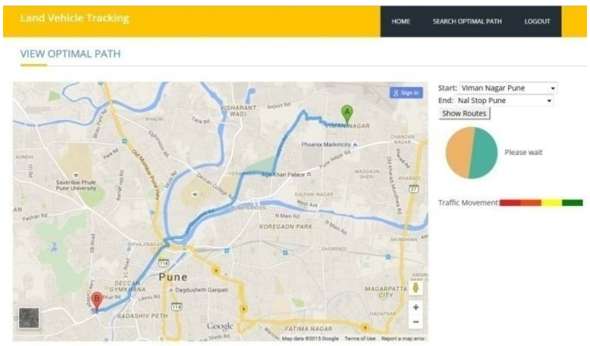

Figure 2: General Route.

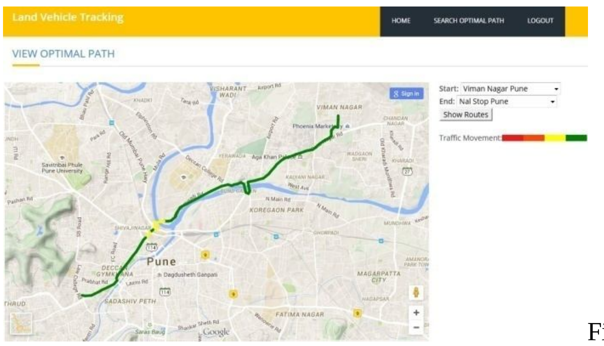

Figure 3: First Alternate Route.

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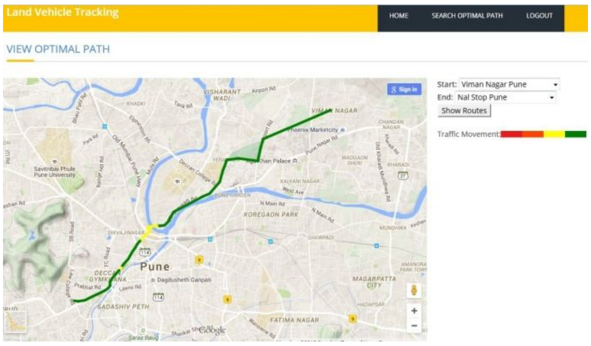

Figure 4: Second Alternate Route.

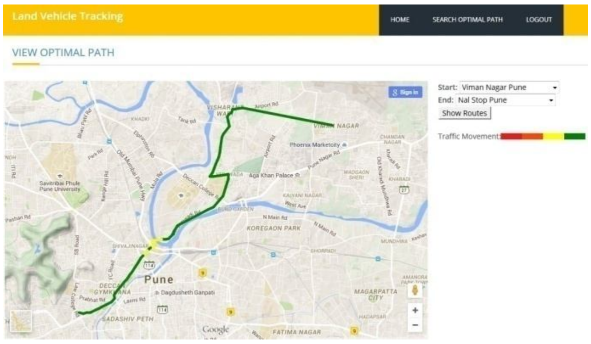

Figure 5: Third Alternate Route

X. CONCLUSION

System presents an effective and efficient solution to estimate the real time traffic states of large-scale urban road networks with a large number of GPS probe vehicles as well as non GPS vehicles. This solution includes a canvas google map for the traffic state monitoring system and various traffic state estimation algorithms. We propose an algorithm which is combination and modification of various approaches. The following methods are used for traffic state estimation: 1) the vehicle-tracking-based method. 2) Location Based Distance method. These methods improve performance while using in combination. Non GPS vehicles can be tracked via internet service. It is combined approach for traffic state Estimation which will improve performance and generate more accurate results.

REFERENCES

[1] Qing-Jie Kong, Member, IEEE, Qiankun Zhao, Chao Wei, and Yuncai Liu, "Efficient Traffic State Estimation for Large Scale Urban Road Networks", IEEE Transactions On Intelligent Transportation Systems, Vol. 14, No. 1, March 2013

[2] Q.-J. Kong, Z. Li, Y. Chen, and Y. Liu, "An approach to urban traffic state estimation by fusing multisource information," IEEE Trans. Intell. Transp. Syst., vol. 10, no. 3, pp. 499–511, Sep. 2009.

[3] M. P. Hunter, S. K. Wu, H. K. Kim, and W. Suh, "A probe vehicle based evaluation of adaptive traffic signal control," IEEE Trans. Intell. Transp. Syst., vol. 13, no. 2, pp. 704–713, Jun. 2012.

[4] H.-Y. Cheng and S.-H. Hsu, "Intelligent highway traffic surveillance with self diagnosis abilities," IEEE Trans. Intell. Transp. Syst., vol. 12, no. 4, pp. 1462–1472, Dec. 2011.

[5] F. Calabrese, M. Colonna, P. Lovisolo, D. Parata, and C. Ratti, "Real time urban monitoring using cell phones: A case study in Rome," IEEE Trans. Intell.Transp. Syst., vol. 12, no. 1, pp. 141–151, Mar. 2011.

[6] M. Ndoye, A. M. Barker, J. V. Krogmeier, and D. M. Bullock, "A recursive multiscale correlation averaging algorithm for an automated distributed road condition monitoring system," IEEE Trans. Intel. Transp. Syst., vol. 12, no. 3, pp. 795–808, Sep. 2011.

[7] W. Shi, Q.-J. Kong, and Y. Liu, "A GPS/GIS integrated system for urban traffic flow analysis," in Proc. IEEE Intell. Transp. Syst. Conf., Beijing,China, 2008, pp. 844–849.

[8] Q. Zhao, Q.-J. Kong, Y. Xia, and Y. Liu, "An improved method for estimating urban traffic state via probe vehicle tracking," in Proc. 30th Chin. Control Conf., Yantai, China, 2011, pp. 5586–5590.

[9] M. Rahmani, H. N. Koutsopoulos, and A. Ranganathan, "Requirements and potential of GPS-based floating car data for traffic management Stockholm case study," in Proc. 13th Int. IEEE Annu. Conf. Intell. Transp. Syst., Madeira Island, Portugal, 2010, pp. 730–735.

[10] R. Pueboobpaphan and T. Nakatsuji, "Real-time traffic state estimation on urban road network: The application of unscented Kalman filter," in Proc. 9th Int. Conf. Appl. Adv. Tech. Transp., Chicago, IL, 2006, pp. 542–547.

[11] S. Jia, H. Peng, and S. Liu, "Urban traffic state estimation considering resident travel characteristics and road network capacity," J. Transp. Syst. Eng. Inf. Tech., vol. 11, no. 5, pp. 81–85, Oct. 2011.