GREENROUTE: AN ECO-FRIENDLY OPTIMAL ROUTE

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***Abstract*— Travelling is a major part of our daily life. We all need to travel from one place to another to reach our destination. One of the major problems faced with travelling today is traffic congestion. It will consume a lot of our valuable time in the congestion. So the major solution to such a problem is rerouting the vehicles. Also long time exposure to polluted and congested road environment leads to many of the breathing and health problems to human beings. So the aim of this paper is to find out a route with less congestion and pollution. The system uses ant colony optimization to determine the optimal route from multiple routes. Google maps can be used to get real time route information.**

***Index Terms*— Ant colony optimization, Traffic congestion**

I.INTRODUCTION

Travelling is a major part of our daily life. People travel from one place to another. The vehicles on the road are increasing day by day. But the major problem faced is that the development inroad infrastructure is happening at a very low rate.

The major problem the people are facing today is difficulty in managing the traffic in roads. The best way to reduce the traffic and manage the traffic is to reroute the vehicles. The vehicles must be rerouted to a less congested route.

Another major issue faced by the people are health issues. While travelling through a congested route, the chance of getting affected is higher. It causes many health issues like breathing difficulties, asthmas etc. The better way to reduce the chance of being affected by these problems is rerouting itself.

This system proposes a vehicle rerouting system. System ensures the user to travel through least congested and polluted routed. The congestion of an area could be found out using the velocity of the vehicles in a route. Air quality is measured using an API called Breezometer api.

The best route among multiple set of routes will be selected using the ant colony optimization method. Google map APIs are used inorder to get the real time route information.

II.RELATED STUDIES

Many previous works were done for detecting the traffic congestion. There were many works that concentrated on the identification of congestion at a particular point by a dedicated device [1]. In such works, a dedicated device was installed which could determine the velocity of the vehicle or the number of vehicles. Devices such as inductive loops were used as such devices. But the installation and maintenance of such devices were difficult.

Other method included a camera device installed in an airplane which is at a high altitude [2]. The images taken at regular intervals and the processing of such images were done to determine the congestion rate. Involving such tasks also makes the system more tedious and expensive.

Video data was also used to collect such information. In [4] RFID and GSM technologies were used. In this technique, the vehicle congestion is detected using signals send from an active beacon. This paper also discussed about the various techniques to prevent the congestion.

In [6] the technique used was change in earth's magnetic field. The movement of vehicles was taken as a measure to determine the congestion conditions.

In [7] a real time routing of vehicles during traffic congestion was considered. The shortest path between a pair of nodes was considered. But to be exact, stochastic shortest paths were to be considered. But the integration of stochastic shortest path problem with the dynamic vehicle routing problem was difficult.

In [16] the proposed method only aims at simplifying the solution construction, that is, the second phase of ant colony optimization algorithm. It does provide any guarantee to
the solution quality.

III.PROPOSED METHODOLOGY

The proposed system aims at finding the best and optimal route from a source to a destination. It considers the factors such as congestion and air quality of the route along with the distance to determine the best route. The source and destination points could be located with the help of online map services like Google maps. The congestion detection is done with the help of probe vehicular data. The air quality is determined with the help of APIs. The best path out of the multiple set of paths is obtained by applying ant colony optimization technique.

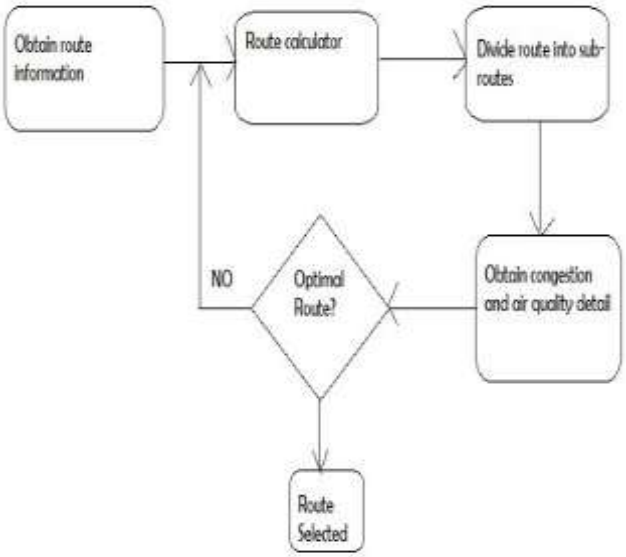

Fig.1 Proposed system architecture

3.1 Route identification

The routes from a source to a destination could be determined using map services like Google map. It provides APIs and man services to determine the route. Google maps could be easily integrated to the HTML page using JavaScript codes. Google map provide services like DirectionsService to provide the route information. It also helps to identify the junction points in the route using services like waypoints.

3.2 Subdividing route

The entire route from a source to a destination may be very lengthy. It would become difficult to manipulate best route from such a big data. So inorder to be efficient, the entire route is subdivided into smaller segments. The intermediate points may be divided considering time or distance as a factor for division. The way points obtained from route information will be useful in segmenting the entire route. Traffic congestion and air quality in each segment is estimated and the decision is taken based on that.

3.3 Mapping trajectory data

In order for the coordination of map data and trajectory data map matching technique is used. The points are mapped to nearest road segment data available. After map matching process, vehicles needed to be considered for obtaining speed information could be identified.

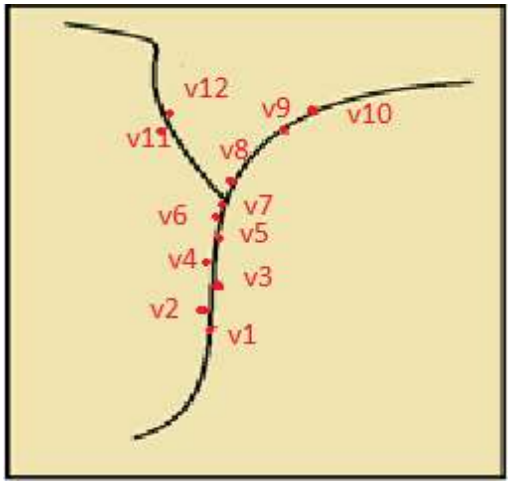

Fig.2 Map matching technique

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3.4 Congestion and estimation

Traffic congestion is caused due to the increase in the number of vehicles. As the number of vehicles at a particular region is high, the individual speed of the vehicles decreases. As a result of which the time taken to travel increases. This can lead to loss in time, effort, fuel etc. Proposed work measures congestion as a decrease in speed of the probe taxis in that area. The system reads the vehicle data and matches it with the segment and identifies the vehicle travelling in that route. The velocity of the vehicle can be identified by tracking the latitude-longitude pairs shared by vehicles at adjacent time intervals. There occur some situations where there is no vehicle data available at a region. Such a condition is known as sparseness of data.
In order to deal with the sparse data, multiple linear regression concepts are used. Solution is to employ geographical hash to characterize the regions of Earth's surface and study the speed of central region by means of the speed of eight neighbour regions with multiple linear regression approach.

3.5 Air quality detection

The proposed method integrates Breezometer API. It is an API used for providing the air quality detail of a particular area. Given the latitude-longitude pair of an area, the API returns information such as fair air quality, good air quality etc. Breezometer has created a new unified index for determining air quality. The value ranges from 100 (Excellent air quality) to 0 (Poor air quality) and are determined based on concentrations of predefined air pollutants depending on local standards.

3.6 Obtaining route with least travel time

The travel time for optimal path will be the one with less congestion and good air quality index. Once velocity of a particular route is obtained, it is easy to determine the time form distance and velocity. Also the route with less air pollution should be selected. The time a person breathes in particular environment can be considered as a travel time for pollution less route estimation. The travel time of each of the available routes is comparable. Thus can be used to select the congestion less and pollution less route.

3.7 Optimal path identification

To obtain the optimal path from available set of paths, ant colony optimization is considered. Ant colony optimization requires a graph network where each of the nodes represents the intermediate points of a route and the edges represents the sub-routes. Optimization can consider the distance as the cost matrix for the links between the cities. The main advantage is that any parameter can be included other than distance with the help of pheromone updates.
There should be a network structure for road. The ants consider several possible routes in the network from source to destination. Distance is the major decision parameter. But the average speed in the route segment and the air quality level at the route segment could be considered and affect the amount of pheromone updated. The ants select the route based on pheromone content in a link. So the average velocity and the air quality can also influence the selection of route. In this, a network is identified and using distance, congestion and air quality, and applying ACO best route is selected.

$$p_{xy}^{k} = \frac{(\tau_{xy}^{\alpha})(\eta_{xy}^{\beta})}{\sum_{z \in \text{allowed}_y} (\tau_{xz}^{\alpha})(\eta_{xz}^{\beta})}$$

Here, the τ parameter is considered as the distance parameter of the route. η parameter is used as the parameter for indicating congestion rate of a particular route and also the air quality value of that route.
The best path would be the one with less congestion and air pollution value. ACO is used to select an optimal path aong the multiple set of paths.

IV.CONCLUSION

Travelling is part of our daily life. To meet the time requirements of travel, congestion must be avoided. The best method to solve it is by rerouting the vehicles to a less congested route. Also due to heavy pollution during the travel, it can cause major health

issues to human beings. In order to save people from such situations, rerouting is the better option. This work aimed to determine pollution less and congestion less route from a source to a destination. Since Google map API is used, it provides a real-time system. Also ant colony optimization method is used to obtain the optimal
route with less congestion and pollution.

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