Optimization of Routes for Vehicles on Google Map

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Abstract— There are many schools, colleges and industries which provide transportation facilities to their students and employees residing at various places in a city. Also there are many state transport services which provide transportation service facilities to middle class citizens at affordable rates. Nowadays fuel prices are rising day by day, due to which the cost of running vehicles is increasing and the profit margin is decreasing. Thus it is becoming difficult to run a transportation business for schools, colleges and state governments etc. Hence it is required to reduce vehicle running cost in order to make it favourable for both the passengers and transportation service providers. For achieving this goal, we have to run the vehicles on such an optimal route which covers more passengers in less time and less distance. The route optimization for vehicles in any area of work is an important need in order to reduce cost as well as time. Here Google map of Hingna road, Nagpur is taken as a reference and imported from website of open street map on SUMO simulator. Then for the purpose of optimization of routes and providing proper scheduling of vehicles ACO and PSO algorithms are implemented on the taken Google map.

Key words: ant colony optimization, proper scheduling, particle swarm optimization , route optimization

I. INTRODUCTION

The efficient transport service means providing a service which takes less time of passengers and consumes less fuel so that it will be beneficial for both the passengers and transport organisation. This can be done by optimization of routes as per the need of passengers and proper scheduling of the vehicles on these routes. Instead of doing this by using traditional ways, we can do this by using current technologies in the intelligent transportation field such as ACO and PSO algorithms.

The optimal routing and proper scheduling with maximum resource utilization is a need in a real world scenario. For this purpose a Google map of Hingna road, Nagpur is imported from open street map website on a simulator named Simulation of Urban MObility (SUMO) and along with map many information about it has also been imported in xml files. The information includes routing file, edge file, node file, map configuration, lane id, street id etc.

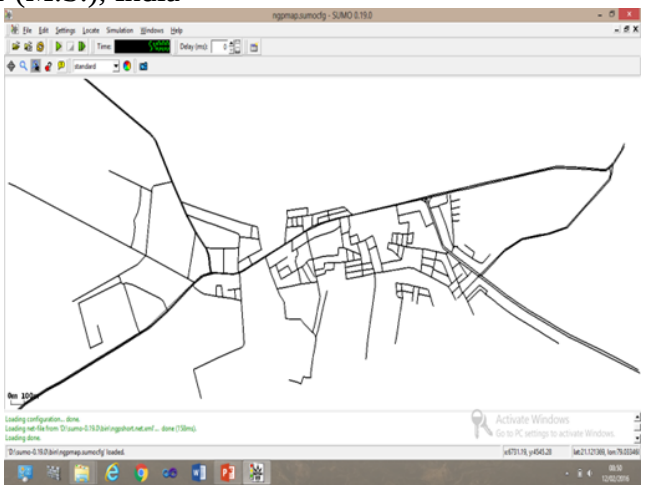

Fig. 1: Google Map of Hingna road, Nagpur

The above figure shows a Google map of Hingna road of Nagpur, Maharashtra which is used for analysis in the paper.

II. MAP ANALYSIS

The analysis of the information imported along with map in xml files is done using the SUMO simulator. SUMO is a free and open simulation suit. The simulator facilitates the analysis and evaluation of the task before implementing in real world scenario. It is tool which includes vehicles, public transport, and pedestrians. We can add any number of vehicles on this simulator along with vehicle information such as vehicle number, its speed, its capacity etc. We can test working of an algorithm and modify it as per requirement before using it in real world. The analysis of map is done here by studying its configuration, its route information, its edges information, its node information, lane and street id's of map.

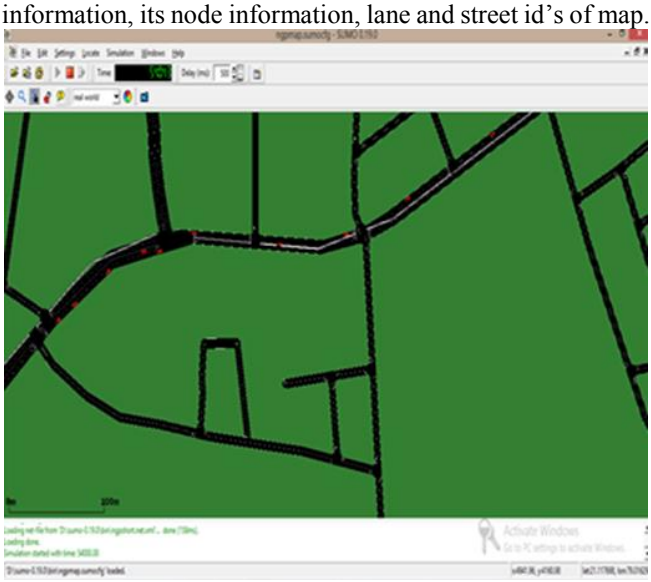

Fig. 2: Simulation of Urban Mobility

III. APPROACHES

The proposed plan of work is as follows:

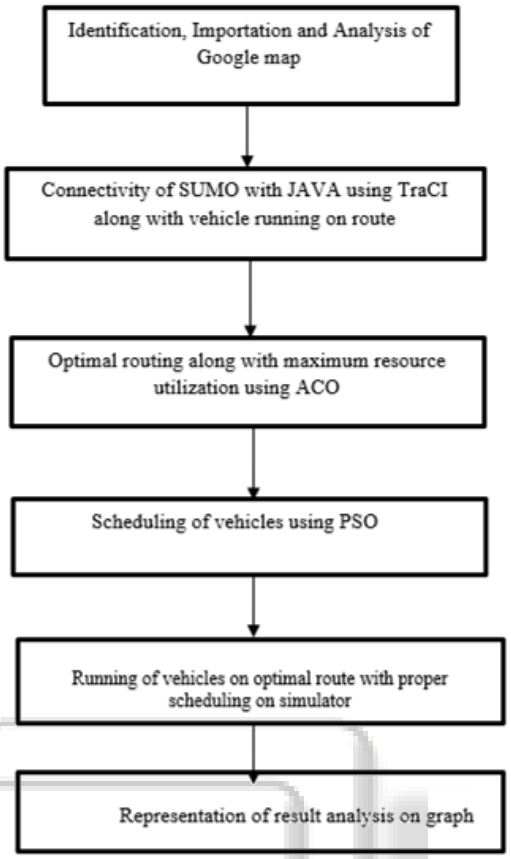

Fig. 3: Proposed flow of work

After the importation and analysis of map on SUMO simulator, connectivity of the simulator and JAVA is done using TraCI i.e. Traffic Control Interface. It provides access to SUMO using TCP based client server architecture. It works as a driver and used as middle layer in architecture between eclipse and Sumo. Testing of vehicle running on routes is done. After that implementation of ACO algorithm is done for finding optimal route along with maximum resource utilization on taken Google map. Since there are multiple vehicles for which proper scheduling is required which is achieved by PSO algorithm. At last analysis of result is done on graph.

A. Route Optimization:

The route optimization is achieved by ACO algorithm [3]. This algorithm is used to find optimal path among many available paths along with high resource utilization [7]. For achieving this some parameters such as time, stop delay, speed, distance, fuel consumption and capacity of vehicles are taken into consideration.

Flow of Algorithm:

The overall procedure used is as follows:

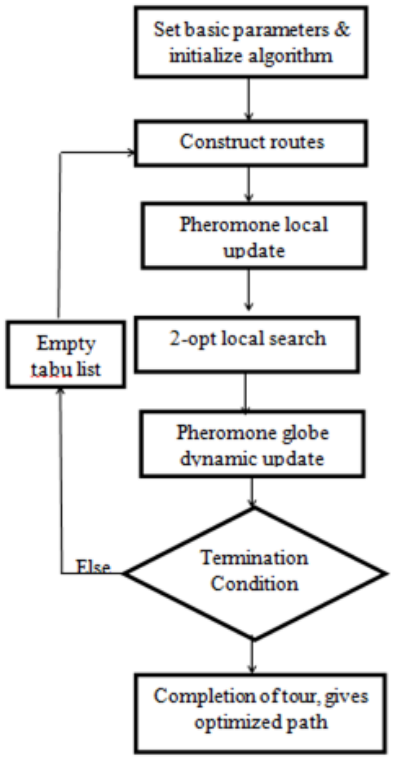

Fig. 4: Flow diagram of procedure of algorithm.

- Initialize some parameters such as pheromone values, iteration number, distance between junctions, table of latest optimal path i.e. tabu. Every ant is randomly distributed at different junctions, therefore set every ants tabu table with initial value.
- Each and every ant constructs its individual path and assigns pheromone values to each individual path between the junctions.
- Update pheromone value after each local iteration.
- Search the latest optimal path when every ant completes its path construction locally.
- After each global iteration, reduce pheromone values to some extent depending upon quality of path obtained between the junctions. The optimal path thus contains more amounts of pheromone values.
- If optimized path is achieved then algorithms ends or start again the whole procedure.

B. Proper Scheduling of Vehicles:

In case of multiple number of vehicles the task of proper scheduling arises. This task here is achieved by PSO algorithm by considering some parameters such as passengers, traffic, time etc. Arrival and departure time are set and by applying algorithm vehicles are assigned timing at different junctions.

IV. EXPERIMENTAL RESULTS

Files such as routing file, edge file, node file, sumo and map configuration file are given as an input in the execution process. Since, at each junction and lane, the junction id and lane id is given on the map. Then after sources and destination from the Google map are given as an input in terms of junction and lane ids. The number of vehicles is added along with its vehicle number, speed and capacity. The input also requires iteration number. As high iteration number is given

in input, more number of routes will be generated. Also each junction is considered as stops and some number of passengers is allotted at every stops. For testing purpose here iteration number 10 is given as input. Then after number of possible routes between given sources and destination are generated.

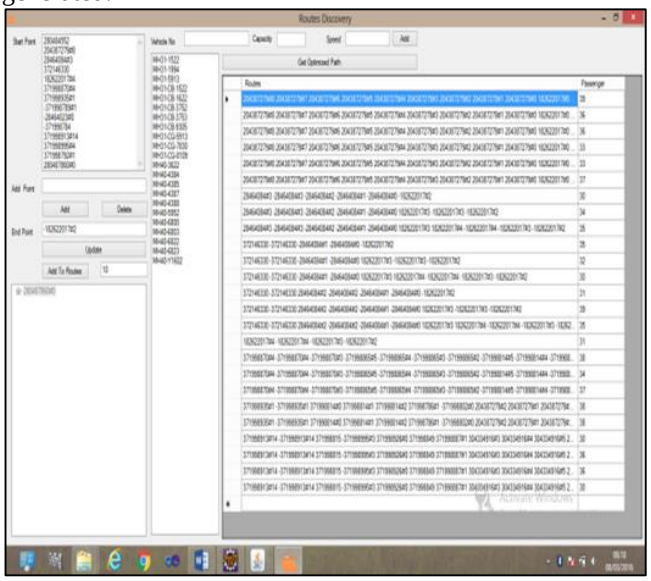

Fig. 5: All possible routes obtained

The above figure shows the possible paths between the given sources and destination. It also shows the number of passengers covered by each and every possible path.

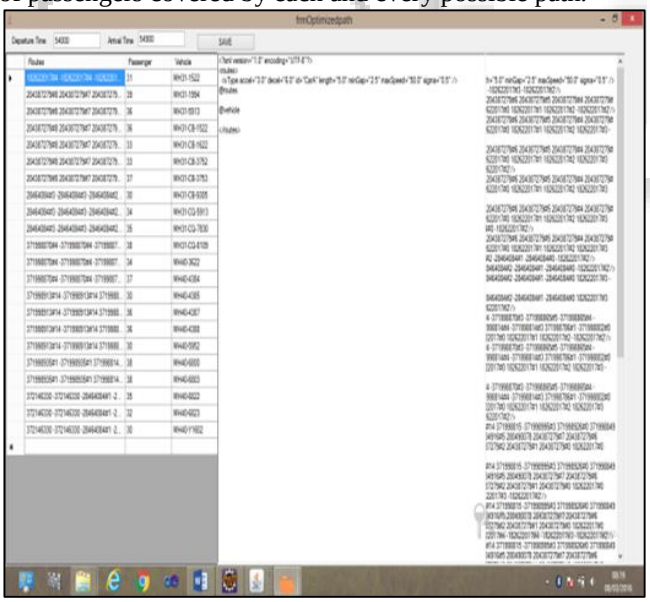

Fig. 6: Optimized routes obtained along with proper scheduling

The above figure shows the optimal paths obtained from the many possible paths between sources and destination. It also shows the number of passengers covered by each and every optimal path. The arrival and departure time is also set there and each optimal path gets assigned vehicles to provide proper scheduling.

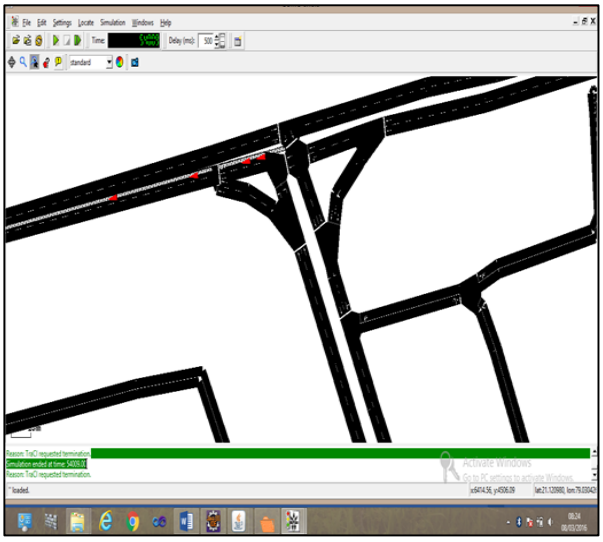

Fig. 7: Running of vehicles on optimized path

The above figure shows running of vehicles on obtained optimized path with proper scheduling of vehicles. Vehicles are shown here in red colour triangular shape.

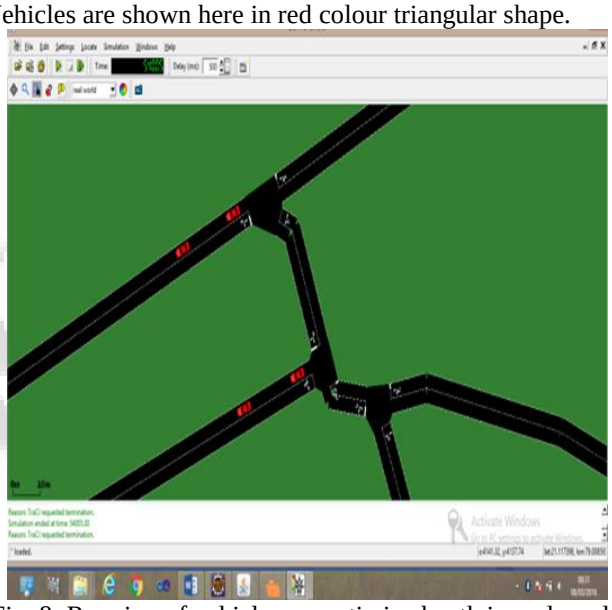

Fig. 8: Running of vehicles on optimized path in real world view

The above figure shows the running of vehicles on obtained optimized path with proper scheduling in real world view. Here also vehicles are shown in red colour.

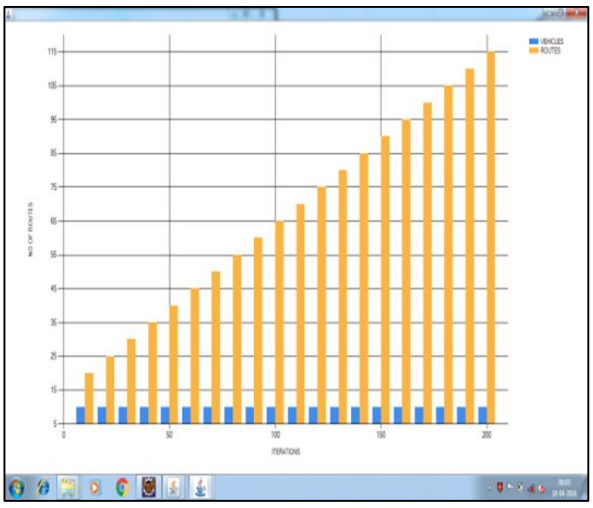

Fig. 9: Graph of no. of iterations Vs routes

The above shown graph illustrates that as number of iterations of algorithm increases number of optimal routes generated also increases.

V. CONCLUSION

This paper presents the optimization of paths for vehicles with proper scheduling on Google map taken from web. Thus by implementing above mentioned two algorithms the goal of transferring more passengers at low running cost is achieved. Hence, this work will help transport organizations in running the business efficiently.

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