

Improving efficiency of school bus routing using AI based on bio-inspired computing: A Survey

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Abstract - In the current work, bus routing problem has been addressed using ant colony and other optimization techniques. These techniques are good for theoretical applications and can be used for lesser number of bus stops. Though these techniques have good accuracy of routing, but the accuracy can further be improved by advanced techniques like AI. In this work we propose to improve the routing efficiency of bus routing problem using Genetic Algorithm based AI technique. The results will be compared with the existing algorithms in order to improve the overall system efficiency and reduce the delay needed for routing. We plan to test the system in a real time bus environment for result evaluations.

Key Words: School bus, Routing, Artificial intelligence Genetic algorithm, Bio-inspired computing.

1.INTRODUCTION

The School Bus Routing Problem (SBRP) is a classical combinatorial optimization problem in which, set of bus stops has considered consists of generating an efficient schedule for a number of school buses. Each bus takes students from various bus stops and delivers them to their designated schools while satisfying different conditions such as the bus has to follow the shortest path to reach the relevant destination as the bus follows the shortest path time is also reduces. Time and cost both are the important factors as the bus follows the shortest path cost has also reduced. The School bus routing problem (SBRP) can be divided into some sub-problems: Data Preparation; Bus Stop Selection; Routes Generation; and Route Scheduling. As far as we are concerned, genetic algorithm deals with the data preparation, routing, bus stop selection of the School bus routing problem (SBRP). Normally, the research work deals with the Route Generation and the Route Scheduling steps. Here is the advantage for selecting shortest path using genetic algorithm, artificial intelligence method has used for reducing the complexity of the network by reducing the path over the complex network. Here we are using the heuristic algorithm as our base.

Genetic Algorithm method for solving both constrained and unconstrained optimization problems. Genetic algorithm helps to find the shortest path with more accuracy even in complex network also.

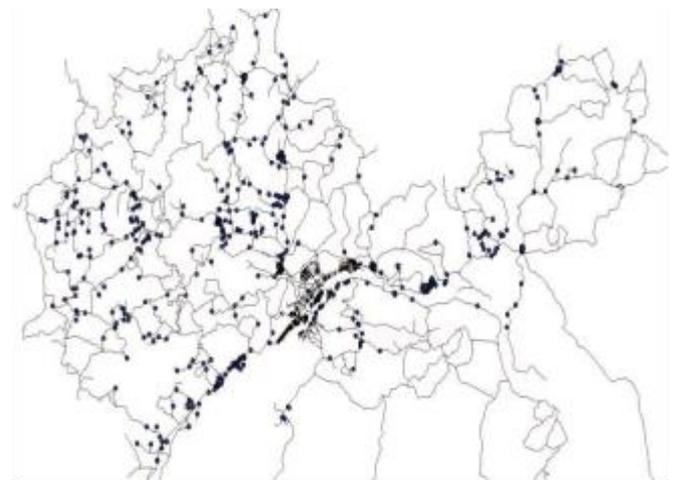


Figure 1 : Roads and Bus Stops

GPS or Global Positioning System, this network of orbiting satellites that sends precise details of their position in space back to earth. The signals are sent to GPS receivers, such as navigation devices are used to calculate the exact position, speed and time at the vehicles location.

1.1 Bio-inspired Computation

It integrates contrasting techniques of genetic algorithms to solve school bus routing real world problems.

1.2 Artificial intelligence

Father of Artificial Intelligence, John McCarthy said that it is "The science and engineering of making intelligent machines, especially intelligent computer programs". Artificial Intelligence is a method helps to make a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems. Artificial intelligence is intelligence produce by machines in this project also artificial intelligence method helps for getting the result with more accuracy.

Important Features of AI

To make Expert System - System which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users.

2. LITERATURE SURVEY

M. F. Faraj, J. F. M. Sarubbi, C. M. Silva, M. F. Porto, and N. T.R.Nunes[2]: They proposed an intelligent school transportation structures, mainly focusing on real time vehicle children tracking and route planning. The focus on route planning and tracking is to find the hidden practical problems and threats present in school transportation, keeping in mind safety.

P. Schittekat, J. Kinable, K. Sørensen, F. Spieksma, and J. Springael [3] : They proposed an algorithm for deployment of roadside units based on partial mobility information, partition of the road network into same size urban cells, and used the migration ratios between adjacent urban cells in order to infer the better locations for the deployment of the roadside units.

J. Park and B.-I. Kim[5]: They proposed the school bus routing and scheduling problem with transfers arising in the field of non-periodic public transportation systems, deals with the transportation of pupils from home to their school in the morning taking the possibility that pupils may change buses into account. Allowing transfers has several consequences. On the other hand, it allows more flexibility in the bus network structure and can, therefore, help to reduce operating costs.

B.-I. Kim and S. Jeong[7] : They have consider the generation of the origin-destination (OD) matrix, basic data in any vehicle routing or traveling salesman problem in their work. The terms was like this, OD matrix must be generated by calculating the shortest paths between some nodes. Candidate methods were like repetitive use of one-to-all shortest path algorithms such as Dijkstra's algorithm, Floyd-Warshall algorithm, and use of specifically designed some-to-some shortest path algorithms.

R. Bowerman, B. Hall, and P.Calamai[11]: They proposed an algorithm for generating a solution of multi-objective approach to modeling the urban school bus routing problem. Because school bus transportation services are provided through the public sector, the service must be evaluated by both efficiency and equity measures.

This technique first groups students into clusters using a multi-objective districting algorithm and then forms a school bus route and the bus stops for each cluster using a combination of a set covering algorithm and a traveling salesman problem algorithm.

3. CONCLUSIONS

Our research will reduce the delay in routing, and improve the accuracy of routing for the bus routing problem using advanced AI based Genetic algorithm technique. We will compare our work with the existing research in order to get a better analysis of our system.

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