© 2018 IJSRSET | Volume 4 | Issue 8 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Efficiency improvement and analysis of school bus routing using bio-inspired computing and AI method

Gawande P.V[1], Lokhande S.V[2]
[1]Assistant Professor, Department of EC, PBCOE, Maharashtra, India
[2]M.Tech Student Department of EC, PBCOE, Maharashtra, India

ABSTRACT

In this paper we present an optimization model for bus routing. The School Bus Routing Problem (SBRP) covers the issue of establishing plans to efficiently transport students distributed across a designated area to the relevant schools using defined resources. The model can be applied to a real network, and results are presented. 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.

Keywords: bio-inspired computing, AI method, School Bus Routing Problem , SBRP, SBRP-MLP , travelling salesman period , genetic algorithms

I. INTRODUCTION

In this study, Data feeding step has done before via coding and thus, the necessary pieces of information had been prepared and an algorithm for solving the other problems, Bus Stop Selection, Bus Route Generation and Route Scheduling problem,the route generation it is the shortest route over the road network. The 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 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.so from this time and cost can get save. As per the security purpose if bus is not following the described shortest path an alert message can get through gsm module.so the described model is a real time model for finding the shortest path in the road network and as per the security purpose an alert message can get.

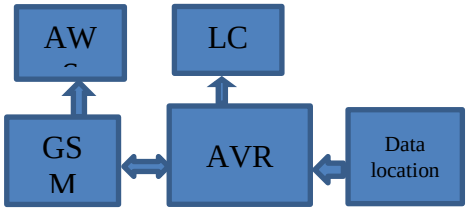

Figure 1: block diagram of model

II. RELATED WORK

(1)School bus planning is usually divided into routing and scheduling because of the complexity of solving them concurrently. However, the separation between these two steps may lead to worse solutions with higher overall costs than from solving them together.

When the minimal number of trips in the routing problem is being determined, neglecting trip compatibility could increase the number of buses needed in the scheduling problem. They proposes a new formulation for the multi-school homogeneous fleet routing problem that maximizes trip compatibility while minimizing total travel time. This plan incorporates the trip compatibility problem in the routing problem. This heuristic algorithm for solving this problem decomposes the problem by schools. To compare the performance of the model with traditional routing problems, eight midsize data sets were generated. Importing the generated trips of the routing problems into the bus scheduling (blocking) problem shows that the proposed model can reduce the buses needed by up to one fourth percent. A sensitivity analysis on coefficients of the model illustrates the effect of the weight of trip compatibility.

(2) The underdevelopment of Brazilian rural families is largely explained by their historical process of formation and by their poor access to a functional education and transportation systems. In the last decade, the federal government has been encouraging the nucleation of rural schools to offer better structured schools to the rural students. Multi-grade rural schools, often located closer to the rural families but with students of different grades being taught by the same teacher at the same class, are being shutdown and transfered to bigger, better installed facilities located near to the counties' downtown area. The success of such endeavour relies on offering a transportation system for the rural students. Hence the Brazilian federal government has been making a great effort to support local administrators to provide better transport to rural students. One of such efforts gave rise to a central decision support system which solves the mixed load capacitated rural school bus routing problem with heterogeneous fleet.

(3) The school bus routing problem (SBRP) seeks to the optimal routes for a fleet of school buses to transport students to schools. To share resources between schools, school bus routing problem with mixed load plan (SBRP-MLP) they proposed, in which school buses are allowed to pick up students of different schools and deliver them to their schools. They presented two modes, SBRP-MLP with virtual stops and SBRP-MLP with interscholastic transportation. To solve the two SBRP-MLPs efficiently, a two-stage heuristic algorithm is developed. . The results of several tests suggest that the proposed SBRP-MLP modes take less time than the SBRP with single load plan. Moreover, it was found that the SBRP-MLP with virtual stops is suitable for small-scale cases, while the SBRP-MLP with interscholastic transportation is appropriate for large-scale cases. In addition, the results also indicate that the algorithm is feasible for solving the SBRP-MLP.

III. PEROPOSED WORK

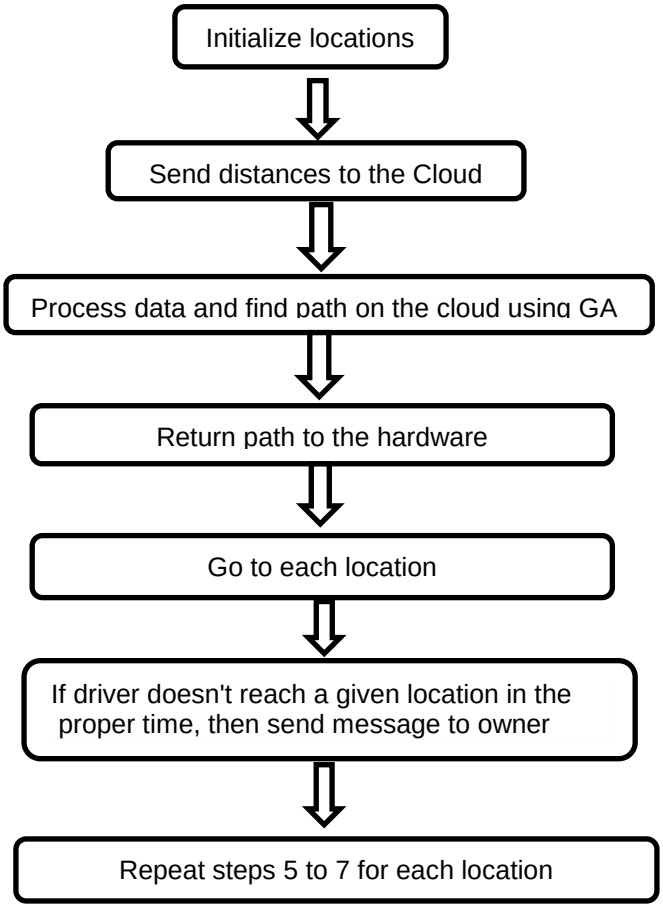

Figure 2: Flow Graph of proposed model

GENETIC ALGORITHMS

The idea of genetic algorithms (GAs) was first conceived by Professor John Holland of the University of Michigan in 1975. Genetic algorithms are computer based search and optimization algorithms which work on the mechanics of natural genetics and natural selection (Goldberg, 1989). The mechanics of a simple genetic algorithm are simple involving copying strings and swapping partial strings. The explanation of why this simple process works is subtle yet powerful. Simplicity of operation and implicit parallelization are two of the main attractions of the genetic algorithm approach.

Working Principle

GAs begin with a population of string structures created at random. Thereafter, each string in the population is evaluated. The population is then operated by three main operators - reproduction, crossovers and mutation - to create a hopefully better population. The population is further evaluated and tested for termination. If the termination criteria are not met, the population is again operated by above three operators and evaluated. This procedure is continued until the termination criteria are met. One cycle of these operators and the evaluation procedure is known as a generation in GA terminology. Figure 3 illustrates a pseudo code for a simple genetic algorithm.

```
begin
Initialize population of strings;
Compute fitness of population;
Repeat
Reproduction;
Crossover;
Mutation;
Compute fitness of population;
Until (termination criteria);
end.
```

Figure 3. Pseudo Code for a Simple GA

IV. EXPERIMENTAL RESULT

Experiment is done by using genetic algorithm, Artificial intelligence method . This will help to get the real time system with more accuracy to find the shortest path in the network after feeding the bus stop data in the form of code. Here will do the interfacing of arduino AVR development kit with GSM module, arduino AVR development kit will get the location data directly through coding then We will connect our GSM module with cloud server to send data over there then cloud server i.e, amazon website services(AWS) will perform school bus routing by using Genetic Algorithm and will give result back to the arduino kit the result we will be able to see on LCD display that will be the shortest path only. Not just this but an alert message can get through sim card if any bus does not reaches to a particular destination with in a time limit. So, the images of two different outputs has shown below. One image has shown for hardware part the result can be seen on LCD display. Output for Genetic Algorithm for travelling salesman period (TSP) has shown Where A,B,C,D,E,F,G are six different data locations .And distance in kilometers can feed where the factors population ,generation ,elitism has shown to feed the particular values stands for

Population=No. of solution for one generation
Generation=No. of times the solution has generated
Elitism=Best solution(Fitness value)

As we can see in output pictures as the distance is less error percentage is also less and time required to get the shortest path is also less has shown in figure 4. And can see the result in figure 5.figure 6 and 7 shown for more distance.

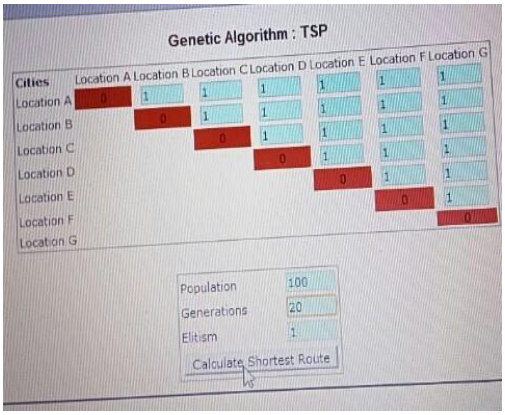

Figure 4: If minimum distance has taken

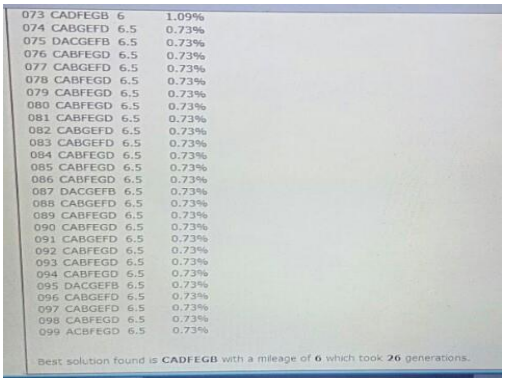

Figure 5: result for minimum distance best solution

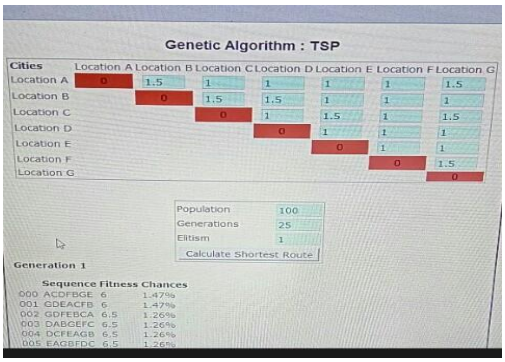

Figure 6:if distance has increased

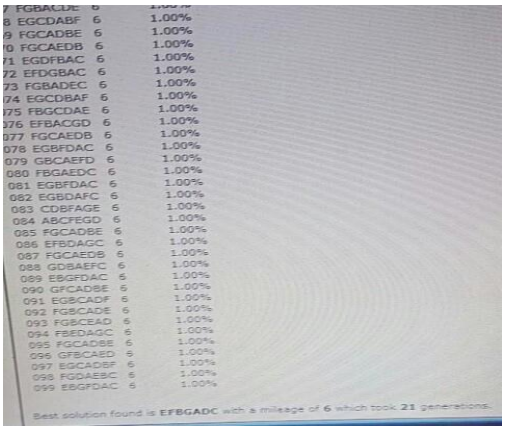

Figure 7: result if distance has increased

Figure 8: Hardware output on LCD display

V. CONCLUSION

The optimal allocation of buses with a conventional approach poses considerable difficulty like the complex nature of the route choice model. Hence genetic algorithms (GAs) are proposed as the computational tool because of their ability to handle large and complex problems. The solution framework for the present problem involves two phases: (1) bus stop data feeding (2) finding the shortest path in the road network by use of genetic algorithms as an optimization tool. The proposed model, is applied to the transit network of the different- different location already feeding the location data of the road network to get the shortest path,this research will help to 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. one more advantage is to get the alert message using sim-card if bus is not following the displayed shortest path as per the security of the system. .

VI. REFERENCES

[1]. Shafahi, A., Aliari, S., and Haghani, A., 2018. Balanced scheduling of school bus trips using a perfect matching heuristic. Transportation Research Board 97th Annual Meeting, Jan 2018, in Washington, D.C. arXiv preprint arXiv:1708.09338.

[2]. Shafahi, A., Wang, Z. and Haghani, A., 2017. Solving the school bus routing problem by maximizing trip compatibility. Transportation Research Record: Journal of the Transportation Research Board, (2667), pp.17-27. DOI: 10.3141/2667-03.

[3]. de Souza Lima, F.M., et al., 2017. A multi-objective capacitated rural school bus routing problem with heterogeneous fleet and mixed loads. 4OR, pp.1-28

[4]. Yao, B., Cao, Q., Wang, Z., Hu, P., Zhang, M. and Yu, B., 2016. A two-stage heuristic algorithm for the school bus routing problem with mixed load plan. Transportation Letters, 8(4), pp.205-219.

[5]. Bogl, M., Doerner, K.F., and Parragh, S.N., 2015. The school bus routing and scheduling problem with transfers. Networks, 65(2), pp.180-203.

[6]. Chen, X., et al., 2015. Exact and metaheuristic approaches for a bi-objective school bus scheduling problem. PloS one, 10(7), p.e0132600

[7]. Kang, M., et al., 2015. Development of a genetic algorithm for the school bus routing problem. International Journal of Software Engineering and Its Applications, 9(5), pp.107-126.

[8]. Kumar, Y. and Jain, S., 2015, September. School bus routing based on branch and bound approach. In Computer, Communication, and Control (IC4), 2015 International Conference on (pp. 1-4). IEEE.

[9]. Santana, L., Ramiro, E. and Romero Carvajal, J.D.J., 2015. A hybrid column generation and clustering approach to the school bus routing problem with time windows. Ingeniería, 20(1), pp.101-117.

[10]. Silva, C.M., et al., 2015, September. A Mixed Load Solution for the Rural School Bus Routing Problem. In Intelligent Transportation Systems (ITSC), 2015 IEEE 18th International Conference on (pp. 1940-1945). IEEE.

[11]. Yan, S., Hsiao, F.Y. and Chen, Y.C., 2015. Inter-school bus scheduling under stochastic travel times. Networks and Spatial Economics, 15(4), pp.1049-1074.

[12]. Caceres, H., Batta, R., and He, Q. "School Bus Routing with Stochastic Demand and Duration Constraints." submitted to Transportation Science (2014).

[13]. Faraj, M.F., et al., 2014, October. A real geographical application for the school bus routing problem. In Intelligent Transportation Systems (ITSC), 2014 IEEE 17th International Conference on (pp. 2762-2767). IEEE.

[14]. Kinable, J., Spieksma, F.C., and Vanden Berghe, G., 2014. School bus routing—a column