COST OPTIMIZATION OF COURIER DISPATCH SYSTEM USING GENETIC ALGORITHM

Rajeshsingh[*]

Ganesh Tugave[**]

Piyush Patil[**]

Abstract-

Path cost optimization is essential for maneuvering vehicles in a cost effective way. The term *cost* can be interpreted as fuel consumption, path visibility, probability of being detected, probability of being attacked or a combination of the above. Exact algorithms such as linear programming and dynamic programming can always provide globally optimum solution to such a problem. However, as the size and dimension of the search space increases, computational complexities of these algorithms rise drastically. Meta-heuristic algorithms such as evolutionary algorithms and genetic algorithms can provide optimum tosub-optimum solutions to large scale path cost optimization problems.

This paper presents a genetic algorithmic approachto the finding optimum cost for shortest path (SP) routing problem.

Keywords: - Genetic Algorithm (GA), Travelling Salesman Problem (TSP), Sailor Assignment Problem (SAP), Shortest Routing Path (SP), Linear Programming (LP), Dynamic Programming (DP)

[*] Proffesor Sinhgad Institute, Lonavala

[**] Student Sinhgad Institute, Lonavala

1. INTRODUCTION

A number of exact algorithms and meta-heuristic algorithmshave been developed to solve the path cost optimizationproblem. Linear Programming (LP) and Dynamic Programming (DP) are exact algorithms, which can alwaysprovide globally optimum solution to an optimization problem.

However, because of their computational complexity,exact algorithms are notapplicable in applications with large search spaces. Meta-heuristic algorithms, such as evolutionary algorithms (EA) and genetic algorithms (GA),are global optimization methods which are able to providepromising results even when the dimension of search spaceis high.In this we have proposed a biological term GeneticAlgorithm. It combines two algorithms namely Travelling Salesman Problem (TSP) and Sailor Assignment Problem (SAP).

Advantage of TSP is it can find optimum solution for the single person. If we want to find optimum solution for multiple persons it fails.

Advantage of the SAP is it can solves problem of assigning jobs to multiple persons.

The proposed system combines these two algorithms into one i.e. Genetic Algorithm.

2. Literature Survey

TABLE I

Sr.	Paper Name	Preposition	Advantages	Disadvantages
I.	Path Cost Optimization Using Genetic Algorithm with Supervised Crossover Operator	Useful for Finding the path and cost	Finds just path so traditional approach	Can not find the minimum cost of path.
II.	A Genetic Algorithm for Shortest Path Routing Problem and the Sizing of Populations	Finding the shortest Path among cities	It uses Dijkstra's Algorithm	Dijkstra's algorithm is too much difficult to implement.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.
International Journal of Management, IT and Engineering
http://www.ijmra.us

92

III.	Decision Support for Vehicle Dispatching Using Genetic Programming	Vehicle dispatching consists of allocating real-time service requests to a fleet of moving vehicles.	A good analysis and overview of problems where each service request comprises both a pickup and delivery location	It uses static methods tofinding the paths.

3. A COURIER SERVICE

Inthe context of a courier service company, the dispatching problem can be described as follows. Any courier company delivers a couriers within urban area as well as in the different cities.Each customer specifies delivery location, as well as a soft upper bound on the courier or the specific address is specified on that. So the courier delivery person has to reach on that location and deliver the courier within some stipulated time with optimizing the cost. The cost can be as specified in the abstract.

Since customersdemand fast service, the routing and scheduling is done in realtime. In particular, the dispatching situation must be evaluatedeach time a new customer visit into the dispatch office. Atthat time, some of the earlier orders have been deliveredand therefore are no longerconsidered. The remaining ordershave been assigned to the vehicles and are about to be dispatch,to their destination. Since the planned routeand schedule of each vehicle for previously allocated requestsis known, the problem is to determine the assignment of thenew request to a particular vehicle, as well as the new plannedroute and schedule for this vehicle. In solving this problem,the dispatcher must find a good compromise between conflictingobjectives likeminimizing operations cost (e.g., fuel

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.
International Journal of Management, IT and Engineering
http://www.ijmra.us

93

consumption), maximizing system's throughput (e.g., numberof servicedcustomers), and maximizing service quality (e.g.,meeting due dates).

Now we will turn over the solution for dispatching the couriers.

At the very first stage, a customer from any location submits his delivery product to the nearest courier office. In further procedure that courier is took to the main office by their respective delivery person and onwards the dispatching person from that office asks the Genetic system to give the optimized solution for dispatching the courier.

While having survey of the techniques for delivering the couriers which is mentioned below in the form of graph
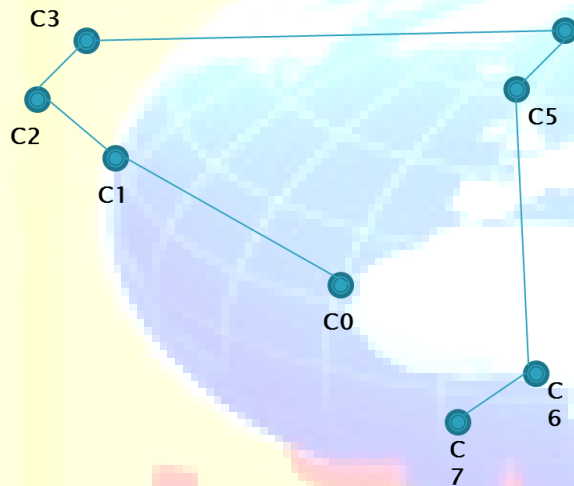
As shown above in the graph only a singledispatch person will be dispatching acourier, as starting from C0 (city) and have to visit all other cities to dispatch a courier to city C7 (city).

Now by having the survey we understood that this technique is complicated because here we apply only a single person to dispatch a courier.

So, proposed system shows that we can apply multiple persons for dispatching job. In the graph mentioned below consider C0 city as main office. Multiple dispatching persons will collect their couriers to be delivered.

C3

C5

C2

C4

C1

C0

C6

C7
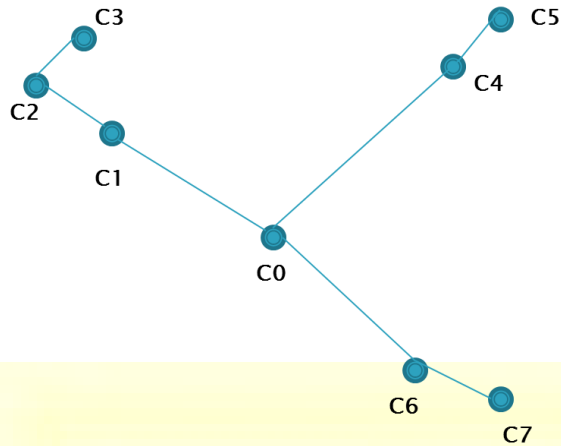
4.   GENETIC ALGORITHM

Biological term used in Genetic Algorithm like, when two organisms met they share their genes, the resultant offspring may end up half the genes from one parent and half to another this process is called recombination. The new created offspring are muted, means the resultant offspring is result of both.

The simplest form of genetic algorithm involves following types of operators: selection, crossover (single point), and mutation.

I.   Selection:-

This operator selects chromosomes in the population for reproduction. The fitter the chromosome, the more times it is likely to be selected to reproduce.

II.   Crossover:-

This operator randomly chooses a locus andexchanges the subsequences before and   after that locus between two chromosomes to create two offspring. For example, the strings 10000100 and 11111111 could be crossed over after the third locus in each to produce the two offspring 10011111 and 11100100. The crossover operator roughly mimics biological recombination between two single−chromosome (haploid) organisms.

III.   Mutation:-

This operator randomly flips some of the bits in a chromosome. For example, the string 00000100 might be mutated in its second position to yield 01000100. Mutation can occur at each bit position in a string with some probability, usually very small (e.g., 0.001).

5. Conclusion

So, the proposed system developed gives desired number of shortest path and helps the administrator to assign job to multiple courier dispatch persons. Thus the main target of optimization in any work can be achieved successfully by Genetic Algorithm.Also, Genetic Algorithm technique we can use in other workings like, in Networking (for routing packets), in real life such as for courier system, Tourist Management System.

References

[1] H.-J.Wang, X.-Q. Bian, X. Zhang, M.-Y. Fu and J. Li, "TwoApproaches for Autonomous Underwater Vehicle GlobalPath Planning in Large Range Ocean Environment," In *Proceedingsof the 2004 International Conference on IntelligentMechatronics and Automation,* (ICIMA 2004), Chengdu,China, pp. 224–227, Aug. 2004.

[2] Y.-H. Qu, Q. Pan and J.-G. Yan, "Flight path planning of UAV based on heuristically search and genetic algorithms," In *Proceedings of the 31st Annual Conference of IEEE IndustrialElectronics Society,* (IECON 2005), Raleigh, NC, USA, pp. 45–49, Nov. 2005.

[3] D. C. Park and S. E. Choi, "A neural network based multi-destinationrouting algorithm for communication network," in *Proc. Joint Conf.Neural Networks*, 1998, pp. 1673–1678.

[4] J. Inagaki, M. Haseyama, and H. Kitajima, "A genetic algorithm for determiningmultiple routes and its applications," in *Proc. IEEE Int. Symp.Circuits and Systems*, 1999, pp. 137–140.

[5] N. Shahidi, H. Esmaeilzadeh, M. Abdollahi, and C. Lucas,"Memetic algorithm based path planning for a mobilerobot," *International Journal of Information Technology,*vol. 1, no. 3, pp. 100–103, 2005.

[6] C. R. Reeves and J. E. Rowe, *Genetic Algorithms – Principlesand Perspectives: A Guide to GA Theory*, Norwell,MA: Kluwer, 2003.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.
International Journal of Management, IT and Engineering
http://www.ijmra.us

96

[7] R. L. Carraway, T. L. Morin and H. Moskowitz, "Generalizeddynamic programming for stochastic combinatorialoptimization," *Operations Research,* vol. 37, no. 5, pp. 819–829, Sept. 1989.

[8] D. E. Goldberg, *Genetic Algorithms in Search, Optimization and Machine Learning*. Reading, MA: Addison-Wesley, 1989.

[9] J. H. Holland, *Adaptation in Natural and Artificial Systems*. Ann Arbor, MI: Univ. of Michigan Press, 1975.

[10] J. R. Koza, *Genetic Programming: On the Programming of Computers By Means of Natural Selection*. Cambridge, MA: MIT Press, 1992.

[11] A. Kumar and Y. P. Gupta, Eds., *Comput. Oper. Res.*, (special issue on genetic algorithms), vol. 22 pp. 1–157, 1995.

[12] J. Y. Potvin, G. Dufour, and J. M. Rousseau, "Learning vehicle dispatching with linear programming models," *Comput. Oper. Res.*, vol.20, pp. 371–380, 1993.

[13] W. B. Powell, "A comparative review of alternative algorithms forthe dynamic vehicle allocation problem," in *Vehicle Routing: Methods and Studies*, B. L. Golden and A. A. Assad, Eds. Amsterdam, The Netherlands: North-Holland, 1988, pp. 249–291.