ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 3, Issue 9, September 2015**

# Genetic Algorithm Based Multicast Routing Used In Mobile Ad Hoc Networks

M.Beema Mehraj

Assistant Professor, Department of Computer Science, Bharath University, Chennai, Tamil Nadu, India

**ABSTRACT:** Many intelligent optimization techniques like Artificial Neural Networks (ANN),Genetic Algorithms (GAs), etc., were being proposed to find the static shortest path. Rapid advancements in the wireless communication particularly in the field of mobile networks has emerged as two major fields namely Mobile Ad hoc Networks (MANETs) and Wireless Sensor Networks (WSN). Topology dynamics is the top most challenge in the mobile wireless network field i.e., the network topology changes over time due to energy conservation or node mobility. In order to find the shortest path (SP) with in this network becomes a dynamic optimization problem due to nodes mobility. Nodes usually die due to low energy or it may move, this scenario makes the network to be more complex for finding shortest path. In this paper we propose a novel method of using Genetic Algorithms (GAs) to solve the dynamic shortest path discovery and routing in MANETs. MANETs is one of the faster growing new-generation wireless networks. The experimental results indicate that this GA based algorithm can quick adopt to environmental change (i.e. the network topology change) and produce high quality solutions after each change.

## I. INTRODUCTION

Mobile *ad hoc* network (MANET) is a self-organizing and self-configuring multihop wireless network, which is composed of a set of Mobile Hosts (MHs) that can move around freely and cooperate in relaying packets on behalf of one another. MANET supports robust and efficient operations by incorporating the routing functionality into MHs. In MANETs, the unicast routing establishes a multihop forwarding path for two nodes beyond the direct wireless communication range. Routing protocols also maintain connectivity when links on these paths break due to effects such as node movement, battery drainage, radio propagation, and wireless interference. In multihop networks, routing is one of the most important issues that has a significant impact on the performance of networks. So far, there are mainly two types of routing protocols in MANETs, namely, topological routing and geographic routing. In the topological routing, mobile nodes utilize the topological information to construct routing tables or search routes directly. In the geographic routing, each node knows its own position and makes routing decisions based on the position of the destination and the positions of its local neighbors.

Here, I adapt and investigate several genetic algorithms(GAs) that are developed to deal with general DOPs to solve the DSPRP in MANETs. First, I design the components of the standard GA (SGA) specifically for the DSPRP. Then, I integrate several immigrants and memory schemes and their combination into the GA to enhance its searching capacity for the SPs in dynamic environments. Once the topology is changed, new immigrants or the useful information stored in the memory can help guide the search of good solutions in the new environment.

## II. LITERATURE SURVEY

**A neural network for shortest path computation:**

This paper presents a new neural network to solve the shortest path problem for inter-network routing. The proposed solution extends the traditional single-layer recurrent Hopfield architecture introducing a two-layer architecture that automatically guarantees an entire set of constraints held by any valid solution to the shortest path problem. This new method addresses some of the limitations of previous solutions, in particular the lack of reliability in what concerns successful and valid convergence. Experimental results show that an improvement in successful convergence can be achieved in certain classes of graphs. Additionally, computation performance is also improved at the expense of slightly worse results

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 3, Issue 9, September 2015**

**Comparison of steady state and generational genetic algorithms for use in non stationary environments:**

The objective of this study is a comparison of two models of the genetic algorithm, the generational and incremental/steady state genetic algorithms, for use in non stationary/dynamic environments. It is experimentally shown that the choice of a suitable version of the genetic algorithm can improve its performance in such environments. This can extend the ability of the genetic algorithm to track environmental changes which are relatively small and occur with low frequency without the need to implement an additional technique for tracking changing optima.

**Evolutionary optimization in dynamic environment**

The behavior of standard evolutionary algorithm in the case of multi-modal optimization problems meets a major difficulty. It generally converges towards a single optimum point failing to maintain in the population the multiple optima of the problem under consideration. Various methods enrich the standard algorithm to obtain efficient techniques for solving multi-modal problems. These methods mainly consist of increasing the population diversity and of maintaining the promising areas in the search space in order to finally achieve convergence of the population towards the multiple optima. The present paper introduces mmEA, an evolutionary algorithm for multimodal optimization based on multidimensional exploration of the search space. This technique doesn't require any user defined parameter except those specific to standard evolutionary algorithm. Experiments and comparisons with similar techniques from literature, for static and dynamic environment, prove that mmEA technique is promising.

**Conclusion**

The drawback is the shortest path (SP) routing problem, which belongs to the topological routing. The SP routing problem aims to find the SP from a specific source to a specific destination in a given network while minimizing the total cost associated with the path. The SP routing problem is a classical combinatorial optimization problem arising in many design and planning contexts .There are several deterministic search algorithms for the SP problem: Dijkstra’s algorithm, the breadth-first search algorithm, the Bellman–Ford algorithm, etc. The DSPRP in MANETs is a real-world dynamic optimization problem (DOP). In recent years, studying evolutionary algorithms(EAs) for DOPs has attracted a growing interest due to its importance in EA’s real-world applications. The simplest way of addressing DOPs is to restart EAs from scratch whenever an environment change is detected. Though the restart scheme really works for some cases, for many DOPs, it is more efficient to develop other approaches that make use of knowledge gathered from old environments. Over the years, several approaches have been developed for EAs to address dynamic environments, such as maintaining diversity during the run via random immigrants, increasing diversity after a change, using memory schemes to reuse stored useful information applying multi population and speciation schemes to search in different regions of the search,and adapting (the parameters of) operators to quickly respond to a new environment. Once the topology is changed, new immigrants or the useful information stored in the memory can help guide the search of good solutions in the new environment.

**SYSTEM ANALYSIS**

A **systems analysis** researches problem, plans solutions, recommends software and systems, and coordinates development to meet business or other requirements. They will be familiar with a variety of programming languages, operating systems, and computer hardware platforms. Because they often write user requests into technical specifications, the systems analysts are the liaisons between vendors and information technology professionals.[1] They may be responsible for developing cost analysis, design considerations, and implementation time-lines.

A systems analysis may:

- Plan a system flow from the ground up.
- Interact with customers to learn and document requirements that are then used to produce business requirements documents.
- Write technical requirements from a critical phase.
- Interact with designers to understand software limitations.
- Help programmers during system development, ex: provide use cases, flowcharts or even Database design.
- Perform system testing.
- Deploy the completed system.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 9, September 2015

- Document requirements or contribute to user manuals.

**FEASIBILITY STUDY**

Feasibility studies aim to objectively and rationally uncover the strengths and weaknesses of the existing business or proposed venture, opportunities and threats as presented by the environment, the resources required to carry through, and ultimately the prospects for success. In its simplest terms, the two criteria to judge feasibility are cost required and value to be attained. As such, a well-designed feasibility study should provide a historical background of the business or project, description of the product or service, accounting statements, details of the operations and management, marketing research and policies, financial data, legal requirements and tax obligations. Generally, feasibility studies precede technical development and project implementation.

- Economic feasibility
- Environmental feasibility
- Technology feasibility
- Legal feasibility

**Economic feasibility:**

Economic analysis is the most frequently used method for evaluating the effectiveness of a new system. More commonly known as cost/benefit analysis, the procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs. If benefits outweigh costs, then the decision is made to design and implement the system. An entrepreneur must accurately weigh the cost versus benefits before taking an action.

Cost-based study: It is important to identify cost and benefit factors, which can be categorized as follows: 1. Development costs; and 2. Operating costs. This is an analysis of the costs to be incurred in the system and the benefits derivable out of the system.

Time-based study: This is an analysis of the time required to achieve a return on investments. The future value of a project is also a factor.

**Environmental feasibility:**

In the same way that the technical and financial feasibility, the yield of the investment and the Market studies in the project's development are determined, it is now very advisable and even necessary to evaluate the Environmental Feasibility of the projects.

From the initial processes of planning and selection of the site, the design of the architecture and engineering and the construction and operation of a determined project, it is very important to consider the natural terrain features of the site and the region to identify the environmental regulations and restrictions of ground use; factors that can influence the selection of the site and the characteristics of the project.

**Technology feasibility:**

The assessment is based on an outline design of system requirements in terms of Input, Processes, Output, Fields, Programs, and Procedures. This can be quantified in terms of volumes of data, trends, frequency of updating, etc. in order to estimate whether the new system will perform adequately or not. Technological feasibility is carried out to determine whether the company has the capability, in terms of software, hardware, personnel and expertise, to handle the completion of the project[1]. When writing a feasibility report the following should be taken to consideration:

- A brief description of the business to assess more possible factor/s which could affect the study
- The part of the business being examined
- The human and economic factor
- The possible solutions to the problems

At this level, the concern is whether the proposal is both *technically* and *legally* feasible (assuming moderate cost).

**Legal feasibility:**

Determines whether the proposed system conflicts with legal requirements, e.g. a data processing system must comply with the local Data Protection Acts.

## IV. SYSTEM REQUIREMENTS

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 3, Issue 9, September 2015**

**4.1 HARDWARE REQUIREMENTS:**

Hard disc : 40 GB
RAM : 512MB DD RAM
Processor : Pentium IV 2.6 GHz
Monitor : 15" Color

**4.2 SOFTWARE REQUIREMENTS:**

Front End : Java Swings
Operating System : Windows XP/07
IDE : Net Beans, Eclipse

**MODULE DESCRIPTION:**

The following modules are implemented in this project,

- ✓ Network model implementation
- ✓ Shortest path implementation
  - ▪ Unicast routing
  - ▪ Multicast routing
- ✓ Dynamic Environment Change

**1. NETWORK MODEL:**

First sample network has to be designed. Here some of the mobile nodes can be added to the particular network region. After, the creation of nodes connections will be established. Then path cost will be set for each connectivity.

**2. SHORTEST PATH:**

This module is used to find the shortest path from the source node to the destination node[2]. Here shortest path is calculated for both

- ▪ Unicast routing
- ▪ Multicast routing

**2.1. Unicast Routing:**

The message packets are sent from source to destination by multi hop forwarding path, so the shortest path is calculated between single source to the single destination.

**2.2. Multicast Routing:**

The single message in forwarded from the source to multiple destination,
So the shortest path is finding between single source to the multiple selected nodes in the network.

**1. DYNAMIC ENVIRONMENT CHANGE:**

This module is designed to make change in the network model. Here two techniques are used to change network model.

- ▪ Mobility
- ▪ Power loss

In MANET, nodes are not in fixed position; they are changing their position time to time. It affects the path cost also. So, it has to run the shortest path once again.

Some times due to power loss, the mobile nodes on link can be failure. This also make change in network structure.

Due to the above reasons population in particular region is changed in every generation, so we have to maintain the diversity level. For that we are calling the immigrants method. Memory scheme method is used to enhance the performance of GA, by storing the old environment changes for the new generations.

**3.1 DYNAMIC SP ROUTING PROBLEM:**

In this section, I first present our network model and then formulate the DSPRP. We consider a MANET operating within a fixed geographical region[3]. We model it by an undirected and connected topology graph *G*0 (*V*0 , *E*0 ), where *V*0 represents the set of wireless nodes (i.e., routers) and *E*0 represents the set of communication links connecting two neighboring routers falling into the radio transmission range. A communication link (*i*, *j*) cannot be used for packet transmission unless both node *i* and node *j* have a radio interface each with a common channel. However, the channel assignment is beyond the scope of this paper. In addition, message transmission on a wireless communication link will incur remarkable delay and cost[4]. The DSPRP can be informally described as follows. Initially, given a network of wireless routers, a delay upper bound, a source node, and a destination node, we wish to find a delay bounded least cost loop-free path on the topology graph. Then, periodically or stochastically, due to energy conservation or some other issues, some nodes are scheduled to sleep or some sleeping nodes are scheduled to wake up. Therefore, the network topology changes from time to time. The objective of the DSPRP is to quickly find the new optimal delay-constrained least cost acyclic path after each topology change.

### 3.2 SPECIALIZED GA FOR THE SP PROBLEM:

This section describes the design of the GA for the SP problem.The design of the GA involves several key components: geneticrepresentation, population initialization, fitness function,selection scheme, crossover, and mutation. A routing path consistsof a sequence of adjacent nodes in the network. Hence, it is a natural choice to adopt the path-oriented encoding method.For the routing problem, the path-oriented encoding and the path-based crossover and mutation are also very popular

#### 3.2.1. Genetic Representation:

A routing path is encoded by a string of positive integers that represent the IDs of nodes through which the path passes. Each locus of the string represents an order of a node (indicated by the gene of the locus). The gene of the first locus is for the source node and the gene of the last locus is for the destination node. The length of a routing path should not exceed the maximum length[5].

#### 3.2.2. Population Initialization:

In the GA, each chromosome corresponds to a potential solution. The initial population *Q* is composed of a certain number of, say *q*, chromosomes[6]. To promote the genetic diversity, in our algorithm, the corresponding routing path is randomly generated for each chromosome in the initial population. We start to search a random path from *s* to *r* by randomly selecting a node *v*1 from *N(V1)*, the neighborhood of *s*. Then, we randomly select a node *v*2 from *N*(*v*1 ). This process is repeated until *r* is reached. Since the path should be loop-free, those nodes that are already included in the current path are excluded from being selected as the next node to be added into the path, thereby avoiding reentry of the same node into a path.

#### 3.2.3. Fitness Function:

It is used to find the least cost path between the source and the destination. My primary criterion of solution quality is the path cost[7]. Therefore, among a set of candidate solutions (i.e., unicast paths), we choose the one with the least path cost

#### 3.2.4. Selection Scheme:

Selection plays an important role in improving the average quality of the population by passing the high-quality chromosomes to the next generation. The selection of chromosome is based on the fitness value.

#### 3.2.5. Crossover and Mutation:

A GA relies on two basic genetic operators, crossover and mutation. crossover processes the current solutions so as to find better ones. Mutation helps a GA keep away from local optima. Here chromosomes are expressed by the path structure, the single-point crossover to exchange partial chromosomes (subpaths) at positionally independent crossing sites between two chromosomes.The population will undergo the mutation operation after the crossover operation is performed. Both crossover and mutation may produce new chromosomes that represent infeasible solutions. Therefore, we check if the path represented by a new chromosome is acyclic. If not, a repair function will be applied to eliminate the loops[8].

### 3.3. INVESTIGATED GAs FOR THE DSPRP:

**3.3.1. GAs with Immigrants schemes:**

In stationary environments, convergence at a proper pace is really what we expect for GAs to locate the optimum solutions for many optimization problems[9]. However, for DOPs, convergence usually becomes a big problem for GAs because changing environments usually require GAs to keep a certain population diversity level to maintain their adaptability. To address this problem, the random immigrants approach is a quite natural and simple way[10]. The random immigrants maintains the diversity level of the population through replacing some individuals of the current population with random individuals, called *random immigrants,* every generation. As to which individuals in the population should be replaced, usually there are two strategies: replacing random individuals or replacing the worst ones.

**3.3.2. GAs with memory schemes:**

While the immigrant's schemes use random immigrants to maintain the population diversity to adapt to the changing environments, the memory scheme aims to enhance the performance of GAs for DOPs in a different way. It works by storing useful information from the current environment ,either implicitly through redundant representations or explicitly by storing good (usually best) solutions of the current population in an extra memory. The stored information can be reused later in new environments[11][12]. For example, for the explicit memory scheme, when the environment changes, old solutions in the memory that fit the new environment well will be reactivated, and hence, may adapt GAs to the new environment more directly than random immigrants would do. Especially, when the environment changes cyclically, memory can work very well. This is because in cyclic dynamic environments, as time passes, the environment will return to some old environment precisely, and the solution in the memory, which has been optimized with respect to the old environment, will instantaneously move the GA to the reappeared optimum of that environment.

## V. CRITICAL ANALYSIS

**Problems faced:**

Wireless Networks growth and application is rapidly increasing. One of the problems in wireless networks is topology dynamics i.e. Network topology change over time due to energy conservation or node mobility**.**Finding static shortest path (SP) is a major problem. Various methods have been proposed to find the optimal shortest path like Artificial Neural Network, Particle Swarm Optimization, Genetic Algorithms and so on.

**Limitations:**

In this paper we propose a novel method of using Genetic Algorithms (GAs) to solve the dynamic shortest path discovery and routing in MANETs. MANETs is one of the faster growing new-generation wireless networks. The experimental results indicate that this GA based algorithm can quick adopt to environmental change (i.e. the network topology change) and produce high quality solutions after each change.

## VI. CONCLUSION

MANET is a self-organizing and self-configuring multi hop wireless network, which has a wide usage nowadays. The SP routing problem aims to establish a multihop forwarding path from a source node to a destination node and is one important issue that significantly affects the performance of MANETs. So far, most SP routing algorithms in the literature consider only the fixed network topology. It is much more challenging to deal with the SP routing problem in a continuously changing network like MANETs than to solve the static one in a fixed infrastructure. In recent years, there has been a growing interest in studying Gas for DOPs. Among approaches developed for GAs to deal with DOPs, immigrants schemes aim at maintaining the diversity of the population throughout the run via introducing random individuals into the current population, while memory schemes aim at storing useful information for possible reuse in a cyclic dynamic environment. This paper investigates the application of GAs for solving the DSPRP in MANETs. A DSPRP model is built up in this paper, specialized GA is designed for the SP problem in MANET, Immigrants and/or memory schemes that have been developed for GAs for general DOPs are adapted and integrated into - specialized GA (which gives several GA variants) to solve the DSPRP in MANETs. The experimental results indicate that both immigrants and memory schemes enhance the performance of GAs for the DSPRP in MANETs. Generally speaking, the immigrants schemes show their power in acyclic dynamic environments, and the memory related schemes beat other schemes in cyclic dynamic environments. Finally this work investigates both the effectiveness and efficiency of GAs with immigrants and memory schemes in solving the DSPRP in the real-world networks, i.e., MANETs. There are

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 9, September 2015

several relevant future works. One interesting work is to further investigate other approaches developed for GAs for general DOPs to solve the DSPRP in MANETs and other relevant networks.

## REFERENCES


1. Ghosh, P., Mitchell, M., and Gold, J. (2010). LSGA: Combining level-sets and genetic algorithms for segmentation. Evolutionary Intelligence, 3, 1-11.
2. Udayakumar R., Khanaa V., Kaliyamurthie K.P., "High data rate for coherent optical wired communication using DSP", Indian Journal of Science and Technology, ISSN : 0974-6846, 6(S6) (2013) 4772-4776.
3. Brumby, S. P., Perkins, S. J., Theiler, J., Szymanski, J. J., Bloch, J. J., and Mitchell, M. (1999). Investigation of image feature extraction by a genetic algorithm. In Proceedings of the International Society for Optical Engineering, Proceedings of SPIE 3812, 24-31. Bellingham, WA: SPIE Press.
4. Hariharan V.S., Nandlal B., Srilatha K.T., "Efficacy of various root canal irrigants on removal of smear layer in the primary root canals after hand instrumentation: A scanning electron microscopy study", Journal of Indian Society of Pedodontics and Preventive Dentistry, ISSN : 0970-4388, 28(4) (2010) pp.271-277.
5. van Nimwegen, E., Crutchfield, J. P., and Mitchell, M. (1999). Statistical dynamics of the Royal Road genetic algorithm. Theoretical Computer Science, 229 (1), 41–102.
6. Udayakumar R., Khanaa V., Kaliyamurthie K.P., "Optical ring architecture performance evaluation using ordinary receiver", Indian Journal of Science and Technology, ISSN : 0974-6846, 6(S6) (2013) pp. 4742-4747.
7. van Nimwegen, E., Crutchfield, J. P., and Mitchell, M. (1997). Finite populations induce metastability in evolutionary search. Physics Letters A, 229 (2), 144-150.
8. Kanniga E., Selvaramarathnam K., Sundararajan M., "Embedded control using mems sensor with voice command and CCTV camera", Indian Journal of Science and Technology, ISSN : 0974-6846, 6(S6) (2013) pp.4794-4796.
9. Mitchell, M., Holland, J. H., and Forrest, S. (1994). When will a genetic algorithm outperform hill climbing? In J. D. Cowan, G. Tesauro, and J. Alspector (editors), Advances in Neural Information Processing Systems 6, 51-58, San Mateo, CA: Morgan Kaufmann.
10. Udayakumar R., Khanaa V., Kaliyamurthie K.P., "Performance analysis of resilient ftth architecture with protection mechanism", Indian Journal of Science and Technology, ISSN : 0974-6846, 6(S6) (2013) pp. 4737-4741
11. Forrest, S. and Mitchell, M. (1993). What makes a problem hard for a genetic algorithm? Some anomalous results and their explanation. Machine Learning, 13, 285-319.
12. Mitchell, M., Forrest, S., and Holland, J. H. (1992). The royal road for genetic algorithms: Fitness landscapes and GA performance. In F. J. Varela and P. Bourgine (editors), Proceedings of the First European Conference on Artificial Life. Cambridge, MA: MIT Press.
13. B.Vamsi Krishna, Significance of TSC on Reactive power Compensation, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, ISSN (Online): 2278 – 8875,pp 7067-7078, Vol. 3, Issue 2, Febuary 2014
14. B.Vamsi Krishna, Realization of AC-AC Converter Using Matrix Converter, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, ISSN (Online): 2278 – 8875,pp 6505-6512, Vol. 3, Issue 1, January 2014
15. D.Sridhar raja, Comparison of UWB Band pass filter and EBG embedded UWB Band pass filter, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, ISSN 2278 – 8875,pp 253-257 ,Vol. 1, Issue 4, October 2012
16. D.Sridhar raja, Performances of Asymmetric Electromagnetic Band Gap Structure in UWB Band pass notch filter, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, ISSN (Online): 2278 – 8875,pp 5492-5496, Vol. 2, Issue 11, November 2013
17. Dr.S.Senthil kumar, Geothermal Power Plant Design using PLC and SCADA, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, ISSN 2278 – 8875,pp 30-34, Vol. 1, Issue 1, July 2012