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Efficient Genetic Algorithm for Optimal Routing In Ad Hoc Networks

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Abstract- Ad-hoc network is a collection of mobile hosts. This network uses two different types of protocols. They are proactive protocol and reactive protocol. Proactive protocol maintains routing table information. Reactive protocol is a path between source and destination and also called as on-demand protocol. Genetic algorithm (GA) is used to find the optimal path between the source and destination nodes. GA maintains a population of candidate solutions, where each candidate solution is called chromosome. GA is uses either crossover and mutation reproduction. The steps of GA are reproduction, fitness evaluation and selection. The developed genetic algorithm uses evaluation of fitness function for cost and bandwidth.

Keywords— ***Ad-Hoc Networks, Genetic Algorithm, Fitness Function, Optimal Routing.***

I. INTRODUCTION

Mobile ad-hoc networks (MANET'S) are decentralized, self-organizing networks capable of forming a network without relying on any fixed infrastructure .defining on ad hoc network as an autonomous system of mobile hosts connected by wireless links. A routing algorithm should strive to find a shortest path for transmission packet.ad hoc network features are mobility and flexibility, peer-to-peer multi-hop networks. Routing in mobile ad hoc networks depends on many factors for topology; find optimal path selection of routers.ad hoc network uses two different types of protocols. They protocols are Proactive and Reactive protocols.

Proactive protocol in a MANET should track of routes in all nodes destination. This protocol maintains routing table information and also called table-driven protocol. (Example of important proactive protocols for destination sequenced distance vector-DSDV, wireless routing protocol-WRP). In reactive protocols a node defining to route discovery process and also called on demand distance vector routing. The protocols are two types of mechanisms of "route discovery" and "route maintenance". (Example of reactive protocol for dynamic source routing protocol -DSR).

This paper proposed for solving the optimal path routing problem using genetic algorithm. Genetic algorithm is a programming methods and evaluation of problem solving method. The genetic algorithm then evaluates each candidate to fitness function. This algorithm is best of the searching algorithm. The proposed genetic algorithm using best optimal path between source and destination nodes in ad hoc networks and evaluate of fitness function for cost and bandwidth.

II. RELATED WORK

Ad hoc routing protocols can be divided into two categories: topology based and position based [1].Topology based routing protocols use the information about the links that exists in the network to perform packet forwarding. Position-based routing protocols use the geographical position of nodes to make routing decisions, which results in improving efficiency and performance. In recent developments, position-based routing protocols exhibit better scalability, performance and robustness against frequent topological changes.

Topology-based routing can be further divided into two approaches: Proactive and reactive approach. Proactive routing protocols periodically broadcast control messages in an attempt to have each node always know a current route to all destinations. Proactive approach maintains routing information about the available paths in the network even if these paths are not currently used. But the drawback of this approach is that the maintenance of unused paths. Reactive routing protocols maintain only the routes that are currently in use thereby reducing the burden on the network, are more appropriate for wireless environments because they initiate a route discovery process only when data packets need to be routed. There is no periodic routing packet required. The destination sequenced distance vector and the wireless routing protocol are popular examples of table driven protocols. Dynamic source routing, on demand distance vector routing and associatively-based routing is representative on demand (reactive) protocol.

In [2] Ziqiang Wang et al proposed a PSO Based Multicast Routing Algorithm with Bandwidth and Delay as the Quality of Service Constraints for optimization. In [2] Liu Jing et al have addressed the Quality of Service Multicast routing problem using Particle Swarm Optimization with the Quality of Service Parameters under consideration were Cost ,Delay ,Delay Jitter and Packet Loss. In [2] Mala et al discuss solving the Multicast Routing problem with Quality of Service parameters Buffer Space and Queuing Delay in addition to the other basic Quality of Service Parameters using Particle Swarm Optimization. The next section discusses the proposed work and the algorithm for solving the problem under study. The simulation and results are discussed in the Simulation and performance analysis section,

followed by conclusion. Each node selectively adds only the best (most fit) nodes in its neighbourhood to its proactive region.

In [3], the adjustment of the zone is based on an approximation cost model. [3] Adjusts the proactive region in order to make a node more accessible. We change the Proactive region in order to reduce route acquisition latencies. Unlike [3], we use the concept of FITNESS (a Genetic Algorithm-based technique) to determine the node's participation in proactive routing. This yields a more realistic proactive region as it takes into account the changing environment of a node.

III. ROUTING IN ADHOC NETWORKS

Routing is the act of moving information from a source to destination nodes. The routing concept basically involves are two types, first, determine the optimal routing path and Second, transferring the information packets through on network. Routing protocol use several metrics to calculate the best path for routing the packets to its destination. These metrics are a standard measurement that could be number of hops, which is used by routing algorithm to determine the optimal path for the packet to its destination.

Routing is mainly classified into static routing and dynamic routing. Static routing is maintains a routing table. Dynamic routing is refers to the routing strategy that being is learnt by an interior and exterior routing protocol. The examples for routing algorithm that was historically at the beginning of mobile ad hoc network research, DSDV and DSR.

A. Destination Sequence Distance Vector (DSDV)

Destination sequence distance vector (DSDV) routing is an enhancement to distance vector routing for ad hoc networks. DSDV is used as routing information protocol (RIP) in wired networks. It adds a new attributes, sequence number, to each route table entry of the conventional RIP. DSDV two things are,

1. Sequence Number
2. Damping.

B. Dynamic source routing (DSR)

The dynamic source routing protocol is a source routed on –demand protocol. These protocols are route discovery and route maintenance. The route request packet contains the address of the source and the destination.

The basic principle of source routing used for fixed networks. Dynamic source routing eliminates all periodic routing updates. A node needs to discover a route and transmits a route request with a unique identifier and the destination address. An another ad hoc routing protocols are flat ad hoc routing protocol, hierarchical ad hoc routing protocol, geographic position assisted ad hoc routing protocol.

IV . GENETIC ALGORITHM

Genetic algorithm is a search technique used in computing to find true and approximate solutions to optimization and search problems. A genetic algorithm maintains a population of candidate solutions. Each candidate solution is called a chromosome. Subsection of the chromosomes, which are called genes (or) each character in the string, is called a **gene.** Genetic algorithms are example of evolutionary computing methods and optimization-type algorithms. The basic for evolutionary computing algorithms is biological evolution, where over time evolution produces the best **fittest** individuals. A set of chromosomes from a population, which is evaluated by a fitness function. A genetic algorithm (GA) is a computational model consisting of five parts.

1. Set of individuals, p.
2. Crossover technique
3. Mutation algorithm
4. Fitness function.
5. Algorithm applies to crossover and mutation technique.

The problem to be solved is presented as one of these individuals. A complete search of all possible individuals the best individual or solution to the problem using the predefined fitness function.

Genetic algorithm:

```
Input:
P …….// initial population
Output:
P'…….//improved population
Genetic algorithm:
Repeat
N=\p\;
P'=Φ;
Repeat
i1, i2 = select (p);
o1, 02 = cross (i1, i2);
o1= mutate (o1);
```



```
o2= mutate (o2);
p'  = p' U {o1, o2};
Until \p'\ =N;
p =p';
```

The steps performed by genetic algorithm. Initially a population of individual, P is created and new population P'. The algorithm repeatedly selects individuals from whom to create a new one. These parents, i1, i2 are used to produce two offspring. o1, o2 using a crossover technique. Then mutants may be generated. Crossover technique is basically consisting in a random exchange of bits between two strings of the intermediate population. Mutation operator is some bits of new strings. This algorithm an acceptable solution is found optimal path.

Genetic algorithms for network topological design and the chromosome is chosen to contained the network parameters. The evaluation function is fitness to each chromosome is chosen according to the objective of the design problem. The objective is to minimize the route source and destination.

V. GENETIC ALGORITHM FOR AD HOC NETWORK

Genetic algorithm for ad hoc network worked as a connected graph with nodes. The optimization is the cost of path between nodes. The goal of algorithm has to find the shortest path with minimum cost between source and destination nodes.

A. Representation of a Chromosome

A chromosome corresponds to possible solution of the optimization problem. Each chromosome represents a path consist of sequence of positive integer that ID.

B. Evaluation of Fitness Function

The fitness function translating the chromosome in terms of physical denoted and evaluate of fitness based problem solution. The fitness functions in the shortest path routing problem to find the minimal cost path and fitness of bandwidth. The fitness function is defined as follows:

$$f\,i = \frac{1}{\sum_{j-1}^{li-1} Cgi(j),gi(j+1)} \frac{}{+\sum_{j-1}^{li-1} Bgi(j),gi(j+1)}$$

where, fi represent fitness value of the i^{th} chromosome, li is the length of the chromosome, gi (j) represents the gene of the j^{th} point in the i^{th} chromosome and C is the link cost and B is the link bandwidth.

C. Selection of Best Fit

The selection process of the best fit is to improve the average quality of the selection. The selecting individuals from the population. There are two basic types of selection process.

1. Proportionate.
2. ordinal-based selection.

Proportionate selection is chromosome based on their fitness values to the fitness of the other chromosomes in the population. Ordinal –based selection schemes select chromosome based not their fitness. The chromosomes are ranked by according to the fitness values.

D. Crossover

Crossover process of two mating solutions and exchanging data between them finding new solutions. Crossover is performed on strings using midpoint crossover. The crossover operation of genetic algorithm is based on exchange between two chromosomes of fixed length.

```
Parent 1      11 000  ------- 11 111  child 1
Parent 2      10 111  ------- 10 000  child 2
                Crossover operator
```

E. Mutation

The mutation operator randomly alters genes to partially shift the search to new locations in the solution pace.

```
0000 ------ 0001
```

VI. EXPECTED RESULTS

The proposed genetic algorithm is implemented in JAVA. The fitness function of minimal cost function and bandwidth metrics to optimal path for source and destination nodes in ad hoc networks. Other than optimal route we compared the fitness function for cost value used optimal path and fitness of bandwidth values using optimal path to source and destination nodes.

VII. CONCLUSION

This work presents a routing protocol for mobile ad hoc network using genetic algorithm. The proposed scheme for genetic algorithm to find the optimal path from source and destination nodes. The process of evaluate fitness function for bandwidth used optimal route in MANET. We simulate our routing protocol using JAVA and obtain the result that shows the optimal routing path.

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