Design an Implementation of Routing Algorithm Using PSO

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Abstract—*In this paper, we have considered the routing approaches in mobile ad hoc networks from the security and congestion viewpoint. We have analyzed the threats against ad hoc routing and presented the requirements that need to be addressed for secure routing. Existing secure routing algorithm for mobile ad hoc networks are not much secure. And importance of Mobile networks cannot be denied as the world of computing is getting portable and compact. Unlike wired networks, mobile networks pose a number of challenges to security solutions due to their unpredictable topology, wireless shared medium, heterogeneous resources and stringent resource constraints etc. The Security research area is still open as many of the provided solutions are designed keeping a limited size scenario and limited kind of attacks and vulnerabilities. The proposed algorithm intends to provide security. The Secure Compromising path Algorithm provides a foundation for governing a secure communication system for mobile ad hoc networks. In this work, a preventive approach is defined to perform the communication over the safe path. The path safety can be performed from the attacked nodes as well as from the congested nodes.*

Keywords:- Shortest path (SP), Particle Swarm Optimization (PSO),Genetic Algorithm (GA), Evolutionary Algorithms (EAs)

Objectives:-The proposed research work is about to achieve the following research objectives

- Study and analyze existing shortest path techniques in MANET
- Define a Mobile Network along with specific energy based parameters.
- Detection of Broken link or intrusion over the network
- Design an Improved Path Selection Algorithm that is inspired from PSO
- Implementation of proposed algorithm in Matlab Environment.
- Analysis of Results

I. INTRODUCTION

Evolutionary Algorithms (EAs) have attracted considerable attention for solving the SP problems as they provide a more robust and efficient approach for solving complex problems [1], [2]. Among them, the Genetic Algorithm (GA) is the most used for search space optimization problems. Beside it, Particle Swarm Optimization (PSO) is another effective meta-heuristic approach to solve search space network problems with a priority encoding method being applied to represent valid paths for the routing paths [3].

The Particle Swarm Optimization algorithm is based on certain social behaviors observed in flocks of birds, schools of fish, etc., from which certain aspects of intelligence emerge. After its development by Kennedy and Eberhart [4] in 1995, this evolutionary paradigm has been eriously studied on and grown in the past decade. The standard PSO model consists of a swarm of particles, moving interactively through the feasible problem space to find new solutions. Each particle has a position represented by a position vector; where *i* is the index of the particle, and a velocity represented by a velocity vector. Each particle remembers its own best position so far in the vector p_{best} and the best position vector among the swarm is stored in a vector g_{best} the search for the optimal position (solution) advances as the particles' velocities and positions are updated. In every iteration, the fitness of each particle's position is calculated using a pre-defined fitness function and the velocity of each particle is updated using the *gbest* and *pbest* which were previously defined. A particle's velocity and position are updated as follows:

$$v_{id} = wv_{id} + c_1 r_1 (p_{Best} - x_{id}) + c_2 r_2 (g_{Best} - x_{id});$$
$$i = 1,2,..., N, and\ d = 1,2,..., D$$

$$x_{id} = x_{id} + v_{id}$$

Particle Swarm Optimization optimizes an objective function by undertaking a population – based search. The population consists of potential solutions, named particles, which are metaphor of birds in flocks. These particles are randomly initialized and freely fly across the multi dimensional search space. During flight, each particle updates its own velocity and position based on the best experience of its own and the entire population. The various steps involved in Particle Swarm Optimization Algorithm are as follows:

Step 1: The velocity and position of all particles are randomly set to within pre-defined ranges.

Step 2: Velocity updating – At each iteration, the velocities of all particles are updated according to,

$$v_i = v_i + c_1 R_1 (p_{i,best} - p_i) + c_2 R_2 (g_{i,best} - p_i)$$

where p_i and v_i are the position and velocity of particle i, respectively; $p_{i,best}$ and $g_{i,best}$ is the position with the 'best' objective value found so far by particle i and the entire.

population respectively; w is a parameter controlling the dynamics of flying; R_1 and R_2 are random variables in the range [0,1]; c_1 and c_2 are factors controlling the related weighting of corresponding terms. The random variables help the PSO with the ability of stochastic searching.

Step 3: Position updating – The positions of all particles are updated according to,

$$p_i = p_i + v_i$$

After updating, p_i should be checked and limited to the allowed range.

Step 4: Memory updating – Update $p_{i,best}$ and $g_{i,best}$ when condition is met,

$$p_{i,best} = p_i \quad if \quad f(p_i) > f(p_{i,best})$$

$$g_{i,best} = g_i \quad if \quad f(g_i) > f(g_{i,best})$$

where f(x) is the objective function to be optimized.

Step 5: Stopping Condition –The algorithm repeats steps 2 to 4 until certain stopping conditions are met, such as a pre-defined number of iterations. Once stopped, the algorithm reports the values of g_{best} and $f(g_{best})$ as its solution.

PSO utilizes several searching points and the searching points gradually get close to the global optimal point using its pbest and gbest. Initial positions of pbest and gbest are different. However, using thee different direction of pbest and gbest, all agents gradually get close to the global optimum.

II. Research Methodology

A. *Right Path Selection*

In an adhoc network distance is the major factor respective to which routing algorithm. But in these presented work we have considered multiple parameters to identify the right communication path. The parameters included in this work are

(i) Distance
(ii) Energy
(iii) Effective Throughput
(iv) Ideal Rate Analysis
(v) Load Analysis

Based on these all vectors the reliable and efficient communication path will be generated and that path will be taken as the main routing path on which the communication will be performed. As the algorithm begin, the source and the destination nodes are specified explicitly between which the communication path will be generated. Now it will send the request to the source node and the wait is performed for the reply. As the reply is obtained it signify the right communication can be taken place. Now to perform the effective communication between the source and the destination the effective parameters are required to identify for each neighbor node of current node.

Now to perform the effective communication we need to find the next effective neighbor over which the communication will be performed. In this work, the parametric analysis is performed on each node to identify the best neighbor. The parameters considered here are the throughput analysis, energy, delay analysis on each node. As the parameters are identify for all the neighbors, best neighbor is selected from the list. Now it will check the node for valid node. As the reply is obtained from this best node effectively. Set this node as the best neighbor and the communication will be performed over that node. If reply is not accurate, the attacker node is identified. In such case the PSO will be called to perform the safe communication. The algorithmic approach of the work is shown in figure 1

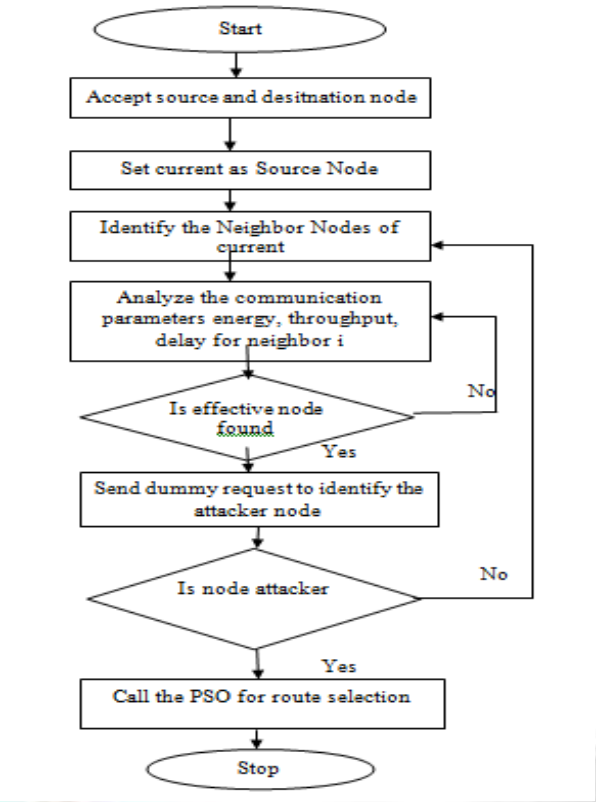

Fig. 1: Effective Routing Algorithm

B. *Parameters Used*

- Throughput Analysis
- Time Delay
- Energy
- Distance

In this present work we have improve the path selection algorithm by using the concept of Swarm optimization. The first step is to setup the network with specific parameters. These parameters includes

1. Throughput: This property represents the number of successful packet delivery for a specific communication. This parameter is basically defines the ratio of packets transmitted and the packet successfully arrived to the destination. The packet delivery ratio we have analyzed on intermediate nodes to identify the problem area over the network.
2. Time Delay: It defines the delay in the communication. The delay will occur because of congestion over the network.
3. Energy: As each node in the communication is a sensor node, because of this each node is defined with specific energy we have defined 5 Joule to each node. With each communication over the network some energy is lost. If the energy is less then minimum required energy or 0 the node will be dead itself.
4. Distance: It is the actual taken to perform the communication over the network.

III. Simulation And Analysis

The proposed work is about to find the optimal solution of any broken link or data loss in a high speed Wireless LAN. The proposed work is about the generation of such an approach that will dynamically compensate the problem of

link failure and provide the optimize solution without any data loss. The proposed system will give the benefit in terms of Efficiency and accuracy.

Scenario

Parameter	Value
Number of Nodes	30
Topography Dimension	100 m x 100 m
Traffic Type	CBR
Topology	Random
Initial Node	1
Destination Node	30

The proposed work is about to introduce a compromising path to transfer data from some safe route if there are some chances of occurring of any intrusion or the congestion in the route of the basic routing algorithm.

A. Results

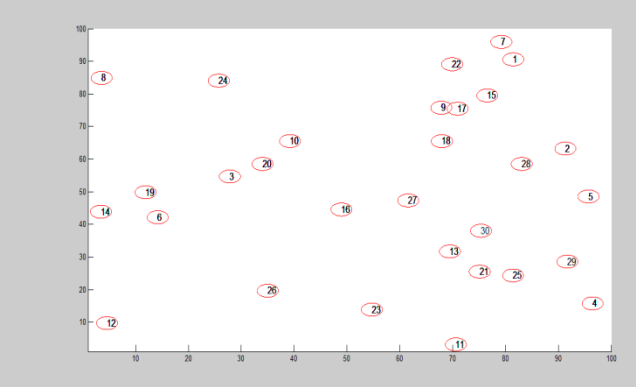

Fig.2 : Network Architecture

In figure 2 we can see that the network is defined with 30 number of nodes. As we can see the nodes are numbered from 1 to 30. Blue nodes are showing source node and the destination node. All other nodes are the intermediate nodes.

The path obtained from the network is

1=>8=>16=>13=>30

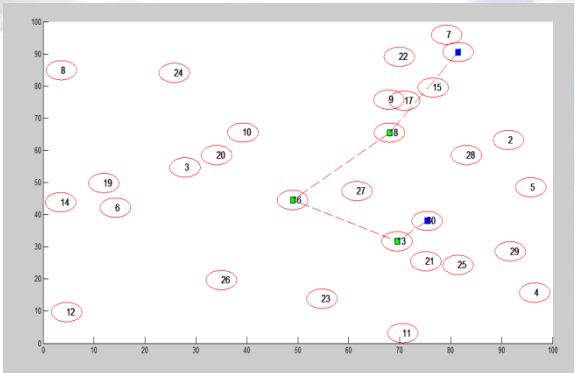

Fig.3: Generated Path(Existing Approach)

The distance covered is

Parameters	Values
Distance	89.60
Energy Consumed	1.39e+004
Network Delay	3.72+005 ms

IV. Conclusion And Future Scope

A. Conclusion

In this paper, we have considered the routing approaches in mobile ad hoc networks from the security and congestion viewpoint. We have analyzed the threats against ad hoc routing and presented the requirements that need to be addressed for secure routing. Existing secure routing algorithm for mobile ad hoc networks are not much secure. And importance of Mobile networks cannot be denied as the world of computing is getting portable and compact. Unlike wired networks, mobile networks pose a number of challenges to security solutions due to their unpredictable topology, wireless shared medium, heterogeneous resources and stringent resource constraints etc. The Security research area is still open as many of the provided solutions are designed keeping a limited size scenario and limited kind of attacks and vulnerabilities.

In this present work, we have defined an PSO improved safe routing approach to transfer data from congestion free and attack safe path. Generally, the shortest path is the most favorite area for the attackers to perform the intrusion, but the presented approach will not cover any node that is having the higher probability of the attack or the congestion. As the communication will be performed over a congestion free path, the energy and the delay over the network will be reduced. The presented approach is effective in terms of energy and the time as well as to provide a reliable route over the network. The obtained results shows that the presented approach has improve the network reliability and the energy.

The proposed algorithm intends to provide security. The Secure Compromising path Algorithm provides a foundation for governing a secure communication system for mobile ad hoc networks.

B. Future Work

The proposed algorithm presented in this paper considers defend of Man in Middle Attack as well as provide the safe communication in case of congested networks. In this work, a preventive approach is defined to perform the communication over the safe path. The path safety can be performed from the attacked nodes as well as from the congested nodes. The improvement over the work can be performed in different ways.

- In this present work, PSO is used as the optimization and safe route generation algorithm. In future, some other optimization functions can be used for the path generation such as ACO, genetics, ABC etc.
- The presented work is the generic model respective to the attack. In future the work can be performed respective to the particular attack type over the network.

Refrence

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