Design an Algorithm Using PSO in Matlab Environment

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Abstract— *A Mobile ad hoc network is a group of wireless mobile computers (or nodes). In which nodes collaborate by forwarding packets for such other to allow them to communicate outside range of direct wireless transmission. Routing data packets through the shortest path (SP) is an efficient approach to increase the Quality of Service (QoS) in expanding networks as it minimizes cost or delay while maximizing quality or bandwidth. In this paper we are finding the shortest network path essential routing data packets through the shortest path. For finding the shortest path network we use two research methodologies.*

1. *Right path selection*
2. *Swarm Optimization Algorithm*

Keywords: Shortest path (SP), Quality of Service (QoS), Particle Swarm Optimization (PSO), Genetic Algorithm (GA), Evolutionary Algorithms (EAs)

I. Introduction

A Mobile ad hoc network is a group of wireless mobile computers (or nodes). In which nodes collaborate by forwarding packets for such other to allow them to communicate outside range of direct wireless transmission. PSO is used for shortest path problem inspired byway real Ant find shortest path for there nest to food sources. PSO is also inspired by behavior of swarm of fishes or flocks of birds to find a good food place[1]. Variation of SP routing problems have to be solved to achieve advanced communication in a wide variety network problems such as K-shortest paths [7], constrained shortest-path [8], multi objective shortest path [9] and so on

II. Objective Of This Paper

1. Study PSO
2. Find the shortest path

A. PSO

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 [3], [4]. 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 [5].

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 [6] in 1995, this evolutionary paradigm has been seriously 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.

B. Advantages Of Pso:

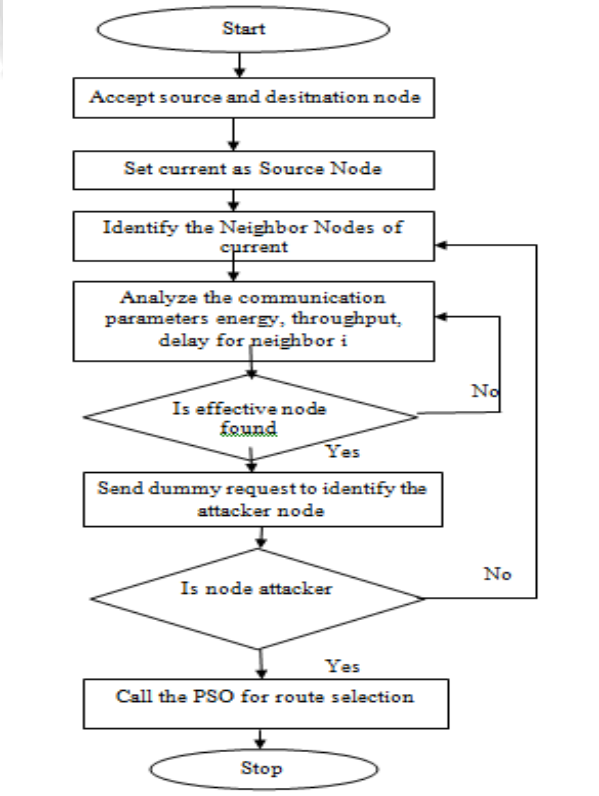
1. PSO is based on the intelligence. It can be applied into both scientific research and engineering use.
2. PSO has no overlapping and mutation calculation. The search can be carried out by the speed of the particle. During the development of several generations, only the most optimist particle can transmit information onto the other particles, and the speed of the researching is very fast.
3. The calculation in PSO is very simple. Compared with the other developing calculations, it occupies the bigger optimization ability and it can be completed easily.
4. PSO adopts the real number code, and it is decided directly by the solution. The number of the dimension is equalto the constant of the solution.[1]

III. Limitations Of Pso:

1. The method easily suffers from the partial optimism, which causes the less exact at the regulation of its speed and the direction.
2. The method cannot work out the problems of scattering and optimization.
3. The method cannot work out the problems of non-coordinate system, such as the solu-tion to the energy field and the moving rules of the particles in the energy field.[1]

IV. Applications Of Pso:

The first practical application of PSO was in the field of neural network training and was reported together with the Effective Routing Algorithm



algorithm itself. Many more areas of application have been explored ever since, including telecommunications, control, data mining, design, com- binatorial optimization, power systems, signal processing, and many others.

Although PSO has been used mainly to solve unconstrained, single-objective optimization problems, PSO algorithms have been developed to solve constrained problems, multi-objective optimization problems, problems with dynamically changing landscapes, and to find multiple solutions.[1]

A. Advantages Of Manet

The following are the advantages of MANET:

- They provide access to information and services regardless of geographic position.
- These networks can be set up at any place and time .[2]

B. Disadvantages Of Manet

Some of the disadvantages of MANETs are as follows:

- Limited resources and physical security.
- Intrinsic mutual trust vulnerable to attacks.
- Lack of authorization facilities.
- Volatile network topology makes it hard to detect malicious nodes.
- Security protocols for wired networks cannot work for ad hoc networks.[2]

V. Simulation

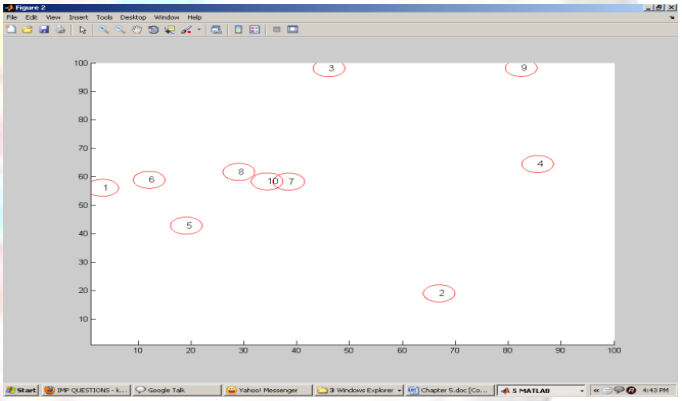


Fig. 1: Network Architecture

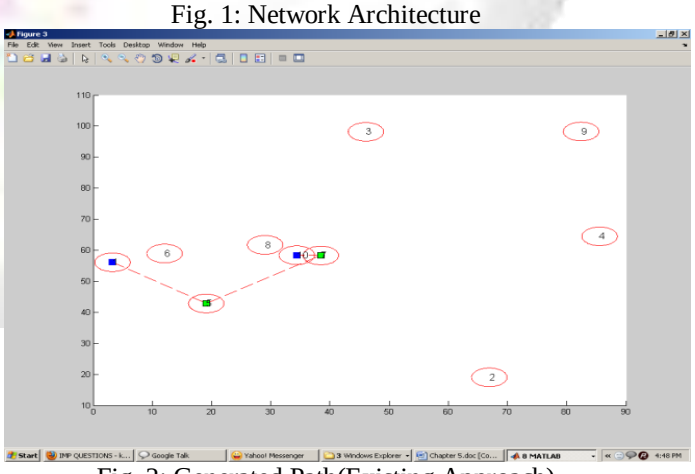


Fig. 2: Generated Path(Existing Approach)

VI. 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 provides 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.

VII. Future Work

The proposed algorithm presented in this paper considers the 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.

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