Design an Improved Path Selection Algorithm that is Inspired from Particle Swarm Optimization (PSO)

[1] Manju Chaudhary, [2] Sunil Ahuja, [3] Komal

[1] Student, Department of CSE,DIET , Karnal, India

[2] Assistant Professor, Department of CSE, DIET , Karnal, India

[3] Doon Valley Institute of Engg and Technology, Karnal, India

Abstract - A MANET is a group of mobile users(node) that communicate over reasonably slow wireless links. Wireless Mobile Ad-hoc networks (MANET) require a routing schemes for reliable performance so In this paper, Particle Swarm Optimization (PSO) technique is proposed which is improved safe routing approach to transfer data from congestion free and attack safe path. In this paper we analyze the Path Selection Routing along with the concept of Swarm Optimization. The initial route will be identified by the Path Selection algorithm and in case of any broken link or intrusion in the path it will look for the Alternate path using Swarm optimization. In this paper PSO technique is compared with the shortest path selection algorithm using DSDV protocol by using parameter distance ,energy and network delay.

Keywords - *DSDV, MANET , PSO, etc.*

1.Introduction

Ad hoc is used to describe solutions that are developed on-the-fly for a specific purpose. In computer networking, an ad hoc network refers Wireless base station to a network connection established for a single session and does not require a router or a For example, if you need to transfer a file to your friend's laptop, you might create an ad- hoc network between your computer and his laptop to transfer the file. This may be done using an Ethernet crossover cable, or the computers' wireless cards to communicate with each other.

If you need to share files with more than one computer, you could set up a mutli-hop ad hoc network, which can transfer data over multiple nodes. Basically, an ad hoc network is a temporary network connection created for a specific purpose (such as transferring data from one computer to another). If the network is set up for a longer period of time, it is just a plain old local area network nodes which are connected via wired links.

2. MANET

A Mobile ad hoc network is a group of wireless mobile computers (or nodes). In which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points, and can be quickly and inexpensively set up as needed. A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links.

Properties of MANET Routing Protocols

The properties that are desirable in MANET Routing protocols are:
i). *Distributed operation*: The protocol should be distributed. It should not be dependent on a centralized controlling node. This is the case even for stationary networks. The dissimilarity is that the nodes in an ad-hoc network can enter or leave the network very easily and because of mobility the network can be partitioned.

ii). *Loop free:* To improve the overall performance, the routing protocol should assurance that the routes supplied are loop free. This avoids any misuse of bandwidth or CPU consumption.

iii). *Demand based operation:* To minimize the control overhead in the network and thus not misuse the network resources the protocol should be reactive.
This means that the protocol should react only when needed and should not periodically broadcast control information.

iv). *Unidirectional link support:* The radio environment can cause the formation of unidirectional links. Utilization

of these links and not only the bi-directional links improves the routing protocol performance.

v). *Security:* The radio environment is especially vulnerable to impersonation attacks so to ensure the wanted behavior of the routing protocol we need some sort of security measures. Authentication and encryption is the way to go and problem here lies within distributing the keys among the nodes in the ad-hoc network.
vi). *Multiple routes:* To reduce the number of reactions to topological changes and congestion multiple routes can be used. If one route becomes invalid, it is possible that another stored route could still be valid and thus saving the routing protocol from initiating another route discovery procedure.

vii). *Power conservation:* The nodes in the ad-hoc network can be laptops and thin clients such as PDA‘s that are limited in battery power and therefore uses some standby mode to save the power. It is therefore very important that the routing protocol has support for these sleep modes.

viii). *Quality of Service Support*: Some sort of Quality of service is necessary to incorporate into the routing protocol. This helps to find what these networks will be used for. It could be for instance real time traffic support .

Problems in routing with Mobile Ad hoc Networks

i). *Asymmetric links:* Most of the wired networks rely on the symmetric links which are always fixed. But this is not a case with ad-hoc networks as the nodes are mobile and constantly changing their position within network.

ii). *Routing Overhead:* In wireless ad hoc networks, nodes often change their location within network. So, some stale routes are generated in the routing table which leads to unnecessary routing overhead.

iii). *Interference:* This is the major problem with mobile ad-hoc networks as links come and go depending on the transmission characteristics, one transmission might interfere with another one and node might overhear transmissions of other nodes and can corrupt the total transmission.

iv). *Dynamic Topology:* Since the topology is not constant; so the mobile node might move or medium characteristics might change. In ad-hoc networks, routing tables must somehow reflect these changes in topology and routing algorithms have to be adapted. For example in a fixed network routing table updating takes place for every 30sec. This updating frequency might be very low for ad-hoc networks.

3. Routing Protocol

In *ad hoc networks*, nodes are not familiar with the topology of their networks. Instead, they have to discover it: typically, a new node announces its presence and listens for announcements broadcast by its neighbors. Each node learns about others nearby and how to reach them, and may announce that it too can reach them Classification of routing protocols in mobile ad hoc network can be done in many ways, but most of these are done depending on routing strategy and network structure. The routing protocols can be categorized as flat routing, hierarchical routing and geographic position assisted routing while depending on the network structure.*Flat Routing Protocols can be reactive and proactive protocol.*

Proactive(Table Driven) : This type of protocols maintains fresh lists of destinations and their routes by periodically distributing routing tables throughout the network.this outing is mostly based on LS(LINK STATE)
Reactive (On Demand): This type of protocols finds a route on demand by flooding the network with Route Request packets. This routing is based on DV (distance-vector).

4. Overview of DSDV

DSDV Protocol: (Destination Sequenced Distance Vector (DSDV) Protocol)
– The destination address
– The number of hops required to reach the destination and
– The new sequence number, originally stamped by the destination
-- Pro Active protocol

The transmitted routing tables will also contain the hardware address, network address of the mobile host transmitting them. The routing tables will contain the sequence number created by the transmitter and hence the most new destination sequence number is preferred as the basis for making forwarding decisions. This new sequence number is also updated to all the hosts in the network which may decide on how to maintain the routing entry for that originating mobile host. After receiving the route information, receiving node increments the metric and transmits information by broadcasting. Incrementing metric is done before transmission because, incoming packet will have to travel one more hop to reach its destination. Time between broadcasting the routing information packets is the other important factor to be considered. When the new information is received by the mobile host it will be retransmitted soon effecting the most rapid possible dissemination of routing information among all the cooperating mobile hosts.

5. PSO (Particle Swarm Optimization)

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 [13] 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 $d= 1,2,.....,D$
$x_{id} = x_{id} + v_{id}$

The description of the Swarm concept is presented here

1. At regular interval any node s(Source) is selected to send data to some destination node d.
2. Each forward Swarm selects the next hop nde using the routing table information. the next node selected depends on some random scheme. If all nodes already visited a uniform selection will be performed
3. If the selected node is some attack or damage node or it is not currently available. the forward Swarm wait to turn in the low priority node from the queue.
4. It will identify any of the next non visited node and pay some delay on it.
5. If some cycle detected the Swarm is forced to turn on the visited node.
6. When the Swarm reaches the destination node a backward Swarm is generated to transfer all its memory.
7. Backward Swarm uses same path generated by forward Swarm.

By default route is chosen on the basis of Path selection formula and i.e. we will choose the lowest energy path. It means every time the selected path is using lowest energy. In case there is problem in the selection of the path then we apply the Swarm Algorithm the purpose of which is to continue sending data using the previous path .

6. Introduction to MATLAB Tool

SIMULATION TOOL
MATLAB Editor is used for writing the code to implement our algorithm.
The result will be shown in the command window of MATLAB.
AN OVERVIEW OF MATLAB ENVIRONMENT
MATLAB is a high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran. [Matlab Toolbox]

Introduction and Key Features

- Developing Algorithms and Applications
- Analyzing and Accessing Data
- Visualizing Data
- Performing Numeric Computation
- Publishing Results and Deploying Applications

MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numeric computation. Using the MATLAB product, you can solve technical computing problems faster than with traditional programming languages, such as C, C++, and Fortran.You can use MATLAB in a wide range of applications, including signal and image processing, communications, control design, test and measurement, financial modeling and analysis, and computational biology. Add-on toolboxes (collections of special-purpose MATLAB functions, available separately) extend the MATLAB environment to solve particular classes of problems in these application areas .MATLAB provides a number of features for documenting and sharing your work.

KEY FEATURES

- High-level language for technical computing
- Development environment for managing code, files, and data
- Interactive tools for iterative exploration, design, and problem solving
- Mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, and numerical integration
- 2-D and 3-D graphics functions for visualizing data
- Tools for building custom graphical user interfaces
- Functions for integrating MATLAB based algorithms with external applications and languages, such as C, C++, Fortran, Java, COM, and Microsoft Excel

7. Proposed Work

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.

Various Parameters that are used to measure the effective data path in network using any number of nodes. 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

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.

Time Delay : It defines the delay in the communication. The delay will occur because of congestion over the network.

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 Jule 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.

Distance : It is the actual taken to perform the communication over the network.

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.. The results obtained here is by using 30 nodes are shown in this paper.

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

8. Simulation Results

Comparison Of Performance Using DSDV and PSO

The distance covered is

Table 1.1: Distance Covered By network of 30 Nodes

Parameters	Values
Distance	49.1774
Energy Consumed	7.7048e+003
Network Delay	2.0275e+005 ms

The distance covered is:

Table 5.2 Distance Covered By network of 30 Nodes with PSO

Parameters	Values
Distance	78.6763
Energy Consumed	1.0324e+004
Network Delay	2.3411e+005ms

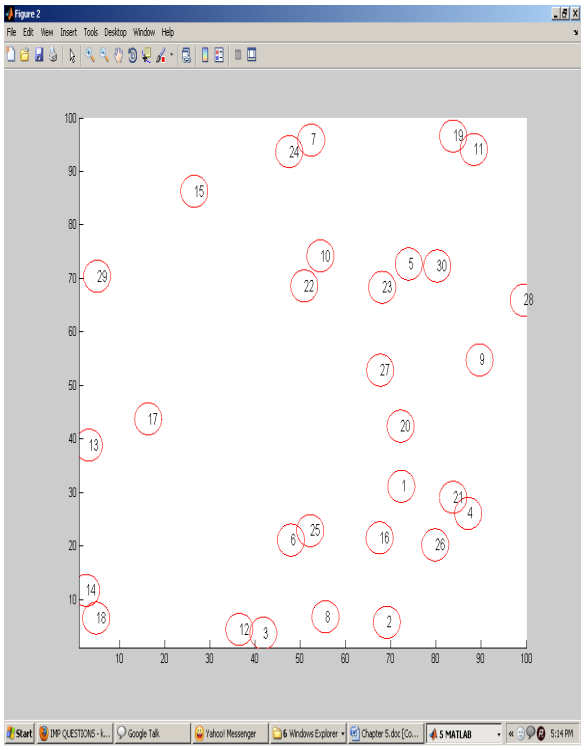

Fig 1.1 : Network Architecture using 30 nodes

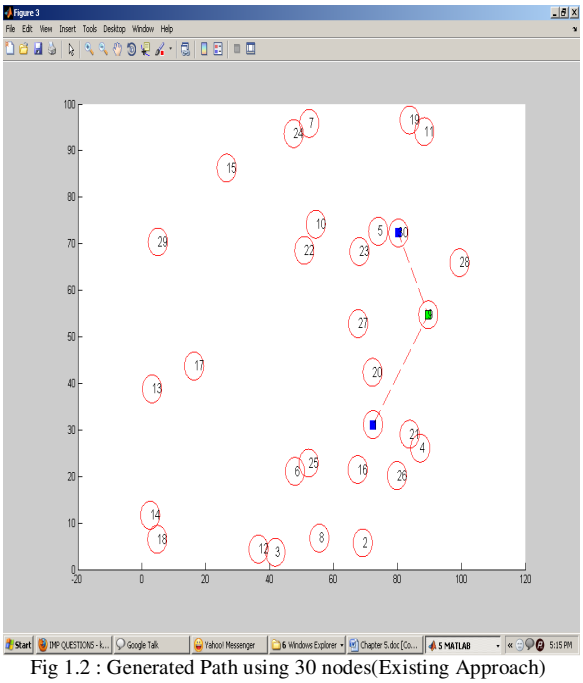

Fig 1.2 : Generated Path using 30 nodes(Existing Approach)

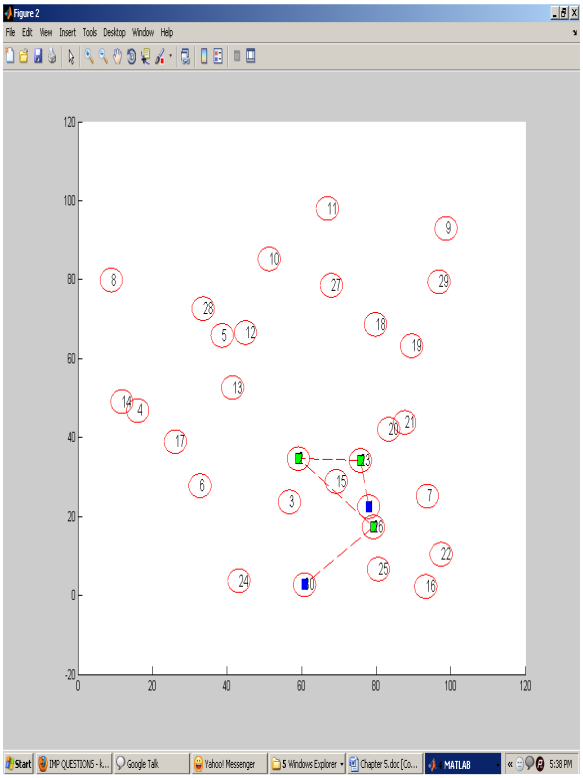

Fig 1.3 : Generated Path using 30 nodes with PSO (Proposed Work)

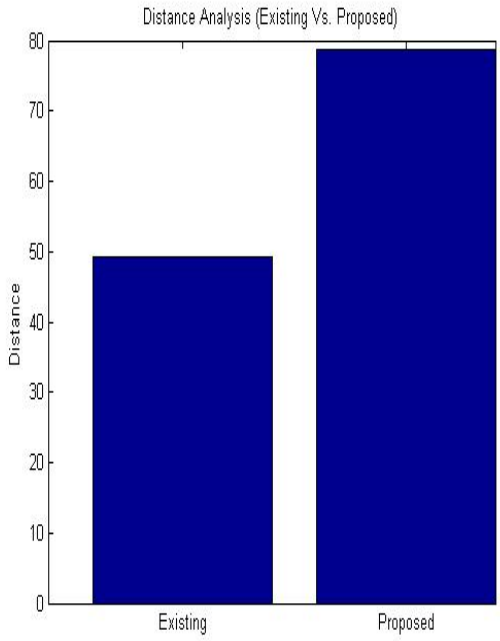

Fig 1.4: Distance Analysis using 30 nodes (Existing Vs. Proposed)

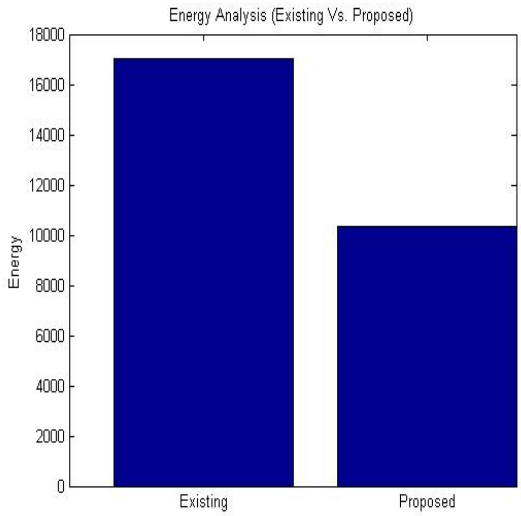

Fig 1.5 : Energy Analysis using 30 nodes (Existing Vs. Proposed)

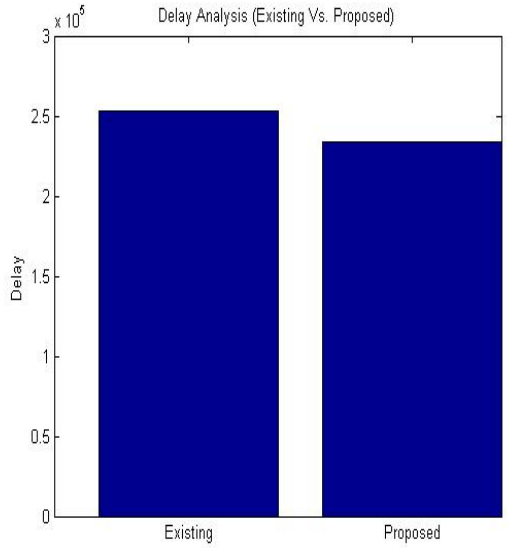

Figure 5.6 : Delay using 30 nodes (Existing Vs. Proposed)

9. 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.The 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 favourite 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 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.

10. 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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