A GENETIC APPROACH TO OPTIMIZE THE ROUTE SELECTION IN MOBILE NETWORKS

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ABSTRACT

QOS is always the basic requirement of any network. Mobile Area network is most busy network these days because of voice and video data transmission over it. Because of this the optimization of QOS is most required in such networks. The proposed work is to define a genetic based routing approach to optimize the routing in MANETs. In this work we will perform the population generation respective to number of all node paths between two nodes. Now we will select any two random path and perform a cross over on it. The crossover will generate a result path from this and finally the mutation is applied on to it perform the filtration process. The genetic approach will generate an optimized path on the basic of congestion over the network. The result path will improve the data delivery over the network.

***Keywords**: MANET, QOS, Genetic, Delivery, Routing, Optimized.*

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I. INTRODUCTION

Wireless communication between mobile users is becoming more popular than ever before. This is due to recent technological advancement in laptop computers and wireless data communication devices, such as wireless modems and wireless LANs. This has lead to lower prices and higher data rates, which are the two main reasons why mobile computing continues to enjoy rapid growth.

There are two distinct approaches for enabling wireless communication between two hosts. The first approach is to let the existing cellular network infrastructure carry data as well as voice. The major problems include the problem of handoff. Which tries to handle the situation when a connection should be smoothly handed over from one base station to another station without noticeable delay or packet loss. Another problem is that network based on the cellular infrastructure is limited to places where there exists such a cellular network infrastructure.

The second approach is to form an ad hoc network among all users wanting to communicate with each others. This means that all users participating in the ad hoc network among all users wanting to communicate with each other .This means that all users participating in ad hoc networks must be willing to forward data packets to make sure that the packets are delivered from source to destination.

This form of networking is limited in range by the individual nodes transmission ranges and is typically smaller compared to the range of cellular systems. This does not mean that the cellular approach, ad hoc networks have several advantages compared to traditional cellular approach is better than the ad hoc approach. Ad hoc networks have several advantages compared to traditional cellular systems.

These advantages include:

- On demand setup
- Fault tolerance
- Unconstrained connectivity

Ad hoc networks do not rely on any pre-established infrastructure and can therefore be deployed in places with no infrastructure. This is useful in disaster recovery situations and places with non-existing or damaged communication infrastructure where people participating in the conference can form a temporary network without engaging the services of pre-existing network [1].

Because nodes are forwarding packets for each other, some sort of routing protocol is necessary to make the routing decisions. Currently there does not exist any standard for a routing protocol for ad hoc networks, instead this is work in, progress .many problems remain to be solved before any standard can be determined. This research looks at some problems and tries to evaluate some of the currently proposed protocols.

A mobile ad hoc network (MANET) is a collection of mobile computers or devices that cooperatively communicate with each other without any pre-established infrastructures such as a centralized access point. Computing nodes (usually wireless) in an ad hoc network act as routers to deliver messages between nodes that are not within their wireless communication range. Because of this unique capability, mobile ad hoc networks are envisioned in many critical applications (e.g., in battlefields).Therefore, these critical ad hoc networks should be sufficiently protected to achieve confidentiality, integrity, and availability.

The dynamic and cooperative nature of MANETs presents substantial challenges in securing these networks. Unlike wired networks which have a higher level of security for gateways and routers, ad hoc networks have the characteristics such as dynamically changing topology, weak physical protection of nodes, the absence of centralized administration, and highly dependence on inherent node cooperation. As the topology keeping changing, these networks do not have a well-defined boundary, and thus, network-based access control mechanisms such as firewalls are not directly applicable.

Due to the highly dynamic nature of mobile nodes and the absence of a central controller, traditional routing protocols used for a wired network cannot be applied directly to a MANET. Some of the considerations required in the design of MANET routing protocols include the mobility of nodes, unstable channel states and resource constraints such as power and bandwidth. In a MANET, the movement of nodes will cause communication between nodes to be disrupted from frequent path breaks and reconnections. Also, the broadcasting of radio channels can be highly unstable and the network layer has to interact with the MAC layer for available channels. In addition, power availability is often limited since the nodes are connected to batteries.

Problems With MANET

- **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

Routing

Because of the fact that it may be necessary to hop several hops (multi-hop) before a packet reaches the destination, a routing protocol is needed. The routing protocol has two main functions, selection of routes for various source-destination pairs and the delivery of messages to their correct destination. The second function is conceptually straightforward using a variety of protocols and data structures (routing tables). This report is focused on selecting and finding routes.

Link State

In link-state routing [13], each node maintains a view of the complete topology with a cost for each link. To keep these costs consistent; each node periodically broadcasts the link costs of its outgoing links to all other nodes using flooding. As each node receives this information, it updates its view of the network and applies a shortest path algorithm to choose the next-hop for each destination.

Some link costs in a node view can be incorrect because of long propagation delays, partitioned networks, etc. Such inconsistent network topology views can lead to formation of routing-loops. These loops are however short-lived, because they disappear in the time it takes a message to traverse the diameter of the network.

Distance Vector

In distance vector [14] each node only monitors the cost of its outgoing links, but instead of broadcasting this information to all nodes, it periodically broadcasts to each of its neighbors an estimate of the shortest distance to every other node in the network. The receiving nodes then use this information to recalculate the routing tables, by using a shortest path algorithm.

Compared to link-state, distance vector is more computation efficient, easier to implement and requires much less storage space. However, it is well known that distance vector can cause the formation of both short-lived and long-lived routing loops. The primary cause for this is that the nodes choose their next-hops in a completely distributed manner based on information that can be stale.

Source Routing

Source routing [3] means that each packet must carry the complete path that the packet should take through the network. The routing decision is therefore made at the source. The advantage with this approach is that it is very easy to avoid routing loops. The disadvantage is that each packet requires a slight overhead.

II. LITERATURE SURVEY

The advancement of growing information technology requires a network type which can handle heterogeneous devices, which do not depend on infrastructure. This is called Mobile Ad hoc Network (MANET). MANET can be formed from a collection of nodes using wireless interface to communicate with each others. Every node can act as a host or a router. A node can receive and forward packet to next node. In order to do this, we need a routing protocol which support multihop. Routing protocol in ad hoc network is a challenging issue to support mobile node. There are two types of routing protocol in ad-hoc network [2].

Destination Sequenced Distance Vector (DSDV), Cluster Switch Gateway Routing (CSGR), wireless Routing Protocol (WRP), Optimized Link State Routing (OLSR)

Dynamic Source Routing (DSR), Ad hoc On-demand Distance Vector (AODV), Temporally Ordered Routing Algorithm (TORA), Associativity Based Routing (ABR), Signal Stability Routing (SSR) A hybrid routing protocol is combination between proactive and reactive protocols, for example Zone Routing Protocol (ZRP). AODV is one of the routing protocols which have been widely used in research, in simulation and tested. In Uppsala University, Sweden, Bjorn Wiberg and Erick Nordstrom have successfully developed an implementation of AODV routing protocol called AODV-UU. AODV-UU can be used in simulation and tested implementation. Ali Hamidian in has developed AODV+ for gateway ad hoc network in NS-2 simulation extension. Mobile MAN project in [23-241 have built a testbed which combine two routing protocol, AODV-UU and OLSR, to inform ad hoc backbone using PDA.

The concept of hybrid network is a combination of infrastructure network and MANET. This condition enables multihop routing between mobile nodes to a base station. The aim is to gain an efficient infrastructure, to expand the coverage area of the base station and to minimize power consumption [2].

MANET

IETF has a working group named MANET (mobile adhoc network) that is working in the field of ad hoc networks. They are currently developing routing specifications for ad hoc IP networks that support scaling to a couple of hundred nodes. Their goal is to be finished in the end of the year 1999 and then introduce these specifications to the internet standard tracks.

Even if MANET currently is working on routing protocols, it also serves as a meeting place and forum, so people can discuss issues concerning ad hoc networks, currently they have seven routing protocols drafts [1].

If a routing protocol is needed, why not use a conventional routing protocol like link state or distance vector? They are well tested and most computer communications people are familiar with them. The main problem with link-state and distance vector is that they are designed for a static topology, which means that they would have problems to converge to a steady state in an ad-hoc network with a very frequently changing topology.

Link state and distance vector would probably work very well in an ad-hoc network with low mobility, i.e. a network where the topology is not changing very often. The problem that still remains is that link-state and distance-vector are highly dependent on periodic control messages. As the number of network nodes can be large, the potential number of destinations is also large. This requires large and frequent exchange of data among the network nodes. This is in contradiction with the fact that all updates in a wireless interconnected ad hoc network are transmitted over the air and thus are costly in resources such as bandwidth, battery power and CPU. Because both link-state and distance vector tries to maintain routes to all reachable destinations, it is necessary to maintain these routes and this also wastes resources for the same reason as above.

Another characteristic for conventional protocols is that they assume bi-directional links, e.g. that the transmission between two hosts works equally well in both directions. In the wireless radio environment this is not always the case.

Because many of the proposed ad-hoc routing protocols have a traditional routing protocol as underlying algorithm, it is necessary to understand the basic operation for conventional protocols like distance vector, link state and source routing.

Mobile ad hoc networks (MANET) are autonomous systems of mobile nodes interconnected by wireless links .Any node in a MANET acts as a router to support connectivity to other mobile nodes that are out of range .The nodes are free to move randomly and organize themselves arbitrarily. The inherent flexibility offered by these networks, originally conceived for mostly purposes such as battlefield communication and battlefield sensor monitoring network, allows for ease of development and appeals to various commercial applications such as convection meetings, electronic classrooms, search-and-rescue efforts, disaster relief, and law enforcement. A side effect of this flexibility is the ease with which a node can join or leave a MANET.Lack of any fixed physical and, sometimes, administrative infrastructure in these networks makes the task pf securing them extremely challenging.

The Engineering Task Force's (IETF) MANET Working Group (WG) identifies Optimized Link State Routing (OLSR) (7) as one of four base routing protocols for use in MANETs. Recent research efforts (3) (4) have focused on providing schemes to block unauthorized users from joining an OLSR MANET and to prevent authorized nodes from compromising the security of the MANET. Our previous work (4) proposed an efficient approach to integrate a fully distributed certification authority (CA) in OLSR. A public-key infrastructure (PKI) was tightly coupled with an OLSR MANET at the network layer. In (3), the approach was based on authentication checks of the OLSR control message. Signatures were introduced as a separate type of control message and served to validate the origin and integrity of information.

III. PROPOSED WORK

We are providing the solution of above said problem using the genetic approach. There are a few reasons why it can be beneficial to use genetic algorithms for training neural networks. With regard solely to the problem of weight (and bias) selection for networks with fixed topologies and transfer genetic algorithms are particularly good at efficiently searching large and complex spaces to find nearly global optima. As the complexity of the search space increases, genetic algorithms present an increasingly attractive alternative to gradient-based techniques such as back propagation. Even better, genetic algorithms are an excellent complement to gradient-based techniques such as back propagation for complex searches complement to gradient-based techniques such as back propagation for complex searches

A second advantage of genetic algorithms is their generality. With only minor changes to the algorithm, genetic algorithms can be used to train all different varieties of networks. They can select weights for recurrent networks, i.e. networks whose topologies have closed paths.

A third reason to study genetic algorithms for learning neural networks is that this is an important method used in nature.

Our proposed methodology involves the following steps:

1. Generate the possible path between source and the destination
2. Analyze and collect all the possible paths between the initial and the Goal State.
3. Repeat Steps 4 & 5 such that most distinguish path not occurred
4. Select Two possible path P1 {p11,p12,p13,….,p1n} and P2 {p21,p22,p23….p2n}
5. Perform Crossover on P1 & P2 such that
   a. Generate a new sequence P3= {p31, p32, p33…p3n}, the sequence will be elected on the basis of the frequency of a state at index position i.
6. Performed the Mutation on P3 to perform the pruning on dead nodes.
7. Exit

A suitable encoding is found for the solution to perform optimized route so that each possible solution has a unique encoding and the encoding is some form of a string.

The initial population is then selected, usually at random through alternative techniques and fitness of each individual in the population is then computed i.e. how well the individual fits the problem and whether it is near the optimum compared to the other individuals in the population. This fitness is used to find the individual's probability of crossover. If an individual has a high probability (which indicates that it is significantly closer to the optimum than the rest of its generation) then it is more likely to be chosen to crossover.

Crossover is where the two individuals are recombined to create new individuals which are copied into the new generation. Next mutation occurs. Some individuals are chosen randomly to be mutated and then a mutation point is randomly chosen. The character in the corresponding position of the string is changed. Once this is done, a new generation has been formed and the process is repeated until some stopping criteria have been reached. At this point the individual who is closest to the optimum is decoded and the process is complete.

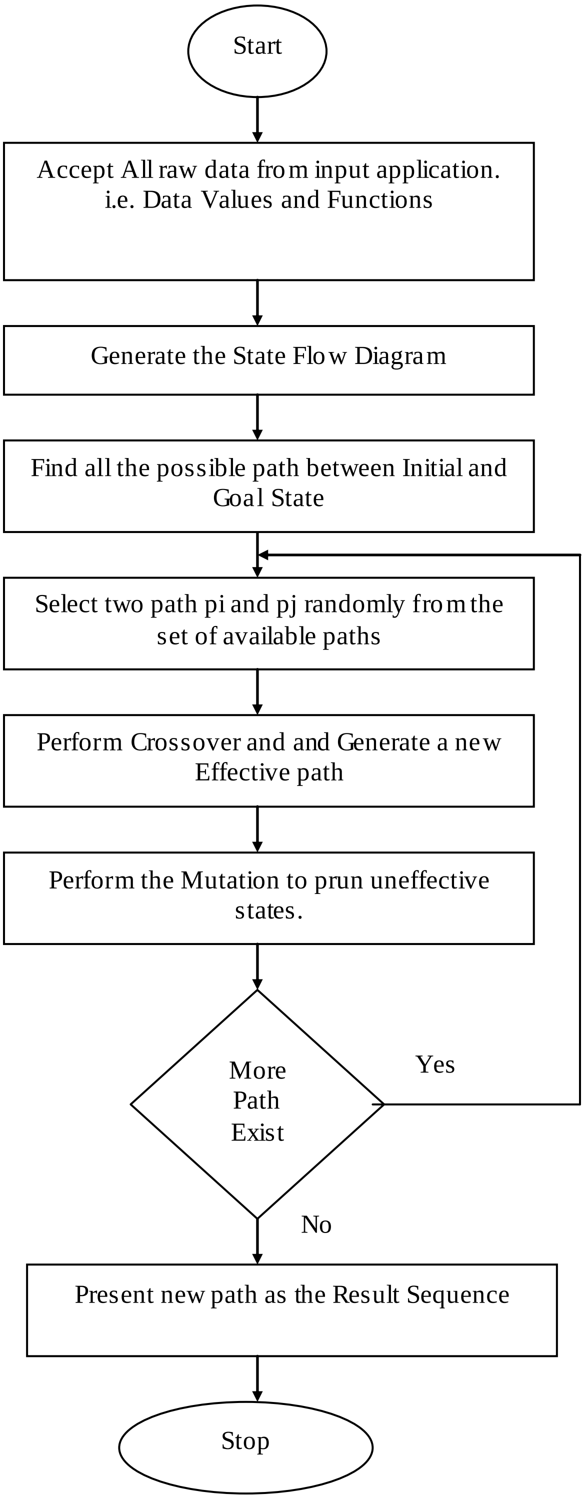

Figure 1: Proposed Approach

The Figure1 shows the flowchart of proposed approach. Here the steps of the algorithm are described

Genetics Tools

A simple genetic algorithm that yields good result in many practical problems is composed of three operators

- **Reproduction**
- **Crossover**
- **Mutation**

Reproduction

Reproduction is a process in which individual are copied according to their objective functional values. In natural population fitness is determined by creature ability to survive predators. To define the fitness function is a in given problem is a tedious job, many criteria has to be considered.

Crossover

Crossover is process, which occurs after reproduction, a simple crossover may proceed in two steps. First, members of the newly reproduced in the mating pool are mated in random. Secondly a *crossover point* is randomly chosen for two randomly selected individuals (parents). This point occurs between two bits and divides each individual into left and right sections. Crossover then swaps the left (or the right) section of the two individuals.

Mutation

The purpose of mutation is to provide some small random change in the chromosomes. Mutation operates at the bit level by randomly flipping bits within the current population. Mutation rates are low, generally around one bit per thousand. In Neural network mutation we are providing by means a small random change. Mutation will give the guarantee that a chromosome will not get struck at a certain values

Mutation alters one individual, parent, to produce a single new individual, child. Let pm be the probability of mutation, then as in the crossover routine, we first determine whether we are going to perform mutation on the current pair of parent chromosomes. If a mutation operation is called for, we select a mutating point mpoint, and then change a true to a false (1 to 0) or vice versa. The real value and fitness of the new individual child are then computed:

IV. CONCLUSION

In this presented work we have generate a new routing sequence based on the Genetic algorithm. In this work we have studied all possible paths between each pair of nodes and find a new efficient routing that is congestion free and that will result more reliable data transmission. As the use of the Genetic approach result the intelligent approach to identify the new route over the network.

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