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A Survey on Using Fuzzy Logic in Edge Selection of XTC Algorithm for MANET

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ABSTRACT: In mobile adhoc networks, each and every node can move freely with its own speed. There is no static topology in mobile adhoc networks. The nodes position or location keeps changing without any predictions. In such environment, the nodes have to communicate with each other. The nodes make use of batteries or alternative means for energy and lifetime. Preserving energy of the mobile nodes is one of the most important criteria to be dealt with. Since mobile nodes have limited energy for communication and transmission of information, Topology control algorithms are used to save the energy of the nodes, to increase the lifetime of the networking nodes and to ensure efficient communication between the nodes of the mobile adhoc network. One such topology control algorithm is XTC (Extended Topology Control) algorithm. XTC algorithm can work in any environment under any condition. For an XTC algorithm, the node of a network may not need to know about the geographical location of other nodes. XTC works in three phases. i.e. Neighbour ordering, neighbour order exchange and edge selection. In the third phase of XTC algorithm we are incorporating fuzzy logic for edge selection. To improve routing efficiency the decisions of fuzzy logic system is assumed to be appropriate.

KEYWORDS: XTC, MANETs, Fuzzy logic, Topology control, Energy efficient

I. INTRODUCTION

Mobile adhoc networks and sensor networks has been widely used in almost any application across the world. Mobile adhoc networks are group of mobile nodes that communicate with each other. Manets have dynamic topology i.e. nodes will not be in same position. The nodes of a mobile adhoc network keep moving from one location to another location and thus form the dynamic topology of the network. In a mobile adhoc network, one of the most important criteria to be dealt with is lifetime of the nodes. As node substitution, in case of a node failure requires a considerable amount of work and if the power failure of the node increases then it will become cumbersome to perform any operation on network. So, to ensure that the network works effectively and efficiently, it is necessary to conserve energy of the nodes for having long battery lifetime. Topology control algorithms are used to maintain the topology in such a way that the node's life increases. Topology control algorithms avoid the long distance communication between the nodes. It controls the topology of the network to save power and lifetime of nodes. There are many topology algorithms that are used. One such algorithm is XTC. XTC is a novel algorithm that works in all conditions and doesn't require information of location of nodes that are present in the network. XTC satisfies symmetry, connectivity, low degree and planarity properties of undirected graphs. The algorithm works with a general notion of a quality order over a node's neighbours. XTC algorithm works in three phases i.e. neighbour discovery, neighbour order exchange and edge selection. In this paper, edge selection of XTC algorithm is done through fuzzy logic. Fuzzy logic is used to select the edge for communication between the nodes of the mobile adhoc network. Fuzzy set theory is an extension of conventional set theory. It works on the values between 0 and 1. Fuzzy theory has the attributes that are between complete true and complete false values. The capability of fuzzy logic is exploited in many fields like: image, speech and signal processing; aerospace, robotics and embedded systems industries.

II. RELATED WORK

XTC is a topology control algorithm that works in any type of environment and for any undirected graph. The distinctive attributes of XTC algorithm are symmetry, connectivity, sparseness, and planarity. XTC topology control algorithm is faster than any other existing algorithms. XTC topology control algorithm need not know the exact node locations. The technique of XTC for saving energy is to avoid long-distance communication links and in place of it

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route a message over several small (energy-efficient) links. XTC algorithm's primary concern is to preserve energy of the nodes of the network.

The XTC algorithm consists of three main phases i.e. Neighbour ordering, Neighbour order exchange and edge selection. In neighbour ordering phase, each node of the network computes a total order over all its neighbour nodes of the network graph. From an abstract point of view, the total order computed is used to reflect the quality of the links to the neighbours. A node will consider its neighbours in graph according to neighbour order information with respect to decreasing link quality. The neighbour ordering can also be done by taking into consideration other notions, such as signal attenuation or packet arrival rate.

In the second step the neighbour order information is exchanged among all neighbours. Typically a node broadcasts its own neighbour order while receiving the orders established by all of its neighbours.

During the third step, which does not require any further communication, each node selects those neighbouring nodes which will form its neighbourhood in the resulting topology control graph, depending on the previously exchanged neighbour order information. The XTC algorithm is executed at all nodes. At first, the nodes information table is empty. A node traverses with decreasing link quality. First good neighbours are identified and worse neighbours are considered next. Each node computes the total order for all the neighbouring nodes. As all the nodes have completed the ordering information, neighbour exchange phase begins. After completion of the neighbour exchange phase, edge selection for the communication takes place.

III. PROPOSED SYSTEM

A. *Fuzzy logic*

Fuzzy set theory works on crisp input values. In a fuzzy system, membership functions are used for fuzzification of input variables and de-fuzzification of output variables. Fuzzification is a process in which crisp input values are represented using membership functions. Crisp input values are provided to a fuzzy logic system. Fuzzy inference engine applies a set of rules on the given input values with specific constraints to make a decision.

In the XTC algorithm that we are using, after first step we will get the total order of the nodes and its neighbouring nodes. Once the neighbour exchange information is given, the next phase is edge selection in which the system has to select a node for transferring the data. The node for communication is selected based on the fuzzy inference engine. Nodes total ordering and neighbour info is given as input the fuzzy system. Based on the membership function used, it will decide which node to use for communication.

Fuzzy system applies a set of rules to determine the edge to be used for communication. If an edge is found suitable then it is selected for route data transfer.

A fuzzy system can be shown as follows

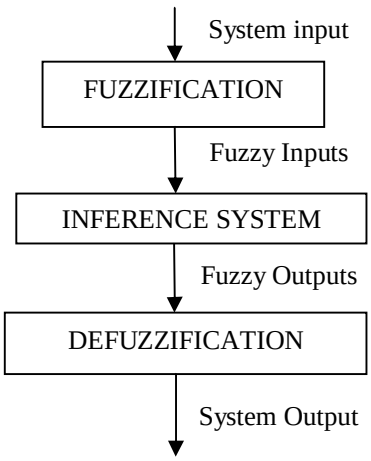

Fig.1. Fuzzy System

B. *XTC using fuzzy logic framework*

XTC algorithm is simple and local topology control algorithm. XTC topology control algorithm can work without GPS and even in a mountainous and obstructed environment. XTC algorithm features all the relevant properties of topology

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control while being faster than any previous proposals. First step in XTC algorithm is computing the total order over nodes neighbours. Once the total order is computed, the neighbour order information is exchanged between all the nodes of the network.

In the third phase of XTC algorithm, we are incorporating the concept of fuzzy logic. Using fuzzy theory, the selection of nodes is done for communication. Fuzzy logic can be used very effectively for selecting the nodes. It works on precise information and data.

Fuzzy logic selects best node of good link quality for communication. Each node has the information of computed total order of its neighbouring nodes. Edge selection mechanism using Fuzzy Logic is used to select an edge from all the edges of the graph of the network for efficient transfer of information. It uses the ordering information of nodes based on the link quality for selecting the edge.

C. *Notations*

Notations used in the description and analysis of XTC using fuzzy logic algorithm are as follows

N	**Node**
G	**Graph**
T_{ord}	**Total order**
F_{sys}	**Fuzzy inference engine**
I_r	**Inference rules**

IV. XTC ALGORITHM USING FUZZY LOGIC

For all nodes in G
Step 1: Compute T_{ord} for N over its neighbours
Step 2: Broadcast T_{ord} to each neighbour in G
Step 3: Receive T_{ord} from all neighbours of N
Step 4: Input to F_{sys} is T_{ord}
Step 5: Apply I_r
Step 6: Evaluate the output of F_{sys}
end

Fuzzy Inference System (FIS) is designed for edge selection. Mamdani Model can be used for developing a fuzzy inference system for edge selection since it is simple, has widespread acceptance and can operate on imprecise inputs. Using a fuzzy inference system involves fuzzification and defuzzification process.

Input variables: total order information based on link quality of nodes. For an edge to be selected, it should have been traversed first among all the neighbouring nodes.

Link quality is divided into three degrees: low, medium and high.

Membership functions defined: Triangle and trapezoidal membership functions are used since the degree of these functions can be easily determined. Triangle membership functions represent the fuzzy input sets medium and trapezoid membership functions represent low and high fuzzy sets.

Triangle membership functions are used to represent output sets small, medium, large and trapezoid membership functions to represent very small and very large fuzzy sets.

Output Evaluation: The aggregate of a fuzzy set encompasses a range of output values, and so must be defuzzified in order to resolve a single output value from the set.

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V. CONCLUSION AND FUTURE WORK

Reducing energy consumption is the one of the most important concern based on other evaluation parameters of MANET. So fuzzy logic derived from fuzzy set theory, as an intelligent tool can be incorporated with MANETs. XTC avoids long distance communication between the nodes and hence helps in saving energy and lifetime of nodes of the network XTC algorithm can be used in conjunction with fuzzy logic. For MANETs fuzzy logic offers following advantages: (i) the terms used in MANET such as lower latency, longer lifetime etc can be easily represented with fuzzy logic. (ii) Fuzzy logic has the ability to work with imprecise data and to make a decision by considering the input. (iii) Fuzzy logic is flexible, fault tolerant, requires less system development cost and design time. It is very important to have correct computed order at the end of first phase of XTC. If order computation has any errors or inaccuracy, it may mislead to wrong neighbour information, which in turn may affect the lifetime of nodes and operations of network.

REFERENCES

1. A Naga Raju, Dr S Rmachandram," FUZZY COST BASED MULTIPATH ROUTING FOR MOBILE AD-HOC NETWORKS" Journal of Theoretical and Applied Information Technology, @ 2005-2008 page, Vol4 No4 ,319-326.
2. L. Jia, R. Rajaraman, and C. Scheideler. On Local Algorithms for Topology Control and Routing in Ad Hoc Networks. In *Proc. of the* 15 th *Annual ACM Symposium on Parallel Algorithms and Architectures (SPAA)*, 2003.
3. R. Prakash. Unidirectional Links Prove Costly in Wireless Ad-Hoc Networks. In *Proc. of the* 3 rd *International Workshop on Discrete Algorithms and Methodsfor Mobile Computing and Communications (DIAL-M)*, 1999.
4. Andreas Meier, Matthias Woehrle, Mischa Weise, Jan Beutel, and Lothar Thiele. Nose: Efficient maintenance and initialization of wireless sensor networks. In Proc. Sixth Annual IEEE Communications Society Conference on Sensor, Mesh, and Ad Hoc Communications and Networks (SECON 2009), pages 1–9, Rome, Italy, June 2009. IEEE.
5. Zheng, Rong, and Robin Kravets. "On-demand power management for ad hoc networks." Ad Hoc Networks 3.1 (2005): 51-68.
6. Wang, Jin, et al. "Energy consumption of swarm intelligence inspired routing algorithms in manets." Multimedia and Ubiquitous Engineering, 2007. MUE'07. International Conference on. IEEE, 2007.
7. Zadeh, Lotfi A. "Fuzzy sets." Information and control 8.3 (1965): 338-353.
8. A.P.Burnwal, Abhishek Kumar and Santosh Kumar Das, "Assessment of fuzzy set theory in different paradigm", International Journal of Advanced Technology & Engineering Research , pp. 16-22 (2013).
9. Wang, P.P.ed., "Advances in Fuzzy sets, Possibility theory and application", Plenum Press, New York, 1983. S. Guha and S. Khuller. Approximation algorithms for connected dominating sets. *Algorithmica*, 20(4):374–387, 1998.

BIOGRAPHY

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