Ant Colony Based Mobile Routing
In Wireless Sensor Networks

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Abstract: WSNs now days becoming more & more important in research area. Advancements in WSN enable a wide range of environmental monitoring and object tracking applications. New Mobile nodes constantly change the topology in network. Thus self – optimizing mechanism is at high priority required to manage frequent change in topology in WSNs. By other conventional routing Ants - based routing is more scalable & robust. Thus is this paper, represents the overview of Wireless sensor networks along with Ant Colony Based Routing Protocol. Along with a new enhances protocol design of Ant Based routing is presented in this work. The proposed enhancement will includes energy consumption, stability and duration in communications.

Keywords: WSN, Ant Based Routing, WANET

1. LITERATURE REVIEW

In 2009, K. Saleem, N. Fisal, S. Hafizah, S. Kamilah, and R. A. Rashid, "**A Self-Optimized Multipath Routing Protocol for Wireless Sensor Networks**", in this author come up with the optimal and organized route for WSN. In addition, Along with to enhanced the multipath capability to avoid congestion in WSN. [1]

In 2009, K.Saleem, N.Fisal, S.Hafizah, S.Kamilah and Rozeha A. Rashid, "**Ant based Self-organized Routing Protocol for Wireless Sensor Networks**", in this author presented the design and result of ant based autonomous routing algorithm for the sensor networks. [2]

In 2012, Dr.S.A. Ladhake, Prof. Shradha A Thakare, "**A Review: Ant Based Ad hoc Routing Protocols**", in this author describes different type of ant based algorithms. [3]

In 2017. Anand Nayyar, Rajeshwar Singh,"

Ant Colony Optimization (ACO) Based Routing Protocols For Wireless Sensor Networks (WSN): A Survey" , In this author presents comprehensive study of Ant Colony Optimization based routing protocols for WSN. [4]

2. WIRELESS SENSOR NETWORK

WSN consists of thousands of autonomous mobile nodes that have limited energy level are deployed in wide range of network range. Thus effective routing protocol is still in high demand as network topology are change & expanding day by day rapidly.

2.2 Protocol Challenges In WS Networks

2.2.1 **Limited Memory Requirements**: Sensor mobile nodes comprising WSN are physically equipped with Low-Memory & processing power.

2.2.2 **Deployment:** Sensor mobile nodes exist randomly in any network Performance of any routing protocol deeply depends on the application used in this deployment.

2.2.3 **Energy Efficiency**: In Sensor mobile nodes energy efficiency is at top most priority as they exhaust the energy while performing each and every task even in packet forwarding for someone else in network.

2.2.4 **Scalability:** In today's world as network topology is changing rapidly more & more mobile sensor node are adding in network. Thus now days protocols must be able to handle large networks.

2.2.5 **Fault Tolerance**: In mobile nodes few of the issue that can occur at any time in the network as listed as: power failure, physical damage, radio interference which overall affects the entire WSN performance

2.2.6 **End-To-End Delay**: Time taken by a data packet to reach from source node to destination node. One-Way: The time from source to destination, Round-Trip: Combined time required from source to destination and from destination to source.

3. ANT BASED ROUTING PROTOCOL

Ant Based Colony Optimization protocol based on no. of features few of them are listed below by which it will be the most suitable for developing WS Networks. Figure 1 represents based structure of Ant Based routing protocol.[5][6]
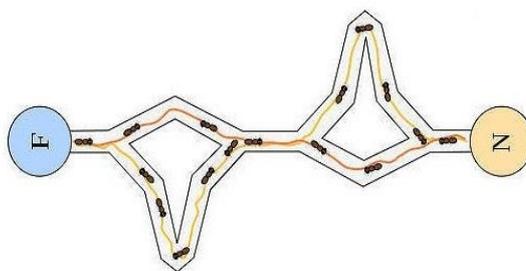
Figure1: Ant based Routing Protocol

1. **Distributed**: Failure rates are reduced to large extent in sensor mobile nodes communications.
2. Every node in the network will perform in getting its own routing table from source to destination and wise versa.
3. ACO algorithms have capability of Self-Organizing which is very important as sensor nodes, when deployed randomly have to fully robust, scalable and fault tolerant.
4. ACO algorithms are very well suited to adapt to all kinds of changes in real-world topology and increase in number of nodes and packet traffic.

4. WORKING PRINCIPLE OF ANT ALGORITHM

Ant Based algorithm has been developed by DiCaro and Dorigo (1998), inspired by real working of ants, How to search for food, and the way they route them self towards the food in the real world. Firstly Ants starts moving towards their food irrespective of knowing complete path. Whenever they reach an intersection they select one path and proceed. While preceding them left back phenomenon by which they came to know that this is selected path in future.

At any intersection Ant has to select the path on which they want to proceed. And the process will remain same backward towards nest.

After these Ants will focus on shorter route as Ants which are using shorter route will leave behind more phenomenon. Eventually all Ants will follow shorter route. [7][8]

4.1 Limitation of Existing Scheme

In the communication process whenever a node detects that the current route in use is no longer exist in the network then the node start route discovery process. In route discovery process following steps is followed:

1.   Every node broadcasts time to live packets in the network. Lifetime of these packets is of max two hops.
2.   Every node that receives time to live packets sends back ACK to the original sender of the packets. By this ACK nodes mark their presence in the network.
3.   Same procedure is repeated for backward route in the network.

In this process sometime time required for this process is too long by which communication process came to halt. Further it increases the overhead over the nodes for energy consumption and consumes processing power at every node.

5.   ANT COLONY OPTIMIZATION BASED ROUTE PROTOCOL - PROPOSED

New optimization in existing protocol is as followed:

Addition of Maintenance Node in the Network

Maintenance node is defined as a host in network which will overhear every transmission in the wireless network. New added node will now take part in the communication process. Similarly as network expands any no. of maintenance node can be added in the network.

Working architecture of new maintenance node is as follow:

1. Suppose in any network node S wants to communicate to node D through node N1 in the network.
2. Node S will forward packet to node N1 which will further forward packet to destination node D in the network.
3. Now Maintenance node M will hear the communication between node S, N1, D. And will monitor the communication process.
4. Now Node M will come in action when the packets from Node N1 will not reach to the node D. In this case node M will send a packet to node D to ensure node D is still in network.
5. If node M will able to establish Communication with node D. That means node N1 which is intermediate node is not reachable by node D in the network.
6. At this stage maintenance node call form New Route Repair. And mark this as link failure prior to actually link failure.
7. Further communication from node S to node D will take place from new route while N1 will remain in reach of Node S.

New Route Repair

In the case of a link failure, new proposed route repair technique can be used in the network assuming that further no communication between two nodes will take takes places as of now. For this new route will be determined as per following new defined rules:

1. Firstly maintenance node will mark the node as moved out of the network and node is no longer available for the existing communication process.
2. Node M will send packets to corresponding node in the networks for removing entries for that particular node from routing information. And imitate route discovery process.
3. Then all nodes in the network remove all associated entries regarding the moved node from its routing table. Now route discovery starts by Flooding out Time to live packets with 2 hops max life. By this nodes will updates routing table.

6. FURTHER WORK

IN this I have defined new proposed Ant Based Route Repair Algorithm. Now left out work is make new definition exists in particle forms. For this I am working on implementation part & more step by step refinement on this algorithm.

7. CONCLUSION

With this paper I have presents an brief overview on Wireless Sensor Network along with rapidly changing Ant Colony based Routing Protocol. Along with this I have proposed a new Route Repair Scheme in this algorithm by which a new route is liable at the time of link failure. This will make network more reliable and robust.

REFERENCES

[1] K. Saleem, N. Fisal, S. Hafizah, S. Kamilah, and R. A. Rashid, "A Self-Optimized Multipath Routing Protocol for Wireless Sensor Networks, International Journal of Recent Trends in Engineering, Vol 2, No. 1, November 2009

[2] K.Saleem, N.Fisal, S.Hafizah, S.Kamilah and Rozeha A. Rashid, "Ant based Self-organized Routing Protocol for Wireless Sensor Networks, International Journal of Communication Networks and Information Security (IJCNIS) Vol. 1, No. 2, August 2009

[3] Dr.S.A. Ladhake, Prof. Shradha A Thakare, "A Review: Ant Based Ad hoc Routing Protocols", International Journal of Emerging Technology and Advanced Engineering ISSN 2250-2459, Volume 2, Issue 1, January 2012

[4] Anand Nayyar, Rajeshwar Singh ,"Ant Colony Optimization (ACO) Based Routing Protocols For Wireless Sensor Networks (WSN): A Survey" International Journal of Advanced Computer Science and Applications, Vol. 8, No. 2, 2017

[5] A study and implementation of ant based routing algorithms for mobile ad hoc networks - Siva Kumar - faculty of information and communication engineering, Anna university Chennai, Chennai - 600 025

[6] The Efficient Ant Routing Protocol for MANET - Srinivas Sethi et. al. / (IJCSE) International Journal on Computer Science and Engineering Vol. 02, No. 07, 2010, 2414-2420 - Srinivas Sethi, Siba K.Udgata

[7] Efficient Ant Colony Optimization (ACO) based Routing Algorithm for Manets - By P. Kranthi Kumar & Dr. V. V. Rama Prasad - Global Journal of Computer Science and Technology: E Network, Web & Security - Volume 15 Issue 3 Version 1.0 Year 2015.

[8] A Self-Optimized Multipath Routing Protocol for Wireless Sensor Networks - International Journal of Recent Trends in Engineering, Vol 2, No. 1, November 2009 - K. Saleem, N. Fisal, S. Hafizah, S. Kamilah, and R. A. Rashid - Universiti Teknologi Malaysia/Faculty of Electrical Engineering, Skudai, Malaysia