Re-Routing Based Hybrid ACO-PSO Based Routing Algorithm for MANETs

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Abstract: The main problem in constructing a MANET is usually providing just about every device to help keep up with the data and instructions required to suitably direct traffic. These systems can operate by themselves or might be connected on the larger Web. They may possibly contain just one or multiple and different transceivers among nodes. This ends up with a remarkably dynamic, autonomous topology. This paper deals with a re-routing based hybrid ACO-PSO based routing algorithm for MANET which is used for mobile multi-hop ad-hoc networks for boosting the performance of the existing protocol for mobile ad hoc network.

Index Terms: MANET, Hybrid ACO-PSO

1. ANT COLONY OPTIMIZATION

Ant colony optimization is defined as a Meta heuristic technique that uses cooperation and adaptation mechanism of ants based on their natural behavior for finding the optimal solution. In the beginning, the ants randomly wander. On discovering a food source the ant walks back to the colony leaving behind pheromones on the way, signaling that this is the path that leads to the food source. When other ants observe the pheromone, they trace that path as it indicates a certain probability. Every ant leaves pheromone on their way back from the food source, thus strengthening pheromone on the path every time an ant passes through it .The ACO algorithm is based on following three things.

- i. Each path followed by the ant represents a candidate solution.
- ii. The amount of pheromone deposition is relative to the quality of candidate solution for the problem.
- iii. When an ant encounters multiple paths, it chooses the one with more pheromones deposited on it.
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2. PARITCLE SWARM OPTIMIZATION

Particle swarm optimization is a computational problem solving technique. It is used to optimize the problem repeatedly making effort to enhance a candidate solution. PSO optimizes a problem by considering candidate solutions and making these particles move around the search space considering suitable define mathe matical formu lae that help the particle's position and velocity. Each partic le's individual local best known position affects its movement. Local and global best positions are being updated continuously every time other particle encounters a better position. And this is exactly how the swarm is directed towards its best and optimal solution. The particles are made to move about in the search-space in accordance to some elementary equations and formulae. The particle's individual best known position and the best known position of the whole swarm decides about how the particles are suppose to move about in the search space. The process of updating positions to improved positions is repeated with a hope of eventually discovering the best solution.

3. RELATED WORK

[7] Ad hoc networks that are capable of changing locations and configuring themselves are called MANET. A single protocol cannot suit perfectly to all networks. There are certain parameters for every network that help to decide which protocol to choose for this particular network. These parameters might as well be some important network characteristics like density or size and even the mobility of the nodes. In this paper the author investigates the security Issues and the counter steps taken over the Network Layer. The Network security unrolls computer security, hence computer security is very important but there are many considerable factors to it, such as maintenance of nodes that also play routers for discovering and maintaining various network routes. Routing protocols has the primary concern of establishing and maintaining the best route between the communicating parties. Any attack can disrupt communication and can paralyze the whole network. Thus, network layer security is crucial for the whole network[8] Developers of wireless sensor networks faced the problems emerging from failures of links communication . memory limitations, computational restrains, and limitation of energy resources. Many optimization problems in wireless sensor networks are solved with the help of approaches that are inspired from the natural biological behavior of insects. A similar solution is provided by another bioinspired approach called Particle swarm optimization (PSO). PSO also addresses the issues of localization of nodes, clustering, aggregation of data and optimal deployment. The papers discuss the above mentioned problems and suggest PSO to the rescue. It also explains its suitability of PSO for these networks.[9] The use of Ant Colony Optimization approach (ACO) by a protocol spawns many paths from source to destination. This aids in getting improved packet delivery ratio by providing the benefit of backup path always available. This paper applies the ACO approach on an already existing protocol that is Conditional Max-Min Battery Capacity Routing (CMMBCR). This protocol maintains the overall transmission energy throughout the network and the residual battery capacity of the nodes. The comparison of this protocol with the classical protocol establishes that this protocol gives better results [10]Wireless sensor networks have strict hardware and resource constraints thus they need efficient routing to deal with this problem. This paper brings to light an exhaustive study and contrast between classical routing protocols and swarm based routing protocols for wireless sensor networks. The paper emphasizes on a need to have specialized performance metrics to study and compare different protocols.[18]The inspiration for making routing protocols with better performance in wireless sensor networks is derived from energy aware routing schemes. This paper proposes an energy-aware routing protocol. The protocol maintains a good balance of energy load among the nodes in order to maintain minimum energy level thus increasing the network lifetime. The protocol uses The Ant Colony Optimization (ACO) based approach to do so. The results of simulation establish that the ACO-EEAODR has superior performance than EEAODR approach. This comparison is made on the basis of in terms of performance metrics and power consumption and network lifetime. [19]In mobile ad hoc networks

boosting security and reducing the number of misbehaving nodes is of vital importance thus it has become an important research domain. Misbehavior may seriously downgrade the throughput, delivery ratio and delay in the network. The misbehavior nodes select a small SIFS (SIFS*) and TO_{CT} S (TO_{CT} S*) values, which in turn are optimized to reduce misbehavior to the minimal. The particle swarm optimization technique has been applied to minimize the number of misbehaving nodes in MANET. It also helps to increase the throughput, delivery ratio and delay in MANETs. [20] The author considers that Ad-Hoc networks optimization problems like routing, power consumption, node deployment and localization. Efforts have been made by various researchers in order to find solutions for this problem .The recent efforts being approaches based on Swarm Intelligence. The paper presents, a survey on different ACO based routing algorithms for Wireless Sensor network (WSN) and Mobile Ad-Hoc Network (MANETs).Also, the algorithms are compared on the basis of pheromone function to select next node, the type of simulator being used and power consumption, and other performance metrics. [21] Agent-based routing represents a set of fundamental rules that all the participating nodes shall follow. Routing turns into an association between nodes, reducing computational and resource costs. Swarm Intelligence takes inspiration from the behavior of some insects. This paper discusses various Swarm Intelligence based routing protocols, and also examines the new bee-inspired routing protocol that provides multi-path routing. Results from simulation indicate that using Swarm Intelligence provides better adaptability and efficiency than traditional approaches. [23] Nowadays, with the proliferation of wireless devices like laptops, smart phones, sensors, mobile ad hoc networking has become very important. The recurring changes in the topology caused by mobile nodes, the unreliability, and the limited bandwidth that wireless channels offer add up to the complexity of the MANETs. Various approaches are being put forward for effectual routing which upholds to boost the results. Since many routing techniques have been proposed, so it becomes difficult to decide which technique will work best with the apparent network conditions. This paper gives an audit of various routing protocols proposed in literature. [24] ACO routing algorithm applies routing metrics like position and energy parameters to achieve better performance and increased lifetime of the network. The proposed scheme omits the use of GPS for knowing the distance between nodes because of the limiting factors such as small size and less computational power and restricted energy resources for the network. The distance between nodes can also be identified by using Received Signal Strength Indicator (RSSI) as a parameter. Proposed optimization algorithm makes sure that nodes

in the network do not run out of the energy above their threshold. Hence, the total energy consumption is reduced, thus increasing the lifetime of network devices as well as the network.

IV. METHODOLOGY



Figure 1: Flowchart -Proposed Technique

- Step 1: Ad-hoc network is initialized with its corresponding characteristics like moving range, maximum dimensions, number of nodes etc.
- **Step 2:** Sender(s) are initiated and their data is being multicast to its defined nodes.
- **Step 3:** Distance matrix is be evaluated using distance information that every node has about its neighboring nodes.
- **Step 4:** Apply path re-routing using improved path re-routing based hybrid ACO-PSO based algorithm to check where failure is found / timeout met in the developed path.
- **Step 5:** Evaluate energy dissipation as well as other parameters
- **Step 6:** If any failure is detected then apply rerouting to transmit the packet, otherwise goto step2.

V. SIMULATION AND RESULTS

1. END TO END DELAY: The period of time taken by the packet to be transmitted all over a system from origin to vacation spot is called end-to-end delay. It is really a common expression in IP system monitoring, along with differs through Round-Trip Time (RTT).

Table 1: End To End Delay Values



2. POWER CONS UMPTION: With electrical design, power consumption often describes the power over period supplied to function an electrical appliance. The vitality used through equipment is always more as opposed to energy really needed. This is due to no gear is 100% useful. Power will be wasted since heat, vibrations and/or electromagnetic rays. Power consumption is frequently measured within units regarding several kilowatt hours.

Table 2: Power Consumption	Values
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Number of nodes	Power consumption
100	4
150	7
200	7
250	8
300	8
350	5
400	5



Fig. 3: Power Consumption Graph

CONCLUSION

A new improved technique is proposed In the interest of overcoming the constraints of the earlier work. The issue of node failure is being addressed by the proposed technique. The proposed algorithm applies path rerouting to handle node failure. Re-routing will be applied on the node whose successive node has failed. This boosts the performance by reducing the power consumption and end-to end delay. The new path will be generated based upon the improved path re-routing based hybrid ACO-PSO based routing algorithm.

REFERENCES

- 1. Günes, Sorges, Bouazizi I. ARA-the ant-colony based routing algorithm for MANETs. In: International conference on parallel processing workshopsIEEE Computer Society Press; 2002. p. 79–85.
- 2. Breed Gary. Wireless ad hoc networks: basic concepts. High Freq Electron 2007:44–6.
- 3. Munaretto Anelise, Fonseca Mauro. Routing and quality of service support for mobile ad hoc networks. Comput Networks 2007;51(11):3142–56.
- Amri Huda Al, Abolhasan Mehran, Wysocki Tadeusz. Scalability of MANET routing protocols for heterogeneous and homogenous networks. ComputElectr Eng 2010;36(4):752–65.
- 5. Ali Zulfiqar, Shahzad. Critical analysis of swarm intelligence based routing protocols in ad-hoc and sensor wireless networks. In: International conference on computer networks and information technology; 2011. p. 287–292.
- Gupta Sachin Kumar, Saket. Routing protocols in mobile ad-hoc networks. Special Issue Int J Comput Appl2011;4(December):24–7.
- 7. Praveen Joshi :Security issues in routing protocols in MANETs at network layer. P. Joshi / Procedia Computer Science 3 (2011) 954–960
- 8. Raghavendra V. Kulkarni, Ganesh Kumar Venayagamoorthy:Particle Swarm Optimization in

Wireless-Sensor Networks: A Brief Survey .IEEE transactions on systems, MAN and cybernetics—part c: applications and reviews, Vol. 41, No. 2, March 2011

- Sanjay K. Dhurandher, Mohammad S. Obaidatand Mayank Gupta: Application of Ant colony optimization to develop energy efficient protocol in mobile ad-hoc networks.Wireless Information Networks and Systems (WINSYS), 2011 Proceedings of the International Conference on
- Adamu Murtala Zungeru , Li-Minn Ang , Kah Phooi Seng :Classical and swarm intelligence based routing protocols for wireless sensor networks: A survey and comparison .Journal of Network and Computer Applications 35 (2012) 1508–1536.
- Guo Lei, Zhang Lincong, Peng Yuhuai, Jingjing Wu, Zhang Xiaoying, Hou Weigang, et al. Multi-path routing in spatial wireless ad hoc networks. Comput Electr Eng 2012;38(3):473–91.
- Mahmood Toqeer, Nawaz Tabassam, Ashraf Rehan, Adnan Shah Syed M. Gossip based routing protocol design for ad hoc networks. IJCSI Int J Comput Sci Issues 2012;9(1):177–81.
- Pi Shangchao, Sun Baolin. Fuzzy controllers based multipath routing algorithm in MANET routing. In: International conference on applied physics and industrial engineering. Part B, vol. 24; 2012. p. 1178– 85.
- Thanushkodi, Deeba K. Hybrid intelligent algorithm [improved particle swarm optimization (PSO) with ant colony optimization (ACO)] for multiprocessor job scheduling. Sci Res Essays 2012;7(20):1935–53.
- Aarti, Dr. S. S. Tyagi. A Study of MANET: Characteristics, Challenges, Application and Security Attacks. IJARCSSE Volume 3, Issue 5, May 2013
- Cheng Hui, Yang Shengxiang, Cao Jiannong. Dynamic genetic algorithms for the dynamic load balanced clustering problem in mobile ad hoc networks. Expert Syst App12013;40(4):1381–92.
- Ejaz Waleed, Manzoor Kamran, Kim Hyung Joo, Jang Byung Tae, Jin Gwang-Ja, Kim Hyung Seok. Twostate routing protocol for maritime multi-hop Wireless networks. Comput Electr Eng 2013;39(6):1854–66.
- Issac Woungang, Sanjay Kumar Dhurendher, Mohammad S. Obaidat, Alexander Ferwom, Waqas Shah: An ant-swarm inspired energy efficient ad-hoc on demand routing protocol for mobile ad-hoc networks. 978-1-4673-3122-7/13/\$31.00 ©2013 IEEE
- 19. R. Kalairasi, Dr. Shridharan: Performance improvement of mobile ad hoc network using particle swarm optimization.. Journal of Computational Information Systems 9: 11 (2013) 4213–4221
- Sudarshan D Shirk ande, Rambabu A Vatti: ACO based routing algorithms for adhoc network(WSN, MANETs): A Survey. 2013 International Conference on communication systems and network topology

- Alexandros Giagkos, Myra S. Wilson : BeeIP A Swarm Intelligence based routing for wireless ad hoc networks .Information Sciences 265 (2014) 23–35
- 22. B. Nancharaiah, B. Chandra Mohan :The performance of hybrid routing intelligent algorithm in a mobile adhoc network. Computers and Electrical Engineering 40 (2014) 1255–1264
- 23. Mahima Chitkara, Mohd. Waseem Ahmad : Review on MANET: Characteristics, Challenges, Imperatives, and Routing protocols. IJCSMC, Vol. 3, Issue. 2, February 2014, pg.432 437
- Vallikannu R , A. George , S.K. Srivatsa: Autonomous localization based energy saving mechanism in indoor MANETs using ACO .1570-8667/© 2014 Elsevier B. V