MANET protocol with Ant colony optimization for real time applications

Pavan kumar Panakanti

1Professor, Dept of CSE, CMR Institute of Technology, Hyderabad, TS, India.

http://doi.org/10.26782/jmcms.2019.10.00035

Abstract:

Mobile ad-hoc network is a most significant job in military applications since it is explicitly planned system for on demand requirement and in circumstances where set up of physical system is beyond the realm of imagination. This special kind of network which takes control in infrastructure less correspondence handles genuine difficulties carefully, for example, exceedingly hearty and dynamic military work stations, devices and littler sub-arranges in the front line. In this manner, there is an intense interest of planning productive directing conventions guaranteeing security and unwavering quality for fruitful transmission of exceedingly touchy and secret military data in guard systems. With this target, a power effective system layer directing convention in the system for military application is structured and mimicked utilizing another cross layer approach of configuration to expand unwavering quality and system lifetime up to a more prominent degree. But here PDO-AODV approach not supports to optimal path selection. So we propose a new ACO-DAEE (Ant colony optimization with delay aware energy efficient) for optimal path selection and mitigating the delay time in network system. The main goal is to maintain the optimal routes in network, during data transmission in an efficient manner. Our simulation results indicate that ACO-ADEE performs extremely well in terms of packet delivery ratio, end to end delay, and throughput. Simulation results through NS2 software to verify the effectiveness of our method.

Keywords: Mobile ad-hoc network, ACO-DAEE, optimal path selection, NS2 software

I. Introduction:

In Present generation the enormous innovative restoration of wireless communication [XXII] is developed on arrangement of Mobile ad hoc networks (MANETs). MANETs are fantastic systems administration form that is based with no settled system. In view of the very unique, amazingly portable and self configurable nature of its self-governing nodes, execution of this system is remarkable as far as transmission, throughput and unwavering quality. Mobile ad hoc networks [XXII] have significant function and activities in battle fields and in a emergency circumstances, for example, arrangement of networks, higher safety efforts in systems, any start to finish transmitting, versatile network beyond
disappointment, hostile to sticking component, and so on. All system action must be done suddenly with no connection disappointment even in miniaturized scale second dimension. The fighters during on line fight ought to have the option to remain constantly associated with one another so as to get any most recent data, or order from their boss or to examine before any activity. Once in a while infiltration of the satellite sign isn't attractive to caverns or thick woods or under ocean places where it is again testing to support connectivity.

Many research works have concentrated on the security of MANETs. The greater part of them manage countable action and discovery ways to deal with battle individual getting out of hand hubs. In such manner, the adequacy of these methodologies ends up frail when different noxious hubs connive together to start a cooperative assault, which may result to additionally pulverizing harms to the system.

II. Related work

In previous works [XXIII], The main Controller of all capacities Power delay advanced AODV protocol which is a routing engine in Mobile network station. Three significant assignments can be executed Successively by AODV portable position or static location of a node and after a packet lands to a node, for example, the channel detecting, the smaller than expected collection of data taking care of module and a keen choice taking sub module. In the main sub module of channel detecting, With the formal interference of time status messages are transferred occasionally by the node so as to communicate nearness of that node in the channel. In the following sub module a little database is kept up to save and review directing data's in regards to a specific way, which can be alluded next time information transmission happens in between same sender and collector. An edge esteem is determined specifically method to choose the following jump station according to the calculation as given underneath, which will be utilized in the steering choice module to at last select an appropriate station. Between the information connection layer and the framework layer by presenting a well disposed parcel between the two cross layer instrument. To decrease the overhead of course detecting regarding deferral and power utilization we propose that this amicable bundle gives fundamental data from the information access connection layer to its upper system layer. Built up an enhanced channel get to procedure near MAC layer to make it good to work with PDO-AODV.

III. Proposed framework

In this section, The working model is presented, ACO Based Efficient Routing protocol for MANET with Distance, Energy, and Link quality. The model shown in figure 1 is consists of three main components -Trust Model, Optimal Forwarder Selection Function and Improved Pheromone Update Model.
A. Trust model

In Trust Model, nodes rate each other by utilizing the data of their own immediate collaborations with their neighbors. This is named in the writing as First Hand Information (FHI). So as to make the rating impartial, the nodes likewise gather their neighbors' co operations with that node being evaluated considered as circuitous communication. This rating data gathered from the neighbors is otherwise called Second Hand Information (SHI). The simulation period is now divided into ‘n’ slots where each slot consists of two sub-periods -Forwarding and Monitoring Interval, TFMI followed by Update Interval TUPI as shown in Table1.

B. Forwarder selection function

This function is a probability function that is utilized at each node along the way from source to sink node in the system to choose the best next neighbor to advance the parcel to the sink node. The Forwarder Selection Function should dependably pick an ideal way from source to the sink to advance the bundles with the sole goal to improve the Network Lifetime by adjusting the vitality among the nodes in the system to guarantee that a few nodes along the way don't get drained quick and in the
meanwhile choosing great quality connections along the way to ensure that node vitality isn't squandered because of too visit re-transmissions.

In light of these targets, we have utilized FSF, a probability function to choose the best forwarder node among the neighboring nodes of the present node, which depends on Pheromone Trail (PT) and heuristic capacity including two sections speaking to Node Energy level (EN) and node connect quality (LP) capacities. Pheromone Trail (PT) speaks to the centralization of pheromone stored on the way between the nodes thinking about Energy, separation and connection quality along the way (containing the connection among present and neighboring nodes) from source to goal. As such, higher PT speaks to the better great quality way from source node to the goal regarding vitality, separation and connection quality. Node Energy (EN) work speaks to vitality dimension of the neighbor node and Link quality (LP) work speaks to the nature of the connection between the present node and the neighbor node under thought.

The Forwarder Selection Function is a probability function which must always choose an optimal path from source to the sink to forward the packets with multiple objectives:

- To provide a secure trustworthy path from source to sink by avoiding insider attacks,
- To improve the Network Lifetime by balancing the energy among the nodes in the network to ensure that some nodes along the path do not get depleted fast (resulting in Network disconnections or partitioning)
- At the same time selecting good quality links along the path to guarantee that node energy is not wasted due to too frequent retransmissions.
- Further, selection of shorter paths involving less number of nodes resulting in further saving of energy due to less number of nodes participating in packet forwarding.

\[
\text{FSF} (n_i, n_j) = \begin{cases} 
\frac{[PT(n_i,n_j)]^a[EN(n_j)]^b[LP(n_i,n_j)]^c[TR(n_i,n_j)]^d}{\sum_{n_j \in \text{NBS}(n_i)}[PT(n_i,n_j)]^a[EN(n_j)]^b[LP(n_i,n_j)]^c[TR(n_i,n_j)]^d} & \text{if } n_j \in \text{NBS}(n_i) \\
0 & \text{otherwise}
\end{cases}
\]  

Where NBS (n_i) speaks to the arrangement of neighboring nodes of n_i, PT (n_i,n_j) speaks to the convergence of pheromone stored on the way between the nodes n_i and n_j, EN (n_j) speaks to the vitality dimension of the neighbor node n_j, TR (n_i,n_i) speaks to the Trust rating of the neighbor node n_j as given by node n_i.

LP (n_i, n_j) speaks to the nature of the connection between nodes n_i and n_j, i.e., link probability. The Expected Transmission Count, ETX is an estimation of the transmission connect which is determined dependent on the past occasions happened on that interface.

---

Pavan kumar Panakanti
Then the link probability $LP (n_i, n_j)$ between nodes $n_i$ and $n_j$ is given by the expression:

$$LP (n_i, n_j) = \frac{1}{ETX (n_i, n_j)}$$  \hspace{1cm} (2)

$\alpha, \beta, \gamma, \delta$ are the parameters to control the significance or importance of pheromone trail of the path, node energy level, link quality between nodes and node trust rating. When $\alpha=\beta=\gamma=\delta=1$, all four parameters PT, EN, LP, TR are given equal importance in the selection of the forwarder node. If one is interested in giving higher importance to TR, node trust rating, then one could make $\alpha=\beta=\gamma=2, \delta=1$, similarly $\alpha=2, \beta=1, \gamma=\delta=2$ to raise importance of EN, Node Energy Level, $\alpha=2, \beta=\delta=2, \gamma=1$ to make importance of link quality more significant in the selection of forwarder node.

Let $EI (n_j)$ be the initial energy of node $n_j$ and $ER (n_j)$ be the Remaining (Actual) Energy of node $n_j$, then the Node Energy level, $EN (n_j)$ is defined as

$$EN (n_j) = \frac{ER (n_j)}{EI (n_j)} \text{ Where } ER (n_j) > E_{th}$$  \hspace{1cm} (3)

C. Pheromone Model

It has been seen that the measure of pheromone figured to be put on the way during return adventure isn't appropriate to mirror that way as the ideal during the reenactment time frame. Most grounded way ought to have biggest measure of pheromone though weakest way ought to have least measure of pheromone or very nearly zero. Among the contending more grounded ways for choice, the varieties in pheromone focus ought to be with the end goal that constantly most grounded way is chosen.

Recalling these, this model has been arranged considering the parameters the forward ant has accumulated during its development from source to the objective. When this forward ant achieves the goal, the accompanying parameters gathered by the forward subterranean ant are analyzed.

IV. Result and discussion:

Our analyses are led utilizing the NS-2.34 simulator. We direct the investigations in two stages. The underlying advance is to check the feasibility of our arrangement, and after that more profound examination is examination is done to survey the postponement and throughput in more detail.

In the first step, there are 40 mobile nodes in the system, and correspondence begins from source to goal. Here hop to hop correspondence happens and we can ascertain the distance dependent on position of an individual node. The individual correspondence between client to client, quantities of information streams estimated. Here we can realize the transmission rate of each node dependent on pheromone esteems. In our work, we can keep up power and postponement for individual nodes and finding the ideal way for determination of a routing.

The associations among versatile nodes are UDP associations, and we send CBR (Constant Bit Rate) traffic in every correspondence channel. The CBR rate of the associations is 512Kb/s. The size of the situation field is 1500m x 1500m. The
directing convention we use is a reexamined AODV steering convention that coordinates our ACO-DAEE, PDO-AODV strategies.

Simulation table:

| PARAMETER                   | VALUE               |
|-----------------------------|---------------------|
| Application traffic         | CBR                 |
| Transmission rate           | 5 packets/sec       |
| Radio range                 | 250m                |
| Packet size                 | 1000 bytes          |
| Channel data rate           | 2Mbps               |
| Maximum speed               | 20m/s               |
| Simulation time             | 10secs              |
| Number of nodes             | 40                  |
| Area                        | 1500x1500           |
| Routing protocol            | AODV                |
| Routing methods             | PDO-AODV, ACO-DAEE  |

Table2: simulation table for network process

![ROUTING DELAY](image-url)

Figure2: NETWORK DELAY
The above graph represented as delay time in system, and it tends to be relies upon time to differ the yield. Here its rely upon number of bundles voyaging and conveyed according to process. Here every parcel voyaging time dependent on that defer time estimated. The exhibition of the ACO-DAEE decline the postpone time in system contrast with Power and Delay Optimized-AODV technique and Cross Layer Power Control strategy.

**Figure 3: Packet delivery ratio**

The above graph represented as packet delivery ratio, also, it tends to be relies upon time to differ the yield. Here its rely upon number of packets voyaging and conveyed according to process. The exhibition of the ACO-DAEE improves the delivery proportion contrast with Power and Delay Optimized-AODV strategy and Cross Layer Power Control technique.

**Figure 4: Network performance**

The above graph represented as Throughput, also, it tends to be relies upon time to differ the output. The presentation of the ACO-DAEE improves the throughput
contrast with Power and Delay Optimized-AODV with DDOS attack algorithm and Cross Layer Power Control technique.

V. Conclusion:

In this analysis, Writers assessed the problem of power efficiency, selecting of node and unnecessary load burden adjusting for mobile ad-hoc networks utilizing a connection based cross layer component. Notwithstanding this we have utilized a companionship based handshake utility as a cross layer approach between information connection layer and system layer to quicken the directing layer process. Here accumulation of information and deferral on steering all the more so we proposed ACO (insect province improvement) with postpone aware energy efficient strategy. This convention takes care of the asset imperative issue of specially appointed system, all things considered, recreation study demonstrates that it explains preferred execution over another driving MANET conventions dependent on comparable cross layer approach. We additionally led reproduction by utilizing NS2 and exploratory results exhibit that our ACO-DAEE is handy for the separate defer mindful nodes and improve the presentation proportion in system.

References:

I. Agbaria, A.; Gershinsky, G.; Naaman N. & Shagin,K. Extrapolation-based and QoS-aware real-time communication in wireless mobile ad hoc networks. In the 8th IFIP Annual Mediterranean Adhoc Networking Workshop, Med-Hoc-Net 2009. pp.21-26. doi: 10.1109/MEDHOCNET.2009.5205201

II. Ahmed, M.; Elmoniem, Abd; Ibrahim, Hosny M.; Mohamed, Marghny H. & Hedar, Abdel Rahman. Ant colony and load balancing optimizations for AODV routing protocol. Int. J. Sensor Networks Data Commun., 2012, 1. doi: 10.4303/ijsndc/X110203.

III. Amulya Boyina, K. Praveen Kumar “Active Coplanar Wave guide Fed Switchable Multimode Antenna Design and Analysis” Journal Of Mechanics Of Continua And Mathematical Sciences (JMCMS), Vol.-14, No.-4, July-August (2019) pp 188-196.

IV. B. Venkateswar Rao, Praveen Kumar Kancherla, Sunita Panda “Multiband slotted Elliptical printed Antenna Design and Analysis” Journal Of Mechanics Of Continua And Mathematical Sciences (JMCMS), Vol.-14, No.-4, July-August (2019) pp 378-386.
V. K. Praveen Kumar, “Active Switchable Band-Notched UWB Patch Antenna”, International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-8 Issue-8 June, 2019.

VI. K. Praveen Kumar, “Circularly Polarization of Edge-Fed Square Patch Antenna using Truncated Technique for WLAN Applications”, International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-8 Issue-8 June, 2019.

VII. K. Praveen Kumar, "Design of 3D EBG for L band Applications" IEEE International conference on communication technology ICCT-April 2015. Noor Ul Islam University Tamilnadu.

VIII. K. Praveen Kumar, Dr. Habibulla Khan "Active progressive stacked electromagnetic band gap structure (APSEBG) structure design for low profile steerable antenna applications" International Conference on Contemporary engineering and technology 2018 (ICCET-2018) March 10 - 11, 2018. Prince Shri Venkateshwara Padmavathy Engineering College, Chennai.

IX. K. Praveen Kumar, Dr. Habibulla Khan "Active PSEBG structure design for low profile steerable antenna applications" Journal of advanced research in dynamical and control systems, Vol-10, Special issue-03, 2018.

X. K. Praveen Kumar, Dr. Habibulla Khan, "Design and characterization of Optimized stacked electromagnetic band gap ground plane for low profile patch antennas" International journal of pure and applied mathematics, Vol 118, No. 20, 2018, 4765-4776.

XI. K. Praveen Kumar, Dr. Habibulla Khan "Optimization of EBG structures for Mutual coupling reduction in antenna arrays; A comparative study" International Conference on Contemporary engineering and technology 2018 (ICCET-2018) March 10 - 11, 2018. Prince Shri Venkateshwara Padmavathy Engineering College, Chennai.

XII. K. Praveen Kumar, Dr. Habibulla Khan "Optimization of EBG structure for mutual coupling reduction in antenna arrays; a comparitive study" International Journal of engineering and technology, Vol-7, No-3.6, Special issue-06, 2018.

XIII. K. Praveen Kumar, Dr Habibulla Khan " Surface wave suppression band, In phase reflection band and High Impedance region of 3DEBG Characterization" International journal of applied engineering research (IJAER), Vol 10, No 11, 2015.

XIV. K. Praveen Kumar, Dr Habibulla Khan " The surface properties of TMMD-HIS material; a measurement" IEEE International conference on electrical, electronics, signals, communication & optimization EESCO - January 2015.
XV. K. Praveen Kumar, "Effect of 2DEBG structure on Monopole Antenna Radiation and Analysis of It’s characteristics" IEEE International conference on communication technology ICCT-April-2015. Noor Ul Islam University Tamilnadu.

XVI. K. Praveen Kumar, Kumaraswamy Gajula “Fractal Array antenna Design for C-Band Applications”, International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-8 Issue-8 June, 2019.

XVII. K. Praveen Kumar, "Mutual Coupling Reduction between antenna elements using 3DEBG" IEEE International conference on communication technology ICCT-April-2015. Noor Ul Islam University Tamilnadu.

XVIII. K. Praveen Kumar, "The surface properties of TMMD-HIS material; A measurement" IEEE International conference on communication technology ICCT-April-2015. Noor Ul Islam University Tamilnadu.

XIX. K. Praveen Kumar, “Triple Band Edge Feed Patch Antenna; Design and Analysis”, International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-8 Issue-8 June, 2019.

XX. K Satish Reddy a, K Praveen Kumar, Habibulla Khan, Harswaroop Vaish “Measuring the surface properties of a Novel 3-D Artificial Magnetic Material” 2nd International Conference on Nanomaterials and Technologies (CNT 2014), Elsevier Procedia material Science.

XXI. Kumaraswami Gajula, Amulya Boyina, K. Praveen Kumar “Active Quad band Antenna Design for Wireless Medical and Satellite Communication Applications” Journal Of Mechanics Of Continua And Mathematical Sciences (JMCMS), Vol.-14, No.-4, July-August (2019) pp 239-252.

XXII. Mamata Rath, Binod Kumar Pattanayak and Bidudhendu Pati, - Energy efficient MANET Protocol using Cross Layer Design for Military Applications -, vol.66, no.2, March 2016, pp.146-150.

XXIII. Mamata Rath, Binod Kumar, Pattanayak and Bibudhendu Pati, - Energy efficient MANET Protocol Using Cross Layer Design for Military Applications -, Vol.66.2, March 2016, pp.146-150, DOI:10.14429/dsj.66.9705.

XXIV. Siva, K. &  P. Duraiswamy, K. A QoS routing protocol formobile ad hoc networks based on the load distribution. Inthe IEEE International Conference on ComputationalIntelligence and Computing Research (ICCIC), 2010,pp.1-6.doi: 10.1109/ICCIC.2010.5705724.

XXV. Srivastava, S.; Daniel, A.K.; Singh, R. & Saini, J.P. Energyefficientposition based routing protocol for mobile ad hoc Networks. In the IEEE International Conference on RadarCommunication and Computing (ICRCC), 2012, pp.18-23.doi: 10.1109/ICRCC.2012.6450540.