

Efficient Optimization Techniques for Improving the Residual Energy of Wireless Adhoc Network

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ABSTRACT: Mobile Adhoc network establishes communication without centralized controller or base station. Each mobile node is driven by battery. Key factor to enhance the lifetime is efficient use of battery. The gigantic field of wireless networks has always been the most alluring topic for research as it provides varied phenomenal to explore complexities of networking. Many researches and thesis have shown the maximum utilization of the operational parameters of wireless adhoc networks. In this paper we are going to discuss information regarding intelligent model for wireless networks, their protocols and algorithm efficiency. We are then focusing on the optimization and applications related to the wireless adhoc networks. Failures of node due to limiting power causes system to fail and hence it minimizes the connectivity inside the network between end to end terminals.

Optimization and organization of network resources are responsible for communication over a longer duration in large-scale networks and are helpful to build intelligence. Algorithms is tested for average residual energy, Packet delivery, throughput, delay, jitter, control overhead & normalized routing overheads. Proposed model using Pareto distribution approach have shown to exhibit excellent performance.

KEYWORDS: Ambient intelligence, deployment, Residual energy, Jitter, Pareto, Hyper exponential.

I. INTRODUCTION

Wireless Ad-hoc networks are deployment of several devices equipped with processing capability for a collaborative measurement process. Sensors are in the form of nodes which are sprayed over the globe in random fashion. Every wireless network has some different characteristics as compared to the wired ones. They mainly consist of Sensor devices (usually hardware), Wireless communication modules and Open Source (API). In addition to the wireless communication modules different protocols are followed in different systems depending on the behaviour of the clustering nodes and processing base station.

.A node structure consist three main sections of microcontrollers for data processing, battery for power requirements and storage for containing information in regards to future processing. Different communication modules can be used according to the requirements like IEEE 802.15.4, Zigbee, DigiMesh, Bluetooth, GPRS, 3G support, Wifi etc. For storing all sort of processing information and calculative measurements EEPROM's (Electrically erasable program read only memory) are widely used. Nowadays SD cards are available to store upto 2 Giga Bytes of data.

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II. RELATED WORK

Energy Model for Multihop Wireless Network

Model is been proposed for estimating total energy consumed in [1] for multihop adhoc network while transmitting data packets over wireless multihop network. For monitoring the remaining hop energy, the proposed model have been improved. This model consider the communication model for energy consumption, throughput, and reliability, retransmission of data packets, acknowledgement and communication delay.

Power conservation has two important sections where the receiver and transmitter consumes energy. Transmitter will consume energy which includes energy of power amplifier, processing circuits and power required for transmitting data packets.

In analytical model various parameters required are

(a, b) is the wireless link

Sender is a

Receiver is b

data rate is d_r

P_{tp} is the power for transmitter

P_r is the power for receiver

The efficiency of power amplifier k_a

X is the length of bits in a packet

$\epsilon(a,b)$ is the conservation of energy required by a for transmitting the data

$$C(a,b)=(P_{tp}+P_r)K_a$$

Model for Fading Channel with Multiple domain Components:

Accurate channel models are required for wireless communication having multiple dominant specular components for improvising efficiency of spectrum in Femtocell design and high speed train applications which are maintained in [2]. The fading model is considered as simple and flexible for the diffuse scatter & multiple specular components, with a parameter adjustment of severity of the fading. For received signal representation which is composed of both line of sight component & scatter components, the Ricean fading channel model is best suited & explained in [3]. LOS fading conditions of different severity is represented by Generalized Ricean Model. Many researchers have considered nakagami m distribution and Ricean distribution [4].

In the design of fading wireless system, distribution for the Nakagami-m has better results in many application and is the excellent model for diffuse fading explained in [5], [6], [7].

Probability distribution function of the Nakagami-m $f(r,m,\Omega)=\frac{m^m}{\Gamma(m)}\Omega^{-m}r^{2m-1}\exp(-m\Omega r^2)$

Protocols in Mobile Adhoc network:-

The mobile adhoc network has the self-design limit of cell phones and are associated by remote connection. Amid the most recent couple of years, calamity, military and law requirement division have taken up parcel of difficulties of research in different parts of Manets.

Correlation of fundamental conventions i.e. DSDV, LSR and AODV is completed by numerous scientists as far as various computational parameters. These conventions are autonomous of the area and security of routing. For routing in combat zone, area based conventions are conspicuous and takes help of GPS to get the genuine area as directions. Address resolution protocol contributes in security in view of trust qualities. SPAAR will be valuable for diminishing

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the quantity of directing messages however it won't be used for high hazard management. PRISM is an a responsive protocol which will be helpful for limiting directing overheads and gives security against outcasts and insider assault. Alert, being a Proactive convention will likewise give security to the system against inside and outside assault [8].

Optimization of Energy using Cluster-based WSN

Sensor networks have many applications in military, healthcare & creating intelligent networks. No maintenance needed in case of wireless sensor network. The network lifetime will be restricted by the battery. In the cluster design, the cluster heads is responsible for efficient energy management. We always focuses on creating an energy-saving method for the cluster heads. In this method, "polling" approach has been effective in absolute data transmission and reception. Cluster head will save power through sleep mode of data reception [9].

Packet Arrival Analysis

Clustering plays a vital role for increasing the life span & scalability of the network. There is a very important & interesting area of investigation in the cluster i.e. about the type of distribution for arrival at the cluster head and intermediate routing node. For estimating the performance metric, modelling the network becomes essential. Exponential distribution in wireless sensor network is presented for estimating the arrival distribution. This work will be further extended to find the impact of delay & how it affects the inter arrival distribution based on the type of MAC control used in WSN [10].

Single transmission is done in a transmission area using MAC as wireless channels are essentially a medium for broadcast. As a result of this, simultaneous transfer is not possible. The MAC layer is responsible for introducing a non-deterministic delay for accessing the channel. If a adjacent node is transmitting a packet, the MAC packet introduces a delays in transmission for the random amount of time so that collisions could be avoided between the ongoing transmission and the nodes which are trying to access the channel. The distribution of interarrival times of the packets do not occur frequently & generally it is assumed by a poisson's process as well as the inter arrival time by exponential distribution.

Interference due to various routing strategies in Adhoc Wireless Networks:

The performance of wireless adhoc network in terms of delay, coverage & interference is affected by the routing strategies. Power control is done & interference is observed in a network using different routing strategies. Analytical model is formulated & tested for calculating mean value and variance of interference while considering the signal power using different routing methods based on long hop [11].

Two issues have been identified i) Impact on overall performance due to interference. Power control of nodes and impact of geographical routing algorithm on nodes are explained in terms of interference in [12- 13]. Power control of signal is depicted in [14]

Particle Sworn Optimization for minimal Transmission Power:

There is enormous development in Internet of things because of interconnections of more sensor nodes. In remote sensor systems, energy constrained gadgets and methods assume an imperative part to save energy of a node. Energy saving is conceivable at a cost of system. Its results will be looked for keeping the correspondence powerful. Particle Sworn Optimization is compelling in effective computing of different transmission powers for every node. The outcomes acquired demonstrates that the PSO is effective in saving energy with a solitary transmission control level [15].

Brought together arrangement addresses many issues, for example, node limitation, ideal node sending, data grouping and information total [16].In this correspondence inside a solitary cluster is considered. In the event that considered node connectivity and organization, a PSO based calculation is proposed .For finding semi optimal transmission

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energy of every node with a specific end goal to limit energy utilization while keeping the completely availability among nodes.

There are numerous arrangements accessible which concentrate on energy saving issue. For example, Latiff et. al has proposed a clustering method which utilizes PSO for accomplishing the proficient energy management. This is finished by PSO where the determination of cluster heads (CH's) happens as indicated by the remaining energy, which has been demonstrated to essentially expand the lifetime and data delivery in WSN systems [17]. Energy efficiency has likewise been accomplished utilizing Particle Sworn advancement for the directing convention. This work is finished by Sarangi and Thankchan [18] indicates PSO calculates the cheapest route and outperforms over the Genetic Algorithm. Hoetalet. al have actualized a joint enhancement of BERs, finding Unmanned Ariel vehicle (UAV) course, and energy consumption of system in light of energy modification utilizing PSO. Changing the node transmission power is the essential target .In this work, sensor network has been contemplated giving the establishment to hub organization and vitality productive emphases [19]. There are a lot of testing issues that impacts the outline of routing algorithms in Wireless sensor arrange and which has been completed by Hannef and Deng [20] and gave a straightforward characterization of directing calculations. Near investigation in light of WSN has been examined. Topology control methods are utilized for expanding the lifetime of battery controlled WSN's and its energy efficiency has been considered by Aziz et al [21] whose work concentrate on choosing an arrangement of nodes in a system for development of proficient topology. The determination of neighbouring nodes happens and its criteria, to be specific, density of node, energy reserve and node identifier.

Particle Swarm Optimization:

PSO calculation is presented by B Nancharaih and B Chandra mohan .Important measures in portable adhoc systems are end to end delay, control utilization and cost of correspondence .For the change of different measurements, PSO & ACO optimization is utilized [22]. In ACO calculation, mobile agents are utilized as ants to recognize most possible way and best way in a system. The PSO gives the best strategy to identifying position, speed and limits cost, power, and end to end delay.

Performance of a Hybrid Routing Intelligent Algorithm:

It has been seen that various metrics have been improved using Ant colony Optimization & Particle Swarm Optimization. ACO algorithm has efficiently used ants to identify most feasible and best path in a network. Location of path is specified by ACO algorithm when they want to communicate between two nodes. Solution for Cost ,power, end to end delay, particles position ,velocity have been suggested by PSO in a best possible manner as narrated in [23]. Particle Swarm Optimization is the efficient mathematical modelling for the food searching activity of a swarm of particles .Each Swarm particle will add a velocity & its position's to achieve best optimal point. It will have two main operators: a position update and a velocity update. For each generation, each particle will be accelerated in the direction of pbest & gbest position.

$$vid = w \times vid + c_1 r_1 (pid - xid) + c_2 r_2 (pgd - xid)$$

$$xid = xid + vid$$

These equation provides the formula for position & velocity update.

The velocity of particle is Vid ,

The current position of the particle is X_{id}

w is the inertial weight

C_1 is the cognitive inertial coefficient

C_2 is the social acceleration coefficient

The own best position of the particle is P_{id}

Global best position among the particles of a group is P_{gd} .

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r_1, r_2 will be the random numbers distributed uniformly from [0 to 1].
Xid+1 is the modified position.

Multihop Wireless Adhoc Network Routing

In the past few years many routing algorithm has been developed with multihop nature of adhoc networks. This requirement arises due to less coverage area of the mobile nodes in wireless adhoc network. Using random mobility model, many packet level simulation have been carried out using TORA, DSDV, DSR & AODV routing protocols [24].

Estimation Model for quality of link in energy efficient wireless sensor Networking

Nodes are intelligent & will make decision when to transmit packet in a network in order to reduce cost of retransmission & packet loss. In this paper, expected duration is computed for stable quality of link using CDF of the S/N ration of received acknowledged packets. Imote-2 model has been designed & transmitted more than 70,000 packets. Packet delivery is high in 90% of time if comparison is done with the packets transmission without quality knowledge [25].

Parameter Estimation over Wireless Sensor Network using Centralized Adaption

Nodes transmit the data over central processing unit using CLMS algorithm through fading channels. There are lot of impairments including path loss, fading, link failure, transmitted data degrades the performance of adaptive solution. In this paper a novel CLMS calculation will utilize a refined variant of the transmitted information and it will have interface disappointment alert technique for disposing of seriously mutilated information. The execution of this CLMS calculation is degrades in remote sensor systems where connects amongst nodes and combination focus had been impaired by noise and fading. The BC-CLMS calculation is enhanced adaptation for stable and better coverage towards an unbiased estimate for little adaption step estimate [26].

Communication Services in a Real Time wireless Industrial Network

For high reliability & meeting time requirements, wireless communication system used in industrial applications should cope up with performance measures of real time wired hybrid networks. Scheduling framework will be a relevant for deploying real time behaviour in case of distributed measurement of control processes. In IEEE 802.11g network, models for transmission time for retransmission has been designed due to channel interference and impairment [27].

III. EXPERIMENTAL RESULTS

We have simulated various networks using different probabilistic approaches. We have found that there is a impact on energy, packet delivery ratio & throughput if nodes are placed using probabilistic distributions in a specific range inside a network. Table 1 provides the simulation parameters for creating networks. These parameters are useful & effective for analysing computational parameters in wireless Adhoc networks. Figure a, b are the Nam files generated using NS2 which shows various networks created using simulation parameters as mentioned in table.

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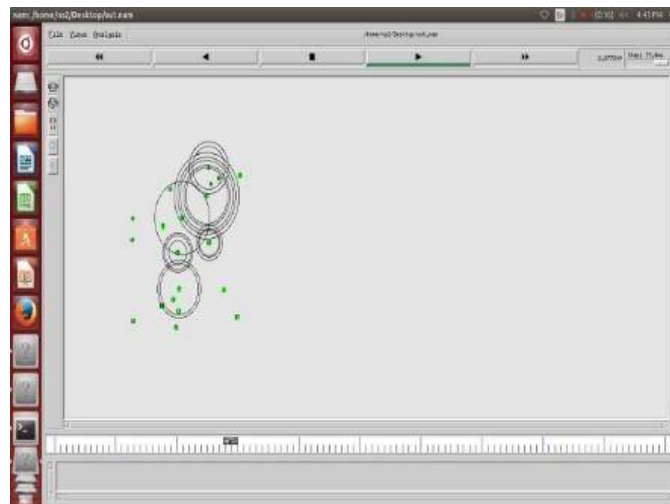
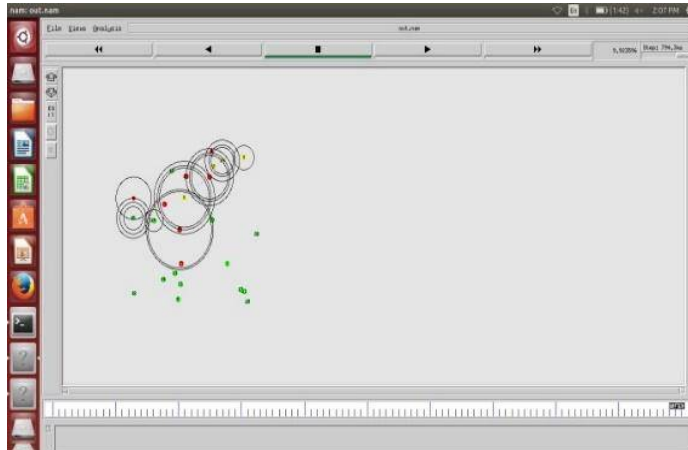


Fig.. Network Animated File (a) 25 nodes (b) 20 nodes

Table 1: Simulation Parameters:

Number of nodes	25
Routing Protocol	AODV
X	4126
Y	100
Initial Energy	5
Idle Power	0.0144
Rx Power	0.0144
Tx Power	10.10
Sleep Power	0.000015
Packet Size	50
Packet interval	0.10

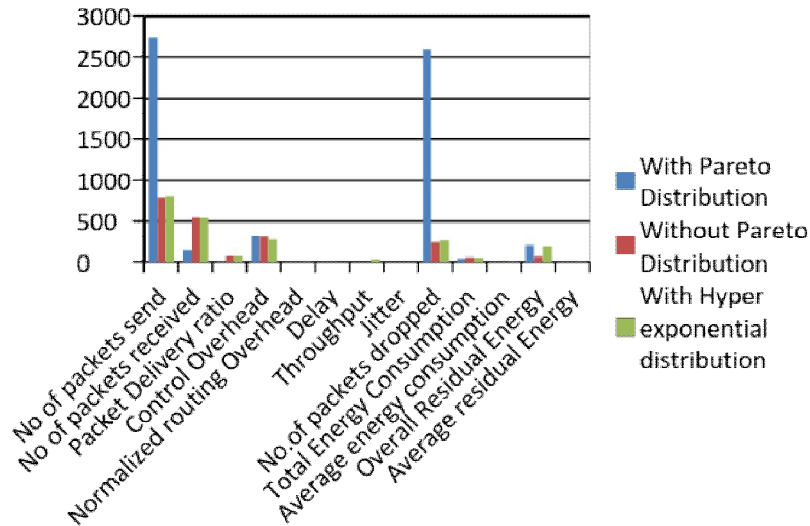
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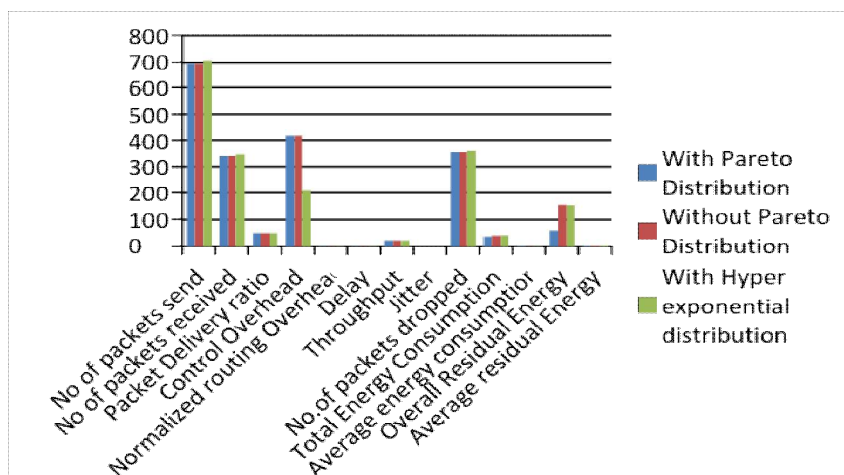
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Graph1:-Computational Parameters for 25 mobile nodes



Graph 1 shows that average residual energy is high i.e.3.76 Joule if packets are distributed using Pareto approach in a network of 25 mobile nodes. These residual energy for no Pareto approach is 2.67 Joule & 3.92 Joule for Hyper exponential approach. However average energy consumption of mobile nodes is 0.8586 joule. Jitter during packet transmission is 0.016 which is also comparable with hyper exponential distribution.

Graph 2:-Computational Parameters for 20 mobile nodes



Graph 2 shows the various computational parameters computed using Pareto & hyper exponential distribution of wireless adhoc network in 20 node scenario. Average residual energy of packets after active communication in a wireless Ad hoc network using Pareto distribution is 3.95 Joule which is greater as compared to 3.02 using normal distribution & 3.92 for Hyper exponential approach. Nodes in a mobile Adhoc networks are distributed using Pareto

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Distribution, Hyper exponential distribution, exponential distribution and different ranges are assigned. Simulations are done in NS2 for the following parameters

Parameters for Pareto

Avg-10

Shape factor -1.2

Parameters for Hyper exponential

\$r_1\$ set avg_ 1.0

\$r_1\$ set cov_ 4.0

V. CONCLUSION

In this paper we have discussed the energy efficiency of wireless adhoc network using probabilistic approach & suggested new method for improving average residual energy of a node. It has been observed that average residual energy is improved if packets are distributed using Pareto distribution. This probabilistic approach is forwarding packets through multiple paths without making network much complex. Survivability of a network is important criterion in deciding the network protocols efficiency. It includes the network lifetime measure as well as the service type. These factors are very important for evaluating network. Nowadays the ongoing projects are focusing towards the area of Smart Intelligence system, IOT applications, Machine learning & Automation technology. These networks are used in military for creating network for tactical operation. These networks might be of important use in following areas

Traffic congestion- Monitoring of road vehicles and the pedestrian walking on a route so as to optimize the result and conclude the possible traffic prone road maps.

Smart lighting- Sense the level of brightness in the streets and according to the threshold value changes the state of switch to turn on and off of the street lights.

Quality of Service- This is the most important application of Wireless Adhoc network. It provides the information of vibration frequency, strokes, forces and breakage etc. by sensing the products while transporting with the help of road ways like trucks, cars, ships and cargos.

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