IJCTA, 9(12), 2016, pp. 5711-5717

Design of Poisson distribution based Energy -Efficient Protocol (PB-EEP) in Wireless Sensor Networks

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Abstract : This paper aims at developing an energy efficient routing protocol for heterogeneous wireless sensor networks deployed over regions. In wireless sensor network the key issue targeted are the lifetime, fault node discovery and recovery technique. These issues are studied and a new feasible and efficient solution is developed to improve energy. In this work we are using Poisson distribution to find the probable energy efficient node to distribute packets to the destination.

Keywords : ODV, DSR, Routing Protocols, Wireless Sensor Networks.

1. INTRODUCTION

Wireless Sensor Network is the trending technology, glued more researchers due to its complexity and necessity. Unlike infrastructure based network WSNs need the contribution of all node and its dedication to serve other nodes data. While at the same time securing data from various eavesdropping and various attacks also adds more complexity to the network. Moreover the contribution of node is necessitated in Ad-hoc even the packet is not intended for it. Due to these reasons, a node with more neighbors might be targeted by more number of nodes than a corner node who has less number of neighbors. Finding the energy efficient next hop is more important to survive longer in WSN. Earlier proactive protocols were used even it adds more features like fast routing, table maintenance, it lags in performance due to the bulk and frequent beacon signaling. Reactive protocols are on demand routing in which it does not need any periodic signalling information between nodes. Later hybrid protocols were introduced with more features. Every node is responsible for data extraction and computation. It acquires the data from the real environment and has to manipulate the data as per routing protocol. All nodes in a network have to follow a same routing protocol since each protocol proposes different packet format and manipulation. It is still difficult in giving assurance to successful delivery of packets in WSNs, after so many protocols have been introduced. All of these processes required real time response and concurrency between nodes.

2. RELATED WORKS

To eliminate or in order to reduce complexity in infrastructure networks, Wireless Sensor Network (WSN) introduced communication network, in between the nodes for routing purposes. Paper [1] explains the concept of wireless devices which communicate on the fly for their own applications, not on base station network (nodes). For that, fly for applications [1] discussed an algorithm of multipath OLSR (Optimized Link State Routing) helps to enhance exchanges between the number of nodes and their energy optimization of nodes, to choose alive nodes in network nearly 10 to 25% and end to end delay as QoS parameter. These optimization overheads and some other measures of routing algorithms had presented in OLSRM and OLSR (Optimization of Energy Consumption for OLSR Routing Protocol in MANET).

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To enhance wireless sensor networks communication to best extent, one of important factor is energy efficiency because it is related to speed and data collection between sensor nodes in network. To improve this factor, sink mobility along a constrained path is opened to unlimited communication time to observe and monitor data to collect exact sensor nodes deployed randomly. Paper [2] proposed a novel data collection scheme, through this scheme we address the issues which are related to speed to data collection and energy consumption. This scheme introduces Maximum Amount Shortest Path which increase throughput on network, as find optimizing in energy. Genetic algorithm helps to solve integer linear programming problem which helps to formulated MASP in implementation and distributed algorithm also include in two- phase protocol. This experiment results are validated through OMNET++ for both protocols and algorithm. [2] Efficient Data Collection in Wireless Sensor Networks with Path- Constrained Mobile Sinks in WSN, single path routing protocols are forms holes in the network, nodes which are present in that single path are handle the data transmission in that network. To overcome problem in single path routing, WSN recommended multipath routing protocols in networks to increases nodes lifetime by properly handle traffic and distributing in multiple paths. In paper [3], author proposed multipath routing to spread load in different nodes and multipath search protocols discover disjoint paths between the sink and source nodes. The proposed protocols show better improvement in packet delivery, fraction, node to node impediment and energy expenditure as compared to EENDMRP and AOMDV. [3] Energy-Aware Node Disjoint Multipath Routing Protocol for Wireless Sensor Networks.

To transfer data from one node to another node in wireless sensor network is very important due to we transfer the datawith low energy efficient manner. Optimized link state routing protocol (OLSR) was proposed in [4] to fulfil the core functionality and enhancements from auxiliary functions. Message corresponding to functions handle by nodes, not by this node which are implemented by OLSR. In OLSR, all nodes addressed by "major address" in network to forwarding data packets. In multiple interfaces major address is used to identify nodes, which is chosen. Finally, transmission power using MIMO (Multi-Input and Multi-output) is minimize.

Energy consumption is crucial issue in wireless sensor network, when we collect the data from sensor node which is placed near the sink is high. Due to energy consumption resulting leads to limit the network lifetime and network partitioning. To solve this problem, this paper proposed Shortest Path Member Assignment (SPMAS) scheme helps to improve the throughput for sensor nodes by providing the optimal assignment as well as energy efficiency. This proposed scheme implemented in different scenarios like trajectories of mobile sinks and validate for NS-2. [5] Efficient Data Collection with path Constrained Mobile sinks using Shortest Path Member Assignment Scheme in WSNs

Advantages and disadvantages

This protocol uses a reactive approach, which eliminates the need to flood the network from time to time with table update messages that are required in a table-driven approach. In a reactive approach such as this, a route is established only when it is required and hence the need to find routes to all other nodes in the network as required by the table-driven approach is eliminated. The intermediate nodes also utilize the route cache information powerfully to trim down control overhead.

The disadvantage of this protocol is that the route maintenance system does not locally patch up out of order link. Stale route cache information could also result in inconsistency through the route rebuilding phase. The connection setup delay is higher than in table-driven protocols. Although the protocol performs fine in fixed and low mobility environments, the performance degrades rapidly with growing mobility. Also, sizeable routing overhead is involved due to the source routing mechanism employed in DSR. This routing overhead is directly proportional to the path length.

3. ENERGY EFFICIENT CHARACTERISTICS OF ROUTING PROTOCOLS

In this division, a range of metrics connected to energy efficiency on WSNs are discussed, that are used to estimate the behavior of routing protocols.

1. **Energy per Packet.** It refers to the amount of energy spent while sending a packet from a source to a destination.
2. **Energy and Reliability.** This refers the way that a tradeoff between diverse applications is achieved.
3. **Network Lifetime.** It corresponds to the time when the first node exhausts its power.
4. **Average Energy Dissipated.** This phrase refers to the average dissipation of energy per node over time in the system.
5. **Low energy consumption.** A low power procedure has to consume less energy than traditional protocols.
6. **Total number of Nodes Alive.** It gives an design of the region coverage of the network over time.
7. **Total Number of Data Signals Received at BS.** This word is alike to the energy saved by the protocol by not transmitting data packets continuously.
8. **Average Packet Delay.** This metric is considered as the average one-way latency that is observed between the transmission and response of a data packet at the destination.
9. **Packet Delivery Ratio.** It is calculated as the ratio of the number of distinct packets gathered at destinations to the amount really sent from source sensors.
10. **Time until the First Node Dies.** This term indicates the duration for which all sensor nodes on the network are alive.
11. **Energy Spent per Round.** This is connected to the entire amount of energy spend in routing messages in a round.
12. **Idle Listening.** A sensor node that is in idle observing mode does not throw or accept data, but it acquires significant amount of energy.
13. **Packet size.** The size of a packet decides the moment that a communication will last. Therefore it is effective in energy consumption.
14. **Distance.** The distance between the source and recipient can influence the power that is required to send and receive packets.

Today home network are the emerging area in networking with help of wireless sensors, due rapid development in the internet. Sensors are placed in consumer product, so its help to collect the data information from the recent places. Consumer product have tiny battery, which cannot replace by every time, in this situation monitoring energy consumption in product is must. For that we proposed two algorithm Energy-efficient Clustering Multi-sink algorithms (ECMA) and Energy- efficient Algorithm (MEA) to solve sink mobility problem and improve performance on network with energy efficient, same thing proposed to multiple sinks also. [6] Efficient Algorithms were suggested to improve the Performance of Wireless Sensors Network using Multi-sink and Mobile Sink.

This paper proposed Connectivity-Based Data Collection (CBDC) algorithm belongs to new data gathering algorithm used in mobile sinks for data gathering with minimized power resources, path constraints and time. The presented CBCD results are compared with LEACH-C algorithm in different levels of sensors networks, in varying mobile sinks. [7] Connectivity-Based Data Gathering with Path-Constrained Mobile Sink in Wireless Sensor Networks. In WSNs, issue like latency in data collection and speed of mobile base stations, rendezvous-based data collection approach points to data originated from sources and arrives at base stations. An approach combines in-network data caching and controlled mobility, achieve a desirable balance between data collection delay and network energy saving were discussed in paper [8].

4. METHODOLOGY

The successful delivery of packets is still unsure in Ad-hoc network. Network life time enhancement and traffic handling are important criteria. All of earlier protocols and routing methods have focused on parameters

mostly in terms of residual energy, battery power. Most of them are still at simulation, implementing them in real time impacts more critics in results. In this paper, we proposed and discussed the result observed at real time implementations. We propose to merge Ad-hoc routing with Poisson distribution in selection of energy efficient node. We add those features with wireless routing and hence provide new concepts in routing and achieving high performance of infrastructure less network. This paper focuses at multiple parameters such as number of neighbors, Travel time, energy of a node etc.

A. Route Discovery & Selection

Before sending data packets source node initiates route discovery process by flooding route request to all neighbor nodes. Each node further floods the request packet till the destination has been found and time to live expire this process would be continued. Route request packet consists of SoF, EoF, source address, destination address, node id as depicted in fig. S0F and EoF are denoted by eight bits '00001110' and '11110001' respectively. SoF is immediately followed by Identifier byte and node id. Here node id represents the intermediate hop which routes to destiny.

SoF	Req	SA	NA	DA	EoF

Fig. 1. Request Packet format.

Initially source node transits request packet with its own address written in SA and NA. An intermediate node left SA, DA and overwrites NA with its own address. Hence node next to it can get to know from where it is receiving packets. In reply packet every node sends set of parameters like number of neighbors to sender, received signal strength.

Reply packet is similar like request packet but packet overhead is added for additional parameters. These parameters are being a key input to the sending node in selection of next hop. Each intermediate node selects best next hops by using BAT algorithm will be discussed later in this paper.

B. Route Maintenance

Route reply packet sent only by the intermediate node which found destination reachable to it by either direct or indirect. If the source node has received route reply packet within TTL period, then definitely there some path exists between source and destination. The data packets will be forwarded to the next hop which found earlier in route discovery process. Each node looks for regular update from its neighbor regarding its number of neighbor state, energy of last received packet, failure status. Route maintenance is most important similar like route discovery.

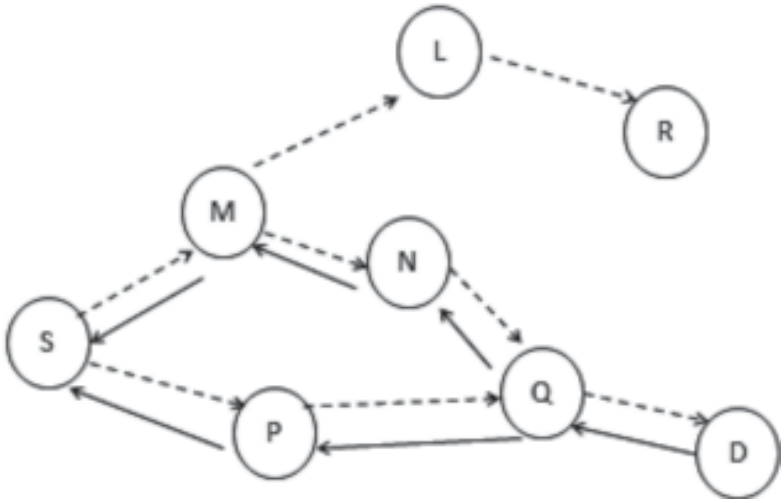

Fig. 2. Route Discovery

In fig 2 source node floods route request and receives reply from various path via destination is reachable. Every node frequently gets update from neighbor about their traffic handling and congestion status. Suppose N is the best next hop it carries traffic. When node N is overloaded by successive packets it would results in packet loss and poor packet delivery ratio. Node M is the sender to node N would be informed about the congestion state. Similar like pattern has to be followed in our proposed method and finally source node can get idea on which node faces the overloaded traffic problem. Hence source node selects next best hop by PB-EEP algorithm. Each node frequently sends the details about number of packets transmitted via it.

C. PB-EEP Algorithm

Route discovery and maintenance process in WSN simply seeks path and frequently check only the presence of neighbors by beacon hello packets. It helps in detecting the route presence. But it does not provide any information about the neighbor. This would effect in loss and lifetime reduction. Though source node sends less number of packets to an intermediate node, the intermediate node may sense more congestion, it would affect ongoing transmission. In case a node involved in two different packet transmissions, then both route maintenance process would be thinking that the neighbor is available for its own packet transmission by seeing the beacon signal. Hence the particular node X receives data packets from both transmissions. When more no of packets were handled by a single node then its energy drains earlier and causes node to die and extend to stay out of network. Sometimes results in network portioning and it must be avoided to stay longer and improve network life time. We conclude that apart from presence, the traffic handled by all intermediate nodes would play more in packet routing.

PB-EEP Algorithm

1. Send Request packet wait till TTL (T_L) expire.
2. If route reply received, find the energy efficient next hop N_E.
   Where NE • $\{H_{max}, EEN_{max}\}$
3. Each node Ni finds energy efficient neighbor N_{i+1}.
4. Carry data packet at selected best route.
5. Sense number of packets carried by intermediate node N_{i+1}.
6. If traffic handled $T_h > T_l$, send congestion indication to node N_{i-1}. else continue step 5 for every certain period.
7. If T_h is high then stop sending new packets to that node and continue with step 1.

5. SIMULATION SETUP

NS2 Network Simulator tool is used to evaluate the performance of different Ad hoc routing in wireless sensor networks. In this simulation, we have tested routing protocols with 50 nodes. The nodes are deployed randomly in a terrain of 200 X 200 m2. CBR is used as data traffic application with multiple source and destination. The parameters used in the simulation are summarized in the table below:

Table 1. Parameters used in Simulation

Parameters	*Values*
Routing Protocols	AODV, PB-EEP
MAC Layer	802.11
Packet Size	512 bytes
Terrain Size	200 X 200 m2
Nodes	50
Node Placement	Random

Parameters	*Values*
Data Traffic Type	CBR
Source	Multiple Source and Destination
Total Bytes of Data sent	10000 bytes
Simulation Time	1000 sec
Antenna Type	Omni Directional
Simulator	NS 2.28

6. RESULT & DISCUSSION

Real time implementation of Ad-hoc network and the verification of various algorithms are quite difficult and different than implementing in simulation. Network lifetime should be long enough to survive longer and it is affected by network parameters like traffic size, number of packets. Network life time is the lifetime over which no existing connected node drained out its energy in packet transmission and no node dies. Network parameters of entire network can be estimated by analyzing a single node with more number of neighbors or node which involved in more number of packet transmission.

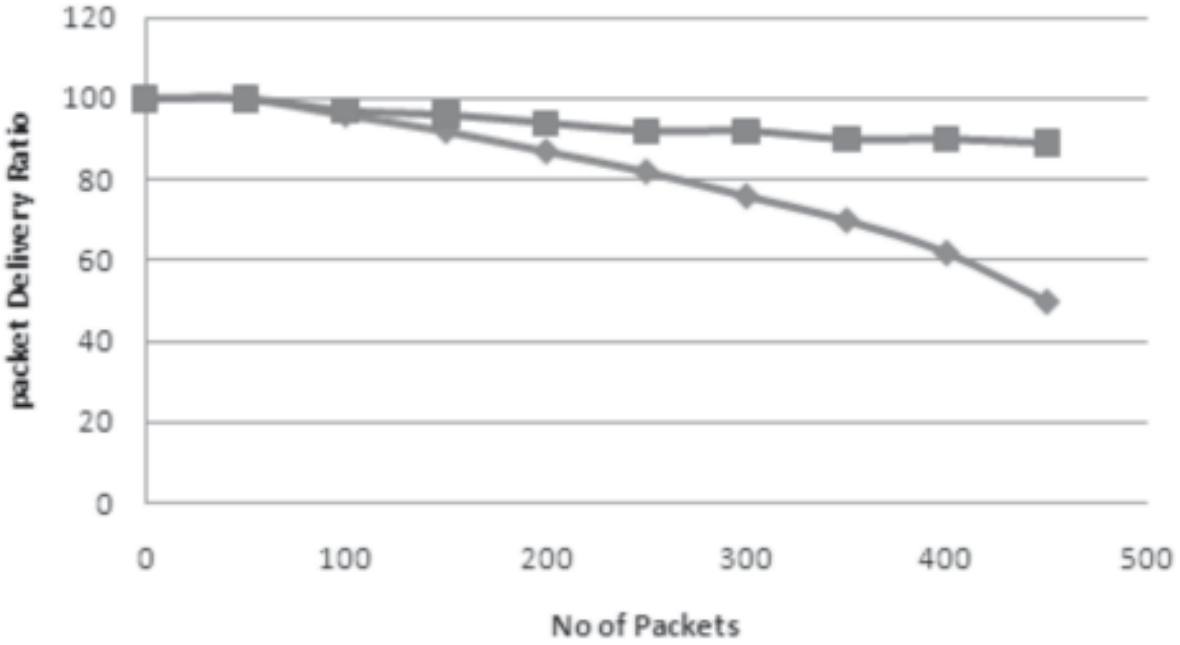

Fig. 3. Packet Delivery Ratio

In fig Network lifetime has been analyzed by having various traffic size. *i.e.*, numbers of bits transmitted. When the traffic size increases lifetime decreases slightly till certain point, after which it falls quickly in increasing traffic size. In earlier AODV method, when the number of packets transmitted from source increases all of them follows a same path and does not bother about the congestion. It causes poor quality in packet delivery. This paper is proposed to consider the congestion of next hop before forwarding it. Fig shows that even source transmits more number of packets it results in good packet delivery ratio, since every node seeks and selects the best next hop by EEP and hence congestion were eliminated. When congestion rate increased, it adds more delay in end to end transmission and sometimes results in packet loss. It has been avoided by proper loading of intermediate node and hence delay is restrained in limit.

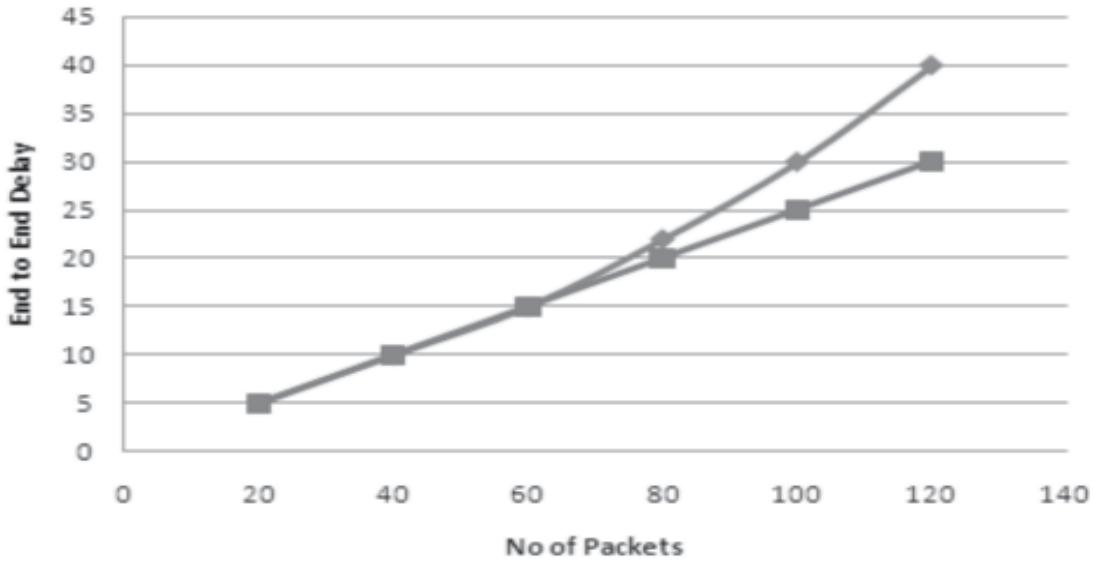

Fig. 4. End to End Delay Vs Number of packets.

7. CONCLUSION

The Poisson distribution based Energy Efficient Routing protocol (PB-EEP) proposed in this paper improves the lifetime of a node. The PB-EEP produces better results than the existing AODV in terms of packet delivery ratio, end-to-end delay, and residual energy at nodes and normalized routing load. The performance of proposed algorithm is also compared with the existing AODV protocol and it is observed from the simulation result that PB-EEP outperforms AODV routing protocol.

8. REFERENCES

1. Yang, X.-S.: 2011, "Bat algorithm for multi-objective optimization," International Journal of Bio-Inspired Computation 3(5), 267-274.
2. X. S. Yang, "A New Metaheuristic Bat-Inspired Algorithm," Nature Inspired Cooperative Strategies for Optimization (NISCO 2010) (Eds. J. R. Gonzalez et al.), Studies in Computational Intelligence, Springer Berlin, 284, Springer, 65-74 (2010).
3. Musikapun, P. and Pongcharoen, P.: 2012, "Solving multi- stage multi-machine multi-product scheduling problem using bat algorithm," International Conference on Management and Artificial Intelligence, Vol. 35, IACSIT Press, pp. 98-102.
4. Kirti Aniruddha Adoni -"Optimization of Energy Consumption for OLSR Routing Protocol in MANET" - International Journal of Wireless & Mobile Networks (IJWMN) Vol. 4, No. 1, February 2012
5. Shuai Gao, Hongke Zhang, and Sajal K. Das "Efficient Data Collection in Wireless Sensor Networks with Path-Constrained Mobile Sinks"- IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 10, NO. 5, APRIL 2011
6. Prof.N.A.Mhetre " Efficient Data Collection with path Constrained Mobile sinks using Shortest Path Member Assignment Scheme in WSNs " International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 1, January 2013).
7. S.Velu chamy AN ENERGY EFFICIENT ROUTING BASED ON OLSR IN WIRELESS SENSOR NETWORK IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727 PP 48-57
8. Abdullah I. Alhasanat "Connectivity-Based Data Gathering with Path-Constrained Mobile Sink in Wireless Sensor Networks" Scientific Research journal Wireless Sensor Network, 2014, 6, 118-128
9. Di Francesco, M. and Das, S.K. (2011) Data Collection in Wireless Sensor Networks with Mobile Elements: A Survey. ACM Transactions on Sensor Networks (TOSN), 8, Article No. 7.
10. Xing, G., Li, M., Wang, T., Jia, W. and Huang, J. (2012) Efficient Rendezvous Algorithms for Mobility-Enabled Wireless Sensor Networks. IEEE Transactions on Mobile Computing, 11, 47-60
11. Somasundara, A., Kansal, A., Jea, D., Estrin, D. and Srivastava, M. (2006) Controllably Mobile Infrastructure for Low Energy Embedded Networks. IEEE Transactions on Mobile Computing, 5, 958-973.