Proficient Performance and Data Collection Improvement in Wireless Sensors Network over MAC Protocol

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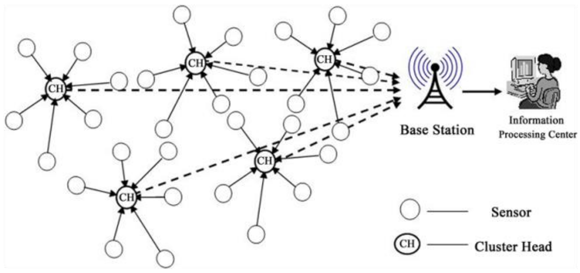
ABSTRACT: The infrastructure of wireless sensor networks (WSN) is structured in an ad-hoc manner and organized nodes reporting the events to the Base Station (BS). A WSN is integrated with smart technologies to develop fast Internet of Things (IoT) communications among different applications. Recently, many researchers proposed their solutions to optimize IoT data transmissions in an energy efficient manner with cost effective support. However, most of the solutions have focused on the design and development of static topologies and overlooked the dynamic structure of mobile sensor nodes. Furthermore, due to limited constraints of sensor nodes with open accessibility of wireless communications medium, data protection against malicious activities need to be redesign with the least network overheads. Therefore, the contribution of this article is to propose an intrusion prevention framework for mobile IoT devices with its integration to WSN so that to provide data security with improved network delivery ratio. The proposed framework is composed of two sub-components. The proposed protocol effects in higher dispensed sensors and a properly-balanced clustering gadget improving the community's lifetime. The Modified Energy Aware Routing (MEAR) method carries two protocols, which include MCP based totally Efficient MAC primarily based EAR. In segment, Transmission range adjusting by the initializing the Maximum Capacity Path based multi hop routing by using imposing Energy Aware Routing. For the EAR implementation, want to calculate the nodes Initial Energy, Residual Energy and Optimum power path. The simulation results demonstrate a significant improvement when compared to existing solutions in terms of different network metrics. Furthermore, start to finish secure and multi-bounce directing ways are created dependent on the blockchain design. The re-enactment results exhibit a critical improvement when contrasted with existing arrangements regarding distinctive organization measurements.

1. INTRODUCTION

Advancement in wireless communication and electronics over the years has led to the development of WSNs. WSNs are formed by sets of distributed autonomous devices with several distinct characteristics to sense, process, transmit and receive observed or measured condition. Its deployment has been enhanced by its small, inexpensive and smart sensor which is easily deployable. In its simplest form, the sensor node is made up of a sensor component that measures the condition of the observed situation or physical surrounding of interest while the microprocessor component of the node ensures the information obtained are intelligently computed. The wireless radio embedded in the nodes allows communication between the neighbouring nodes. A considerable number of these sensors are used to cover the area of interest since a single sensor node can only provide limited information.

1.2 Wireless Sensor Network

Wireless sensor network (WSN) has been widely deployed for various purposes, such as remote environment monitoring, health-care, and air quality monitoring. By employing a large number of low-power sensors, WSN collects desired information in a distributed and self-organized manner. Such feature has made WSN a key enabler to realize the Internet-of-Things (IoT) and green communication era. One well-known concern in WSNs is that the network lifetime is greatly restrained by the battery capacity of sensor nodes. To address this issue, many efforts have been made in recent years, focusing on either exploiting sustainable energy to diversify the energy supply or greening network to reduce energy expenditure. Among these, energy harvesting has received considerable attention owing to its ability in extending the lifetime of WSNs. By utilizing the energy harvesting unit and the energy buffer, each sensor node of WSN can harvest energy (e.g., solar and wind power) from environments, thereby ensuring an unlimited energy supply to each node. This type of network is referred to as the energy harvesting WSN (EH-WSN). Sustainable energy supply techniques have also been suggested in hyper cellular networks. Further applications can be found in wireless energy transfer and energy cooperation.



WSN Formation

Routing schemes in WSNs aim to deliver data from the data sources (nodes with sensing capabilities) to a data sink (typically, a base station) in an energy-efficient and reliable way. A survey of several routing algorithms may be found in literature survey. Most proposed algorithms are based on shortest path routing or multi-path approaches and may indirectly reduce energy usage, but they do not explicitly use energy consumption models to address optimality of a routing policy with respect to energy-aware metrics. Such "energy awareness" has motivated a number of minimum-energy routing algorithms which typically seek paths minimizing the energy per packet consumed. However, seeking a minimum energy path can rapidly deplete energy from some nodes and ultimately reduce the full network's lifetime by destroying its connectivity. Conventional proposed an Energy Aware Routing (EAR) policy which does not attempt to use a single optimal path, but rather a number of suboptimal paths that are probabilistically selected. In a similar problem is studied with the inclusion of uncertainties in several WSN parameters. Routing algorithm plays a crucial role in the process. Clustering builds a hierarchy of clusters or groups of sensing nodes that collects and transfers the data to its respective cluster head (CH). The CH then groups the data and sends the fused to sink node or base station (BS) which acts as middleware between the end user and the network.

This project aims to select the CH considering important parameters like the initial energy, remaining energy of the individual node and the optimal number of CHs in the network. The modification is done in the classical LEACH algorithm. With the completion of each round, the residual energy of the non-CH nodes are checked, and the one with the higher energy level in comparison to others has a higher probability for CH selection for the current round. This would prevent the network to die out too early thereby enhancing the network lifetime.

The project presents a mobile cluster head framework, which aims to longer network lifetime with lightweight efficient data routing between node and mobile IoT devices based on WSN. Unlike other solutions, our proposed framework fragments the IoT objects into various clusters and performs the cluster heads selection by using the uncertainty principle. In addition, based on network measurement and analysis, the up to date position of mobile cluster heads are determined. Moreover, in most of the existing solutions, it is not easy to guarantee a secured and reliable end to end data transmissions between mobile IoT objects due to their limited constraints. Unlike other solutions, our proposed framework presents a lightweight and reliable end-to-end efficient routing approach. Accordingly, the proposed framework improves routing performance for mobile IoT devices in terms of security and energy utilization.

2. RELATED WORKS

The field of WSNs is typically characterized by limited power devices in terms of computational, processing, memory and energy resources. All the nodes are interconnected through wireless transmission in an unfixed and ad-hoc based approach. The main role of sensor nodes is just capturing the information and forwarded towards end-points by using intermediate devices.

A. Mahajan, and R. M. Hegde, [1 In this paper, we utilize a recent development in social networks called small world traits for offering a singular method of joint localization and data gathering over WSN. A small international WSN is developed by using introducing records MULEs (cellular ubiquitous LAN extensions) right into a traditional WSN. Small world WSN famous low average route period and high average clustering coefficient. Such a small world WSN whilst designed with novel routing strategies ends in decreased hop counts in sensor information transmission. Additionally, a method for gold standard information MULE allocation is also developed. This technique minimizes an objective feature that's a normalized weighted sum of network parameters like bandwidth requirement and localization mistakes. The most effective data MULE allocation approach computes both the top of the line range of records MULEs and their placement within the community.

S. Kurt, H. U. Yildiz, [2] a detailed link layer version by way of using the characteristics of Tmote Sky WSN nodes and channel traits based on real measurements of SG path loss for numerous environments. A novel Mixed Integer Programming (MIP) framework is created by using using the aforementioned link layer model for WSN lifetime maximization by way of joint optimization of transmission energy stage and information packet size. We analyzed the WSN performance by systematic exploration of the parameter area for diverse SG environments through the numerical answers of the optimization model.

T. Liu, T. Gu, [3], the problem of power balanced statistics collection in wireless sensor networks, aiming to stability electricity consumption amongst all sensor nodes at some point of the information propagation technique. Energy balanced data collection can doubtlessly store electricity consumption and lengthen network lifetime, and therefore it has many sensible implications for sensor community layout and deployment. The conventional hop-by way of-hop transmission version lets in a sensor node to propagate its packets in a hop-by using hop manner towards the sink, resulting in negative energy balancing for the whole community. To deal with the problem, we follow a slice primarily based strength version, and divide the problem into inter-slice and intra-slice strength balancing problems.

P. Nayak and B. Vathasavai, [4] modern researchers have brought about the proposition of many numerous clustering algorithms. However, maximum of the proposed algorithms overburden the cluster head (CH) for the duration of cluster formation. To conquer this hassle, many researchers have provide you with the concept of fuzzy good judgment (FL), which is applied in WSN for choice making. These algorithms focus on the efficiency of CH, which can be adoptive, flexible, and smart sufficient to distribute the load most of the sensor nodes which can decorate the community lifetime. But unfortunately, most of the algorithms use type-1 FL (T1FL) version. In this paper, we advise a clustering algorithm on the idea of c language type-2 FL model, waiting for to handle unsure degree decision better than T1FL version.

P. Cheng, Y. Qi, K. Xin, [5] kingdom estimation is of first-rate importance in numerous programs primarily based on wireless networked manage structures. Wireless sensor node commonly forwards its facts to a faraway receiver thru a series of relay nodes with the intention to shop its limited power. In this paper, we look at the information forwarding strategy layout for correct far flung kingdom estimation in multi-hop wireless networks. Stability circumstance, estimation performance and strength performance of both the two techniques are theoretically analyzed. We in addition advocate an Event-induced Forwarding Strategy (EFS) that's able to stability the estimation accuracy and relay power consumption. Numerical examples are employed to demonstrate the effectiveness of our design.

2.1 Existing System

One of the primary issues of IoT is to deal with a huge variety of sensors that will be deployed, in terms of the fee of servicing and upkeep. Further changing sensor batteries that are already positioned in the community subject can be a tedious job. For instance, in case a sensor is to be deployed on a certain animal or species, it calls for the battery of the sensor to survive the animal that is far extra practicable.

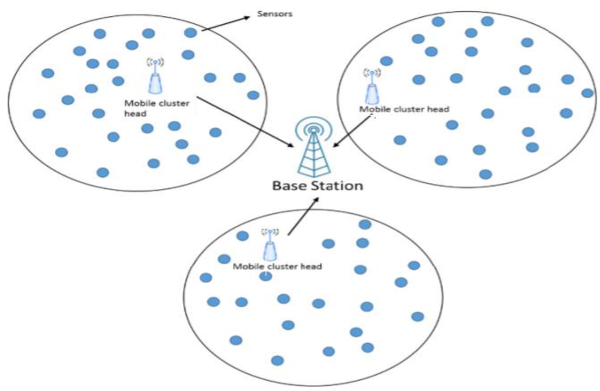
LEACH protocol has intensively been modified by way of researchers to enhance the community overall performance. Technical researchers are contributing vigorously in enhancing current algorithms for better performance of the IoT device. An strength-green believe derivation method was discussed for WSN-based IoT networks. The scheme makes use of danger strategy analysis to lessen network overhead by way of deriving an premiere quantity of hints.

- The existing R-LEACH clustering algorithm that involves two tiers: set-up and steady-kingdom degrees.
- In set-up phase, the sensor nodes are deployed inside the network and are sub-divided into clusters headed by means of a CH responsible for the collection of facts from sensing nodes.
- Actual records routing takes place at some stage in the regular-kingdom degree, where the accrued statistics is forwarded to the BS by means of the CHs of the network.

3. PROPOSED SYSTEM

The EARR scheme specifically specializes in when the relay node will be brought about to perform the relocation method and in which to move to. Besides the sink relocation scheme, the whole operation of the WSNs for environment tracking additionally desires to incorporate the routing technique for reporting the sensed records from the source to the relay (sink), as well as the energy intake version. In this phase I record, we are able to first off in brief describe the strength consumption model for message relaying. Then, the electricity-aware routing approach (the MCP) that is followed in the EARR technique can be illustrated the usage of a routing instance. At the give up of this file, some related studies works for efficient routing can also be addressed.

3.1. Architecture Diagram



Proposed Architecture

- In this assignment change, we use a dynamic routing protocol, known as Maximum Capacity Path (MCP), as the underlying routing protocol of the proposed Energy Aware routing technique.
- The MCP mainly consists of 3 process steps. They are,
- Layering graph G right into a layered community N;
- Determining the maximum capacity course for each sensor node; and
- Routing accomplished and residual electricity up to date.
- The MCP will iteratively carry out the above 3 steps for each round of message reporting.

The community lifetime of a WSN, energy saving is the key layout problem. Routing protocol designs of message reporting in a WSN can generally be categorized into two classes: static routing and dynamic routing. For the static routing type, when because the message reporting paths are decided, every sensor node will report its sensed information along the predetermined route to the sink at any time. On the alternative hand, a dynamic routing protocol would possibly modify the routing paths in every transmission round in keeping with the cutting-edge nation of the sensor nodes' residual battery electricity. Due to the truth that the dynamic routing protocols can stability the burden on every sensor node, it plays better for network lifetime prolonging than the static routing protocols.

In this project, we design, analyze and evaluate a highly efficient WSN MAC protocol specially designed to collect information from a large number of sensors, utilizing information theoretic concepts and novel signaling and decoding techniques which allow us to jointly optimize all layers together.

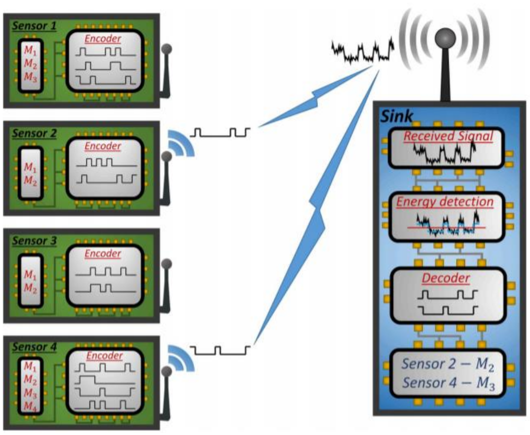


Fig. 3.1. Data is collected by a sink, when K sensors, out of a large population of N sensors in the network have a message to transmit over the wireless channel.

Whenever a sensor wishes to transmit a report, it waits to receive a predefined periodic preamble sent by its designated sink, and then transmits a sequence of impulses according to the transmission pattern which corresponds to the report it wishes to send. The sink node can receive and decode several simultaneous transmissions in a way that it can recognize both the sender and the information sent from the collected channel output received. Namely, a collision resolution procedure or scheduling are not required to decode the K simultaneously transmission. This is done using a carefully designed codebook, and a matching decoding algorithm that identifies both the sensors which transmitted as well as their codewords. Interestingly, unlike Code-Division Multiple-Access Channels (CDMA), the sink node can rely on a simple energy detection in order to decode, and not on the exact received power or any power adaptation mechanism, thus dramatically improving robustness.

To provide some insight into the suggested approach and illustrate its basic concept, consider the toy example depicted in Figure 3.1. In this example, we assume four sensors transmitting to a sink. The four sensors have 3, 2, 2 and 4 messages each. Each one of the messages is assigned a unique pattern, comprised of high and low level elements which are known to the sensor itself and to the sink.

- For example, Sensor 1's first message is encoded starting with a low level symbol followed by a high level symbol, a sequence of 4 low level symbols, etc.
- After receiving a predefined beacon from the sink, which initiates a conceptual set of mini-timeslots, each sensor ready to transmit emits energy (transmits) according to the pattern assigned to the message to be transmitted.
- Specifically, it emits energy in the minislots which correspond to a high level in the message pattern and stays idle in the other minislots.
- In the above example only two sensors are awake and ready to transmit (sensors 2 and 4).
- Sensor 2 emits energy in minislots 2, 8 and 11 according to the pattern assigned to its second message, and Sensor 4 emits energy in minislots 1, 6 and 11 according to the pattern assigned to its third message.
- The received signal at the sink is a combination of the two transmitted sequences (energy at minislots 1, 2, 6, 8 and 11, with some additional noise).
- The sink performs an energy detection procedure on the received signal according to a predefined threshold, identifying which minislots were busy and which were idle (below the energy threshold). Note that due to the energy aggregate, the receiver gain can be saturated (e.g., several sensors emitted energy into the same minislot) yet all the sink needs to identify is on which minislots the energy is above the noise level (above the threshold).
- In other words, each minislot should be at a length sufficient to decode one bit and the sink cares only

about the Boolean sum of the "bit" patterns used by the transmitting sensors. Based on the filtered sequence (the energy detection sequence in the figure) the sink deduces which set of transmitted sequences could have generated the sequence received.

3.2. EAR-MCP Techniques

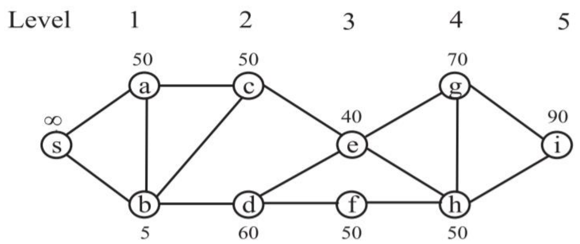
In this proposed work, we use a dynamic routing protocol, called Maximum Capacity Path (MCP), as the underlying routing protocol of the proposed routing method. The MCP is proposed to perform well in prolonging network lifetime in a WSN. In the following, we will use an example to illustrate the procedure steps of the MCP routing algorithm.

A WSN and its current residual battery energy state of sensor node can be modelled by a capacity graph *G = (V, E),* where set *V* denotes the collection of sensor nodes and *E* denotes all of the possible direct communication between sensor nodes. And let $r: V \rightarrow R^+$ be the residual battery energy function to represent each sensor's residual battery energy.

For example node *s* stands for the sink with infinity energy due to the fact that it can plug in to a power line or is equipped with an extremely large capacity battery compared to that of the sensor nodes. The value that is associated with node *a* is equal to 50, which stands for the current residual battery energy of sensor node a. The MCP mainly consists of three procedure steps. They are,

1. Layering graph G into a layered network N;
2. Determining the maximum capacity path for each sensor node; and
3. Routing performed and residual energy updated. The MCP will iteratively perform the above three steps for each round of message reporting.

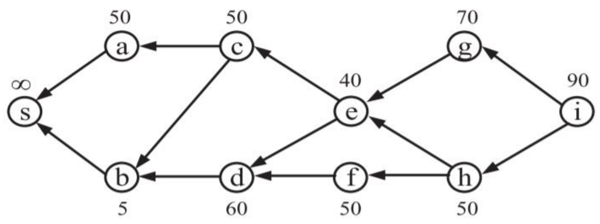
Detailed operations for layering the graph in the first step are as follows. Let level number *Lv* with respect to each sensor node $v \in V$ denotes the shortest path length from *v* to the sink *s*



(a)

For the example in Fig. (a), since the shortest path length from nodes *g* and *h* to node *s* are both 4, *Lg* = *Lh* = 4. The layered network *N* can be obtained from graph *G* by deleting the edges $(u,v) \in E$ such that *Lu* = *Lv*.

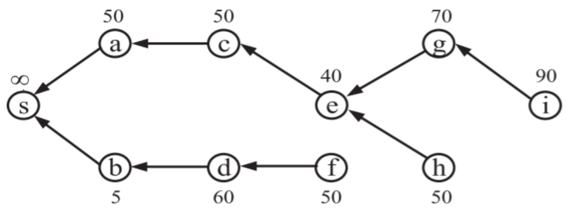
For example, as shown in Fig. (a), since *La* = *Lb* = 1 and *Lg* = *Lh* = 4, then edges (*a, b*) and (*g, h*) will be deleted from *G*. Then the layered network *N* obtained from *G* is a directed graph, such that for all of the remaining edges $(u,v) \in E$ after the deleting operation, the directed edge (*u,v*) from node *u* to node *v*, if *Lu* = *Lv* + 1.



(b)

Fig2. (b) shows the resulting network obtained from *G* in Fig. (a). Let *Pus* = *u, u1, u2,..., ul, s* be a path from node *u* to the sink *s* in *N*. And we let the capacity *c*(*Pus*) of path *Pus* be the minimum value of residual battery energy in path *Pus*; that is, *c*(*Pus*) = min{ *r*(*u*),*r*(*u1*),*r*(*u2*), . . . ,*r*(*ul*)}. Let *P*us* be the maximum capacity path with the maximum capacity value among every path from node *u* to *s*. The resulting graph of the union of each maximum capacity path *P*us*, $\forall u \in V$ will be the routing paths for message reporting.

For example Fig. (c) Shows the resulting maximum capacity paths obtained from the layered graph *N* of Fig. (b). the above operations are the second procedure steps of the MCP. Now, as a sensor node u detects an abnormal event or has sensed data to report to the sink node *s*, and then the message will be relayed along the maximum capacity path *P*us* to *s*.



(c)

Fig. 2 MCP Working

For example, the maximum capacity path *P*gs* = *g*, *e*, *c*, *a*, *s*. After the message relaying from node *g* to s along path *P*gs*, the residual battery energy of each sensor node in the path is updated accordingly. The above three procedure steps will be repeated for each transmission round until one of the nodes drains out its battery energy.

4. EXPERIMENTAL RESULTS

In this module, a wireless sensor network is created. All the nodes are configured and randomly deployed in the network area. Since our network is a wireless sensor network, nodes are assigned with initial energy, transmitting energy and receiving energy. A routing protocol is implemented in the network. Sender and receiver nodes are randomly selected and the communication is initiated. Initialize the wireless network nodes with multihop network by randomly deploying 30 nodes in an area of 1200 X 1200. Nodes are assigned with initial energy, transmitting energy and receiving energy. A routing protocol is implemented in the network. Sender and receiver nodes are randomly selected

Table I

Simulation Parameter

Simulator	NS2
Simulation time	10s
Area	1200X1200
Number of node	30
Physical Layer	IEEE 802.11
Routing protocol	AODV/EARR
Mobility model	Random way point
Radio type	802.11a/g
Transmission rate	10 packets/s
Packet Size	512/ 1024
Pause time	0s

The figure is showing the comparison graph to represent the amount of packets lost over the network. Here X Axis represents the number of nodes and the y axis represents the energy in the network. In case of proposed network, the predictive rules are implemented. The results shows that the conferred work offers the packet lost at the start, however because the algorithmic approach is enforced and therefore the route reconfiguration is finished, then no a lot of knowledge lost is there.

4.1 Network Deployment

All the nodes are configured to exchange the location and initial energy information among all the nodes. All the nodes are configured to exchange the location and initial energy information among all the nodes.

A routing protocol is implemented in the network. Base Station is configured with highest communication range. As shown in Figure, the proposed scheme generates lower normalized routing overhead than the MCP-based WSN and existing routing.

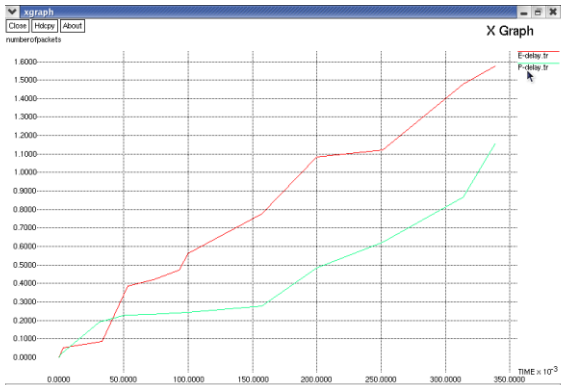


Fig.4 Delay vs. Time

The figure is showing the comparison graph to represent the number of packets delay over the network in Existing and Proposed Approach. Here X Axis represents the nodes and the y axis represents the number of packets delay in the network. The results show that the packet delay in proposed work is reduced.

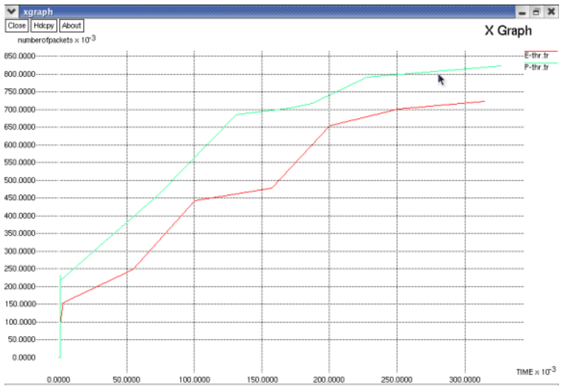


Fig 5 Throughputs vs. Time

Fig 5 shows the response time for node mobility events and is compared with the LEACH- networks. This experiment considers the link failure issue for a single data flow and the influence of other background traffic is not considered here. The figure is representing the graph which analysis on last packet time over the network. Here X Axis represents the number of nodes and the y axis represents the last throughput.

The results here shows that the in both kind of network the communication is performed on same rate but the difference is in terms of packet forwarding and rerouting of the network.

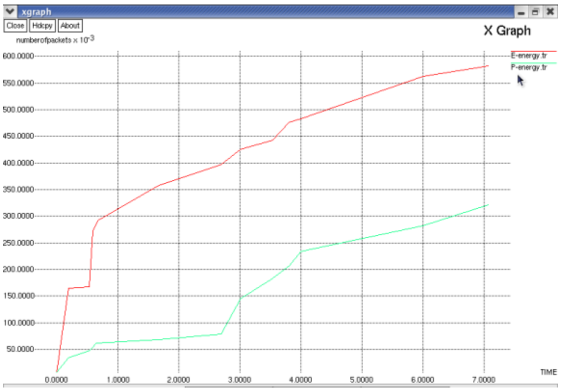


Fig 6 Energy vs. Nodes

As shown in Figure, the proposed TLS scheme generates lower normalized routing overhead than the AODV routing. The figure is showing the comparison graph to represent the number of energy over the network in Existing and Proposed Approach. Here X Axis represents the nodes and the y axis represents the number of packets delay in the network. The results shows that the packet delay in proposed work is reduced

Data Transmission is established between nodes using UDP agent and CBR traffic. In this module, to enable all the nodes to get the global energy model, we propose a proposed algorithm, that under this general dynamic battery model, there exists an optimal policy consisting of time-invariant routing probabilities in a fixed topology network and these can be obtained by solving a set of problems. In this proposed work, we use a dynamic routing protocol, called Maximum Capacity Path (MCP). Exchange all node energy and location information. Determining the maximum capacity path for each sensor node; and Routing performed and residual energy updated. The MCP will iteratively perform the above three steps for each round of message reporting.

In this module, the performance of the proposed network coding method is analyzed. Based on the analyzed results X-graphs are plotted. Throughput, delay, energy consumption are the basic parameters considered here and X-graphs are plotted for these parameters. Finally, the results obtained from this module is compared with previous results and comparison X-graphs are plotted. Form the comparison result, final RESULT is concluded.

4.2. Performance Metrics

1. Throughput:

It is the ratio of the total number of bits transmitted (Btx) to the time required for this transmission, i.e. the difference of data transmission end time and start time (tstart).

Throughput = $(B_{tx})/(t_{end} - t_{start})$ bps

2. Packet Delivery Ratio:

This is defined as the ratio of the number of packets received at the destination and the number of packets sent by the source. Here, $pktd_i$ is the number of packets received by the destination node in the ith application, and $pkts_i$is the number of packets sent by the source node in the ith application.

3. Average End-to-End Delay:

It is average transmission delay of packets transmitted from source to destination. D is computed as the ratio of the sum of individual delay of each received data packet to the total number of data packets received.

D= no. of received packed/total time

5. CONCLUSION

Since energy and lifetime are two major constraints in designing any routing protocol for WSN, much research has been done to achieve the goal. Choosing an energy-efficient routing algorithm that distributes the load in the network evenly is a challenging process. A relocatable sink is another approach for prolonging network lifetime by avoiding staying at a certain location for too long which may harm the lifetime of nearby sensor nodes. This approach can not only relieve the burden of the hot-spot, but can also integrate the energy-aware routing to enhance the performance of the prolonging network lifetime. In this thesis, proposed an energy-aware CH relocation method, which adopts the modified energy-aware routing MCP as the underlying routing method for message relaying. An energy-green routing set of rules that distributes the load inside the network calmly is a difficult process. Using the MEAR protocol, more advantageous routing process can be used correctly in scenarios like environmental tracking using IoT. Simulation end result shows advanced community performance for metrics which includes residual electricity, packets sent to BS, throughput and lifelong.

FUTURE WORK

As future work will be consider security key constrained WSN applications and design a routing protocol that can achieve the best secure trade-off between network lifetimes in multi-hop networks.

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