Energy Efficient Data Transmission in Wireless Sensor Network Using Cross Site Leaping Algorithm

M. Divya, K.R. Kavitha, A.P. Jaya Krishna

Abstract---- The sink mobility along a controlled path can get better energy efficiency in wireless sensor networks. To remain incident delay to the ground value, an application that requires instance data snapshots, it is for all time desirable to decrease the duration of a data collection process and during the attack between source to destination. Due to the path constraint, a sink with constant speed has limited communication time to collect data from the sensor nodes deployed randomly. These significant challenges in jointly improving the amount of data collected and reducing energy consumption. To address this issue, Cross Site Leaping Algorithm (CSLA) to improve energy consumption. To monitor the performance of all nodes in the network we use angular node. From this angular node will monitor the energy level of all other nodes. Before the data transmission, the transmitter power, receiver power and bandwidth of the signal are calculated by CSLA. The CSLA will collect the information about the data which need to send from source to destination and it will find the efficient path to send a data. And also introduced attack and packet issue, we proposed a linear discriminant packet flow analysis system (LDPA) to promote energy consumption and detect the attack. We have presented LDPA for WSNs that is secure and robust against malicious insider attack by any compromised or faulty node in the network. In contrast to the traditional snapshot aggregation approach in WSNs, a node in the proposed algorithm instead of unicasting its sensed information to its parent node, broadcasts its estimate to all its neighbors. This makes the system more fault-tolerant and increase the information availability in the network. The simulations conducted on the proposed algorithm have produced results that demonstrate its effectiveness.

Keywords--- WSN, linear discriminant packet flow analysis system, optimized rout path switch, cross-site leaping algorithm.

I. INTRODUCTION

The purpose of traditional data networks such as the Internet is to enable end-to-end information transfer. Information streams in such networks are carried across point-to-point links, with intermediate nodes simply forwarding data packets without modifying their payloads. In contrast, the purpose of a wireless sensor network (WSN) is to provide the users with access to the information of interest from the data gathered by spatially distributed sensors. Examples include the average temperature in a network of temperature sensors, a particular trigger in the case of an alarm network, or the location of an event. Such aggregate functions could be computed under the end-to-end information flow paradigm by communicating all relevant data to a central collector node. This, however, is a highly inefficient solution for WSNs which have severe constraints in energy, memory and bandwidth, and where tight latency constraints are to be met. An alternative solution is to perform in-network computations. Each node, in the proposed algorithm, instead of unicasting its sensed information to its parent, broadcasts its estimate to all its neighbors. This makes the protocol more fault-tolerant and increases the information availability in the network. The proposed protocol is similar to the one suggested in. However, it is more secure and reliable even in presence of faulty nodes in a WSN.

1.1. Network Clustering

Data clustering is one of the fundamental tools we have for understanding the structure of data set. It plays a crucial, foundational role in machine learning, data mining, information retrieval, and pattern recognition. Clustering aims to categorize data into groups or clusters such that the data in the same cluster are more similar to each other than to those in different clusters recognition. Many well-established clustering algorithms, such as k-means and PAM, have been designed for numerical data, whose inherent properties can be naturally employed to measure a distance (e.g., Euclidean) between feature vectors. However, these cannot be directly applied for clustering of categorical data, where domain values are discrete and have no ordering defined.

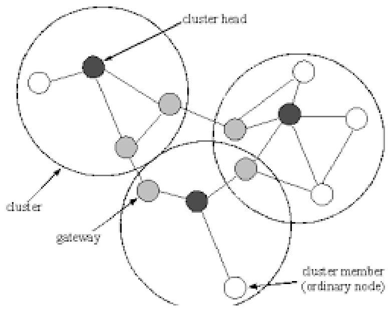

Figure 2: Clustering Technique

1.2. Energy consumption

The energy consumption rate for sensors in a wireless sensor network varies greatly based on the protocols the sensors use for communications. Results for energy consumption, transmitted and received power, minimum voltage supply required for operation, effect of transmission power on energy consumption, and different methods for

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measuring lifetime of a sensor node are presented.

The behavior of sensor nodes when they are close to their end of lifetime is described and analyzed. A comparison with other models for energy consumption is made and suggestions for future work are presented.

II. RELATED WORKS

WSN with a huge amount of possibilities to route and control the different nodes, those nodes incorporate the possibility of transmitting and receiving signals from/to several nodes jointly through beam forming [1]. At the receiver, data from each node can be de-multiplexed with the use of a frequency shift keying direct sequence spread spectrum modulation scheme that enables multiple access without destroying the beam forming characteristics of the network. This transmission scheme suffers from collisions and retransmissions which result in high energy consumption [2]. Routing algorithms depleted the power of the last tier before the fusion center in continuous monitoring applications. New battery technologies and energy-efficient systems is to prevent nodes from dying out, event-tracking applications with simpler traffic patterns [3].

The concept of Optimal Opportunistic Routing using Sleep mode (O2RS) is introduced to optimize and preserve energy among sensor nodes leading to increased efficiency of the linear (1-D) system. During transmission of data packets, sleep mode ensures that nodes are active only during transmission which in turn tends to preserve their energy [4]. The problem with current wireless ad-hoc approaches, however, is that they do not leverage the cooperative capability of the nodes within the network. To do so would permit the reduction of network power requirements or increase the network data rate or improve the network connectivity range [5]. One simple approach is to minimize the power consumed to deliver a packet to the destination. The typical solution is to use the shortest path with link costs equal to the energy required in each link to transmit a packet. Another approach is to maximize the lifetime of the network. There are various ways to define the lifetime of a WSN [6]. If suppose the signal containing scheduling information is received at a very low power due to the impairments introduced by the wireless channel, the sensor node might be unable to decode it and consequently it will remain inactive [7]. A routing algorithm, performance region is divided to some sectors, and there are several relay nodes in each industry. Relay nodes gather data from sensor nodes around them and data transfer to the base station based on the shortest path and minimum skip possible in two-dimensional coordinates (x, y) to the base station [8].

The unique role of the BS makes it a natural target for an adversary that desires to achieve the most impactful attack possible against a WSN with the least amount of effort [9].It describes an approach using cooperation between nodes to collaboratively create MIMO, diversity and beam formed antennas from the distributed sensor elements. In the sensor domain, the advantages of wireless connected sensor arrays forming self-organizing ad-hoc networks has the considerable benefit of reducing the infrastructure required for deployment [10]. An energy efficient K-means clustering-based routing protocol and considers an optimal fixed packet size according to the radio parameters and channel conditions of the transceiver. K-means based aware energy clustering (KEAC) regarding network lifetime and increases the overall throughput of the network [11].

A non-convex optimization problem jointly optimizes the energy beam forming and the data routing. The analytical and numerical results show that optimal energy beam forming gives two times better monitoring performance than that of WET without using energy beam forming [12]. The channel estimation algorithm executed simultaneously with the previous two stages Implementation of Data Logging based Scheduling and Routing scheme (DLSR) for WSN is introduced with maximum Energy and Throughput and then a path recovery algorithm is introduced in the presence of the Void path or node failures [13]. In this approach, the mobility pattern of a sink takes a discrete form we require each epoch be much longer than the moving time imposing these anchor points simplifies the design of the mobile sink and limits the extra overhead introduced to the energy protocol. In addition, a continuous movement is not necessary, as a granularity of displacement smaller than the magnitude of the effective radio range may not lead to any topological change [14]. Considering battery energy consumption, we show that our proposed transmission scheme is capable of increasing the life time of sensor nodes that need to communicate over long distances. We show that layered collaborative beam forming gives more impressive performance in terms of energy savings to achieve a SEP at the receiver with respect to direct beam forming and direct single link transmission for the same source-receiver pair [15].

Constructing a load-balanced forest to maximize the network lifetime, in which each sink is the root of an energy tree with the depth no more than number. Each sensor belongs to only one of these trees; each sensor can reach a sink with no more than number of hops [16]. CRP (comprehensive routing protocol) multiple paths are found between source and destination, and sub-optimal paths are used occasionally referring to the probabilistic forwarding table to provide substantial gains. Therefore, the frequency a node acting as a router which represents its reputation is also considered as one of the decision factors [17]. variations of the policy are also presented by redefining the optimization problem considering: 1) concomitant hop size variation by sensors over lifetime along with optimal duty cycles, and 2) a distinct set of hop sizes for sensors in each ring [18].

A new routing protocol for greedy forwarding based on throughput energy aware multi-path routing protocol (GFTEM), which is based on the selection of next hop node that has the highest throughput and closer to the destination node. The OMNET++ simulator has been used to study the behavior of the protocols regarding the end-to-end delay, packet error rate and residual energy [19].

III. IMPLEMENTATION

A) An Energy-Efficient Cross-site leaping algorithm in Wireless Sensor Networks

In our proposed system used the wireless ad hoc sensor networks.

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The wireless ad hoc sensor network commonly used one Base Station. The source node is to send all data in to the base station (BS). BS only to identifying correct destination node also sends data in to network. In our network the groups of nodes are inter-connected. The inter-connected nodes are called the clustered node. So, it's using the Energy-Based Clustering protocol. Then Each Clustering network have one cluster head node. The cluster head node is to be collecting information in to BS. Then using the energy-based clustering protocol to choose or find another path for data transmission. Using this path without packet loss all data will send into correct destination. The cluster head generates the energy beam it rang of beam only provide the energy for cluster nodes. In addition, to provide the opportunity for random generation of improved information, random virtual cross site nodes are generated and substituted in the optimization.

The algorithm has been tested on several test functions that present difficulties common to many global optimization problems. The effectiveness and suitability of this algorithm have also been demonstrated by applying it to a groundwater model calibration problem. Compared with a genetic algorithm, the experimental results in terms of the likelihood of convergence to a global optimal solution and the solution speed suggest that the CSLA can be an effective tool for solving combinatorial optimization problems. Considering that minimizing the total energy consumption may not lead to the maximum network lifetime, we also plan to study the sub sink selection problem with network lifetime maximization as the optimization of this work. To avoid problem that the reincarnation clustering mechanism consumes large amounts of energy, CSLA has a clustering process at network launch time. At the network deployment phase, the Sink node broadcasts a signal in the network with a given transmission power.

Once each sensor node receives this signal, it calculates its approximate distance to the Sink node according to the received signal strength. The cluster head is the most important node which does not only manage the cluster members, coordinate the data transmission of the member nodes, but also fuses the data collected by cluster members, and sends the processed data to the Sink node. Due to the heavy burden of cluster head, we select the node with the higher residual energy as the cluster head at the beginning of each data collection cycle and reconstruct cluster

b) An Energy-Efficient Data Transmission in WSN Using Linear Discriminant Packet Flow Analysis System

We have proposed an energy efficient aggregation for WSNs that is secure and robust against malicious insider attack launched by compromised or faulty node(s).In WSN has some features such as constraint on energy, limit on communications and computing capacity, large numbers of sensors in wide, dynamic infrastructure, huge bursting data flow, and data centric etc. Simulations carried out on the proposed algorithm have demonstrated the effectiveness of the security module of the scheme. One simple approach is to minimize the power consumed to deliver a packet to the destination. Linear Discriminant Packet Flow Analysis System designing an integrated approach towards development of a data aggregation model that combines several important issues such as: security, processing overhead, communication overhead, energy consumption, and data compression rate and send the data sequential flow. Issues like scalability and reliability of the aggregation scheme in presence of various types of malicious (e.g. black hole, gray hole, wormhole etc.) nodes that do not participate in packet forwarding, would also be considered in the design.

3.1 BLOCK DIAGRAM

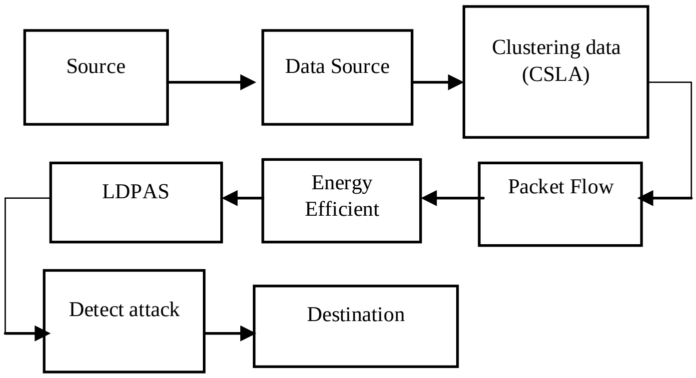

Figure 3: An Energy-Efficient Data Transmission in WSN Using LDPAS

3.2 Linear Discriminant Packet Flow Analysis System algorithm

The different characteristics of sensor networks introduce new challenges, amongst which prolonging the sensor lifespan is the most important. Linear Discriminant Packet Flow Analysis system. In such applications, clustering plays an important role in enhancement of the life span and scalability of the network and detect the attack. Although researchers continue to address these challenges, the type of distributions for arrivals at the cluster head and intermediary routing nodes is still an interesting area of investigation. Quality of Service (QoS) provision in relation to the end to end delay of transmitted packets to remains a serious concern along with the commonly accepted challenges such as energy consumption, network connectivity, data aggregation, computation power and then send the data source to destination sequentially.

3.3 Algorithm process

$$d_{ij} = rand()*(x_{bi}-x_{ij}) + rand()*(x_{gj}-x_{ij}) \;\ldots\ldots\; (1)$$

$$newx_{ij} = x_{ij} + d_{ij} \;\ldots\ldots\; (2)$$

$$new\ x_{ij} = \{\ \underline{x}_j + \beta(x_j - \underline{x}_j), \quad if\ r < pr, \;\ldots\ldots\; (3)$$

where i=1,2,…,s; j=1,2,…, n; X_i ($x_{i1}, x_{i2},…, x_{in}$) is the i'th individual in the subgroup, x_b($x_{b1}, x_{b2},…, x_{bn}$) is the local best individual in the subgroup X_g ($x_{g1}, x_{g2},…, x_{gn}$) is the global best individual in the whole energy $newX_i$ ($newx_{i1}, newx_{i2},…,newx_{in}$) is a new individual generated by the update strategy d_{ij} is the movement distance of X_i at its j'th component; rand() is a random number between 0 and 1. The $newX_{ij}$ is processed by means of hit-wall method to avoid exceeding the boundaries.

Where β and rare two random numbers between 0 and 1

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Pr is a random probability value at the component of new x_{ij}; x_i and x_j are respectively the legal minimum and maximum. To avoid generating similar individuals and reduce the diversity of the algorithm, here, each x_j corresponds to different β's.

Each X_i ($x_{i1}, x_{i2} \ldots x_{in}$) in the subgroup is updated by (1, 2), and an individual new X_i is generated by (3). If the new X_i is better than the X_i, then the new X_i will replace the X_i. Otherwise, the X_i will be updated. If the local deep searching of all subgroups has finished and the hybrid iteration number meet the pre-set interval G, all node will be mixed, sorted, and grouped again. Next, do the local deep searching afresh. This process will be repeated until the terminal condition of the algorithm is reached. The detail process is as follows.

3.4 Algorithm Steps

Step 1: Randomly generate the energy which contains F=m × s nodes (where m stands for the number of subgroups and s for the number of nodes in each subset), and set the numbers of the internal iteration and the hybrid iteration;

Step 2: Calculate the fitness value of each frog and find out the global best individual X_g;

Step 3: Sort F node by their fitness values in descending order and divide them into m subgroups and each subgroup contains s node;

Step 4: Determine the best individual X_b in each subgroup;

Step 5: Update every individual in each subgroup by (1, 2, 3);

Step 6: Calculate the fitness value of each node and find out the global best individual X_g;

Step 7: Sort and group all node again if the hybrid iteration number reaches G;

Step 8: Judge whether the stopping criterion is met and if so, the program will be terminated and the optimum X_g is outputted; otherwise the execution process will jump to step4.

3.5 Cluster Performance

This module is developed to wireless Topology-based tree design all node place particular distance. Without using any cables then fully wireless equipment-based transmission and received packet data. Node and wireless sensor between calculate distance and transmission range then physically all nodes interconnected. The clustering method is used to one current cluster head. These head used to collect all the data in the source node. Commonly cluster means a group of node inner connecting in the network. The data will be transfer in the clustering head as well as clustering nodes.

IV. RESULTS AND DISCUSSION

This section analyses the performance comparison of the proposed approach to reduce the data flooding, offered load on the performance of the broadcast schemes and to guarantee QoS parameter. The comparison parameter considered is the number of retransmissions of a single packet via broadcast technique. The model investigates the performance of these flooding mechanisms is the unit disk model, i.e. nodes are randomly dispatched uniformly on a map and the network graph is then obtained by connecting nodes which are at a distance smaller than or equal to the unit.

The density of the network is varied by varying the number of nodes in the network. The density of nodes and traffic load are changed for various values from low to high. This is due to the fact that the proposed approach is applicable for network having different network densities and a speed between 1 and 4m/s, which mimic the human speed. For each simulation, the number of random sources and destination connections are chosen as 10 and generates 4 data packets/second.

4.1 Analysis of Packet Delivery Ratio

Packet Delivery Ratio (PDR) is used to evaluate the quality of the network. It defines the ratio between the packets received by the destination and the packets generated by the source. It can be obtained by using script, which generates the trace file and the result.

PDR = Received packets/ Generated packets * 100

Table 1: Packet Delivery Ratio comparative analysis

Number of nodes	BLAC	SDP	CSLA
20	0	0	0
40	30.42	40.35	51.98
60	37.45	42.23	52.12
80	52.98	50.87	61.65
100	63.45	84.55	91.55

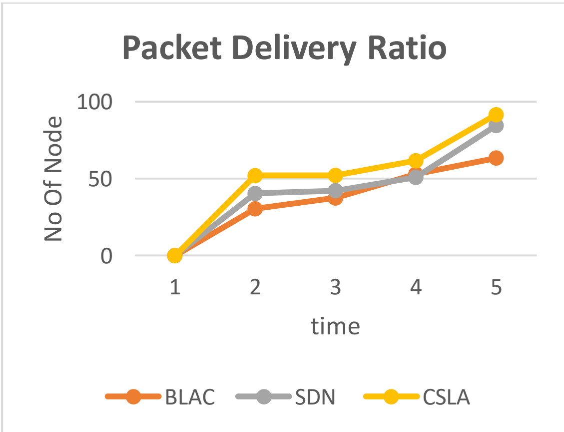

Fig. 4: Packet Delivery Ratio Comparative Analysis

Here,

CSLA – Cross Site Leaping Algorithm.

SDP - Semi-Definite Optimization Problem.

BLAC -Battery-Level Aware Clustering.

4.2 Energy Consumption in WSN

Wireless Sensor Network (WSN) is known to be a highly resource constrained class of network where energy consumption is one of the prime concerns. The main reasons for energy consumption are, for example, longer distance among the nodes and cluster head and that nodes randomly advertise themselves as cluster heads based on the energy level of the nodes.

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Energy awareness in WSNs is an emerging research area and the protocols presented in the relevant are focused on determining low-cost paths within the network. On the other hand, we try to avoid in-network transmissions if the induced error is acceptable. It enhances the reliability in packet transmission by predicting energy robust and near-by nodes in the data forwarding path towards the destination, using back propagation neural network algorithm. We have demonstrated through simulation results the improvement in battery energy consumption without trading off with the speed of data communication which is achieved at the cost of minimal overhead charges.

4.3 Analysis of End to End Delay

The data exchange between the war's troops located at different location in the terrain causes a high end to end delay. The time which is taken by the source node to deliver the data successfully to the destination is called as end to end delay. It is the difference between the time at which packets generated by the sender and the time the packets received by the receiver and it can be obtained from the trace file.

End to end delay = Received time – Send time

Table 2: End to End Delay

Rate of Sending Packets/sec	BLAC	SDP	CSLA
10	0.54	0.58	1.18
20	5.2562	5.7271	6.7144
30	3.2545	4.2123	5.2124
40	8.4241	8.5956	8.7142
50	6.2412	8.1417	8.2450

Table 2 shows the end to end delay analysis of the proposed system with the existing systems.

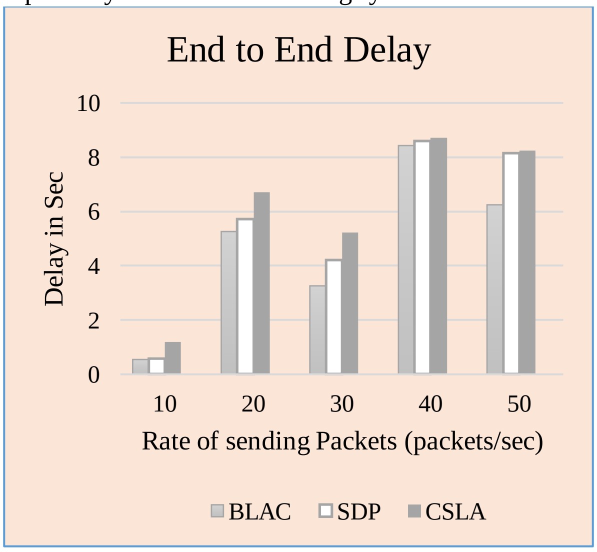

Fig. 5: End to End Delay Ratios

Fig 5 shows the end to end analysis of the proposed scheme with the existing systems. The delay calculated based on rate of sending packets in particular seconds. But, the slight variation is there. The proposed scheme leads to only tolerated delay in the network, even though the packets/sec. If the destination moves closer to the source node, the delay will be decreased. Otherwise, the delay will be increased.

4.4 Throughput Ratio

The throughput ratio defines the rate of data packets received at a destination according to the number of packets generated by the source node for a specified period of time.

Throughput = Received data * 8 / Data transmission period

Table 4.4 shows the throughput ratio analysis of the proposed system with the existing systems.

Fig 6 shows the comparative analysis of throughput ratio of the proposed scheme with the existing, based on the values is given below

- BLAC has improved its throughput by 19%.
- The proposed CSLA has improved by an average of 8% with SDP.

From the analysis, it is clearly shown that the proposed CSLA has improved its throughput ratio to 34.5 % which is compared with the existing system.

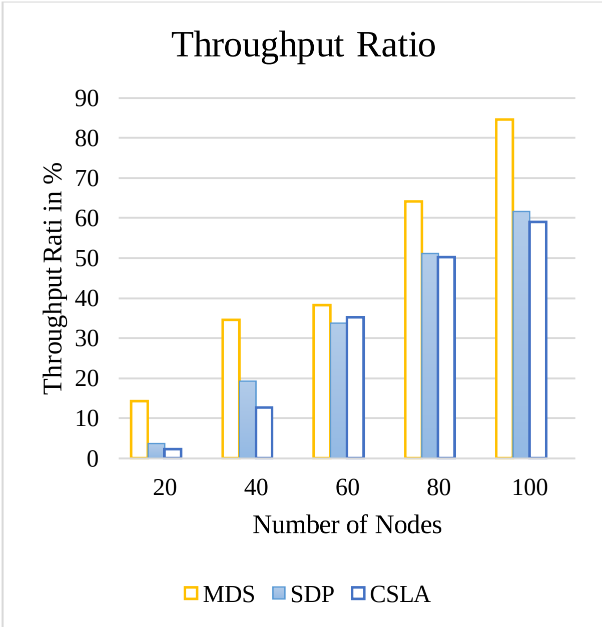

Fig. 6: Throughput ratio analysis

4.5 CH Energy Ratio

However, we believe that this is justified because the network used in this scenario had a limited number of CH nodes; it was not a true simulation but a use case where there were fewer interactions between nodes.

Table 3: Energy ratio comparison

	CH1	CH2	CH3
CSLA	93.82	90.27	91.04
BLAC	95.65	97.68	97.57

We examined the residual energy of the nodes in this scenario, as depicted in Table 3, after data transmission from each CH to the BS.

The distant node H1 profited from this approach and its remaining energy was higher, establishing the efficacy of CSLA with distant clusters.

In contrast, the other nodes had their residual energies lowered when using CSLA.

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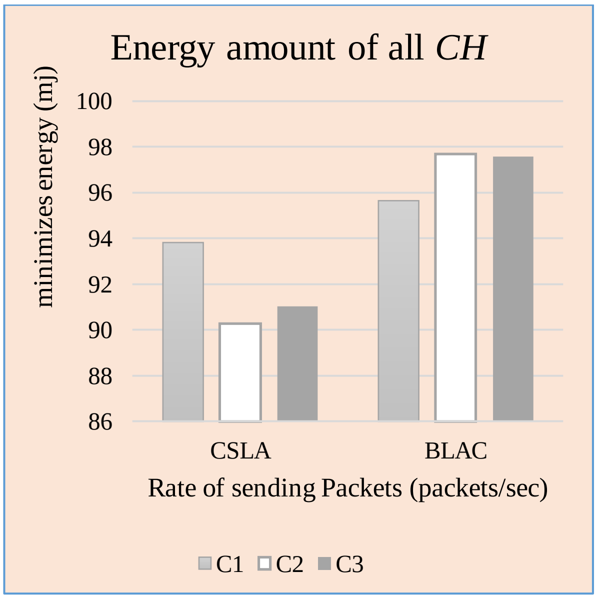

Fig 7: CH Energy ratio analysis

Pattern utility methods are frequently based on Comparison of time complexity, which attempts to transform the original features into an appropriate time complexity. For pattern utility, the original meaning of the features is generally lost.

V. CONCLUSION

As a conclusion, in this paper the comprehensive performance evaluation of two different algorithm, considering that minimizing the total energy consumption may not lead to the maximum network lifetime, we also plan to study the sub sink selection problem with network lifetime maximization as the optimization of this work. To avoid problem that the reincarnation clustering mechanism consumes large amounts of energy, CSLA has a clustering process at network launch time. At the network deployment phase, the Sink node broadcasts a signal in the network with a given transmission power. Surge and LDPAS has been conducted through simulation in terms of the percentage of energy consumption and send data sequentially. It can be clearly seen that LDPAS (clustering) as good as in wireless sensor networks because it was consumed more energy in mobile environment. However, there are still some room for improvement to enhance the performance of LDPAS. We also have identified some factors that might contribute to the degradation performance and highlight distribution of energy extends the lifetime of the nodes within the network thus stabilizing the neighboring node. This indirectly can reduce energy consumption as much as possible in mobile environment. The three metrics of packet delivery ratio, end to end delay and throughput are evaluated using AODV protocol in three density regions of low density, medium density and high density in network scene as well as in node point. In future work based on the future wireless sensor network find the energy reduce consumption as the mobile sink.

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