# Hybrid Energy Efficient Distributed Clustering Approach for WSN Using Linear Data Acquisition Algorithm

T. Suganya Angelin and R. Kiruthika

**Abstract---** One of the key ways to sustain network life in wireless sensor networks (WSNs) by Clustering. It involves grouping of sensor nodes into clusters and electing cluster heads (CHs) for all the clusters. A Hybrid Energy-Efficient Distributed Clustering to Prolonging network lifetime by distributing energy consumption. To obtain it, we add a small slot in a round frame, which is enables to exchange the remaining energy messages between the base station (BS), cluster heads, and nodes. Results have taken some parameters like throughput, Packet end-to-end delay, network load are to be taken. As for the fault tolerance or communication security, it may be easier to scale a solution to a cluster rather than to the whole network. Regarding energy consumption, it is far less consuming if each "normal" node sends data to the "closest" CH rather than emitting directly to the BS. The proposed algorithm used to implement different simulation results revealed that the HEED protocol achieves the best energy management, higher network lifetime and longest life span and implement the security as a result of a better load balancing model implemented by the protocol resulting from multi-hopping routing and better spreading of cluster heads around the network.

**Keywords---** Wireless Sensor Networks, Hybrid-Energy Efficient, Multi-Hopping Routing.

## I. INTRODUCTION

### *1. Network*

The network is easily a set of terminals, desktops, servers, and components that allow data flow and use of resources between each other. A network of computers is a group of computers. It's two types:

1. Wired Network
2. Wireless Network

#### *1.1.1 Wired VS Wireless Networks*

There are Wired and Wireless Networks available today for various types of networks. The wire is different from the wire point to the wire from the pointer point.

#### *1.1.2 Wired Networks*

These networks are usually associated with wires and cables. Typically the types of networks used in this type of cables are CAT5 or CAT6 cables. The connection is usually accompanied by the help of physical devices, such as switches and hubs, to increase connectivity strength.

These networks are usually faster than efficient low cost and wireless networks. There is a very small feasibility of getting disconnected after the connection is set up.

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***Advantages***

- 100Mbps speed to a wireless network offers connection 1000Mbps.
- Physical and standard wire connections have some wireless networking connections that do not have interference and fluctuations in the available bandwidth.

***Disadvantages***

- Due to a failure of the cables even due to computer systems it would be more difficult to replace that particular cable as many cables are expensive to maintain the network as it involves more and more costs.
- When using a laptop that needs to be connected to the network, a wired network controls the logical reason for buying a computer in the first place.

### *1.1.3 Wireless Networks*

Use wireless networks and use some sort of radio frequencies in the air to get data using some physical cables instead. In fact, these networks are so excited and appreciated that it is without needing to lay out expensive cables and maintenance costs.

***Advantages***

- Provide real-time information access and even mobile users in their home or office.
- surroundings up a wireless system is easy and fast without the need to pull out the walls and cables on the roof.
- The network can be extended to places which cannot be wired.
- Wireless networks provide more flexibility and adapt to the internal changes of the network.

***Disadvantages***

- Weather, interference due to other radio frequency devices, or barriers such as walls.
- The total action is affected when there are too many connections.

### *1.2 Problems in Wireless Communications*

Wireless communication issues There are a number of different types of transmission, pathway loss, interference, and controlled frequency spectrum. There is a number of breeders, among which there are barriers to creating a signal, transmitting the paths beyond the direct line of view, distortion and margin and scatter view due to the signs of which the target is traveling from its source. Transmission from the transmitter transmits the pathway loss signal strength exemptions. The path loss is determined in the ratio between the forces of the signal sent to the receiver signal. Radio frequency and terrain are mainly dependent on various factors. It is important to estimate foot loss in wireless communications networks. Because of the lack of radio frequency and landscape everywhere, it is difficult to estimate significant path loss during interaction. When interacting, the number of signals in the atmosphere causes the destruction of the original signal to interfere with each other.

Frequency and bands are provided through many wireless technologies, limited wireless technology is shared by the Limited Frequency Spectrum.

It's a very modern multi-user multitasking environment with a modern PC or hardware for software, no cheap (or nearly not) cash cost.

One of the most standards of Linux and Windows is basically a POSIX compliant UNIX. Linux includes all the UNIX standard tools and utilities. It is known as an advanced graphical user interface. Linux uses a standard, network-transparent X-windowing system with a "window manager."

### *1.3 Benefits*

#### *1.3.1 Low Cost*

Linux does not require time and money to get licenses, and its software comes with most GNU General Public License. It can start working immediately without worrying about how it can stop working because your software free trial version expires. In addition, there are large repositories that you need to download high-quality software for any work freely.

#### *1.3.2 Stability*

No need to reboot from time to time to maintain Linux performance levels. It is freezing up or due to memory leaks and does not slow down over time. (Up to a year or more) is not uncommon for hundreds of days up to the continuous.

#### *1.3.3 Performance*

Linux workstations and networks provide lasting high performance. It can handle an unusually large number of users at the same time, and older computers can respond to enough to be useful again.

#### *1.3.4 Network Friendliness*

Linux has created a team of programmers on the Internet and therefore has strong support for network functionality; Customer and server systems can be easily installed on any computer running Linux. It can perform reliable faster and higher backup than network alternatives.

#### *1.3.5 Flexibility*

Linux can use high-performance server applications, desktop applications, and embedded systems. You can only save the disc by installing the required components for a particular app. You can control specific computers by installing for office applications that you can instead choose for the whole package.

#### *1.3.6 Compatibility*

It runs on all common UNIX software packages and can execute all common file formats.

#### *1.3.7 Choice*

Lots of Linux distributions give you a choice. Each distribution is improved and proved by various systems. If you are the best you can take one; The core functions are the same; Most software runs on most distributions.

#### *1.3.8 Fast and Easy Installation*

Most Linux distributions come with user friendly installation and system schemes. Well-known software such as popular Linux versions come with tools like user friendly installation scaffolding.

#### *1.3.9 Full Usage of Hard Disk*

Linux proceed to work well even if the hard drive is almost full.

#### *1.3.10 Multitasking*

Linux is designed to do several things at the same time; Eg, your other work speed does not work as a large axis in the backdrop.

### *1.3.11 Security*

Linux is one of the most secure operating systems. Access to "Valls" and Flexible File Access to prevent unnecessary visitors or viruses from accessing the system. Linux users have the option of choosing to download software for free from online repositories consisting of thousands of high quality packages. Credit card numbers or other important personal information are not needed for purchase procurement.

### *1.4 Hybrid IP Traceback Scheme with Packet Counters*

One of the most serious threats to the Internet security is a DoS (Denial of Service) attack, where an attacker attempts to make a target host fail by sending a huge number of packets to the host. In fastidious, in recent years, a DDoS attack, where there are many attackers scattered over the Internet, has become more prevailing. Such a DDoS attack can be represented by an attack tree, the leaves and the root of which are the attackers and the victim, respectively. Furthermore, we call a path along which an attack packet traverses from one attacker to the victim an attack path.

A promising countermeasure against DoS/DDoS attacks is called IP traceback. In IP traceback schemes, each router on attack paths stores information about the paths on itself or packets. Then the victim uses the data to recover the attack tree and to find out the attackers. IP traceback schemes are roughly classified two-fold: probabilistic packet marking (PPM for short) protocols and logging ones. In PPM protocols, each router probabilistically writes path information onto the packets it receives. On the other hand, recording IP traceback protocols make each participating router sample packets, and store path information on itself PPM and logging protocols have some advantages, although, they have serious disadvantages. Therefore to take benefits of PPM and logging approaches, hybrid IP traceback schemes have attracted much attention these years.

### *1.5 Transmission Media*

In multi-hop WSN nodes communicate with each other through a wireless link. Wireless links are more prone to interference, fading, etc. These links can be radio, infrared or optical media. ISM (Industrial, Scientific, and Medical) band can be used for radio links. ISM band offers license-free communication in most of the countries. These bands are globally available and not bound to any particular standard. Therefore, it is easier for the implementation of power saving strategies in WSN using these bands. But these bands have power limitation and prone to harmful interference from the existing application. On the other hand, an infrared communication link is license free and robust against interferences but it requires a line of sight between transmitter and receiver. The unusual application areas of WSN make a choice of transmission media more difficult.

In any application, maintaining Quality of Service is important. But in WSN it is a challenging issue. Generally, WSN is scalable. But in large scale WSN with the sink if a distant node wants to send the data packet to sink then the packet has to follow along multi-hop path which increases the possibility of fading and packet loss in a wireless communication medium. Long multi-hop path also increases delay for an end to end packet delivery which is not desirable for time critical application like disaster management. The packet loss problem may be solved by retransmission of packet using a simply acknowledge scheme. But the packet retransmission energy and energy required for sending an acknowledgment for each packet is very high. Retransmission also increases the delay in data delivery.

### *1.6 Energy Efficiency*

Energy efficiency program best practices in energy efficiency less energy efficiency, tables refers to the use of some of

these programs for the same or advanced level meal chapter of the energy consumer service. The term energy efficiency as used here includes these economic and environmental savings enthusing less energy at any time, including at times of mates are extrapolations of the results from region peak demand through demand response and peak al program to a national scope. Actual savings at the shaving efforts. Regional level varies based on a number of factors.

### *1.7 Time-delay*

Time-delay systems (TDS) arise from inherent time-delays in the components of the systems, or from the deliberate introduction of time-delays into the systems for control purposes. Such time-delays occur often in systems in engineering, biology, chemistry, physics, and ecology. Time-delay systems can be represented by delay differential equations (DDEs), which belong to the class of functional differential equations, and have been extensively studied over the past decade's such time-delays can limit and degrade the achievable performance of controlled systems, and even induce instability. Time-based systems are harder to analyze classical methods and design stable control designs, in particular, will lead to a number of roots characteristic equation. Thus, such problems are often solved indirectly by using an approximation.

### *Scheduling based Data Transfer*

The protocol, the network must maintain each node's resources. A single knee failure in relay networks is usually unimportant if it does not lose sense and communication coverage; Ad-hoc networks, instead, are based on personal communication and are associated with any tip connection loss. The purpose of the QoS is to support the routing of prototypes, routing of mobile terminals, and many other things. They have each sensor node transmits and receives data with fixed transmission and reception power, respectively. So the power consumption is independent of the transmission distance between adjacent nodes. Accordingly, we adopt the following energy model due to calculating the power consumption.

### *Clustering in Wireless Sensor Network*

Their limited, small power sources are becoming the most precious resource for the sensor nodes in networks. To improve the use of energy resources, researchers have put forward several opinions from the angles developed. Clustering of terminals WSNs plays an important role in preserving energy. Approaches to solving conflicts arising from clustering useful data transmissions. Users have collected data from a WSN tank's sensor knots and the same via the Internet or other private virtual network (PVN). By default, the WSNs feature and the Hock Network needs to inherit. The WSN belongs to the limited range of wireless personal area network (LPWPAN).In an environment the sensor ends can collect data and transmit it directly or collectively into a sink via other edges. Many sensor applications are equipped with sensor nodes to achieve measurement health and reduced network traffic congestion.A clusters are provided with cluster heads and these cluster heads transmit the aggregated data to the base station or the sink. AA WSN can effectively suggest a sleep / wrapping schedule for the set solution to reduce power consumption. In many sensor applications, there is no need to take all the sensor nodes up and take the energy. Based on the theoretical and external dependence, some sensor edges can be used in sleep mode. An effective schedule can be devised and communicated to these sensor nodes through the sink or administrator. Also, clustering ensures scalability of the application performance due to its semi-distributed nature. That is, a set approach, the sensor networks transmitting energy control energy awareness program (EACLE) provides a shared approach to the path to reach the tank. This project sets the stage of transition power between the intrinsic batch and energy-saving improvements.

***Assumptions and Traffic Model***

The interval range for packet broadcasts is greater than the broadcast range. In our analysis, any interactions or receptions can occur simultaneously within the scope of that intervention. Nodes may be part of their interference region outside the network boundaries of the network closely.

In order to properly apply our analysis results to simulation scenarios, we define the concept of effective interference range. Its interruption area inside the network boundary is completely the same as the interval range of useful interference range.

Otherwise, it is defined by the radius of the disk whose area of network interfaces will be equal to the area in the area of interference.

***Throughput Analysis***

The network displays are two different types ie saturated and unsubstantiated. The difference is based on traffic load on the total MAC layer on the network. In a saturated network, the MAC layer can not handle any additional transmissions beyond the current load. For such scenarios, besides other factors, the total end-to-end throughput is limited by the hop-by-hop throughput, commonly referred to as the capacity of the network. In an unsaturated network, the raw channel capacity is not fully utilized. In such situations, the regulatory network qualification does not play any role. However, such other factors as the channel error rate and the allowed link layer replications affect the output rate.

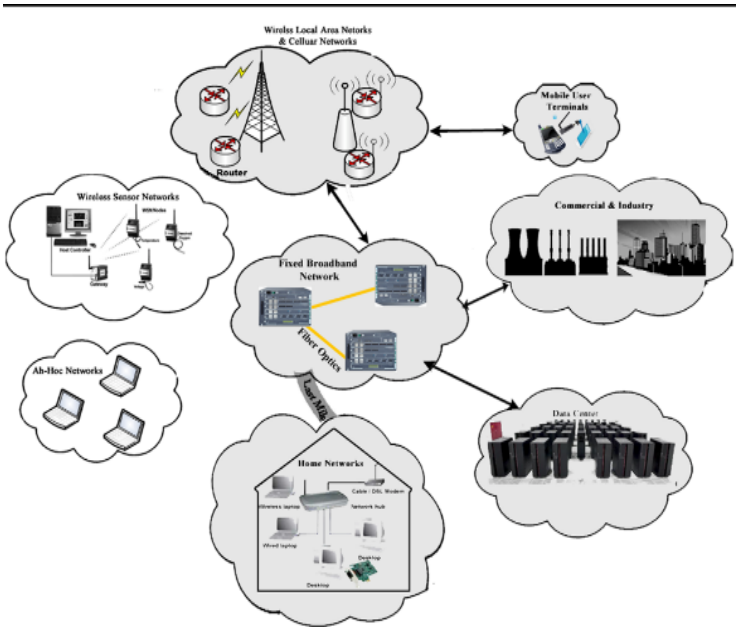


Figure 1.1: Energy-efficient Networking

## II. RELATED WORKS

Wireless Recharge Sensor Networks is a framework for unbounded and informative collecting of mobile power. Recent years Wireless Sensor Networks have made rapid growth and rapid growth of technologies for improving energy efficiency. However, the low output of energy capturing devices can only provide intermittent recharging opportunities to support low-rate data services due to spatial-temporal, geographical or environmental factors. To provide steady and high recharging rates and achieve energy efficient data gathering from sensors, this technique utilize mobility for joint energy replenishment

and data gathering Finally, they validate the effectiveness of our approaches by extensive numerical results, which show that solutions can achieve perpetual network operations and provide high network utility[1]

Moving mobile data collection and power provisioning in Wireless Recharge Sensor Networks. The emerging wireless energy transfer technology enables charging sensor batteries in a wireless sensor network (WSN) and maintaining perpetual operation of the network. Recent break-through in this area has opened up a new dimension to the design of sensor network protocols. In the meanwhile, mobile data gathering has been considered as an efficient alternative to data relaying in WSNs. Furthermore, a distributed algorithm composed of cross-layer data control, scheduling and routing subalgorithms for each sensor node, and sojourn time allocation subalgorithm for the mobile collector at different anchor points. They provide the convergence analysis of these subalgorithms. Finally, the WerMDG algorithm in a distributed manner in the NS2 simulator and give extensive numerical results to verify the convergence of the algorithm and the impact of utility weight, link capacity and recharging rate on network performance[2]

Multiple Pump Wireless Sensor Networks Mobile Charging and Information Making: Why Using the efficient use of the number of mobile devices starting from the multi-sized problem sensors sensors go to collect and collect such data for everlasting work (when the WRSN Wireless Recharge sensor network gets a great deal of attention).

They use the Mobile Device Planning Algorithm (MDSA), using a limited number of mobile devices that do not harm and create sensor data to create a new algorithm that explores the problem of multiple tank's (PERDCMS) problem. Concrete results show that the simulated results are more functional than the MDSA method [3]

Rechargeable sensor networks gather wireless power with unused data and mobile data. The emerging wireless energy transfer technology enables charging sensor batteries in a wireless sensor network (WSN) and maintaining perpetual operation of the network. Recent breakthrough in this area has opened up a new dimension to the design of sensor network protocols. In the meanwhile, mobile data gathering has been considered as an efficient alternative to data relaying in WSNs. A distributed algorithm composed of cross-layer data control, scheduling and routing subalgorithms for each sensor node, and sojourn time allocation subalgorithm for the mobile collector at different anchor points. Finally, this technique give extensive numerical results to verify the convergence and the impact of utility weight on network performance.[4]

Recharge Wireless Sensor Networks on Wireless Power Transfer and Max Flow. Rechargeable or energy harvest Wireless Sensor Networks (WSNs), the most important concern is the flow or data rate at one or more sinks. However, this data rate is enhanced with the power and connectivity of each node available. To date, in order to increase the amount of data extracted from a WSN, past works are considered routing approaches or they improve the location of waste. They created three hybrid solutions to create the mixed-number linear program (MILP) for the NP-hard problem in the hands of the ACS, proposing three novel solutions: (a) the path, preferably sinking. Then it was said that using the LEGRANNEE and subclass optimization MILP searches for a neighboring solution that would result in almost a high flow rate and (iii) Lagop. This technique shows that the maximum performance of the tap test scenes is obtained by MILP, with the highest possible rate of 99.40% of the flow rate.[5]

Mobility is assisted by collecting data on multiple-power power replenishable wireless sensor networks.Wireless sensor networks adopting static data gathering may suffer from unbalanced energy consumption due to non-uniform packet relay in such networks, especially in large scale networks. On the other hand, although mobile data gathering provides a reasonable approach to solving this problem, it inevitably introduces longer data collection latency due to the use of mobile data

collectors. The performance of this scheme by extensive simulations and the results show that MADG provides significant improvement in terms of balancing energy consumption and the amount data gathered compared to previous work.[6]

Rechargeable sensor optimization of information through dynamic sense and routing on networks.Data gathering in wireless sensor networks typically involves two steps: data sensing and data transmission, which dominate the energy consumption of each sensor. In Rechargeable Sensor Networks (RSNs), in order to optimize data gathering, energy should be carefully allocated to data sensing and data transmission due to time-varying renewable energy arrival and limited battery capacity. In DS2RC, each sensor can adaptively adjust its transmit energy consumption during network operation according to the amount of available energy, and select the optimal sensing rate and routing, which can efficiently improve data gathering. The optimality and the convergence of this algorithms. Extensive simulations are performed to demonstrate the efficiency of BEAS and DS2RC by comparing with existing algorithms.[7]

Vehicle movement costs and capacity controls A mobile data collecting framework for wireless recharge sensor networks.Many recent works can be said to have learned mobile vehicle planning to recharge the sensor nodes via wireless power transmission technologies. Unfortunately, most of them did not override key consumers with energy consumption and recharge their ability to lead to problem table or stand alone vehicles.an adaptive algorithm that partitions the network and forms Capacitated Minimum Spanning Trees per partition. Through extensive evaluations, to find that the adaptive algorithm can keep the number of nonfunctional nodes at zero. It also reduces transient energy depletion and saves energy. Other common information collecting methods show comparisons to reduce the secrecy of two orders at the level of electric storage.[8]

To improve the efficiency of wireless recharge sensor networks using resonant reassembly. Wireless charging wireless sensor has provided a convenient alternative to the sensors' power in the networks. Due to physical restraints, we reviewed a single node recharge at a time with only limited capacity and scalability in previous works. Recent advance on multi-hop wireless charging is gaining momentum to provide fundamental support to address this problem. Finally, on finding more space to create a post-optimization algorithm that adds to the total system cost reduction, and reassessment adds even more parking locations to improve results based on charging. This technique shows that these algorithms can handle dynamic energy requests effectively, and at least three times in the nodes, minimize service interruptions by the amount of magnitude compared to a single node charging program.[9]

WiField, a word IEEE 802.11 based farm sensor information collection and logging platform.A new agricultural sensor data logging platform (WiField) is described, based on IEEE 802.11 WiFi technology. It is low-cost, low-power, and achieves long (>2km) range communication to on-farm WiFi access points. WiFi is an attractive choice for this application because of the wide range of other devices that increasingly need internet access in farming systems. It integrates solar charging of rechargeable batteries, or can be run off disposable batteries for at least an entire growing season due to design choices that minimize power consumption. It is designed to upload data to cloud services in real-time. The data is then processed in the cloud and interactive graphs are produced, so multiple users can access up-to-date information in order to make optimized, timely farming decisions. The use of the WiField devices in a cotton farming operation is described, for scheduling irrigations and determining crop water use through the soil profile.[10]

A novel energy replenishment and data gathering mechanism in wireless rechargeable sensor networks. Current study on prolonging lifetime for wireless sensor networks (WSNs) mainly focuses on two techniques. The first technique is to reduce energy consumption of sensor nodes, while the second technique is to recharge sensor nodes by harvesting energy from the

ambient environment or RF based energy transmission. the application of OWER-MDG in WSNs and provide an efficient algorithm which maximizes network utility. The numerical results demonstrate the performance advantage of OWER-MDG and provide a guidance on parameter selection for system design.[11]

Improvement-based distributed algorithms for mobile data collection in wireless sensor networks. Recent advances have shown a great potential of mobile data gathering in wireless sensor networks, where one or more mobile collectors are employed to collect data from sensors via short-range communications.

Among a variety of data gathering approaches, one typical scheme is called anchor-based mobile data gathering. To efficiently solve these problems, decompose each of them into several subproblems and solve them in a distributed manner, which facilitates the scalable implementation of the optimization algorithms. Finally, to provide extensive numerical results to demonstrate the usage and efficiency of this algorithms and complement our theoretical analysis.[12].

Genetic Algorithm based Approach to Determine Optimal Collection Points for Big Data Gathering in Distributed Sensor Networks. Distributed sensor networks have become one of the primary source of generating big data. Therefore energy efficient data gathering in densely distributed sensor networks is a demanding area of research. . In this technique use genetic algorithm based approach to optimally select the data gathering points that minimize the distance of mobile sink trajectory to improve data collection time. The experimental results depict that this technique is able to achieve optimal trajectory for mobile sink compared to Expectation Minimization technique.[13]

Adaptive distributed energy-saving data gathering technique for wireless sensor networks. Popularity of wireless sensor networks (WSNs) is increasing day a day where hundreds or thousands of applications are explored. In most of such applications, the need of gathering data periodically about the monitored environment beside the limited, generally irreplaceable, power sensor sources make energy conservation and big data gathering reduction two fundamental challenges in such networks. ADiDaG works into rounds where each round consists of three phases: data gathering, sampling decision, and transmission. These phases respectively use Map reduce, longest common subsequence similarity and grouping approach in order to search data redundancy and adapt sensor sampling rate at each round[14]

Wireless Sensor Networking is a cross-layer optimization of information related to networks. The meeting issue relates to the sensor data by a tank's node with a wireless sensor network.

The sensor edges are controlled by the energy to maximize the network lifetime and design are efficient shared protocolso.

Many of the existing approaches are only focused on coordinating the routing layer, but in fact the routing program is often combined with the firm layer and connectivity access power control in the MAC layer. In this case, the problem can not be turned into a focal advantage, but a twin character is interrupted when implementing the Liguria double system.

An efficient heuristic algorithm, JRPRA, to solve the general problem, and show through numerical experiments that it can significantly narrow the gap between the computed and optimal solutions.[15]

## III. IMPLEMENTATION OF PROPOSED SYSTEM

Energy Efficiency of the HEED protocol was distributed, of the most widely known clustering-based protocols for WSNs. The different simulation results revealed that, the HEED protocol achieves the best energy management, higher network lifetime and longest life span as a result of a better load balancing model implemented by the protocol resulting

from multi-hopping routing and a better spreading of cluster heads around the network.

Linear Data Acquisition algorithm (LDA) used to implement the throughput and security data packets and it is used fixed node as the cluster head, then it has to collect data from all of its child nodes and has to process the data for all the time period. This leads to faster battery drainage in the fixed cluster head.

When solutions are either slipping or a set of parameters, they routinely compromise the rest of the performance factors. This problem leads to many interesting questions and solutions describing a WSN capability. Slicing on the theoretical and spatial domains, the process is more complex, with more complex diversity and very special.

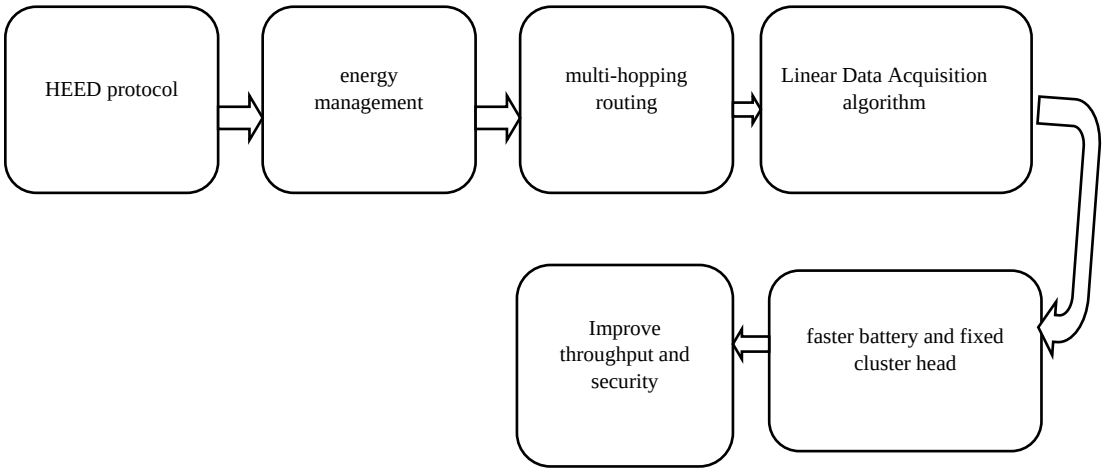


Figure 3.1: Implementation of Proposed System

### *3.1.Linear Data Acquisition algorithm*

**Algorithm**

Input: Node selection

Output**:** Improve Communication security

Step 1: Start the program

Step 2:Find source and destination

Step 3: To identify available path between

source to destination

Step 4: To apply to Linear Data Acquisitionalgorithm

Step 5: If (Authorized)

Every group contains various key using a linear feedback shift register.

$$n = n_{0,} n_{1,} n_{2,} \dots \dots . . n - 1$$

Else

Step 6: There is no security path available between source to destination. If change the path

Step 7: if (Every node) // check the secure path between source to destination

To generate the network establishments

Else

Go to Step 5

Step 8: end

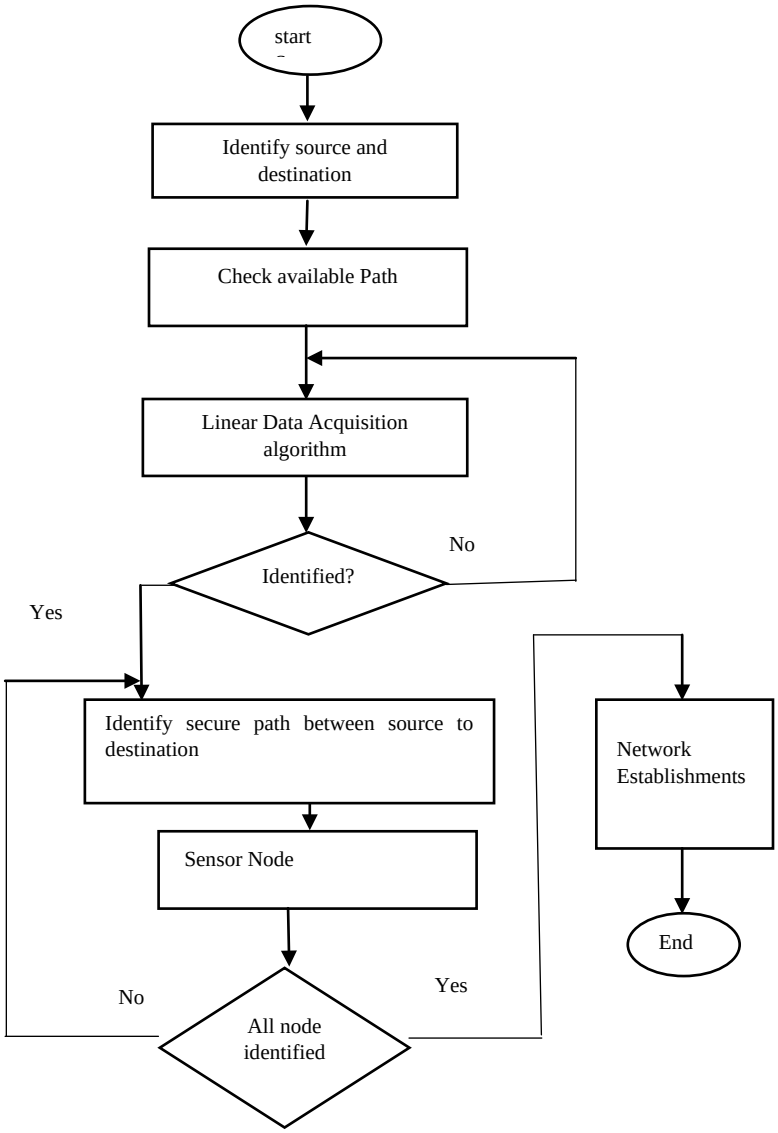


Figure 3.2: Identify the path between source to destination

Figure 3.2 describes the node is the initial network, and identified secure path between source to destination.

### *3.2 Energy Consummation*

This algorithm describes an effective network lifetime and determines the availability of its entire lifetime system.

**Algorithm:**

Input: Identify a path

Output: improve Energy consummation

Start

For each node (Previous node S (n))

{

For each round (Previous trip D (t))

{

To calculate the number of throughput n (Dh);

To calculate the Remaining Energy En (T) with En (i), F (DT), , n (TR);

To calculate the Energy Consumption Rate for EN (n);

To calculate Delay D for D (n);

}

}

## IV. RESULTS AND DISCUSSION

The proposed Linear Data Acquisition Algorithm (LDA) used to long-term evaluation of security network is based on and analyzed for its efficiency. Nodes are a significant source of transport in urban areas. Through this is a significant relationship between the cores of the sensor and the device-related sensor in the range from the target source.

### *4.1 Packet Delivery Ratio*

The Pocket Delivery Rate (PDR) is used to evaluate the network quality. Data packets will be replaced From the sender to the shortest path Receiver. The pocket is identifying Done and sent by short Path. The packet delivery rate will increase.

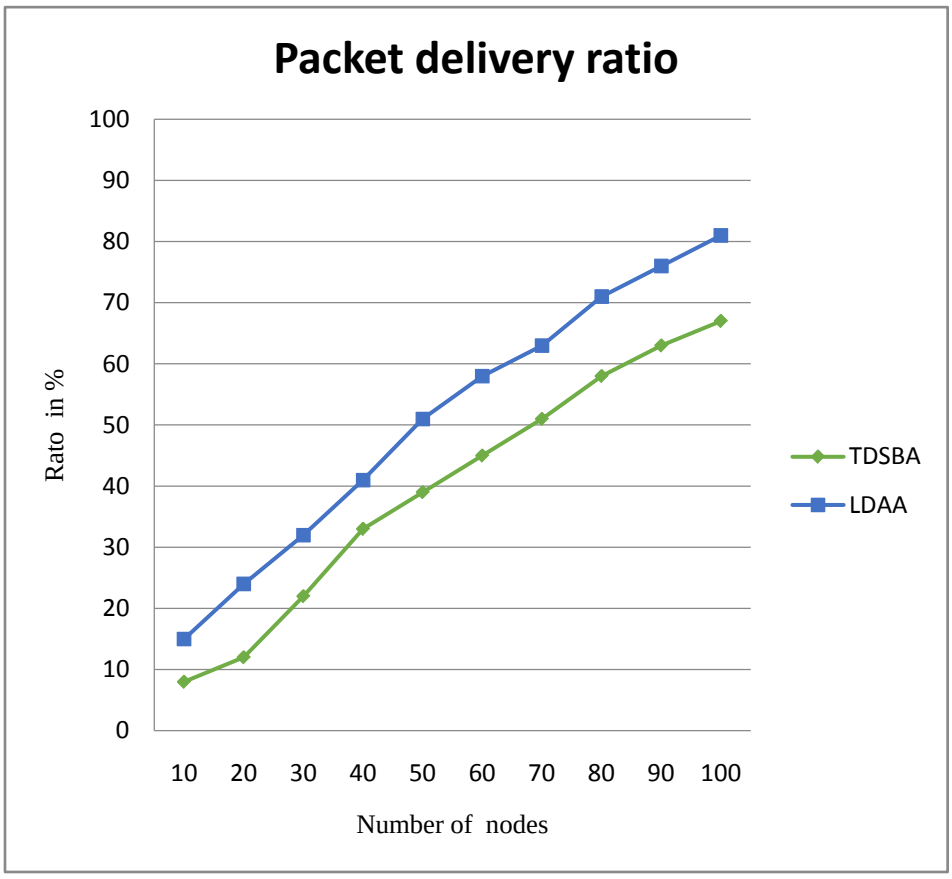


Figure 4.1: Comparison of Packet Delivery Ratio

Figure 4.1 Describes the clear understanding that the systematic method indicates energy consumption.

### *4.2 Throughput*

Active successful messages are targeted at target. In this way, longevity and use of phase are continuously concentrated in the language.

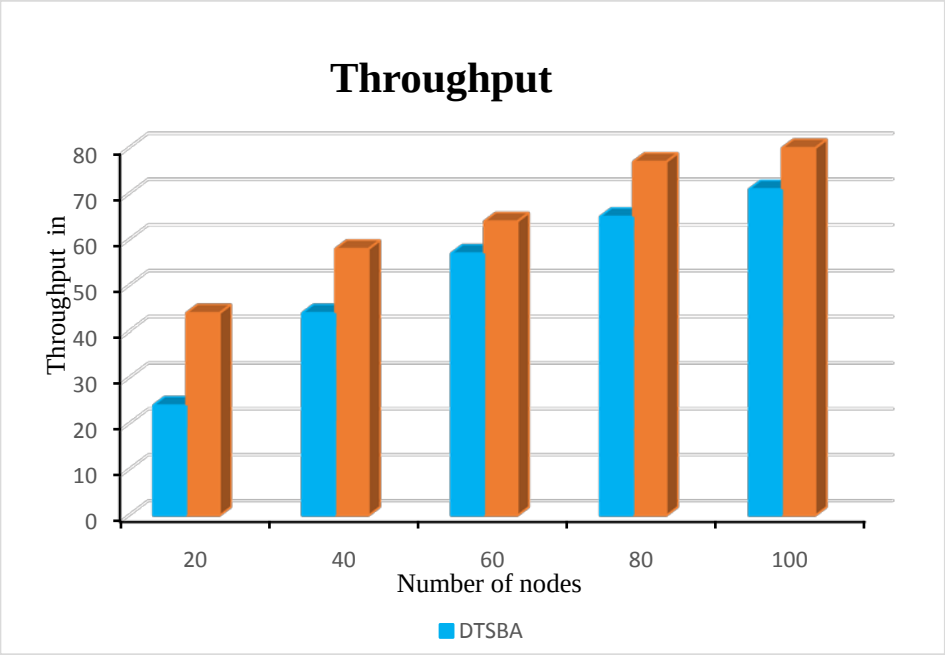


Figure 4.2: Comparison of Throughput

Figure 4.2 Describes the number of output performance counters based on the number of time intervals provided on targeted location. It is a measure that defines how fast a node can send data through the network.

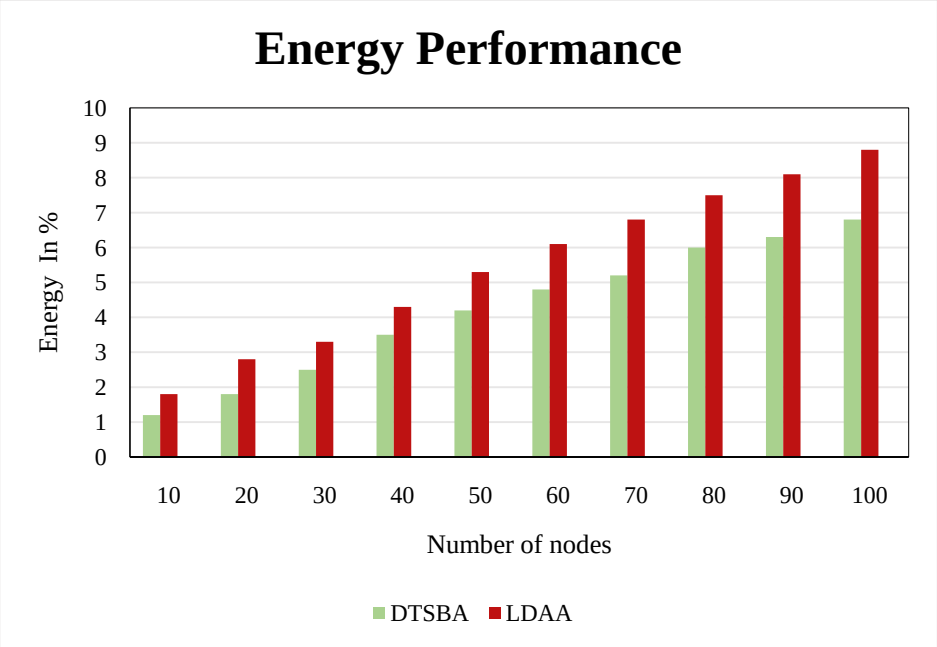


Figure 4.3: Comparison of Energy Performance

Figure 4.1 Energy efficiency describes the production of different formats, which indicates that the proposed project's energy duration has increased.

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