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# A Stochastic Geometry Analysis in Heterogeneous Networks

**Sindhu M[1], Dhanalakshmi L[2]**

*[1]PG Student, [2]Assistant Professor*
*[1,2]Dept. of Electronics and Communication Engineering, Bangalore Institute of Technology, Karnataka, India*

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**Abstract –** *A Wireless Sensor Network (WSN's) comprises of enormous group of sensor module with confined benefited cellular equipped power. It monitors a physical environment and a sink node or a centralized base station is present which collects the data gathered by the sensor nodes for processing and analyzing the data and to detect changes in the environment and alerts the end user. As a result, the scheme of an efficient power and stretchable routing convention is a crucial way for the WSN's implementation. This paper represents improved method for power efficiency selection and the reselection of the cluster head for multiple path routing to convey the information from the origin to the sink node without any data loss and consumption of the time and concurrently improving the packet delivery ratio and also the throughput. For the purpose of achieving the stability of the system application the multipath scheme is used. The intrusive estimation for terms like packet delivery ratio, throughput and intensity application is found. The result shows that more amount of energy is saved and time delay is also reduced. Hence the lifetime of the sensor nodes is more reliable compared to the other routing techniques.*

***Key Words*: WSN, Packet Delivery Ratio, Throughput, Network Lifetime.**

## 1. INTRODUCTION

Wireless Sensor Network (WSN's) comprises of immense collection of balance node with confined benefit as power unit is equipped with potency. WSN is a diffused method that require a huge amount of appropriation, self-accommodate, slight, low graded apparatus called sensor nodes. Routing Protocol is the necessary activity of adaptable nodes in WSN's and MANET's.

The equivalent and unshared transmission strategy in which the MNO's can handle individualistic in the absence of splitting framework and also scale with other MNO's. In spite of the structure studied is a heterogeneous network which consists of both massive cells and portable cells, even now works unconventionally. As a result, the MNO poses restricted analysis or elevated total cost of ownership (TCO), and could not convey expected measurements. Node in WSN's are randomly distributed over a given land region. In such occurrence hardly the limitation in this method can acquire densely chosen while further get lesser integer of lump.

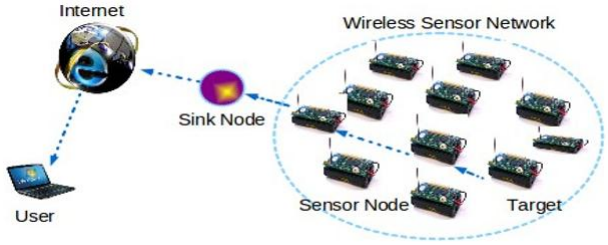


Figure 1: Outline of Wireless Sensor Network.

Clusters with region form routine are promoted for accommodation. Cluster form scheme can reduce power usage and it also clarifies the network management by examining to combine nodes in the given sets. Cluster form admission magnifies the flexibility, robustness and also implements load stability with specific collection.

The sensor nodes can be added or removed depending upon the application, no complex procedures are involved. In figure 2 shows a general topology of sensor nodes in the network connected to the base station through wireless links.

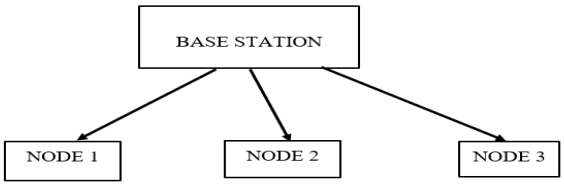


Figure 2: WSN Components: Base Station and Distributed Nodes.

To fetch the wireless linkage through the end user and the BSs are irregular due to multichannel fading such as small-scale fading and large-scale fading. Moreover, the allocation of end user and the main station where mainly the small cell base stations are arbitrary. Theoretical conformation-established pattern of such matrix has been involved since it can express the topological randomness. The evolution constitutes a new provocation for the acceptable network analysis and selection procedure. As a substitute of subsequent the uncomplicated procedure for detection and attachment, now we can enhance the system utilization which is greatly dependent on a descent examine network analysis and selection policy. When there is numerous access available in the network, users may have trouble in choosing,

which network to relate to and how to substantiate with that defined network.

This method relates to "network selection" or "access selection" and it is a key apparatus to non-homogeneous wireless method. It is carried out in three cases, instantly the end user makes beginning procedure, later on the end user makes a current utility appeal and finally when there is a surrender appeal. Accordingly, the network determination has individual aim and hence it uses discrete standard to model the conclusion.

### 1.1 Objective of Project

1) Cluster position routing process is capable of assuring load stability and elegant choice of cluster head to expand the system lifespan.

2) The system is cleaved into identical quadrangle dimension cluster and the integer of nodule in each cluster is recognized by its integrated value.

3) Multiple hop conversation process is used among the source node to the clusterhead to find out the shortest path.

4) The realization of the present process is substantiated in phrase of the achievement boundary such as packet delivery ratio, power application, network lifetime and calculation overhead.

### 1.2 Problem Statement

It needs enormous amount of energy as well as time to regulate and prosperously achieve. Generally, the utilization of these assets will expand in proportion to the number of frameworks that are accessible to the end user.

A absolute examination need to be taken into account which is necessary to carry out system selection.

- **Terminal capabilities:** It refers to the maintenance of many interfacing capacity and also potential used at the ultimate and etc. It also takes part when the end user is susceptible to the terms.
- **Bandwidth:** The bandwidth density is available at the destination. Hence, it is used when the specific application is taken into account and maintain the load of a stabilized system network.
- **Mobility aspects:** It is used to calculate the speed and direction.
- **Received Signal Strength (RSS):** SINR is found by this process.

The advance process contains the phases mentioned below:

- Organization Stage
- Creation of the Cluster Stage
- Selection of the Cluster Head Stage
- Data Communication with multiple path Stage
- Reselecting the CH Stage

The advance routing convention is based on the reactive convention classification which is based on the routing upgrade technique. The advance motion commonly assigns the load beyond the system which enhances system effective, and improves system lifespan. Figure 3 shows the advance procedure replica.

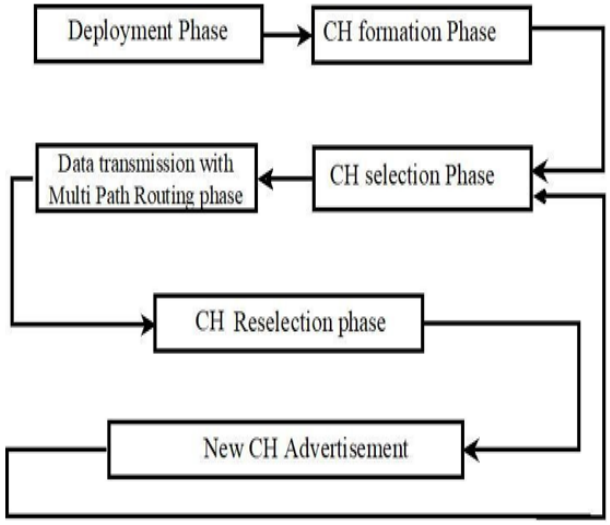


Figure 3: Advance System Model

## 2. SYSTEM MODEL

Wireless Sensor Network are collected from various carrier nodule which are issued with the processor, memory bank, and alternate radio technologies. The carrier nodule co-operates with everyone to communicate the carrier information to the main base station, called as the destination nodes. The main aim of routing convention is to magnify both dependable and lifespan of wireless sensor network by observing the ability of a sensing nodes with measuring limitations, such as finite capability, moderate exhibitor and lesser connection transmission capacity.

We can consider node according to our requirement from the center as base station to transfer the information from the origin to the terminal. The clusters head is represented by A, B, C, D. with the help of destination nodes. For considering the source node we should always consider the cluster head. From the cluster it will go to the base station and as well as different clusters that are been considered.

For a heterogeneous network the data will be transferred only from the head of the cluster. Figure 4 represents the cluster formation from the nodes that is been considered.

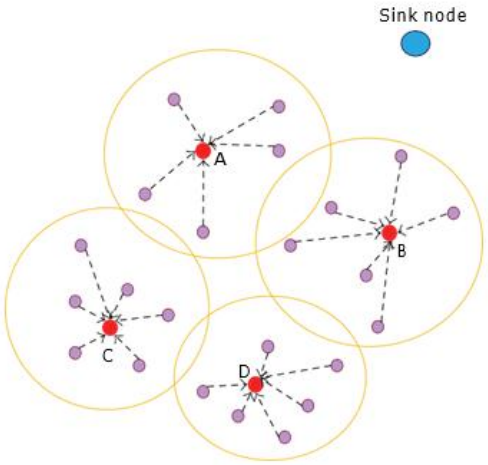


Figure 4: Representation of Cluster Construction

### 2.1 The Advance System Model consists of following steps:

- Organization Stage
- Creation of the Cluster Stage
- Selection of the Cluster Head Stage
- Data Communication with multiple path Stage
- Reselecting the CH Stage

### 2.1.1 Organization Stage or Node Initialization:

The set of nodes (where nodes are denoted as n = 1, 2, 3, 4, 5…….) that are organized inconsistent in a given chosen region of a quadrangle defined. At this moment the mentioned node parameters are x and y axis, ID.

### 2.1.2 Creation of Cluster Stage

The information that is formed from different sensor has been used to identify the clusters and those clusters are noticed by the cluster ID, using the design process. Usually while doing clustering, the path that is established is done in three ways:

- Geographical distance
- Power Sensor
- Multipathing

The cluster formation is done by K – mediods.
**Geographical Distance:** The geographical distance is used to find the interspace among the nodes and nearby main station.
**Power Sensor:** Resending of packets is reduced then the sensor lifetime or the validity becomes more.

The clusters are formed only from the cluster head with center as main station. Those cluster head are named as CH1, CH2, CH3, CH4 and the clusters that are formed are denoted as C1, C2, C3, C4.

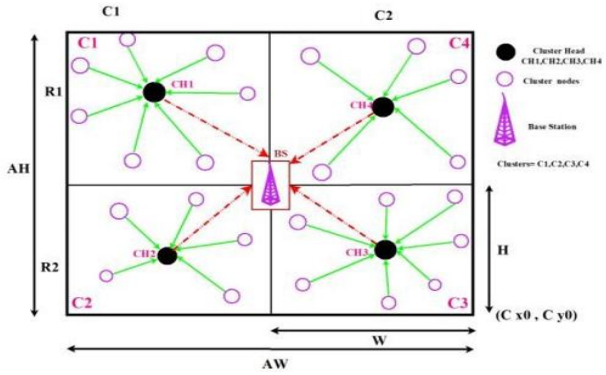


Figure 5: Cluster Formation

### 2.1.3 Selection of Cluster Head Stage

This phase is mainly necessary for any type of power convention. The task of this phase is to transmit the information from all the node and that information should be forwarded to the base station. Consequently, it is necessary to select the magnificent nodes as the CH is been adjoined by all the node. The main terms of the advanced process are:

- $R_E$
- $K_D$ (nearest to base station)
- Node Density is established on the integer of the nearby node.

The steps that are involved in cluster formation and finding the shortest path are described below:

- Node Initialization
- Cluster Formation
- Network Initialization
- Source – Destination node
- Route Request Reply
- Path Selection
- Performance
- Exit

**2.2 Dijkstra's Algorithm** was found by the computer scientist Edsger Dijkstra in 1959. It is a single source shortest path tree algorithm. The algorithm is developed for directed or undirected, connected and weighted graphs, where the weights are strictly non-negative.

### 2.2.1 Dijkstra's Design to calculate the Shortest Path

The router builds a graphical representation of the system. It recognizes the origin and terminal node, namely R1 and R2. The router constructs a model which is defined as adjoining model. In this adjoining model, a correlated indicate weight [x, y] is the weight of a links among nodes Rx and Ry. If there is no straight link among Rx and Ry, this weight is recognized as "infinity."

### 2.2.2 Procedure for finding the shortest path using Dijkstra's design is as follows:

1) The router constructs a standing node for the system. The following steps are as follows:
   - Precursor department - shows the preceding nodes.
   - Distance department-show the addition of the weight from origin to that terminal nodes.
   - Description department - shows the standing nodes; each node will have one status node ie, "everlasting" or "temporary."
2) In the upcoming step, the router classifies the terms of position document and set their description to "temporary" and their distance to "infinity".
3) T-node is been set for the router. If R1 is the origin T-node, ie, the router alters R1's description to "everlasting." Once a description is altered to "everlasting," it never alters again.
4) The status document is been updated by the router for all temporary node that are straightly link to the origin T-node.
5) Temporary node moves back to router and selects the one whose influence to R1 is lower. Node is terminated as sink nodes.
6) The T- node does not belong to R2 then the router moves back to the step 5.
7) If it belongs to R2 then it is extracted from the previous node and continues this until R1 arrive. The better route from R1 to R2 is shown.

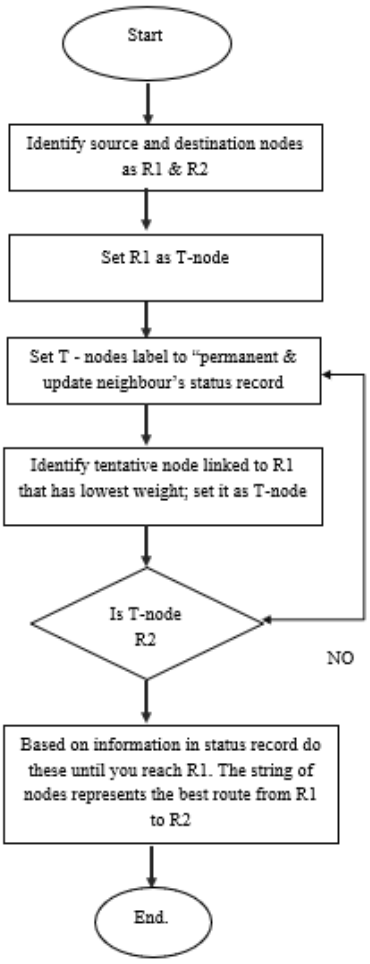


Figure 6: Flowchart of Dijkstra's Algorithm

**2.3 Route Request Reply:** After finding the shortest path, we use node confidentiality. After path is established, the packets are been aggregated and the data is sent. All the calculations are done in this process. The shortest path can be found.

**2.4 Path Selection:** While finding out the shortest path for the transmission of data, we introduce an attack namely anamoly attack which is used to measure the networking performance.

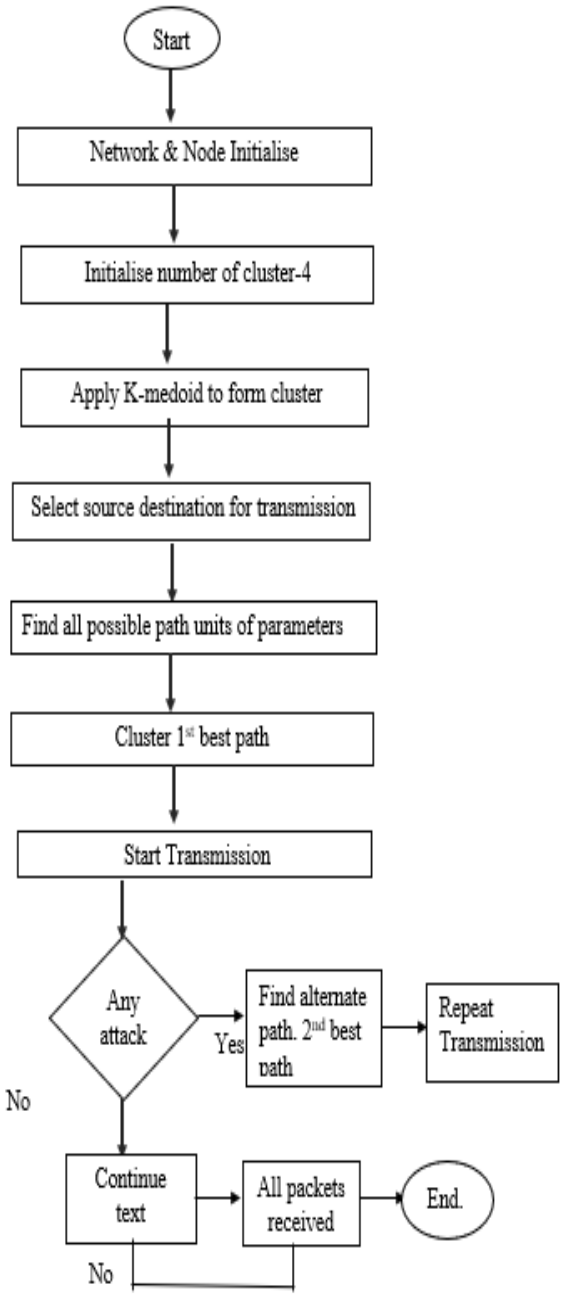


Figure 7: Flow Diagram of Project

**2.5 Performance:** The parameters that are calculated are

**Packet Delivery Ratio:** This is used to overcome time delay that occurs when the data are transmitted from the origin to target. Therefore, we can reduce the usage of time.
**Throughput:** It is the number of messages successfully delivered per unit time.
**Energy Consumption:** It is the amount of energy consumed by the sensor nodes in the network during data transmission.

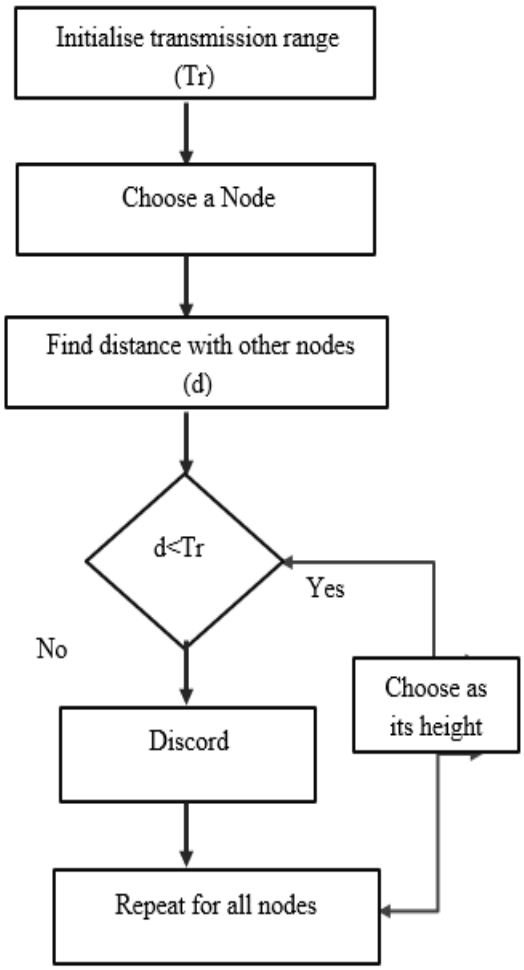


Figure 8: Flow Diagram to find the distance

## 3. RESULTS

The completion of suggested design is estimated by conveying out substantial replica. The completion of present process is related with dissimilar power effective cluster-based arrangement. After all the steps of node initialization, cluster formation, initializing source-destination, to find the shortest path we introduce anamoly attack when there is overflow in the data and buffer occurs.

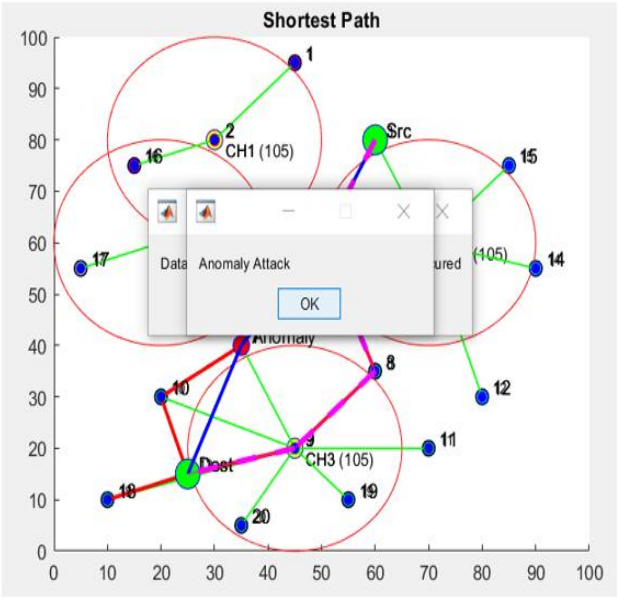


Figure 9: Detection of Anamoly attack

The final output for obtaining the shortest path after the queue buffer: The blue line indicates the shortest path.

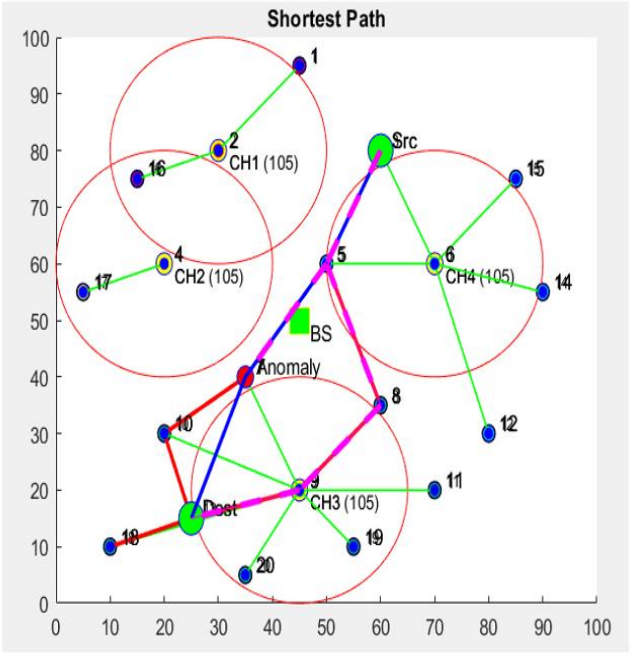


Figure 10: Obtaining the final shortest path

**Performance**
The final process is the performance where the parameters are been calculated.

**Packet Delivery Ratio:** This is used to overcome time delay that occurs when the data are transmitted from the origin to target. Therefore, we can reduce the usage of time. Here we consider different hops from where the data or the packets can be transmitted.

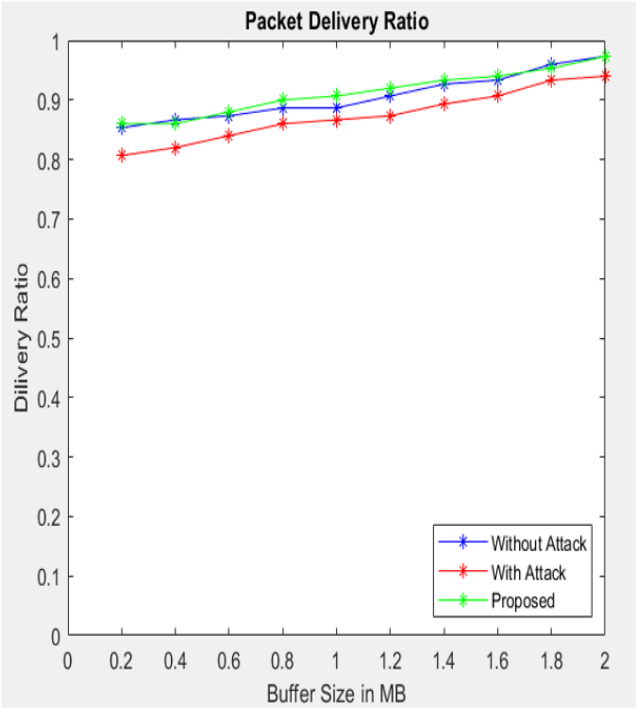


Figure 11: Representation of Packet Delivery Ratio

**Throughput:** Resending of data are of more chances. Hence the throughput is found out to overcome this situation. If there is chances of the packets of data that is been leaked, then there is chance for the resending of the packet that is been already sent. Hence it can overcome by calculating the throughput

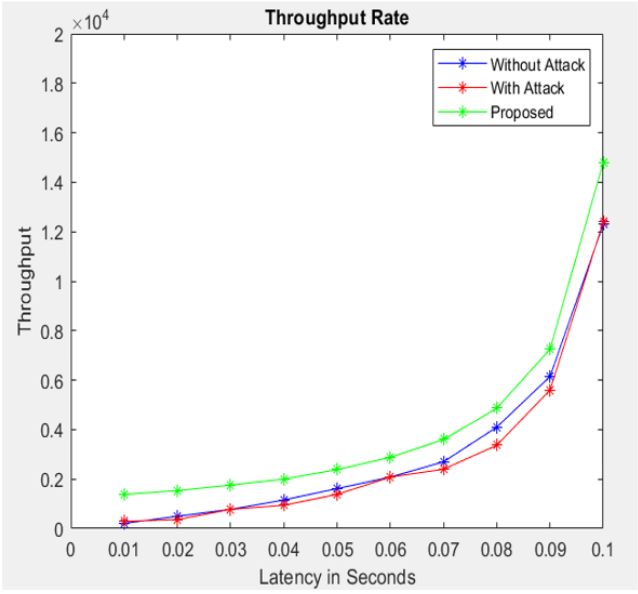


Figure 12: Characterization of Throughput

## 4. CONCLUSIONS

The existing routines are accomplishing with respect to throughput, packet delivery ratio, power utilization because of the complete system achievement lower than assess. Therefore to prevent this the advance technique uses enhanced stochastic geometric analysis of heterogeneous network routing for route analysis and also the transmission of data. The advance work removes unnecessary information to additionally upgrade the comprehensive end to end delay with less power utilization and loss in the delay. The development exhibits the advance process excessively work with regard to throughput, power utilization, packet delivery ratio, estimation expenses and system lifespan contrast to other method.

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