The Research Monograph Series in Computing, Electrical & Communication Networks
Vol. 1 (01), May 2023, pp. 65–75

CHAPTER 5

DESIGNING SIMULATION FRAMEWORK FOR MULTI HOP ROUTING IN WIRELESS SENSOR NETWORK USING PSO ALGORITHM

5.1 INTRODUCTION

Wireless Sensor network is an advanced wireless sensor technology used in various applications such as medical – health monitoring, military applications etc. In this work we have proposed a new routing scheme for enhancing the existing routing protocol's performance. The main key parameter of the WSN is power consistency; WSN's key performance measure is network topological lifetime. The routing scheme should be capable of less power consumption, best path prediction and efficient communication etc. The routing data packets within the sensor nodes should be more focused in order to achieve high performance because reliable data delivery leads to increased performance. The main criteria of routing protocols are not to sacrifice the network's performance. The above stated problem are taken into the consideration and here we proposed a new scheme with all the possible and reliable solutions for the above stated problem with the algorithm called "straight line routing scheme".

5.2 PREVIOUS ATTEMPT

Initial level of research in WSN routing start up with genetic approach which was discussed deeply in the work entitled "Optimizing Localization Route Using Particle Swarm-A Genetic Approach". Several algorithms exists in literature, since some are of in vital role other may not. Since WSN focus on low power consumption during packet transmission and receiving, finally we adopt by merging swarm particle based algorithm with genetic approach. Initially we order the nodes based on their energy criterion, and then focusing towards node path; this can be done using Proactive route algorithm for finding optimal path between Source-Destination (S-D) nodes.

Fast processing and pre traversal can be done using selective flooding approach and results are in genetic. We have improved our results with high accuracy and optimality in rendering routes. GSO algorithm consists in a strong cooperation of GA and PSO, since it maintains the integration of the two techniques for the entire run. In each iteration, in fact, the population is divided into two parts and they are evolved with the two techniques in that order. Next start up with the hybrid model in combining k-means and PSO.

The work comprises with the clustering setup of each node and how reliably routing takes place within the clusters. The main challenge of the proposed model using K-means and PSO is discovering neighbour nodes and during node failure the clustering algorithm fails to predict the neighbour node. The next level of the research is continued with the above stated challenge and proposed a new routing scheme with discovering neighbour node by deploying the sensor node region within the cell region by using Voronoi cell structure. Here the routing scheme was well adapted for the nodes within the single cell region when the region is deviated, the routing becomes complex in positioning the homogeneous sensor nodes.

5.3 PROPOSED METHODOLOGY

In the proposed model there are various entities are to be considered to outperforms the proposed routing, initially node identity is one of the key term used in our model to distinguish the nodes. Base stations are the active servers used to hold all the records and patterns. Multi hop count and relay counter are used to count the number of nodes in the straight lines. The methodology is clearly defined in the algorithmic section.

5.4 NODE DISCOVERY

RTS/CTS are two reliable request response messages broadcasted to find the neighbour nodes. Initially the root node sends the ARP RTS message to all the nodes. Once the node within the range receives the request, then the node replies with the node identity (PMAC address). The node starts to send the ACK reply/response with CTS message. Once the CTS message is received at the root node, based on common evaluation the neighbour nodes are identified.

5.5 MULTI-HOP ROUTING USING PSO

In multi hop networks, the routing is very critical and node behaviour is not at stable range. Hence we proposed a new routing scheme called

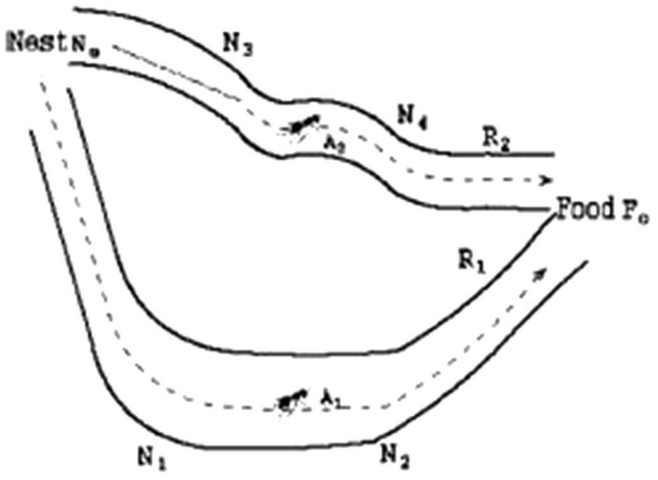

Figure 5.1. Working Model of Ant Colony Optimization.

Figure 5.2. Ant Colony Straight Line Routing.

straight line routing with ACO (Ant colony optimization algorithm) to find the straight line of the nodes. The simulation results demonstrated in Figure 5.4 shows the range of nodes which are available in straight line among the heterogeneous nodes in multi hop networks. Figure 5.1 denotes the actual working model of the Ant Colony optimization algorithm. The PCO routing approach is adapted here but the routing takes for the nodes available in the straight line. In Figure 5.4 the left hand side image shows the deviation of the nodes and node relay which lies in the straight line.

Figure 5.3. Path Discovery by Ant.

5.6 THE ALGORITHM FOR THE STRAIGHT LINE ROUTING

Figure 5.2 and Figure 5.3 denotes how Ant works, Figure 5.3 clearly defines the path discovered by the Ant by means of pheromone

Function Straightline_Routing
Find **hop count**
For all the nodes <hop_count
Discover all the nodes
Find the **relay node**
Calculate **nexthop_relay**
Find_**straightlines**(hopvalue,next_hop relay);
Apply **ACO** (**nexthop**, **solution**, **pheromone**);
Straightline(**ACO**);
End **For**;
End

5.7 IMPLEMENTATION RESULTS

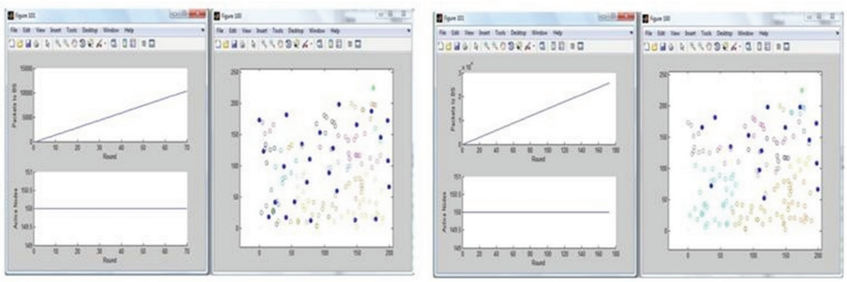

Figure 5.4. Range of nodes in active heterogeneous networks.

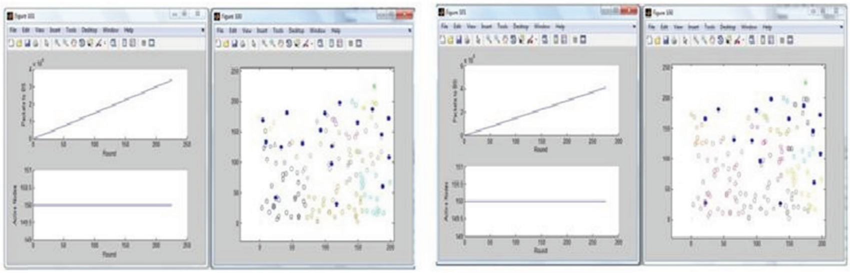

Figure 5.5. Node Activity monitor in generating next hops.

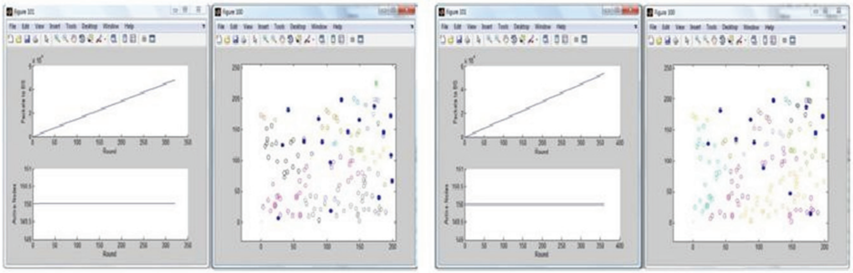

Figure 5.6. Point parameters for generating the straight line.

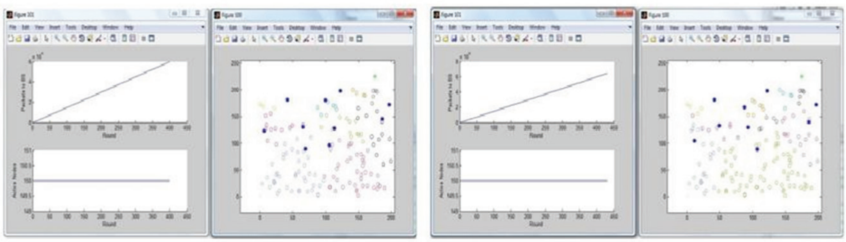

Figure 5.7. Evaluation of the points and ACO routing parameters.

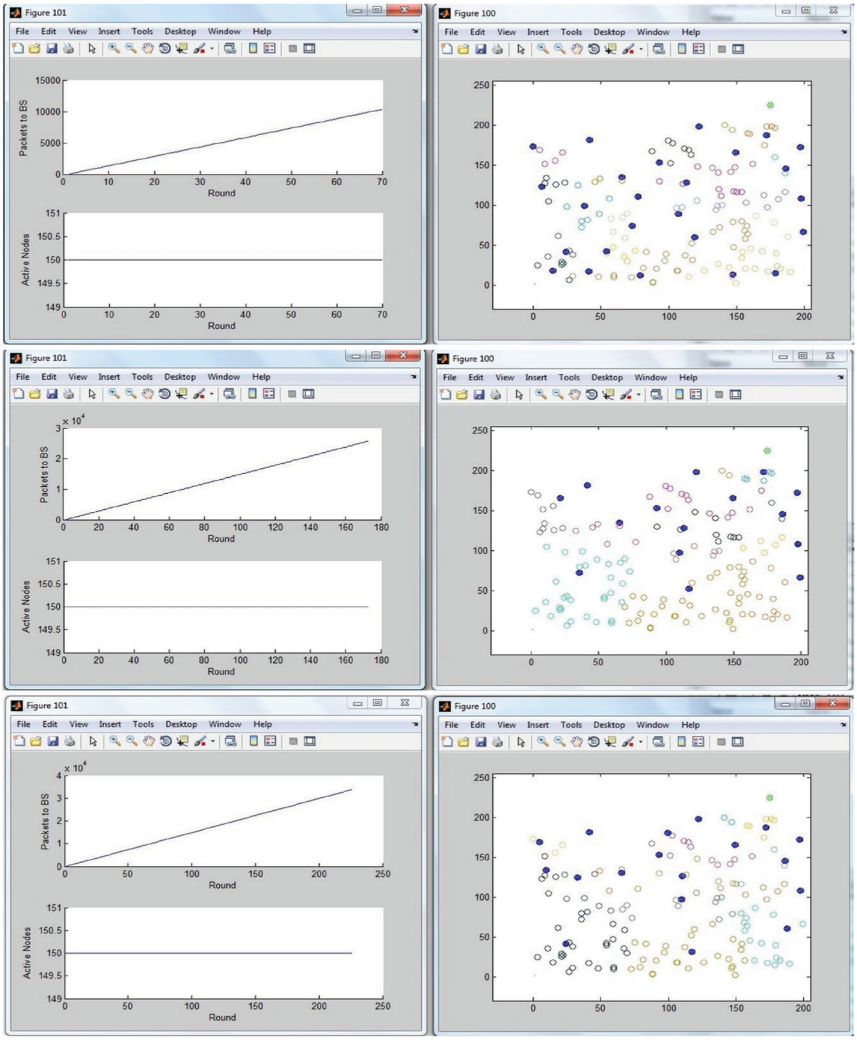

Figure 5.8. Straight line routing with consistency using PCO and active routing within the nodes.

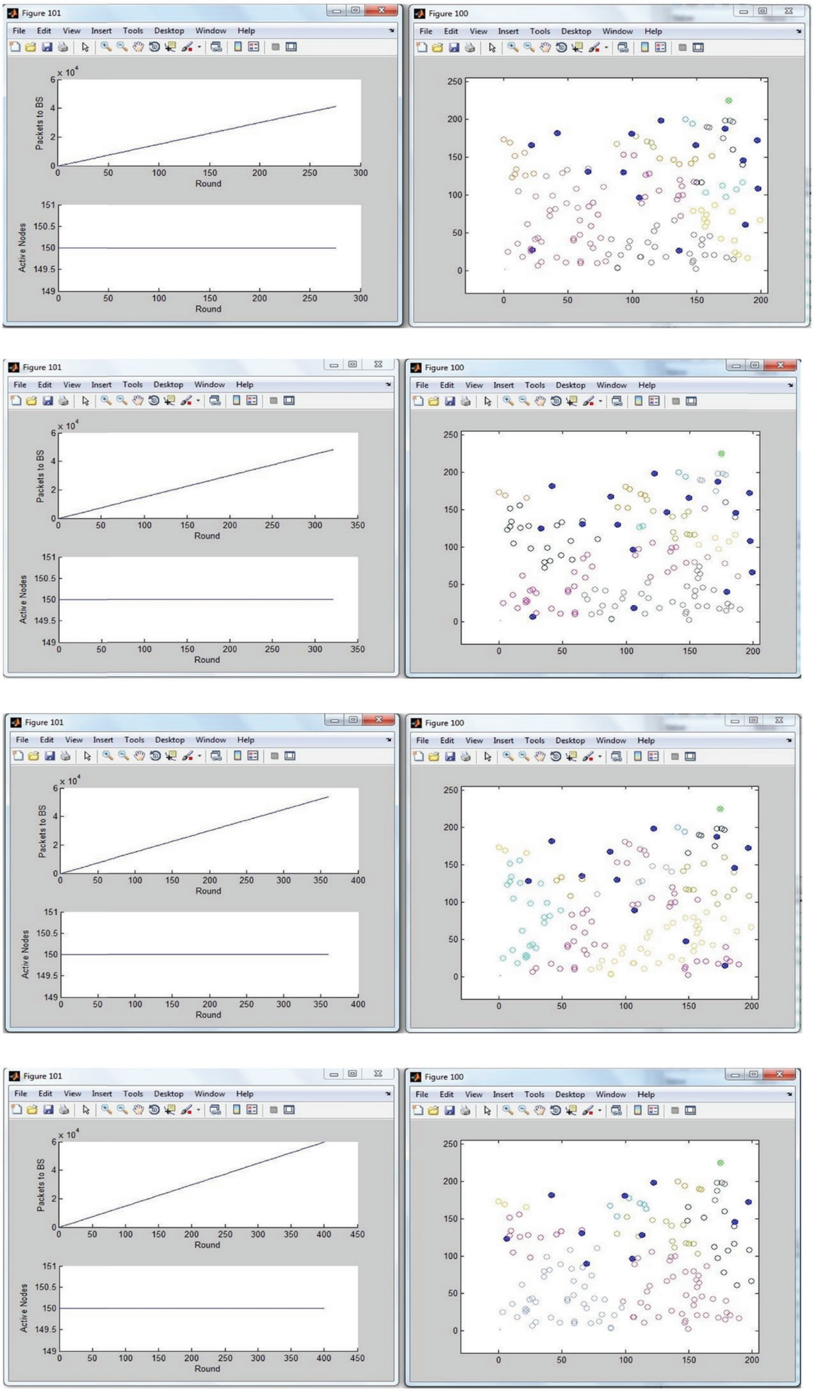

Figure 5.8 (Continued)

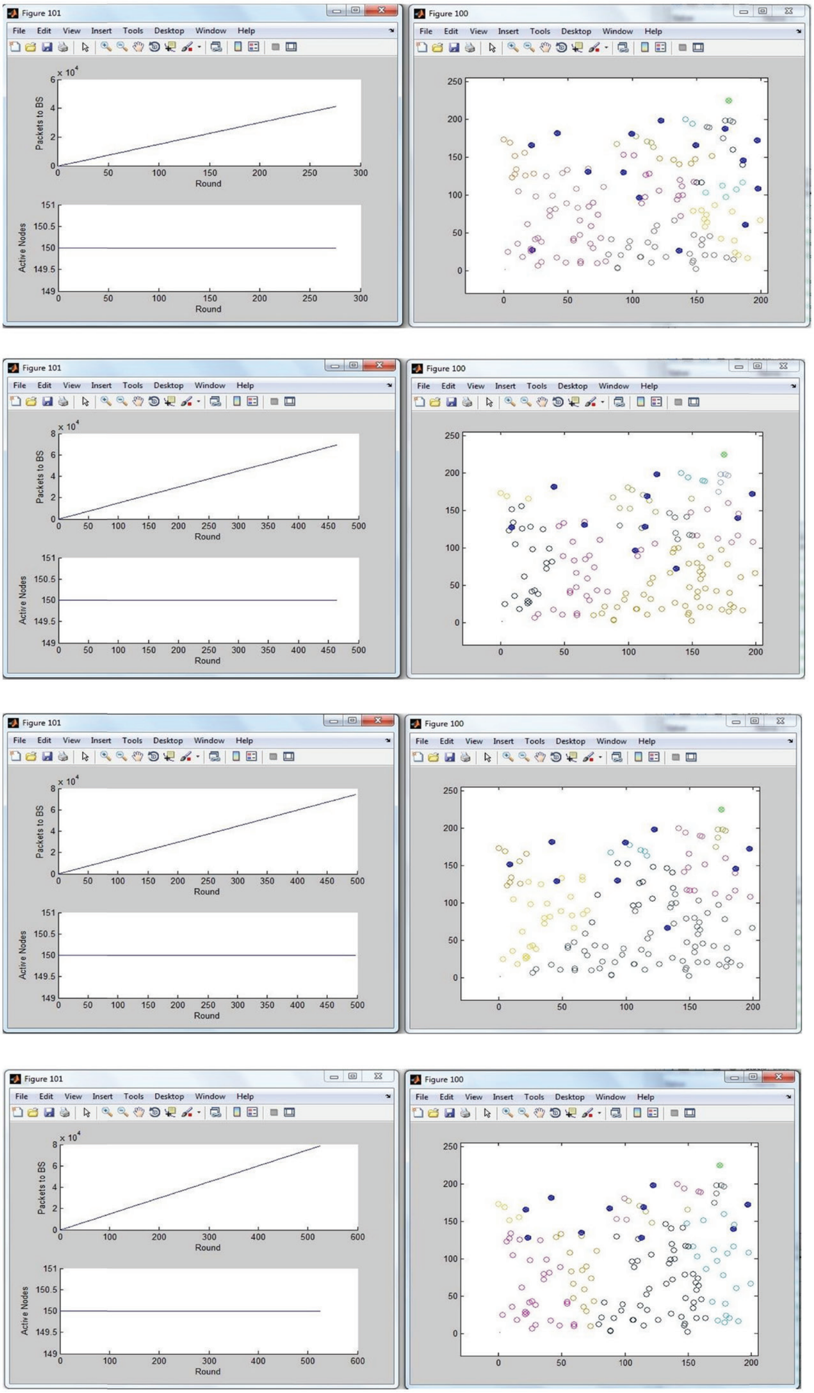

Figure 5.8. (Continued)

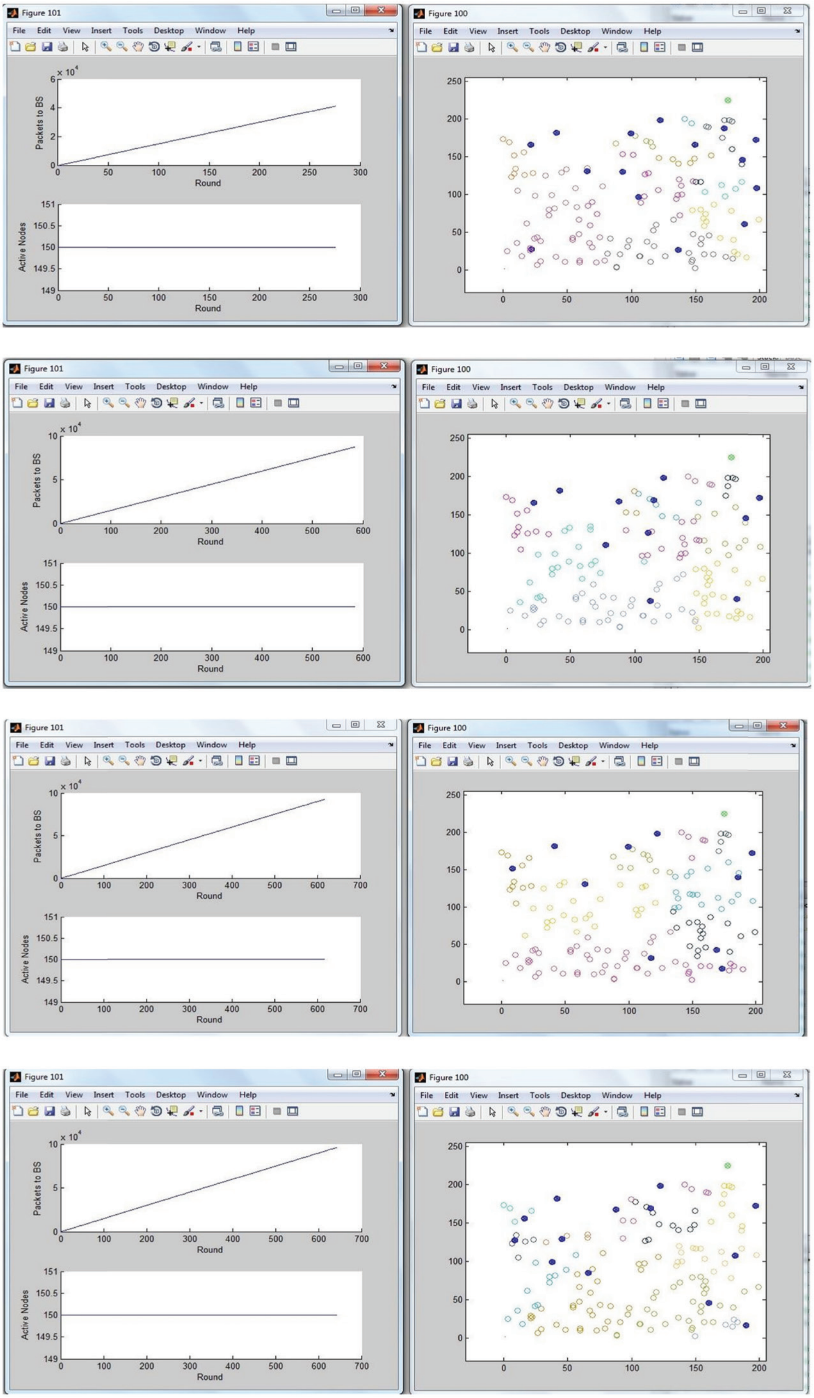

Figure 5.8. (Continued)

5.8 PERFORMANCE ANALYSIS

Here in the experimental setup we simulated the proposed model with recursive iteration. Figure 5.8 shows the actual routing scheme, which was proposed in this model. Figures 5.4–5.7 shows the actual experimental process model of the proposed scheme. Blue dots in the Figure 5.8-c denote the points for straight line routing. Simple illustration of the experimental setup is stated in the Figure 5.9 with active base stations and nodes with next hop relay in the straight line points.

The main challenge in the proposed scheme during straight line routing, the coordinate's o the heterogeneous nodes predicted are not in stable states, this leads to miss rate of data packets during data transmission. Here the coordinates of the heterogeneous pattern are clearly mentioned in Figure 5.9(a-d). The straight line points predicted will also have multi paths in terms of routing orientation. Here the coordinates of the heterogeneous pattern are clearly mentioned in Figure 5.9(a-d). The straight line points predicted will also have multi

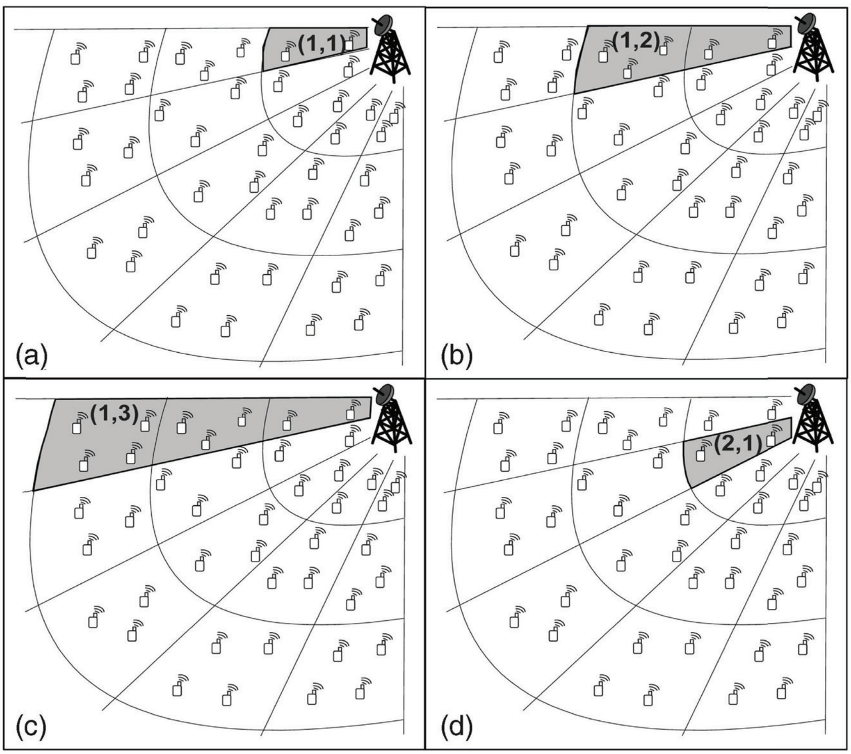

Figure 5.9. Next hop relay in straight line Routing.

paths in terms of routing orientation and it is often taken to mean simultaneous management and utilization of multiple available paths for the transmission of streams of data emanating from an application or multiple applications. In this form, each stream is assigned a separate path, uniquely to the extent supported by the number of paths available. If there are more streams than available paths, some streams will share paths. This provides better utilization of available bandwidth by creating multiple active transmission queues. It also provides a measure of fault tolerance in that, should a path fail, only the traffic assigned to that path is affected, the other paths continuing to serve their stream flows; there is also, ideally, an alternative path immediately available upon which to continue or restart the interrupted stream.

This method provides better transmission performance and fault tolerance by providing:

- Simultaneous, parallel transport over multiple carriers.
- Load balancing over available assets.
- Avoidance of path discovery when reassigning an interrupted stream.

Shortcomings of this method are:

- Some applications may be slower in offering traffic to the transport layer, thus starving paths assigned to them, causing under-utilization.
- Moving to the alternative path will incur a potentially disruptive period during which the connection is re-established [adapted from Wikipedia, as on 19.09.2014].

5.9 CONCLUSION

The proposed new framework for routing data packets in multi hops networks. The proposed model is highly reliable and energetic in terms of routing in Wireless sensor networks. We have applied the proposed model to heterogeneous network, the model performs with 80% accuracy, in homogeneous networks, and the model performs with 85% of accuracy. The distributed sensor nodes are reliable in terms of routing in following the packet strategic and the CTS/RTS message helps in finding neighbour nodes and node discovery. In future, we are considering our work model for closed neighbour discovery in the form of centralized analytical model to determine with all necessary routing parameters which is not considered here (deviation value, route path value, and local entity value) and Multi path routing scheme using our proposed straight line routing algorithm is likely to be extended.