ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 6, June 2017

# Implementation of ZHLS-GRP Hybrid Technique for Routing Protocols and BPSO in MANETs

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**ABSTRACT**: Routing between the source and destination with optimality has becoming primary part of several researchers work. Many of the techniques have been proposed till now which works individually to acquire the optimized routing but fails to accomplish. Consequently, this paper has proposed the hybridization of two different routing protocols which works on the same scheme of finding the location of node i.e. GPS in the network. The ZHLS protocol has used to send the packet from the corresponding one node to another within a zone whereas the GRP protocol operates with different zones of the network. Moreover, the Binary Particle Swarm Optimization algorithm has applied to optimize the selection of route in GRP from respective source to the destination. The experimental analysis have performed using MATLAB software tool to accomplish the proposed work. The simulation analysis is used to perform comparison between different traditional algorithms such as GRP, DSR, and AODV with the proposed ZHLS-GRP algorithm. From the results acquired, it has concluded that the proposed technique outperforms the traditional algorithms in terms of PDR, End-to End delay and network load.

**KEYWORDS:** BPSO, End-to-End Delay, GRP, PDR, Routing protocol, ZHLS

## I. INTRODUCTION

Consider the cellular and IP mobile networks that have wired backbones as well as centralized controllers whereas the mobile ad hoc networks neither have a centralized controllers and the wired backbone. These types of networks are self organizing and are most suitable to the rapid deployment. A node in the network is treated as an end node or a host as well as a routing node i.e. router. The topology of the network is always changing because of the mobility of the network [1]. The route between the sources to the destination dynamically changes. Considering this fact, establishment of a route from source to the destination is quite challenging for the researchers from several years [2][3]. Moreover, the minimum communication overhead is also primary while finding a route. Thus, in order to reduce the number of route discovery packets, routing table building in LSP packets in reactive and proactive routing protocols respectively, a hierarchical based routing which are combination of proactive and routing protocols ZHLS i.e. Zone based Hierarchical Link State routing protocols have been proposed.

In ZHLS routing protocol, the whole network has divided into zones which are non-overlapping and consists of two different topology i.e. Zone level and node level topology which has been shown in the above figure 1 (a) and (b) [4]. In the figure, (a) describes the whole network which is divided into nine different zones and in (b) the one individual zone's i.e. 5th node level topology has described. Basically in node level topology or for data packet forwarding in node level topology, intrazone routing table is used and in case of zone level data packet forwarding, interzone routing table is used. The nodes which are linked to other zone's nodes and forward the packets between zones are considered as gateway nodes. In the figure 1 (b) j, h, f and g nodes are gateway nodes of zone 5.

Initially, each node in the network knows its actual position as well as zone ID with the help of GPS i.e. Global Positioning system [5]. Then, an intrazone and interzone routing table is constructed through each node and follows some steps such as:

1. Initially, each node broadcasts a request termed as a link request.
2. Then nodes who receive the link request revert to that node with a link response. In the response, a node ID and Zone ID is contained.

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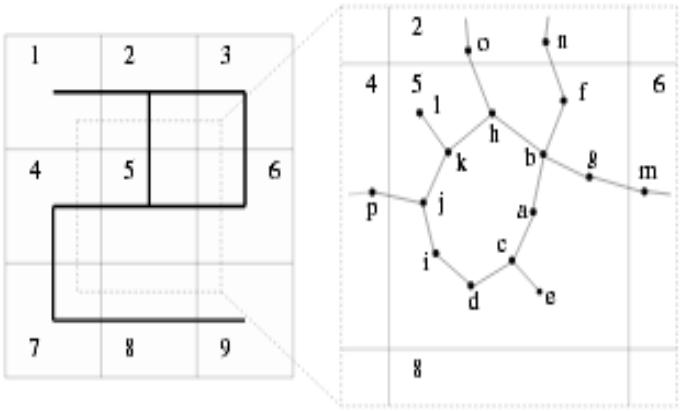
Vol. 5, Issue 6, June 2017

3. Once all the link responses are received, then a node generates Node link State Packet i.e. NodeLSP which contains neighbours node IDs of the same zone as well as Zone IDs of different Zone's neighbors.
4. After performing these tasks, a node floods NodeLSP throughout its zone.

When the zone received NodeLSPs from all the nodes in the network, then a shortest path algorithm has used by the node in order to build a intrazone routing table.




(a) Zone level topology (b) Node level topology
Fig.1. ZHLS network structure [4]

Likewise, ZHLS routing protocol, in the Geographic routing protocol, Global positioning system has used to locate the node which is the base of acquiring the distance between nodes. Correspondingly, all the routing decisions have taken based on these distances [6]. This protocol is depending upon the hierarchical flooding algorithm in which it limits the flooding to those nodes that are nearby. This procedure has applied into the grid to the topology where the exchange of routing information is limit to the nodes belongs to the same section of the grid.

Another term used for the geographic routing is the geo routing or position based routing which totally relies on the geographic position information. This protocol is basically designed to send the message to the destination while using its geographic location rather than network address [7]. In the geographic routing, it requires that only source should aware of its own location and the destination. Based on this information, a message has been routed to the corresponding destination [8]. Consequently, by using this information a message can be routed to their destination without having knowledge about the topology of the network or any kind of prior route discovery [9].

In the proposed, both these protocols are used. Initially ZHLS protocol is used to send the packet from source to the destination and GRP is used to transfer the packet from one zone to another zone. Thus, hybridization of both these protocols is used to acquire optimal path without any packet loss and high packet delivery ratio from sources to the destination. In addition to this, BPSO optimization technique has used to optimize the route. The reason behind considering this algorithm is the advanced version of Particle Swarm Optimization algorithm and it reduces the computational complexity in the network while optimizing the route.

## II. RELATED WORK

Routing is the process of selecting best paths in a network. In the past, the term routing was also used to mean forwarding network traffic among networks. However this latter function is much better described as simply forwarding. Routing is performed for many kinds of networks, including the telephone network (circuit switching), electronic data networks (such as the Internet), and transportation networks. The routing can be achieved by using various routing techniques. There are many routing techniques developed that can help to generate the efficient path for communication. But the problem still does exist in this field regarding the situation if the routing zones overlap and what if the single point failure takes place at the time of routing. Hence in order to solve this problem, the techniques like ZHLS and GRP were developed. These techniques were quite efficient to solve the issues. But these techniques were implemented on the individual basis hence were not able to exploit the full advantages. Another issue is that none

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of the optimization techniques were implemented to optimize the results. Hence there is a need to develop such a technique which comprises of both of these techniques with optimized results.

## III. PROPOSED ALGORITHM

Routing is the concept of delivering the data from source to destination node by following an optimum or shortest route which is created by using the nodes of the network. It is the most prominent field to work upon. After having a review to the above defined problem, it is observed that in traditional work the ZHLS and GRP were implemented on the individual basis. Hence proposed work implements the hybrid routing protocol which comprises of ZHLS i.e. Zone Based Hierarchical Link State algorithm and GRP (Geographic Routing Protocol).

The hybridization of these techniques will leads to an enhancement in the performance of the network with respect to routing. The hybrid technique is also optimized in this study by using BPSO (Binary Particle Swarm Optimization). The BPSO is an optimization algorithm which outperforms other optimization algorithms.

The proposed algorithm is a combination of intrazone and interzone communication between different nodes and zones in the network. For the intrazone communication, ZHLS routing protocol is used and enhanced BPSO based GRP routing protocol is used for the interzone communication. In order to simulate the proposed work, following steps are followed:

1. Initially, define the parameters for the network such as area of the network on which all the chosen nodes will be deployed, define the number of zones in the network and the number of nodes in each defined zones.
2. After initiation of network, define the source and the destination node to accomplish the task of transmission of packets from one hop to another.
3. Once the source and the destination have been selected, then check if source and destination nodes are in the same zone or not. If the source and destination relies in the same zone then there can be two options either intrazone or interzone clustering.
4. If yes then ZHLS based routing approach will be applied for intrazone clustering.
5. In intrazone clustering, both source and destination relies in the same zone so the shortest distance will be choosing by them for transmission of packets in that zone.
6. After selecting the path and transmission is done, calculate the performance of the proposed technique in terms of performance parameters such as Packet Deliver Ratio, End- to – End delay and load of the network.
7. Now consider another case, where the source and destination are in opposite zones. For their communication, apply enhance Binary Particle Swarm Optimization based GRP protocol. Thus, this step will perform interzone communication in the network.
8. As the interzone communication is based on the BPSO so the selection of next hop will be done on the basis of fitness value. The nodes having maximum fitness value will be chosen as a next hop or next source till the destination.
9. Lastly, the final route is selected and transmission of packets will be done.
10. On the whole, performance parameters calculation is executed after interzone and intrazone clustering to concludes the performance of the proposed technique with respect to different traditional algorithms.

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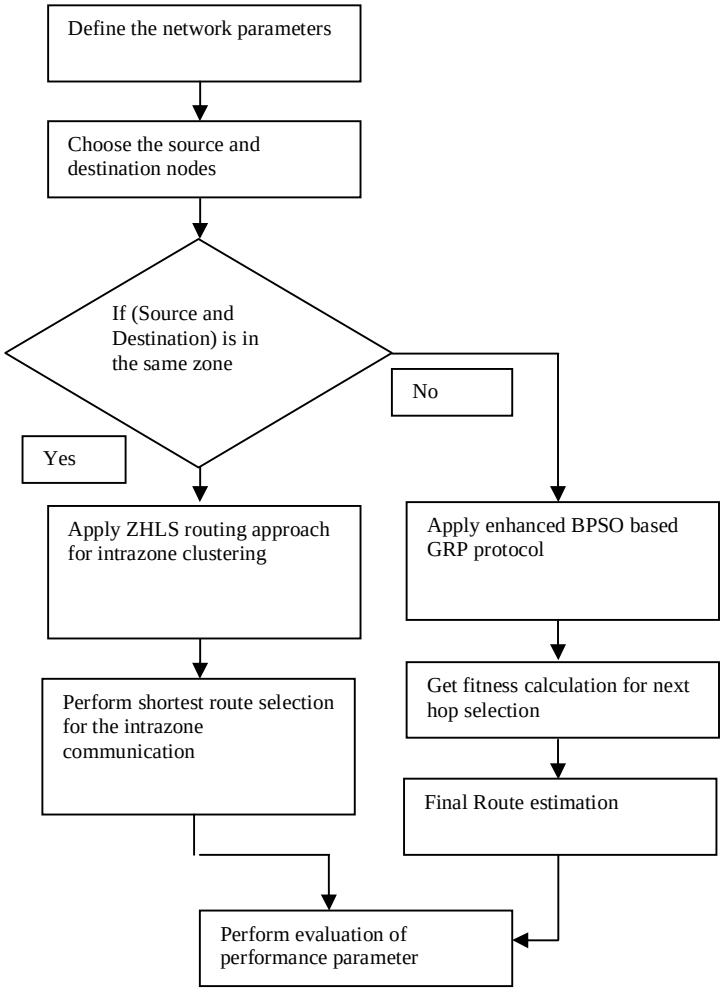


Fig.2. Framework of the proposed model

## IV. SIMULATION RESULTS AND DISCUSSION

This section of the paper concludes the experimental analysis which has performed using the proposed approach and the traditional approaches. In the proposed method, a head of the zone has selected on delay, PDR and bandwidth. The optimized results are shown below:

The figure below shows the different zones which have different nodes in it. The number of nodes in the network is chosen by the user and each zone will have same number of nodes.

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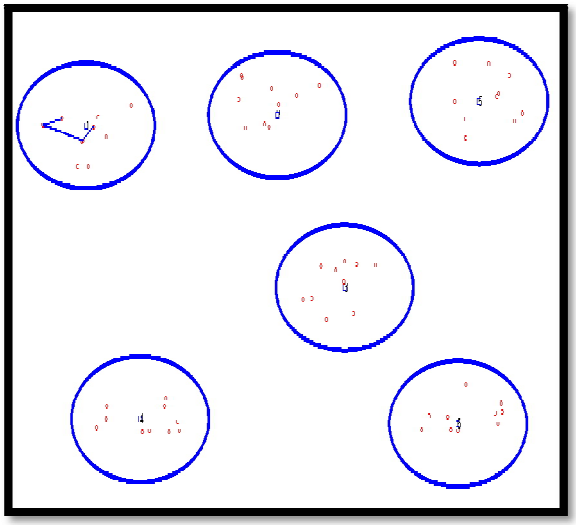

Fig.3. Routing network using ZHLS

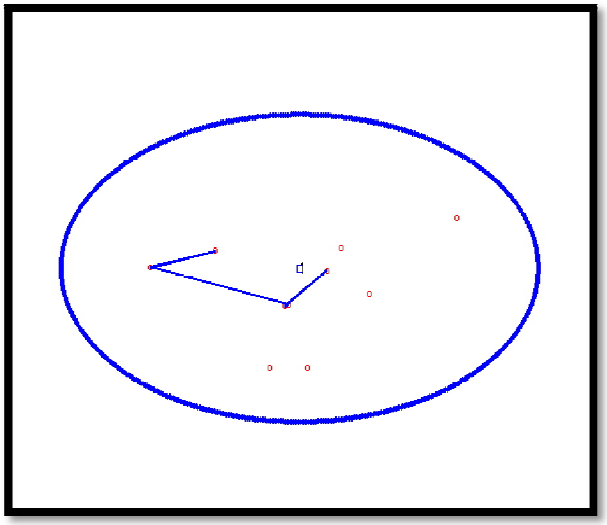

Fig.4. Intrazone communication in the network

The belwo figure illustrates the intrazone communication between the network. In the intrazone, the communication done between the source and destination which lays in that particular zone.

The normalized network load has been shown in the below figure in which comparison has done between different routing protocols such as traditional as well as proposed techniques. The graph is represented in the terms of node density with respect to normalized routing load. The acquired output is in the form of seconds. From the figure it has clearly shown that the proposed technique outperforms where the load in the network is quite lesser in comparison with other techniques.

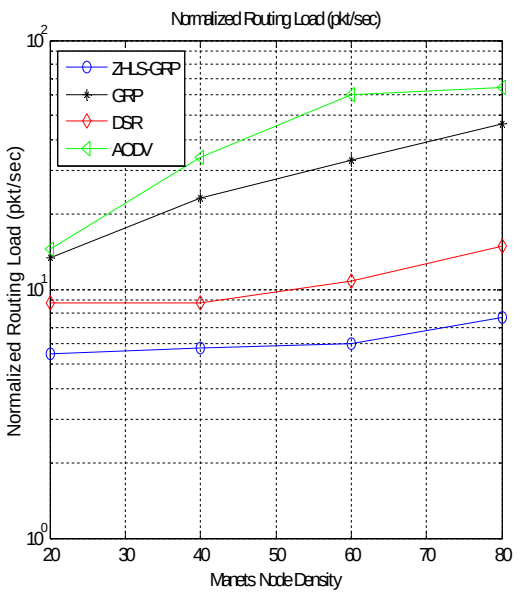


Fig.5. Normalized routing load of the network

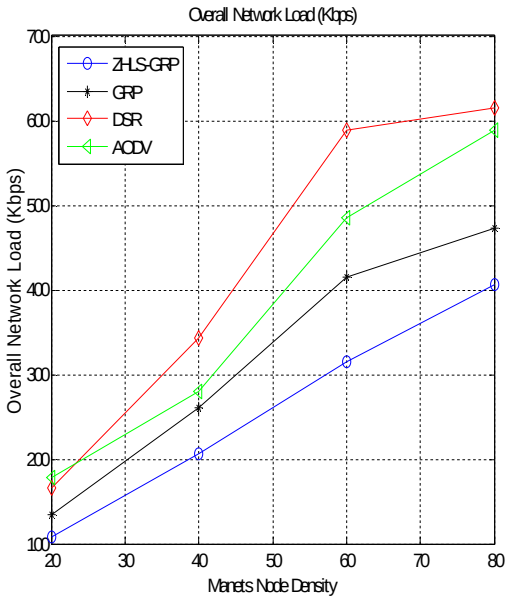


Fig.6. Overall network load

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The figure 6 below depicts the overall load of the network. The comparison has done between traditional and proposed techniques in terms of varying node density. The overall load in the network has reduced using the proposed technique whereas, the DSR have the highest load in the network.

The figure 7 shows the Packet delivery ratio of the proposed technique with respect to traditional technique. The packet deilvery ratio is used to represent the number of packets sent at the destination in terms of packet loss. So from the figure, it can be easily exemplifies that proposed ZHLS-GRP technique outperforms the other techniques as while the transmission proposed technique is able to receive more number of packets at the destination.

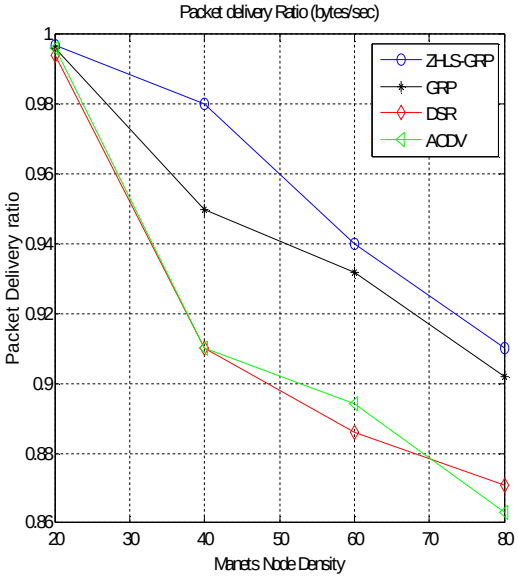


Fig.7. Packet Delivery Ratio of different approaches

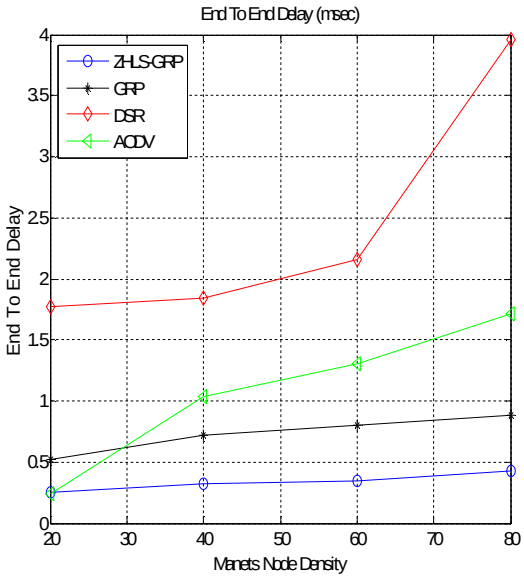


Fig. 8. Comparison of traditional and proposed approaches in terms of End to End delay

The delay in the network illustrates the efficiency of the technique. The least delay concludes the higher effectiveness which can be shown in the proposed technique. The delay of the projected work varies from 0 to 0.5 milliseconds which are used to send packet from source to the destination. From the results acquired it has confirmed that proposed methodology performs accordingly.

## V. CONCLUSION AND FUTURE WORK

In this paper, the main focus was on the optimality of selection of routing while applying hybridization of ZHLS and GRP protocol. The results acquired from their simulation confirm that the proposed technique performs better, efficient and effectively in comparison with other traditional routing protocols. The performance parameters which conclude this fact are PDR, End-to End delay and network load. The proposed protocols have less number of end to end delay which means that packets have sent to the source to the destination within less time. Moreover, the more number of packets have delivered to the destination with less network load. Among different traditional protocols, DSR is considered as the least efficient protocol. On the flip side, ZHLS-GRP is placed at first in achieving the high optimality path.

In future, further enhancements can be done by using advanced routing protocols with hybrid optimization techniques. The hybridization of fuzzy logics and neural network termed as ANFIS can be used to optimize the routing results.

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