CHAPTER 7

COMPARISON WITH WEIGHTED ROUGH SET MODEL, PROPAGATING NEIGHBORHOOD INFORMATION ALGORITHM AND PROBABILISTIC BROADCASTING ALGORITHM WITH EFFECT TO PAUSE-TIME AND SPEED

7.1 Introduction

The well known Fisheye State routing (FSR) protocol determines a route when no route exists or route breaks. To establish new path from source to destination, it broadcast control packets (route request packets), which increases the network Bandwidth consumption and to reduce flooding. As mobile Adhoc networks have limited Bandwidth, it is important to reduce the flooding. This chapter provides a protocol in Weighted Rough set model (WRS) which dominates Probabilistic Broadcasting Algorithm and Propagating Neighborhood Information Study method to control the route request packets in the existing Fisheye State routing (FSR) protocol in Grid. WRS model finds the candidate node set by finding the similarity relation among the 1-hop and 2-hop neighbors. Weighted Rough set model considers the object (node) importance also and this model gives better results compared with FSR in Grid. Weighted Rough set theory is a mathematical tool to deal with vagueness, uncertainty and it also considers the importance of the objects (nodes). In this chapter comparison is made with the results of Weighted Rough Set (WRS) model in Grid Fisheye State Routing (FSR) protocol with Flooding by Propagating Neighborhood Information Algorithm Study and Probabilistic Broadcasting Algorithm. It is found that WRS model has shown improved performance in several important
parameters like Throughput, energy consumption, Packet Delivery Ratio, Delay, Overhead and Normalized Overhead with respect to Pause-time. Also another comparison is made with the same parameters with respect to Speed.

7.2 Research Motivation
Proposed research work from previous chapters 3, 4, 5 and 6 have led to compare the three techniques. The final comparison with Weighted Rough Set Model, Propagating Neighborhood Information Algorithm Study and Probabilistic Broadcasting Algorithm is studied to reduce the redundant broadcasting with respect to Pause-time and Speed with various parameters such as Average Consumed Energy, Total Consumed Energy, Packet Delivery Ratio, Delay, Throughput, Overhead and Normalized Overhead. In a particular situation adhoc networks are stable for a short stipulated time interval and this stability is made use to collect the neighbor node information which is kept with each node. A node needs to find the destination from the source then the collected node information will be helpful to establish a long term valid path. WRS method is the long term valid path in turn to reduce the number of unnecessary Route Request control packets. The Comparative study between Propagating Neighborhood Information Algorithm, Probabilistic Broadcasting Algorithm and Weighted Rough Set Model with FSR Protocol in Grid using MANET results with efficient progress in WRS Model.

7.3 Probabilistic Flooding with FSR protocol in Grid
The study highlighted in chapter 5 with the great need for a new broadcasting strategy that can dynamically adjust the broadcast probability
to take into account the current state of the node in two hops in order to ensure a certain level of control over rebroadcasting, and thus helps to improve reachability and saved rebroadcasts.

The simple flooding scheme is a straightforward broadcasting approach that is easy to implement with guaranteed message dissemination. In this scheme, a source broadcast messages to every neighbor who in turn rebroadcasts received messages to its neighbors and so on. This process continues until all reachable nodes have received and rebroadcast the message once. The probabilistic flooding scheme is one of the alternative approaches that aim at reducing redundancy through rebroadcast timing control in an attempt to alleviate the broadcast storm problem. In this scheme, when receiving a broadcast message for the first time, a node rebroadcasts the message with a pre-determined probability $P$, so that every node has the same probability to rebroadcast the message, regardless of its number of neighbors. In dense networks, multiple nodes share similar transmission range. Therefore, these probabilities control the frequency of rebroadcasts and thus could save network resources without affecting delivery ratios. It should be noticed that in sparse networks there is much less shared coverage, thus some nodes will not receive all the broadcast messages unless the probability parameter is high. Another possible area for improving includes investigating the effect of nodes transmission ranges on the rebroadcast probability. An alternate approach based on Fuzzy set methodology is described in this work for the selection of best routing path with minimum number of resources.
7.4 Propagation Neighborhood Information Study with FSR in Grid

The suggested protocol falls under the category of Proactive protocols. The nodes in this approach obtain the routes only when demand arises. The nodes use the common flooding approach to acquire the routes. Though flooding is used at the initial phases, it is decreased gradually. The most common method of using a cache with a fixed Time-out period for each route is also used. The nodes are equipped with a small cache to save the routes and a Time-out value is chosen. However, the variation in the approach comes from the fact that the expiry of the Time-out period does not trigger an update. The routes of the destination in the cache are rather erased after the Time-out period. The nodes may then have to use flooding again to regain the routes, but in order to avoid that routes are shared between the nodes based on some criteria.

The primary focus of the protocol is on sharing information about the neighborhood of a peer with yet another node in the network. The neighborhood of a peer here reflects the contacts of the node in question with that of other nodes in the network. In other words, the neighborhood reflects the entries of routes in the cache. This information regarding the contacts with a node has other nodes in the vicinity is stored in tables or any other suitable data structure that is compatible with the protocol being adopted. The sharing of neighborhood information is not a mandatory task rather it is done at the discretion of the nodes concerned. The given approach intends to minimize the flooding requests that are needed to acquire the same information in the absence of the sharing mechanism. This above method is completely discussed in chapter 5 with Fuzzy-Rough Technique.
7.5 Weighted Rough Set FSR in Grid

The proposed protocol zeroes in reduction of the redundant flooding in Route Request Phase (RREQ) of FSR. In the existing FSR protocol local connectivity of the mobile node is identified by use of several techniques including local broadcast known as hello messages. Here, a special hello packet is introduced when there is a change in the topology. It carries not only the existing status of the neighbor node but also sends neighbor node attributes. The routing tables within the neighborhood of a node are organized to optimize response time to local movements and to provide quick response time for establishment of new routes. In the present work node relative information is additionally added to the existing routing table. The primary objectives in the existing FSR algorithm are more effectively utilized in the present work as follows. The broadcast of discovery packets take place only when necessary. Local connectivity management and general topology maintenance are distinguished. Information about changes in local connectivity is disseminated to neighboring mobile nodes which may likely to seek information.

The Algorithm of the Modified FSR in Grid RREQ Phase and the Algorithm for Relative Weight Calculation is explained in chapter 6 which follows this technique for the below comparison results.

7.6 Simulation Results

The Simulation is investigated with the Network simulator 2. The simulation time was 15 minutes according to simulator clock. The total of 45 nodes is randomly placed in field of 600 X 600 m² with 20 seconds of Pause-time. Power range of each node is 250m.
7.6.1 The Performance Measures with Effect to Pause-time

The performance of proposed protocol is evaluated using the following metrics:

**Average Consumed Energy versus Pause-time**
Average Consumed Energy is the energy consumed between nodes. In figure 7.1 it is stable with respect to Pause-time as the energy consumed is less in WRS Model. Average Energy Consumed in ROUGH is reduced than Probabilistic Broadcasting (APBMAN) and Propagating Neighborhood method (FLOODING) with Pause-time in simulation.

**Total Consumed Energy versus Pause-time**
Total Consumed Energy is the energy consumed through the entire network (whole network). Figure 7.2 explains that the energy consumed is less in ROUGH than Probabilistic Broadcasting (APBMAN) and Propagating Neighborhood method (FLOODING) with respect to Pause-time in the whole network.

**Packet Delivery Ratio versus Pause-time**
Figure 7.3 shows that packet delivery is efficient in Weighted Rough Set (WRS) routing with 90% efficiency than APBMAN and FLOODING method.

**Throughput versus Pause-time**
The Throughput is shown in Figure 7.4 with respect to Pause-time. According to this simulation results, it has stable performance in WRS
method as it delivers data packets at higher rate than APBMAN and FLOODING method.

**Overhead versus Pause-time**

Network Control Overhead (NCO) is used to show the efficiency of the MANET’s routing protocol scheme. Figure 7.5 shows very less performance in WRS method with Pause-time rate than APBMAN and FLOODING method. Efficient result is produced in Weighted Rough Set Method.

**Normalized Overhead versus Pause-time**

The graphs in Figure 7.6, illustrate the Normalized routing overhead experienced in the 600 X 600 m² boundary. The Figures clearly explain that in Weighted Rough Set routing is comparatively reduced in rate than APBMAN and FLOODING method. In this simulation, the maximum update interval for the intrascope and interscope is set to be half. The routes produced would have been less accurate which may have result in a drop in Throughput. This means that accuracy of the routes will be high during high mobility where nodes are more likely to migrate more frequently and experience topology changes, and when mobility is low, less updates are sent. From the result shown in Figure 7.6, it can be seen that Weighted Rough set routing produced less overhead gradually, across all different level of Node Density and Pause-time.
Figure 7.1: Comparison - Average Consumed Energy versus Pause-time

Figure 7.2: Comparison - Total Consumed Energy versus Pause-time
Figure 7.3: Comparison - Packet Delivery Ratio versus Pause-time

Figure 7.4: Comparison - Throughput versus Pause-time
Figure 7.5: Comparison - Overhead versus Pause-time

Figure 7.6: Comparison - Normalized Overhead versus Pause-time
7.6.2 Performance Measures with Effect to Speed

The performance of proposed protocol is evaluated using the following metrics in three different algorithms:

*Average Consumed Energy versus Speed*

Average Consumed Energy is the energy consumed between nodes. In figure 7.7 is stable with respect to Speed as the Average Energy Consumed is less in WRS Model (ROUGH). Average consumed energy in Propagating Neighborhood method (FLOODING) is high than Probabilistic Broadcasting (APBMAN) and WRS Model (ROUGH) with Speed.

*Total Consumed Energy versus Speed*

Total Consumed Energy is the energy consumed through the entire network (whole network). Figure 7.8 explains that the energy consumed is less in ROUGH than Probabilistic Broadcasting (APBMAN) and Propagating Neighborhood method (FLOODING) with respect to Speed in the whole network.

*Packet Delivery Ratio versus Speed*

Packet Delivery Ratio has substantial decrease in APBMAN and FLOODING method as Speed increases. But figure 7.9 shows that packet delivery is efficient to certain period in ROUGH (WRS Model) as between 80 to 90% than APBMAN and FLOODING method. Figure 7.9 shows that a Packet Delivery Ratio result is varied for different mean Node Speeds.
Throughput versus Speed

Throughput is the average rate of successful message delivery over a communication channel. The Throughput shown in Figure 7.10 is with respect to Speed. The figure 7.10 shows that a Throughput result is varied for different mean Node Speeds as proportionally equal to Packet Delivery Ratio in figure 7.9.

Delay versus Speed

Delay is well decreased in FLOODING in Figure 7.11. But it has increase in ROUGH (WRS Model) and APBMAN technique. For each simulation the Delay has been varied from 1, 2 to 5 m/s.

![Figure 7.7: Comparison - Speed versus Average Consumed Energy](image)
Figure 7.8: Comparison - Speed versus Total Consumed Energy

Figure 7.9: Comparison - Speed Vs Packet Delivery Ratio
Figure 7.10: Comparison - Speed Vs Throughput

Figure 7.11: Comparison - Speed Vs Delay
7.7 Summary

In this Chapter three different Algorithms are compared and discussed to find a method to reduce the redundant broadcasting with different metrics. In a particular situation adhoc networks are stable for a short stipulated time interval and this stability is made use to collect the neighbor node information which is kept with each node. A node needs to find the destination from the source, and then the collected node information will be helpful to establish a long term valid path. WRS method is the long term valid path in turn to reduce the number of unnecessary Route Request control packets. The Comparative study between Propagating Neighborhood Information Algorithm, Probabilistic Broadcasting Algorithm and Weighted Rough Set Model with FSR Protocol in Grid using MANET results with efficient progress in WRS Model with effect to Pause-time. Certainly WRS Model is good with effect to Speed in Average consumed energy, Total Consumed energy, Packet Delivery Ratio and Throughput. But there is a certain increase in Delay as there is also an increase in speed. Delay is well decreased in Propagating Neighborhood (FLOODING) method. Further the above three techniques are compared with ID3 Entropy algorithm to find the information gain and optimal path management approach called path vector calculation based on Fuzzy and Rough set theory are addressed in the next chapter and also the set of rules are generated from all three techniques with the information gain ratio.