CHAPTER V

An efficient routing method with the consideration of self-seeking nodes in wireless mesh networks

The wireless mesh network enables a cooperative communication between the nodes in the mesh topology. Each node in the mesh network serves as a relay node for other nodes. The cooperative communication in the wireless mesh network faces one challenge of relay node behaves as a self-seeking node. The self-seeking node never performs its functions for other nodes. The self-seeking node performs its own functions correctly but it never shares its resources and serves for other nodes. To handle such a problem, we propose a new methodology with the consideration of self-seeking nodes. The self-seeking node is detected by using the self-seeking detection algorithm. After that, the routing protocol never chooses the self-seeking node as the relay node.

5.1 Introduction:

Wireless mesh network is a network of wireless connected in the mesh topology. In wireless mesh network, the nodes not only gather and broadcasting its own data but also acts as a relay node to forward the data packets from other nodes. Generally, the mesh network can be deliberate by using flooding technique as well as routing technique. In this paper, we are considering the routing technique for routing the data packets from source to destination. The data packets are routed hop by hop until it reaches the destination. The challenge faced by the routing technique is as follows: the connection
stability and the reconfiguration of blocked path which is handled by using the self-healing methods. It enables the routing based network to operate when there is error in the path.

Wireless mesh networks are widely used in the military applications. Each node in the mesh network contains multiple radios. So it allows better modularity and also can handle multiple frequency bands. In military application the data reliability is the important one because of its confidentiality. The routing protocol has been proposed to provide the reliability for the data transmission. But in the presence of self-seeking node the reliability is the unexpected one. In the secure hybrid wireless mesh routing protocol is proposed to route the data packets in the secured manner. They were used the cryptographic techniques for providing authentication and integrity of the routing messages. They were ensures the confidentiality of the data. They failed to consider the self-seeking behavior of the node.

The security enhanced AODV is proposed. They are using Blom’s key predistribution scheme to compute the pairwise transient key and group transient key. These two keys are used for the authentication between the nodes. The pairwise transient key is shared by each pair of nodes. Group transient key is shared by each node’s neighbor list secretly. The message authentication code is attached at the end of the AODV routing message to ensure the authentication and integrity of the message for each and every intermediate link in the route. But, one major disadvantage is they did not
consider the self-seeking behavior of the node while discover the route to the destination in the WMN.

The security framework has been proposed. In that they provide the solution for integrity and authenticity of routing messages, detection of misbehavior (packet drooping, packet modification) of nodes and dynamically manage the node throughput in the network. But the self-seeking behavior of the node in the wireless mesh network is not considered when performing the route discovery operation.

The secure routing protocol for wireless mesh network (SRPM) has been introduced. This protocol is well performed against the threats in multi hop routing. It can work well over range of scenarios. The self-seeking behavior of the node is not included in this protocol. The self-seeking behavior of the nodes decreases the throughput and the reliability. To give remedy for all those things, in this paper, we propose an efficient routing method with the consideration of the self-seeking behavior of the nodes connected in the wireless mesh network. Our proposed method increases the system throughput and ensures the reliability of the data transmitted over the mesh network.

5.2 Proposed methodology:

In the wireless mesh network, the nodes have to perform its own functions and have to act as a relay node to forward the data packets from other nodes. There are so many routing protocols to provide the path to reach the destination in the efficient manner
and also provide security by using the cryptographic techniques. But nobody consider the self-seeking behavior of the nodes in the route discovered to reach the destination. The node which never shares its resources with other nodes is called as self-seeking node. Even though it has the capacity to transmit the data it never serve for other nodes as a relay node. If the self-seeking node present in the route to reach the destination in the sense the data never reach the destination because of the self-seeking behavior of the node. So, while we are choosing the next forwarder node, we have to consider the self-seeking behavior of the node. Before disseminating the route request message to all the nodes present in the neighbor list, we have to detect the self-seeking node present in the network.

![Figure 5.1 Block diagram of routing with the consideration of self-seeking nodes](image_url)

Figure 5.1 Block diagram of routing with the consideration of self-seeking nodes
Figure 5.1 explains that the process of our proposed methodology. The source node in the mesh network discovers the route to reach the destination in the following manner:

**Step 1:** Each and every node in the network calculates its one-hop neighbors and the distance to the destination node.

**Step 2:** The source node executes the self-seeking node detection algorithm for its neighbor nodes to find out the selfish node present in the network.

**Step 3:** The source node transmits its data packet to the node which is closer to the destination than other nodes in its neighbor list.

**Step 4:** The forwarder node selected by the source node again goes to the step 2 and select next forwarder node.

**Step 5:** The process continues until it reaches the destination.

The self-seeking nodes present in the wireless mesh network are detected by using the following algorithm:

**Self-seeking node detection** {

\[ \text{N}_i \leftarrow \text{Neighbor list of node i} \]

\[ \text{C}_i \leftarrow \text{Capacity of node i} \]

\[ \text{S}_d \leftarrow \text{Size of the data to be transmitted} \]

Foreach neighbor node {

}
Sent RREQ to $N_i$ with $S_d$ attached

If \{ $N_i$ is not sent RREP within time limit \} \{

If \{ $S_d \leq C_i \&\& L_{i,n}$ \}

$N_i \rightarrow$ Selfish node

\} else {

$N_i \rightarrow$ Normal node

\}

The above algorithm explains the procedure to detect the self-seeking node present in the network. Our ultimate goal is to avoid the self-seeking node in the route. Initially the source node sends the RREQ message to the nodes present in their neighbor list. The node which is not reply to that request message within time limit in the sense the source node have to check that, whether it has the capacity to transmit its data and check that whether there is a link exist with between that two nodes or not. Even though it has the capacity as well as link is also there, it never accepts my request means that node is marked as selfish node. The nodes never try to transmit its data through self-seeking node. All the nodes in the network consider the self-seeking node while choosing the next forwarder or relay node.

The self-seeking node present in the wireless mesh network leads to wide range of problems. The self-seeking node never forwards the data to other nodes to conserve its
own resources. The self-seeking node enjoys the remuneration provided by the resources of other nodes but it never uses its own resources to help other nodes. So that the self-seeking node present in the path causes the major problem in the wireless mesh network. Our proposed routing methodology provides the solution against the above problem. The self-seeking nodes perform its own functions in the perfect manner. So we can’t exclude that node from the network. But we have to consider the self-seeking behavior of the nodes while discover the route to reach the destination.

5.3 Simulation Results and analysis:

The simulation results are obtained by using NS2 simulator. The nodes are distributed in the simulation area 05 2000×2000. The nodes are connected in the mesh topology. The instance for the topography class is used to get the location of each and every node in the simulation area. The General operation director is assigned to each node in our simulation. This object is used to store an array of shortest number of hops required to reach from one node to another. The channel and the antenna used to receive and transmit the signal are set to each and every node by using node-config command in the Simulation class.

In our simulation the 30 number of nodes are distributed in the free space medium. The signals are propagated by using the two ray ground propagation model. The interface queue length is 100 packets. The nodes are having the transmission range of 250 meter. The number of selfish nodes introduced in our simulation is 3. The performance is
evaluated by record all network parameters in to the trace file. While we are executing the trace graph, the following outputs are obtained.

The system throughput is estimated by calculating the number of packets received per unit time. The graph is plotted between time and the number of packets received. The results obtained while using the AODV alone to discover the route and with the consideration of self-seeking node are separately stored in the trace file. If we are executing that two trace files we are getting the output shown in the figure.5.2. From that, we can justify our proposed method gives higher throughput.

![Throughput Analysis Graph](image-url)
The delay is estimated by using lastPktTime_ command in Ns2. This command returns the time when the last packet was received. The delay is the time duration between the current packets received and the last packet received. Figure.5.3 shows that the delay is present in the system because of the presence of the self-seeking nodes in the network. The delay is very low for the routing with the consideration of self-seeking node while compare with the AODV protocol.
The self-seeking present in our system is detected by using the self-seeking node detection algorithm. The number of selfish node gets decreased. The number of selfish nodes present in the route while we are considering the self-seeking node and also without considering the self-seeking node is analysed and record into the trace file. The figure.5.4 shows the output get while executing that two trace files. Thus, the number of self-seeking node gets decreased while increasing the capacity of each and every node.