CHAPTER 4

RELIABLE ROUTING SCHEME

4.1 RELIABLE ROUTING APPROACH

The reliable routing scheme consists of three phases. They are given as follows

(i) path discovery phase
(ii) reliability computation phase
(iii) path maintenance phase

When a node wants to communicate with another node, the route is checked in the route table. If a valid entry is found for the destination, then it uses that path. If the destination address is not in the route table, then the node broadcasts the Route Request (RREQ) to its neighbours to locate the destination. Neighbours again forward this request by broadcasting RREQ to their neighbours. This process continues until all fresh routes to the destination are located after getting Route Request Reply (RREP) messages. Then the node computes the reliability of the identified paths. Once the reliability is computed, the path with the highest reliability is chosen for communication. For path maintenance, each node periodically broadcasts a HELLO message to its neighbours and if a node has moved out, it informs other nodes by Route Error (RERR) message.
4.2 ROUTE DISCOVERY

When a source node wants to communicate with a destination node, it checks its route table to confirm whether it has a valid route to the destination. If so, it sends the packet to the appropriate next hop towards the destination. However, if the node does not have a valid route to the destination, it must initiate a route discovery process. To begin such a process, the source creates a RREQ packet. Route discovery typically involves a network-wide flood of RREQ packets targeting the destination and waiting for a RREP. An intermediate node generates a RREP if a valid route to the destination is available, or else the RREQ is rebroadcasted to other nodes. Duplicate copies of the RREQ packet received at any node are discarded. When the destination receives a RREQ, it also generates a RREP, which is routed back to the source via the reverse path. A forward path to the destination is established as the RREP proceeds towards the source. Figure 4.1 shows the procedure of initiating a route discovery process.
Figure 4.1 Procedure for initiating a route discovery process

After initiating the route discovery process, the node waits for the RREP packets. The information from the RREP packet is extracted when the received RREP packet’s source address is same as the node’s address. The procedure is depicted in Figure 4.2.
4.3 RELIABILITY COMPUTATION

The multiple RREP messages received are processed and multiple paths are found out between the source and the destination. The reliability computation phase computes the transmission reliability of each path available between the source and the destination. In order to perform the computation, the reliability value of every node in the path should be known. Let $p = (s, n_1, n_2, ..., n_t)$ be the path between the source and the destination,
where \( n_1, n_2, ..., n_l \) are \( l \) different nodes between the source \( s \) and the destination \( t \). Let \( r_i \) be the reliability of the \( i^{th} \) node. Thus, the reliability of data transmission along path \( p \) is \( R_p = \prod r_i \), for all \( i \) nodes in set \( p \). Once the transmission reliability is computed, the data packets are routed through the path which is having greater reliability value. The procedure is shown in Figure 4.3.

**Figure 4.3 Procedure for forwarding data packets**

4.4 **ROUTE MAINTENANCE**

Route maintenance is done using RERR packets. When a link failure is detected, a RERR is sent back via separately maintained predecessor links to all sources. Routes are erased by the RERR along its way. When a traffic source receives a RERR, it initiates a new route discovery if the route
is still required. Unused routes are dropped from the table when the route is not used for a long time.

In general, route links in an ad-hoc network are broken frequently due to mobility of nodes, congestion and packet collisions. Like AODV, each node of the proposed routing scheme is dependent on sending out HELLO packets to maintain local connectivity. Failure to receive a HELLO packet from a neighbour is regarded as an indication that the link to the neighbour is broken. A RERR packet is propagated from the upstream node of the failed link to the source node of the route. When an intermediate node receives a RERR packet, it marks its route to the destination as invalid and then propagates the RERR to its precursor node along the reverse route path. After receiving the RERR, the source invalidates the route path to destination and chooses a valid path as an active routing path from the routing table to continue forward data packets.