ABSTRACT

Ad hoc wireless networks have almost become ubiquitous with the advances in the performance of mobile devices, capability of the wireless media and the arising of the need for an infrastructure-free network. The performance of such network banks on the various protocols deployed at each layer of the network. Routing and physical level protocols play a pivotal role in the performance of ad hoc network. Routing protocols used in wired networks cannot be used in ad hoc networks because of the distinctive nature of the latter. This resulted in the emergence of a class of specialized protocols called the Ad hoc Routing Protocols. In the wireless physical layer, the propagation is enhanced with the adaptive array of antennas. Incorporating this cutting edge technology of physical layer into the higher layer is a need for the present generation. The three major contributions of this research work are (i) Performance analysis of Ad hoc on Demand Distance Vector (AODV) Routing Protocol, (ii) Physical and Graph based inference modelling and routing in mobile ad hoc network (MANET) and (iii) Seamless Communication in Mobile Ad hoc Network using Adaptive arrays.

The first objective was to analyze the performance of Ad hoc on demand Distance Vector routing protocol by simulation. The simulation was carried out by employing the libraries provided by the simulator. This simulation was developed to model the communication of multimedia packets in an ad hoc wireless network which deployed AODV routing protocol. The characteristics of the multimedia packets were in accordance with the traffic dimensioning principles for multimedia wireless networks. The simulation results were obtained and plotted for throughput, latency, and control packet overhead which could be used to adjudge the performance of the protocol.
The second objective was to design an analytical model to assess the effect of interference on data reception probability based on the information locally available at the node, because interference is a common issue in wireless communication as it results in packet delay, retransmission and packet loss. Providing interference awareness to functions such as routing helps in the enhancement of overall network performance since it reduces packet loss. Most of the existing systems capture the effects of interference by active probing, which is the process of measuring the effects of interference by periodically sending small active probe packets over the network. But, it causes additional overhead in the network and the link quality is perverted due to the interaction with other networking functions. In this proposed work, the interference was modelled using physical interference model and interference graph method. The above methods were used to arrive at an optimal routing metric based on the local information available at the node and it was incorporated in the routing protocol. Thus, it was found that the proposed method could improve the performance of AODV routing protocol by selecting the appropriate path which had very less or no interference.

The third objective was to develop a low computational complexity, subspace tracking algorithm for tracking Direction of Arrival (DOA) and provide seamless connectivity in mobile ad hoc network. Adaptive antenna arrays have been widely used in communication systems in recent days. The characteristics of Adaptive antenna arrays provide the ability to customize the radiation pattern based on the changes in the environment by making use of DOA estimation and adaptive beam forming. However, when adaptive antenna arrays are used in highly mobile environments like Mobile ad hoc Network, the radiation pattern obtained by using adaptive algorithm may be desired with respect to node’s previous location instead of current location.
The issues that arise due to mobility can be solved by continuously tracking the direction of arrival of desired target. DOA is time varying with mobile environment. Hence existing DOA estimation algorithms like MUSIC and ESPRIT cannot be used to track the signal subspace recursively as they are based on batch Eigen value decomposition which is highly time consuming with time complexity of $O(n^3)$. Also, DOA estimation algorithms do not yield robust subspace estimates when SNR is low. From simulation, it was clear that the proposed DOA tracking algorithm was able to track the mobile target accurately. The performance evaluation showed that the proposed DOA tracking took less time for tracking the current location of mobile target when compared with DOA estimation. Also, the tracking process was not affected by SNR.