ABSTRACT

This is the era of wireless communication. World is passing from the revolution of wireless communication technology and its numerous applications. It has been captured the attention of the media and the imagination of the public. Various wireless communication networks which are based on infrastructure such as cellular networks, Wireless Local Area Network (WLAN), Wireless Personal Area Network (WPAN), Bluetooth, Ultra-Wide Band (UWB) networks, WiMax are very popular and spreading with a very fast pace. Among these, cellular networks, Bluetooth networks, and WLANs are the most widely used networks. However, cellular networks and WLANs require centralized administration and costly infrastructure. In Bluetooth technology, hosts can connect to each other in an ad hoc fashion wirelessly, but this technology is only targeted at low power short-range wire replacement. Today having network connectivity and network speed all the time is the prime need of business and individual as well. This need can be realized by wireless networks.

Wireless networks are of two types one infrastructure based and other infrastructure less and can be deployed anywhere and anytime. The infrastructures less networks are called wireless mobile Ad-hoc networks (MANET). In wireless infrastructure less mobile Ad-hoc network autonomous mobile users (nodes) are connected through wireless links to build a live and on-the-fly network. Easy deployment, speed of development, and decreased dependency on the infrastructure is the main reasons to use ad-hoc network. Many new applications like automated highways and factories, smart homes and appliances, remote telemedicine and wireless sensor networks are emerging from research ideas to concrete systems. The explosive growth of wireless systems coupled with the wide spread of laptop and palmtop computers suggests a brilliant and bright future for wireless networks, both as stand-alone systems and as part of the larger networking infrastructure.

In infrastructure-less mobile network nodes are free to move randomly and organize themselves arbitrarily, thus the networks wireless topology may change rapidly and unpredictably even they do not have any existing network infrastructure or centralized administration. To this problem the design of infrastructure-less Mobile Ad hoc network involves some very critical & difficult issues that have resisted a common solution yet.
These issues touch all aspects of Ad-hoc networking and prevent wide spread use of infrastructure less Mobile Ad hoc network. The various issues and challenges are lack of mobility management, limited transmission range, imprecise state information, error prone shared radio channel, limited resource availability, energy constrained operation, routing protocols and network scalability. Further if the battery power of the nodes is depleted fully, then it results in network partition and so these nodes become a critical spot in the network. These critical nodes can deplete their battery power earlier because of excessive load and processing for data forwarding. These unbalanced loads turn to increase the chances of node failure, network partition and reduce the route lifetime and route reliability. Due to this, routing and scalability issues become a vital research topic in wireless mobile infrastructure-less networks.

The research work of this thesis is divided in two sections, firstly to study and compare performance analysis of some well known routing protocols and other one, scalability/clustering in wireless mobile Ad-hoc network. It provides not only general consideration of infrastructure-less network, but also gives a comprehensive picture of protocol stack of network layer and helps to better understand mobile infrastructure-less network which is similar to the TCP/IP suite. The main difference between these two protocols stacks lies in the network layer. The development goals are presented for an infrastructure-less network routing protocol. Also, it provides introduction and classification of routing protocols followed by scalability (clustering) in infrastructure wireless mobile Ad hoc networks. The comprehensive literature review about different routing protocols and different clustering schemes is presented and classified various routing protocols and clustering schemes proposed.

The research work proposed two novel schemes/algorithm one for dividing the large network into small network named Hierarchical Ad-hoc on demand distance vector (HAODV) scheme based on novel efficiency division factor (EDF) scheme and other cluster head gateway (CHG) scheme which select only one node as a cluster head (CH) and gateway node in place of two separate nodes. Both schemes select AODV routing protocols as a platform of existing clustering routing protocols.

The work begins by investigating some fundamentals of routing protocols and clustering schemes. Some well known routing protocols such as Ad hoc on demand distance vector (AODV) routing and dynamic source routing (DSR) protocols is simulated and
compared for the different metrics such as throughput, end to end delay, route discovery time and routing traffic received. The comprehensive study of routing protocols shows that according to the particular application or scenario, routing protocol may be selected easily and can be applied. The simulation work and analysis showed that AODV performs better than DSR for the above said parameters. The result validation also shows AODV and DSR improvement for end to end delay and throughput.

Further, a novel HAODV (Hierarchical Ad hoc on demand distance Vector) routing algorithm scheme is proposed for selecting Cluster Head (CH) and cluster member (CM) nodes in a clustered network. The uniqueness of the developed algorithm is that this approach uses Efficiency Division Factor (EDF) for electing Cluster Head (CH) and cluster members (CMs). The work begins by investigating some fundamental tradeoff and performance limits of existing clustering routing protocols based on some parameters such as throughput, delay jitter and number of packets drop. Proposed HAODV algorithm shows how an alternative approach that uses Efficiency Division Factor (EDF) for electing Cluster Head (CH) can improve the overall performance of the wireless infrastructure less network. On the basis of Efficiency Division factor (EDF) of individual node, the cluster head (CH) assigns the work load to its cluster member node in the network and hence thus overall performance of the network is increased. The primary functions of HAODV routing algorithm is to divide large network into small clusters, Election of Cluster Head (CH) based on EDF factor and then to distribute load among cluster nodes as per their work division factor (WDF).

The other proposed novel cluster head gateway (CHG) approach provides election of a single node for clustered network using Hierarchical Ad hoc on demand Vector (HAODV) routing protocols which is called CHG node in place of cluster head (CH) node and gateway node separately. The primary function of CHG node is to work individually and independently in place of Cluster Head and gateway node hence reduction of gateway node. The proposed approach has been simulated with the help of Exacta Cyber++ simulator and improves performance of clustered network for performance metrics end to end delay, jitters and number of packets drop with less complexity in frequent election of cluster head (CH) and gateway node separately and hence provide stability to the network. The result validation shows that present CHG approach improves end to end delay, jitter and number of packets dropped.