ABSTRACT

A Mobile Ad-hoc Network (MANET) is a self-organizing network where mobile nodes are interconnected by wireless multi-hop communication paths. Unlike conventional wireless networks, ad hoc networks have no fixed network infrastructure or administrative support. The topology of mobile ad hoc networks changes dynamically as the mobile nodes join or leave the network. MANETs are widely used in various areas like personal area networking, battlefield communications and disaster recovery, civilian environments, emergency operations and the business interest of resident applications which made its effective performance to be an absolute necessity.

In MANETs, the clustering technique allows the nodes to divide into group of nodes called clusters. Since the nodes in the clustered mobile ad hoc network finding the exact service is a challenging task, a service discovery method is needed. Since, the nodes communicate with other nodes their load may increase due to service registration, request, and reply. Thus, load balancing is important to balance the load and provide services to the service requesters.

This research has focused on designing a Clustering protocol and service discovery with load balancing for mobile ad hoc network (CSLB-MANET) to provide services to requested nodes. In Mobile Ad hoc Network, clustering is an important issue. The clusters split the network into a few little arrangements of nodes, presenting a hierarchically organized different clusters based on different parameters. In this thesis, the performance of cluster improves, such as packet delivery ratio and network life time by developing an optimized clustering algorithm which is used a mathematical model that gives a hierarchal structure to select the cluster head. In the self-organized clustering method, an Optimized Cluster Head selection using Analytical Hierarchy Process and Particle Swarm Optimization (OC-AHPPSO) is designed and
implemented. This method is developed by using well-established optimization algorithms namely Analytical Hierarchy Process (AHP) and Particle swarm optimization (PSO). The Analytical Hierarchy Process is used in formulation of factors subjective and objective weights of each node. Energy, coverage area, mobility, quality of service is taken as the main factor and each factor has some sub-criteria. There are 7 sub-criteria taken into consideration for finding the weight of each node. In addition, an improved Particle Swarm Optimization (PSO) algorithm is also used for optimized the clusters weights and then rank these set of nodes with the aim of selecting the highest weighted node as the optimized cluster head. The OC-AHPPSO reduces the re-affiliation rate to improve the bandwidth utilization; minimum mean number of clusters reduces the delay and the re-election rate for improving the cluster stability. The OC-AHPPSO also reduces energy consumption and end-to-end delay of cluster heads and increases the throughput.

A service is any software component or hardware resource that is accessible by others. A node in MANET can provide some services to other nodes in their vicinity. The use of service has increased rapidly with an increase in the number of available services. Finding the service is the difficult task in the clustered ad hoc network. The Service Discovery Protocol (SDP) helps devices to locate these services in the cluster and invoke them. In order to achieve an efficient service discovery, this thesis focuses on designing a cluster based service discovery model (CSDM-LDA) for clustered OC-AHPPSO for service registering and service provisioning among all mobile nodes in a mobile ad hoc network (MANETs). A dynamic backbone of nodes (i.e. cluster heads) that forms a service repository to which MANET nodes can advertise their services and/or send their service queries. The designed model is based on storing services with their service description on cluster head nodes that are found in accordance with the proposed OC-AHPPSO cluster head election model. This CHN handles the discovery agent in which Linear Discriminant Analysis (LDA) is used for service discovery by reducing the dimension of service data and
ignoring the inequality of local data points of the similar class using matrix representation and calculating the overall score of QoS for each service then rank the services based on their overall QoS and selects services with highest QoS values. The CSDM-LDA service discovery is improved by additionally considering service matching and it avoids the duplication of services. The CSDM-LDA model is analyzed in terms of success hit ratio, discovery overhead, average response time, network life time during discovery. The CSDM-LDA achieves low communication overhead and success of service discovery is increased. In addition, it takes less energy consumption during service discovery; minimizes the discovery overhead, and fast rank identification while searching services.

MANETs are deployed in uncontrolled environments and the nodes communicate with other nodes, their load may increase due to service registration, request, and reply. Hence, load balanced cluster based service discovery (LB-CSDM) model is designed and implemented by incorporating load balancing feature in the CSDM-LDA model. The load is shared across different components viz. service requester, service provider and cluster head using Markov process. Various test assessments have been carried out to evaluate LB-CSDM algorithm and their performances are compared based on the Success rate, Connection rate, Bandwidth usage, average response time and average load.

The performance of the work is evaluated and compared with that of the existing methods. The CSLB-MANET consists of OC-AHPPSO, CSDM-LDA and LB-CSDM. The OC-AHPPSO algorithm maximizes the network lifetime by 11% and 20% compared to MAHPCP and CLPSO algorithms. The mean number of cluster is reduced to 17% and 22% compared to MAHPCP and CLPSO. The re-affiliation rate is decreased by 10% and 20%, resulting in stable cluster head selection. Thereby it avoids frequent re-clustering; re-election rate is reduced by 12% to 25%. The CSDM-LDA on OC-AHPPSO does not cause any
control overhead on the network. The inter-cluster and intra-cluster service discovery success ratio of the CSDM-LDA is 77% and 98% respectively. Thereby the success hit ratio is increased by 20% and 34% compared to Distributed Service Discovery Model (DSDM) and Light Weight Service Discovery (LWSD) respectively. This scheme provides more accuracy and it is easier to find the first ranked services to be very fast compared to the existing approaches. Compared to the previous method, the service discovery success ratio is improved to 4% when the clustered network is load balanced and 99% of the overall SREQs are managed at most 10% by each SPN within the cluster. This shows that the proposed CSLB-MANET does well in balancing the load among the various nodes and provides services to the service requesters quickly in the MANET.