This dissertation addresses issues pertaining to the development of a routing algorithm for a clustered multi-hop radio network, which plays a critical role in path planning from source to destination without the help of the GPS system.

The main contributions of this dissertation are in the areas of generating location specific content with respect to landmarks, clustering and development of a routing algorithm for a clustered network. The research goals are to make progress towards achieving path planning in the clustered network. Making the routing decision is a critical issue in reaching a destination from a source. Decision making at each level is to be simplified by some means to achieve path planning. Routing is carried out by using the location specific content and clustering concept.

The metric dimension concept takes care of generating location specific content with respect to landmarks. The graphs with metric dimension two is characterized. The disadvantage of this concept is that it constructs both overlapping and non-overlapping clusters. This makes it difficult to make decision for those nodes which are overlapped. A new concept called cluster dimension of a graph is introduced, which strictly constructs a non-overlapping cluster. The graphs with cluster dimension two is characterized. A construction of non-overlapping clusters is obtained by the LandMarks for Uniquely Addressing and Clustering (LMUAC) algorithm. In switching from one cluster head of source to another cluster head of destination, if the source and destination are in different clusters, then a special hierarchical code is constructed. The expansion of the network can be carried out or not without modifying the cost of Cluster Heads is discussed.

To manage essential network operations, such as routing, the new routing algorithm called LandMarks for Uniquely Addressing and Clustering (LMUAC) routing algorithm for a clustered network is defined. The LandMarks for Uniquely
Addressing and Clustering (LMUAC) routing algorithm operates in three stages. The first stage is FORWARDING, i.e., forwarding the data packet from source to the cluster head of that cluster. The second stage is SWITCHING which takes care of switching between cluster heads. The final stage is route discovery, the discovery of routes is carried out based upon the parameters setting for a particular application. The role of the member nodes is minimized, the routing table size at each and every member node in a cluster is minimized and the execution time of the jobs in each node is minimized, while decision making of the route is maximized.

The path length in non clustered and clustered network is estimated, performance issues are compared with varying diameter. The path length (Upper bound) for clustered and non clustered shows that the smaller diameter of clusters perform better than the non clustered networks. The Path length (PL) (Upper Bound) is best suited if the selection is carried if \( d < D \). Then \( PL_{N,d} < PL_D \).

Similarly the Maximum link (ML) utilization is faster than the non clustered Network. The \( ML_{LMUAC(i=j)} < ML_{LMUAC(i\neq j)} < ML_c < ML_{nc} \) is proved.

Lastly the memory space (MS) requirement with respect to the non clustered (nc) network is compared, Hierarchy 3 level (H3L) clustered and the clustered network. The memory space \( MS_{LMUAC(\Delta i)} < MS_{LMUAC} < MS_{H3L} < MS_{nc} \) is better if the value of \( i \) is smaller it requires only a small amount of routing Table.