CHAPTER 1 INTRODUCTION

1.1 OVERVIEW

Traditional wireless networks have an infrastructure such as the access point in order to handle the communication among nodes. This type of network is a single-hop network. A mobile ad hoc network (MANET) is a self organized network of mobile nodes connected by wireless links and requires no infrastructure for communication. The nodes can move freely and in arbitrary manner. All nodes within the range of each other can communicate without the need of a central access point. Each node can act as both a router and as a host for multi-hop messages. The nodes in the network forward messages on behalf of other nodes which are not in the transmission range of each other. Hence separate schemes are required for such dynamically changing network. It is anytime, anywhere type of network. Because of this, such a network can be quickly deployed in emergence services such as disaster recovery like fire and search and rescue operation, and, further, the ease of data acquisition in inhospitable terrains makes it suitable for military operations. It is also applicable in meetings, conferences, classrooms, and vehicular networks, etc.

1.2 MOTIVATION

An accelerating energy crisis in the oil and gas industry is driving the development and investment in MANET technologies in the oil and gas industry. The importance of MANET in oil and gas industry can be understood from the following. The crude oil is available in the remote area of seas where it is very difficult to implement infrastructure oriented network for communication. As such the working staff sometimes faces catastrophic situations in such remote areas and it is very difficult for them to communicate with each other without any infrastructure. This calls for the infrastructure less network, namely, MANET for such a sector to be implemented.

MANET was designed such that a certain number of nodes should be able to communicate with each other in situations where these nodes come together,
i.e., come within the transmission range of each other. Since MANET nodes need not cater to a fixed network for long time use, suffice it to equip them with low power and computing facility with routing capabilities. Because, in MANET, topology frequently changes, and nodes have got limited power so its routing is challenged by these factors. So the conventional routing protocols employed for wired networks cannot be used. This has been the motivation behind taking up the design of a suitable protocol for MANET in the present work. Initial routing protocol considered the minimum number of hops as metric, but the problem of overuse of nodes on a path may result in the disruption in communication. It becomes a serious problem considering the rescue operation where all nodes need to be connected. Also, it may lead to delay in communication and looking at the demand of real time applications this may be a serious concern and motivated us to investigate into this field.

1.3 PROBLEM FORMULATION

The nodes in MANET are mobile, which may result in dynamic topology with high rate of link breakage and network partitions interrupting the ongoing communication or transmission. The nodes in MANET are dependable upon the exhaustible power supply. Also, because of shared nature of medium, the transmitted packets may also cause energy loss in the surrounding nodes due to overhearing. Further, compared to wired network there is increased possibility of packet loss and congestion in MANET resulting in energy consumption. Energy consumption can also be due to receiving of the data, transmitting of the data, traffic, mobility and size of the network. While the problem of network partitioning due to the movement of nodes cannot be handled by routing protocol, partitioning due to outage of battery can be solved by routing decisions. Routing techniques helps in path establishment for communication.

MANET consists of different types of overheads such as Routing overhead (Route request, route reply and route error packets). The overhead caused in managing the link failure is a significant contributor of energy consumption. As the start node of the broken link has to wait/ retry for a time out interval before deciding that the link is failed and can not be used further and has to
inform through RERR packet to all other nodes using the failed link as one of the hop in their paths. Also the packets following this path experience large delays and the source node has to find a new route to destination. This problem occurs rather more frequently in wireless networks. Hence the problem of energy consumption due to overheads in routing protocols requires special attention and further study.

1.4 OBJECTIVES

In view of the above issues (Sections 1.1-1.4), in the present work, the following objectives have been set:

- To carry out energy consumption analysis due to overheads in MANET under various routing techniques.
- To investigate into the different issues that affect communication.
- To make efforts with a view to reducing the energy consumption in managing the link failure.
- To put efforts for providing QOS (quality of service) in the routing technique.

1.5 RESEARCH METHODOLOGY

The research methodology adopted in the present work comprises the following phases (Fig. 1.1).

(a) **Reviewing previous work and relevant literature**

A literature survey has been carried out with a view to reviewing and revisiting the previous work related to the problems (Section 1.3) and the objectives (Section 1.4). The knowledge gained during this phase has been subsequently used during the implementation/development phase of the work. The energy management schemes and different layer protocols reported in the literature have been studied in detail for acquiring the knowledge that has been used in designing the new protocol in the present work. The review of the previous work has also included the simulation tool that has helped the present work in the analysis and implementation phase.
(b) Identifying related problems

In the existing literature mainly energy consumption analyses of routing protocols have been studied. Their emphasis was in reducing the energy consumption in route finding through various approaches such as the transmission power control or the sending of the data through multiple paths to improve network lifetime by uniform utilization of nodes. However, as far as the author is aware, none studied the amount of energy consumed in managing the link failures in different routing techniques so that efforts could be put to improve the performance of routing techniques. Thus, the problem has been identified as of to design an energy aware routing technique avoiding route breaks and complying with congestion (interface queue length) over the path.

(c) Simulation study and analysis

The existing routing protocols have been analyzed in order to gain the insight and ensure the correctness of the existing results. Different scenarios are developed as per the requirement and also an energy model is considered needed for evaluating the energy consumption of different protocols.

(d) Design and Implementation of the technique

After analyzing the existing protocols, a better performing protocol has been extended to propose its energy efficient version. The proposed protocols has been designed and implemented over the simulator. In order to verify its implementation and correctness of the protocol, the testing has been done.

(e) Analysis/evaluation

The implemented technique has been analyzed and the results evaluated and compared with the objectives.

(f) Modification/improvement

The design under (e) above has been put iterative modifications until the results converge to the desired objectives.

(g) Write up of the report to on the work
The work has been reported in journals (see Section 1.6). Also, the complete work has been reported in the form of a thesis (Section 1.7).

**1.6 CONTRIBUTIONS**

The main contributions of our research are listed below; these have been elaborated further in the thesis (Chapter 4-6).

- Performance evaluation has been carried out on various MANET routing protocols based on energy consumption, network lifetime, throughput and number of link breaks.

- A technique to predict the link stability is proposed. The technique considers the node stability and the link lifetime in order to measure link stability.

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Fig. 1.1: Flow chart for adopted research methodology
The proposed technique performance has been evaluated on Dynamic Source routing protocol.

The reduction in the cost incurred in managing the link breaks by the proposed technique of predicting the link stability has been established.

Publications from the Thesis


1.7 THEESIS OUTLINE AND PLAN AND SCOPE

The first three chapters, including the present chapter, introduce the subject; present the literature survey, explain the objective of the work discussing in what way the present work is different from and an improvement over the previously reported work; state the problem undertaken providing the plan and scope of the work, and revisit all the necessary concepts which are necessary to execute the work. The next three chapters embody the core work carried out highlighting the results and their interpretation.

Chapter 2 presents the work done on energy management at different layers for MANET and as well as the related work on energy efficient routing protocols. Chapter 3 describes the basic concepts needed to understand the thesis.

Chapters 4-6 embody a report on the work done within the purview of the plan and scope of the present work.

Chapter 4 describes the performance analysis carried out on various routing protocols and also on the selection of appropriate routing protocols as per the
present work.

Chapter 5 presents the proposed technique to derive the link stability and the design of EAEDSR routing protocol.

Chapter 6 presents the implementation detail and results analysis of the EAEDSR routing protocol.

Chapter 7 concludes the work summarizing it and highlighting the major findings and their interpretation as well as pointing out the limitation of the present work and the scope for further work.