Dynamic Routing Using Petal Ant Colony Optimization for Mobile Ad-hoc Networks

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***Abstract*—A Mobile Ad-hoc Network (MANET) is a temporary wireless network that configures itself as needed. Each MANET node has a finite number of resources and serves as both a node and a router at the same time. MANET nodes are mobile and move from one location to another. Because MANET nodes are dynamic, choosing an optimal node for data transfer is a difficult issue. Because packets must propagate in a multi-hop manner, they take a longer path and may endure a longer delay, causing them to become lost in the network. The network's overall performance suffers as a result of the re-transmission of those lost packets. We propose a modified version of a nature-inspired algorithm called Petal Ant based Dynamic Routing (PADR) in this research study, which reconstructs data packets to traverse inside a given region and achieves minimal delay during data transmission. The PADR is simulated in Network Simulator (NS2) and compared against nature-inspired routing protocols like PAR and SARA, as well as traditional routing protocols like AODV.**

Keywords*—Petal ant routing; dynamic petal ant routing; MANET; ant colony optimization

I. Introduction

In our day-to-day lives, wireless communication networks are becoming increasingly crucial [3] [12]. Wireless devices connect, exchange, and transfer data wirelessly, giving them a substantial level of mobility [20]. Infrastructure-based networks and infrastructure-less networks are the two types of wireless networks available [1] [19]. Wireless devices communicate in infrastructure-based networks through a centralized administration, such as a base station or an access point [28]. The wireless device communicates directly with no pre-existing communication infrastructure in an infrastructure-less network, which is known as an Ad-hoc Network. Mobile Ad-hoc Network is an example of an ad-hoc network (MANET) [5].

The Mobile Ad-hoc Network is a transitory wireless network made up of a collection of wireless devices such as laptops, PDAs, and mobile phones that may dynamically configure, communicate, and react with no central administration [6][7]. Because MANET's nodes are mobile, they connect to other networks using a regular Wi-Fi connection [23]. Because MANET mobile nodes communicate with one another over a wireless medium, the devices must establish a communication link and send data to others even when they are not in direct transmission range [14][30]. MANETs, in general, forward data in a multi-hop fashion and serve as routers even when no infrastructure equipment is present [16][31]. Congestion, routing, security, and other challenges arise as a result of a MANET's absence of infrastructure equipment [18] [29]. One of the most important challenges is routing, because when determining the best way for data transmission, complications like delay, performance, throughput, and overheads can generate a slew of problems and reduce network efficiency [4] [15]. As a result, additional strategies are required to overcome such difficulties with high node mobility, according to [25] [17]. A Routing in a MANET is a common theme that has resulted in numerous routing protocols in the literature and has remained a difficult issue for the past few decades [21] [22].

The key contributions and originality aspects of the proposed routing are as follows:

1) To identify the shortfalls of existing PAR route discovery procedure. We provide a cutting-edge technique for obtaining petal width from static to dynamic petal between end nodes.

2) Our approach aims to maximize the data delivery rate between end-to-end nodes during data transmission by discriminating the mobile node during the process. We propose an innovative technique of electing the nearest neighboring node so that delay and routing overheads between end nodes is minimum as quoted in the algorithm. This impacts the performance and user experience of various applications and services in the real world.

3) For each of the proposed tests, 20 simulation runs were conducted ranging from 15 to 150 mobile nodes, and an average value was calculated at the end of the simulation. The suggested routing algorithm is evaluated for various metrics such as packet delivery fraction, throughput, overhead and delay, and the results are compared with PAR routing.

Overall, this article proposes an extension of the ant colony optimization technique, a nature-inspired algorithm that optimizes both the route discovery and route maintenance mechanisms for data delivery from groups of mobile nodes in MANETs. The proposed technique evaluation results demonstrate its effectiveness in discriminating node during route discovery and provides better performance than PAR routing strategy. The following section contains various related works, our contributions, and an analysis of the results.