Qos Improvement Using Hybrid Genetic Algorithm Based AODV In Manet

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Abstract: Multi hop links are used to communicate between nodes in a Mobile Ad Hoc Network (MANET). Data packets are routed through intermediate nodes in the network to the destination node since each node functions as a router. Dynamic routing protocols are being developed for network communication efficiency. Routing protocols in MANETS face problems such as versatility, scalability, and restricted bandwidth. A fuzzy logic approach is suggested as part of the study. In this work, a fuzzy logic methodology is planned to choose the best routes in order to better QoS End-to-end delay (Ae), when a node leaves the network (Nl), A fuzzy rule-based scheme NR includes the number of packets dropped (ND) and the number of path error RRER caused parameters. Simulations are carried out in this study using the proposed fuzzy approach process Simulations are carried out in this study using the future process fuzzy approach. The measurement criteria are throughput and the number of packets dropped. The tentative results obtained show that the proposed fuzzy approach improves the QoS better than existing regular Ad hoc On-demand Distance Vector (AODV) routing protocol.

In the final stage of investigation, the use of a hybrid optimization approach to choose the best route is suggested. The proposed hybrid optimization is based on the Genetic Algorithm (GA) and the Hill Climbing algorithm. The hybrid optimization aids in the resolution of the local minimum problem Hill-climbing begins with an infeasible solution and continues until a viable solution is found, at which point the viable solution is returned to GA. The simulation results show that the throughput is high. When compared to the AODV protocol, the proposed Fuzzy-Hybrid GA method yields about 29.56 percent more and 6.33 percent more when compared to the Fuzzy-GA solution.

Keywords:

1. Introduction

A self-governing arrangement of hubs moving in a subjective design framing a structure with no centralized support is known as an ad hoc system. Multi jump joins are used to connect between hubs in a Mobile Ad hoc Network (MANET). Information packets are sent through the system's hubs to the destination, as each hub acts as a switch. For effective correspondence in the system, dynamic steering conventions were created. Portability of the hubs, enormous number of hubs, and constrained transmission capacity are a portion of the difficulties looked by the directing conventions [1]. Numerous quantities of directing conventions were created for MANETS. Proactive conventions discover courses by occasional flooding and keep up system topological data in every hub, in sensitive conventions, courses are revealed only when they are required, regardless of the need for them. Receptive conventions update when there is no information transmission between hubs in the system, directing data results in a significant increase in system overheads. Responsive steering conventions decrease the control overheads which is advantageous in high versatility systems where occasional updates in directing data leads to critical increment in system overheads when there is no information transmission between hubs in the system. On-Demand Ad-Hoc Distance Vector (AODV) The route recovery mechanism, security, anomaly detection, and other aspects of AODV have all been extensively researched.

1.1 Ad-Hoc On-Demand Distance Vector (AODV)

AODV has been widely studied in terms of the route recovery mechanism, security, Anomaly detection, sparse and dense network with different mobility patterns and speeds [2]. Unreliable connections, low signal quality, higher latency, and higher packet losses are common problems faced by nodes in unexpected networks located on the edge of the network. The efficiency of routing protocols is influenced by the quality of the nodes. Link failures between nodes are common in high-quality networks [3]. On connection failures, AODV begins new route discoveries as alternate routes. As a result, in high-quality networks, as connection failures increase, route discovery increases proportionately, resulting in an increase in routing load. Nodes tend to cluster in low-quality areas, resulting in congestion in high-traffic areas. This has the impact of increased routing masses lead to a decrease in the output and packet transmission magnitude relationship resulting in a decrease in network efficiency as low-quality nodes begin to cluster, creating congestion in high-traffic areas. This results in dilapidation of the network performance by rising routing loads and decreasing output and packet delivery magnitude relation. a fuzzy genetic formula primarily based AODV is estimated to avoid abnormal behavior of

routing throughout high quality. The estimated methodology improves act by applying resident congestion ways in AODV routing protocols.

1.2 Fuzzy Based Routing in MANETs

for the development of machine-controlled systems Fuzzy management is based on fuzzy pure mathematics, which is a generalization of classical pure mathematics in which set membership isn't defined by a mathematician expression: it's allowed to be represented in degrees of membership within the range 0 1 in order to imitate the human linguistic approach to describing conditions such as cold, heat, and so on. [4]. A fuzzy controller can be articulated victimization rules of the shape IF {state} THEN {behavior} by using such an associate degree method. The association values determine how much each rule "fires," demonstrating the rule set's and the correlative relationship's mutual support.

1.3 Evolutionary Algorithm based Routing in MANETs

The directing capacity must discover a way that can fulfill the clients' prerequisites. Not with standing QoS parameters, in a business multi-supplier condition, strategy limitations should likewise be genuinely considered. In this approach, heuristics, for example, aware strategies must to be utilized to locate a close ideal arrangement.

GA is a programming method that mirrors the organic development as a critical thinking strategy [5]. When taking care of a particular issue, the input to GA is a potential arrangements area, area encoded with a wellness capability calculation allowing quantitative evaluation of each up and coming arrangement. Every applicant's assessment depends on the wellness work. The calculation automatically choices people for the production of new ones. Age of freaks is additionally conceivable This calculation offers a collection of chromosomes originating from a population To begin, a human population, P, is formed, followed by a new population, P'. The algorithm selects people for the creation of new ones on its own. Every chromosome's comfort potential is selected depending on the plan problem target that's to decrease the supply-intention route for systems' topological form [6]. When a chromosome is found inside gadget parameters, it is chosen. The well-being capacity of each chromosome is chosen based on the plan issue goal, which is to reduce the supply-intention path.

2. Literature Survey

This section discusses some of the work that has been published in the literature in the areas of pretty routing using fuzzy logic and optimization methods like evolutionary algorithms and swarm intelligence.

2.1 Fuzzy based routing

Mohan et al. [6] proposed A Reliable Routing Algorithm in MANET Using Fuzzy was proposed by Network topology was represented using Peri nets were used to reflect network topology, and fuzzy reasoning was used to build a routing tree that can be used to find a reliable path from a source node to a destination node. Established routing methods were compared to the degree of reliability. The results showed that the AODV protocol was more reliable by more than 80%.

Hiremath and Joshi [7] proposed an energy-efficient routing protocol with adaptive fuzzy threshold energy. For ad hoc networks, Erroneous routing information was generated by mobile nodes. The proposed method used fuzzy logic to choose the highest stability route for transmission from a source node to a destination node, using probable life time and number of hops as input parameters. For ad hoc networks, fuzzy logic DSR was compared to existing DSR. The results showed that the fuzzy charity solution worked.

Abirami, et al., [8] proposed the Fuzzy based Balanced Power Aware Routing Algorithm (FBPR), which incorporates a path management mechanism and a secure route using fuzzy logic. By creating a new path across neighbouring nodes, the path maintenance mechanism minimised path breakages.

Anjun, et al., [9] proposed A novel optimized data delivery framework - FLDF using Fuzzy logic for ICAMNs message where two nodes meet in the network and each employs Fuzzy logic to evaluate delivery preferences of possible messages based on fuzzy. Following assessment nodes choose to store messages with a higher distribution priority in the future. Simulation demonstrated the proposed FLDF's enhanced delivery performance over existing SCF schemes.

VikasSiwach, Dr. Yudhvir Singh, Seema, DheerDhwaj Barak [10], proposed a novel optimised data distribution system - FLDF using Fuzzy logic for ICAMNs message delivery, in which two network nodes meet and each uses fuzzy logic to compare message delivery preferences based on fuzzy sets. The assessment nodes that follow select/store messages with a higher delivery priority in the future.

Ghalavand et al. [11] proposed a reliable fuzzy-logic based routing algorithm for finding a reliable reactive protocol in MANETs. Using a genetic intelligent approach, all possible paths from the source node to the

destination node were identified, and congestion-free efficient routing was achieved. The ACK was sent in the reverse order of route selection for the chosen path. Based on a parameter called reliability value, nodes with the highest trust value and the most energy are chosen as routers during route selection. This provided a secure source-to-destination path, extending network life and lowering packet loss during transmission. Sujatha et al, [12] proposed a technique to evaluate exposure to attacks in AODV, specifically the Black Hole attack, and to create a specification-based Intrusion Detection System (IDS) using GA. 2.2

2.2 Genetic Algorithm based routing

Routing based on the Genetic Algorithm Anjum et al used a genetic algorithm to present optimal routing in an ad-hoc network [9]. Since MANET nodes are mobile, determining the shortest path between a source and a destination node while maintaining QoS was a difficult job. To find partial shortest paths, this GA algorithm used chromosomes of different lengths and cross-over partial chromosomes. The GA scheme was put up against the DSR routing system. During route discovery, nodes with the highest trust value and the most energy are chosen as routers based on a parameter called reliability value. This formed a reliable source to destination route, increased network life and decreased packet loss during transmission. In this approach, all the possible paths from the source node to the destination node were found and congestion free efficient routing was achieved by using genetic intelligent approach. For the selected path ACK was sent in the reverse order of path selection.

An adaptive Fuzzy based Balanced Power Aware Routing Algorithm (FBPRA) incorporating path maintenance Abirami et al. suggest a mechanism and a safe path based on fuzzy logic. Abirami et al. suggest an mechanism and a safe route based on fuzzy logic. Path breakages were minimized by the path maintenance mechanism, which established a new path across neighboring nodes before the packet transmitted path was broken due to node mobility [8]. Performance evaluation was through simulation to compare the proposed fuzzy logic approach and classical methods. The results reveal that the proposed algorithm improves network performance effectively.

2.3 Swarm Intelligence based Routing

The swam intelligence based routing algorithm has introduced the concept of trust into multicast routing problem which is finally, using a modified ant colony algorithm and a multicast trusted routing algorithm with QoS multi constraints, a multicast trusted routing algorithm with QoS multi constraints was suggested.. In the new algorithm, ants move constantly on the network to find an optimal constrained multicast security tree. Simulation results indicate that the proposed algorithm can quickly find the feasible solution to solve constrained multicast security routing issues. Compared to CSTMAN, the packet delivery ratio of new algorithm is improved

3 Research Contributions

The most important aspects of the work completed in the following areas: i) fuzzy logic routing, ii) fuzzy logic and GA-based routing, and iii) hybrid optimization approach

3.1 MANET Routing: A Fuzzy Logic Approach

This paper suggests a fuzzy reasoning and method for selecting ideal courses to satisfy the QoS criteria of MANET-based applications that has been passed down through the generations. The phonetic factors real start to finish delay (Ae), number of times the hub leaves the machine (Nl), number of parcels dropped (Nd), and number of Rerr generated from the fuzzy principle-based structure (Nr). A typical reasoning with a degree of involvement is called a fuzzy rationale [14]. To compute results, the fuzzy input information activates one or more standards in the fuzzy model. In the "IF" and "THEN" sections, IF - THEN principles direct information values to yield space with regard to suggestion relations between fuzzy sets.

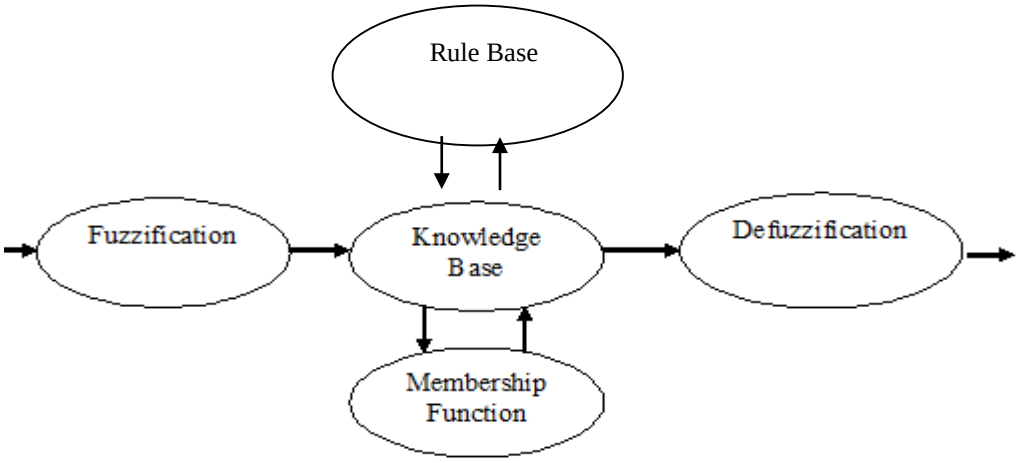

Figure 1 A diagram of a generalized fuzzy system

Provides a diagram of generalized fuzzy scheme, the ability of fuzzy which appeals to decision-making systems because it can handle inconsistencies and non-linearity in physical systems in a way that is similar to human reasoning.. Fuzzification, knowledge base (rule and function), and defuzzification are the three components of a fuzzy logic system. In fuzzy sets, fuzzification defines the degree of membership to a crisp input. The input-yield fuzzy factors fuzzy relationship is defined by a fuzzy standard base. The enrollment degree indicated by fuzzifier specifies the fuzzy norm base yield. Defuzzification converts yields into new qualities based on a fuzzy guideline foundation. The Fuzzy Logic Controller (FLC) has two inputs: message priority and network status, as well as a routing decision as an output. The following are the Mamdani rules: Ai, Bj, and Ck are linguistic values (fuzzy sets determine meaning) of linguistic variables x, y, and z in universes of discourse U, V, and W, respectively.

The capacity of the chosen route to satisfy the needed QoS demand at a low cost and without violating policy is critical to success

A rule with DoS of 1.0 indicates maximum support, while a DoS of 0.1 indicates very low support. In this work, the proposed algorithm selects all rules with DoS greater than 0.75. For the given input value the route preference is computed based on the four input parameters, the end-to-end delay is manageable by the proposed technique at lower speeds, however at higher speeds the performance starts degrading and is similar to AODV.

3.2 MANET Routing: Optimization Approach

Genetic Algorithm is used to develop our routing Unit's initial rule set as well as its membership features. The capacity of the chosen route to satisfy the needed QoS demand at a low cost and without violating policy is critical to success.

GAs offer an enhancement technique where the stochastic pursuit calculation depends on natural standards of development like choice, traverse and change. The difficulties of manually selecting suitable rules and membership functions for a given problem are solved by incorporating GAs into fuzzy structures. The GA is in charge of selecting a high-performing rule set and tuning the membership functions in relation to it. As a result, high-performing, robust routing algorithms that can operate across a broad parameter range and are almost entirely computer-designed are generated. As a result, this algorithm can solve a wide variety of problems, including linear, nonlinear, discontinuous, discrete, and so on. In such systems, information in the form of linguistic variables can be used to solve problems. parameters of the fuzzy membership function Number of laws, fuzzy rules, etc.

In such systems, knowledge in the form of linguistic variables, fuzzy membership function parameters, fuzzy rules, number of rules, etc. can be converted into suitable candidate solutions through genetic code structure of GA. This work focuses on identifying the best rules for fuzzy based routing using genetic algorithm. In GA, each chromosome represents a possible solution with several options at first. Initial chromosomes are pathways discovered during the route discovery process.

The shortest path and the shortest delay time are the most relevant factors, followed by buffer capacity. The fitness of each chromosome is determined as

$$f(Ch_i) = [\sum_{l \in P(s,r)} C_l + C_d]$$

Each chromosome's fitness value is expressed by Ch, and its delay time is represented by Cd, where Cl represents path cost.

Figure 2 shows the performance comparisons of AODV routing and proposed Fuzzy Genetic approach. The proposed fuzzy GA solution outperforms the aodv protocol by around 27.1 percent.

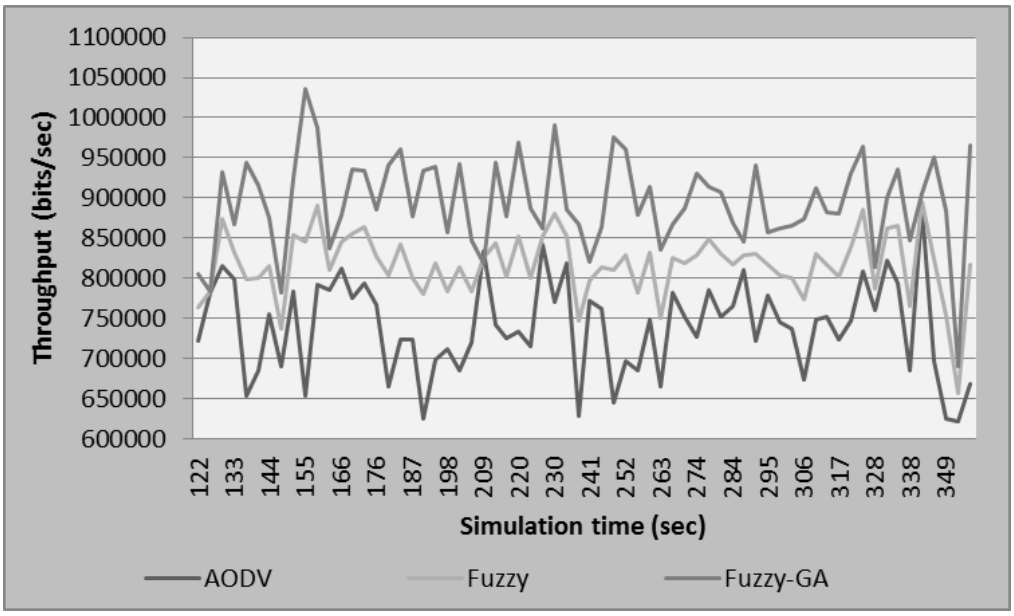

Figure 2: Throughput

3.3 Hybrid Optimization Approach for Optimal Route Selection in MANET

Routing in MANETs must take into account essential characteristics such as node mobility. In MANETs, work on single path (or uni-path) routing are available in the literature [13]. Multiple paths can be established between a single source and a single destination node using multipath routing. Due to the limited bandwidth between nodes in MANETs, multipath routing is proposed to improve data transmission efficiency (fault tolerance) or to ensure load balancing.

The use of a hybrid optimization approach to choose the best route is suggested. The proposed hybrid optimization is based on the Genetic Algorithm (GA) and the Hill Climbing Algorithm (HCA).

Hill-climbing is a Local Search-related mathematical optimization technique. It begins with an initial solution (impossible solution), which is then mutated to see if the mutation has a higher probability of success. If the new solution is better than the previous one in terms of fitness, the new solution is kept; otherwise, the existing solution is kept. Climbing a hill works as long as possible by iteratively refining a solution by neighborhood transformations.

Hill climbing progression has four knowledge parameters: aim job, early stages, range, and hunt venture. Change parameter premise spreads out the quest room for hill climbing. The premise of the search space is generally a symmetrical set or non-declined [15]. Unbending body revolution is symmetrical. Turn and interpretation are corresponded, as revolution around a self-assertive point can deteriorate into pivot around source in addition to an interpretation. Relative change isn't symmetrical, yet is non-declined.

Algorithm for GA with Hill Climbing

Build a random population

for I from 1 to generation number,

and for j from 1 to population size.

Select parents using crossover and mutation operators,

if new_ solution isn't a viable option, create a new solution.

N is the number of new solutions available.

N = Hill-Climbing (N)

end if

end for

build the next generation

if the stop condition is satisfied

put an end to the algorithm

end if

end for

Hill-Climbing (current solution) is a method

Do next solution = extend current solution

if fitness of next solution> fitness of current solution

Do next solution = extend current solution

end if

end while

Start the population at random.

Build a generator for I using 1 as a starting point.

j's population should be increased by one.

seek out a relative

The suggested combination of GA and hill climbing is used to enhance our routing unit's initial rule-set, Figure 3 compares the efficiency of AODV fuzzy GA routing and the planned fuzzy GA routing, as well as membership functions.When compared to the AODV protocol, the proposed fuzzy hybrid GA solution produces approximately 29.56 percent more and by 6.

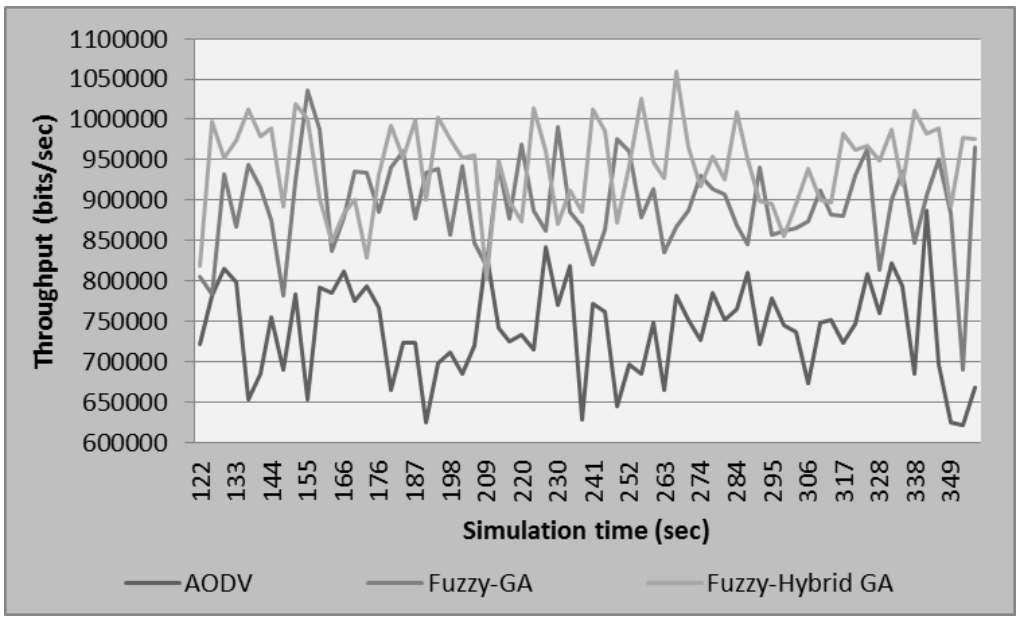

Figure 3 Throughput in bits / second

4 Conclusions and Future Work

4.1 Conclusions

MANETs have dynamic nature and face when interacting, issues such as node mobility, power consumption, information delay, and authentication will arise. Routing protocols are used to address such issues. Use of routing protocols resolves such problems. A routing algorithm with rules for controlling network activity makes up an ad hoc network routing protocol.

AODV is a network overhead-inducing on-demand solution that uses periodic "Hello" broadcasts to monitor neighboring nodes. In AODV, a path should be discovered before data packet transmission. The performance of interactive applications suffers as a result of such initial search latency. Similarly, path quality is uncertain prior to call setup and is only discovered during setup. Intermediate nodes in an active session must also keep track of route continuity, which adds latency and overhead. The simplest solution is to apply qos routing optimization.

To implement QoS routing, optimization is the best approach. In this approach, all the possible paths from the source node to the destination node were found and efficient routing was achieved by using genetic intelligent strategy. GA is used to enhance the routing's initial rule set as well as its membership features. The capacity of the chosen route to satisfy the needed QoS demand at a low cost and without violating policy is critical to success. GA is faster than routing protocols at deciding the shortest path

The simulation results showed that the When compared to the aodv protocol, the proposed fuzzy ga solution yields around 23.14 percent more throughputs. 3.14 % in additional to project Fuzzy-GA method when comparing to the AODV protocol. The proposed hybrid optimization is based on the genetic algorithm ga and the hill climbing algorithm helps to solve the local minima problem in the final stage of investigation. Simulation results demonstrate that for random waypoint mobility speed, the throughput is around 29.56% and 6.33% more in the proposed Hybrid approach when compared to the regular AODV protocol and Fuzzy-Genetic approach.

4.2 Future work

The projected fuzzy technique was investigated on small network with different mobility. Conversely research ensures to be carried out using huge network area with dense and sparse node. The proposed hybrid technique can also be investigated for other popular routing algorithms including DSR and TORA. Most of the work in MANET does not focus on energy efficiency. Conversely with MANET's becoming everywhere, it is necessary to investigate the routine of energy consumed under different scenarios

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