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ESPS: Efficient Stable Path Selection Approach for Improved Network Performance

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Abstract*: In mobile networks, a major challenge is to provide seamless connectivity without incurring excessive routing overhead. For these typical challenges of link stability, a promising approach is to use not just a single path, but set of redundant paths, to mask link failures in the network. This approach requires three components. Specifically, it requires a mechanism for route discovery, a mechanism for sending a packet along a selected route, and a high level protocol for selecting the most reliable set of routes from the many redundant paths that may exist in the network. In this research work, we proposed, "Efficient Stable Path Selection (ESPS)" approach which is truly based on Ant Colony Optimization (ACO) based search algorithm, ensures that contributes stable quality performance of network and to estimate the optimal stable path services randomly based on QoS parameter requirements and existing movements of packet flow, so that efficient path selection can easily capture by designing of proposed ESPS approach. In this work proposed of new approach by designing new routing protocol i.e. MCCP. The implementation of the ESPS approach is implemented using NS2 simulation environment and the AOMDV routing protocol is used to incorporate the multipath in network. The experimental results are measured in terms of end to end delay, average throughput, and packet delivery ratio.

Keywords:* MANET, NS2, network node, ACO, Stable Route, Path Selection, Routing Protocol

I. INTRODUCTION

In the current years, remote innovation has delighted in a colossal ascent in prevalence and utilization, consequently opening new fields of uses in the area of systems administration. Without utilizing any settled basic help the data is trading in the system of cell phones. Such systems are named as ad –hoc network. Correspondence conventions should manage a habitually changing system topology. Be that as it may, numerous applications require stable associations with ensure a specific level of QoS (Quality of administration). In get to systems, get to point handovers may disturb the information exchange. Maybe also, benefit settings ought to be exchanged to the new access focuses, acquainting extra overhead and postponements with the association. In wireless communication systems, there will be a need for rapid deployment of independent mobile users. Such network scenarios cannot rely on centralized and organized connectivity, and can be conceived as applications of MANET. With the development of wireless communication technology, two basic wireless network models have been developed for the wireless communication system. MANETs are suitable for applications in which no infrastructure exists such as military battlefield, survivable, efficient, dynamic communication for emergency/rescue operations, disaster relief efforts, vehicular communications and mining operations. In these applications, communication and collaboration among a given group of nodes are necessary [1] [2] [3]. To link the connection between nodes, route stability is more importance for betterment of the network performance in ad-hoc manner to reduce the redundancy of the path and enabling to use multipath routing among multiple available path. Therefore, in this project work our aims to improve the performance of the network to ensure by route stability between nodes. In our work, we have designed route (path) stability using the recentness and the lifetime of contacts and we wonder if the stability of the interactions can be useful for our task.

A. What is MANET?

A Mobile Ad hoc network (MANET) is a set of mobile nodes which communicate wirelessly over radio frequencies with no centralized infrastructure. This is in unambiguous difference to the infrastructure of other networks such as Local Area Networks, or even peer to peer networks. The properties of mobility and wireless communication present huge problems to the creation of such networks and the maintenance of services on these networks. Since nodes keep moving away or towards each other, it is understandable that parameters like Quality of Service (QoS) will suffer unless special schemes are developed to sustain such networks. With the ubiquity of laptops and mobile devices, there is an ever increasing importance for the realization of such networks [4] [5].

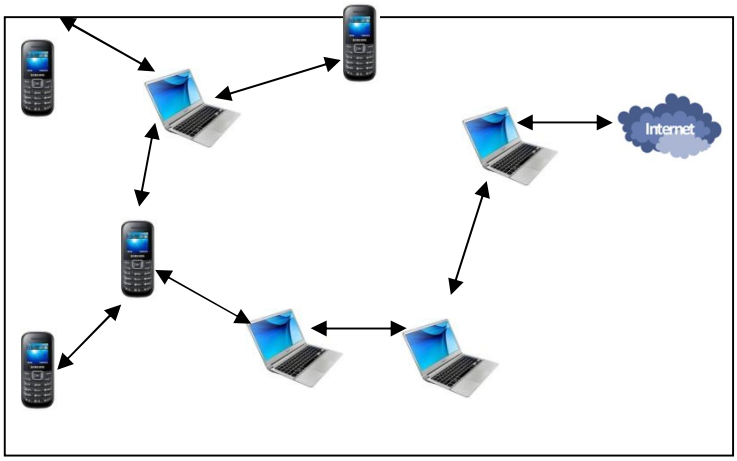

Figure 1 Example of MANET

B. Fundamental Aspects of Route Stability in MANET

To meet the nature of administration necessities of portable clients, a few measurements can be considered for choosing a source goal steering way. The major parts of Route strength are resolved as takes after [6] [7]:

1) *Stable Routes*: To amplify throughput and diminish movement dormancy, it is basic to guarantee dependable source-goal associations after some time. A course ought to along these lines be chosen in view of some information of the hubs movement and on a likelihood model of the way future accessibility.

2) *Proficient Route Repair:* If a gauge of the way term is accessible, benefit disturbance because of course disappointment can be kept away from by making an elective way before the present one breaks. Note that having some data on the way length maintains a strategic distance from misuse of radio assets due to pre-allotment of reinforcement ways.

3) *System Connectivity:* Connectivity and topology qualities of a MANET are controlled by the connection progression. These are key issues to arrange plan, since they decide the framework ability to help client correspondences and their unwavering quality level.

4) *Connection Reliability*: Reliability is a system's capacity to play out an assigned arrangement of capacities under specific conditions for determined operational circumstances, while accessibility is a system's capacity to play out its capacities at any given moment under specific conditions. Keeping in mind the end goal to figure the connection unwavering quality we require the appropriation of the time a MN spends in the convergence district.

II. PROPOSED WORK

In this section includes the methodology and algorithmic approaches for efficient route finding in ad-hoc network.

A. Methodology

To find the solution of this approach, which show that route stability during network life time Here, we enlist basic 3 segments of our methodology that construct entire system that proving efficiency and effectiveness of this work.

1) Initial Assumption
2) Assigning Parameter
3) Choice of Algorithm

B. Assumption

For securing system, the proposed calculation is creating utilizing diverse requirement. So we essentially we have to expect a few requirements to advance further. Therefore, we create simulation scenario for 07 network node. We create simulation for new protocol MCCP and AOMDV protocol. This two simulation, demonstrate the packet transmission using NS2.

Furthermore, to process proposed strategy, we utilize some system parameter to process the utilization of ACO calculation from this we get the best consequence of course determination. In next point we expect a few basic parameter which is used to help algorithm construction that is discussed below.

C. Parameter Selection

In this section we describe assigned parameter to proposed approach by we have apply ACO algorithm. Following are the parameter:

1) *Mobility:* The assessment of the future position of a node is called its Mobility Prediction. The meaning of 'position' varies with the kind of wireless network being used. Therefore, in this concern we mean the mobility of the node by location. On the off chance that hubs change their area after some time, they need to refresh their area gauges much of the time with a specific end goal to stay away from errors coming about because of utilizing obsolete area gauges. Moreover, node movement during the measurement of parameters needed for location computation can cause inaccuracies in the estimated location. Mobility of node can be find using distance and respective time difference in following formula:

$$Mobility(M) = \frac{\Delta d}{\Delta t}$$

2) *Signal Strength Power:* The signal strength of a node shows the transmission power ability thus for more optimal node selection the signal strength of the node is used. The signal strength of the node can be represented using the letter S_s for further discussion.

3) *Degree of Node:* A single node shows how many connections are employed in network to the intended node. This is simply the connectivity to the other node. If there are diverse numbers of node which are moving randomly and node connected to one to other. Therefore communication is happened using node connection. For example, let there are 5 nodes, i.e. n_1, n_2, n_3, n_4, n_5. If node n_1 connected to then$_2$,n_3 and n_4 node. Then degree of n_1 is 3.

4) *Algorithm Selection:* This is the main phase of methodology that proven the effectiveness of best route selection. Our approach is different to base approach in terms of algorithm. In base method Swarm Intelligent based user connectivity is proposed, but in proposed Stable Route Selection method we are using Ant Colony Optimization (ACO) algorithm.

D. Proposed Algorithm

The entire process of the efficient path selection approach which proposed by designing new routing protocol MCCP can be summarized as the algorithm the table 1 shows the process of the proposed algorithm:

Table 1: Efficient Stable Path Selection Algorithm

Input: Number of Nodes (NN); *Output:* Optimized Path (O);
Process: 1. Initialize the Network, with N nodes where$N$ = 1,2,3,…..,, in ideal condition. 2: Initialize Route Discovery by Source Node N_s 3:N_s sends RREQ Packets to Destination N_d 4: Wait Until all Route Replies not received **1.** Prepare routing table T **2.** $i = 1; i < T.length; i++for$ a. $Path_i = T.nextHop$ **3.** End for **4.** $POP_i = Path_i$ **5.** $foreachnodeN \in POP_ldo$ a. Find signal strength S_s, degree of node D, Mobility M

b. $Fit = node.computeFitness(S_s, D, M)$
c. Aggregate Fit to path as $FitPathVal$

6. End for

7. $O = ACO.Optimize(POP_i, FitPathVal)$

Return O

III. IMPLEMENTATION

The performance of the proposed scheme is analyzed by using the Network simulator (NS2). The NS2 is an open source programming language written in C++ and OTCL (Object Oriented Tool Command Language). NS2 is a discrete event time driven simulator which is used to mainly model the network protocols. The nodes are distributed in the simulation environment. The nodes have to be configured as mobile nodes by using the node-config command in NS2 [8]. The network parameters used for the simulation of the proposed scheme are tabulated below:

The simulation of the proposed scheme has 22 nodes deployed in the simulation area 1100×1000. The nodes are moved randomly within the simulation area by using the mobility model Random waypoint as shown in Table 2

Table 2: Simulation Scenarios

Parameters	Values
Dimension	1000 X 1000
Antenna Model	Omni Antenna
Channel Type	Wireless Channel
Radio-Propagation	Two Ray Ground
Routing Protocol	AOMDV
Traffic Model	CBR
Number of Nodes	22
Mobility Model	Random Waypoint

IV. RESULT ANALYSIS

In this section, the comparative study of the proposed for most stable path selection and traditional AOMDV is provided on the basis of the similar performance factors.

Table 3. Previous and proposed work comparison

S.No.	Parameters	MCCP Ratio	AOMDV	
			Previous Work	Proposed Work
1.	End to end delay	0.002266	0.207114	0.006538
2.	Packet delivery ratio	99.410	98.9110	97.9100
3.	Average throughput	Received Packets 12683	-	Received Packets 11322

A. *End to End delay*

End to end delay on network refers to the time taken, for a packet to be transmitted across a network from source to destination device, this delay is calculated using the below given formula.

$$E2EDelay = ReceivingTime - SendingTime$$

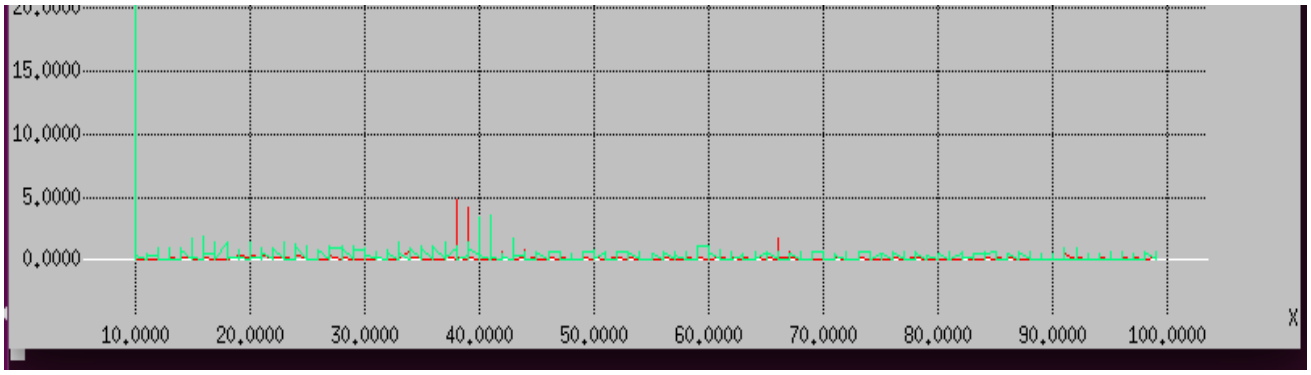

Figure 2 End to End Delays

Figure 2 shows the comparative End to End Delay of the AOMDV routing and the proposed best stable path finding technique of MACC routing. In this figure 5.1 the X axis contains the simulation time and the Y axis shows the performance of network in terms of milliseconds. According to the obtained results the proposed technique is produces less end to end delay as compared to traditional technique under different nodes. Therefore the proposed technique is applicable for efficiently select available stable route produces less amount of time.

Table 4. MCCP and AOMDV E2E comparison

S.No.	Parameters	Values
1.	MCCP	0.002266
2.	AOMDV	0.006538

B. *Packet Delivery Ratio*

Packet delivery ratio is the ratio of total number of data packets that were delivered successfully to intended destinations to the total number of data packets generated, where PDR can be estimated using the formula given:

$$PDR(\quad) = \frac{TotalDeliveredPackets}{TotalSentPackets} X100$$

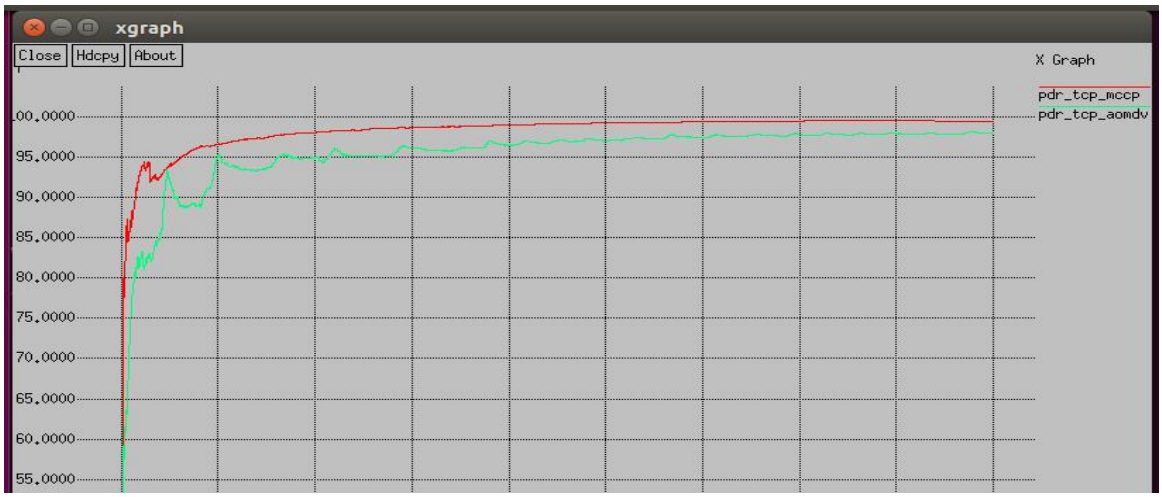

Figure 3 Packet Delivery Ratios

The comparative packet delivery ratio of the networks is given using figure 3, in this diagram the X axis shows the simulation time and the Y axis shows the amount of packets successfully delivered in terms of the percentage. The red line of diagram represents the performance of the AOMDV routing and the gree line shows the performance of the proposed MACC protocol. According to the obtained results the proposed technique delivers more packets as compared to the traditional technique even when the network contains various multiple routes from source to destination therefore the proposed technique able to escape the inefficient route and improve the network performance.

Table 5. MCCP and AOMDV PDR comparison

S.No.	Parameters	Values
1.	MCCP	99.410
2.	AOMDV	97.9100

C. Average Throughput

Network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot.

Table 6. MCCP and AOMDV average throughput comparison

S.No.	Parameters	Start Time	Stop Time	Received packets	Average Tput
1.	MCCP	10	99	12683	610.147
2.	AOMDV	10	99	11322	564.102

V. CONCLUSION

Finding the optimal (Efficient) path in dynamically changing resource constrained MANET is challenging. Links unreliability poses a critical issue in ad hoc environment. A routing algorithm for mobile ad-hoc networks (MANETs) should not only route using short-distance paths, but should also be adaptable to highly dynamic changes in network topology since the network topology can change frequently and wireless communication channels are inherently unreliable. The theme of the research work is centered in ad-hoc nature for efficient route selection which is an important aspect of MANETs. We successfully proposed *ESPS*, i.e. *Efficient Stable Path Selection* algorithm by designed new protocol named as *MCCP* to improved network performance. This research work allowed the network to establish stable routes necessary to correct and efficiently deliver network data to the destination in a more reliable manner. To discover optimal route which is ensure high stability for a long time that maintain the all communication session during each simulation of network. Proposed approach is based on the Ant Colony Optimization (ACO) heuristic search algorithm. Therefore, for a long time, it means that to get most optimal path, we implemented 22 network nodes to explore the map and find optimal solutions. The proposed ESPS based best route selection for high stability has achieved better data aggregation in an efficient and effective manner in terms of the parameters such as Packet Delivery Ratio (PDR), End to End Delay and throughput and packet drop ratio.

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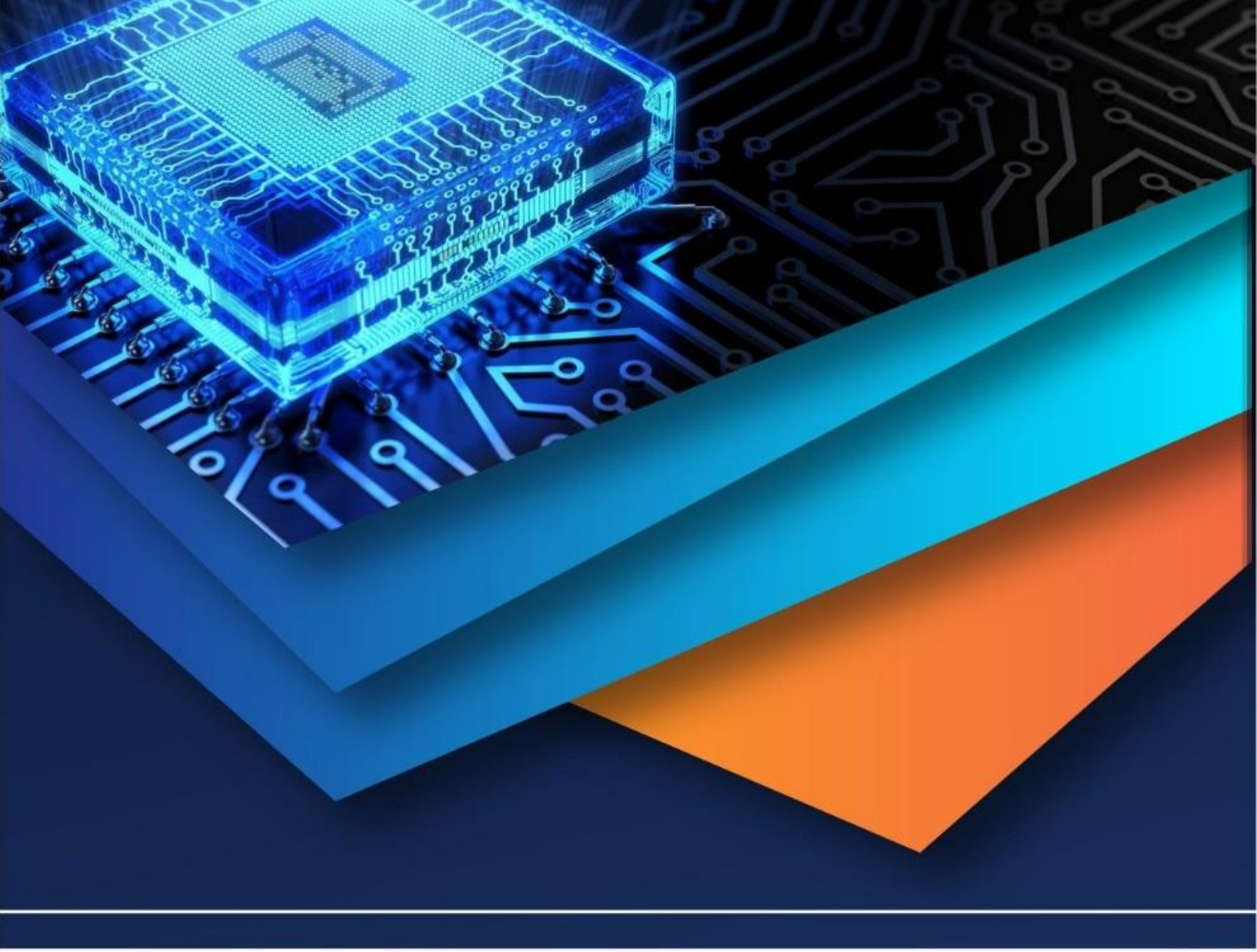

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