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Optimal Route Path Selection In Multipath Manet (Orpm)

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Abstract: MANET is a self-configured network of nodes with little central traffic management infrastructure. These networks have difficulties with congestion control, reliability, and energy consumption. Thanks to recent advancements in ensembles vehicular communication of smart devices with embedded sensors, MANET and WSN and WMN may now play an important role in smart cities. These smart devices, however, are still restricted in terms of power, CPU, and memory. Furthermore, effective routing for dependable network access at any time, any location, and for any reason remains a challenge in multi-hop wireless networks. MANET is a self-configuring, infrastructure-free wireless mobile device network. One of the most efficient communication technologies is multicast. The development of multicast routing methods for wireless MANETs is the subject of several research. Multicasting is a technique for simultaneously delivering the very same message to numerous recipients. However, its dynamic nature, lack of bandwidth, and the limited battery life of portable apps face several challenges when used in an ad-hoc network. Because of its ease of use, efficiency, and mobility, the ODMRP is one of the most commonly used multicast routing protocols in MANETs. On the other hand, ODMRP's sturdiness comes at the expense of a substantial amount of network control overhead. To do so, we've suggested a novel ORPM that is both useful and superior to existing protocols. When the proposed method's findings are compared to the state-of-the-art of current approaches, better results are produced.

Keyword: Ad-hoc multicast routing protocol utilizing increasing numbers (AMRIS), Core assisted multicast protocol (CAMP), Fuzzy Logic (FL), LSF (Link Stability Cost Function), Mobile Ad-hoc Network (MANET), Multicast ad-hoc on-demand multicast routing protocol

(MAODV), On-demand multicast routing protocol (ODMRP). Weight-based Energy-efficient Multicasting (WEEM).

1. INTRODUCTION

For the past four decades, the Internet became one of the essential communication paradigms. Several research academics have studied networks based on communication technologies in the last decade, particularly the wireless connectivity domain. These wireless devices have enabled communication between roaming hosts without the limitations of a conventional connection. In the previous two decades, wireless networks have become increasingly popular in a variety of applications. Wireless networks have become widespread all across the world as a result of their use in military applications. Hosts and routers in wireless networks can roam across the network space, making the topology of the network dynamic and irregular. Due to the unpredictable nature of wireless networks, traditional network architectures currently employed in wireless connections cannot be applied as such in wireless networks. Nodes can receive all broadcast messages sent by other stations in the same subnet in the same subnet. However, this approach has not been viable for nodes in global mobile networks due to bandwidth constraints. As a result, routing systems face several issues in this network paradigm. MANET is a collection of mobile nodes that are connected without the use of a fixed BS or centralized administration. Multicasting is utilized when a node is required to send the very same data to multiple destinations simultaneously. The delivery of data packets to a group of zero or more hosts designated by a single destination is multicasting. Multicast conversations are now possible thanks to the growing adoption of cooperative multimedia applications on mobile devices.

Multicast technology is also utilised in a variety of group-oriented activities, such as videoconference, collaborative effort, and any other application involving one-to-many or many-to-many operations. In multicast communiqué, with management ownership one packet is received by the source, allowing for bandwidth savings, reduced latency, and great scalability. It's especially useful in mobile/wireless situations when mobile phones are power-limited. As a consequence, the multiplexed routing algorithm has sparked a lot of debate. In digital networking ad-hoc networks, pre-existing wireless connection infrastructure, as well as centralised administration, are not required. As a result, in areas where there are no BS, such as battles or disaster zones, wireless ad-hoc devices are especially significant and helpful. In a digital network ad-hoc network, limited resources including such node battery are associated with every mobile node, transmission range, and so on. To increase the network's lifespan, traffic should be carried through paths that avoiding low-power nodes.

MANETs are among the most quickly growing research areas in the realm of new wireless technologies. MANETs provide a routing mechanism that is solely for contributor nodes. As a result, node stochastic behaviour has a substantial influence on routing protocol performance, especially in instances where topology change often. As a result, network improvement may be a significant factor in routing system design, particularly while the similar data is delivered to several receiver node. Multicasting was developed to improve the efficiency of wi-fi communication for organisation applications such as image conferencing, in which overall network use is critical. By minimising bandwidth consumption, sender and router activities, and delivery latency, the multicast method substantially reduces communication costs [1]. Unlike unicasting, multicast messages are introduced into the networks only once and only replicated at branch points. As a consequence, the communication overhead of the network may be efficiently managed. In recent years, many multicast routing techniques have been developed to improve multicast functioning in wireless networks. In the AMRIS [2], CAMP [3], ODMRP [4], and MAODV [5], several routing techniques are employed to solve multicast problems.

A MANET is a personality network of wireless connections that forms a flexible network deprived of a permanent network substructure or centralized BS. MANET has multiple constraints, including changeable topology, restricted system resources, significant node mobility, and low transmission range [6]. MANET is most useful in situations where urgent measures and dynamic configuration are required but no core connection is available. It encompasses military battlegrounds, critical rescue operations, classrooms, and conferences where users could dynamically communicate information via their portable apps [7]. Multipathing is a method that allows you to deliver a communication to a group of nodes at the receiver. Multicasting is a method of sending a data packet to a group of receivers with a particular terminus address to save network resources and improve network efficiency. It's made to communicate in a group setting. For mobile ad-hoc networks, a number of multicast routing methods are available.

As a complete distribution method for future mobile apps, MANETs are attracting many academics [8], [9]. Multicast routing methods based on different routing theories have been described in the literature. Before any routes between any two nodes, a preemptive multicast routing protocol is used, regardless of whether such ways are needed. Reactive multicast routing, on the other hand, only discovers routes when they are required. Some protocols consider all nodes to be peers, whereas others consider nodes at the same organizational level. Some protocols assume that every node knows its current network location and can learn the areas of other nodes. Some multicast routing methods have been established in the literature that are concerned about the amount of battery capacity at the endpoint and the amount of Energy consumed on packet transmission. Some multicast routing systems discover and maintain multiple routes for a treatment pair. The protocols determine these various routes' purpose and use. It's difficult to say what routing protocol is the most appropriate in a given scenario.

2. RELATED WORK

When it comes to energy-efficient multicast routing, Ad-hoc networks are in trouble. The subject of energy-efficient routing has been the subject of several studies. To glean data from imprisoned survivors, [10] created an ad-hoc system of wireless sensor badges. It is shown that smart wristbands have severely limited storage systems and abysmal data rates that are inadequate in an emergency. This issue is modeled like anycast transportation problem wherein the goal is to maximize the time before the first battery runs out. [11] examines and categorizes the suggested energy-aware routing methods for MANETs [49][50][51]. They reduce the amount of active communication energy used to send and receive packets. The amount of passive Energy used when a mobile node is idle yet listens to the wireless medium for any different communications requests from other nodes. The authors divide their findings into two categories: the first includes transmission power regulation and load distribution, while the second provides sleep/power-down mode. In many cases, it is unclear which algorithm is ideal for the circumstance; each protocol does have its own set of pros and downsides.

With the rapid growth of all types of network traffic, Energy is becoming increasingly scarce. In wireless networks, efficiency is becoming a key measure. To increase wireless network energy efficiency, network throughput should minimize network energy consumption and put should be increased. Be kept to a minimum Network coding can enhance things. Network speed, reliability, and load balancing are all essential factors to consider. [12] examined the energy efficiency of network coding. grid wireless instrument network consumption where instruments are squares are arranged in a square arrangement. [13] proposed that exploitation be used. Using network cyphering to improve data collection and announcement on the wireless sensor nodes and spoke about saving Energy their strategy. [14] investigated the minimum-energy multiplex challenge in mobile ad hoc networks and recommended that net-work coding be used to achieve the lowermost energy-per-bit. Most of these techniques, on the other hand, validate their algorithms using predefined network topologies. To increase network energy efficiency, erratically arrange network nodes and create as numerous networks cyphering patterns as feasible in our energy-efficient technique.

[15] presented an energy-efficient communiqué architecture for p2p wireless connections using a feedback optimization approach. They looked at how much energy and forward feedback links are used and discovered that utilizing feedback may increase energy competence for vast amounts of obtainable Energy. [16] investigated combinatorial optimization issues and created connections among nodes in multi-boundary wireless networks while minimizing network energy. [17] presented a novel energy-saving technique based on the network coding for radiocommunication sensor systems. [18] presented a unified MIMIO transmission system that employed network coding to decrease network usage. To evaluate the possible result of communication networks. [19] introduced the ultra-extensive-angle time notion and energy competence measure. According to [20] one of the most essential researches in information and communications technology is Energy efficient research. They discussed the importance of energy efficiency studies and the energy proportionality index. [21] reviewed wireless network energy efficiency measures. They believed that the new energy-efficient design and measure would solve excessive energy usage in wireless networks. [22] investigated methods for increasing the energy efficiency of cellular networks. In opportunistic communications. [23] assessed the performance of a dual-radio design and found that it might significantly reduce

energy consumption while marginally lowering network throughput. [24] examined current energy-effectual routing strategies in wireless hypermedia sensor nodes [52][53][54]. Though various energy-effectual strategies for improving network performance have been developed, most of these approaches ignore the multi-hop case. We investigate the topic of energy-efficient interaction in multi-hop radio networks. The best multi-hop radio networks are built using energy competence as a measure. We may obtain greater energy competence by creating the proper network coding structure.

3. EXISTING METHODS

DLBMRP: A prolong network lifetime is the contribution of this approach. This method uses the NS-2 tool; the Calculation of PDR, PDD, energy consumptions are the outcomes of this approach. When a node desires to join an unestablished multicast group, it will become the leadership of that multicast and is accountable for its upkeep [25]. MAODV may significantly improve performance when node mobility is low, and the network does not experience frequent link failures. To overcome the traffic strain over the system, an energy-conscious metric is employed to redistribute the traffic. The planned protocol divided all moveable nodes into two groups. As proposed by Wang in [26], each group is divided into three groups, each with its tree. The replication results reveal that the suggested protocol outstrips the prevailing methods by a bit of margin. The drawback of this approach is that complex network traffic load are a bit issue to be handled.

EFMMRP: Specifying data transmission optical path is the main contribution from this approach. Single metric is enough to maintain all requirements than network metrics. [27] Each node in a digital network ad-hoc network has a finite amount of Energy and works unattended. As a result, energy-efficient multicast routing techniques must be taken into account for these networks. For the effective exploitation of network resources, a variety of energy-efficient multicast routing techniques have been provided. Network Writing code EEMR technique is one of the examples. FL is a proper mathematical technique for dealing with ambiguous information. It is a ML that allows for the definition of intermediate values between traditional evaluations such as high/low, yes/no, short/long, true/false, small/big, and so on [28]. After a source node wishes to deliver a data packet to a group of packet capturers, it first initiates the local FL supervisor to either examine or neglect the RREQ packet, as described in [29]. FLWMR employs a version of the SMR path discovery method if the option is to transmit the traffic. The negative side of this approach lies at the improper utilization of network resources due to uncertainty issues.

FLMRP: To find an optimal route for the transfer of data packets. The Fuzzification technique for a multicast-based routing protocol is the primary methodology used in this approach. The cross-layer design category of design coupling without new interfaces includes connecting two or more layers without introducing any extra interfaces for information exchange at runtime. Vertical layer calibration captures a variety of parameters from different levels. The three types of cross-layer interactions are direct connection between groups, a shared database between layers, and new abstractions. [30]. The MANET selection procedure is a delicate and crucial operation. Ranking various routes from the intermediate host to the target network can lead to more efficient route selection, as well as a variety of additional advantages for MANET performance [31]. [32] suggested employing fuzzy decision algorithms to implement cross-layer oriented routing and rate management in MANET. This protocol uses FL system-1 to pick a route in the source and FL system-2 to monitor data packet transmission in the destination. The drawback of this approach lies in packet loss and delay.

QMRPRNS: The main contribution lies in tracing a good neighbour node for data transmission. Its advantage lies in QoS based multicast routing. QoS-based multicast routing protocols with the help of reliable neighboring nodes is a methodology used in this process. The source and shared-rooted tree MRP are the two subclasses of tree-based multicast routing routing protocols. Each source generates its tree (DLBMRP) in provider-rooted tree techniques [33]. To maximize the endurance of such networks, it additionally considers the remaining battery lifetime and the rate of battery use [34]. Several techniques for reducing energy usage in ad-hoc wireless networks have been presented [35]. The challenge for the approach is unable to manage network traffic load.

WEEM: The positive edge of this approach lies in finding the route that exists until the entire information packets are being transferred to the end. Weight-based Energy efficient mechanism if the system used for this method. [36] an efficient MANET multicast routing mechanism with minimal control overhead. For multicast sessions, the protocol constructs a common broadcast tree depending on the spatial locations of the nodes. To determine the physical location of the nodes, decentralized location service is utilized, which significantly reduces the overhead cost for knowledge attained and shared broadcasting tree management. For active topology preservation within the zone, the concept of small overlapping zones is in this protocol. [37] In ADHOC networks, it is critical to have a slant that is capable of comprehending a wide range of unusual actions. In truth, technology is incapable of detecting every single infringement. Here is a model for an IDS for a wireless ADHOC network that uses time series technology to analyze infiltration. Time series analysis is a technique for analyzing data. Finding a high priority route with less delay of packets is the main contribution**.** The difficulty of this approach lies at routing multicast packets.

MLSMVP: Maintaining QoS in multicast communication is the main contribution, this could be maintained properly by depending on count of contention at the nodes. The multi-constraints link protocol is mainly used. The advanced the SINR over a connection, the further steady it is thought to be. When compared to LSMRP, ODMRP performs better in PDR and Average E2E Delay. To increase network performance, signal strength was incorporated as a QoS. Some associations fail through the path refresh interval since nodes migrate out of communiqué series of others, according to simulation data for LSMRP. As a result, to approximation the stable link, it is essential to predict node movement. Moralism [38] is an expanded version of LSMRP. To assess the amplitude of the signal strength, a cross-layer technique [39] was used. Each mobile node keeps track of the received signal strength from the preceding nodes. The value of the connection speed for each data packet may be computed and sent to the network layer at the edge of the network at the physical layer. The difficulty of this technique is to keep the route length as short as possible.

Author	Contribution	Methodology	Advantage	Limitations
DLBMRP Ajay Kumar [40]	Network lifetime can be prolonged	DLBMRP	PDR, PDD, Energy consumption	Traffic load for complex networks are issues
EFMMRP [41]	Finding an optimal path for data transmission	EFMMRP	Existing network metrics of the paths are covered in a single metric	Indecision issues initiates to inappropriate application of network properties
FLMRP Narayanan et al. [42]	Finding optimal route	FLMRPM	Route stability, bandwidth	Packet loss and delay
QMRPRNS [43]	Reliable selection of neighbour node	QMRPRNS	QoS based on multicast routing	Unable to manage network traffic load
WEEM [44]	Finding the routes which exist till the end of the communication	WEEM	Less delay with high priority path is selected	Routing multicast packets is a challenge
MLSMRP [45]	Multicast communication with QoS	MLSFMRP	The efficiency of multicast routing depending on contention count	Minimizing the route length

Table 1: comparison among the existing state of art methods

4. PROPOSED ALGORITHM (ORPM)

The uniqueness of an Ad-Hoc Network defines the uniqueness of its multicast paths protocol. ODMRP has an excellent overall performance, according to research. It offers invulnerability to redundant link failure, reducing needless route re-search overheads caused through discrete link disaster and there is no need to induction path conservation as the number of busy nodes grows. As a result, there will be no increase in network management cost, making it more appropriate for Ad Hoc networks with constantly moving nodes. However, because the ODMRP protocol establishes a multicast forwarding grid by flooding JOIN-QUERY messages on a regular basis, during overload, the control will be above of searching and updating routes grows dramatically, and competitive rivalry and struggle on the communal channel strengthen, reducing transmittal competence. Until recently, the emphasis on improving ODMRP has mostly been on how to minimise route flooding information, without taking into account the stability of duplicate routes. When the anticipated route fails, the source node in existing enhanced schemes, which usually use the technique of motion prediction, may re-select the path. The node of redundant connections, on the other hand, may shift and become unstable.

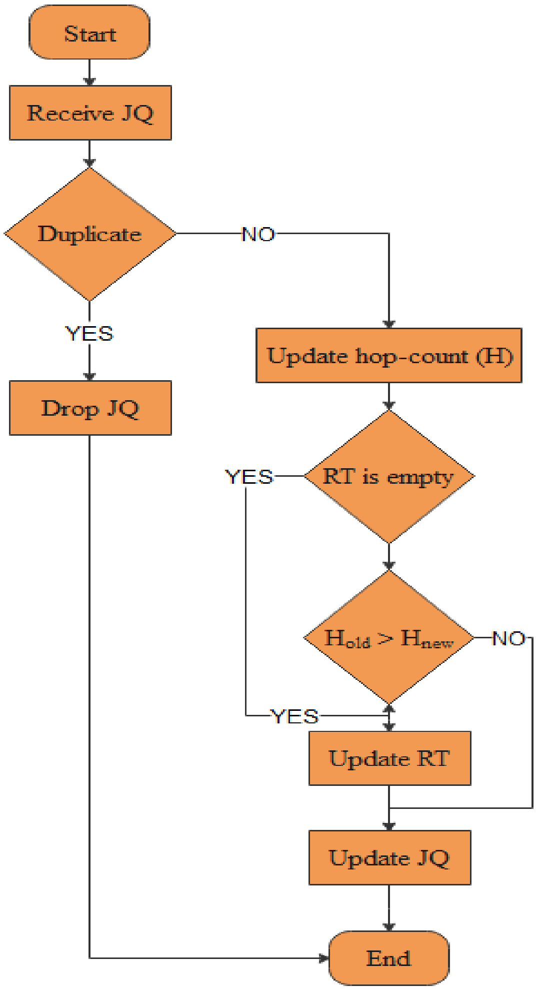

Figure 1: Flowchart for handling J Query

OPRM ALGORITHM

1. if (Join Query)then
   Let Consider
2. M_{Old} = Calculate Metric (R_{old} ,P_{old})
3. M_{new} = Calculate Metric (R_{new} ,P_{new})
4. R_{old} , P_{old} Message Cache
5. R_{new} , P_{new} from Join Query
6. ifM_{old} $\leq$ M_{new} then
7. do not select join query
8. end if

end if
$R_{this} = get\_tx\_rate(Neighbour_{table}, SenderId)$
$P_{this} = get\_tx\_rate(Neighbour_{table}, SenderId)$
$P_{new} = P_{new} + P_{this}$
$R_{new} = \min(R_{new}, R_{this})$
if $M_{old} > M_{new}$ then
update (Up_Node_ID_Table)
if empty (Up_Node_ID_Table)then
Update (Up_Node_ID_Table)
else
R_{old} , P_{old} from Up_Node_ID_Table
M_{old} = calculate metric (R_{old} , P_{old})
M_{new} = calculate metric (R_{new} , P_{new})
if $M_{old} > M_{new}$ then
end if
end if
update _ join_query (R_{new}, P_{new})
if destination is (join table)then
Set (FG_Flag)
D_{new} = get _ SNR ($Neighbour_{Table}$, SenderID)
R_{new} = get _tx_rate($Neighbour_{Table}$, SenderID)
P_{new} = get _tx_rate($Neighbour_{Table}$, SenderID)
if empty (Tx_information_table) then
update_Tx_information_table(D_{new} , R_{new} , P_{new})
else
$D_{old} = get\_SNR\left(Tx_{inforamtion_{Table}}\right)$
if $D_{old} < D_{new}$then
update_Tx_information_table(D_{new} , R_{new} , P_{new})
end if
end if

The above algorithm enables a node to execute a Join Query that has been received. The A-ODMRP node compares previous Join Queries to new measurements, produces a new measure, changes the Upper Node ID Table and also the Join Query's measurement field, and retransmits the JQ. A metric field of the JQ stores the addition of the broadcast PL (P) and the less transmission rate (R) with in the physical layer of the track. Adv-ODMRP uses an assessment of the SNR between nodes to establish an increased transmission frequency and trust power level for the physical layer. When a node gets a indication from a neighbour, it calculates the SNR among the surrounding node and the beacon's sender and records SNR and the sender ID in the Neighbour Table. The information from the Neighbour Table is used by A-ODMRP to create the path metric.

After a node employing Adv-ODMRP generates its personal Join Table, it includes evidence about the Upper Node acquired since the Neighbour Table. A node can obtain information about itself without the sending of extra packets. This information is estimated by the adjacent node using beacons sent by the node itself. Furthermore, unlike ODMRP, Adv-ODMRP allows a node to modify the physical layer broadcast rate and influence level based on the SNR between itself and the transmitter. It makes a change to its Transaction Information Table. Depending on the SNR between both the nodes, a node based with Adv-ODMRP contains an information table providing the appropriate power consumption level and frequency from the physical layer. This information table was created using a heuristic. At the end of this section, you'll find further information about this information table. The node that uses Adv-ODMRP verifies the Join Table's terminus, sets the node's FG Flag, and updates the Transaction Information Table. It then makes its personal Join Table and broadcasts it. Adv-ODMRP improves ODMRP's data transfer mechanism. After a node along Adv-ODMRP discloses multicast information, it utilizes the transfer amount and influence level recorded in the Tx Infor Table for the physical layer.

5. EXPERIMENTAL SETUP

Castalia [46] – one of the best Network simulators used in this implementation as the key component. Castalia is developed based on Om NET++ platform which is used to analyze the wireless network architectures. It has the ability to simulate all kind of network components, nodes, protocols and Architectures [47]. State-of-the art IoT and embedded nodes are also well defined in Castalia simulator. Castalia provides a amiable interface to the users to define custom network components and legacy network node types through C++ programming scripts. Visual Studio [48] is used to develop the application User Interface (UI) and C++ programming language is used to define the proposed method. This interface is used to create a network environment in Castalia for analyzing the performance of existing and proposed Methods. Standard network performance parameters such as Throughput, Packet Delivery Ratio (PDR), Packet Delivery Delay (PDD) and Average Energy consumption are measured during various node Mobilities.

S. No.	Entity	Details
1	Frequency Band	Mixed Mode 2G,3G, 4G and VoLTE
2	RF Range	Based on the type of 100 to 1000 meters
3	Network Density	Typical real-world
4	No. of nodes	2000
5	No. of Routers	Automatic selection
6	Node Placement	random distribution
7	Node Types	Typical MANET nodes
8	Simulation Area	5000 Sq. Meters
9	Node Mobility	5 to 50 m/S in step 5 m/S

Table 2: Simulation Parameters

The network performance assessment metrics are measured for different node velocities for every 5 m/S from 5 m/S to 50 m/S. Simulation criteria is fed to Castalia through the application UI. Results are collected from Castalia after analysis of every method to generate the report file and the same data are used to plot the comparison graphs. Typical network node placement in Castalia is given in Figure [2].

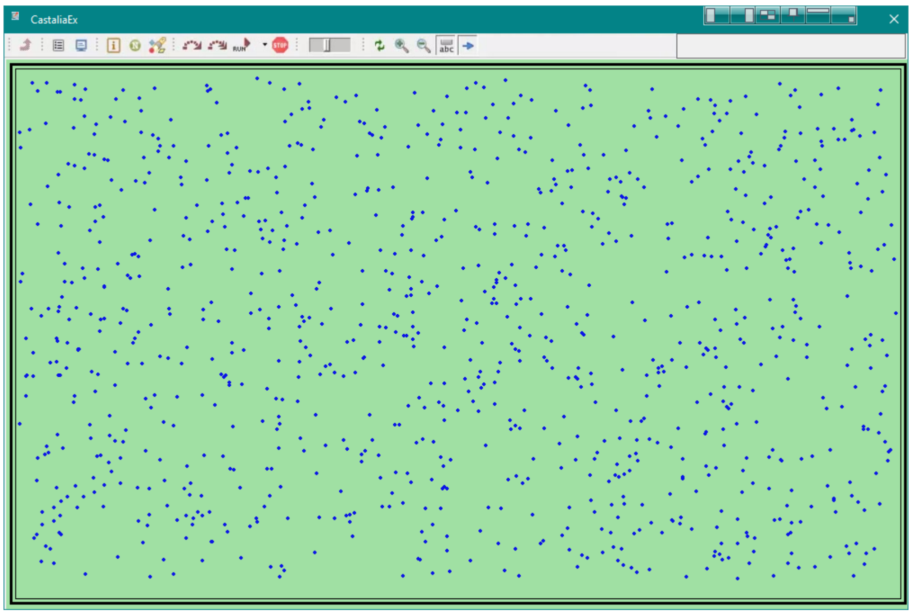

Figure 2: Network Environment for the proposed system

6. EXPERIMENT RESULTS:

The following parameters were used to demonstrate the importance of the suggested method: throughput, PDD, PDR and average Energy.

Throughput: Throughput refers to the rate at which data flows through a communication link. Throughput is a crucial part of environmental monitoring, as it needs continuous data collection. The higher the network's throughput quality, the higher the network's value. The table below shows the observed throughput values derived from the regression results.

Throughput (kbps)							
Mobility (m/S)	**DLBMRP**	**EFMMRP**	**FLMRP**	**QMRPRNS**	**WEEM**	**MLSMRP**	**ORPM**
5	3495927	3435004	3410993	3570390	3496306	3573698	3610468

10	3492958	3413772	3408048	3564985	3493163	3562643	3602635
15	3486401	3392705	3401482	3553839	3484603	3552046	3594776
20	3476642	3371195	3391463	3536775	3472219	3541280	3586917
25	3463105	3351047	3377803	3514183	3454558	3529829	3579210
30	3445573	3330092	3360234	3484995	3431984	3519642	3571240
35	3424569	3308154	3339259	3449984	3404979	3507837	3563429
40	3400218	3287754	3314876	3408849	3373106	3497138	3555506
45	3372430	3266506	3286599	3362547	3336434	3486223	3547754
50	3340823	3245696	3254691	3309301	3294755	3475818	3539963

Table 3: Throughput

The higher the throughput levels, the more efficient the strategy. The proposed approach has very high throughput numbers compared to state-of-the-art techniques, as seen in the table above.

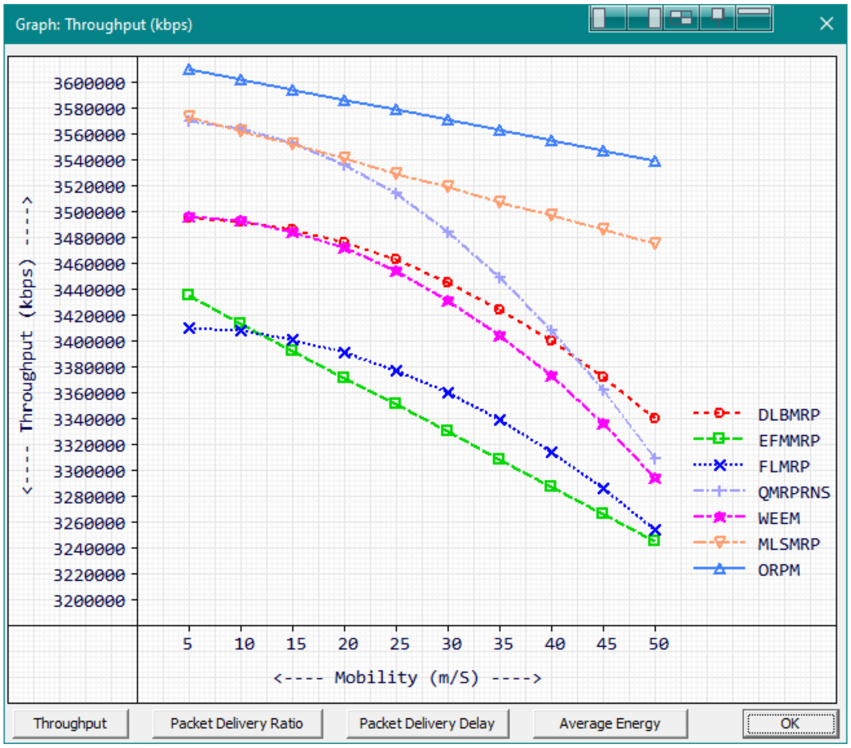

Figure 4: Throughput

PDR: It is calculated as the ratio of the number of packets sent from the origin to the values represented at the destination; higher value less data loss, signalling a network with a robust architecture.

PDR (%)							
Mobility (m/S)	**DLBMRP**	**EFMMRP**	**FLMRP**	**QMRPRNS**	**WEEM**	**MLSMRP**	**ORPM**
5	94	94	90	96	94	98	97
10	93	85	88	95	92	92	95
15	90	80	86	91	90	89	92
20	87	72	84	85	86	85	88
25	83	65	77	78	80	84	87
30	77	57	74	68	72	80	84
35	72	52	67	55	64	75	80
40	64	43	58	42	54	74	79
45	54	38	47	26	41	68	76
50	42	29	36	10	26	65	72

Table 5: Packet Delivery Ratio

$$\textbf{Packet delivery delay} = \frac{\Sigma(\textbf{No. of packets received})}{\Sigma(\textbf{No. of packets sent})}$$

The approach is more efficient the greater the value of PDR. It is evident from the above table values that the proposed method has high PDR values when compared to existing state-of-the-art methodologies.

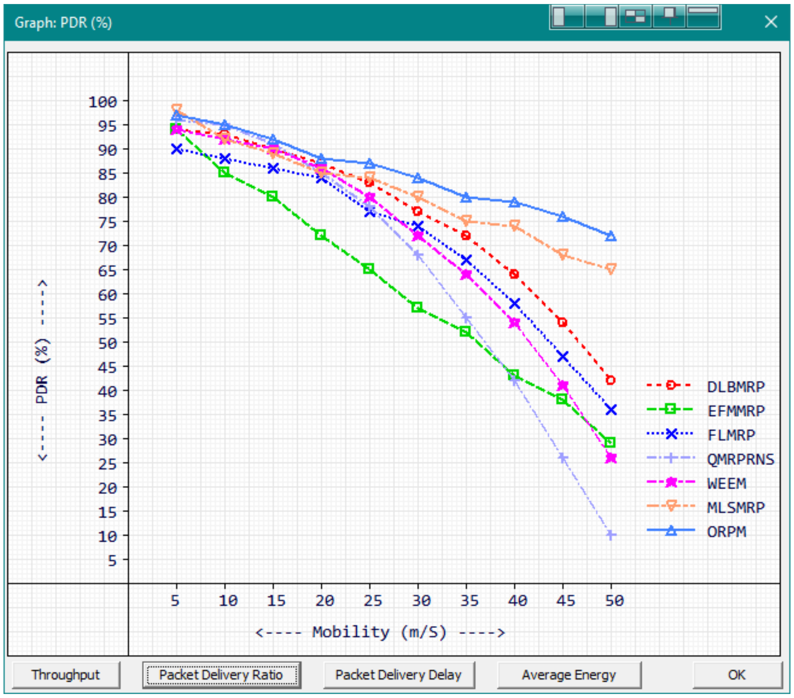

Figure 5: Packet Deliver Ratio

PDD: It is average time it takes for data packets to go from a source node to a group of multicast receivers.

PDD (mS)							
Mobility (m/S)	**DLBMRP**	**EFMMRP**	**FLMRP**	**QMRPRNS**	**WEEM**	**MLSMRP**	**ORPM**
5	155	59	211	52	52	99	92
10	187	217	292	58	57	176	120
15	249	379	395	85	78	252	166
20	357	539	590	122	113	324	200
25	502	717	801	178	162	406	242
30	693	869	1086	247	224	500	279
35	919	1034	1419	333	299	561	306
40	1195	1205	1811	435	386	643	358

45	1500	1362	2273	555	490	737	391
50	1851	1530	2749	687	605	815	427

Table 6: PDD

$$\textbf{Packet delivery delay} = \frac{\Sigma(\textbf{arrive time} - \textbf{send time})}{\Sigma(\textbf{No. of connection})}$$

Less the PDD values more efficient is the proposed approach. From the above table, its very clear that the PDD values for the proposed method is very less when compared with the state of art approach.

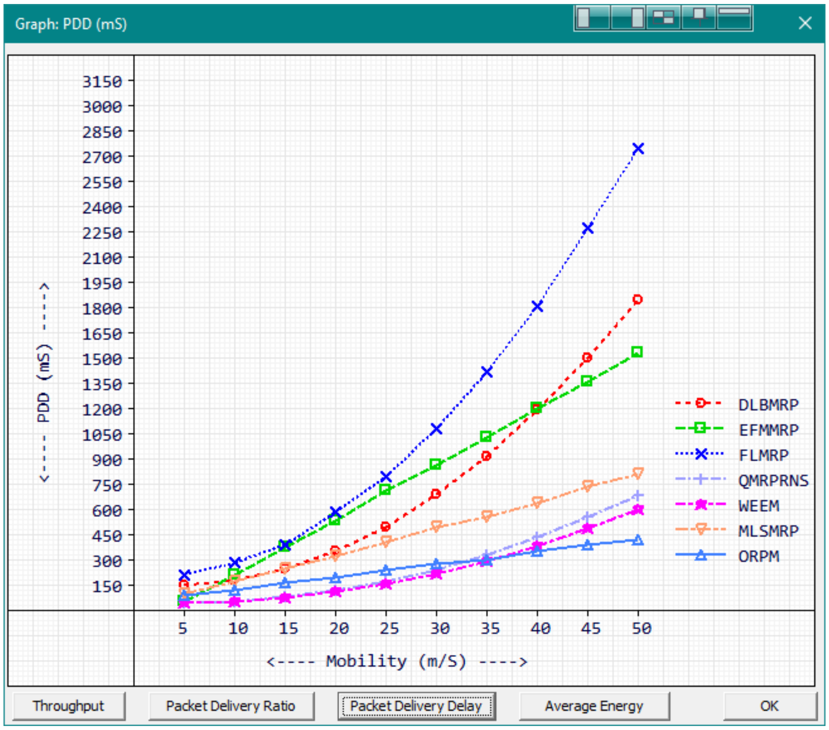

Figure 6: Packet Delivery Delay

Average Energy: It indicates how much energy is expended by the proposed approach to achieve the desired results in the simulation reality. As the amount of power expended reduces, the system's efficiency will improve**.**

Average Energy (uJ)							
Mobility (m/S)	**DLBMRP**	**EFMMRP**	**FLMRP**	**QMRPRNS**	**WEEM**	**MLSMRP**	**ORPM**
5	103	191	259	128	151	180	175
10	118	248	269	137	158	236	204
15	155	300	318	156	176	275	246
20	218	360	383	195	206	322	289

25	308	410	474	241	249	365	332
30	418	461	596	308	305	412	366
35	558	529	731	389	374	452	406
40	718	583	893	481	455	505	457
45	898	635	1079	589	545	550	490
50	1105	687	1298	713	651	590	526

Table 7: Average Energy (uJ)

Less the average Energy consumed, the more efficient the system will be. As it is observed from the above table values that the average Energy consumed by the proposed approach is less when compared with the existing methods.

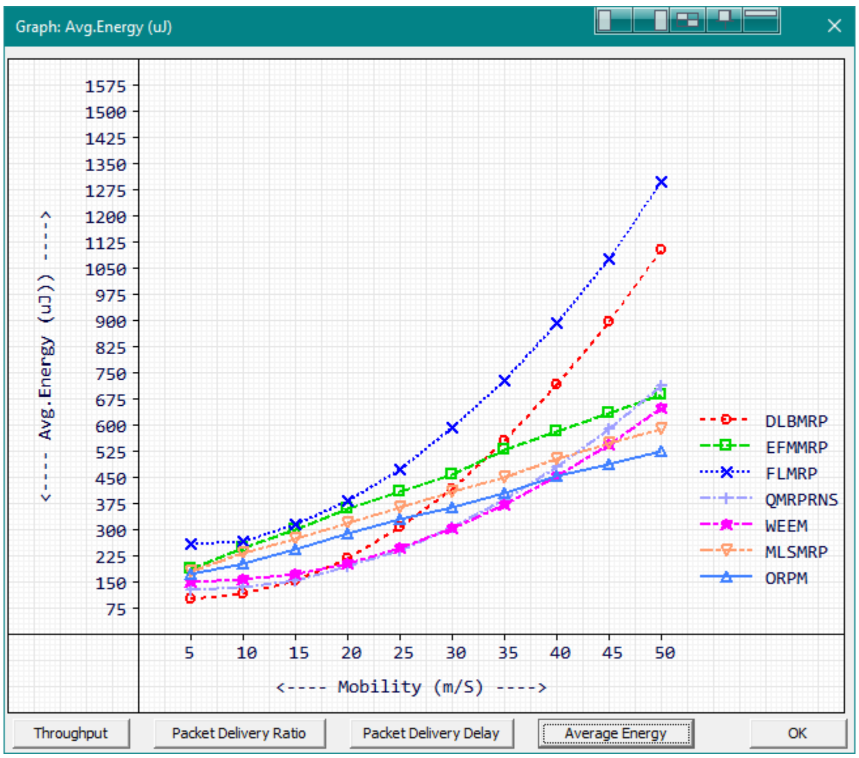

Figure 7: Average Energy

7. CONCLUSION

This paper proposes a feasible multicast routing strategy based on the selection of nearby nodes. This protocol selects nodes with a more excellent reliability pair than the threshold reliability pair factor for data transfer. Throughput, packet delivery ratio, packet delivery latency, and average Energy are the characteristics used to illustrate the relevance of the recommended approach. When these parameters were compared to the state of the art of current methods, the suggested method's results were superior. The suggested method uses 349.1uJ of Energy on average, which is significantly less than the present method. The proposed method's average throughput is

3575189.8kbps, which is exceptionally high when compared to existing methods. Similarly, the average values of PDR and PDD are 85 percent and 258.1 milliseconds, respectively, indicating that the packet delivery ratio is 85 percent lower and the packet delay in data packet delivery is very low. To create a future optimum multipath routing protocol, we want to enhance PDR and decrease PDD in the future.

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