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Review Article

A Survey Paper on Mobility and Energy based Clustering Algorithm in MANET

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Abstract *- Clustering is a highly structured analysis for coordinating routing and improving network performance in MANET using different attributes and metrics. The collaboration and disjoint of mobile nodes from various clusters in the network (MANETs) with their movable nodes' behavior disrupts the network structure unstable, and this issue becomes more severe if the nodes are Cluster Heads (CH). In this article comprehensively investigates of clustering schemes and classifies them into various categories based on the Cluster Head (CH) selection criteria. It helps other researchers to understand how individual forms of clustering algorithms differ from one another. In this review article, the authors emphasize energy and mobility as pivotal criteria for CH selection and cluster maintenance. The article has used quality of service (QoS) indicators to evaluate the efficacy of different existing systems. In research carried out by the different systems, the authors have figured out some key QoS metric commutation and detected several critical factors influencing the effectiveness of clustering methods. Generally, each cluster in the network routing protocol of a MANET includes a CH and multiple neighbor nodes. The benefits of this approach are evident, including higher scalability and stability, reduced management overhead, and a decrease in the number of nodes participating in the same channel.*

Keywords *- CH, Stability, Scalability, QoS, Manet, Energy, Mobility, Clustering methods.*

1. Introduction

Clustering techniques are highly efficient and beneficial for improving the performance of routing and monitoring in MANET structure networks. MANETs need to cover a large transmission area using multiple hops to pass information from one location to another, which is particularly useful in emergency and natural disaster scenarios. MANETs have various applications in the military and civilian domains. Clustering involves subdividing a large network into smaller groups or clusters of nodes. Within each cluster, a Cluster Head (CH) is selected on various parameters. The CH takes on responsibilities related to the cluster, such as managing cluster processes, updating routing information, and discovering new routes. Clustering helps to manage the challenges of routing and monitoring the network, improving its stability and scalability. The key features of MANETs may be attained by clustering the nodes and appointing CHs. The two main functions of clustering algorithms are cluster performance and cluster maintenance. The selection of the CH depends on factors like node energy and distance. The primary goal of the CH is to manage cluster-related activities, including CH re-selection, intra-cluster and inter-cluster communication, and identifying the most optimal routing paths. Previous research has focused on designing clustering mechanisms to mitigate the issues associated with cluster setup formation and preserve the maintenance of the cluster.

1.1. Important Contributions Clustering-Based MANETs Include

1) This review article presents comparable analyses of distinctive clustering scenarios and also introduces a CH (Cluster Head) selection criterion to provide a clear understanding of various clustering algorithms. Additionally, a comparative table is provided for each group of clustering schemes, detailing their methodology, merits, and demerits to enhance the understanding of each clustering approach.
2) The paper makes a straightforward analogy between the different clustering algorithms and illustrates their execution based on their respective parameters.
3) The paper summarizes the execution of each analogy in an evaluation table by considering QoS (Quality of Service) measurements.

4) The QoS measurements are employed to assess the system's performance and identify the most effective clustering techniques.
5) The research and evaluation discuss the primary performance parameters and QoS metrics in MANETs and also identify the vital parameters that can cause disadvantages or impact the output in the network. The paper also appears to be a research overview of cluster-based MANETs. [1]

2. Overview of Clustering Methods

A specific node is applicable within one cluster. Clusters can dispersed based on various characteristics, such as cluster members, Cluster Heads (CH), gateway nodes, and regular neighbour nodes. The node responsible for the cluster head governs the cluster members for cross-cluster processing. This node is responsible for transmitting data and communicating with base stations.

The gateway node is the node with a transmission range that encompasses the cluster heads. [2] Gateway nodes are used to forward data between adjacent relative cluster member nodes. Nodes that are not gateway nodes or cluster heads are referred to as frequent member nodes.

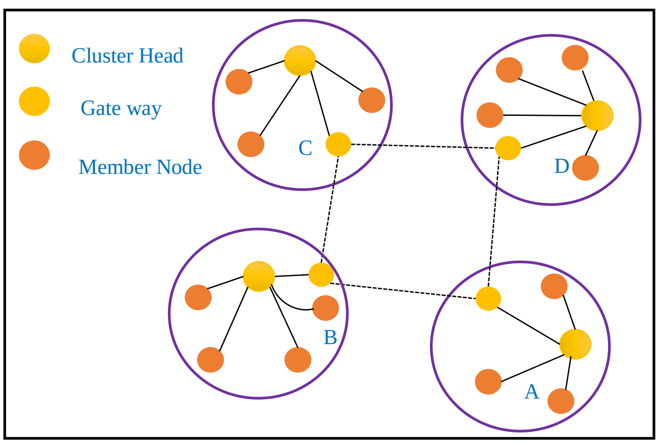

Fig. 1 Cluster formation

3. Clustering Quality Measures

The following metrics are studied to select a higher-quality structure cluster.

3.1. ENERGY

Nodes must be battery powered enough to take on the role of Cluster Head (CH). The CH has a higher load compared to other nodes. The connectivity and degree of linkage between neighboring nodes are important factors.

Nodes with a higher connectivity index are better suited to be the CH. This leads to higher network connectivity and cluster stability.

3.2. MOBILITY

Node mobility refers to the distance a node travels over a given time period. Nodes with regular and relative site mobility, such as speed, movement of node, and direction that are compatible with their neighbouring channels, perform well for the CH role.

The nodes having low mobility are appropriate to become the CH, but it is not ideal if their neighboring nodes have high mobility.

3.3. REPUTATION AND TRUST

Nodes with a good reputation can be trusted to perform the CH function. Trust can be assessed based on the node's correctness and its network functionality.

3.4. NEIGHBORS' QUALITY

Nodes that stay in the cluster for longer durations are better candidates for the CH role. Predicting the future mobility of neighboring nodes is one way to gauge the quality of the neighborhood.

3.5. COMMUNICATION LOAD

The node's communication load, measured by the packets it transmits and receives at regular intervals, is a consideration. Nodes with a lower communication load are more appropriate for the CH role.

4. Classification of Clustering Algorithm

The election of CH is a crucial component in clustering. The CH is chosen depending on various criteria, and the nodes are then grouped into a single cluster.

Not the same clustering algorithms employ diverse parameters for the selection of the CH. The categories of clustering algorithms are shown below:

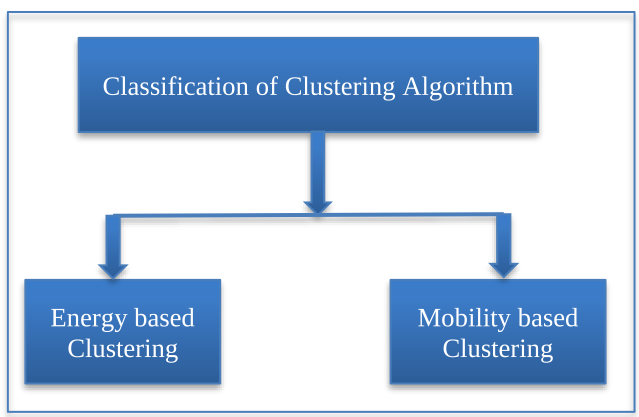

Fig. 2 Classification of clustering

1. Mobility Clustering
2. Energy Clustering

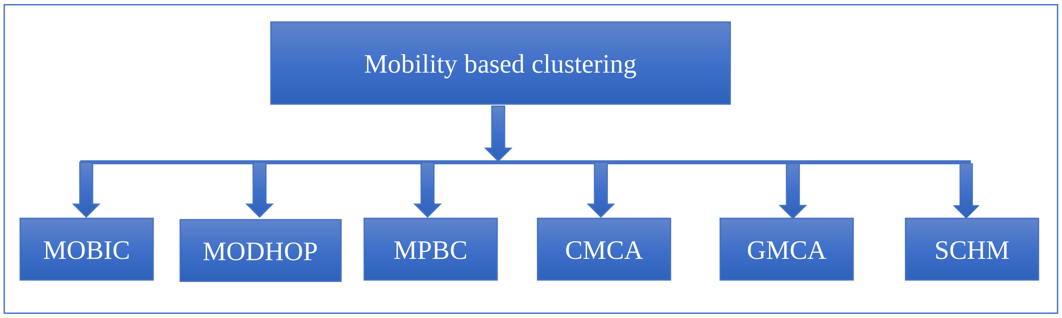

Fig. 3 Classification of mobility based clustering algorithm

4.1. Mobility Dependant Clustering Algorithm

At present, various forms of clustering algorithms that rely on mobility are as follows:

4.1.1. Mobility-Based Metric Clustering Algorithm (MOBIC)

The main factor in determining cluster leaders and the inclusion of members within clusters is mobility. It is believed that using mobility metrics as the basis for cluster formation and leadership selection is a logical approach. The MOBIC Algorithm introduces a novel mobile parametric that is based on the ratio between successive evaluations of energy and power absorbed by each node from its neighboring nodes. Following this, it introduces the MOBIC, which is a similarity indicator to the lowest-ID algorithm but employs a more advanced method. This mobility metric is crucial for the formation of clusters, as it is primarily based on mobility matrices. When a node has a lower mobility value than the overall relative mobility movement between it and its neighbors, it is considered a cluster head. If not, it is considered a cluster member. The algorithm can provide information on the number of clusters up to two hops away. If two nodes are adjacent to each other and are cluster heads, then the mobility metric for these two CH nodes is considered similar. The CH value is retained, and the CH leadership is determined by the minimum lower ID algorithm, with nodes receiving the CH status with the lowest ID. Should the timer expire, it initiates a reclustering process, and if a node's mobility metric is low, it is assumed to be a cluster head.

4.1.2. Mobility Based D Hop Clustering Algorithm (MOBDHOP)

In this MOBDHOP, there is a dynamic with a vital clustering algorithm that offers stable clustering, minimal communication overhead, and low computational complexity. It introduces a unique parameter for comparing the change in distance between two nodes and determining their relative mobility, unlike traditional clustering methods that limit clusters to just two hops.

MOBDHOP allows for clusters to extend up to five hops. The clustering process in MOBDHOP is designed to be adaptable. The algorithm is based on several key assumptions:

- A two-way link (symmetric transmission) is established between two nodes.
- The network's structure is dynamic, meaning it is not divided into separate sections.
- Each node assesses the capacity and the strength of the signal it receives.

The MOBDHOP algorithm is optimized for five key parameters:

- It aims to reduce the number of clusters by optimizing the mobility pattern of groups.
- The algorithm operates asynchronously.
- MOBDHOP is designed to handle cluster formation maintenance and avoid network flooding by managing control packets for information exchange.
- It prevents network-wide flooding by controlling the transmission of control packets.
- The algorithm is designed to handle scenarios where clustering is mostly achieved, but it ensures the existence of stable clusters. To keep up these clusters, MOBDHOP does not require more parameters. Instead, it relies on a set of essential parameters: Count of nodes, merging interval, period of contention, node highest speed, transmission range, pause duration, broadcasting of transmission interval, discovery transmission interval, assignment transmission interval, and simulation requires time. The process of forming clusters in MOBDHOP is structured into three stages:

The initial phase is known as the discovery Phase. Within the discovery phase, nodes exhibit comparable speeds and travel in similar directions, forming a cohesive group of clusters. Each node successfully receives hello messages twice during the merging stage, and all nodes are prompted to connect with adjacent clusters. Two neighboring nodes with gateway nodes are invited to join their respective clusters. For the effective maintenance of the cluster, nodes may activate to join the network, while others may deactivate and exit the network. To ensure the stability of the optimal cluster, MOBDHOP relies on the mobility structured patterns of the nodes. To achieve the necessary scalability, members of the cluster must be positioned bigger than two hops away from the Cluster Head MobDHop, which establishes variable-diameter clusters. The cluster having mobile nodes collectively acquires its diameter. Given that the nodes exhibit consistent behavior and move in a similar direction, they can effectively unite to form a cluster.

4.1.3. Mobility Prediction Based Clustering Algorithm (MPBC)

The MPBC framework comprises an initial clustering phase followed by a maintenance phase. Nodes exhibiting lower successive mobility are designated as Cluster Heads (CHs). During the maintenance phase of the cluster, a mobility prediction strategy is implemented to address various challenges arising from the movement of nodes in the network, such as the potential loss of connected nodes with the current CH and changes in the CH role. The stability of a network is typically maintained in the absence of mobility; however, Mobile Ad Hoc Networks (MANETs) are inherently dynamic wireless local area networks where mobility is a fundamental characteristic. Node mobility metrics pertain to the host movable node in manet. While mobility is not eliminated, it is anticipated. Prediction of node movement: nodes can be selected based on the mobility prediction methodology. Consequently, nodes exhibit stability and are designated to cluster CHs, thereby ensuring the stability of the network. The MPBC employs a movement prediction method that monitors node speed and identifies movement patterns of nodes, which function through three distinct stages [10]

Preprocessing Stage

The preprocessing stage involves the segmentation of network areas into distinct zones. Each zone is further subdivided into cells, with each zone comprising 16 cells. A location value, denoted as p(x,y), is assigned to each cell, which serves as the node's position. The division of the network area into zones and cells is accomplished through the application of a geometric progression.

Mobility Model

The prediction of mobility is based on host information that is retained by cluster nodes. Information regarding the exchange of Hello messages is required for mobility. The network initiates the transmission of Hello messages to identify neighboring nodes. When receiving a hello message, a node updates its neighbor table (NT) with information about the neighboring node. All nodes within the network utilize Hello messages to discover their respective neighbors. Following are neighbors' discovery patterns and the clustering process is initiated.

Cluster Head Election

Every cluster is governed by a leader node, referred to as the CH node. The cluster head is responsible for task allocation and resource management among its member nodes. The selection of an appropriate cluster leader is a critical task. The criteria for selecting the optimal cluster head include parameters such as MPBCA, its Distance metric, Mobility metric, Battery Level power, and node transmission range. A highly secured quality ratio factor is evaluated based on these parameters. In the event that a node fails, it transmits its quality factor, which is then compared with those of neighboring nodes, ultimately leading to the selection of the node with the reduction of weight.

4.1.4. Cluster Based Mobility Considered Algorithm (CMCA)

In the context of CMCA, the mobility node is a critical characteristic. The node designated as the Cluster Head (CH) is the one exhibiting the least mobility. CMCA is structured into three distinct phases. The first phase involves foaming clusters, which are influenced by the mobility speed of the clusters. During this phase, cluster gateways play a role in minimizing transmission. The second phase pertains to the election of the CH, where the node with the least mobility within each cluster is selected as the CH, serving as the cluster identifier. The last phase focuses on determining the node's path to the specified destination, facilitating both inter-cluster and intra-cluster communication. The performance of the routing protocol is assessed using three metrics: packet delivery acceptance rate, average time delay, and normal routing overhead metric.

4.1.5. Group Mobility Based Clustering Algorithm (GMCA)

The Gaussian Markov model incorporates a group mobility framework that utilizes mobility predictions as a dynamic distributed clustering strategy. This route fundamentally relies on group mobility, node velocity, and the directional vector of nodes. Such a mechanism enables nodes to anticipate their mobility in relation to neighboring nodes. This model is particularly effective in illustrating group mobility trends, especially when the primary behavior of mobile groups involves splitting and merging. Additionally, having non-threshold energy of nodes means treating them as neighboring entities.

The operational steps are as follows:

- Each node's having node_id is assigned to both clusterhead_id and group_id.
- A message packet has been broadcast, and it is received from neighboring nodes. The node that sends the broadcast packet is grouped accordingly. Every node that receives this packet will assess the angle as well as the speed of the two nodes' participation in the network. If the nodes are not part of that similar group, the packet is discarded and returned. Conversely, if the nodes belong to the same group, the group_id is assigned as the minimum group_id of the two nodes.
- Each node computes the neighboring energy and mobility information received from adjacent nodes, facilitating distributed execution. Consequently, different nodes have to record three main parameters: residual or threshold energy, neighboring relative nodes, and group relative mobility.
- Subsequently, every node transmits its values to neighbors within the same group and initiates a timer to

generate a one-hop cluster. A comparison is made between the node's values and those of all neighboring nodes. Suppose a node's value exceeds that of all adjacent nodes. In that case, it establishes itself as the cluster head assigns its node_id to the corresponding cluster_id, and sends a declaration message to neighboring nodes within the cluster group. Nodes with lower IDs that are adjacent to other nodes may become the cluster head. Nodes can join the cluster by accepting the received request message. If any node can receive a sent message from the cluster head apart from a declaration message, it will connect to a relative adjacent node and set that node's cluster_id. Upon receiving acceptance, the cluster head is designated for that cluster_id.

4.1.6. Stable Clustering Scheme for High Mobility (SCHM)

SCHM consists of three phases: 1. Cluster head, 2. Cluster member, and 3. Undecided. Initially, all network nodes operate in an undecided state. The relational stability of the node and its neighboring nodes is assessed through the Regional Average Relative Speed (RARS). [13]

$$v_i - \mathrm{RARS} = \frac{\sum_{j=1}^{k} v_{ij}}{K}$$

The above formula can be utilized to calculate relative stability, which is defined by the relative speed of the node.

Table 1. Investigation of clustering depends upon the mobility

Algorithm	Different approach to choose CH	Advantages	Disadvantages	Evaluation
MOBIC	ID with the lowest value of CH	Each Cluster is characterized by both the highest and lowest relative mobility stability metric.	The transmission range is at its lowest	The Reclustering process takes place, resulting in a reduction of network lifetime.
MobDHop	The movement of each node in relation to one another takes into account the differing distances between nodes designated as CH.	Organize nodes exhibiting comparable movement patterns within the cluster. It reduces the count of clusters and enhances the scalability of routing protocols in extensive MANETs.	The presence of relative mobility results in increased overhead due to its high level of dynamics.	MobDHop attained greater stability in its clusters and demonstrated enhanced scalability.
MPBC	Lowest relative mobility	Predicting mobility aids in preventing the unwarranted merging of clusters.	Reduced cluster head life expectancy	It also results in a reduced number of clusters, enhances stability, and attains greater scalability. The changes in cluster heads are minimal. Utilize Mob Hop to assess different performance metrics, including cluster stability, overhead in energy consumption, and latency. Additionally, Higher realistic models of mobility, such as RPGM, are employed in simulations.
CMCA	Lowest mobility CH	In the CMCA framework, the mobility of every node has been assessed. The	As node density increases, there are frequent changes in	It enhances the node scalability and node stability of clusters, with an

		proposed hierarchical routing protocol enhances cluster stability and demonstrates effective performance in network execution.	topology, leading to greater establishment and connection isolation.	efficient routing protocol demonstrating superior adaption and advantages compared to earlier routing protocols.
GMCA	The selection of cluster heads was influenced by their low relative mobility, attributed to substantial reserves of energy of node and higher connectivity.	Enhance the scalability and stability of the network, as well as its performance.	The change in CH is distorted by rapid mobility.	The GMCA algorithm demonstrates superior performance compared to MOBIC and DMGA regarding the rate of change and visibility of cluster heads. Additionally, GMCA has the potential to enhance grid scalability, stability, etc, greatly.
SCHM	The mean relative velocity nodes designated as CH	Reliable clustering in the context of significant mobility.	Additional energy exchange requires control of the messages	Cluster stableing takes place, and scalability diminishes, impacting the network.

4.2. Energy Dependant Clustering

The following are the various forms of energy-based clustering algorithms:

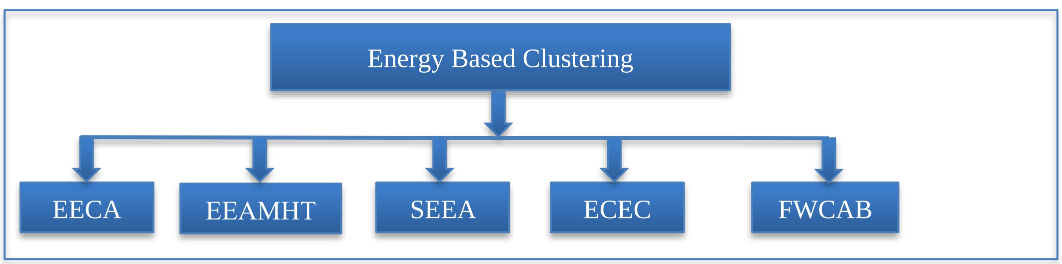

Fig. 4 Categorization of energy dependent clustering algorithm

4.2.1. Energy Proficient Clustering Approach in MANET (EECA)

The Energy Efficient Clustering Approach (EECA) in MANET incorporates an offloading of data technique that effectively ensures traffic in data within the network. The selection of the Cluster Head (CH) in this EECA algorithm depends on the processing capabilities and the link metrics of nodes. Primarily, the server transmits data to CH, which subsequently transmits the information at neighboring nodes at specified Data Bit Rates (DBPs). The process of recombining data at the CH facilitates load balancing across the network. This clustering strategy significantly reduces energy consumption, optimizes network traffic, and enhances throughput through reliable routing mechanisms.[13]

4.2.2. Energy Efficient Algorithm Using Max-Heap Tree (EEAMHT)

The EEAMHT algorithm is a more structured and efficient clustering method to facilitate a max-heap tree for the election of Cluster Heads. It enhances both the stability of the network and the MANET structure. Depending on the energy levels of the nodes, if low or High, the node with the highest energy among its member nodes in a cluster is nominated as the CH. The EEAMHT algorithm incorporates the concept of Multipoint Relay (MRP) to facilitate communication between CHs. MRP is instrumental in alleviating congestion in the network by conserving the energy of the remaining CHs. The EEAMHT approach involves partitioning the entire network into several clusters, followed by the implementation of its four-phase process: 1. Cluster Development, 2. Election of CH, 3. Intra-cluster Communication 4. Inter-cluster Communication. The first phase entails the dividing of the entire network area into a fixed count of clusters with movable nodes extending beyond the cluster boundaries. In the second phase, the energy of each node is measured in joules, and an index number is assigned for identification purposes. The third phase establishes a one-hop connection between the CH and each member node within the tree structure. Consequently, other nodes cannot connect directly to the cluster; however, the CH can communicate directly with its member nodes. Active CHs maintain communication while immobile member nodes are placed in dead mode. A node approach has a packet from sleeping nodes, and the CH sends an acknowledgement prompting the sleep mode to switch to active mode. After communication concludes, the nodes revert to sleep mode. In the fourth Phase, the Optimized Link State Routing (OLSR) is employed, utilizing the MPR concept to elect a CH through which data packets can be transmitted. This strategy reduces the count of neighboring nodes and conserves power for other CHs, thereby reducing network congestion.

4.2.3. Strength Based Energy Efficient Algorithm (SEEA)

In the SEEA framework, nodes with higher energy levels are prioritized. Each node is assigned specific data and processing tasks.[16] The SEEA ensures that information is transmitted without loss while addressing multiple constraints, such as link weight and energy consumption during power control transmission. The packets are transmitted using the maximum available battery power, focusing on nodes with greater energy reserves to facilitate the transfer from the source to the destination. This approach enhances the overall network lifespan and optimizes energy conservation among the nodes.

4.2.4. Enhance Cluster Based Energy Conservation (ECEC)

The Enhance Cluster Based Energy Conservation (ECEC) methodology focuses on optimizing energy consumption among network nodes. This enhancement occurs through Energy Conservation Enhancement (ECE), which prioritizes maintaining network connectivity[17] while considering energy as a critical factor. To prolong the network's lifespan, the approach aims to minimize the connectivity among nodes. ECEC is also capable of identifying non-essential nodes to conserve energy further. The algorithm includes a cluster generation phase that relies on estimated energy values. Higher energy levels of nodes are elected as CH. During the selection process of the cluster head and gateway node, it transmits a recovery message that includes a specialized ID, the ID of the cluster, its location, its velocity, estimated network lifetime, and transmission coverage rate. ECEC employs a technology for the removal of non-essential nodes, facilitating communication with the gateway node within the cluster. This strategy opts for the shortest and most reliable with efficient paths connected to adjacent clusters while relocating the same gateway nodes, thereby enhancing power conservation and presenting an effective solution for energy management.

4.2.5. Flexible Weighted Clustering Algorithm (FWCABP)

The Flexible Weighted Clustering algorithm based on battery power (FWCABP) ensures higher stability within the network structure, reduces the count of clusters, and secures nodes with low energy from being designated as cluster heads. This approach effectively minimizes the complexity involved in cluster formation and maintenance. The experiments were designed to evaluate the algorithm's effectiveness in forming clusters, the frequency of affiliations, and changes in cluster heads. In this algorithm, cluster heads are selected from nodes with low battery power.

During the cluster formation phase, member nodes are identified, and a HELLO message is transmitted to all member nodes to ensure that the cluster is aware of each node's information. In the cluster maintenance phase, new nodes are evaluated based on their battery power against predefined threshold values to determine their eligibility as cluster heads, particularly for those with low battery power. This process enhances network performance while also reducing network traffic during the selection of cluster heads.

5. Conclusion

The article investigates different clustering algorithms that prioritize mobility and energy as essential parameters. Mobile Ad Hoc Networks (MANETs) can serve as emergency communication networks during crises, such as power grid failures caused by catastrophic events. Given their adaptive and innovative characteristics in response to changes in the network environment, researchers have proposed several new clustering schemes within MANETs to improve overall network performance. However, there are certain limitations in configuration at different levels, and the critical attributes are primarily centered on various factors, including connectivity of the network, stability of cluster, PDR, throughput and power. The choice of Cluster Heads (CH) depends upon the different criteria outlined in Tables 1 and 2. An adequate clustering scheme must be considered to improve the standard of clusters. The selection process for the maximum parameters and CH during cluster formation presents an optimizing challenge with more objectives, which are summarized in tabular form.

Table 2. Analysis of energy based clustering

Algorithm	Different approach to choose CH	Advantages	Disadvantages	Evaluation
EECA [14]	High Energy node	The reduction of power consumption enhances the longevity of the network.	During the clustering process, there is an increase in the information message control.	The technology of data offloading regulates network traffic effectively. It plays a crucial role in minimizing power consumption and alleviating traffic load in data while ensuring routing is stable.
EEAMHT [15]	Maxheap serves as a selection mechanism for CH, and it operates depending on energy levels.	The utilization of power has been minimized.	The utilization of energy has been significantly reduced.	Communication among Cluster Heads (CHs) employs a multi-point relay system. Connections between cluster members and CHs are established through single-hop clustering.
SEEA[16]	Nodes exhibiting the highest energy levels have been designated as Cluster Heads.	The longevity of the network is enhanced, scalability is improved, and the delay is minimized.	Rise in Network traffic.	In comparison to the ESAR algorithm, the SEEA demonstrates superior performance with maximum throughput, an enhanced PDR, reduced delay transmission, decreased PL, lower Energy consumption, and extended network lifespan.
ECEC[17]	Higher parametric nodes' estimated energy power has been chosen as cluster heads.	Decrease energy usage.	A state of minimal connectivity is achieved.	Reduced energy usage and enhanced network longevity.
FWCABP[18]	CH has been designated as having a low battery power status.	Minimal clustering overhead.	As the selection of the cluster head progresses, the network traffic experiences an increase.	Adjusting the relative position of the node results in reduced power consumption.

Table 3. Comparative investigation of QOS parameters associated with mobility and energy for clustering algorithm

Category of clustering	**Name of Algorithm with Reference**	**Network lifetime**	**Energy consumption**	**Hop count**	**Overlapping**	**CH change**	**Delay**	**PDR**	**Throughput**	**No of nodes and cluster**
Mobility based clustering	MOBIC [8]	Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Achieved
	MobDHop [9]	Achieved	Achieved	Not Achieved	Not Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved	Achieved
	CMCA [11]	Achieved	Achieved	Achieved	Not Achieved	Achieved	Not Achieved	Not Achieved	Achieved	Achieved
	SCHM [16]	Achieved	No	Achieved	Not Achieved	Not Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved
	MPBC [10]	Achieved	Achieved	Achieved	Not Achieved	Not Achieved	Achieved	Not Achieved	Achieved	Not Achieved
	GMCA [12]	Achieved	Achieved	Achieved	Not Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved
Energy based Clustering	FWCABP [18]	Achieved	Not Achieved	Not Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved	Achieved	Not Achieved
	ECEC[17]	Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved
	SEEA [16]	Not Achieved	Achieved	Achieved	Achieved	Not Achieved	Not Achieved	Achieved	Achieved	Not Achieved
	EEAMHT [15]	Achieved	Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved
	EECA [16]	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Not Achieved	Achieved	Not Achieved	Not Achieved	Not Achieved

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