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IMPROVED ENERGY EFFICIENT CLUSTERING IN MANETS USING META-HEURISTIC OPTIMIZATION

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Abstract

A mobile ad hoc network (MANET) is a wireless network created by a radio terminal built into a mesh topology. Each node is deflected with respect to the other nodes. The Temporary networks can self-heal and automatically redirect back around a lost node. There is an MANET networks require different network layout protocols, such as remote hierarchical remote vector navigation, associative-based navigation, ad-assigning remote vector navigation, and dynamic source navigation. An improved meta-heuristic optimization algorithm is proposed in this paper. It works in conjunction with an autonomous mobile network to increase its power and efficiency. It can transmit large amounts of data using less power and its bandwidth speed increases as its data transfer speed increases. This will improve the amount of service generated there and the users can satisfy the provided services.

Keywords:

MANET, Mesh Topology, Autonomous Mobile Network, Energy Efficiency

1. INTRODUCTION

The computer network, which is an integral part of companies and organizations, is no longer limited to the cable platform. With the proliferation of mobile electronic gadgets such as laptops, tablets and smart phones, the need to connect to the wireless network has further increased. Therefore, today corporate networks are a combination of wired and wireless systems [1]. In a wireless network, we use radio waves to send and receive information, and generally refer to the wireless access point (wireless access point) as a computer point. The wireless network of radio frequencies used to send data through the air pet to connect to the wireless network card only requires a wireless network there [2]. Wireless networks typically have an access point (AP) that has one or more antennas to send and receive radio signals. These antennas are divided into several types. In temporary variants, wireless devices such as laptops connect to other wireless devices in a peer-to-peer environment without the need for a central interface device [3]. The advantage of this type of network is that there is no need to purchase access points.

In wireless infrastructure mode, users are connected to a central device called an access point. Users send data and information to the central access point [4]. Conversely, a central access point sends data to their desired location. As the access point is wired to the wired network, users can access the wired network resources [5]. The cable network is more popular than the wireless network due to the advantages of network traffic control and the like. Another type we need to be aware of is wireless network topology mesh topology. In mesh topology, many wireless routers are connected. (Each router has a connection to another router) [6]. This is done to create fault tolerance. Increasing frequency bandwidth is one of the new ways to increase the rate of information and data traffic on wireless networks [7].

There are different types of MANETs can be useful in different scenarios. Perhaps, you want to connect two laptops in one room without wireless internet. In this case, it would be best if you know what kind of network connection you can use [8]. The MANETs access points typically operate in 'infrastructure' or 'temporary' mode. Also, many MANETs enabled devices can only connect to infrastructure-mode networks that are not temporary [9].

Most people are familiar with MANET networks that operate in infrastructure mode. After all, it is the type of wireless connection found in cafes, hotels, office spaces, homes and schools. Basically, when devices are connected to this network, they communicate through a single access point, which is usually a wireless router [10]. Take for example two laptops that are placed next to each other. They can be connected to the same wireless network, but they are not directly connected to each other. What happens is that one device sends the packets to the access point and the packets are sent to the other laptop [11]. To connect all devices, you need an infrastructure system network with a central access point. The Temporary networks, also known as 'peer-to-peer' mode, do not require a centralized access point. In this type of wireless network, devices can connect directly to each other [12]. You can set up two laptops in temporary wireless mode and they do not need a centralized access point to connect directly to each other [13].

An Ad-hoc home networks are useful when you need to share files or other data directly with another computer, but do not have access to the MANET [14]. Multiple laptops can be connected to a makeshift network until all adapter cards are connected to the same SSID (Service State Identifier) configured in ad hoc mode. Computers should be within 100 meters of each other [15].

If you are the person setting up the temporary network, when you disconnect from the network, other users will also be disconnected. When everyone disconnects from it, an ad network will be deleted when it is good or bad, depending on your vision; it really a spontaneous network [16]. You can use an ad wireless network to share your computer Internet connection with another computer.

It is easy to connect two devices in temporary mode because they do not require a centralized access point. For example, you are in a hotel room without MANET and want to connect two laptops directly to each other [17]. You can do so by creating a temporary MANET network with temporary mode. You do not need a router because the new MANET Direct standard is configured in temporary mode, allowing laptops to communicate

directly with MANET signals. On the other hand, if you want to create a more permanent network, it is a good idea to set it up in infrastructure mode [18].

2. BACKGROUND

As a result, metaheuristic algorithms are becoming increasingly prominent in today's world as a result of the distinct advantages they provide over other optimization methods. In recent years, metaheuristics have become increasingly popular for identifying high-quality solutions to difficult real-world issues, such as combinatorial problems, since they are capable of dealing with problems that have many objectives, multiple solutions, and nonlinear formulations.

For example, utilising evolutionary techniques such as Genetic Algorithms (GA) and Ant Colony Optimization, the optimization of fed-batch fermentation has been successfully achieved (ACO). It has also been applied to optimization frameworks incorporating GA and SA, including the design and synthesis of heat exchanger networks, as well as model predictive control. It has been said that some hybrid-GA algorithms are unique when it comes to making predictions. Other hybrid-GA algorithms have also been said to be unique.

In this research, we've provided a hyperheuristic technique that integrates GA, SA, and ACO. The use of a hyperheuristic during a search involves employing a sequence of solvers (low-level algorithms) to pick and implement the most expedient approach. Several studies have demonstrated that hyperheuristics can be useful in the solution of difficult computational search problems.

For a variety of traditional metaheuristics, hyperheuristic-based algorithms have been developed. However, the combination of several metaheuristics has not been extensively examined in operational research. The researchers discussed their hyperheuristic design choices, and they identified the most significant issues that should be addressed in future research efforts. The high computing needs of hyperheuristics have been noted as a significant disadvantage. Using parallelism to accelerate computations in this case looks to be a cutting-edge technique to increase efficiency.

Parallel algorithms are being created as a result of the requirement for speedy solutions to optimization problems as well as the development of new concurrent computing architectures in the computing industry. In terms of speedup and efficiency, the parallel method based on a GA model performs admirably when applied to a large-scale project. This is what the general public believes.

3. PROPOSED SYSTEM

The meta-heuristic optimization algorithm (MHOA) was proposed here to improve the energy efficiency. The Mobile Ad-hoc networks are local area networks. This is also known as mobile P2P networks, to which devices communicate directly. Like other P2P architectures, ad-hoc networks are small devices that are very close to each other.

3.1 ANTENNA DIRECTION

There are several known methods for determining the coverage area of wireless antennas used to control connections and wireless network security. These methods are commonly used by changing the parameters and specifications of the antenna. This shown in Fig.1.

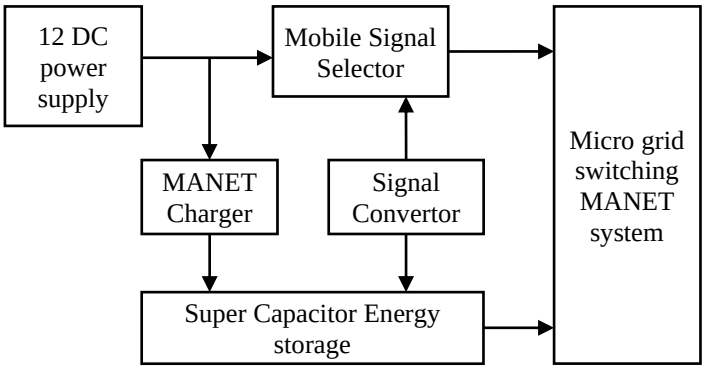

Fig.1. Proposed system design

- ***Omni Direction***: This antenna transmits radio signals in all directions, thus covering the vast area around it.
- ***Half Direction***: The radio signals in this model of antennas are in one direction, but a large area is covered in the same direction. For example, imagine streetlights that illuminate a specific area and shine from top to bottom. The method of transmitting radio signals is very similar to the operation of an electric light pole.
- ***More Direction***: Also known as one-way antennas, these antennas transmit radio signals in one direction and over a small area. These antennas are commonly used to make point-to-point connections.

3.2 ANTENNA/ACCESS POINT INSTALLATION LOCATION

For best performance and coverage area, it is essential to have complete information about the situation between the receiving antenna and the transmitters and to ensure that there is no obstruction between the antennas. It is clear that radio signals are observed when crossing obstacles such as mountains or concrete buildings. So you should always check if the antenna or access point is at a good distance from the wireless network users.

If a user is too far away from the antenna, he or she may not be able to connect to the network or may find it difficult to connect to the network. From a security standpoint, all network administrators attempt to generate wireless network signals. Only include users of the same organization. Therefore, the best place to install the antenna or access point is at the center of the system or organization. If we install an access point or antenna near the exterior walls, it will also include radio signals outside the building and those outside the company will be able to connect to the wireless network

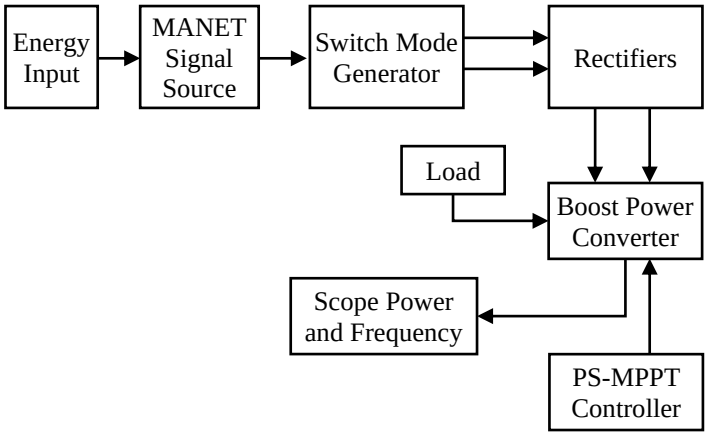

Fig.2. Clustering Formation and Control

3.3 EFFICIENT ENERGY CLUSTERING

Network security experts believe that the signal strength can be controlled by changing the power point of the access point. If some users are unable to connect to a wireless network due to long distances, they can amplify the signal by increasing the power and thus traveling longer distances. But when it comes to security, experts say choosing the least amount of space involves the desired location.

In short, this is what we said: Wireless operating systems on enterprise networks have access points with one or more antennas, and users connect to them using a wireless network card. Access points are often connected to the cable network, so wireless network users can use the cable network resources. Home users can use wireless routers, which act as routers and access points, and enable services such as NAT and DHCP.

MANET offers less security. If an attacker falls within the scope of your MANET, there is no problem with it.

Step 1: Open Command Prompt and enter this code, change your network name and your password with your information:

Step 2: nets set hosted network mode = SSID = your network name key = Allow your password

Step 3: Then launch the hosted network: Hello

Step 4: Go to Control Panel and select Network and Sharing Center. Change adapter settings to open network connections.

Step 5: Enable Internet connection sharing by right-clicking on a device connected to the Internet.

Step 6: Share the box that allows other network users to connect through this computer Internet connection.

Step 7: In the drop-down menu, select Temporary Network Connections and click OK.

For file and printer sharing, all users must be in the same workspace or if one computer is connected to a domain, other users must have access to the accounts on that computer. Other limitations of temporary wireless networking include lack of security and slow data rate.

4. RESULTS AND DISCUSSION

The meta-heuristic optimization algorithm (MHOA) was proposed was compared with the existing three-tier fuzzy cluster algorithm (TTFCA), Ant-based clustering algorithms (ABCA), A clustering scheme for hierarchical Control in multi-hop wireless networks (CSHC), A Trusted Water Fall Model (TWFM) and Dolphin swarm inspired protocol (DSIP).

5. ENERGY CONSUMPTION

Energy consumption in general varies depending on the amount of energy used on it. That is, measured by multiplying the different number of power units consumed over a period of time. This can be calculated as follows.

$$\text{Energy Consumption } (E) = P^*(0.001t) \quad (1)$$

where, E = Energy consumption of the equipment, P = Power utilized by the equipment and t = time taken to consume the power.

The Table.1 shows the estimation of the energy consumption between existing TTFCA, ABCA, CSHC, TWFM, DSIP and proposed MHOA

Table.1. Comparison of Energy Consumption (%)

Nodes	TTFCA	ABCA	CSHC	TWFM	DSIP	MHOA
100	78.11	87.54	93.54	80.77	88.74	68.47
200	75.22	80.21	90.58	78.54	84.57	64.87
300	71.17	74.25	84.57	74.88	82.36	60.88
400	70.58	80.87	82.14	70.24	79.14	54.87
500	66.54	65.25	80.47	68.25	74.58	52.27

5.1 ENERGY EFFICIENCY

Energy efficiency is the ratio between the performed output energy and the given input energy. Once the efficiency was increased then the given equipment utilized the maximum given energy. Hence the system and equipment are performed well.

$$\sigma = (E_{out}/E_{in}) * 100 \quad (2)$$

where, σ = Energy efficiency of the system, E_{out} = Output energy utilization in Joules and E_{in} = Input energy utilization in Joules

The Table.2 shows the estimation of the energy efficiency between existing TTFCA, ABCA, CSHC, TWFM, DSIP and proposed MHOA

Table.2. Comparison of Energy efficiency (%)

Nodes	TTFCA	ABCA	CSHC	TWFM	DSIP	MHOA
100	62.46	59.46	69.23	51.26	72.69	92.89
200	69.79	62.42	71.46	55.43	73.78	95.78
300	75.75	68.43	72.25	57.64	74.01	96.83
400	69.13	70.86	73.28	60.86	74.84	97.42
500	84.75	72.53	74.47	65.42	75.56	99.46

5.2 ENERGY STORAGE

The following formula is used to store the energy stored capacitor used in all the modules commonly proposed methods in which the energy is stored.

$$\text{Energy Storage } (E) = 0.5CV^2 \quad (3)$$

where, E = Energy utilized in Joules (J), C = Capacitance in (F) and V = Voltage in volts (V).

The Table.3 shows the estimation of the energy storage between existing TTFCA, ABCA, CSHC, TWFM, DSIP and proposed MHOA

Table.3. Comparison of Energy Storage (%)

Nodes	TTFCA	ABCA	CSHC	TWFM	DSIP	MHOA
100	52.46	49.46	59.23	41.26	67.53	82.89
200	59.79	52.42	61.46	45.43	69.58	85.78
300	65.75	58.43	65.12	47.64	71.57	89.83
400	59.13	60.86	69.76	50.86	73.88	90.42
500	74.75	62.53	71.75	55.42	75.21	94.46

5.3 POWER CONSUMPTION

The Power required for each device must be fully supplied. Ensuring that such a payment is made is seen as the proper cost to the power generated. Failure to do so will affect the award performance.

$$P_v = P_{Solir} - (V_{out} * I_{in}) \quad (4)$$

The Table.4 shows the estimation of the power consumption between existing TTFCA, ABCA, CSHC, TWFM, DSIP and proposed MHOA

Table.4. Comparison of Power consumption (%)

Nodes	TTFCA	ABCA	CSHC	TWFM	DSIP	MHOA
100	61.89	82.46	53.46	51.23	60.26	31.53
200	64.78	89.79	56.42	53.46	64.43	35.13
300	68.83	95.75	62.43	57.12	66.64	39.12
400	69.42	97.87	64.86	58.76	69.86	45.13
500	73.46	99.58	66.53	59.74	74.42	47.73

6. CONCLUSION

It is worth noting that wireless routers generally have more powerful antennas and radios. Therefore, they are the best access points to cover a wide area. When you compare infrastructure and temporary networks, the latter relies solely on the limited power of the laptop wireless radio. It said additional system resources were needed in the temporary mode. As the devices move, the physical structure of the network changes. On the other hand, the access point of the infrastructure mode is generally fixed. There will be more wireless interference when multiple devices are connected to a temporary network. Instead of going through a single access point, each device should make a direct connection to each other. So, if you want to connect a laptop to another laptop outside its range, the unit data has to be passed through other devices. The future enhancement in MANET is to sending the data across multiple devices. Naturally it is much slower than doing it with a single access point. These improvement measurements are implemented with multi access point system. Then will enhance the multi-channel communication in MANET.

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