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OPTICS Clustering used for Energy-Feasible Routing Rules in Ad-hoc Networks with Greedy Method

[1]Prakash Kumar,[2]Vinay Singhr,[3]Naghma Khatoon

[1]Research Scholar,[2]Associate Professor,[3]Assistant Professor
[1]Faculty of Computing and Information Technology
[1] Usha Martin University, Ranchi,, India

Abstract: In the world of wireless technology, adhoc networks are crucial. It is crucial that it be based on a self-rebuilding configuration of dynamic devices connected in an infrastructure-free network with decentralized management.
To describe the system, they depend solely on the supplementary nodes. The elements of composite distributed systems that provide dynamic construction inside a network are used to build the dynamically generated nodes. Even though the connections between nodes are only transitory, they alter along with the nodes' ongoing evolution. Therefore, even if typical broadcast networks are absent, a condensed connection inside the nodes could survive..
The wireless cellular system first appeared in the late 1980s. It vigorously progressed over the first, second, and third generations, but remained under sustainable contact access points. These access points were physical communication media-connected fixed sockets. In contrast, mobile nodes are free to roam the domain until they come within range of an access point.

Index Terms - **Energy efficiency, Optics, AODV, Clustering, MANET, Routing**.

I. INTRODUCTION

Adhoc means "for this or for this only" in Latin. The wireless network construction link identifies these independent wireless networks. These networks are continually reshaping and recreating mobile node networks.
The purpose of transitory networks is to transport data. These networks include computers, handheld digital gadgets, wearable CPUs, cell phones, and so forth. Every node has the capability of sending and receiving information.

I.1 Peculiarities of dynamic networks:

1. Morphologically dynamic nature: The nodes in the network are continuously in motion at different speeds and in random directions..
2. The Bounded source of energy: The lone sources of energy for the nodes are their batteries. The batteries do not produce much energy for the system and are static in nature and can't be refreshed.
3. Sparse transmission capacity: With respect to infrastructure networks, these types of networks provide less capacity for bandwidth.
4. Threats on reliability: Networking threats such as spoofing, snooping and denial of service are much more common on the desk of such a system.
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I.2 The Fields of Application:

It was primarily created for military operations to quickly set up networks on the battlefield in uncharted territory.
These are also useful for multimedia and, in rare cases, can connect to other networks.
1. Collaborative work: Business contexts require group computing outside of the organisation, such as in business gatherings where participants must work together and share information on a specific project.
2. Management of crises Applications: When natural disasters happen, established infrastructure networks suffer damage. To save lives, immediate rescue efforts are needed. Rapid network installation is required to save operations within hours.
3. Bluetooth and Personal Area Networking: A personal area network (PAN) is a confined, short-distance network that consists of a collection of electronics tied to a certain person, such as a belt, watch, or other items.

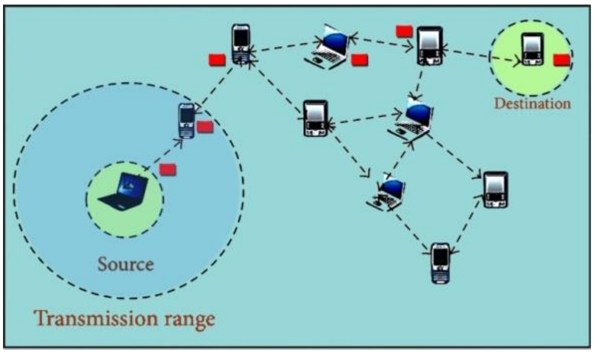

Figure1: MANET

I.3 MANET Types

There are various types of MANETs depending on node mobility and communication range, including:

1. Vehicular Ad hoc Networks (VANETs): These networks are made up of moveable nodes that have a top speed of 40 km/h and are coupled with wifi routers that have a range of 100 to 300 metres.

2. Smart Phone Ad hoc Networks (SPANs): Even without assistance of cellular connectivity or other conventional network topologies, smart phones can connect to each other through these forms of networks.

3. Internet-deployed mobile adhoc networks (iMANETs): Portable nodes are linked to fixed internet gateways via these ad hoc networks..

4. In tactical and military: Security is the primary issue with MANETs. The Wave Relay from Persistent Systems is an example of this kind of implementation.

I.4 Protocols for MANET Routing

For ad hoc interaction between nodes, a number of routing designs have been established.

This subsection discusses the various routing mechanisms implemented in MANET deployments.

I.4.1Reactive Routing Protocols

Whenever a route is required, then the reactive protocol seeks one. The route discovery process is initiated as required by the request message (RREQ) that floods the network.

Ad- hoc On-demand Distance Vector Protocol (AODV)

Regular global route notifications are optional for AODV. It offers a loop-free route even if a link is broken while repairs are being made. AODV finds routes, follows source routes, but also depends on intermediary nodes. Nodes employ the destination sequence number while keeping track of the increasing sequence number counter to prevent loops.

1.4.2 Proactive Routing Protocols

Each and every node within the system that provides proactive routing protocol is capable of communicating with every other node. Routing data is regularly exchanged between the node and its neighbours. The DSDV protocol is a destination-sequenced distance vector protocol, makes use of a routing method known as Bellman-Ford. On each node, the routing tables are initialised empty. The routing database at the node now has entries for nearby nodes with metrics connected to the node after the initial advertisement.

I. LITERATURE REVIEW

Even though creating energy-efficient routes is a more exciting objective, it has a major principal design problem with cellular ad hoc networks, which is the mobile node process time, regarded as the most significant limiting factor. in creating well-organized routes (MANETs). The proposed routing protocols, which consider energy for MANETs, are analysed and organised into categories in this article. As a mobile node uses passive energy, less communication energy is needed to send or receive packets. While not in use, it monitors its wireless channel for any future requests for transmission from several other nodes. The first group includes load distribution and transmission power switch mechanisms, while the second category includes sleep/power-down mode strategies.

In the future computing environment, including mobile networks without infrastructure, wirelessly connected mobile devices play a significant role [1]. A wireless LAN with IEEE 802.11 support underpins the most widely used mobile infrastructure. Wireless linkage between a mobile node and a base station in this network are limited to one hop both are fixed. An infrastructure-free network (MANET) is a network that has more than one hop, where each node connects to other nodes either formally or informally by way of intermediary nodes.

It may be claimed that every node within such a MANET technically uses a transportable router because each node inside a MANET establishes and preserves paths using a widely used routing mechanism. For applications involving specific outdoor activities, communications in places lacking wireless infrastructure, crises and natural disasters, and military operations, they are appropriate because they are infrastructure-free, self-organizing, and instantaneously deployable wireless networks [2, 3]. The extremely dynamic and distributed nature of routing makes it one of the trickiest problems in MANETs. Perhaps the most crucial element of the design is energy-efficient routing for MANETs because moveable nodes only have small batteries that can power them.

Based on the aforementioned lectures, the research classifies and analyses a variety of energy-efficient routing algorithms designed with MANETs in mind [4–15]. Based on the time at which energy optimization is reached, they can be loosely categorised. It uses battery power when a mobile node sends or receives packets on the fly. Passively scanning the wireless channel for upcoming requests for interaction from those other components also uses energy supplied by the battery. Thus, energy-optimized routing solutions either minimize energy use at peak times or energy required for data packets to be actively transmitted and received.

Which class of algorithms—is superior depends on the situation; there are no guarantees. Every protocol has unique benefits and drawbacks that are specific to the scenario they are being used in. To create a routing tool that is more energy-efficient, it is expected that the current explanations will be combined and incorporated. Energy-aware MAC and transport protocol development has received significant attention because energy efficiency is a significant concern at higher network layers as well [16]. An autonomous function for each layer is envisaged in multi-layered network architecture. To the contrary, as several recent studies have shown, cross-layer design is necessary to get the best energy performance [17, 18]. Numerous of the routing protocols discussed in this study employ a similar idea.

II. RELATED WORK

In the domain where the nodes are continuously in a state of motion, a route-mapped protocol called "CBRP", also known as Cluster Based Routing Protocol, is utilized.

III.1 MANET ENERGY EFFICIENT ROUTING

A routing protocol's fundamental objective is to connect two nodes and preserve network operation for as long as feasible, as opposed to merely assigning exact and effective paths between them. It is possible to achieve this by lowering the energy consumption of mobile nodes during energetic communication and while they are idle. The use of sleep/power-down techniques, broadcast battery power control, and load allocators, along with other methods, is done to diminish on energy usage while inactive.

III.2 NEED FOR ENERGY EFFICIENT ROUTING PROTOCOL

Because the nodes are dynamic and have the capacity to participate in data packet routing, mobile ad hoc networks significantly benefit from energy-efficient routing methods. These goals can be achieved by lowering the energy consumption of mobile nodes through both active and dormant connections.

Power-Down/Sleep Mode Approach

Through communication in the inactive mode, this is made accessible for use. When sending or receiving no packets to or from another node, a node will often put its hardware or subsystem into a sleep mode to conserve energy.

III.3 PROTOCOL OF MANET's:

III.3.1 DSDV ("Dynamic_Destination_Sequenced_Distance_Vector_Routing_Protocol")

Each station in a mobile network has a routing desk that contains a list of all possible destinations, the number of hops required to go there, and the terminal node's given progression number.

III.3.2 (FSR) Fisheye Routing

The term "Fisheye State Routing" refers to a GSR advancement. A sizable amount of network bandwidth is split on large updated message sizes in GSR.

III.3.3 (HSR) Hierarchical State Routing

One of its kind and distinctive properties of hierarchical state routing include multilayer segmenting and clustering of mobile network nodes coherently (HSR).

III.3.4 (GSR) Global State Routing

Each node in the network builds distance vector table, a neighbour list, a topology table, and a table for the next hop counter.

III.3.5 (WRP) Wireless Routing Protocol

A link-cost, distance, routing, and a list of interactions table that need to be retransmitted are all kept on file by the network node.

III.3.6 Cluster-head Gateway Switch Routing Protocol

Each bunch of portable nodes has a designated cluster head. The cluster consists of all nodes within the range of the cluster-transmission head.

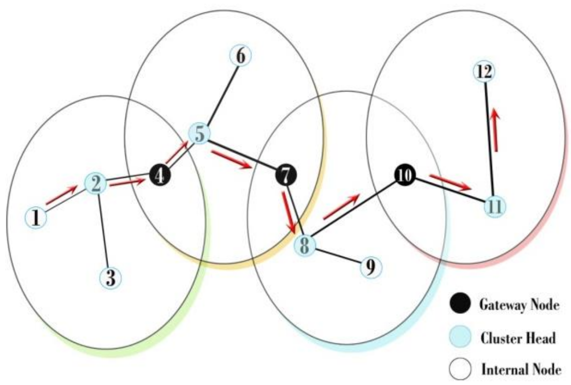

Figure 2: Example of CGSR routing from node1 to node 12

III. OPTICS CLUSTERING SCHEME WITH GREEDY ALGORITHM

The acronym for OPTICS [23-25] is Ordering Points to Identify Clustering Structure. A technique based on bulk, is used to identify cluster structures in spatial data. While OPTICS and DBSCAN are comparable, OPTICS resolves DBSCAN's primary drawback, which is its inability to find meaningful clusters in data with varying densities.

<u>**Basic Terms related to Optics:**</u>

1. eps: The surrounding areas of a dataset are described by eps. If data points equal eps or are smaller, they are considered neighbours in both cases.

2. MinPts: A cluster must have a certain number of data points, at the very least.

3. Core Point: a data point with a surrounding area of at least MinPts data points.
4. Core_Distance: The object's core distance is the minimum number of eps that ensures its eps-neighbourhood contains at least MinPts objects.
5. Reachability_Distance: Reachability distances of oy from nucleus object ox is the minimum radius value that makes oy density reachable.

Visualizing the above terms and the procedure

It is possible to locate points that are a part of nearby clusters using the algorithm's epsilon and given numbers of point concepts.

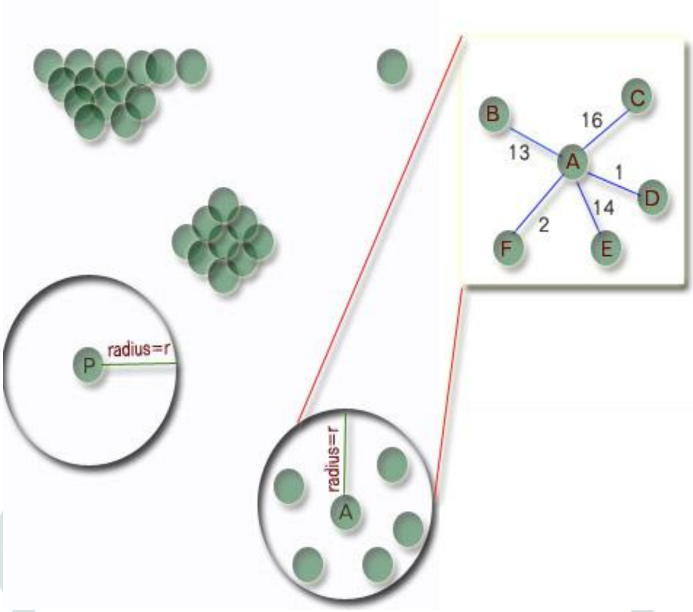

Figure 3: Identification of shortest path

Step1	Center Point	Distance to center(ordered)	Updated Current Score List	Output Score List
1	A	(D,1)(E,1.4)(B,1.3)(C,1.6)(F,2)	[(A,)(D,1))(**E,1.4**)(B,1.3)(C,1.6)(F,2)]	[(A,)]
2	D	(E,1)(C,1.7)	[(**E,1**),(B,1.3)(C,1.6)(F,2)]	[(A,)(D,1)]

Table1

The algorithm:

```
Algorithm 1: The OPTICS algorithm.
Input: Points PX, ε and min_Pts.
Output: Ord, Core_Distance, and ReDist.

procedure ORG_OPTICS(PX, ε, min_Pts, Ord)
    posn:=0
    for each unprocessed point ox ε PX do
    mark ox as processed
    N:=GET_NEIGHBOURS(ox, ε)
    SET_CORE_DISTANCE(ox, Ne, ε, min_Pts)
        Ord[posn]:=x;
        pos:=pos + 1
        ReDist[ox]:=NULL
        if Core_Distance[ox]<>NULL
        then
            UPDATE(ox, Ne, PQ)
            while PQ <>empty do
            oy:=EXTRACT_MIN(PQ)
            mark oy as processed
            N:=GET_NEIGHBOURS(oy, ε)
        SET_CORE_DISTANCE(oy, Ne, ε, min_Pts)
            Ord[posn]:=oy; posn:=posn + 1
            if Core_Distance[y]<>NULL then
                UPDATE(oy, Ne, PQ)
```

```
#Algorithm 3: The POrder_To_Cluster function.
#Input: Ord and ReDist, ε'.
#Output: CL_ID.

procedure POrder_To_Cluster (Ord, ε')
  id := 0
    for each ox ε Ord do
        if ReDist[ox] > ε' then
         if Core_Distance[ox]<= ε' then
              pid:=pid + 1
              CL_ID[ox] = pid
         else
              CL_ID[ox] = "P_Noise"
        else
              CL_ID[ox] = pid
```

```
#Algorithm 3: The POrder_To_Cluster function.
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                    pid:=pid + 1
                    CL_ID[ox] = pid
                else
                    CL_ID[ox] = "P_Noise"
            else
                    CL_ID[ox] = pid
```

```
#Algorithm 4: Prims Algo. for MST
#Input_Parameter: X=Set of points,ε and min_Pts.
#Output: MST, PT.

procedure PKOPTICS(PX, ε, min_Pts, PT)
    for each unprocessed point ox ε PX do
        Check_mark ox as processed
        Ne:=GET_NEIGHBORS(ox, ε)
    SET_CORE_DISTANCE(ox, Ne, ε, min_Pts)
    if Core_DistanceD[x] <> NULL
    then
        MOD_UPDATE(x,Ne,Pt)
        while Pt <> NULL do
        (pu, pv, pw):=EXTRACT_MIN(Pt)
        PT:=PT U (pu, pv, pw)
        mark pu as processed_point
        Ne':=GET_NEIGHBOURS(pu, ε)
        SET_CORE_DISTANCE(pu, Ne', ε,min_Pts)
        if Core_Distance[pu]<>NULL then
        MOD_UPDATE(pu, Ne ,Pt )
```

IV. RESULTS AND DISCUSSION

The model for computing for the proposed technique is shown in this portion of the description. Here, we mainly implement already-existing related clustering algorithms, such as DBSCAN and OPTICS. Proposing GAOPTICS we use a greedy algorithm and optics to identify and remove the longest path of core distance.

Network Simulator: Python and C++ with SWIG interface

Simulation Parameter

Parameter	Value
Number_ of_Nodes	100-500
Simulation_ Area	50x50
Simulation_ Iteration	1000
Initial_ Position	125,125
Packet_ Size	4000bits
Header_ Length	150bits
Transmission_ Range	30m
Routing_Protocol	AODV
Initial_Energy	1J

Table 2

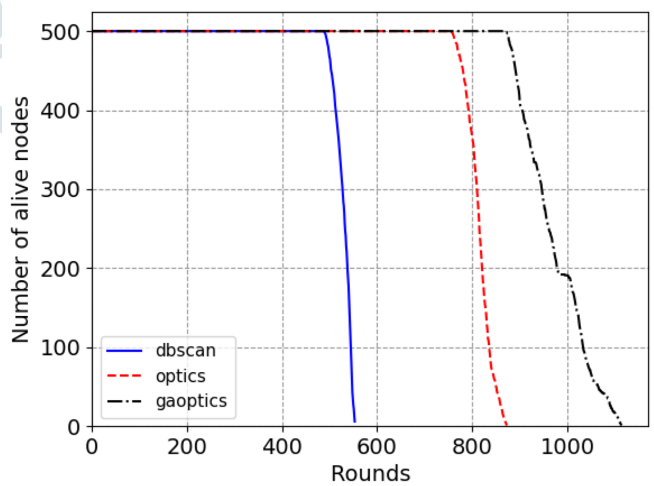

Figure 4: Alive Nodes.

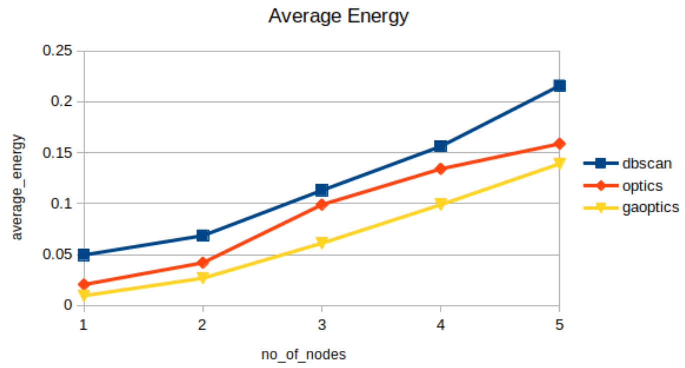

Figure 5: Energy Value of the nodes.

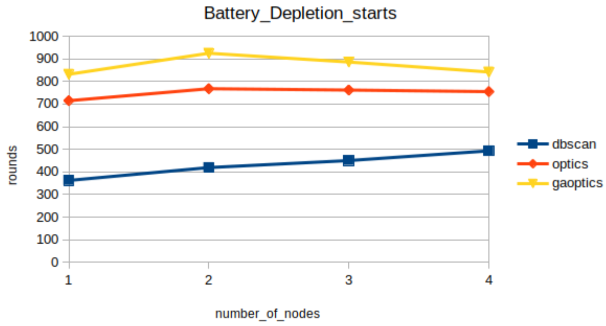

Figure 6: Battery reduction.

The following analysis is run on the simulation results. In Fig. 7, the early depletion is shown at 393 for DBSCAN and at 715 for OPTICS. At 842, the recommended algorithm appears. According to DBSCAN, there is a 30% depletion at 519, a 30% depletion at 802, and a 30% depletion at 959 in the case of OPTICS and the recommended method. Additionally, the average energy for dbscan is 0.1529, for optics it is 0.0989, and for gaoptics it is 0.0789.
As a result, it appears that optics algorithms progress more steadily than DBSCAN algorithms. The gaoptics approach with MST has a longer lifespan than the previously described methods. The average node energy of the aforementioned technique is greater than that of its counterpart in all rounds, according the simulation results.
Even though OPTICS is not a brand-new clustering methodology, it is an intriguing method that gets a lot of attention. It has the advantage of recognizing various densities and only calls for minor parameter changes. The Prim's technique can be used to find the lowest spanning tree, and the deletion of heavily weighted paths can be made more efficient.
The results showed that the GAOPTICS technique performed better than the alternative

IV. Acknowledgment

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References

[1] J. Kennedy and R. Eberhart, “Particle swarm optimization,” in Proceedings of the IEEE International Conference on Neural Networks, vol. 4, December 1995.

[2] Y. del Valle, G. K. Venayagamoorthy, S. Mohagheghi, J.-C. Hernandez, and R. G. Harley, “Particle swarm optimization: basic concepts, variants and applications in power systems,” IEEE Transactions on Evolutionary Computation, vol. 12, 2008.

[3] U. Shuchita and G. Charu, “Node disjoint multipath routing considering link and node stability protocol: a characteristic evaluation,” International Journal of Computer Science Issues, vol. 7, 2010.

[4] N. Raza, M. U. Aftab, M. Q. Akbar, O. Ashraf, and M. Irfan, “Mobile ad-hoc networks applications and its challenges,” Communications and Network, vol. 8, 2016.

[5] D. M. Bokhari, H. S. A. Hamatta, and S. T. Siddigui, “A review of clustering algorithms as applied in MANETs,” International Journal of Advanced Research in Computer Science and Software Engineering Research, 2012.

[6] M. Chatterjee, S. K. Das, and D. Turgut, “On-demand weighted clustering algorithm (WCA) for ad hoc networks,” in Proceedings of the IEEE Global Telecommunication Conference (GLOBECOM ’00), vol. 3, pp. 1697–1701, 2000.

[7] W. Choi and M. Woo, “A distributed weighted clustering algorithm for mobile ad hoc networks,” in Proceedings of the IEEE Advanced International Conference on Telecommunications and International Conference on Internet and Web Applications and Services (AICT/ICIW ’06), February 2006.

[8] W. Bednarczyk and P. Gajewski, “An enhanced algorithm for MANET clustering based on weighted parameters,” Universal Journal of Communications and Network, vol. 1, no. 3, pp. 88– 94, 2013.
[9] V. Sucasas, A. Radwan, H. Marques, J. Rodriguez, S. Vahid, and R. Tafazolli, “Ad hoc networks: a survey on clustering techniques for cooperative wireless networks,”Ad Hoc Networks, vol. 47, pp. 53–81, 2016.

[10] M. Rath, B. K. Pattanayak, and B. BibudhenduPati, “QoS satisfaction in MANET based real time applications,” International Journal of ControlTheory and Applications, International Science Press, vol. 7, pp. 3069–3083, 2016.

[11] S. B. Rakas and V. Timcenko, “A survey on quality of service in MANET,” Infoteh-Jahorina, vol. 15, pp. 349–352, 2016.

[12] B. M. Nyambo, G. K. Janssens, and W. Lamotte, “Quality of service in mobile ad hoc networks carrying multimedia traffic,” International Journal on Information Technologies & Security, no. 2, pp. 41–68, 2014.

[13] D. Nguyen, P. Minet, T. Kunz, and L. Lamont, “On the selection of cluster heads in MANETs,” International Journal of Computer Science Issues, vol. 8, no. 2, pp. 1–12, 2011.

[14] Y. Li, F. Wang, F. Huang, and D. Yang, “A novel enhanced weighted clustering algorithm for mobile networks,” in Proceedings of the IEEE 5th International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM ’09), pp. 2801–2804, IEEE, Beijing, China, September 2009. 12 Wireless Communications and Mobile Computing

[15] A. Ziagham and M. NooriMehr, “MOSIC: mobility-aware single-hop clustering scheme for vehicular ad hoc networks on highways,” International Journal of Advanced Computer Science and Applications, vol. 7, no. 9, pp. 424–431, 2016.

[16] S. Chandra, I. Saha, P. Mitra, B. Saha, and S. Roy, “A brief overview of clustering schemes applied on mobile ad-hoc networks,” International Journal of Advanced Research in Computer Science and Software Engineering, vol. 5, pp. 667–675, 2015.

[17] K. Hussain, A. H. Abdullah, S. Iqbal, K. M. Awan, and F. Ahsan, “Efficient cluster head selection algorithm for MANET,” Journal of Computer Networks and Communications, vol. 2013, Article ID 723913, 7 pages, 2013.

[18] M. Jiang, “Cluster based routing protocol (CBRP),” draft-ietfmanet-cbrp-spec-01.txt, 1999.

[19] Dongkuan Xu1,2 · Yingjie Tian2,3 “A Comprehensive Survey of Clustering Algorithms” 40745-015-0040-1 © Springer-Verlag Berlin Heidelberg 2015

[20] Priyanka Sharma1, Inderjeet Kaur2 1 ” A Comparative Study on Energy Efficient Routing Protocols in Wireless Sensor Networks” IJCSI International Journal of Computer Science Issues, Volume 12, Issue 4, July 2015

[21] Naghma Khatoon and Amritanjali “Mobility Aware Energy Efficient Clustering for MANET: A Bio-Inspired Approach with Particle Swarm Optimization” November 2017

[22] Pankaj Palta, Mandeep Kaur,Tejpal Sharma,Ranjit Singh,Jagbir Singh “A survey on Routing Protocols in Wireless Sensor Networks” *Vol-3, Issue-5 , May- 2016]*

[23] Mihael Ankerst, Markus M. Breunig, Hans-Peter Kriegel, Jörg Sander “OPTICS: Ordering Points To Identify the Clustering Structure” Proc. ACM SIGMOD’99 Int. Conf. on Management of Data, Philadelphia PA, 1999..

[24] Mirco Nanni · Dino Pedreschi “Time-focused clustering of trajectories of moving objects” © Springer Science + Business Media, LLC 2006

[25] Chansu Yu,1,*,y Ben Lee2 and Hee Yong Youn3 “Energy efficient routing protocols for mobile ad hoc networks” Wirel. Commun. Mob. Comput. 2003