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# A State of the Art Review on Mobile Ad hoc and Wireless Sensor

**N.Ravi[1*], G. Ramachandran[2]**

[1]Department of Computer and Information Sciences, Annamalai University, Annamalainagar – 608 002, Tamil Nadu, India
[2]Department of Computer Science & Engineering, Annamalai University, Annamalainagar – 608 002, Tamil Nadu, India

[*]*Corresponding Author: csravi2017@gmai, Tel.: 04144-230776/09443666345*

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***Abstract*—** In recent days, routing and security in the Mobile Ad hoc wireless Network is becoming more popular. The increased usage of mobile phones and internet connections facilitates the need of Mobile ad hoc wireless network. As the technology grows, the security and threats are also growing in an increased rate. Further, ensuring security for these networks is big challenge. Hence, this paper focuses on the area of Mobile ad hoc network and provides a comprehensive literature on the node stability, localization and routing. Further, this paper extensively review the routing strategies carried out in Sensor and Mobile Ad hoc Network. In addition, it also gives a deep insight about the challenges involved and precisely categorizes it with a complete study. Finally, this paper concludes by leveraging the lessons learnt from this survey.

***Keywords*—** *MANET, MASNET, WSN, Cluster Head.*

## I. INTRODUCTION

Mobile Ad hoc Network (MANET) (Fig. 1) and Mobile Ad hoc Sensor Network (MASNET) (Fig. 2)are infrastructure less network which serves for various application including military, drone, photography, secure wireless transactions etc. Nodes within the network are free to move randomly in any place within the coverage range.

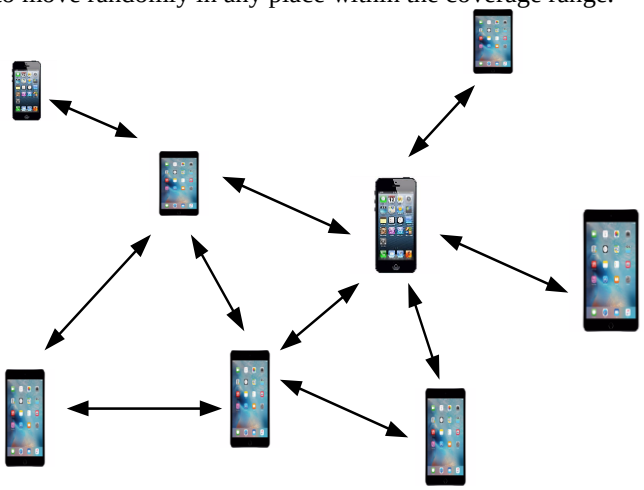

**Fig. 1 Mobile Ad hocNetwork**

Further, these types of networks are widely called as multi-hop network because it is based on intermediate hop for data communication. These networks have a wide range of applications in place where an emergency wireless communication has to be established.

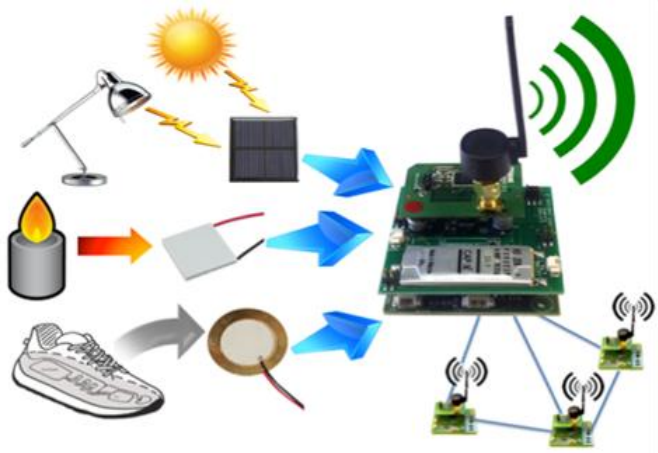

**Fig. 2 Mobile Ad hoc Sensor Network**

MANETs and MASNETs are formed as a group of nodes which performs transmission of data within itself. Further, the node communicates over a established wireless links within the transmission range. Further, important features used in these networks are hoping and multi-hop tendency to transmit and receive data over the wireless communication. These networks communicate in their own defined channel represented as multi-hopping.

Further, there is no explicit consideration carried out for these networks. This is due to the increasing dependency on more reliability in service which by default incorporates its design plan with more accurate in precision level. Hence, the

 

systems connected to these networks are considered to more reliable. Further, due to the multi-hop nature possessed by the MANETs and MASNETs the network reliability is high and the existence of reliable network connectivity is completely depends on the probability. However, this leads to uninterrupted connection and transaction with the communication in these networks. The security when considered to the other network is still prone to various attacks and it requires substantial improvement. This paper surveys the state of the art literature in MANET and MASNETs and provides deep insight focusing more on research challenges and possible solutions.

The organization of this paper is as follows. Section II deals with literature review where the state of the art technologies are discussed. Section III explores energy aware routing, node localization, multipath approach etc. The penultimate section states the lesson learnt and finally the paper is concluded with future directions towards this research.

## II. RELATED WORK

This section explores the state of the art literature review available in this area. Further, this paper focuses more on clustering based approach which is considered to be more robust in MANETs and MASNETs.

CLUSTERING BASED APPROACH

Various authors contributed in clustering based approach in order to build efficiency within the network. The following work states the recent literature available.

Tianshu Wang et al. [1] proposed an energy efficient clustering and routing approach GECR which is a genetic algorithm used to extend the network life and improve the energy efficiency. The algorithm is encoding the clustering and routing schemes together in the same genetic code, they calculated total energy consumed by all the sensor nodes globally. For the current iteration, efficiency of sensors has been improved by adding the optimal solution which has been attained in the preceding iteration to the preliminary residents. GECR algorithm has been compared to another GA-based routing and clustering algorithms such as Genetic Adaptive Routing (GAR), Gbest-guided Artificial Chemical Reaction (GACR), GALBCA, LEACH, ASLPR and the performance of GECR concerning energy consumption, network life cycle and load balancing is better than the other GA-algorithms.

J.T. Thirukrishna et al. [2] proposed Optimized Radio Energy Algorithm (OREA) to minimize the energy level through homogenous WSN as well as Power-Aware Distance Source Routing (PADSR) protocol. This protocol is used to find the path to make communication possible between the nodes. To calculate the energy degeneracy during reception and transmission in WSNs, Radio Energy Model has been used. Similarly, to provide extended life to the network, PADSR algorithm is useful.

Sarma et al. [3] proposed a reliable routing protocol and a novel energy-efficient for mobile WSNs. As energy has always been an essential concern in WSN hence it is very important to use power in effective way. In this protocol, they assumed mobility in base station and sensor nodes also. To minimize the energy requirements, concept of Cluster Head (CH) panel also has been introduced because the proposed protocol is graded and cluster-based. Each cluster consists of one CH vertex and each CH node has been enhancing by two DCH nodes. These vertices are also known as cluster management nodes. Alternative paths are used between the base station and a CH node for data transmission. Performance using this protocol has been compared with M-LEACH, and it is concluded that the proposed contract outperformed M- LEACH in the form of the lifetime and throughout improvement is 15% on average over M-LEACH.

Raghunandan. G.H [4] proposed an algorithm to increase the sensor lifetime in WSN using flexibility and dynamism execute clustering arrangement. In WSNs, for a particular requirement individual sensor are distributed in space. To control corporeal or eco-friendly circumstances, for example sound, heat, vibration, burden, and many more, radars are designed. Information has been collected from the environment and passed the received data through the network to a base station via these sensors' nodes. Lifetime of network is the most critical aspect of WSNs. As sensor has a vital component called battery which supplies sufficient energy to the actuated devices in sensors to perform. The gathered data from sensors is sent to the central vertex. As in communication processes energy is consumed hence optimal use of power is very necessary.

Since sensors are fixed in the environment depending upon application, so sensors may be scattered in a way that they may be more distant from the base station. Sensors are having more distance from base station so greater energy is being exhausted by them. Hence, positioning of the bunch head is necessary for dispensation and transport of the material. Supplementary dynamism lumps can be castoff to accomplish distinguishing in the presence of the goal. In this case, in broadcasting statistics from the bunch head to the base position much vigor is required than the relay from a radar junction to the bunch head. In this algorithm, cluster head has been chosen in such a way that well-adjusted total of the energy expenditure should be in the wireless sensor. This is the commanding feature of this technique. With the help of this technique, maintenance of energy can be done. They have fixed Gateway nodes and base station. Simulation

 

results proved the efficiency of this algorithm with the help of the Gateway nodes and Centrality based CH election.

Lin et al. [5] proposed Fan-Shaped Clustering (FSC) which is also known as a clustering protocol, used to barrier an extensive system into fan-shaped groups. A big concern in WSNs is the partial lifetime of sensor junctions. Hence, extension of lifetime is a big challenge. In extensive sensor systems it has become much critical to handle this challenge as much dynamism is expended due to more data gatherings and container broadcasting. Different saving methods like well-organized bunch head and convey choice and section of re-bunching have been proposed. These methods gave easy but healthy steering and hotspot answer. By experiments they have shown that some critical parameters such as the energy threshold for relays, CHs and the radius of the central area, are obtained in the simulation. At last, they have shown by performance analysis that energy can be saved efficiently using the proposed FSC. Concerning both strengths packet collection and rate saving, the proposed method is much improved than a fusion, energy-efficient and distributed clustering.

Gu et al. [6] proposed and analyzed a coated bunching process to retain liveliness stability of bunch heads in the system. To improve the efficiency of finite energy resource, a very common approach in WSNs is clustering. The system has been divided evenly into clusters in each layer. However, each sensor node is at different distance from base station so the usage of energy is usually unbalanced by each cluster head. The bunches heads which are closer the base station is much vulnerable to being elected as transmitted junctions to transference data. In Energy Efficient Link Clustering (EELC), based on their residual energy, the network is immovable bunched with revolving bunch heads. By simulation, EELC is compared to Random Distributed Layered Clustering protocol (RDLC) and Uniform Cost Search (UCS). Outcomes showed that this algorithm increased energy efficiency and improved network lifetime.

ENERGY AWARE APPROACH

Wanga et al. [7] proposed an algorithm known as Grid-based Energy-aware and Congestion-aware Routing (GECR) to estimate universally the whole energy expended by all radar nodes. This algorithm encodes the routing scheme and bunching arrangement composed. As per the application of WSNs, sensors have been hired broadly in several grounds, together with fitness maintenance, military agriculture, and industry and business applications. It can be shown by experimental results that the performance of GECR was better than other methods such as GAR, GACR, GALBCA, LEACH-GA, and ASLPR.

Simulation experiments indicated that in relations of freight matching, the system life sequence, and energy feasting, the presentation of their projected set of rules were recovering than that of other GA-based bunching and routing algorithms. 0.8%, 9.4%, 4%, and 19%, respectively is the usual volumes of vigor expended by the cluster heads when via GECR in the four states were, then those by the second most ideal process, although the normal totals of dynamism disbursed by all nodes. While using GECR in the four set-ups average amount of energy consumed was 28.7%, 40.6%, 27.8%, and 35.8% lesser than those by the poorest procedure. Also, with the deepest regular energy paid by the bunches cluster heads and the bottommost energy expended by all the nodes, the GECR is the most energy-efficient.

Warrier and Kumar [8] provided a survey about WSNs. They have given course-plotting procedures which is a stratified architecture. This technique has given an ephemeral introduction about energy gathering WSNs. Due to the concept of “3 any”-any person, wireless networks have been becoming popular, anywhere and anytime. Since transistor broadcast and acceptance devours huge volume of energy that’s why supremacy is a vital feature to be measured. In past decades, routing protocols have been designed in such a manner that to extend the life time of networks, energy used in communication between nodes must be minimum.

The graded construction method has been careful to be the greatest. This approach provided expandability along with extended networkgeneration. For most of the submissions, energy spare is very much luxurious. Using MATLAB, Mobile Bowl Amended Energy-Competent PEGASIS-based Direction-finding Procedure and Modified LEACH has been compared. Simulation results between two protocols MIEEPB and MODLEACH showed thatMIEEPB outperformed than MODLEACH.

NODE LOCALIZATION

Dimitrios Zorbas et al. [9] proposed an efficient localized as well as a centralized algorithm to prolong the lifetime of cluster. In conniving energy competent WSNs, due to wireless arraigning several new challenges come forward. In a wireless charging problem, tall energy incomes have been positioned in the system to boost power inhibited nodes. But due to the declining consequence of the indications, only a scarce node can give remarkable profit from the pony power announcement. In this algorithm, first they examined the utility of systematizing RF-power harvesting lumps in clusters. Then by locating a charger close to the cluster head they extended the lifetime of network. Thus, there is the requirement of optimal charger placement. After that, they compared solution from this method to other solutions in the literature. Simulation results showed the successfulness of their approach. By results they showed that there was an increase in the lifetime up to 360% on comparing with the outdated 1-hop announcement process between the nodes and the basin.

 

Sudhir Kumar [10] proposed a compartmental model-based which is based on cluster size optimization using resourceful indications in WSNs. For dissimilar instructions of the Taylor series growth in the apportioned model, the most advantageous number of clusters has been computed to minimize the energy utilization. Depending upon the respectable accessibility of the indicators in the given area of curiosity, Wi-Fi, acoustic, and perceptible light can be utilized. Disparity of unprincipled indication power with propagation detachment has been described in this apportioned model which is an attenuation model. Using second-order Taylor series expansion method, exact performance of the compartmental model has been approximated. This compartmental method has been compared to the existing models like exponential and log models. Then regarding average energy consumption, it was shown that there was an improvement of 6% and 8% in the compartmental model respectively.

As a result, on comparison with both the acoustic signals and Wi-Fi, the noticeable sunny signal was created to be 12 % more efficient. Moreover, there was an improvement in seeing up to the second order term of the Taylor series development only.

Han [11] anticipated an algorithm which is known Multiple-Hop Energy Efficient Cluster Algorithm (MHEECA). It is used to gain a finest pathway between Cluster Heads (CHs) and Base Station (BS) for figures communication. This algorithm was proposed for heterogeneous sensor networks. Lots of researchers are attracted by WSN because it has potential broad applications and individual challenges in every field of real-life. Main concern of researchers in WSNs is to develop such a routing protocol which is an energy–competent decorum and has its noteworthy impression on stability and the inclusive period of the sensor system.

Using weighted election probabilities and energy-distance of each node, they selected the most favorable energy-composed collection head signal CH. All the bumps organized themselves into a collection. First CH received the information from the member nodes. Based on Dijkstra's algorithm by assuming a multiple-hop announcement track, each CH node collected the data and transferred it to the BS. Simulation results showed MHEECA was more powerful to balance and reduce energy expenditure. Hence this algorithm is helpful in extending the lifetime of wireless sensor nodes.

Huang et al. [12] projected an energy-efficient multi-hop routing protocol, Annulus Sector Grid Routing Protocol (ASGRP) which is based on annulus sector grid gathering for WSNs. In WSNs there are great figure of sensor nodes. Sensor nodes frequently have minimal energy and are installed in the desolate setting randomly or manually. Main issue is that the batteries of the nodes cannot be re-energized or traded frequently. Therefore, there is a need to strategy energy-efficient course-plotting conventions to maximize the network generation. The proposed protocol improved the way in which clusters are created in a WSN. The annulus sector grid clustering method based on arithmetic progression has been offered to split the network zone into bands of countless magnitudes. There is no requirement of node to form clusters by broadcasting in this grid division method which diminishes the energy feasting of nodes. Keeping BS as the center argument of the rounded extent, the network area has been divided into annulus sector grids. To rally the energy effectiveness of data broadcast between the BS and CH nodes, an inter-level multi-hop routing algorithm also has been presented.

In this algorithm the Communication Management (CM) nodes have been combined with CH nodes to start routes to diffuse data. Reproduction results also showed that the lifetime of the network has been extended by 24.36–70.68% in the 200 m × 200 m network and 25.47–90.34% in the 400 m × 400 m network while compared the anticipated algorithm ASGRP with existing routing protocols like multi-hop Energy Efficient and Balanced Cluster-Based Data Aggregation Protocol (EEBCDA), Energy Aware Multi-Hop Routing Protocol (EEMRP) and Computer Aided Minimization Procedure Protocol (CAMP). Results demonstrated that the projected decorum pointedly reduced the energy ingesting of respectively smoothed. Together, this method outperforms in energy steadiness and productivity in the greater web zone also.

Debashis De et al. [13] proposed two new approaches which were based on the mechanism of bubbling and border cluster to save the energy. These approaches are also beneficial in cumulative the lifetime of WSN. In recent days, a very important consideration in WSN is the generation of sensor network. It rests on upon how much power sensor nodes are consuming. Hence, to diminish the supremacy expenditure of WSN, they proposed Sparkling Device. They introduced a notion of Limit Collection. In Border Cluster, when there was no mark in the area of interest in WSN, a more significant number of active nodes have been kept in border clusters than in inner clusters.

Also, another concept of Dual Sink was used to minimize energy utilization and to prolong the lifetime of WSN. In Dual Sink, to upsurge the productivity of data assortment a static sink and multiple mobile sank was used. By simulation results, they proved that on an average, using Bubbling Mechanism in their new approach, roughly 10.62% energy of extremely full group head was protected.

MULTI-PATH APPROACH

 

Wael Ali Hussein [14] proposed a new routing protocol for Greedy Forwarding based on Throughput Energy aware Multi-path routing protocol (GFTEM). This protocol is grounded on the choice of succeeding flight node. This protocol has the maximum presentation and is nearer to terminus node. Since, scheming of Wireless Multimedia Sensor Network (WMSN) steering procedures are restricted by typical sensor network etiquettes. In recent days, WMSN requests have been positioned speedily in many smart applications. There are always new challenges for designing routing protocols in WMSN because there are periodic changes in network applications. The main reason of this problem is that the traditional WSN routing protocols cannot be suitable. Therefore, in creating new routing protocols, researchers have been working from past decades. In this series, they developed and compared the routing protocols with the existing routing protocols, as any routing protocol is standardized using replications situation. The routine of GFTEM has been analyzed. They comparedthe proposed protocol GFTEM against Ad hocOn-demand Distance Vector routing protocol (AODV), DynamicMANET On-demand routing protocol (DYMO) and greedy perimeter stateless routing for wireless networks (GPSR) routing protocols.

In addition, the study related to the behavior of the conventions in relationships of endways suspension, packet fault amount and remaining energy, a simulator has been used. Simulation results also exhibited that on comparing with existing routing protocols DYMO, AODV, GPSR, GFTEM has better packet loss ratio, endways interruption with excellent energy efficiency. Moreover, the performance of four routing protocols; GPSR, DYMO, GFTEM and AODV was compared. Comparison showed that the proposed protocol, GFTEM had outperformed overall.

Gotefode et al. [15] designed a Fuzzy rule-based General Self-Organized Tree-Based Energy-Balance routing protocol (FGSTEB). This routing protocol was based on the GSTEB. Using this protocol, they reduced the energy consumption while routing operation. One example of this is that using the tree-based technique the data transmission from the leaf node to the base station. WSN has been considered a huge network of low-cost micro sensors, which are deployed in the environment. As all know, in designing of any sensor networks, savings of energy and improvement in the lifetime of the network is most important concern.

These are some clustering approaches as Low Energy Adaptive Clustering Hierarchy (LEACH), Hybrid Energy Efficient Disturbed Clustering (HEED), Power Efficient Gathering in Sensor Information Systems (PEGASIS), Threshold Based Classification model (TBC) and Power Efficient Data Gathering and Aggregation Protocol (PEDAP) to make energy expenditure minimum. In this protocol, they built a routing tree for data transmission by choosing the appropriate routing path. This method is capable of finding the optimal route to base station using the minimum energy. On comparing with other methods, the performance of the proposed protocol showed the improvement by 10% to 15% in energy consumption. Also, from the simulation result it is clear that the anticipated scheme is capable to growth the lifetime of the network in WSN.

**Lessons learnt**

•Nodes have the tendency to consume a lot of energy that is why one needs to save energy of node. As it is not possible to recharge or to change the batteries in wireless networks very frequently hence to solve these problems, the energy efficient routing is used.

•The broadcast choices of bulges are reformed shortly.

•Due to restricted use of energy stock, stowing skill, and measurement power, sensor node has limited capacity.

•Cultivating the search effectiveness, for the current round they added the optimal solution, which has been attained in the earlier grid to the preliminary people.

•Additionally, to calculate the total expenditure in improving the energy efficiency, they combined routing and clustering scheme. In addition to the statistics from the CHs, CHs transmit the data from the previous hop nodes in cluster-based WSNs.

•Moreover, in constructing the fitness function, load balancing has been considered so that the energy ingesting midst the lumps can be well adjusted.

•Further, security loopholes also play a major role [16-17].

## III. CONCLUSION AND FUTURE SCOPE

This paper concludes by discussing various state of the art literature available in Mobile Adhoc wireless network. From this review, it is observed that the existing methods available as the present day solutions are lacking and possess various functional disadvantages in stability, node failure, energy utilization etc. This makes the entire network to fail and degrade the performance completely. The main part of Mobile Adhoc wireless network, which involve the research challenges such as control overhead within the cluster, cluster construction and load distribution, is not addressed. Furthermore, this paper expose the real challenge in the network and clearly gives an insight about to the researchers by explicitly stating the core area of challenges.

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## Authors Profile

***Mr.N.Ravi*** pursed Bachelor of Science from University of Madras University,Chennai in 1995 and Master of Computer Applications from Bharathidasan University in year 2000. He is currently pursuing Ph.D. and currently working as Assistant Professor & Head in PG Department of Computer Sciences, Department of Computer Science and Applications, Govt.Arts College,Chidambaram,Tamilnadu,India since 2007 He has published more than 5 research papers in reputed international journals and conferences including IEEE and it's also available online. His main research work focuses on MANET,Network Security. He has 18+ years of teaching experience and 3 years of Research Experience.

***Dr G.Ramachandran*** pursed Bachelor of Engineering in Computer Science and Engineering from Annamalai University in the year 1997, Master of Engineering in Computer Science and Engineering from Annamalai University in the year 2005. He completed his Ph.D in the year 2014 and currently working as Assistant Professor in Department of Computer Science and Engineering, Annamalai University, Chidambaram Tamil Nadu India since 2000. He is a life member of ISTE & Computer Society of India since 2002, a life member of the IE(I) since 2018 . He has published more than 20 research papers in reputed international journals including Thomson Reuters (SCI & Web of Science) and conferences including IEEE and it's also available online. His main research work focuses on Peer to Peer Networks, MANET, IoT and Cloud Conputing. He has 18 years of teaching experience and 4 years of Research Experience.

 