Energy Efficient Protocol On Wireless Sensor Network : A Review

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ABSTRACT

In this modren era the energy based routing protocols are studied with the help of different algorithms. In this work Cluster-based routing is a solution to address node heterogeneity, and to limit the amount of routing information that propagates inside the network . The idea behind clustering is to group the network nodes into a number of overlapping clusters. Clustering makes possible a hierarchical routing in which paths are recorded between clusters instead of between nodes. There are different problems like data duplication and data redundancy problem. Another problem is the network life time problem due to the redundancy. During the transmission energy is lossed, so there is energy consumption problem. These problems are resolved in future with the help of energy routing protocols.
Keywords: WSN, WLAN, CH, Energy, Routing

I. INTRODUCTION

A wireless network is any type of computer network that uses wireless data connections for connecting network nodes. Wireless networking is a method by which homes, telecommunications networks and enterprise (business) installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. [1] Wireless telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level (layer) of the OSI model network structure.[2]Examples of wireless networks include cell phone networks, Wi-Fi local networks and terrestrial microwave networks.

II. METHODS AND MATERIAL

1. Types of Wireless Networks
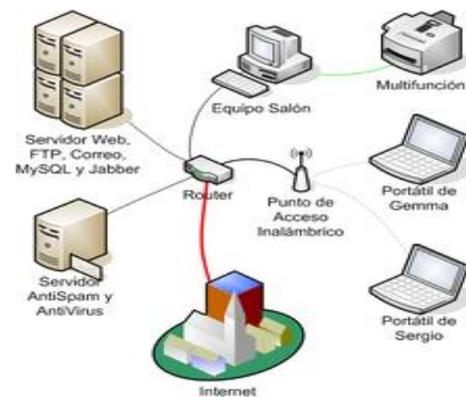
- Wireless PAN
- Wireless LAN
- Wireless WAN

Figure 1. Wireless LAN [5]

A sensor network is an integrated circuit of sensor, embedded compute, modern network, wireless communication and distributed information process. Wireless sensor network is a new information acquiring and processing technology which yields by the recent advances in miniaturization and low power design that led to the development of small-sized battery functioned sensors that are capable of detecting ambient conditions such as temperature and sound [2]. In order to communicate for a very long distance they must create an organization structure amongst these nodes. Since the fundamental advantage of wireless sensor networks is the ability to deploy them in an ad hoc manner, as it is not feasible to organize these nodes into groups pre-deployment. For this reason, there has been a large amount of research into ways of creating these organizational structures [2].
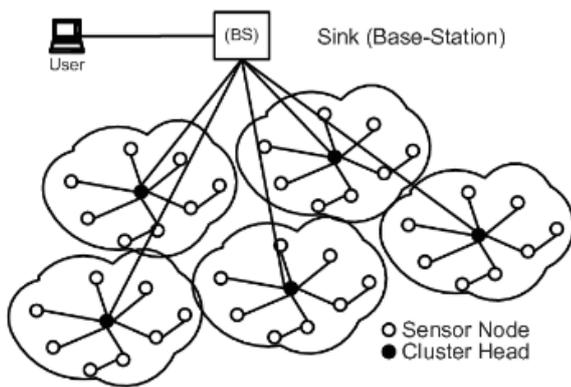
Figure 2. General Architecture of sensor network [6]

Figure 3. Transmission range zones [6]

Figure 2 shows the general architecture of sensor network. The basic parameters of the sensor networks are Sensor Node, Cluster, Cluster head, Base Station and user, in the hierarchical architecture of the group the base station is at the upper level which provides communication link between the user and the clusters. The data in the sensor network are gathered for providing the answers for the queries raised by the user [1]. An essential part of developing WSNs is being energy aware by reducing the power consumption because of the power limitation. There are many possible solutions in order to reduce the power consumption of the wireless sensor nodes such as enhance the storage systems energy density, improve a technique to distribute the power among the nodes, and produce a mechanism to make the nodes scavenge their own power [6]. The clustering algorithms play an important role in not just organizing the network but also control the performance of the network organization. There are several key limitations in wireless sensor networks, that clustering schemes must consider are Energy, Lifetime of Network , Application, Accuracy, Receiver Sensitivity, Type of transmitting signal , Distance ,response time, cluster stability, cluster overlapping, location awareness, QoS support and node mobility.[1]
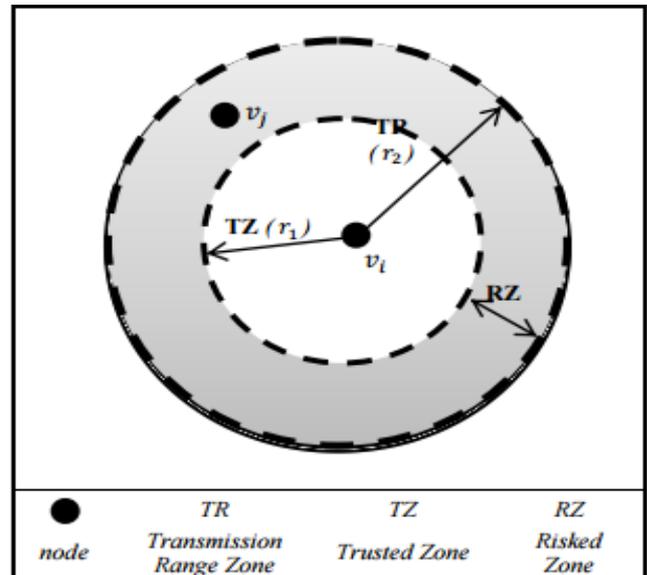
Ad hoc network offers much excellent technology over the traditional cellular network. Flexibility and fast deployment without any infrastructure are the main advantage of an ad hoc network. All nodes in network can be used as relay, for end to end radio transmission using the multi-hop concept. Ad hoc network are wireless, multi-hop, and dynamic network established by a collection of mobile nodes [3].

The concept of clustering is division of the network into different virtual groups, based on rules in order to discriminate the nodes into different sub network. Its goal achieves scalability in presence of large network and high mobility. Various properties of clustering are geographical allocated, balance resource use and service localization. Classification of clustering is followings

- DS-based clustering
- Mobility aware clustering
- Energy efficient clustering
- Load balanced clustering
- Combined metric clustering
- Low maintenance clustering

DS-based clustering a basically dominant set in graph is a subset , in which nodes are assume at the beginning a cluster head role and connected cluster can be merged. DS includes dominating sets and non-dominating sets or nodes. The nodes are connected to cluster head is called dominating set and otherwise it's called non dominating sets or nodes.

Mobility aware clustering: Cluster nodes and cluster head are similar moving pattern together in term direction and speed. Every mobile nodes in a cluster has a path to every other node that will be available for some time period with a probability. These consideration are taken into account.

Energy efficient clustering technique balanced the energy consumption on nodes by moving the cluster head. It achieved limit the time a node act as cluster head using time counter and limit the size of dominating set.

Load balanced clustering limit the minimum and maximum number of cluster in graph. Cluster members and cluster head are periodically broadcast of clustering information. Each cluster head are optimal number of nodes.

Combined metric clustering uses multiple metrics to elect a cluster head. Weighted clustering algorithm is example of combined metric clustering. Its parameters are degree difference, distance to neighbor nodes, average moving speed and cluster head serving time. Cluster heads local areas are minimum for combined weighting factor, where the sum of weighting factor is 1.

Low maintenance clustering reduces the re-affiliation and re-clustering effect. This type of clustering increase the tolerance to topology changes. Least cluster change, 3-hop between adjacent cluster and passive clustering are example of low maintenance clustering.

Recently, many protocols have been introduced to enhance the traffic fluency over the road network [6], [4], [5]. These protocols aim at utilizing the available resources (i.e., road, time, fuel, etc.) efficiently on downtown and highway road scenarios. They intend to control the traffic congestion over the road networks by recommending the optimal path for each traveling vehicle or by intelligently schedule the phases of each located traffic light. First, traffic evaluation and congestion detection protocols mainly evaluate the traffic characteristics over the road network and detect the highly congested area. These protocols present a facility layer for the real-time traffic efficiency applications.

2. Adversary Threats Of Traffic Efficiency Protocols

Some traveling vehicles try to deceive their surrounding vehicles and RSUs by generating fake traffic evaluation reports and producing false congested area alerts. They mean to encourage other drivers to avoid going through the same path that they are traveling. In that case, these malicious drivers enjoy lighter traffic and faster trips. Moreover, malicious and selfish drivers may deliver fake traffic report to the located traffic lights to eliminate the queuing delay at the signalized road intersections and smoothly pass the intersection. Some malicious attackers seek only to decrease the network functionality without the intent of personal gain, so they broadcast fake and misleading reports all over the communication network. In addition, some intruder and criminal drivers aim at stalking other drivers and retrieve their locations and targeted destinations over the road network. In the following, we discuss the possible attacks and the adversary threats on congestion control protocols. 1) Sybil Attacks: Some vehicles broadcast beacon messages with different identities and locations over a certain road segment. 2) Forgery: Some attackers alter the reading of the sensors within their own nodes. They broadcast a periodic beacon with fake data of the vehicle including its position, speed and direction. On the other hand, some vehicles that are used as router to forward messages between adjacent hops over the network can alter and compromise the forwarded data or initiate a fake report. 3) Masquerading: Some attackers claim the identity of another vehicle or RSU over the network. These attackers aim at utilizing some facilities and functionalities illegally. This can be achieved by spoofing the identity of other nodes or replaying some legal packets; that have been sent previously. Masquerading can cause a serious danger situation, for example, in the case that criminal driver pretends to be a traffic light node it can easily create a severe accident at the road intersection by informing two conflicted flows of traffic to pass the intersection simultaneously. 4) Non-repudiation: Some attackers can deny sending and/or receiving a certain packet. The authorized agencies will therefore not be able to determine the identity of the sender. In this case the senders can send a damage data without being asked to take responsibility of sending such a data. 5) Denial of Service: In this case, attackers overload the communication channel or make its utilization difficult. It could be performed by

compromising a number of fake RSUs, or by making a vehicle broadcast large number of messages in a short period of time.
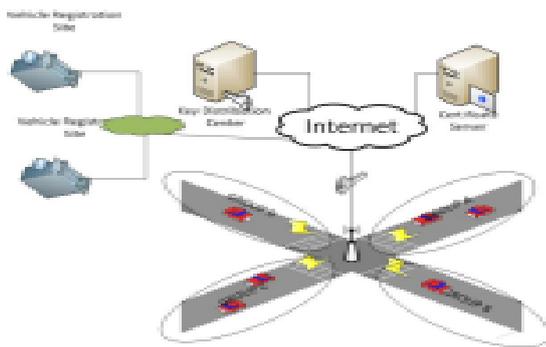

Fig.4: SCOOL Authentication Scenario [9]

3. Literature Survey

A brief literature review is needed in order to understand work done by various scholars in this field. As existence of shadows may cause serious problems while segmenting and tracking objects: shadows can cause object merging. For this reason, shadow detection is applied to locate the shadow regions and distinguish shadows from foreground objects.

Wei Xiang et al.[2016] have studied Recent significant research on wireless sensor networks (WSNs) has led to the widespread adoption of software defined wireless sensor networks (SDWSNs), which can be reconfigured even after deployment. In this paper, we propose an energy-efficient routing algorithm for SDWSNs. In this algorithm, to make the network to be functional, control nodes are selected to assign different tasks dynamically. The selection of control nodes is formulated as an NP-hard problem, taking into consideration of the residual energy of the nodes and the transmission distance. To tackle the NP-hard problem, an efficient particle swarm optimization (PSO) algorithm is proposed. Simulation results show that the proposed algorithm performs well over other comparative algorithms under various scenarios[15].

Lynda Mokdad et.al.[2015] have told the development of wireless communications in the two last decades, new infrastructures had been developed. One of them was the Vehicular Ad hoc Networks (VANETs). They were considered as ad hoc networks with the particularity that the topology is always changed, that make more complicated the resource management and open some beaches in security. Specifically on the

Physical and MAC layers that are more vulnerable as they are built on distributed systems and a fluctuating radio channel. Thus, In this study, they proposed a new algorithm DJAVAN (solution of Detecting Jamming Attacks in Vehicle Ad Hoc Networks) to detect a jamming attack in VANETs using the Packet Delivery Ratio (PDR) and with the performance analysis, we determine the threshold that can make the difference between an attack and a poor radio link.[1]

Baljinder Singh et.al. [2015] have proposed A MANET is a collection of nodes that do not rely on a predefined infrastructure to keep the network connected Wireless sensor networks was being used in many applications like health monitoring, military purposes, and home automation. These networks were equipped with large number of sensors, which are spatially distributed. Wireless sensor networks are widely used in remote areas, defense and military scenarios. Hence, their security is critical issue. They was more vulnerable to attacks than wired networks. Wireless sensor networks suffer from various active and passive attacks. This paper reviews security issues on Ad-hoc network and Ad hoc On-Demand Distance Vector (AODV) protocol.[4]

Sofiah.W.I., et.al (2014) have proposed Wireless sensor network and its applications are interesting research that have been focused recently. head are the important entities of the algorithm for receiving and transmitting data to the base station. The contribution of is mainly on the selection of a secondary cluster head and the routing protocol which the data transmission will involve the nearest cluster head for both tier one and tier two. Due to multi-tier clustering in sensor network, the operations of the sensor network will eventually increase the lifetime of the network compared to LEACH and SEP protocols.[6]

Grover.A., et.al (2014) have told about energy models to cluster based energy efficient routing in Wireless sensor networks (WSNs). In wireless sensor networks, nodes execute on confined force batteries that brings about reducing its lifetime, henceforth WSNs are viewed as a force devouring plans. As the wireless sensor nodes are greatly energy based, the energy efficient routing protocols are necessary with the aim of balancing and reducing energy consumption over the whole network. multi-tier multi-hop clustering scheme to reduce the energy consumption of wireless sensor

network in which, multipath-AODV routing protocol is used to route the data from source to destination. In the demonstration of simulation results, as compare to LEACH the proposed algorithm provides higher performance and longer network lifetime.[7]

Tripathi.A., et.al (2014) have studied Wireless sensor networks (WSNs) consist of sensor nodes. These networks have huge application in habitat monitoring, disaster management, security and military, etc. Wireless sensor nodes are very small in size and have limited processing capability and very low battery power. This restriction of low battery power makes the sensor network prone to failure. Data aggregation is a very crucial technique in WSNs. Data aggregation helps in reducing the energy consumption by eliminating redundancy. This work focuses on summarizing various approaches used for the purpose of data aggregation and its various energy-efficient uses in WSN.[8]

Dawood.M.Sheik., et.al (2012)have proposed use of wireless sensor networks has increased to monitor the disaster management, surveillance and industrial automation. For such applications the sensors have to be grouped together to deploy in large numbers and to operate autonomously in the network. In this analysis of the present-day classification and general grouping of published clustering schemes. The surveys different clustering algorithms for WSNs; give emphasis to their purposes, characteristics, importance, complexity, etc. We also analyses these clustering algorithms based on metrics such as energy efficiency, cluster stability, location awareness, node mobility and QoS support.[9]

Yuea.Jun., et.al (2012) have studied a wireless sensor networks, a clustering scheme is helpful in reducing the energy consumption by aggregating data at intermediate sensors. This paper discusses the important issue of energy optimization in hierarchically-clustered wireless sensor networks to minimize the total energy consumption required to collect data. This algorithm is theoretically analyzed in terms of time complexity. Simulation results are provided to show that, the theoretically calculated energy consumption by the new model matches very well with the simulation results, and the energy consumption is indeed minimized at the optimal number of tiers in the multi-tier clustered wireless sensor networks.[10]

Tharini,C., et.al (2011) proposed a Wireless Sensor Networks have a wide range of applications including environmental monitoring. These networks consist of wireless sensor nodes which are densely deployed to provide a wider coverage area. The dense deployment of the sensor node provides spatial correlation in the network. In this paper an efficient data gathering approach is implemented by combining the dual prediction and clustering algorithm. Clustering algorithm based on spatial correlation is used to cluster the sensor nodes. Then within the cluster, the nodes send their data to the sink using the Normalized Least Mean Square dual prediction algorithm. Simulation results show that the proposed algorithm reduces the average energy consumption of the network.[11]

Rahmani.N., et.al (2010) told the energy constraint is one of the most important restrictions in wireless sensor networks so the issue of energy balancing is essential for prolonging the network lifetime. In this work we propose the new clustering algorithm based on two-tier network topology namely CAT. The cluster head selection algorithm in CAT is done in two stages. So there will be two cluster head in a cluster. This algorithm selects a best sensor node as a cluster head in two phases by different methods. Simulation Results show that the CAT prolongs the network lifetime about 45% and 19% compared to the LEACH and HEED, respectively.[12]

Annoa, J. et.al. (2008) have studied a Sensor networks supported by recent technological advances in low power wireless communications along with silicon integration of various functionalities are emerging as a critically important computer class that enable novel and low cost applications. In this paper, in order to deal with this problem, we propose two fuzzy-based systems for cluster head selection in sensor networks. We call these systems: FCHS System1 and FCHS System2. We evaluate the proposed systems by simulations and have shown that FCHS System2 make a good selection of the cluster head compared with FCHS System1 and another previous system.[13]

Dehni.L., et.al (2006) proposed the use of the wireless sensor networks (WSNs) should be increasing in different fields. However, the sensor's size is an important limitation in term of energetic autonomy, and thus of lifetime because battery must be very small. This is the reason why, today, research mainly carries on the

energy management in the WSNs, taking into account communications, essentially. In this context, we compare different clustering methods used in the WSNs, particularly EECS, with an adaptive routing algorithm that we named LEA2C. This algorithm is based on topological self-organizing maps. We obtain important gains in term of energy and thus of network lifetime.[14]

III. RESULTS AND DISCUSSION

1. Problem Definition

From the above study of review of literature I have studied the different problems that are as follows:

- There is data duplication and data redundancy problem.
- Another problem is the network life time problem due to the redundancy.
- During the transmission energy is lossed, so there is energy consumption problem.
- There is NP-hard scheduling problem that I have seen in the literature survey.
- Another problem is the more bandwidth and less network life time problem.

2. Methodology

This section defining the way of implementation that is to done in this research work. The basic function of opportunist routing (OR) is its ability to overhear the transmitted packet and to coordinate among relaying nodes. In OR, a candidate set is a potential group of nodes that is selected as the next-hop forwarders. Hence, each node in OR can use different potential paths to send packets toward the destination. Any of the candidates of a node that have received the transmitted packet may forward it. The decision of choosing the next forwarder is made by coordination between candidates that have successfully received the transmitted packet.

In this work WCA is designed with the help of Network Simulator. Since we assume that all nodes are identical and produce data at the same rate, to balance load in the system we have to balance the number of nodes in a cluster and the communication energy required per cluster head.

The node degree of a node v_i is deduced as the cardinality of the set $N(v_i)$:

$$deg(v_i) = |N(v_i)| \tag{4.1}$$

Based on the previous equations, we set our stability factor for each node v_i as:

$$STF(v_i) = virD(v_i)/deg(v_i) \tag{4.2}$$

We propose to calculate the relative dissemination degree. This parameter reflects the relative deviation of the number of neighbors in a current setting from that ideal.

$$\beta(v_i) = \frac{|\delta - deg(v_i)|}{deg(v_i)} \tag{4.3}$$

It is known that more power is required to communicate to a larger distance. Therefore, we are motivated to evaluate the energy consumption. For this purpose, for every node v_i, we compute the sum of the distances $D(v_i)$, with its neighbors, as:

$$D(v_i) = \sum_{j=1}^{n} dis(v_i, v_j) \tag{4.4}$$

The cluster head selection process is composed of the following steps:

1. Find the neighbors (degree) of each node using (4.1).
2. For each node, calculate the stability factor using (4.2).
3. For each node, calculate the relative dissemination degree using (4.3).
4. Evaluate the energy consumption using (4.4).
5. Calculate the remaining battery energy of each node (RBE(vi))
6. Calculate the combined weight W(vi) for each for each

Node vi: $W_{vi} = D(Vi)*0.2 + \beta(Vi)*0.5 + STF*0.1 + Mv*0.2$

7. Select the node not situated on the border and having the minimum weight Wvi as a cluster head.
8. Delete node vi and all itsN(vi) from G.
9. Repeat the 7th and 8th steps until G is empty. Awaiting Factor =1

IV. CONCLUSION

In wireless sensor networks, a clustering scheme is helpful in reducing the energy consumption by aggregating data at intermediate sensors. This paper discusses the important issue of energy optimization in hierarchically-clustered wireless sensor networks to minimize the total energy consumption required to

collect data. In the future the different researcher's problems are implemented with the help of different energy routing protocols.

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