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AN EFFICIENT DYNAMIC MOBILE SINK ROUTING FOR WIRELSS SENSOR NETWORKS

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Abstract

Mobile sinks play a great role in many Wireless Sensor Network applications for efficient data accumulation, localized sensor reprogramming and for collecting data from various sensor nodes across the globe. However, in sensor networks that make use of the existing three tier security framework, elevates a new security challenge i.e an attacker can easily create a replicated node and can gain control of the data in the network. Although the three-tier security framework is more resilient to mobile sink replication attacks, it is weak against access point replication attacks. To reduce the damage caused by access node replication attack, strengthening the authentication mechanism between the sensors and access nodes is vital. To achieve this problems many approaches like mobile sink protocol and some other strategies were developed to transfer data through mobile sink mechanisms. These approaches solved only the data transfer problem but fail in solving efficient energy consumption while routing. In this survey we analyzed how to save the energy of the each cluster nodes by selecting Multi Mobile Sink nodes (MME) in WSN. Mobile Sink is one which has a long-lasting life for transfer data to the destination in WSN. For this approach this survey shows the various researchers issues and their benefits.

Keywords: WSN, Multi Mobile Sink, Cluster node, Data transfer and Energy conservation.

I.INTRODUCITON

With the improvement level of advancement technologies in Wireless network, it has to provide it in an effective data transfer mechanism to the user. A network has allowed the rapid development for wireless communications. Wireless Sensor Networks (WSNs) embrace enormous amounts of sensor nodes which make up the networks for monitoring the region of process and feed data about the targets or result of importance back to the end-users. WSN usually contains small, inexpensive and resource limited devices to communicate with each other. WSNs can be commonly used to achieve military tracking and surveillance, dangerous environment exploration, natural disaster release and health monitoring, *etc.* The output of the WSN is reliant on the relationship between the upper bound on the data collected and the number of members belonging to each sub sinks or sub nodes [1].

To exchanging the data, networks have to provide a better node for transferring the data between the nodes. Here better node can have an effective one to providing a service between the nodes. Here this is one of the worst factors. For transferring the data in cluster nodes, any one of the nodes have an efficient energy to transfer the data. Reducing energy consumption in WSN communications has involved increasing alertness recently. They were many techniques like distributed data networks (i.e. antennas), heterogeneous network, multi-hop networks, etc. were developed for this issue. But some techniques provide superior result at the same time it failed in energy consumption for multiple data transfers. Recently, sink mobility has become an important research topic in WSN for energy conservation [1, 2]. The Mobile sink trajectory is random to gather information of significance sensed by the sensor nodes. Collecting effective data by consuming less energy can improve the network performance. And also fixed path node can progress the energy efficiency of single-hop but not in multi-hop and limited paths may cause communication problem to transfer the data. Energy consumption is one of the important factors in mobile sink nodes. In general, energy consumption consists of sensing, processing and transmitting the data. For transferring data we consider the energy consumption only at the communication process, because transmitting of message can take more energy than processing the message. For transferring the data an unbalanced energy problem may occurs due to reducing battery power and also some of initial energy unused. By using WSN, can share the data among sensor-to-sink paths, so they have heavier message transmit

loads and also it consume more energy. The use of mobile sink protocols may provide better energy efficient data transferring mechanisms for WSN. For these issues this survey shows various energy efficient algorithms benefits and their drawbacks [2].

Recent advances in wireless communication technologies and the manufacture of inexpensive wireless devices have led to the introduction of low-power wireless sensor networks. Due to their ease of deployment and the multi functionality of the sensor nodes, wireless sensor networks have been utilized for a variety of applications such as healthcare, target tracking, and environment monitoring [1]. The main responsibility of the sensor nodes in each application is to sense the target area and transmit their collected information to the sink node for further operations. Resource limitations of the sensor nodes and unreliability of low-power wireless links [2], in combination with various performance demands of different applications impose many challenges in designing efficient communication protocols for wireless sensor networks [3]. Meanwhile, designing suitable routing protocols to fulfill different performance demands of various applications is considered as an important issue in wireless sensor networking. In this context, researchers have proposed numerous routing protocols to improve performance demands of different applications through the network layer of wireless sensor networks protocol stack [4, 5].

II. LITERATURE REVIEW

In WSN, data gathering causes more energy consumption. Several ideas where introduced for energy conservation approaches in the wireless sensor networks. Some approaches have benefited for conserving the energy in the single-hop network, but network have to provide benefits to multi-hop networks also. The aim of this survey is to provide a comprehensive study of various researchers' approaches and their limitations for solving efficient energy conservation problems.

Xing, Guoliang, et al [3] analysis the problem of data are delivered to the base station before their deadline, hence Mobile Elements (ME) can't sense the data for transfer of the data to the Rendezvous Point (RP) i.e. next nodes and communication problem may arise. The Mobile Elements progress may experience interrupted due to mechanic problems of motion nodes. Furthermore network may endure from communication delays due to congestion or node/link failures. As a result, data may miss its deadline, or the ME and data may miss each other at RPs.

For these analyzing issues Xing, Guoliang, et al proposed a Rendezvous based approach for exploiting ME to collect the data under secular constrains. Here researchers were present two algorithms which is RP-CP and RP-UG is developed for analyzing constrained and not constrained path for data transmissions for mobile element and the Rendezvous Points. These algorithms were used to facilitate the reliable data transfer from RP to ME were this approach is used to find a set of RP that buffer data from sources and transfer them to MEs when they arrive. By this approach their simulation results shows the reduce energy consumption and well scaled network density and speedup the networks.

S.Sujitha and G.Mohan [4] studied the problem of inefficient communication, reducing the network lifetime, etc because of weighted rendezvous planning (WRP) algorithm. It achieve only for single mobile sink data transfer mechanism and it does not concentrate on multi mobile sink mechanism so they where problem may occur for the energy conservation mechanism and losses of energy due to without sharing of mobile host hence WSN are not frequently visited at any networks. And also if any interference detected in the node then it should not alternate the channel. Then losses of packet or data may occur. This problem leads to falling network lifetime, ineffective communications, etc.

For this problem S.Sujitha and G.Mohan proposed an efficient Multi-sink clustering based weighted rendezvous planning method (EE-MSCWRP), which is used to perform the multiple mobile sink nodes. It is used to consumption of energy under different networks. So we can easily consume the energy in this application. For this multi sink the coordination of the multiple users should be acclimate to make connect to every nodes in various time slots. By this approach they were used to perform this operation in different methods to soling this problem, i.e. *Node Selection Mechanism*, used to select the longtime life node for transferring the data through cluster nodes. H.W. Rabiner et al [5] studied the problem of energy conservations in Wireless Sensor Network, this sensor network contain more data to transfer to an end user. By transmitting the data through a network they occur many problems like high energy conservation, loss of data occurred because of falling battery power problem, etc. so transfer of data may not possible under these issues.

H.W. Rabiner et al studied various approaches and proposed a classic clustering algorithm based on Low- Energy Adaptive Clustering Hierarchy (LEACH) for WSNs. It is a cluster-based protocol used for randomized rotation of local cluster heads to uniformly share the energy load between the sensors in the network. By using this LEACH, it reduces the communication energy for transmitting the data. Hence it has prolonged

lifetime network and static clustering algorithms. By using this static clustering, where data are collected from parallel areas or nodes and transfer it into sink nodes, then it share the task among the nodes to reduce the overload of a single nodes in WSN. On the other hand H.W. Rabiner et al approach have some drawbacks; here no guarantee about the total no. of cluster head nodes, if one cluster node fails means other nodes are unable to transfer the data to the next nodes and this approach is not suitable for multi-hop networks.

Rahmaan K and Narendran M [6] analyze the problem of WSN collusion problem due to the concurrent transmission of data from rendezvous node (RN). By collusion in network they were delay of transferring the data occurred. And some of data were disrupt in WSN transmission. Because of disruption some of the data may eliminate. They were losses of data occurred due to occurrence of disruption problem. And also in some case RN work out of energy hence battery power became low due to fighting with these problems.

For this above issue Rahmaan K and Narendran M proposed a MobiCluster (MC) algorithm to maximizing the connectivity for effective data transfer and enabling the network with less conservation of energy. Here data are collected from all sensor nodes for limitation of energy conservations through MC. This approach is addressed by utilizing the Mobile Sinks to collect the data from remote sensor area and extend the lifetime of RN which lie within the cluster nodes and deliver the data to the designation node. This solves the energy conservation problem, reduces communication costs and preventing the data losses.

Chen, Yuequan et al [7], studied the prolonging lifetime problem of with the increasing no .of data transfer in networks. To discovering the topology and maintaining the cluster head and switching the path are the most important one in networks. If the data are send in the primary path can dissipated at any time because it consume more energy, and if it want to re-select the path is difficult one to choose the alternative path. This can increases the energy consumption problems.

Due to this issues Chen, Yuequan et al proposed a MRMS (Multipath Routing in large scale sensor networks with Multiple Sink nodes) which is used for multiple sink nodes. It is only used for dynamic path method of selection for improving the energy efficiency problem. It distributes the energy in sensor networks to keep the energy of the nodes to improve the performance of data transfer mechanisms. By distributing the energy through node in the cluster every node have the lifetime energy by this approaches. But it failed in multipath mechanism for multi sink nodes.

III. WIRELESS SENSOR NETWORKS

A Wireless Sensor Networks is built of ”nodes” from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a micro controller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoe box down to the size of a grain of dust, although functioning ”motes” of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. Security is important for many sensor network applications. Wireless sensor networks (WSN) are often deployed in hostile environments, where an adversary can physically capture some of the nodes. Once a node is captured, adversary collects all the credentials like keys and identity etc. The attacker can re program it and replicate the node in order to eaves drop the transmitted messages or compromise the functionality of the network. Identity theft leads to two types attack: clone and Sybil. In particularly a harmful attack against sensor networks where one or more node(s) illegitimately claims an identity as replicas is known as the Node Replication attack. The replication attack can be exceedingly injurious to many important functions of the sensor network such as routing, resource allocation, miss-behaviour detection, etc. This paper analyses the threat posed by the replication attack, several novel techniques to detect and defend against the replication attack, and analyses their effectiveness. Wireless sensor networks are used in many applications, in sensing the environmental conditions and transmitting it over longer distances to the base stations. When the base station is far away from the sensing field (where sensors are fixed), the data is sent by a multi-hop. As the data is passing through multiple hops, an intruder can easily cause the attack at any stage in the network.

3.1 TOOL COMMAND LANGUAGE Tcl is a Tool Command Language in which everything is represented as a string, although the internal interpretation may be of any kind. The command set is used for assingnment in tcl. In puts statement the argument must be preceeded with the $ sign , for

procedures args can be passed as both values and names. E.g. Set a 10

3.2 NETWORK ANIMATOR Network Animator(NAM) is a tool used for network simulation traces, supports topology layout and packet level animation. Provides integrated network monitoring within the switch. Collects the network traffic statistics for real time traffic analysis, performance monitoring and trouble shooting. NS with NAM is an efficient tool for dealing the networking concepts. All the routing protocols are in NS and these protocols can be very easily visualized with the NAM. NAM Graphical editor is a latest addition to the NAM, with this there is no need to create a tcl script separately to show the animation. We can make our own network topology, simulate the traffic sources.

3.3 NETWORK SIMULATOR Network Simulator(NS) is a simulator used for research in networks. It supports for simulating Transmission Control Protocol(TCP), routing and multicast protocols over wired and wireless networks. Software used to predict the characteristics of large scale complex network systems. Discrete event simulator uses C++ with oTcl interpreter shell (user interface) which allows the i/p model files to get executed. Almost all network elements are developed as classes. It supports a class hierarchy in C++, very similar class hierarchy in oTcl. The root of this class hierarchy is Tcl Object. User tend to create a new simulation objects through the oTcl interpreter and these objects get mirrored by corresponding objects in the class hierarchy in C++.

3.4 SPECIFICATIONS OF WIRELESS SENSOR NETWORKS

3.4.1 Access Points These are the intermediaries in data transfer. Some of the mobile sinks acts as intermediates. They share keys from both the key pools (static and mobile key pool). Keys from the static key pool facilitates the data transfer between the sensor nodes and them, while the keys from mobile key pool provides authentication for the data transfer between them and the mobile sinks.

3.4.2 Mobile Sinks Mobile sinks informs the sensor nodes about their location updates, frequent changes in the locations of the mobile sinks causes the sensor nodes to collide in the network. Instead of transferring the information to the entire network at each time, the sinks broadcast the update to the local LAN.

3.4.3 Key and Key Pools In order to maintain security, it is very important to encrypt the messages sent among the nodes, so keys must be mutually agreed by the communicating nodes. Establishing the keys for the wireless nodes is a challenging task. Key agreement schemes such as Diffie-Hellman and public key schemes are not suitable for wireless sensor networks. Key pre distribution depends upon the size of the key pool, and the maximum size of the key pool that can be used by the scheme would be s2p, where s is the size of the key pool and p is the probability that two nodes share a common key. Key pre distribution is also not possible since it consumes large amount of memory when the network size is large. So instead of assigning key prior to the data transmission, a scheme is proposed to assign keys randomly [2].

IV. ACHIEVING ENERGY CONSERVATION IN MULTIPLE MOBILE SINK

WSN is one of the important one to transfer the data with the large number of sensor nodes deploy in a field. In single-hop, transfers of data are done only for small area with the limited number of nodes. But in multi-hop, transfer is risky because nodes that are near to each other so they become congested and it have the responsible for transferring the data to the end user [8, 9]. For this congested problem energy may reduce due to the congestion of the data. Reducing energy consumption and preventing the data from congested one and forward it to the end user is one of the major issues through Rendezvous Point (RP) in Multi Mobile Sink Mechanisms (MMSM). To solve energy consumption problem, network have to select the better cluster head to transfer the data by sharing the energy between the nodes, and network provide a better communication between the cluster nodes and also select the long lasting battery for mobility nodes to transfer data among RP.

a. Cluster communication

Cluster communication is one of the important one among the cluster nodes. It groups the reliability for end to end nodes for message transferring and multi connection between the mobile sink (paths) [10]. Here the communication is the process of transferring the data among the nodes. Each and every node in the cluster will act as a both sender and receiver for transferring the data. In network, one node transfer the data to another node means that node is the responsible one to transfer that data to the end node. Transferring of data among the cluster network is the cluster communication [4]. Through this cluster communication the data are travelled among the node so energy of every node will be prevent by sharing the energy between the cluster networks.

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b. Cluster head selection

Through cluster communication selection of cluster head among the cluster nodes can solve better energy consumption problem. In WSN they were n no of nodes were connected to boost the efficiency and throughput of the communication [4, 6]. Each and every node in the network is ready to transfer the data at any point of movement. Transferring of data was done through cluster nodes. In existing the transfer of data are done only in one node i.e. distribution of data were done through a single intermediate node, so they were collusion problem, energy loss were occurred and losses of data also occurred. To avoid this problem data can transfer at any node through network can solve this collusion and energy loss problem. Transfers of the data are done through selection of node in a network and choose the cluster head which have the long lasting life to transfer the data. Cluster head selection should be based on node density, bandwidth of the node, long-lasting energy, communication cost and so on. The network lifetime should be evaluated by the mobile nodes. The cluster of nodes should be elects the cluster head and the cluster head maintains the Report about the nodes in the topology, so it can reduces the energy conservation problem and every node in a cluster have an equal energy no losses of energy will occurred. The Cluster Head should be varied from hop of the nodes.

c. Sink Mobility Pattern using RP

Sink mobility become an important research topic in WSN. Mobile sink path is used to collect the information or data from the sensor nodes. Sink mobility task is to moving and collecting the data from every node [3]. Collecting of effective data through sink mobility can consume low energy and improve the network performances. Fixed path of sink mobility can progress the energy for single-hop network, because it have limited path to communicate and in multi-hop network they were more node which is used to transfer the data, by using fixed path in multi-hop method can solve the energy problem using shortest path finding and it is easy to choose the cluster head and consume low energy for collecting data. While transferring the data in networks data may transfer to every node which is called Rendezvous Point (RP) [11]. RP is a subset of nodes of the Mobile Elements (ME) used to pick the data where it travelling in all the nodes. Using this mechanism source node can process and transfer the data to its nearest node i.e. RP. Then RP collect the data from more than one node until ME arrive to obtain the data. After arrival of ME, buffer size of RP will decreased so we can easily consume the energy for that nodes.

d. Multiple Mobile Elements

Mobile Elements (ME) is one which act like travelling across the network and fetch the data from the RP. It travel and collect the data from every RP for saving the energy of the every node in networks. By providing single ME is not fare one to obtain the data across the networks. Multiple ME can solve the time consuming problem and send the data within a deadline. In very large network MME can prevent the deadline expiration problem. Here each ME is allocated a set of Sensor Nodes. The ME collects data only from allocated set of sensor nodes. By providing this technique then the battery power will maintained for the every node in the networks [3, 12]. Providing MME in the network can improve the battery power of every sensor nodes. When the data are transmitted from the base station through multi-hop every RP must be ready to receive and send the data to the ME when it occurs near the RP, so we can transmit the data with low energy consumption.

V. RANK BASED AND HIERARCHICAL ROUTING PROTOCOLS FOR WSN

Hierarchical clustering in WSN is an energy efficient protocol with three main elements sensor nodes (SN), base station (BS) and cluster heads (CH) The SNs are sensors deployed in the environment to collect data. The main task of a SN in a sensor field is to detect events, perform quick local data processing, and transmit the data. The BS is the data processing point for the data received from the sensor nodes, and from where the data is accessed by the end user.

Low Energy Adaptive Clustering Hierarchy (LEACH)

LEACH was the first dynamic energy efficient cluster head protocol proposed for WSN using homogeneous stationary nodes [31, 32]. In LEACH all nodes have a chance CH and therefore energy spent is balanced for every node. The CH for the Clusters are selected based on their energy load. After its election, the CH broadcasts a message to other nodes, which decide which cluster they want to belong to, based on the signal strength of the CH. The clusters are formed dynamically in each round and the data collection is centralised. A TDMA schedule created by the CH is used to gather data from the sensors.

Load-Balanced Clustering Algorithm

In it, utilizing clustering algorithms to form a hierarchical network topology is a common method of implementing network management and data aggregation in WSNs. Assuming that the residual energy of nodes follows the random distribution, author propose a load-balanced clustering algorithm for WSNs on the basis of their distance and density

distribution, making it essentially different from the previous clustering algorithms [37].

Power-Efficient Gathering in Sensor Information Systems

PEGASIS is an extension of the LEACH protocol, and simulation results show that PEGASISis able to increase the lifetime of the network twice as much as the LEACH protocol. PEGASIS forms chains from sensor nodes, each node transmits the data to neighbour or receives data from a neighbour and only one node is selected from that chain to transmit data to the BS. The data is finally aggregated and sent to the BS. PEGASIS avoids cluster formation, and assumes that all the nodes have knowledge about the network, particularly their positions using a greedy algorithm. [27].

Self-organizing protocol for wsn

Subramanian and Katz [38] not only describe a self organizing protocol but develop taxonomy of sensor applications as well. Based on such taxonomy, they have proposed architectural and infrastructural components necessary for building sensor applications. The architecture supports heterogeneous sensors that can be mobile or stationary. Some sensors, which can be either stationary or mobile, probe the environment and forward the data to designated set of nodes that act as routers.

Threshold Sensitive Energy Efficient Sensor Network Protocol

TEEN is an energy efficient hierarchical clustering protocol which is suitable for time critical applications TEENhas SNs reporting data to CHs. The CH sends aggregated data to the next higher level CH until data reaches the sink. TEEN is designed for reactive networks, where the sensor nodes react immediately to sudden changes in the value of the sensed attribute. Sensor nodes sense the environment continuously, but data transmission is done occasionally and this helps in energy efficiency [10].

Adaptive Periodic Threshold Sensitive Energy Efficient Sensor Network Protocol

APTEEN is an improvement to TEEN and aims at periodic data collection and reacting to time critical events. It is a hybrid clustering based protocol and supports different types of queries like

- Historical query, to get results on past data.
- One-time query that gives a snapshot of the environment and,
- Persistent queries, to monitor an event for a time period.

The cluster head selection in APTEEN is based on the mechanism used in LEACH-C. The cluster exists for an interval called the cluster period, and then the BS regroups clusters, at the cluster change time. [9].

Hybrid, Energy-Efficient Distributed Clustering

HEED is an extension of LEACH and uses residual energy and node degree or density asymmetric for cluster selection to achieve power balancing. HEED has the following features.

- Prolongs network lifetime by distributing energy
- consumption, Terminates clustering process within a constant number of iterations,
- Minimizes control overhead and
- Produces well distributed CHs and compact clusters.

HEED selects CHs based on the residual energy of the SNs and intra-cluster communication cost as a function of cluster density or node degree. HEED clustering improves network lifetime over LEACH clustering randomly selects CHs and cluster size and therefore nodes die faster [23, 24].

Distributed Clustering Technique for wsn

Distributed Clustering or clustered aggregation is a protocol for reactive networks and the first in-network aggregation algorithm exploiting spatial correlation, which trades a negligible quality of result (precision) for a significant energy saving. Distributed Clustering forms clusters of nodes sensing similar values [36].Updated Distributed Clustering Algorithm (updated CAG) [37] is an improvement of Distributed Clustering algorithm, where the clusters are still formed from nodes sensing similar values within a given threshold.

VI. CONCLUSION

Wireless Sensor Network technology offers significant potential in numerous application domains. The applications for WSNs are many and varied. They are used in commercial and industrial applications to monitor data that would be difficult or expensive to monitor using wiredsensors. Typical applications of WSNs include monitoring, tracking, and controlling. Some of the specific applications are habitat monitoring, object tracking, nuclear reactor controlling, fire detection, traffic monitoring and so on. Given the diverse nature of these domains, it is essential that WSNs perform in a reliable and robust fashion. I believe, wireless sensor network has proved its usage in the future distributed computing environment. However, there are significant amount of technical challenges and design issues those needs to be addressed. One of the biggest challenges is the designing of efficient network management architecture to continuously support WSNs for providing services for various sensor applications.

This paper firstly proceeds to categorize routing protocols in wireless sensor networks. This taxonomy includes flat, hierarchical, QoS, and location-based routings and numerous other. After that, it discusses several multi-path routing

mechanisms used to enhance network metrics such as lifetime and latency. These mechanisms are mainly divided into link-disjoint and node disjoint strategy. Using multi-path method is an effective strategy to avoid network partitioning phenomenon and prolong sensors' lifetime. An overview and comparison of various routing protocols in WSNs are also presented.

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