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Review on Data Collection Technique in WSN

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ABSTRACT: Wireless sensor networks (WSNs) become an efficient way to implement several applications in variant areas. Many times in WSN architectures is made up of static nodes those are densely implemented over a sensing area. Now a day's numbers of WSN systems are making use of mobile node. Many of them make use of mobility for solving the issue related to data collection in WSNs. Data collection is the most basic task in WSN system. There are several problems which can be faced while data collection such as energy consumption, time delay, packet collision, more bandwidth constraint, latency, scalability etc. This survey presents some work done related to data collection in WSNs.

KEYWORDS: Data collection, mobile nodes, power management, discovery, data communication, data forwarding.

I. Introduction

Wireless Sensor Networks (WSN) contains number of sensor nodes those are scattered in an areas as well as batteries as a power source. These nodes have sensing unit, data processing unit as well as communication components which creates concept of sensor networks depending on collaborative effort of huge amount of nodes. Sensor nodes like this can be scattered in various places like home, military, science as well as organization for various applications like transportation, health care, disaster recovery, warfare, security, industrial and building automation, also in exploration space. From huge number of the applications phenomena monitoring is the main areas in WSNs. In such networks one can query the physical quantities of the environment.

Indeed, an ordinary wireless sensor network is made out of an extensive number of sensor nodes, which are arbitrarily scattered over the desired area, receiving the signs by a wide range of sensors and the information acquiring unit, processing and transmitting them to a node which is known as sink node. The sink node demands sensory data by forwarding an query via the sensor field. This query is accepted by sensor nodes (or sources). At the point when the node discovers information coordinating the query, the information (or response) is forwarded back to the sink.

As the sensor nodes are not much bigger as well as they makes use of battery as a power source due to which they have restricted amount of energy that can be utilized precisely.

As the sensor nodes are small and battery enable devices, they have limited energy which should be used precisely. Accordingly, the limited sensor resources (specifically, the battery power) are effectively over utilized. Hence, the aim in this case is saving the sensor power for maximizing the lifetime of the network.

In WSNs, compression of data means utilization of compression methods for minimizing the numbers of bytes which are needed for code the various parts of data, therefore the traffic load that should be prepared inside the network.

There are several methods are presented to cover all the issues those are present in WSNs. In this paper we will present some of the systems which are presented to solve the problem in data collection. Also we will analyses those techniques and study their pros and cons.

In this survey, Section II gives the Literature review for Data Collection Techniques in WSNs and also list there pros and cons.

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II. RELATED WORK

In paper [1] authors has developed a data collection protocol for wireless sensor networks which uses a number of mobile sinks. Sinks are enforced for visiting only a proper amount of trusty nodes at the time when all remaining nodes forwards information via multi-hop communication to these nodes for fulfillment of deadline in delivery of sensory information to mobile sink. This developed method is able to extend life time of network by choosing path having a nodes with the high energy for multi hop communication but the sink nodes are has a limit.

In paper [2], authors has developed CS based algorithm which sends a specific number of distributed mobile sinks for efficiently collecting information in WSNs. In this system mobile sinks are not static the moves randomly in a sensing area and meet static sensors which generates CS measurements. The CS measurements generated at every mobile sink are transferred to others via sensor neighborhoods. When every mobile sink gets all the CS measurements needed, it will create the CS recovery algorithm which reconstructs all sensor reading from specific sensing area as well as create the scalar map itself. The presented algorithm balances energy for all static sensors because they have a similar chance for forwarding their information to the mobile sink.

In paper [3] authors have developed an efficient distributed algorithm for constructing a routing DAG (Directed Acyclic Graph), known as, R-DAG, for data collection. This algorithm utilizes of a shortest path DAG as well as adds sibling edges to balance the loads of the base station's children, prolonging the network lifetime.

In paper [4] authors implemented an optimal time slots as well as frequency channel assignment algorithm for tree-based WSNs. Proposed technique is based on dynamic programming and is resilient to link errors. Test runs demonstrated that proposed method outperforms peer approaches under different network configurations and with the presence of unreliable links.

In paper [5] proposed an energy-efficient data collection in wireless sensor networks (WSNs) which is based on an integration of the clustering and compressive sensing (CS). This sparsity facilitates the makes use of CS for energy-efficient data collection in WSNs. Authors introduced the integration of the CS with clustering to benefit from the power saving offered by the two methods. Authors demonstrated that the consolidation of the CS as well as clustering gives a significant energy savings for data collection.

In paper [6] authors have developed a simplified CSS (S-CSS) system that solves the on-demand data collection with ME in wireless sensor networks. Authors also given analytical outcomes on how likely the consolidation can happen, as well as if it happens, how many requests can be combined?

In paper [7] authors have developed an adaptive data collection (ADC) system for mobile sinks in a grid-based wireless sensor network (WSN). The novelty as well as the major contribution of this paper has (i) ADC can adaptively adjust grid lengths by allocating one or more temporary grid nodes between two primary grid nodes, and (ii) ADC can dynamically change the main data collection axis to cope with the moving direction of a sink. Authors have made use of NS-2 for conducting simulations.

In paper [8] authors have developed a robust security system, that allows a sensor to authenticate the data request message to ensure reliable data collection. According to authors the developed security system is robust against severe wireless sensor network attacks, such as wormhole attacks and HELLO flood attacks. Also a threat analysis and determine the probability that at least a single node is under wormhole attack is given in this paper.

In paper [9] authors have developed deploy mobile agents for gathering sensor readings from a provided road segment of interest. The mobile agent migrates among vehicles in the segment through wireless broadcast as well as uses local on-board computational resources to process as well store data as needed. Because of the wireless links are lossy, a broadcast may not reach all the vehicles in the segment; hence, to maximize the reliability of the system,

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authors also designed a termination decision algorithm based on recursive Bayesian estimation by which the agent decides whether all vehicles within the segment have been visited.

In paper [10] authors have developed presented a new approach for data gathering in large scale WSNs using mobile actor nodes (M-actor). Developed method enables the M-actor to compute a set of rendezvous points for data collecting in the deployment area. The developed method exploits information exchanged in the network discovery process to build a topology map. A heuristic yields a set of RPs in a way that guarantees that all sensor nodes will be covered by at least one RP. Using the computed number and locations of the RPs, the M-actor calculates an optimal tour through a GA-based TSP.

As shown in table 1, literature review of various papers has been listed, giving possibility of research gap.

Table 1. Survey Table

Sr no.	Title	Publication/ year	Techniques	Advantages	Research gap
1.	Efficient Delay-Constrained Data Collection in Wireless Sensor Networks Using Mobile Sinks	IFIP, 2015	Based on Team Orienteering Problem	achieves prolonged network lifetime, high performance	---
2.	Mobile distributed compressive sensing for data collection in wireless sensor networks	ATC, 2015	compressive sensing	save power consumption for data transmission	minimizing the total power consumption is not considered
3.	Lifetime-aware data collection in Wireless Sensor Networks	IEEE, 2015	shortest path DAG	outperforms the shortest path DAG	Not considered packet loss
4.	Optimal Time and Channel Assignment for Data Collection in Wireless Sensor Networks	IEEE, 2015	dynamic programming	outperforms peer approaches under different network configurations	Not evaluated on real time application
5.	Cluster-Based Energy-Efficient Data Collection in Wireless Sensor Networks Utilizing Compressive Sensing	MILCOM, 2013	integration of the clustering and compressive sensing	energy savings for data collection	---

III. Proposed System

Figure 1 shows the system architecture of proposed system. In the proposed framework, at first the network is created with the sensor nodes. The procedure of clustering is performed on the sensor nodes. After that cluster head is chosen from each cluster. Cluster head collects the information from every node. After the information collection is done the data is send to the DCN. Then each DCN will send its data to each of the other DCN in the network as all the DCN are connected in mesh topology. Following are some advantages of using mesh topology in the system:

1. When any DCN is attacked then sink can recover data of that DCN from its nearest DCN as all DCN are connected in mesh topology.
2. When both cluster head and DCN are attacked at the same time then also sink can recover data of that DCN from its nearest DCN.

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3. If flat topology is used in cluster then more energy will be consumed as data will be redundant but comparatively in mesh topology the energy consumption will be less. In mesh topology each DCN will send data to each of other DCN in network but in flat topology each node may have repeated data, so the consumption of energy will be more in flat topology than mesh topology. Therefore comparatively mesh topology is better than flat topology.

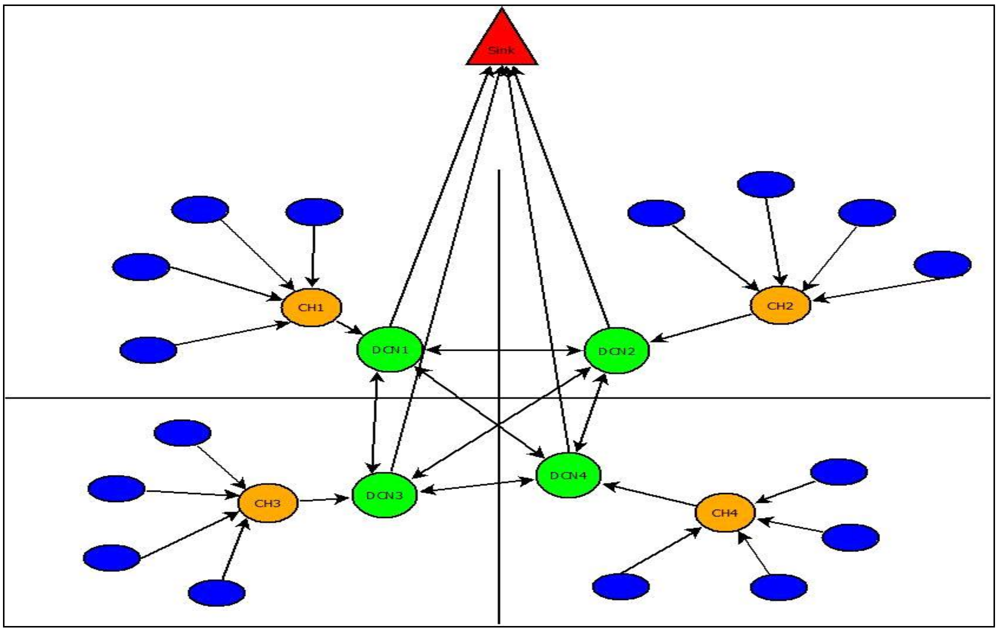

Fig 1. System Architecture

IV. MATHEMATICAL MODEL

Let T be a system such that,
T= {Input, Process, Output}

Input:
Sensing Information
M= {M1, M2, ..., Mn}
M is a set of input represents sensing information needs to be sending to sink.

Process:
1. Set of sensor nodes.
   N= {N1, N2, ..., Nm}
   S is a set of sensor nodes in a network.
   Set up phase
2. Cluster Formation
   F = {F1, F2, ..., Fn}
   F is set of clusters created in set up phase.
   Each cluster contains number of sensor nodes.
3. Cluster Head Selection
   For each Cluster Member calculate threshold value:

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$$T = \frac{E}{D}$$

CH= Minimum (T1,T2,T3,…Tn)

Where,

T1= Threshold of CM1,
E= Energy,
D= Distance from Sink
CH= Cluster Head
CM= Cluster Member

Energy consumed while data sending:

$$E_{TX}(k,d) = E_{elec}*k + €_{amp}*k*d^2$$

Energy consumed while data receiving:

$$E_{RX}(k) = E_{elec}*k$$

Where,

E_{elec} is energy of transmitter
$€_{amp}$ is energy of amplifier
k is constant
d is distance between sender and receiver

Distance Between two nodes

$$\text{distance}(A, B) = \sqrt{(X_A - X_B)^2 + (Y_A - Y_B)^2}$$

where,

X_A – X co-ordinate of node A
X_B – X co-ordinate of node B
Y_A –Y co-ordinate of node A
Y_B– Y co-ordinate of node B

4. Intra cluster Communication
   Selection of Cluster head
   CH= {CH1, CH2, ….., CHn }
   CH is set of cluster heads, which are use full for communication among clusters.
5. DCT Communication
   Formation of Data Collection Node.
   DCN= {DCN1, DCN2, …., DCNn}
   DCN is set of data collection node.
6. Data Recovery
   A = Represent the data recovery process.
   If attack is found in DCN then Sink recovers data from nearest data collection node (DCN).

Output: The authenticated aggregated data at sink securely.

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V. CONCLUSION

This paper analyses various techniques used for data collection in WSNs. Also given the advantages and drawbacks present in the different studies performed by various researchers. To deal with drawbacks in present systems we presented an idea of the new system. In this pape, cluster tree based mesh topology detects and prevents the attacks on cluster member, cluster head and data collection node(DCN). This makes the system secured. Whereas each cluster member chooses the cluster head with maximum energy and minimum distance from sink. This improves the efficiency of the network. Use of mesh topology in cluster tree does not allow malicious data to reach to the sink node. This reduces wastage of energy by denying malicious data and improves network lifetime.

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BIOGRAPHY

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