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Analyzing Data Collection Strategies Using Mobile Sink

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Abstract- One of the most important task of Wireless Sensor Network (WSN) is data collection . In sensor network the sensors are sensing the information and will be collected by the sink node with multi hoping. In such a scenario the energy is consumed by the node is more. In recent years the researchers are focusing on how to minimize the energy of the node and how it will help to improve the life of the node. One of the idea to do this is minimize the hop. The proposed framework is maximizing the lifetime of the wireless sensor networks (WSNs) by using a mobile sink. Proposed work is having the cluster with cluster head. The mobile sink moves towards the cluster head only upon the occurrence of an event .The cluster head is collecting the data from the sensor node and storing the same. Once the data is available to the cluster head, head will inform to the Mobile Sink. The Mobile Sink will move to respective position of the cluster head and data will be collected by Mobile sink.

Keywords- Wireless Sensor Networks, Cluster, Cluster head, Mobile Sink.

I. INTRODUCTION

Wireless sensor network (WSN) normally consists of sensor nodes which are capable of collecting information from the environment and forwarding the data to the Sink (Static)[2]. Normally the sensor node is having the low capacity battery and on the other hand the sink is typically rich in energy. Energy is the main important factor in the WSN because each sensor works with its non-rechargeable battery. Data collection is the principle application in the WSN[9].

To improve the performance of data collection, several approaches have been proposed. With data fusion, correlated data obtained by neighboring sensors can be compressed before being forwarded to the sink. In heterogeneous architecture, powerful sensors with larger energy capacity and stronger communications capability are deployed to reduce the energy consumption of regular sensors and to increase the data collection rate. Using mobile nodes, data can be relayed from a sensor to the sink using less number of hops. In the literature, different types of dada collection methods have been introduced using Mobile Sinks in Wireless Sensor Networks to Improve Building Emergency Response, Query-Based Data Collection in Wireless Sensor Networks with Mobile Sinks, Efficient Data Collection in Wireless Sensor Networks with Path-Constrained Mobile Sinks.

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II. RELATED WORK

Author T. T. Truong et.al [5] have static BS and many stationary sensor nodes. The mobile sinks can collect data locally, or can act as connectors to the disconnected areas. Each sensor transmits data back to the BS through a multi-hop path. Each sensor has the same maximum transmission range. The Mobile Sink is aware of its own position, relying on well-known localization mechanisms. MS broadcasts a beacon message, and this message floods though the network for up to K hops. Each sensor that can hear the beacon decides whether it is better to route via the Mobile, or to continue with its old route to the BS. Using an uncontrolled mobile sink to achieve reliable and robust data delivery in wireless sensor networks during building Emergencies.

Author Long Cheng et.al[3] describe mobile sink moving through the sensing field queries a specific area or a point of interest for query-based data collection. A *Query* packet is injected by the mobile sink and routed to the specific area, and then the corresponding *Response* packet is returned to the mobile sink via multi-hop communication. Due to the mobility of the sink, the *Query* and *Response* should have different routes. In order to minimize the energy consumption and packet delivery latency, QBDCS chooses the optimal time to send the *Query* packet and tailors the routing mechanism for partial sensor nodes forwarding packets[5]. Empirical study has demonstrated that QBDCS can complete a query-based data collection cycle with minimum energy consumption and delivery latency.

Shuai Gao et. al.[10] describe path constrained sink mobility is used to improve the energy efficiency of single hop sensor networks which may be infeasible due to the limits of the path location and communication power. The authors propose multi hop sensor networks with a path-constrained mobile sink where the Shortest Path Tree (SPT) method is used to choose the cluster heads and route data that may result in low energy efficiency for data collection. In MASP, the mapping between sensor nodes and sub sinks is optimized to maximize the amount of data collected by mobile sinks and also balance the energy consumption.

The Author Harshavardhan Sabbineni et.al [1] focuses on algorithms ,using a distributed geographic hash-table mechanism that adds load balancing capabilities to the data-collection process.

The proposed mobility model moves the sink node only upon the occurrence of an event according to the evolution of current events, so as to minimize the energy consumption incurred by the multi hop transmission of the event-data. Data is collected via single-hop routing between the sensor node and the mobile sink.

III. PROPOSED WORK

Some limitations are found in the previous papers e.g. If the sensor node is generating the data and message is passed to the mobile sink. The mobile is accepted to come near the node for data collection. But if before mobile sink reaches to that node data get loss. To over this problem we have proposed a method where each area is having the cluster head.

Scenario details are as follows:

Simulation Tool	Ns2.34 on Ubantu
Area of Sensor Field	250 X 250 m
Topology	Random
Number of sensor node	100 node
Source Node	All
Mobile Node	One
Cluster Head	Randomly Created
Energy	Initial Energy 100

The formation of cluster head is dynamic; one of the nodes will act as cluster head. If the node are 100, then cluster head will be 10.The buffer size of cluster head is comparatively more then node. The cluster head will collect the data from the sensor node when the event is generated .Once the sufficient data is available to cluster head it will inform to Mobile Sink for data Collection.

In this, the area is divided into clusters. The selection of cluster head is dynamic. Once the event is generated the Cluster head will notify to the Mobile Sink. The mobile Sink then moves towards the cluster head and collect the information.

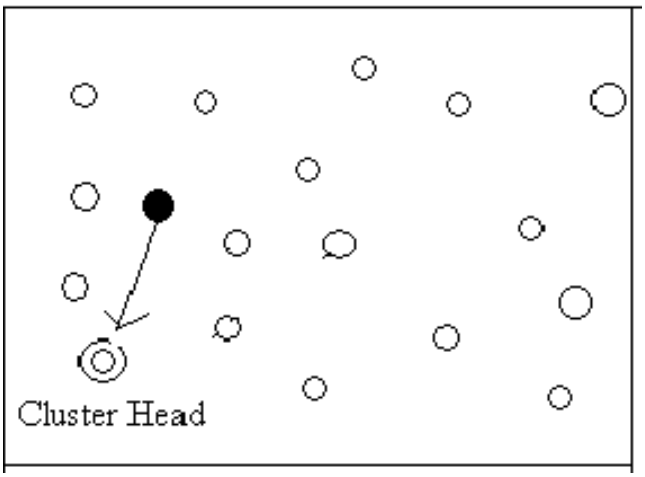

Fig. 1. Sensor node with Mobile Sink

Algorithm: Data collection strategy

1. The whole area is divided into small areas called Clusters
2. Each Cluster is having Cluster Head
3. The event is generated by the sensor node
4. The data is transferred to the cluster head
5. If the cluster head is having sufficient data then cluster head calls the Mobile Sink
6. Mobile Sink will move towards he cluster head and will collect the data.

If the mobile sink is collecting the information from one cluster head and another head is sending request which indicate the data presents, mobile sink will store the information (cluster head position) of that cluster head .Once he data is collected by the mobile sink itwillo be transfer to cluster head the collect the data.

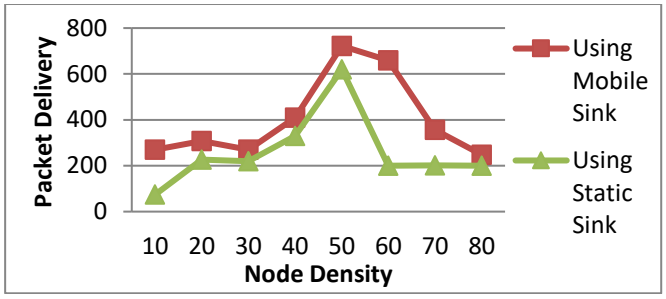

Figure 2: Packet Delivery with and without mobile Sink

The Figure 2. represents the packet delivery with and without mobile sink. The x axis represents the number of nodes and the y axis represents the number of packet received. Using mobile Sink the packet delivery ratio is increases as compared to static sink.

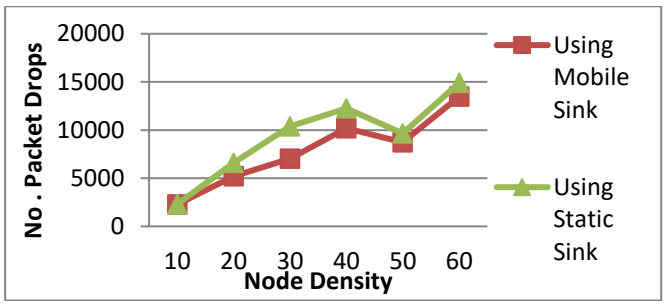

Figure 3: Packet drops with and without mobile sink

As Figure 3 shows the number of packet drops are decreases if the data is collected by mobile sink. As the data is collected by mobile sink in one hop.

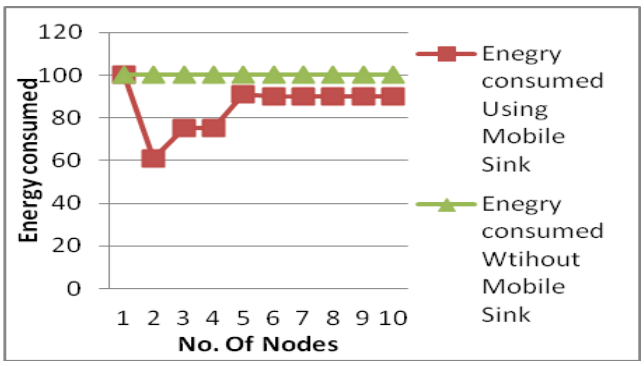

Figure 4: Energy consumed by nodes with and without mobile sink

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The Figure 4: represents the energy consumed with and without mobile sink.
The x axis represents the nodes and the y axis represents Energy consumed by the nodes using mobile Sink. The node consumed full energy when the sink is static.As the data collection is done by mutihoping .But using Mobile sink the consumation of energy is improved.
As the mobile sink is imprving the packet delivery ratio we can increase the number of mobile sink in the area.

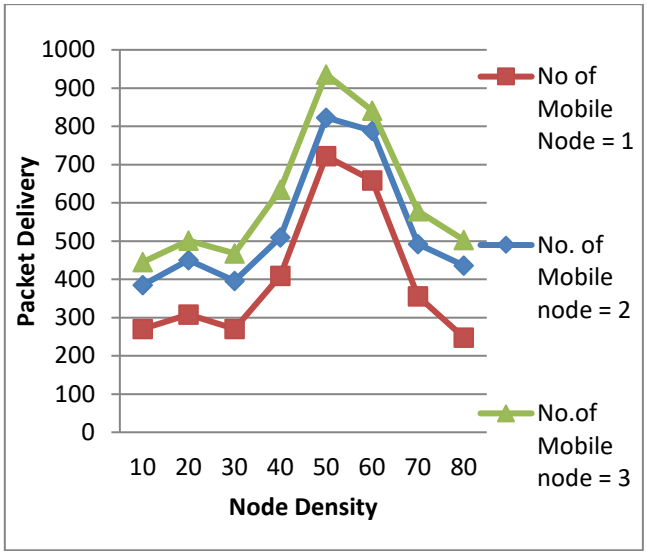

Figure 5: Packet delivery using Single mobile node 1,double mobile node,triple mobile node

As we are incresing number of mobile node in the area like 1,2,3 it is possitivly increases the packet delivery.The graph shows the packet delivery raio vs node density varing the number of mobile nodes. At certain point like when the node density is 50 the packet delivery is maximum.

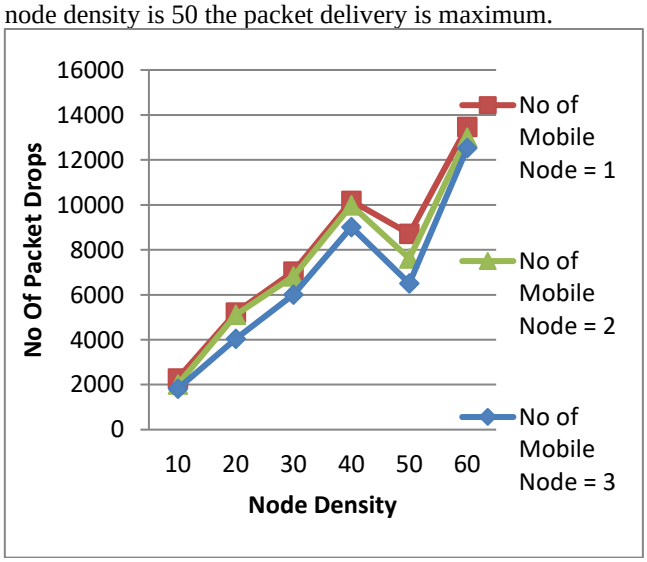

Figure 6 : Packet drops using Single mobile node 1,double mobile node,triple mobile node

The graph shows the packet drops as we are incresing the mobile nodes.The packet drops are minimum if the number of mobile sink is more and maximum if the number of mobile sink is minimum.

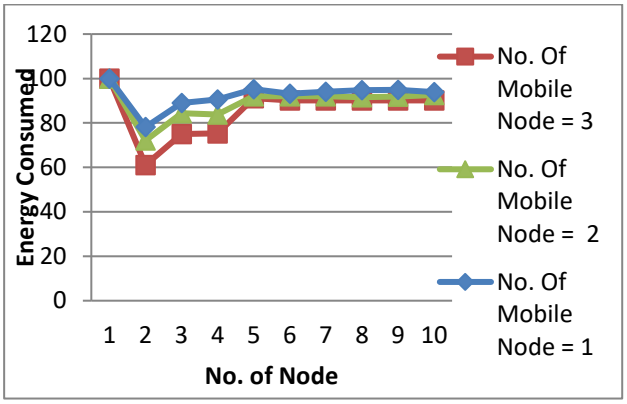

Figure 7 : Energy consumed ny nodes using Single mobile node 1,double mobile node,triple mobile node

The energy consumed by the node if the number mobile node increses.The energy is maximum consumed if the number of mobile node is minimum and energy is minimum consumed if number of mobile node increses.

IV. CONCLUSION AND FUTURE WORK

The proposed work, which leverages mobile, sinks to significantly extend the lifetime of the sensor network. The proposed mobility-management method minimizes the energy consumption by the single hop. The work increase the life of the network by increasing the number of mobile node.The future work will be implementation of the work on hardware device.

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