Tracking Mobile Sink Without Assistance of GPS

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Abstract: **Mobility for data gathering has drawn substantial interests in recent years; the mobility of the sink raises new issues of energy efficiency and connectivity in communications. The current research is either focused on planning a mobile sink's moving trajectory in advance to achieve optimized network performance, or at collecting a small portion of sensed data in the network. The pre-calculated trajectories may not be applicable for mobile sinks in some deployed areas. To overcome these problems, the proposed system introduces new way for mobile sink-based data collection. The proposed protocols features have low-complexity and reduced control overheads.**

Keywords:- Mobile sink, sensor nodes, GPS, broadcasting.

I. INTRODUCTION

The new wave of research in WSNs started in around 1998 and has been attracting more and more attention. In the new wave of sensor network research, networking techniques and networked information processing suitable for highly dynamic ad hoc environments and resource constrained sensor nodes have been the focus [11]. From the past few decades WSN has become one of the fast growing research areas and has been attracting a lot of research activities. A Wireless Sensor Network consists of data collection node which is also known as sink node and some sensor nodes, each sensor node consisting of sensing device, wireless transceiver, a small processor , memory and a tiny battery. Applications of sensor networks are wide ranging and can vary significantly; the original motivation behind the research into WSNs was military application. Some of the major applications of wireless sensor networks are environmental monitoring, health monitoring, industrial sensing, infrastructure security and Context-aware computing. The environmental monitoring can be used for animal tracking, forest surveillance, flood detection, weather forecasting, precision agriculture and habitant monitoring. Some the different types of sensors used in the environmental monitoring system are temperature sensors, humidity sensors, biometric pressure sensors, light sensors, infrared sensors which forward data towards a base station or a data collection node for processing. The base station or the data collection node is called as sink node.

The battery life of a sensor node is a major constraint which effects the network lifetime. To extend the lifetime of network many researchers have been trying to devise an algorithm, however they weren't much effective in the real time applications. The lifetime of a sensor node is still an ongoing research issue. A recent research effort has proven that as long as sink or sensors nodes are static, this issue cannot be fully resolved. Mobile sinks such as, vehicles or bots equipped with radio devices are sent into the field to directly communicate with sensor nodes, resulting in reduced energy consumption and increasing the network life time.

There are few challenges faced by mobile sinks in wireless sensor network. Some of the challenges are use of GPS by sensor node to track the location of the mobile sink which consumes the energy of the sensor nodes, large amount of energy is consumed by the sensor nodes since they have to detect the location of mobile sink with the help of the control messages sent by mobile sink and also since the mobile sink keeps on moving the data packets sent by the sensor nodes are lost or they should be re-routed to the mobile sink this also consumes huge amount of energy.

In the proposed system we design a system which overcomes the problems of the existing system. We propose a protocol which is self adaptive to various application scenarios including control message suppression. The proposed system has the following features

1. The proposed system provides a unique logical coordinate representation for tracking mobile sinks without assistance of GPS devices or predefined landmarks, which is widely applicable to various network settings and scenarios [10].
2. The proposed system outlines a novel low-complexity dynamic routing protocol for data gathering with one or multiple mobile sink(s), which effectively reduces average route length and cuts down total energy consumption.
3. Extensive comparison studies and simulations with popular existing solutions are conducted in the proposed system.

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II . RELATED WORK

Managing mobility of the sink nodes is a challenging issue at present, many researches have been conducted on mobile sinks and also to reduce the network life time with the help of mobile sinks. Weifa Liang et al.[6] proposed a heuristic algorithm for prolonging network lifetime but it calculates the sojourn time and tour prior which is a NP-hard problem, Yu Gu et al.[1] worked on delay constraint problem and proposed a polynomial-time optimal approach for the origin problem but it was only for a single mobile sink and it wasn't applicable for large networks, Jun Luo et al.[3] built a unified framework called as maximising network lifetime in which they considered sinks mobility and routing for maximising the network lifetime they were only able to do it for single mobile sink.

Multiple mobile sinks have a advantage of covering large networks within a short time period but it is difficult to handle since they have to be managed at the same time and routing was a difficult task. Haeyong Kim et al.[5] formulated linear programming for finding optimal locations of the multiple sink and to find optimal traffic flow but in their system the sensor nodes were able to communicate with more than one mobile sink which is a time consuming process, Euisin Lee et al.[2] proposed a scheme that provides sink location service but this schema needed GPS on the sensor nodes which resulted in the reduction of network life time.

III.DESIGN

In a large network where sensor nodes are distributed widely and randomly assuming that the sensor nodes can communicate with each other. We gather the data from the network with the help of the mobile sinks. We send the mobile sinks into the network, the mobile sinks can be bots or vehicles or humans and these mobile sinks contain the radios and the processors for communicating with sensor nodes.

The mobile sink enters the network and it starts to move in the network with low speed. The mobile sink stops at some points which are called as landmarks and it broadcasts control messages to the sensor nodes within its range. Sensor nodes use these messages for finding their location in the network this is done with the help of the hop count from the landmark to the sensor nodes, with the help of this hop count distance the sensor nodes send the data to the mobile sink. The architecture of this system is described with the help of below diagram.

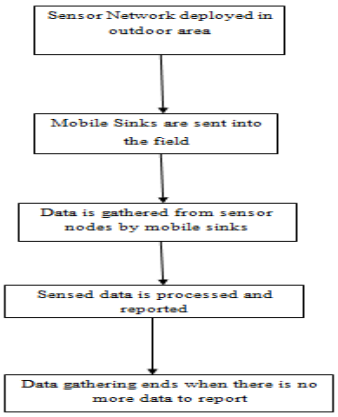

Figure 1. Architecture

IV.PROPOSED SYSTEM

In the proposed system the mobile sink moves in the field to collect data, the mobile sink stops at certain points for a very little amount of time and broadcasts the control messages with low frequency to improve the network lifetime [10]. These points are called as update points each of these points can be considered as landmarks which gives the sensor nodes their location in the field. A sensor node can know its location with the help of the hop count distance to these landmarks similarly the mobile sinks location is detected with the hop count distance from its current landmark to its previous landmark. The locations of the mobile sink and the sensor nodes are detected without the help of GPS in the proposed system which also increases the network lifetime of the WSN's.

The data gathering process of the mobile sinks can be described with the help of the data flow diagram

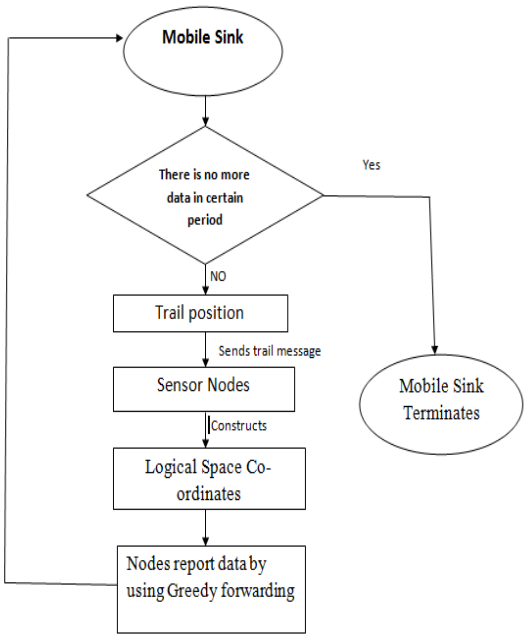

Figure 2. FlowChart

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The data gathering process of the mobile sink ends whenever there is no more further data to be collected or whenever the enough data is collected.

V.IMPLEMENTATION

The implementation is done using ns2 simulator. The nodes are populated randomly in the field, we select some nodes as mobile sinks. The mobile sinks are made to move randomly in the feild and stop at some at some points to collect the data from the sensor node, the sensor nodes broadcast their location to all the sensor nodes. The below figures explain the step by step process.

Nodes are deployed randomly in the field.

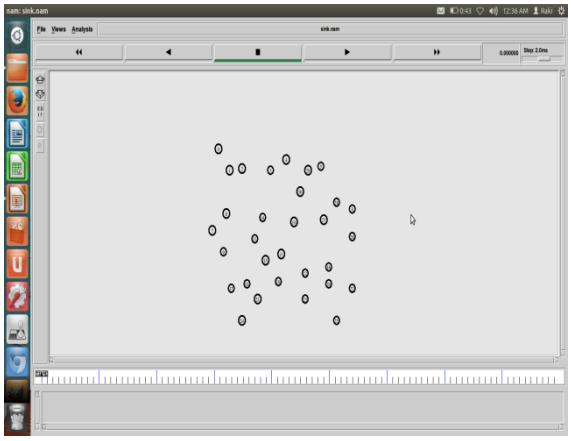

Figure 3. Sensor Nodes

The mobile sinks starts travelling randomly in the field for collect data.

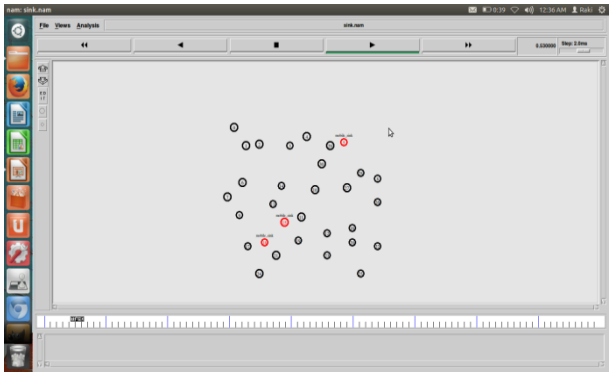

Figure 4. Mobile Sinks and Sensor Nodes

Mobile sinks are sensing data from the sensor nodes

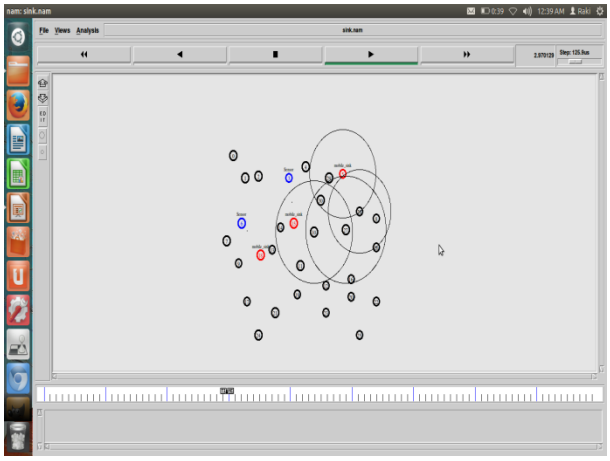

Figure 5. Mobile Nodes collect data

VI.EXPERIMENTATION AND RESULTS

The experiments were conducted based on different inputs. The output motivates to implement the idea in real-time and achieve new results. The output files are presented below in following figures.
The graph below demonstrates the delay of the packets.

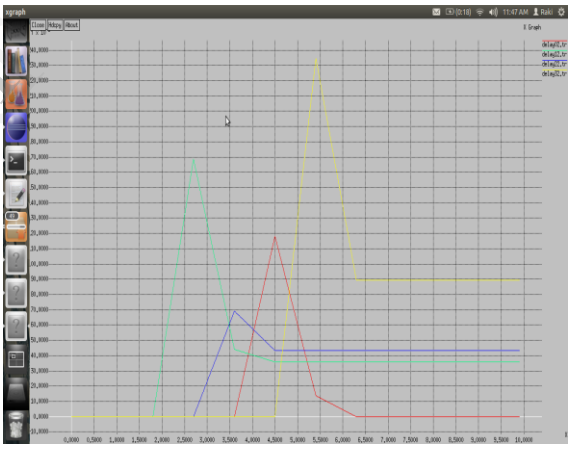

Figure 6. Delay Graph

The below graph shows the packet loss in the experiment.

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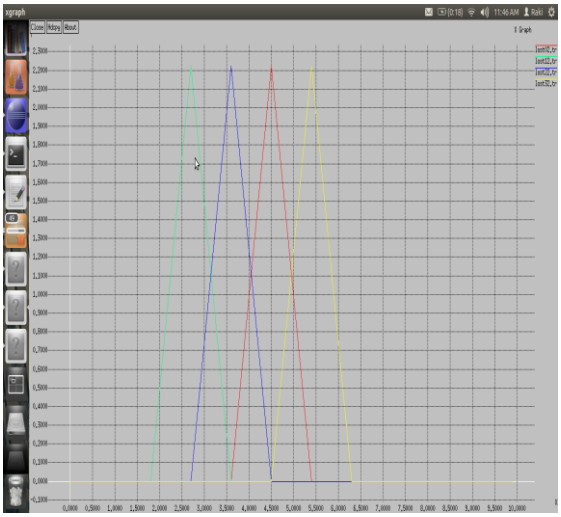

Figure 7. Packet Loss Graph

The below graph calculates the bit rate in the experiment.

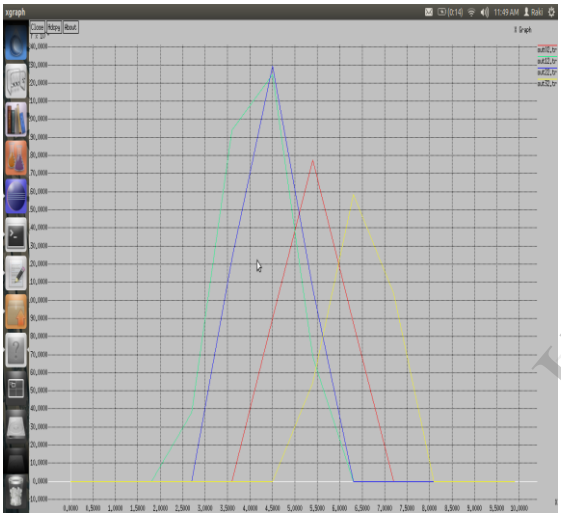

Figure 8. Bit Rate Graph

VII.CONCLUSION AND FUTURE WORK

In this paper we presented the different methodology to collect sensed data from the sensors deployed in the environment by the use mobile sinks. This idea acts as alternative for power conservation in sensor nodes, by increasing lifetime of sensor nodes. The results obtained are presented taking real-time values. As the part of future work we are working on mobile sinks to collect non redundant data from different sensor nodes.

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