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Improving Network Lifetime through Multiple Mobile Sinks in WSN

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ABSTRACT **: Wireless sensor networks is very important field in today's technology and one may concern about the life time of sensors as they have no facility to change the battery of those sensors inside the field. Wireless Sensor Networks are prone to node failure due to power loss. In order to provide reliable service through the network, the network should be self-adjusting and must have adaptable properties as required from time to time. Here in this research we have proposed a new algorithm which makes use of multiple sinks. This shortens the transferring time from node to sink and save battery lifetime. This research is capable of not only to do optimize routing even with that it has the benefit to overcome through pits creating problem around the sink. We have used the Energy Efficient Shortest Path Routing algorithm for routing and multi-hop network to communicate every node with sink and have used Ant colony optimization to determine new position for a sink, so that network will communicate without any problem which generally occurred due to dead nodes around the sink.**

Keywords:- ***WSN, Sink,Network,routing,mobile etc***

I. INTRODUCTION

Wireless communication and networking are becoming very predominant due to their flexibility and ease of deployment. Particularly, sensor networks that involve large numbers of small-sized sensor nodes equipped with sensors and radio for wireless operation have found applications in several commercial and industrial areas *[I.F.Akyildiz, W.Su, Y.Sankarasubramaniam and E.Cayirici, 2002].* Sensors link the physical world with the digital world by capturing and revealing real-world phenomena and converting these into a form that can be processed, stored, and acted upon. Integrated into numerous devices, machines, and environments, sensors provide tremendous societal benefits.

A. Wireless Sensor Networks

Wireless Sensor Networks is a collection of massive number of small, inexpensive, self-powered devices that are capable of sensing, computing and communicating. Recent advances in micro-electro-mechanical systems (MEMS) technology have enabled the development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate untethered in short distances. Smart sensor nodes are low power devices equipped with one or more sensors, a processor, memory, a power supply, a radio and an actuator. A variety of mechanical, thermal, biological, chemical, optical and magnetic sensors may be attached to the sensor node to measure properties of the environment. These sensor nodes are densely deployed either inside the phenomena or very close to it. The nodes are deployed randomly in the inaccessible terrain or disaster relief operations.

Apart from the sensing sensors, the user can also inject queries into the network through sink to know the current status of the area being monitored. The capabilities of sensor nodes in a WSN can vary widely, that is, simple sensor nodes may monitor a single physical phenomenon, while more complex devices may combine many different sensing techniques (e.g., acoustic, optical, magnetic). The different sensing nodes can be deployed depending on the phenomena to be monitored. The deployment of these nodes can be done either randomly or in a preplanned.

B. Single and Static sink

In a simple and Maximum Wireless Sensor networks, there will be only one Sink with a permanent position defined by the algorithm *(Prerana Shrivastava, Dr. S. B. Pokle, International Journal of Engineering and Innovative Technology (IJEIT), Volume 1, Issue 3, March 2012).* Any event change sensed is communicated to the base station with the multihop communication. Many sinks provides nodes to navigate their information to nearby sink through multihop technique. This is more suitable for larger networks with huge number of sensors.

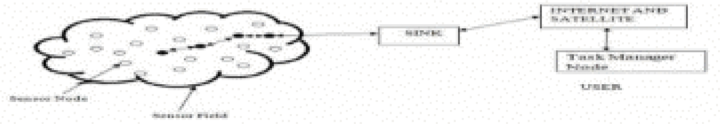

Fig. 1 Static and single sink sensor architecture

C. Multiple Sink

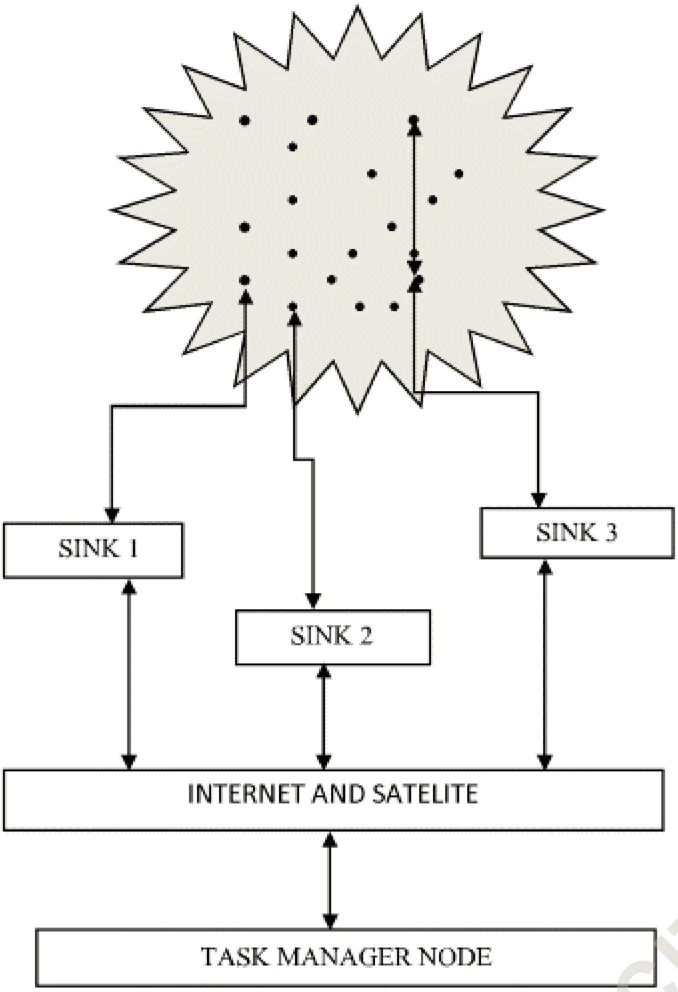

Fig. 2 Multiple Sink architecture

Any node can determine its nearby sink through distance vector algorithm. Number and positioning of the sinks depends on network size and number of nodes *(Wint Yi Poe and Jens B. Schmitt disco — Distributed Computer Systems Lab, University of Kaiserslautern, Germany)* .This highly reduces the distance form node to sink compared with single node. As the battery power depends on the distance between node and sink, it utilizes less battery power and hence enhances the network lifetime.

II.METHODOLOGY

In this work, to experimentally analyze the performance of purposed algorithm we first randomly deployed the sensor nodes in the region of area 200*200m. Optimum number of Sinks can be deployed either in defined position or in random position. After deploying the sinks, we compute the energy field of each sink at the present location .This has been done by calculating the energy of each node in the range for each sink. Now after that we use ACO to compute the next best location for each of the sink.

TABLE I. Simulation parameters

Parameters	Values
Sensor Field Region	200*200
Number Of Nodes	27
Number Of Sinks	3
Query Packet Size	100 Bits
Data Packet Size	1024 Bits
Bit Rate	250 kbps
Carrier Frequency	2.5Ghz
Initial Energy	30 joules
Gain of Transmitter	1
Gain of Receiver	1
Modulation	Dpsk
Simulation Time	100 sec

We initialize the ACO parameters same to all sinks and send the calculated number of ants in each sink region to compute the energy field within their range and give us the next best location for the sink. Now we check that whether the new location is better than the current location .if yes then sinks moves to the next best location and advertises its position to the neighbors. By doing like this , sinks are always remains at its best position and the energy of each and every node in the region is balanced because each sensor node has to transfer less data for other nodes and in this scenario maximum nodes should be in range of sinks and by doing like this no specific nodes should get consumed which results in increase in lifetime of the network and also with sinks at their best position , packets has to traverse less number of hops to reach the sinks, which results in less energy consumption in this algorithm.

The simulation parameters are taken in accordance with the designed network scenario and used energy model. The number of sensors nodes taken is 27 and sinks are randomly deployed in area of 200*200m.The number of nodes in each cell can be varied depending upon the application for which sensor nodes are deployed.

I. RESULTS AND DISCUSSION

The proposed algorithm is evaluated under different scenarios to check their efficiency in the WSN. The various factors that influence the design of WSN are evaluated and

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analyzed to study their impact on the desired results. This chapter includes the performance evaluation parameters, various factors that affect performance and the obtained results in detail.

A. Performance Evaluation Parameters

The proposed work needs to be evaluated against various parameters to measure its performance. Following are the parameters:

1) Energy Consumption: Energy Consumption of the entire network is the main performance evaluation parameter. The overall energy consumption of network includes the energy consumed by all the nodes in *sending and transmitting the data.*

2) Throughput: Throughput tells the average rate of successful packets delivered over the network. It is measured in data packets per second. Lifetime: Network lifetime parameter evaluates the efficiency of the proposed Energy Aware Shortest Path Routing Algorithm. The network lifetime is computed by considering the time when first node of the network dies out. It is the difference of total energy of the network and the summation of average used energy of nodes and their energy deviation.

3) Energy Utilization Efficiency: It is a measure of the ratio of total packet delivered at the destination to the total energy consumed by the network's sensor nodes (Kbits/Joules).

II. PERFORMANCE EVALUATION UNDER MOBILE SINK CASE

We evaluate the performance of purposed algorithm in case of mobile sink and compare with other routing protocols with mobile sink. In this scenario, we assumed our sinks Mobile. In our simulation results as reported in Fig. 2.1, shows the performance in term of network throughput, energy consumption, and energy utilization efficiency of the respective algorithms with different simulation time. In term of successful packet delivery per unit time, it was observed that our purposed algorithm has its maximum throughput at all the speeds sits than other routing algorithm. In Our proposed algorithm Energy Consumption is not increased with increase in speed as in static sink case energy consumption is increased with simulation Time.

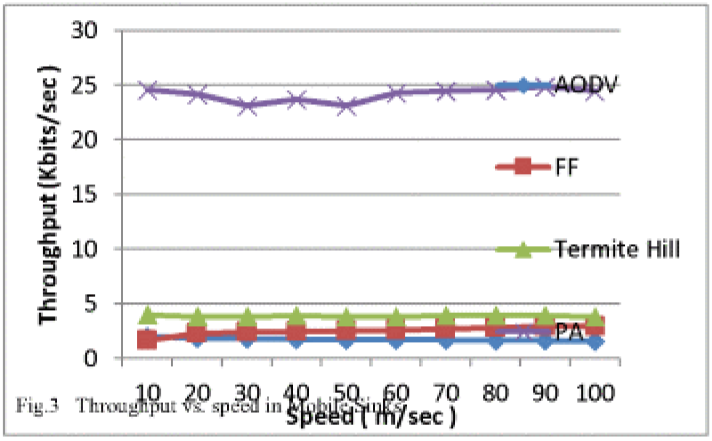

Fig.3 Throughput vs. speed in Mobile Sinks

This fig.3, shows that our proposed algorithm has higher throughput at different speeds than the existing termite-hill algorithm .Our proposed algorithm have higher throughput than the existing algorithm because in this case sink acquires the best position using ACO and it remains this position until next best location is searched. In this case maximum nodes are in reach of sink and packets have to traverse lesser path to the sink.

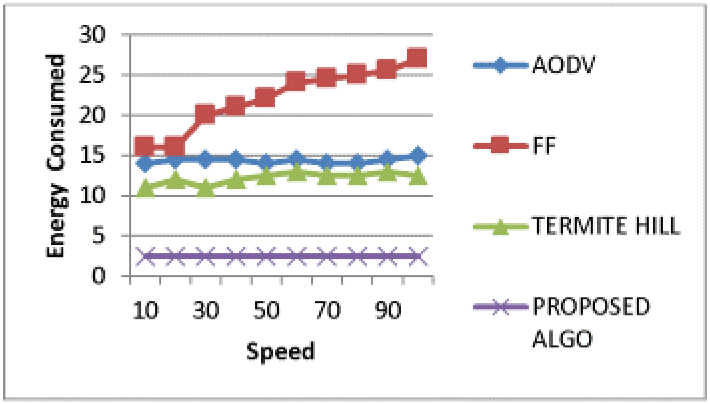

Fig.4 Energy consumed vs. speed in Mobile Sinks

The Fig.4 shows that our proposed algorithm has very less Energy Consumption at different speeds than the existing termite-hill algorithm. Our proposed algorithm have less energy consumption than the existing algorithm because most of the energy is consumed in transferring the packets to another nodes than the actual work but in this case with sinks acquires the best position using ACO, maximum nodes are in reach of sinks and packet have to traverse less path from source to sinks. Due to this our proposed algorithms have less energy Consumption. Moreover energy consumption of proposed algorithm is not increased with the speed as it increased with increase in simulation time.

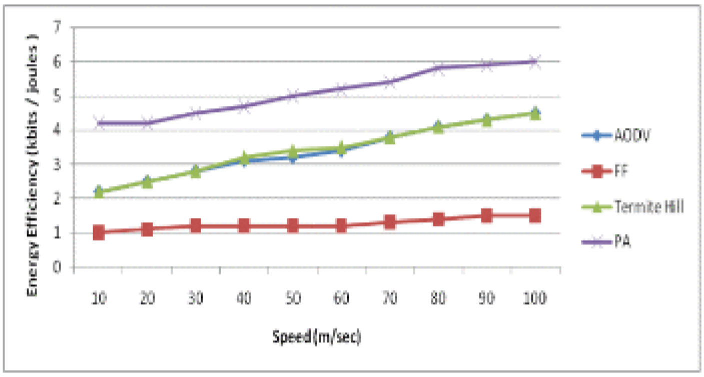

Fig.5 Energy Efficiency vs. Speed in Mobile Sinks Case

This Fig.5 shows that our proposed algorithm has higher energy efficiency at different speeds than the existing termite-hill algorithm. Our proposed algorithm have higher energy efficiency than the existing algorithm because in this case

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sinks acquires the best position using ACO and it remains this position until next best locations are searched. In this case maximum nodes are in reach of sinks and packets have to traverse fewer paths from source to sinks.

IV. CONCLUSIONS AND FUTURE WORK

Network Lifetime is the main issue in WSN .We can enhance lifetime of the WSN only when the load is equally distributed in the network so that all the nodes consumes power equally and network becomes operational as long as possible. This thesis, investigate the impact of sinks mobility and dynamic sinks on network performance in a WSN using static, dynamic and mobility scenario of the network. Through the analysis, it was seen that the performance of the routing protocols in terms of energy utilization efficiency, network reliability, and network lifetime had a strong correlation between sink mobility, dynamic sink and simulation time This thesis exploits following engineering efforts to make a highly efficient Wireless sensor network:

- Energy consumption is decreased due to the energy efficient shortest path routing algorithm.

- The Throughput of our proposed algorithm is greater than Termite-hill, AODV and FF algorithm in mobile sink case.

- Energy efficiency of the proposed algorithm is also increased as compared to other algorithms.

- Network Lifetime of WSN is greatly increased by the proposed algorithm as compared to other algorithms.

III. SCOPE FOR FUTURE WORK

As the research work presented in this thesis has been tested in the simulation environment, so the applicability of the proposed algorithm on the real Wireless Sensor network needs to be checked.

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