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Multi-Path Routing Algorithm with Multiple Mobile Sinks WSN

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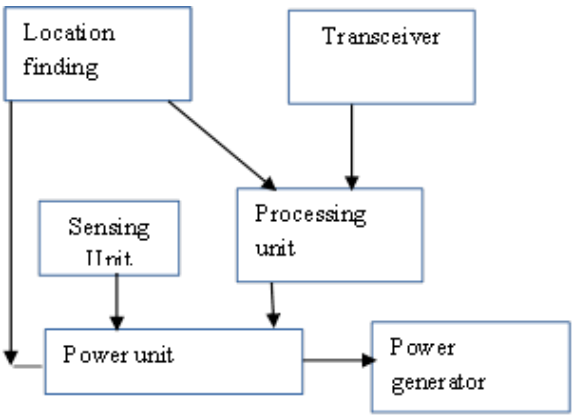
Abstract
WSN (wireless sensor network) has various sensor nodes either moving or stationary in nature. It contains multiple mobile sinks. These mobile sinks are moving in specified path and these mobile sinks are generally moving in nature, So that they can collect the data from the sensor nodes. The base technique was based on multiple mobile sinks which receives the data from sensor nodes when certain event will occur. Compare to it with the base technique which has only single sink and fixed in position. The entire sensor node sends the data to the sink node using relay nodes. Both the techniques have been compared on the basis of various performance parameters like network life time, data transmission, and residual energy. In all the parameters new technique has outperforms the old technique. Such that over all there is an improvement of 21%. So on the basis of current research it is clear that network of wsn nature with multiple mobile sinks works more efficient that the network with single mobile sink.

Keywords: WSN, Event Driven, Stationary Sink, Mobile Sink

Introduction

Wireless Sensor Networks (WSN) is the innovation that comprises of expansive number of small sensor hubs disseminated in a specially appointed way. Sensors are by and large spread over a land range in profoundly thick way. These sensor hubs are of ease and low power which can perform different capacities. The base station is a master node. Data sensed by the network is routed back to a base station. The base station is a larger computer where data from the sensor network will be compiled and processed. The base station may communicate with the Remote Controller node via Internet or Satellite. Human operators controlling the sensor network send commands and receive responses through the base Station.



Architecture of a Wireless Sensor Node

Location Finding:-Location Finding defines the location of the nodes. Localization is estimated the distance between the localized node and the sensor node.

Transceiver: It is a comprising unit which contain both sender and receiver stations. It can send the data to the particular sensing node from the sensor node.

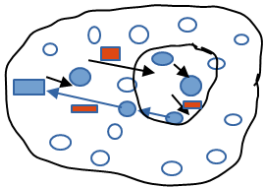
Sensing Unit:-Sensing unit can sense the data, so that it can easily transfer from the data from the source to destination.

Processing Unit:-This unit process the information among the multiple mobile sinks nodes to the sensor nodes and the source nodes.

Power unit: - The power unit defines the unit which is used to convert the power provided by the nodes into the usable power

Power generator:-Power generator is a device in a WSN which can convert the energy into the predefined manner which can be adopted by the nodes itself.
According to the topological structure of the WSNs, routing protocols are divided into the planar
Routing protocol and clustering routing protocol. In planar routing protocol, the status of each node in the network is completely equal. Therefore, the network with planar structure routing protocol does not require any structural maintenance. Also, this structure is relatively simple to implement. Besides, the quality of each node makes a good robustness of the network. However, there are also some problems. Since there is no management node in the network, communication resources cannot be optimized, so that it is not easy to achieve data fusion. Typical planar routing protocols include: Data Diffusion protocol, Rumor routing protocol, Flood routing, and so on. The clustering routing protocol can generate good network topological automatically and improve the efficiency of the routing protocol and MAC protocol. The generated topological structure can lay the foundation for data fusion, time synchronization and so on. Meanwhile, it can save energy consumption of sensor nodes and prolong the lifetime of the network. The clustering algorithm is more suitable for large networks. Typical clustering routing protocols include Leach, Teen.

Mobile Agent Routing Problem
WSN is composed of Processing Element (PE) sensor nodes and communication network. PE is a node that has more power, memory and communication ability. It depends on its network scale to decide mobile agent's best routing. Mobile agent begins with PE, goes along with the route that designed firstly, to collect and fuse the useful data, and then returns to the PE.
Mobile agents always start from the PE nodes. In the moving process, PE nodes give a required message, and dispense the mobile agents to execute the one hop network topology. Mobile agents are flooded to next node with one hop distance, and acquire the node's message near to the PE node, such as energy level, current situation and so on. PE nodes which dispense the mobile agents collect the nodes' message; select the highest energy level node for the next hop, and then execute the next mobile agent flooding for the second time, until it find the all nodes in the area[1].



Multiple Path Routing
Nodes are assumed to be distributed randomly in zone A, and the sensor network has the following features:

1. The network contains numerous sensor nodes, and only one base station (BS). In the network, the sensor nodes are deployed at the detection site. Generally speaking, the nodes cannot move after being deployed, and the number of sensor nodes is decided according to the size of the application system. The BS is deployed in a fixed position outside the detection area.
2. The energies of the sensor nodes are set to be equal and UN-replenish able when the sensor nodes are deployed. The mutual communications can be carried out between a node and the BS. Besides, the wireless transmitting power is limited and adjustable. The wireless transmitting power of the BS is very large.
3. A sensor node sends data to the BS only when an unexpected event happens. While it is not required to periodically send sample data to the BS, the unexpected event is required to be discovered and responded in the first place.
4. The wireless transceiver module will be in dormancy state for a long time. Only when potential risks occur, sensor nodes will be woken up. In the meantime, they transmit the data to the BS.
5. The node zone can be divided into several sub-zones. Each sensor node obtains a zone number according to the deployed location of itself.
6. The sensors adopt the time synchronization.

Event Driven
The event-driven WSNs have the issue of unbalanced energy consumption and the energy waste problem caused by re clustering and rebuilding the routing path when the similar events occur.

Llterature Survey
Y. Ding (2016) et al: In order to save energy for event-driven wireless sensor networks (WSNs) applied to emergency monitoring, a rule driven multi-path routing algorithm with dynamic immune clustering (RDICMR) is proposed. The RDICMR algorithm is executed under the driven of condition rules and implementation rules. The proposed RDICMR algorithm saves a lot of energy in the process of building clusters and data transmission, increases the amount of data transmission and prolongs the lifetime of the network [2].

.**M. A. Ehsan(2016) et al:** Centralized clustering routing schemes promise significant network stability by centralized energy-efficient path planning that prominently share computational burden of monitoring devices of Wireless Sensor Networks (WSNs). Scalability and adaptiveness of WSNs present vital challenges for researchers to design a power-aware, well-organized routing schemes that can maintain centralized routing decisions and distributed data forwarding. Investigations on

central cluster formation acknowledge the fact that higher computational and energy resources of Base Station (BS) are still required in specific network conditions and need more careful path planning to generalized their performance validity[1].

S. A. Alharthi (2016) et al: Due to the inherent limitations of the sensor nodes (SNs) and the distributed nature of information in wireless sensor networks (WSNs), energy efficient routing protocols have received significant research attention. Hierarchical routing based on clustering have been proven to be an effective method for energy-efficiency. Moreover, the presence of heterogeneous nodes with varied initial energies can improve the lifetime of WSNs. Although LEACH (Low Energy Adaptive Clustering Hierarchy) protocol is a homogeneous scheme, its performance can be improved by taking advantage of the presence of heterogeneous nodes. In this paper, a hybrid threshold sensitive and two-level heterogeneous LEACH (HT2HL) protocol is proposed [3].

P.Padmaja(2016) et al: optimization Wireless Sensor Network (WSN) is necessary to reduce redundancy and energy consumption. To optimizing wireless sensor networks for secured data transmission both at cluster head and base station data aggregation is needed. Data aggregation is performed in every router while forwarding data. The life time of sensor network reduces because of employing energy inefficient nodes for data aggregation. Hence aggregation process in WSN should be optimized in energy efficient manner [4].

H. Darji (2016) et al: Traditional routing protocols such as LEACH, PEGASIS, TEEN etc. are no longer appropriate for the Energy Harvesting-Wireless Sensing element Networks (EH-WSN). Requirement is that WSN must have low energy consumption. Machine Learning algorithms can be used for minimizing energy consumption. Thus our main objective is to develop machine learning based routing protocol, which is having energy harvested from environment instead of batteries [5].

In WSN, the sensor nodes are deployed in a sensor field. The deployment of the sensor nodes can be random (i.e. dropped from the aircraft), regular (i.e. well planned or fixed) or mobile sensor nodes can be used. Sensor nodes coordinate among themselves to produce high-quality information about the physical environment. Each sensor node bases its decisions on its mission, the information it currently has, and its knowledge of its computing, communication, and energy resources. Each sensor nodes collect the data and route the data to the base station.

Proposed Algorithm

Step1 Distribute the sensor node in the given area.

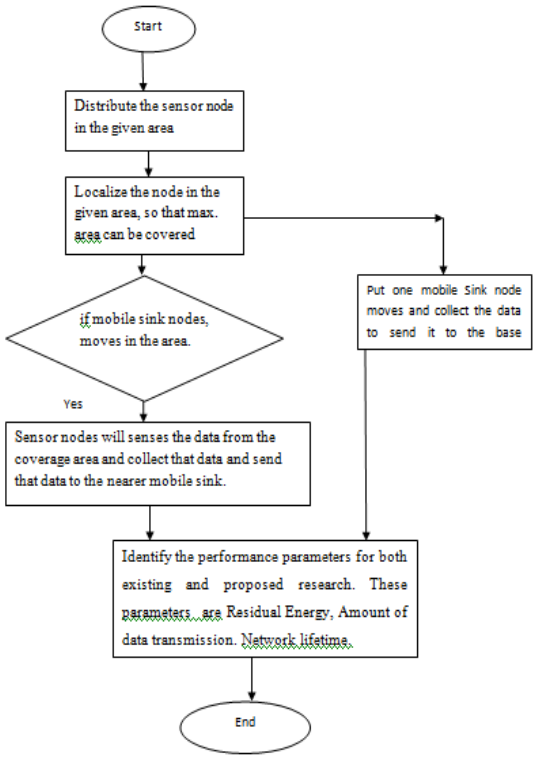
Step2 Localize the node in the given area, so that max. Area can be covered.

Step3 Put multiple mobile sink nodes, which are movable in nature.

Step4 Sensor nodes will senses the data from the coverage area and collect that data and send that data to the nearer mobile sink.

Step5 End

Flowchart



Analysis of Results

WSN is the wireless sensor network having various sensor nodes lying randomly in specific area. There are various mobile sinks which moves in the network area. It collects the data from sensor nodes. Sensor nodes senses the data and moves the data from itself to the mobile sink when certain event will be occurred. Sensor nodes either remain stationary or moves in the area. It depends upon the basic network configuration and application. During the communication sensor nodes moves and communicates requires energy. Any network performance issue is related to that how much energy has been wasted for communicated. Various performance parameters are required to check the performance of the technique. Like Residual Energy, Amount of data transmission, Network lifetime. The results specified that the parameters affect the performance of the overall system performance, as it takes less time and less energy consumed.The amount of data transmission is directly propotional to the other two factors.

a. Residual Energy.

$$R_s = T_e - E_d$$

R_s is residual Energy
T_e is total Energy
E_d is energy dissipate

b.Amount of data transmission.

$$D_t = S_d - D_d$$

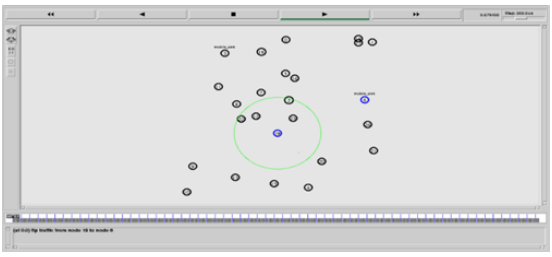
D_t Data Transmitted
S_d Send Data
D_d Dropped Data

c. Network lifetime.

$$N_l = E_r * U$$

N_l is network Life Time.
E_r is Energy remaining.
U is per unit of life for per unit of Energy.

Network for WSN with Multiple mobile Sinks.

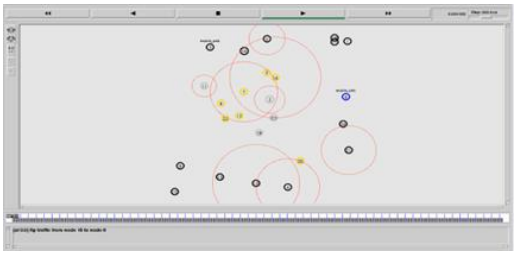


Nam Animation

various sensor nodes lying in stationary position. There are two mobile sinks. Moves in the network. So that sensor nodes senses the data and send data to the mobile sink.

Network for WSN identification of relay Nodes.

In the figure 3 various sensor nodes communicates to each other. While communication source sensor identifies the intermediate nodes so that data from the source node can be send to the destination node either directly or through the intermediate node. Intermediate nodes are shown in yellow color.



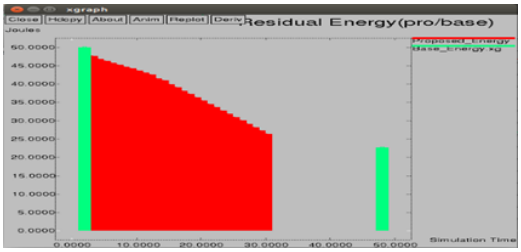
Network showing Identification of path

Graph for comparison of data transmitted

Graph showing the comparison of proposed and base data transmission

In above graph the proposed technique shows better data transmission. That means more data is transmitted in case of multiple mobile sinks. Compared to single mobile sink in case of base paper.

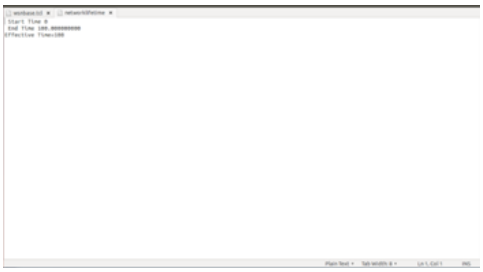
Graph for comparison of Residual Energy



Graph for comparing the residual energy of base and proposed technique

In above graph the residual energy in case of proposed technique is better than the base technique. Red shows the residual energy of proposed technique and green shows the residual energy of base technique. Green line on the right hand side shows lower bottom compared to the right hand side of red.

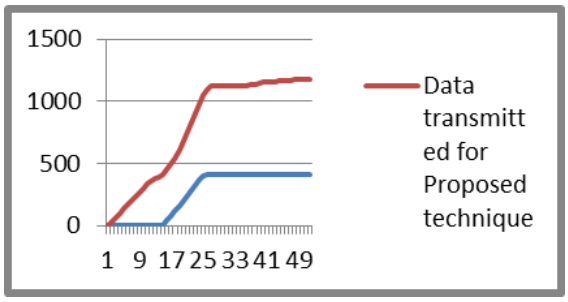
Fig. for total network life time



network life time for the proposed technique

In above diagram shows the network life time. That means how much time network stays live.

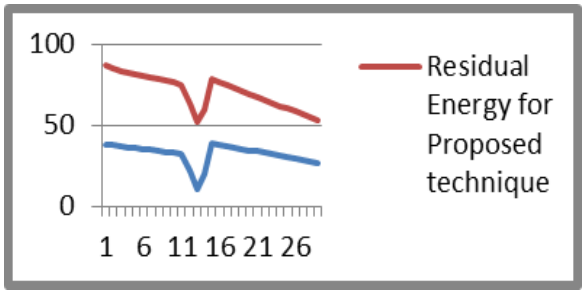
Graph for Comparison of base and proposed technique.



Graph for comparison of data transmitted

This graph shows the data transmission for both base and proposed technique. Proposed technique has better data transmission compared to the base technique.

Graph for Comparison of base and proposed technique.



comparison graph for residual energy of both base and proposed technique

This graph shows the residual energy comparison for both base and proposed technique. Proposed technique with multiple mobile sinks has better residual energy compared to the base technique with single mobile sink.

Comparison table for percentage improvement

Parameters	Existing	Proposed	Improvement
Network life Time	99Sec	100Sec	1%
Residual energy	32.122 Joule	38.32 Joule	19%
Data transmission	257.053 Bytes	543.23 Bytes	47%

From above table it is clear that the there is a improvement in the all the factors. Like residual energy, data transmission and network life time. Residual energy has improved over to 19%. Data transmission has improved over to 47%. And network life time has improved over to 1%. In over- all result approximately has improved over to 21%.

Conclusion

WSN as wireless sensor network has various sensor nodes either moving or stationary. Also has multiple mobile sinks. These mobile sinks are moving in specified path. So that they can collect the data for the sensor nodes. The current technique is based on multiple mobile sinks will receives the data from sensor nodes when certain event will arise. Compare to it in the base paper the single sink. Which has fixed position? The entire sensor node sends the data to the sink node using relay nodes. Both the techniques have been compared on the basis of various performance parameters like network life time, data transmission, and residual energy. In all the parameters new technique has outperforms the old technique. Such that over all there is a improvement of 21%. So on the basis of current research it is clear that network of WSN nature with multiple mobile sinks works more efficient that the network with single mobile sink. In future this technique can be applied to various other routing techniques. So that authenticity of the result can be tested.

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