Research Article

DISTANCE BASED ENERGY EFFICIENT ZONE BASED ROUTING PROTOCOL IN WSN

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A R T I C L E   I N F O

A B S T R A C T

A Wireless Sensor Networks (WSN) is a network which used number of small sensor nodes in a network to construct a wireless communication between nodes. In this paper propose an DE-ZONE based routing protocol which is an enhancement over E-ZONE protocol. All limitations of E-ZONE routing protocol are overcome by DE-ZONE. The distance between CH and BS was more and CH node have died in a short time of period. DE-ZONE contain two parameters energy and distance with using relay node. This protocol increased the reliability of network, reduce the distance between CH and BS, reduce energy consumption of CH.the main reason of behind to design this protocol is to increase the life time of a zone network.

INTRODUCTION

Wireless sensor networks have collected a great study interest in recent years. Especially, they have advantages in unreachable environment[11]. WSNs have establish the connection between the physical world, the computing world and human society. Generally a sensor node consists of sensing elements, microprocessor, limited memory, battery, and low power radio transmitter and receiver. Sensor nodes are usually unattended, resource-constrained, and rechargeable in wireless sensor networks[12]. Architecture of WSN shown in fig.1.
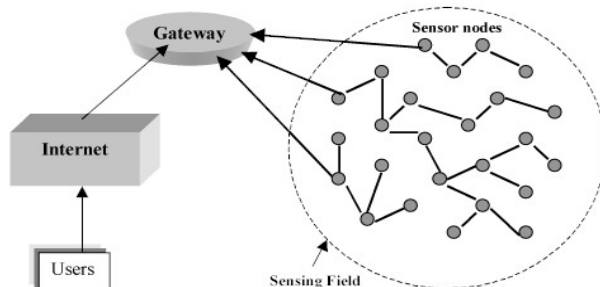

Fig 1 Architecture of WSN[12]

Related Work

Spriti *et al*. [1] had proposed (EECRP) zone based energy-efficient cooperative routing protocol. In this routing protocol there are network was divided into equally zone. To proposed Zone based Cooperative Routing Protocol ZCRP) performed

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better in terms of energy efficiency.The complete network was equally divided into four zones for an equal distribution of network's load. Mann *et al*. [2] had presented Bee Swarm a SI based energy efficient hierarchical routing protocol for WSNs. It consists of three phases(1)Set-up phase-Bee Cluster(2)Route discovery phase-Bee Search and (3) Data transmission phase-Bee Carrier.Bee Swarm perform better in terms of packet delivery, energy consumption and throughput with increased network life compared to other SI based hierarchical routing protocols. Kim *et al*. [3] had proposed Applications with periodic data generation for wireless sensor networks require the maximum lifetime of the network. It work for avoid the life time maximization problem. It improves a novel load balancing scheme that balance the energy consumption of the sensor nodes and maximum network lifetime by load balancing applying the sub-network management in wireless sensor networks. Shio Kumar Singh *et al*. [4] had proposed covered only few sample of routing protocols. The protocols discussed individual advantages and pitfalls. It had proposed energy efficiency, further research would be needed to address issues related to Quality of Service (QoS). Somasundaram *et al*. [5] had proposed work covers the efficient usage of nodes mobility energy or hidden zone issues and routing in WSN.Nodal contact probability and Weighted moving average concepts are used to reduce the impact on mobility issue.It increases the lifetime of the nodes with reduces the nodes early dead. Tyagi *et al*. [6] had proposed various taxonomy clustering and routing techniques in WSNs based upon metrics such as power management, energy management, network lifetime, optimal cluster head selection, multi hop data transmission etc.It described many routing protocols based upon the standard LEACH protocol with their advantages and

disadvantages with respect to the each other.Various parameters such as CH selection, load balancing, routing, security etc. Yan *et al*. [7] had proposed articulate this problem and classify current routing protocols for WSNs into two categories according to their orientation toward either homogeneous or heterogeneous WSNs.Yan categorized them into homogeneous WSNs and heterogeneous ones, each of which can be further divided into static or mobile ones. Routing protocols for homogeneous WSNs are more widely investigated than heterogeneous ones. static WSN's, routing protocols for mobile WSNs promise to bring more benefits to real-time delivery guarantee as well as high coverage, energy efficiency and energy. Yuan *et al*. [8] had proposed An energy efficient overlapping clustering and relay node selection algorithm is proposed, which selects different nodes as CHs and relay node to attain the balancing of energy consumption of the network.A multi-hop energy efficient overlapping clustering and relay nodes selection algorithm has been proposed for WSNs in this paper. Proper boundary nodes in the overlapping area are selected as relay nodes according to the distance metric.Singh *et al*. [9] gave a survey of routing protocols for Wireless Sensor Network and compare their strengths and limitations. Boselin *et al*. [10] had proposed procedure forevaluation of clustering efficiency, routing efficiency, energy efficiency using a distributed clustering approach, the hybrid energy efficient clustering algorithm has been proposed. Zone based transmission power, routing using distributed relay nodes and rapid cluster formation.The work reported in literature was focused on the CH (Cluster Head) selection based of energy factor only. Every CH was transmitting data to the sink directly which lead to more energy consumption and decreased the life time of the network. This paper propose DE-ZONE based routing protocol with two parameters that is energy, distance with using relay node. It is necessary to enhance of the network life time of WSN.E-Zone clustering with energy efficient cluster heads election.The E-zone clustering case chooses the CH for each zone with energy parameter. A clustering algorithm that partitions nodes in to specific zones is an energy saving technique but distance is more in between CH to BS that occur a risk of network die in a less time. The E-Zone algorithm is executed in three phases:(1)network setup(2)CH election for each zone(3)packet transmission from CH to gateway[20].

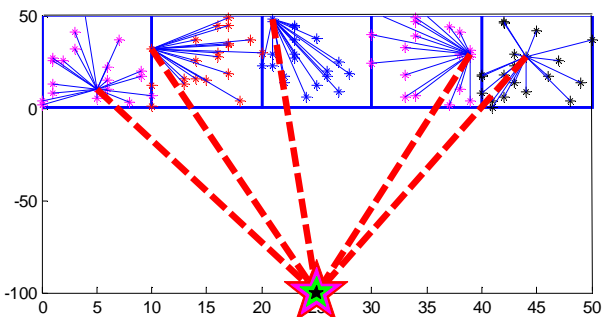**Fig 2** E-ZONE routing protocol

Routing in WSN

Routing is a process of finding a path between source and the destination. Routing in wireless sensor network is a challenging task due to characteristics that differentiate them from other communication and ad-hoc networks [11]. The different types of routing are listed as below.

1. *LEACH Protocol*: In Routing Low-Energy Adaptive Clustering Hierarchy (LEACH) is the first hierarchical based protocol that uses irregular rotation of local cluster base stations (BS). LEACH is used when a node in the network crash or the battery stops working. It is a self-organizing and an adaptive clustering protocol where nodes are grouped into clusters and each cluster contains Cluster Head (CH) and a Cluster Member (CM).

2. *Zone clustering*: It appears less frequently in the literature as compared to Leach.However, for a tactical network, it may be a preferred routing algorithm because the user can specify how zones are characterized for the network. Network is divided into zone that create multitude smaller WSN's. A sensor in each zone has a probability p of becoming a CH during each round.

3. *E-Zone:* In E-Zone(Energy Efficient Zone based routing protocol) there are network was divided into zone and all the communication is done on the energy base. There are CH and Cluster Member selection was based on energy, which had high energy that was selected as a CH in one zone. The E-Zone algorithm is executed in three phases:(1)network setup(2)CH election for each zone and (3)packet transmission from CH to gateway.

4. *DE-ZONE:* In Distance Energy Zone based routing protocol is based clustering chooses the CH in each zone with energy and distance factor, which may lead to the selection of CH which is placed farthest from the sink.CH choose with the maximum energy source of node in a zone. Every CH is transmitting data to the sink with using relay node, which leads to the less energy consumption in the network. As the numbers of transmissions are increased. A clustering algorithm that partitions nodes in to specific zones is a energy saving technique. When compared this protocol to the E-Zone algorithm, there are a lower maximum distance in between CH and BS. In any node must transmit data to CH. DE-Zone routing guarantees a CH is near by in zone as compared to E-Zone. In E-Zone CH selection on the basis of energy that contain a large distance in between CH and BS and it also consume more energy consumption by CH to collect all nodes data and sent to BS.
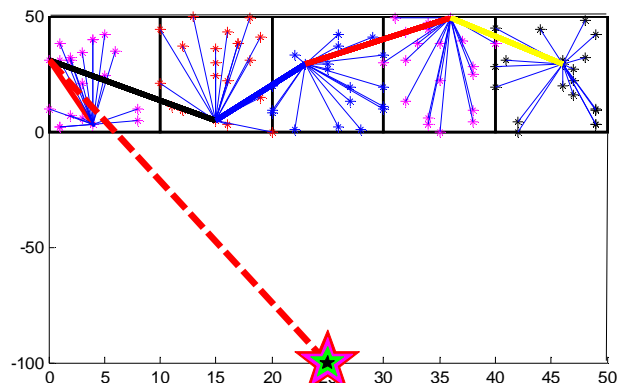

Fig 3 DE-ZONE routing protocol

Simulation Parameters

There are some performance metrics which are taken into consideration for evaluation of proposed protocol.The

simulation parameters taken for the simulation analysis for the proposed work is given as below**.**

1. Network Lifetime: No. of rounds covered till 100% of nodes are dead.
2. Network's remaining energy: It defined the way the network's remaining energy is consumed during data transmission.
3. No. of Dead Nodes: No. of rounds covered by the network till first node dies.
4. Alive Nodes: No. of rounds covered by the network till first node alive.

Table 1 Simulation parameters

Parameter	Value
Network Coverage	(100,100)m
BS Location	(50,150)m
Node Number	100
Initial Energy (Quantity) In Joules	0.5
E_{elc}	50nJ/bit
E_{efs}	10pJ/bit/m^2
E_{mp}	0.0013pJ/bit/m^4
d_0	87m
Energy for data fusing	5nJ/bit/signal
Data Packet Size	4000bits

RESULTS AND DISCUSSION

To propose and implement DE-ZONE routing protocol that is based on E-ZONE routing protocol for the selection of cluster head, Relay node. This protocol is implemented by using parameters Distance, energy.Performance metrics are Network Remaining Energy, Dead Nodes, Alive Nodes and Packet sent to BS. In figure 4 shows Packets sent to BS. In figure 5 shows Networks remaining energy is shown. In figure 6 shows Dead node. In figure 7 shows alive node.
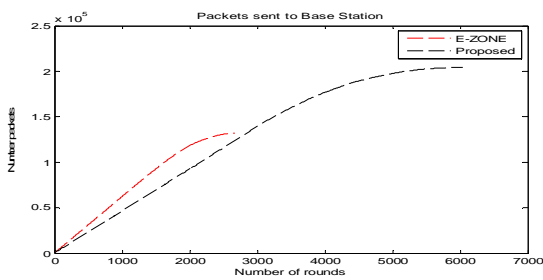
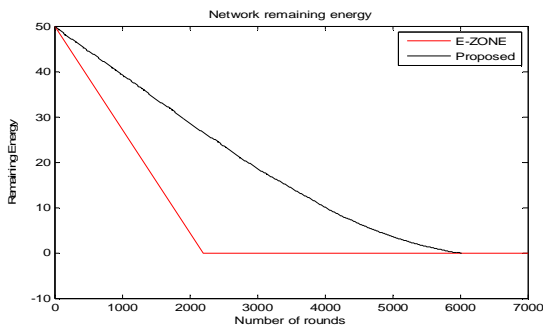

Fig 4 No. of Packets sent to BS

Fig 5 Remaining Energy

In E-ZONE nodes remain alive till max 2000 rounds whereas in DE-ZONE proposed work, nodes play their role till 6000 rounds in fig4. It is clear that DE-ZONE have better results as compare to E-ZONE routing protocol. In network remaining energy fig.5 is till 2000 rounds in E-ZONE but in DE-ZONE

protocol, networks energy is used efficiently and communication took place till 6000 rounds. In fig.6 the E-ZONE routing protocol, networks die at 2200 rounds. On the other hand DE-ZONE, nodes started dying from about 3000 rounds and the whole networks dies at 3000 rounds. Network dies after at approx 6000 rounds. Energy of nodes is consumed considerably and nodes remain alive for long period of time. In the E-ZONE fig.7 routing, nodes remain alive till max 2000 rounds whereas in DE-ZONE nodes play their role till 6000 rounds.
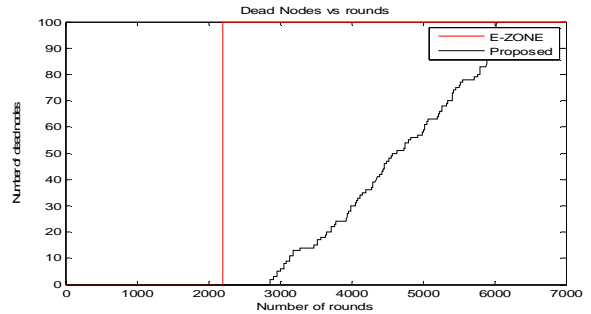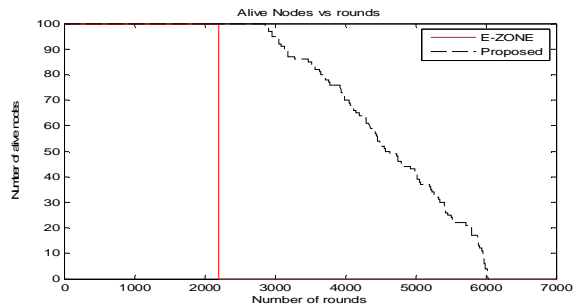

Fig 6 No. of Dead Nodes

Fig 7 No. of Alive Nodes

Table 2 Performance comparison of DE-Zone and E-Zone Routing Protocols

Protocols	First Node Dead (Rounds)	Half Nodes Dead (Rounds)	Last Node Dead (Rounds)
E-ZONE	1073	2092	2674
DE-ZONE	2856	4580	6033

Table 3 Percentage improvement by DE-Zone over the E-Zone protocol

Protocols	%Improvement First Node Dead	%Improvement Half Nodes Dead	%Improvement Last Node Dead
DE-ZONE	166	118.9	125.62

CONCLUSION AND FUTURE SCOPE

Wireless sensor network has outperformed various traditional ad-hoc networks.The battery issue in WSN has been the major concern.In order to cope with that, various routing strategies have been implemented. Here in this paper, DE-ZONE routing protocols ensures the energy balancing in the network. Load of each cluster is divided among CH and Relay Node. CH will collect the data and inter cluster communication is performed by Relay Node. It is seen that 166% improvement in case of first node dead by DE-ZONE protocol is accounted as compared to E-ZONE routing,118.9% improvement in half node and 125.62 % case of last node dead that increased network lifetime. The future work in the proposed protocol can be extended to explore the sink mobility in WSN.

Different quality of service parameters can be considered for the performance investigation

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