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Improvement of LEACH Protocol for Enhancing Features of WSN

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Abstract. *Wireless Sensor Network (WSN) has several applications such as military, industry. and environment. The importance of WSNs in current applications makes the WSN technology highly relevant and significant to the field of communication and computing. However, WSN's performance deals with number of challenges. Energy consumption is the most considerable because nodes use energy to collect, treat, and send data, but they have restricted energy- For this reason. numerous efficient energy routing protocols have been dev eloped to save the consumption or power. Low energy adaptive clustering hierarchy (LEACH) is considered the most attractive one in WSNs, in this projects we evaluate the LEACH approach effectiveness in the cluster-head (CHJ choosing and in data transmission, then we propose an enhanced protocol. proposed algorithm aims to improve energy Consumption and prolong the lifetime of WSN through selecting CHs depending on the remaining power, balancing the number of nodes in clusters. determining abandoned nudes in order to send their data to the sink. Then CHs choose the optimal path to reach the sink, we propose a new approach to achieve better enhancement of WSN in terms of network lifetime and data transmission time represented by reducing the packet delay time. Then, we compare the simulated result of the proposed algorithm with the basic LEACH protocol.*

1. INTRODUCTION

Computing devices have become cheaper. more distributed. and more pervasive in daily life, with the popularity of laptops, cell phones, PDÁs, GPS devices, RFID and intelligent electronics in the post, PC era. The emergence of Wireless Sensor Networks (WSNs) is essentially the latest trend of Moore's Law towards the miniaturization and ubiquity of computing devices. It is now possible to construct a wallet Siu embedded system with the equivalent capability of a 90's PC. Such embedded systems can be supported with scaled down Windows or Linux operating Systems. A Wireless Sensor node (or Simply Sensor node) consists of sensing, computing, communication. actuation, and power components. A few cubic inches are enough to package these integrated components on Single or multiple boards. Utilizing state-of-the-art power-saving Circuitry and network technologies in conjunction with a low-duty cycle mode of Just 1% sensor nodes powered by Just a pair of AA batteries have a lifespan of up to three years. For information sharing, tens thousands of nodes communicate wirelessly in A WSN. They also participate in collaborative processing. WSNs provide an Opportunity for Widespread environmental monitoring and habitat Study. Military surveillance and reconnaissance become more achievable over a battlefield while search and rescue missions are effectively carried in emergent environments. Condition-based maintenance is easily implemented in factories which ensures infrastructure health monitoring in buildings, enables smart homes in residencies, and facilitates patient monitoring inside human bodies. The task organizing a suitable network Infrastructure falls on sensor nodes after they are initially deployed, sensor nodes responsible for self-organizing an appropriate network infrastrue1utÞ often with multi-hop connections between sensor nodes.

The on-board sensors then begin to gather environmental data in continuous or event driven operating modes, employing acoustic, seismic, infrared, or magnetic signals. The global positioning system (GPS) or local positioning algorithms can also use to determine a person's location and position, this data can be received from various points on the network and properly processed to create a global picture of the phenomena or objects under observation. The fundamental tenet WSNs is that, notwithstanding the limitations of each individual sensor node, the combined of the entire is adequate for the desired purpose. By inserting queries into a WSN and gathering information from the so-called base stations (or sink nodes), users can often retrieve information of interest from the network WSNs can be considered as a distributed database_ Additionally, it is anticipated that sensor networks will eventually be connected to the internet, making cross-border information exchange possible.

Wireless Sensor Networks (WSNs) can be defined as infrastructure-less wireless networks that self-configure and monitor physical or environmental conditions such as temperature, sound. vibration. pressure. motion. or pollutants. These networks cooperatively transmit data to a central location or sink, where the data can be observed and analysed. The sink or base station serves as an interface between users and the network, allowing retrieval of relevant information through queries and gathering results, Typically. a WSN comprises hundreds of thousands of sensor nodes that communicate with each other using radio signals. A wireless sensor node is equipped with sensing and computing devices, radio transceivers and power components. However, these nodes have limited pros sing age capacity, and communication bandwidth. Once deployed, the sensor nodes autonomously organize the network i Often on multi-hop communication. The onboard sensors start collecting information interest, and the nodes respond queries or perform specific instructions sent from control site. The nodes' working mode can be either continuous or event-driven. Additionally, Global Positioning System (GPS) and Iota] positioning algorithms can be employed location information, while sensor devices may also incorporate actuators to specific conditions.

Wireless sensor networks (WSNs) present new applications and require unconventional protocol design paradigms due to various constraints. These constraints include low device complexity, low energy consumption for extended network and a balance between communication and signal data processing capabilities. Consequently, substantial research efforts, standardization processes, and industrial investments have been dedicated 10 this field over the past decade [Chiara et al, 2009]. However, the majority or WSN research has focused on designing energy - and computationally efficient algorithms and protocols for simple data oriented monitoring and reporting applications [Labrador et al 2009].

2. ARCHITECTURE OF SENSOR NODE

This section discusses major components and other dependent’s components of wireless sensor

A. Main Components:

l. Sensing Unit All sensor devices arc equipped with sensing units. It is usually divided into two sub units: sensors pan and analog-to-digital. In sensor part which contains cameras, video, sound, and for scalar sensors and analog-to-digital converters. Analog signals generated by sensor nodes and converted into digital signals with help of software and send to processing unit.

2. Power Unit: Power unit provides power to sensor node and sensor uses energy for many areas as sensing environment, data processing which come from sensor nodes and communicated to other sensor nodes. From many researches it is found that more energy is consume than any other processes, Basic source of power of sensor is electrochemical material such as NiMH, NiZ11, and lithium-ion cells.

3. Communication Unit: A communication unit is subsystem, stabilize interface between the device and the network and a make possible transmission and receiver with the help of communication software.

4. Processing Unit After getting information or data from sensor nodes/devices then processing unit starts its execution in the system software as coordinating sensing. It is interacted with storage unit and communication tasks.

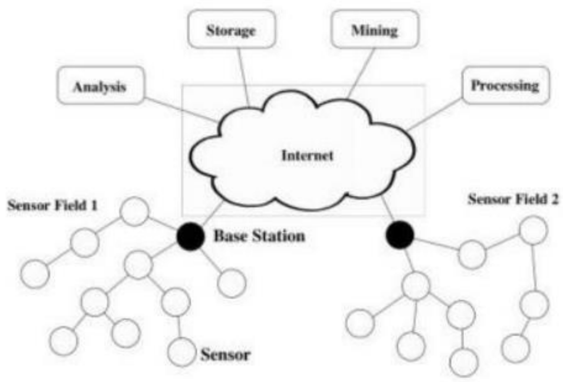

FIGURE 1. general system model of a WSN

WSN Network Topologies: For radio communication networks, the structure of a WSN various topologies like the ones given below.

Star Topologies: Star topology is a communication topology, where each node connects directly to a gateway. A gateway Can send or receive a message to each a messages to serval remote nodes. In instar topologies, the nodes are not permitted to send messages to each other. This allows low-latency communications between the remote node and the gateway (bust station).

Due to dependency on a single node to manage the network the gateway must be within the radio transmission range of the individual nodes- The advantage includes the ability to keep the remote nodes power consumption 10 a minimum and simply under control. The size of the network depends on the number of connections made to the huh.

Tree Topologies:

Tree topology is also called as a cascaded star topology. In nee topologies each node connects to node that is placed higher in the tree, and then to the gateway. The main advantage Of the Cree topology is expansion Of a can be easily possible, and error detection becomes easy _ The disadvantage with this network is that it relies heavily on the hus cable; if it breaks, all the network will collapse.

Mesh Topologies:

The Mesh topologies allow transmission of data from one to another, which is within its radio transmission range. If a node wants la send a message another nude, which is out of the radio communication range, it needs an intermediate node to forward the message to the desired node_ The advantage of this mesh t0L»logy includes easy isolation and detection of faults in the network. The disadvantage is that the network is large and requires huge investment.

of Wireless Sensor Networks;

Depending on the environment, the types of networks are decided that those can be deployed underwater. underground on land. and so on. Different types of WSNs include:

1. Terrestrial WSNs
2. Underground WSNs
3. Underwater WSNs
4. Multimedia WSNs
5. Mobile WSNs

3. LITERATURE SURVEY

l. Akyildiz, lan et al.: Wireless Sensor Networks (W SNs) are spatially dispersed networks furnished with a large number of nodes for monitoring and recording various environmental conditions like humidity, temperature, pressure, lightening conditions etc. Since WSNs are restrained in terms of their processing power. storage resources, battery life they are not themselves proficient to perform such diverse task Set like localization of nodes, data processing etc. Cloud computing CCC) offers on demand access of the resources like networks, storage, servers and applications. The assimilation oi WSN and cloud can provide an open flexible and reconfigurable platform for various monitoring and controlling applications. In this paper, we try to find out how the integration oi WSN and cloud computing can help vs to achieve various Objectives like. Further We have presented extensive Study the current WSN-CC integration along with key issues and "he methodology recommended by different authors in detail- The research challenges, existing solutions and approaches as well as the future directions are also discussed in this paper.

2. M. Quwaider and S. Biswas: This paper presents an experimental modelling framework for energy harvesting in Body Sensor Networks, (BSN). applications assume that the sensor nodes have infinite and continuous source of energy. But in reality, this may not be true. especially for the implanted sensors. Instead. the energy for the implanted BSN sensors is likely to come from harvested energy sources such as piezo electric, magnetic and thermos electric generators. In this paper We will explore on body sensors energy using acceleration which is getting a lot of attention in the research community Recharging batteries with harvested energy could not only extend battery life, but may also dissolve the conventional meaning network life time, While the energy-harvesting sources can vary widely, we will focus priinarily on harvesting using vibration of piezoelectric sensors. Since the piwoeiectric energy harvesting depends on movements, the amount energy harvested at a specific on-body sensor wi I depend on the movement pattern of the body parl that the node is attached to_ As a result, the specific energy generation profile al the BSN nodes does depend on the postural body movement patterns over time.

3. Hein Zelman, Wendi Rabiner, Anantha Chandrakasan, and Hari Balakrishnan: Winless distributed micro sensor systems will enable the reliable monitoring of a variety of environments for both Civil and military applications- In this

we look at communication protocols. which can have significant impact on the overall energy dissipation of these networks. Based on our findings that the conventional protocols of direct transmission, minimum-transmission-energy, multi-hop routing. and static clustering may not be optimal for sensor networks, we propose LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of local cluster-based station (cluster-heads) to evenly distribute the energy load among the sensors in the network LEACH uses localized coordination to enable scalability and robustness for dynamic networks and incorporates data fusion into the routing protocol to reduce the amount of information that Illust he transmitted to the base Station. Simulations *how the LEACH achieve much as a factor of 8 reduction in energy dissipation compared with conventional outing protocols, [n addition, LEACH is åhle Co distribute energy dlssipaiion evenly throughout the sensors, doubling the useful system lifetime for the networks we simulated.

(41 M. Quwaider and S. Biswas, This paper presents novel store-and-forward packet routing algorithms for Wireless Body Area Networks (WBAN) With froguetit postural partitioning. A prototype WBAN has been constructed experimentally characterizing on-body topology disconnections in the presence of ultra-short-range radio links, unpredictable R F attenuation, and human postural mohilily, On-body IYTN routing protocols are then developed using a stochastic link cost Formulation, capturing multi-scale topological localities in huntan postural movements, performance Of pmposed are evaluated experimentally and via simulation, and are compated with a number of existing single-copy IYI'N routing protocols and an on-l»dy packet flMÞding mechanism that serves as a performance hench mark with delay lower-hound. 11 is shown that via multi-scale madelling of the spatio.temporal locality of onbody link discomection patlerns. the proposed algorithms can provide better routing performance compared number of existing probabilistic, opporlunistic, and m; lily-based IY['N muting protocols in the literature.

(Sl Mhatre, Vivek, and Catherine Rosenbergï A eosl based comparative study of homogeneous and heterogeneous clustered sensor networks. We focus on the case where the base station is remotely located and the sensor nodes are nut mobile. Since we are concerned with the overall network dimensioning problem, wc take into account the manufacturing cost of the hardware as well as the battery energy of the nodes A homogeneous sensor network consists of identical nodes , while a heterogeneous sensor network consists of t"' a 01 more types Of nodes into We first Single. hop Clustered Sensor networks {nodes use singe hopping reach the cluster heads). We use I.F.ACII as (he representative single hop homogeneows network, and a sensor network with 1"' o types of nodes as a representative single hop heterogeneous network. For multi-hop homogeneous networks (nodes use multi.hopp•ing io reach the cluster head), we propose and analyse a multi-hop variant of] .EAC.TI that we call M-I.EAC[I. weshaw that M-I.EACEI has heuer energy efficiency than LEACH in many cases. We then compare the cost of multi-hop clustelecl sensor networks with M-LEACH as the representative homogeneous network. and a sensor network with two types of nodes (that use in.cluster multi.hopping) as the representative heterogeneous network.

Block diagram:

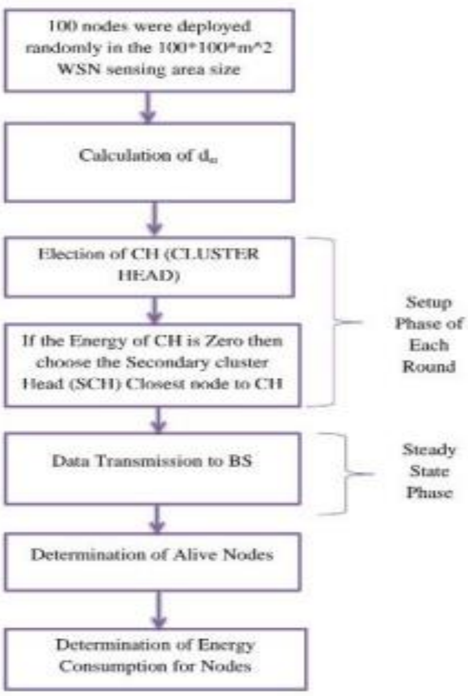

FIGURE 2. Block diagram

4. RESULTS

Network lifetime measurement factor is used to monitor the network life cycle, in this project we focus on the last dead node in the whole network concurrently with data packet transmission through the network, as shown in the figure, by using our proposed algorithm, the last dead node was in round 4812 -The reflection also appears on energy consumption. The network lifetime IS Increased due to the efficient way of energy consumption by transmitting the data packet in our proposed algorithm. Figure shows the energy consumption of the proposed algorithm. AS shown in the figure for example, the average consumed energy in round 1000 was 0.13J.

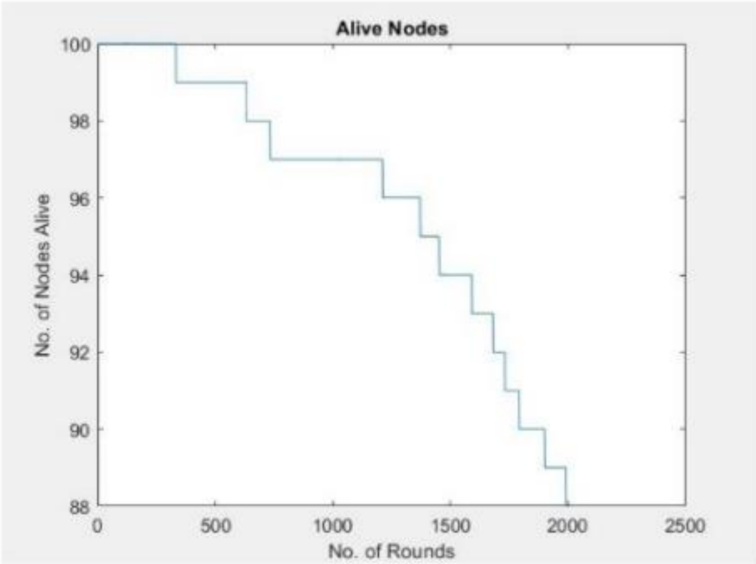

FIGURE 3. Number of Live Nodes

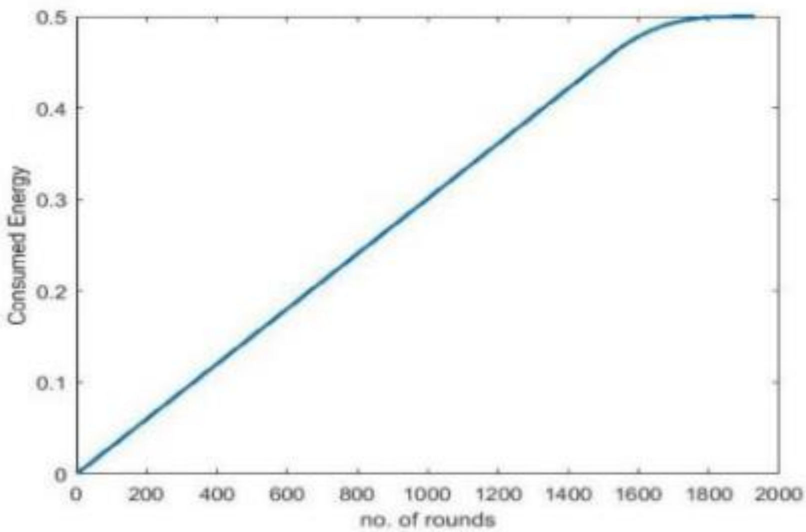

FIGURE 4. Energy Consumption in The Existing Protocol

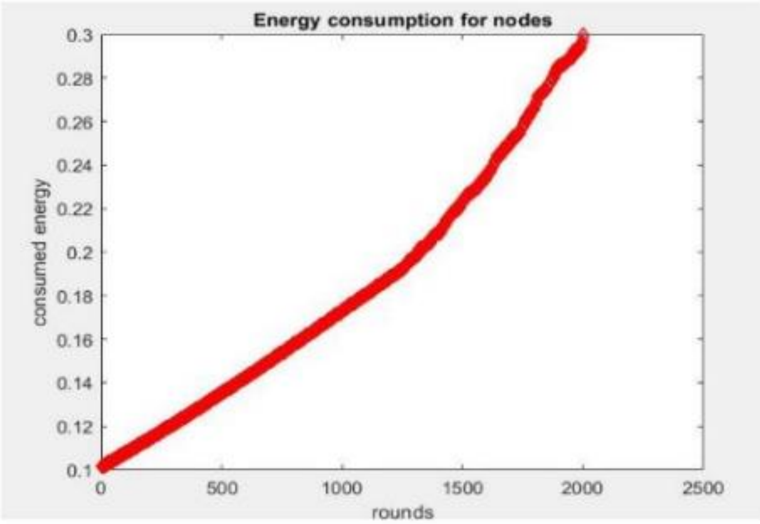

FIGURE 5. Energy Consumption for effective network

TABLE 1. Comparison Table for Two Methods

	EXISTING METHOD		PROPOSED METHOD	
NO. OF ROUNDS	NO. OF ALIVE NODES	ENERGY CONSUMED	NO. OF ALIVE NODES	ENERGY CONSUMED
0	100	0	100	0
200	98	0.06	99	0.01
400	96	0.14	98	0.12
600	90	0.18	97	0.14
800	87	0.22	97	0.15
1000	85	0.31	97	0.17
1200	80	0.35	95	0.18
1400	70	0.43	94	0.20
1600	63	0.48	93	0.23
1800	55	0.5	90	0.26
2000	30	0.5	88	0.29

TABLE 2. Simulation Parameters

Parameters	Value
Number of nodes	100
Field Dimensions	100 x 100m
Transmission Distance	87.70m
Number of Clusters	88
Initial Energy	0.3j
Total Packets	4000
Throughput	35.2
Distance of CH	30.98
Maximum Rounds	2000

5. ADVANTAGES AND APPLICATIONS

Advantages:

1.1f the CH is dead -the secondary cluster head replaces the dead cluster head and pronounces itself as a cluster head.

2.The nearest the distance between CH and BS- the better lifetime and energy-efficient the network is; CH is selected which is nearest to BS

3.111 S-LEACH, the lifetime of the network is improved by selecting Cluster Head (CH) and Secondary Cluster Head (SCH) in the sensor setup phase of each round.

4. Secondary Cluster Head CSCH) is selected nearer to Cluster Head so there is no more energy Consumption problem.

5. Some nodes not able join the cluster because they have not the range ratio of any cluster, So, they connect to HS directly without electing CH by the protocol which called Direct transmission (DTx).

Applications:

1. Industrial control

2. Environmental monitoring,

3. military surveillance,

4.intelligenL transportation systems and medical field.

5. Furthermore, it can function independently in harsh or high-risk places where human presence is not possible

6. Disaster relief operations,

7. Biodiversity mapping

8. monitoring of temperature, pressure, and humidity

6. CONCLUSION

The wireless sensor networks are widely used in different areas. LEACH protocol is one of the most lar approaches in WSN. In this we proposed a new algorithm called Secondary Cluster Head (SCHL which becomes a cluster head simultaneously with the death of the previous CH. Therefore, all WSN cluster keep trans uniting data even if some nodes dead, which increase the network lifetime and the network performance. Also, that Increased the number of transmitted data packet in the network with the same network Settings compared with the basic LEACH protocol.

Future Scope: AS future work, it would be worth to apply the proposed S-LEACH algorithm in different WSN routing protocols to minimize network traffic and the best path for data to travel from cluster to sink.

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