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An multilevel efficient energy clustering protocol with secure routing (MEECSR) in WSNs

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ABSTRACT

Nowadays the interest of research by the researchers is dominating in various areas of wireless sensor networks (WSNs) domain. The task of reducing energy consumption and spreading WSN lifetime are very impressive. Increase of energy stability and developing an advanced routing mechanism is one of the main issues in WSNs. There is a rising concern about protection of data from sensors and these low power devices are not suitable to complex cryptographic algorithms. Hence, the lifetime optimization and security are two conflicting design issues that are not filled to multi-hop wireless sensor networks. This paper presents a multilevel efficient energy clustering protocol with secure routing (MEECSR) protocol with two adjustable parameters: energy balance mastery and probabilistic random walking to avoid the above conflicts. The protocol for energy consumption of a given network topology is severely displaced, which greatly reduces the lifetime of the sensor networks. Also a quantifiable security method is proposed to address the source location privacy. The protocol provides an admirable trade-off between routing efficiency and energy balance can significantly extend the lifetime of the sensor networks in all scenarios. Further, the non-uniform energy deployment shows an increase in the lifetime of the network and the total number of packets delivered. This paper shows the simulation results of security and energy efficiency with different parameters.

Keywords: Deployment, Energy aware, Energy consumption, Lifetime optimization, Secure routing protocol, Security, Uniform energy, Wireless sensor network.

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1. INTRODUCTION

The introduction of wireless sensor network (WSN) includes various sensors installed in the geographic locations of different networks. The main applications that use sensors include some unknown locations that become important parameters for determining network size and energy. Also this is impossible to renew the energy of sensors nodes due to their location and various other challenges.

The advances in the field of remote networks and networking technologies led to the emergence of the novel wireless sensor networks. This network mainly consists of distributed sensor networks that are mainly used to monitor various physical conditions such as motion, movement and temperature etc. of the sensor nodes. These networks became popular in various fields and lately used various known applications such as home automation, health care monitoring, traffic monitoring, and agriculture surveillance monitoring and monitoring the robotic systems.

The wired sensor networks has been replaced by the wireless sensor networks as the basis for wired network data protection system which takes few weeks and it is costly. In wireless sensor networks the basic features like, less cost, low utilization, small size, multifunctional wireless sensor nodes can be described by measurement and integration.

These features ensure that WSN nodes have limited control over computation and system complexity requires applications that are not computational certified.

Improvements to efficient wireless communication and advances within hardware have made it possible to transform, lower costs, and distribute thousands of physical address sensor nodes in geological regions and most applications. It is difficult to recover energy using a replacement battery.

The wireless sensor network provides a wide range of applications for audit illustration, development of editing ideas, automated audits and agribusiness awareness. The multifunctional wireless sensor node described by the hardware-capable remote-moving and interchange design improves the efficiency of low power output and reduces its size. In the WSN, many embedded sensor nodes are located in the request area where possible and in many applications. It is difficult to restore vitality with replacement batteries. The basic resolution of sensor nodes is to collect and communicate information, with the best purpose of easily examining physical and natural conditions.

To increase the throughput required for today's professional steering models, most are trying to find a less power path among the source and the sink for optimum power consumption. In any case, the implementation of the policy regulating energy expertise, if any, the emergence of sensor networks will be multiplied, since it doesn't seek low energy paths from the source sensor node to the destination.

This article focuses on single-line (1-D) systems (Li et al., 2012), which are organized and built for operation between modern and non-military applications such as pipe observation, line inspection. The most efficient energy routing protocols (Karp and Kung, 2000) seek to find the minimum energy path between sources and sink to achieve optimal energy use. However, in case of sensor networks the planning of energy-efficient routing protocols is multiplied because it doesn't just find the minimum power path from a single sensor node to the destination. But also the power supply to the rest of the network.

A new cost aware protocol in which every sensor has to maintain the energy levels of its immediate adjacent neighbouring grids Yu et al. (2001); Ayadi (2011); Bhattacharya et al. (2003); Liao et al. (2015); Zhang and Yu (2008), accordingly our study concentrates on couple of routing strategies to forward message: shortest path and secure forwarding through random walk. A complete literature review is described in the next section.

2. LITERATURE REVIEW

This section presents a literature review of cost-effective secure routing protocol design on various works that have been done so far on wireless sensor networks, which is discussed in the next section.

Tang et al. (2014) have described to consolidate the multimodal sensor data dependent in monitoring the surveillance network. It mainly focuses on multi domain data acquisition by information procurement. It also serves the purpose of recognizing situations that are unnecessary and dangerous to the environment. The tasks required on air terminals and other security sensitive infrastructure can be monitored by this system, which was fully automated. The author describes a method of using information like sound, the way of expanding its capacity to the detected condition to acquire important data.

Li et al. (2011) have performed the assessment using Extremely Opportunistic Routing (ExOR) on Multi Hop Wireless Networks. The ExOR drives for each parcel through a node grouping, accepting every node's decision to sort until the last node communicates the log. The ExOR identifies which was effectively routed by the apparent aggregate nodes. The nearest node communicates with the other nodes. The ExOR design tends to experiment with selecting the sending node after transmission using the appropriate computation. Regardless, when a node sends a pack, it reminds the customer of a basic timetable, in which the potential users must forward the parcel. The node processes the schedule based on shared assessments between node transport rates.

Li et al. (2012) have described the ability to monitor and control the capacity for various real time applications like transportation, production, clinical, biological care, safety and security in wireless integrated network sensor. The micro sensor innovation, less power signal processing, less power computation, less cost wireless networking capability in minimal system using wireless integrated network sensor. With the rapid growth of integrated circuits, the development of more capable low-cost radio sensors and processors enabled the production of a large number of sophisticated methods of connecting world wide networks. It will also stretch from nearby location to worldwide, with various applications like medicine, security, factory automation, environmental observing, and condition-based support.

Karp and Kung (2000) have introduced the analysis in One Dimensional Ad Hoc Networks on statistics of most forward within range (MFR) (Li et al., 2010). This was observed by testing the wireless network highly depends on routing-related parameters. The routing plans were depends upon parameters like Power utilization, Multi hop communication delay, and position assessment. The packets were routed between source and destination were summarized by considering the parameters for examples, Probability Mass Function (pmf) of complete number of hops broadcasts and connection separation probability density function for number.

Xu et al. (2001) have described the wireless sensor networks using QoS to realize geographic optimal routing (GOR). In WSN, the QoS routing was the most significant assessment. The timely data delivery was one of the most essential parameters in most critical monitoring and surveillance systems. The Robust QoS Awareness GOR protocol designed in WSN to optimize QoS efficient QoS-aware geographic opportunistic routing (EQGOR), effectively select and prioritize preset the forwarding candidates, optimized for performance latency WSNs. In

WSN, to ensure the reliability and delay QoS constraints with a multipath directing approach may not be justified.

Yu et al. (2001) have described the possible connection in One-Dimensional Ad Hoc Wireless Networks. In this method, the probability was currently maximized from the C cluster. Similar types of network connections as C = 1 can be inferred as a special case. In addition, an approximate basic equation for the probability of a network connection has been introduced.

Bulusu et al. (2000) have discussed the energy-efficient wireless sensor networks using real-time implementations of clustering based on harmonization protocol. To extend the lifetime in many real time applications like streaming of network operation using wireless sensor networks. In optimization methods are used in WSN, to empower the practical development of a centralized cluster-based protocol. The harmony search algorithm (HSA) used in the WSN for many real time applications. It was important to restrict intra cluster separation between cluster head (CH) and group individuals optimize the energy distribution in WSNs.

Savvides et al. (2001) have introduced the method for routing the power balance on a pre-perceived factor for WSN as an integral part of industrial applications. To establish a governance scheme for the WSN, as the detection of this information can be successfully communicated to the beneficiary, a pre-sensing factor aware factor-energy balanced routing method (FAF-EBRM), a power modulation routing technique has been introduced. Geography was further determined by building components for the neighbourhood and the EEUC. In the review, the FAF-EBRM was different, and the LEACH and EEUC results showed that the FAF-EBRM has overtaken LEACH and EEUC, which adjusts the energy consumption. In other words, high QoS will drag the lifespan of the WSN (Shah and Rabaey, 2002).

Bose et al. (2001) have provided the insight for data gathering in WSN using the energy-balanced routing protocol. In the WSN, the energy is an incredibly important asset for controlling the battery, making energy productive convention was a key testing issue. With the assistance of the idea of potential in material science, the authors formulated the energy-balanced routing protocol (EBRP) by building a blended virtual expected field of energy thickness, leftover vitality. The guideline purpose behind the EBRP was compelling packets to forward towards sink through thick energy so it ensures the nodes with low remaining power.

3. PROPOSED MODEL

The proposed model describes the new approach for efficient multi-level efficient energy clustering protocol with secure routing (MEECSR) based on the energy ratio model that manages energy balance and routing security simultaneously in the WSN. Each sensor is required to immediately maintain the energy levels of the nearby grids. This article focuses on two routing systems for sending message: shortest route and safe sending by random walk.

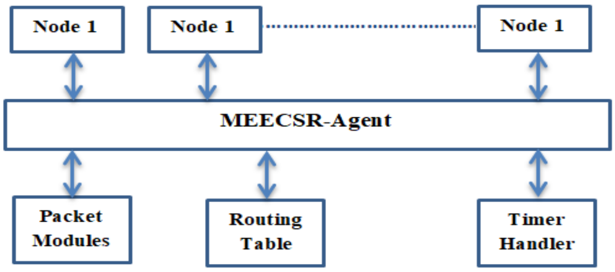

Fig. 1. System architecture for proposed MEECSR

3.1 Advantages

- Reduce the energy consumption.
- Source node privacy.
- Increase message conveyance proportion.
- Minimal time delay.

3.2 The Architecture of Proposed System

The architectural design shown in Fig. 1 illustrates the operational data existing in the security framework based on the 1-D line system process, in which the node is transmitted straight down the road. The greater of the current standard development data acquisition framework was carried out without the need for administrative force. With the requests of the various advances acceptable in the city of understanding, the economical upgrade response required to obtain intelligent movement data should be considered.

The sensor node forwards the collected information to transfer the sensor node, after that the closed-handed sensor node sends forward motion data according to the energy production method to sink the node. One or more exit, eventually the comprehensive development data is generated by the sync node and sent to the operating management center. Great versatility can be used to extend the life of a 1-D line system that requires energy savings in WSN-based information technology (IT) framework.

3.3 Network Model

In this dissertation work, the essential usage limit has been raised with respect to the amount of jumps 'nop'. In order to achieve the best essential techniques by selecting the jumps nop to choose the ideal transmission partition 'dop'.

For example, the balanced essentiality of a structure and the waiting imperativeness of the centers are further considered when choosing the available next-bounce forwarder. The sink node collects the data packets forwarded by the center point h, besides h + i is one of the neighbor of center point h. Suppose if it is closer to surveyed bring about the results having more lingering vitality and has all waiting essentials. The neighboring center point h +

i can be the candidate, at this point the framework can improve the imperativeness usage. The certified candidates rank themselves as shown by their detachments from the energy efficient network and rest of the imperativeness of each center point.

3.4 Energy Balance Control

In the proposed MEECSR protocol, the selection of neighboring nodes is done based on the energy level of each node. The grid with higher energy levels is used to transmit the message, to balance the energy and consumption of the higher energy by the nodes at different levels. The energy balance control degree is enforced as a parameter to have symmetric energy balance control.

In WSNs is also proved that increasing the energy of the main node will increase the steering distance that can effectively control and reduce the power consumption from each node by making the energy levels lower than the node B(N_B).

For node B, the sum of all neighboring grids and the left out available energy of the grid 1 is defined as ε_{r_i}, $i \in N_B$.

The MEECSR selection path algorithm works is derived as:

$$\varepsilon_\alpha(B) = \frac{1}{|N_B|} \sum_{i \in N_B} \varepsilon_{r_i}$$

The above equation of node B can be used to compute the average available energy that is left in the grid N. The balancing of energy among all the node grids in wireless networks is a parameter $\alpha \in [0, 1]$, can be used to send the message, where node B to other grids with higher remaining energy are used.

3.5 Secure Routing Strategy

In the proposed demonstrate the information that is transmitted by the steering system. The steering wheel is an operating system that can provide eccentrics and security. The steering way turns out to be more variable. The primary convention has two alternatives for message sending: one is a deterministic most limited way directing the framework determination calculation, and the other is a safe steering matrix choice calculation through arbitrary strolling. In the deterministic steering approach, the next node is chosen from the light of the relative areas of the grids. For message forwarding the grid which is nearest to the sink node is chosen. In the safe steering case, the next hop grid is arbitrarily sends the forward message.

The dissemination of these two calculations is regulated by the security level called $\beta \in [0, 1]$, conveyed in each message. If the node needs to advance a message, the node first chooses an arbitrary value $\gamma \in [0, 1]$. If $\gamma > \beta$, then each node chooses the following hop grid based on the shortest path routing algorithm; else wise random walking scheme is used to choose the next hop grid. The security level β is a customizable parameter. Little β finds a short routing way and consumes less energy in message forwarding.

3.6 MEECSR Algorithm

The MEECSR algorithm includes routing security. Safety routing increases the cost of extra routing due to the extended routing route.

The Algorithm follows:

Step 1: At source node, create DATA packets:
Given the value of 'alpha'
Set the value of 'beta' for every node:
Calculate threshold Energy = alpha * average energy;
Step 2: Chose a random number for the value of 'gamma'
if (gamma > beta) then
Select a grid whose RT. i. average energy is more and greater than threshold energy
Select a shortest node to the sink node from selected grid
Send the packet to the selected node.
else
Choose a random node from the neighbor node set and send to it.

As b (beta) expanded, the likelihood of the following framework hop to look over an irregular walk likewise expanded. So the steering way is more irregular. Particularly b ¼ 1 an irregular walk turns into the main directing methodology for selecting the following bounce network. The existing examination Heinzelman et al. (2000); Zafar and Town (2011) proposes that messages should not be sent from source to destination node for this situation when b < 1, because MEECSR blends irregular walks with shortest routing.

The shortest routing defined will guarantee that messages will sent from source node to sink node. Be that as it may, the steering way will be more powerful and unusual. Along these lines, it turns out to be increasingly harder for an opponent to grab a message or cause a traffic jam. Accordingly, the conveyance proportion can be expanded under threatening conditions. While giving direct wellbeing, course separation is expanded with the beta security level.

4. PERFORMANCE ANALYSIS

The performance analysis is implemented utilizing network simulator 2 [ns-2]. The results are plotted utilizing GNU plot tool.

4.1 Network Energy

Fig. 2 shows the graph which is plotted using the energy results of the network with respect to the number of nodes. The results are compared with the CASER protocol (Tang et al., 2014).

The energy of the network is better than the proposed protocol compared to CASER, where the neighbor node selection approach is followed, which will increase the number of nodes participating to transmit packets that cause additional overhead to the network.

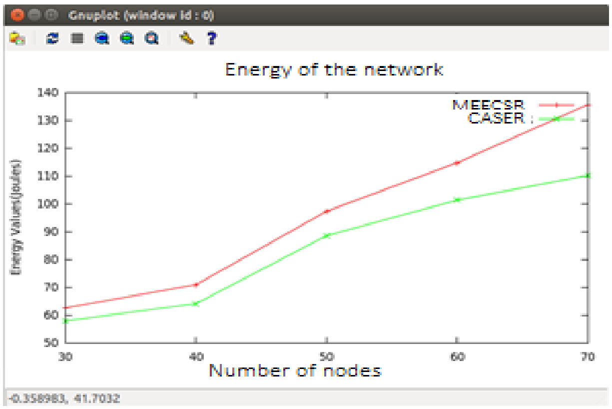

Fig. 2. Energy of the network vs number of nodes

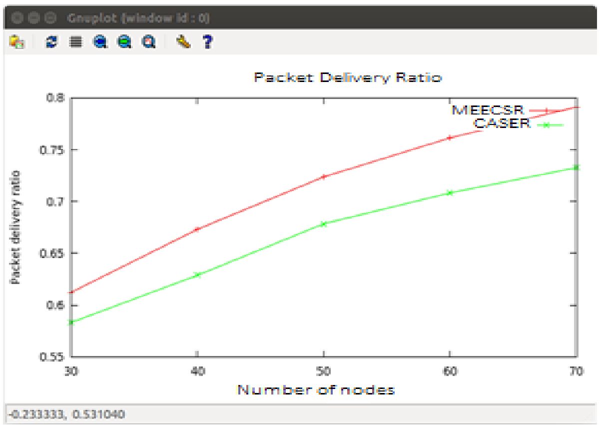

Fig. 3. Packet delivery ratio vs number of nodes

The packet delivery ratio refers to the number of packets received by the sink node with respect to the number of packets communicated by the source node. Fig. 3 graph shows the results of the packet delivery ratio vs the number of nodes. The results show the packet delivery ratio of the proposed protocol is better compared to CASER since routing will ensure the packets will reach the destination. The proposed protocol uses internal queue management that stores packets to be transmitted later if the channel is busy.

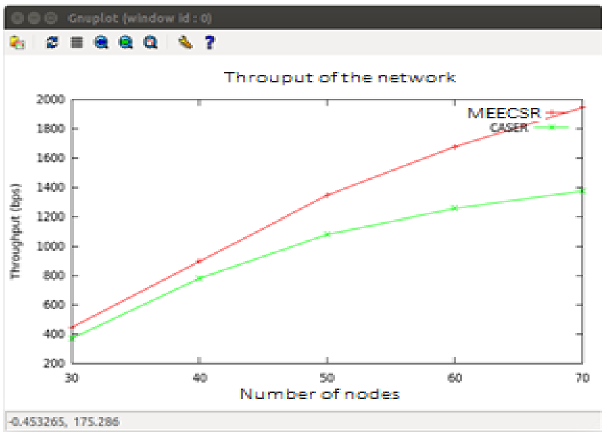

Fig. 4. Throughput vs number of nodes

Fig. 4 shows the consequences of throughput vs number of nodes within the organization. Here, the energy efficient and randomness by introducing the security helps in getting a better delivery of packets as adversaries will fail to corrupt the data. Thus, the results show better performance compared to the CASER protocol.

5. CONCLUSIONS

This paper presents a multilevel efficient energy clustering protocol with secure routing protocol for WSNs to balance the energy consumption in the non- uniform energy deployment strategy to increase the lifespan of the network. The message forwarding approach in the proposed protocol supports the multiple routing to extend the lifespan and increase the security for routing the packets. The theoretical analysis and simulation results provide that the proposed MEESCR routing path has an excellent routing performance based on security and energy balance.

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