ECP 2024 Conference
The 3rd International Electronic Conference on Processes
29–31 May 2024 | Online

An energy-efficient routing technique based on concentric and progressive clusters for wireless sensor networks

Author 1:- Purushothaman Ramaiah Affiliation:- J.J. College of Engineering and Technology, Trichy Author 2:-Jothi Chitra RathakrishnanAffiliation:-Vellammal Institute of Technology, Tiruvallur.Author 3:-Nithyadevi ShanmugamAffiliation:- Sri Krishna College of Technology, Coimbatore.Author 4:-Meenakshi RAffiliation:- J.J. College of Engineering and Technology, TrichyAuthor 5:-Manjunathan AlagarsamyAffiliation:-K.Ramakrishnan College of Technology, Trichy.Author6:-Sureshraj Se PaAffiliation:-J.J. College of Engineering and Technology, Trichy

INTRODUCTION & AIM

Modern cities often have smart parking. Wireless Sensor Networks (WSNs), which are used to identify, track and gather information about the accessibility position of every position space in a specific region are the main equipment used in these smart parking lots. WSN is made up of sensors that can collect, process, and send data to the sink. Nonetheless, the quality and performance of the WSNs are impacted by the sensor's power and communication constraints. The lifespan of the nodes and the WSN as a whole both decline as a result of the node's declining batteries and energy. In order for the base station to obtain information from all WSN networks, we offer a routing protocol in this paper that executions an effective and reliable procedure that permits the establishment of clusters.

This protocol uses an effective and dependable method that reduces sensor energy dissipation and lengthens the WSN's lifespan. The simulation results of the suggested protocol show that it is efficient and reliable in terms of power usage, the dependability of data transfer, and the lifespan of WSN networks when compared to other parking lot management protocols that are currently in use.

METHOD

The Internet of Things (IoT) is widely used in various sectors like economic control, sustainable sensing, naval operations, and locating management. Wireless sensor networks (WSNs) address traffic congestion by identifying open parking spots and transmitting data to a central unit. However, low battery conditions challenge WSN performance. Clustering extends WSN lifespan and reduces energy consumption by rotating the cluster head. Recent algorithms promote a gather architecture, like the Energy-Efficient-Low Energy Adaptive Clustering Hierarchy (EE - LEACH) and the Panel protocol by Schaffer and Buttyán. Centralized Genetic Clustering Protocol (CGC) and Hybrid routing approaches further reduce energy usage. The Energy-Efficient Compressive Detection (EECSR) method and Exterior Gateway Routing Protocol (EGRP) optimize data gathering. Two-level cluster-based routing and Star network topology enhance efficiency. Mode-Switched Routing (MSGR) conserves energy by dividing the detecting region into virtual grids.

Models for Energy Usages: Two-ray ground transfer and free-space transmission are common in WSNs. Free-space transmission occurs when sender and recipient nodes have a direct line of sight, while the two-ray ground transmission model is used when the electromagnetic wave needs to pass through multiple paths to reach the receiver. Our proposed technique, an updated version of existing methods, allows data reception from the base station by every network node while considering varying energy usage as per the recommended model, including energy for data transmission and reception by sensors.

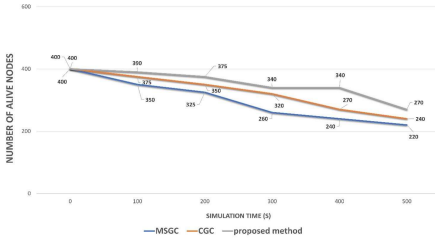
$Conci_{=}$ _____ (6)

Where,

t= the number of neighbours.

(x, y) = node coordinates

(xi, yi)= the coordinates of neighbouring nodes,



RESULTS & DISCUSSION

•**Experiment Design**: The study introduces an innovative Proxy Re-Encryption (PRE) scheme optimized for Wireless Sensor Networks (WSNs). It integrates lightweight symmetric and asymmetric cryptographic techniques to minimize computational costs and conserve energy.

Key Management: Sophisticated key management and digital certificates are incorporated to ensure secure key generation and distribution, facilitating seamless authentication and scalable data sharing among entities in WSNs.

Performance Evaluation: Comprehensive evaluations of security, performance, and energy consumption validated the robustness of the scheme34. The results confirm significant enhancements in security, efficiency, and network lifetime of WSNs5.

Security Analysis: The proposed PRE scheme is analyzed for its resilience against common attacks targeting WSNs, ensuring data security, confidentiality, and integrity while maintaining energy efficiency6.

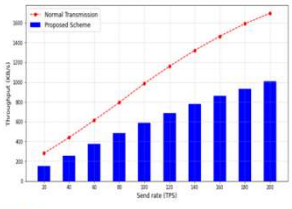


FIGURE 4. Analyzing throughput rates of the proposed PRE scheme vs. standard transmission without encryption under various TPS settings.

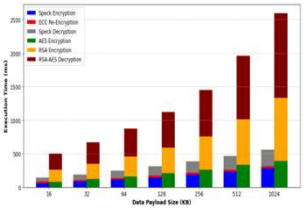


FIGURE 5. Comparative execution times of proposed PRE scheme vs. non-proxy re-encryption approach.

CONCLUSION

This paper introduces an innovative PRE scheme tailored to address unique challenges in WSNs. It enables secure intra- and inter-cluster communication, data sharing, and authentication among nodes. The design optimizes efficiency and conserves resources by balancing lightweight symmetric and asymmetric encryption techniques. Speck symmetric encryption secures SN data, while ECC handles encryption key re-encryption. Efficient key management ensures secure key generation, distribution, and freshness in dynamic WSN environments.

Evaluation results robustly validate the scheme's efficacy, demonstrating enhanced encryption, re-encryption, and decryption performance while minimizing strain on SN resources. The scheme exhibits remarkable scalability, addressing challenges of centralized PRE approaches and mitigating single points of failure. It achieves a notable 40% reduction in SN power consumption and a 32% decrease in overall network power consumption compared to existing solutions. Lightweight and proxy re-encryption methods amplify CH efficiency while maintaining robust security measures.

The scheme is proficient in meeting essential security requirements, including confidentiality, authentication, integrity, and resilience against common WSN threats. Future research will focus on enhancing the scheme's applicability to resource-constrained WSNs, exploring real-world deployment scenarios, scalability, and performance in specific environments.

FUTURE WORK / REFERENCES

S [1] O. A. Khashan, R. Ahmad, and N. M. Khafajah, "An automated lightweight encryption scheme for secure and energy-efficient communication in wireless sensor networks," Ad Hoc Netw., vol. 115, Apr. 2021, Art. no. 102448. [2] O. A. Khashan, S. Alamri, W. Alomoush, M. K. Alsmadi, S. Atawneh, and U. Mir, "Blockchain-based decentralized authentication model for IoT-based E-learning and educational environments," Comput., Mater. Continua, vol. 75, no. 2, pp. 3133–3158, 2023. [3] I. Mashal, O. A. Khashan, M. Hijjawi, and M. Alshinwan, "The determinants of reliable smart grid from experts' perspective," Energy Informat., vol. 6, no. 1, pp. 1–23, Apr. 2023. [4] O. A. Khashan and N. M. Khafajah, "Efficient hybrid centralized and blockchain-based authentication architecture for heterogeneous IoT systems," J. King Saud Univ. Comput. Inf. Sci., vol. 35, no. 2, pp. 726–739, Feb. 2023. [5] A. Sufyan, K. B. Khan, O. A. Khashan, T. Mir, and U. Mir, "From 5G to beyond 5G: A comprehensive survey of wireless network evolution, challenges, and promising technologies," Electronics, vol. 12, no. 10, p. 2200, May 2023. [6] F. H. El-Fouly, M. Kachout, Y. Alharbi, J. S. Alshudukhi, A. Alanazi, and R. A. Ramadan, "Environment-aware energy efficient and reliable routing in real-time multi-sink wireless sensor networks for smart cities applications," Appl. Sci., vol. 13, no. 1, p. 605, Jan. 2023. [7] Z. A. Zukarnain, O. A. Amodu, C. Wenting, and U. A. Bukar, "A survey of Sybil attack countermeasures in underwater sensor and acoustic networks," IEEE Access, vol. 11, pp. 64518–64543, 2023. [8] O. A. Khashan, N. M. Khafajah, W. Alomoush, M. Alshinwan, S. Alamri, S. Atawneh, and M. K. Alsmadi, "Dynamic multimedia encryption using a parallel file system based on multi-core processors," Cryptography, vol. 7, no. 1, p. 12, Mar. 2023. [9] K. Jain, P. S. Mehra, A. K. Dwivedi, and A. Agarwal, "SCADA: Scalable cluster-based data aggregation technique for improving network lifetime of wireless sensor networks," J. Supercomput., vol. 78, pp. 13624–13652, Mar. 2022. [10] O. A. Khashan, "Parallel proxy re-encryption workload distribution for efficient big data sharing in cloud computing," in Proc.