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AN IMPROVED ENERGY EFFICIENT CLUSTERING PROTOCOL TO PROLONG THE LIFETIME OF WSN

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ABSTRACT

The Internet of Things relies heavily on wireless sensor networks (WSNs) (IoT). However, the energy resources of sensor nodes in a WSN-based IoT network are restricted. By grouping nodes into clusters to reduce the transmission distance between sensor nodes and base stations, a clustering protocol offers an effective method for ensuring node energy savings and extending network lifespan (BS). Current clustering protocols, on the other hand, have problems with the clustering mechanism, which has a negative impact on their efficiency.In this paper an energy-efficient clustering protocol of WSN-based IoT devices is proposed. The proposed protocol is divided into three parts. For the overlapping balanced clusters, an optimum number of clusters is first calculated. The balanced-static clusters are then developed using a tweaked fuzzy C-means algorithm in combination with a mechanism to minimise and balance the sensor nodes' energy consumption. Finally, cluster heads (CHs) are chosen in optimal locations by rotating the CH function among cluster members using a new CH selection-rotation algorithm that combines a back-off timer mechanism for CH selection and a rotation mechanism for CH rotation. The suggested protocol, in particular, eliminates and balances energy consumption.The proposed protocol, in particular, reduces and balances node energy usage by optimising clustering structure for a long network lifetime.

Keywords: Wireless sensor network, Internet of Things, clustering protocol, energy consumption, network lifetime.

INTRODUCTION

Wireless Sensor Networks (WSNs) can be defined as a self-configured and infrastructure-less wireless networks to monitor physical or environmental conditions, such as temperature, sound,

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vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location or sink where the data can be observed and analysed. A sink or base station actslike an interface between users and the network. One can retrieve required information from the network by injecting queries and gathering results from the sink. Typically a wireless sensor network contains hundreds of thousands of sensor nodes. The sensor nodes can communicate among themselves using radio signals. A wireless sensor node is equipped with sensing and computing devices, radio transceivers and power components. The individual nodes in a wireless sensor network (WSN) are inherently resource constrained. They have limited processing speed, storage capacity, and communication bandwidth. After the sensor nodes are deployed, they are responsible for self-organizing an appropriate network infrastructure often with multi-hop communication with them. Then the onboard sensors start collecting information of interest.On comparing with centralized algorithms, clustering algorithms are more robust and scalable. To obtain prolong life of the network, energy efficient protocols are designed according to the characteristics of WSN, by efficiently organizing the sensor nodes in clusters.

LITERATURE REVIEW

1. J. Shen, A. Wang, C. Wang, P. C. K. Hung, and C.-F. Lai Studied about a new energy-efficient centroid-based routing protocol (EECRP) for WSN-assisted IoT to increase the performance of the network. The proposed EECRP involves three main parts: a new distributed cluster forming technique that facilitates the self-organization of local nodes, a new set of algorithms for adjusting clusters and rotating the cluster head centred on the centroid location to equally spread the energy load across all sensor nodes.

2. H. P. Gupta, S. V. Rao, A. K. Yadav, and T. Dutta Studied about Dijkstra's shortest path algorithm is used to optimise routes in clustered WSNs among obstacles. And also studied about the proposed method decreases the average hop count, packet latency, and energy consumption of wireless sensor networks (WSNs).

3. Q. Wang, S. Guo, J. Hu, and Y. Yang Studied about how suggested algorithms outperform the hybrid energy-efficient distributed (HEED) clustering algorithm in

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terms of energy cost and network lifespan, according to detailed simulations.

EXISTING METHOD

LEACH routing protocol is a WSN routing algorithm designed by Heinzehnan et al. from MIT in the United States, which is the earliest typical hierarchical routing protocol.LEACH protocol adopts the method of distributed CH election, in which some nodes are randomly selected from the network as CHs, and other nodes become cluster member nodes. The CH broadcasts the message that it becomes a CH, and other nodes select the CH with the strongest received signal to join to form a cluster. The cluster member node collects data and transmits it to the CH, which receives data and transmits it to the BS through single-hop communication. The CHs undertake the heavy tasks, including managing the member nodes of the cluster, collecting the data transmitted by the member nodes, data fusion, and intercluster forwarding. Therefore, to balance the energy consumption of nodes, CHs rotate, and the cluster structure is updated periodically.The basic idea of the LEACH protocol is to divide the network into clusters of equal size. The CH rotates periodically, and each cycle is called a "round." Each round is divided into two stages: the establishment stage of the cluster and the stable transmission stage.

Low Energy Adaptive Clustering Hierarchy (LEACH) protocol is a TDMA based MAC protocol. The principal aim of this protocol is to improve the lifespan of wireless sensor networks by lowering the energy consumption required to create and maintain Cluster Heads.LEACH assumes that each node has a radio powerful enough to directly reach the base station or the nearest cluster head, but that using this radio at full power all the time would waste energy.

PROPOSED METHOD

An improved energy-efficient clustering protocol (IEECP) to prolong the lifetime of the WSN-based IoT involves the following tasks:

1) Selecting the optimal number of clusters based on the modified mathematical model by considering the overlapping case among clusters and multi-hop communications.

2) Forming balanced clusters that reduce the cost in the intra-distance based on modified fuzzy C-means algorithm (M-FCM) that result from a combination of the FCM algorithm with a centralized mechanism.

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3) Reducing the energy overhead that results from the CH selection process in each round by a new integration of the back-off timer mechanism for CH selection with rotation mechanism in one algorithm known as CH selection and rotation model (CHSRA).

4) Balancing the communication distance among the CHs in the network based on a new objective function for the back-off mechanism.

5) Balancing the life of the selected CHs in the cluster based on a new dynamic threshold. However, these factors have not been addressed in depth by the existing studies, hence, affecting the clustering protocol performance.

METHODS OR TECHNIQUES USED IN UR PROJECT

CLUSTERING PROTOCOL: In proposed method a clustering Protocol is used to expand the lifetime of a wireless sensor network.

TOOLS USED

MATLAB Software – Simulator tool

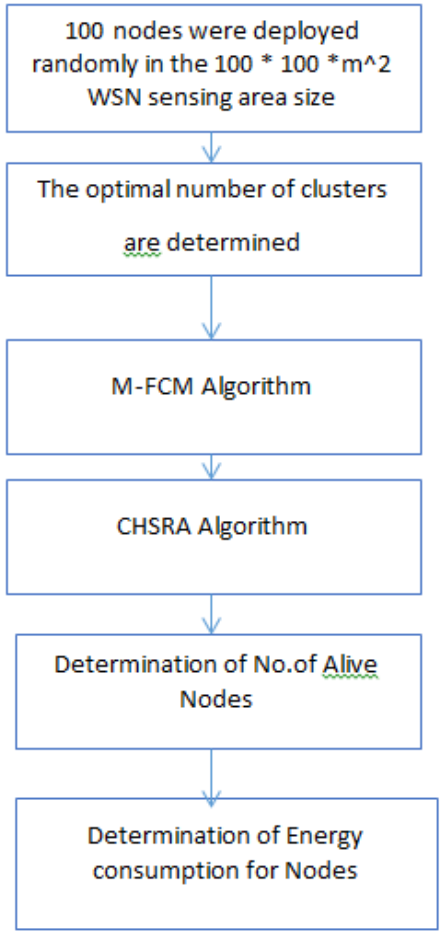

Fig 1: Block Diagramof Proposed System

The execution of the IEECP protocol processes occurs in two different places. The first place is theBS, where the number of clusters is computed initially based on the modified mathematical model, and then the balanced clusters are formed based on the M-FCM. The second place is the node, where the CH selection and rotation are processed based on the CHSRA algorithm.

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RESULT

Table 1: SIMULATION PARAMETERS

PARAMETER	VALUE
Sensor deployment area	100*100 m
Base station Location	(50,50) m
Number of nodes	100
Maximum rounds	5000
Data packet size	4000 bits
Initial energy of sensor	0.5J
Probability of node to become CH	0.1
Number of clusters	5

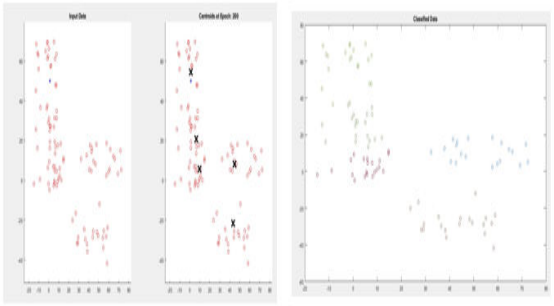

Fig 2: Modified Fuzzy Cmeans Illustration

Fig 3: Classification of nodes

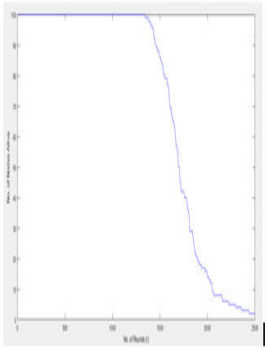

Fig 4: Number of Live nodes

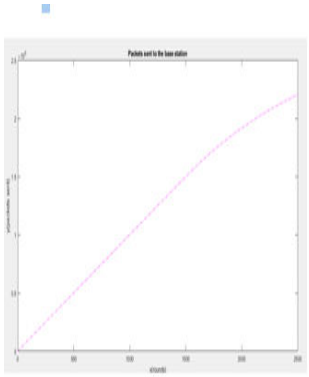

Fig 5: Number of packets sent to BS

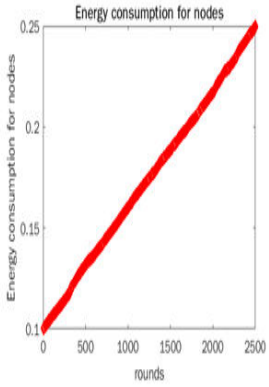

Fig 6: Energy consumption

Table 2:COMPARISON OF ENERGY CONSUMPTION WITH EXISTING PROTOCOL

Number of rounds	Existing(Energy Consumed)	Proposed(Energy Consumed)
500	0.08 J	0.1 J
1000	0.15 J	0.13 J
1500	0.18 J	0.15 J
2000	0.26 J	0.18 J
2500	0.32 J	0.2J

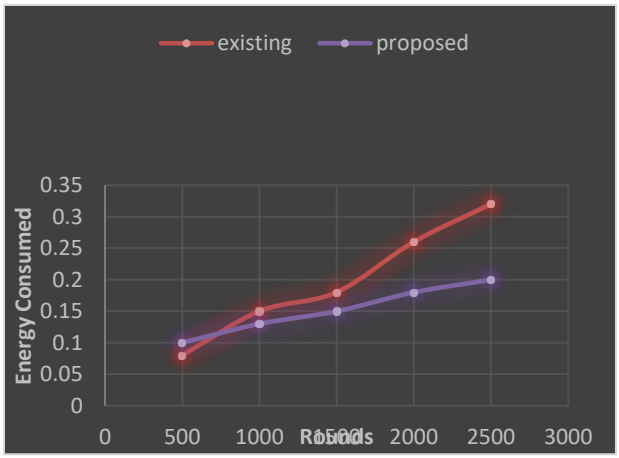

Fig 6: Energy Consumption of Existing and Proposed System

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ADVANTAGES

1.Proposed Protocol IEECP Prolongs the WSN-based IoT lifetime.

2. The proposed protocol reduces and balances the energy consumption of nodes by improving the clustering structure.

3.The evenly distribution of the selected CHs in the monitoring area with low overhead

4.The optimal number of clusters are determined.

5.IEECP gives idea about the number of cluster heads in the network

6.It balances the distance among CHs in adjacent clusters by adopting the routing information in the CH selection process that leads to balanced energy consumption for CHs. The CH rotation process that relies on a threshold value is possible.

7.The CHSRA ensures the balance in energy consumption for the successive CHs of the cluster. So the Proposed Protocol IEECP gives balanced energy consumption.

APPLICATIONS

1.Industrial control.

2.Environmental monitoring.

3. Military surveillance.

4.Intelligent 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

CONCLUSION

In this paper, we propose an improved energy-efficient clustering protocol (IEECP) to prolong the lifetime of WSN-based IoT network through overcoming the problems of the clustering structure that adversely affect the protocol performance. Evidently, the proposed protocol reduces and balances the energy consumption of nodes by improving the clustering structure. Hence, the IEECP is deemed suitable for networks that require a longer lifetime.. In general, the results yield that the IEECP performs better than the existing protocols. Our proposed protocol will be a beneficial contribution to the enhance that will enhance the daily operations in many areas of life, which utilize WSN in the IoT world.

FUTURE SCOPE

In future work, we aim to enhance the protocol by improving the FCM algorithm

concerning the random initial selection. Moreover, we believe that improving the objective function of CH selection through the reliance on weighted energy-based distance for adjacent CHs is also crucially significant. We anticipate that the future clustering protocol can perform excellently when these limitations are taken into consideration.

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