An Improved Energy-Efficient Clustering Protocol to Prolong the Lifetime of the WSN-Based IoT

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Abstract: The "Internet of Things (IoT) greatly depends on Wireless Sensor Networks (WSNs)", which suffer huge issues with energy given the fact that sensor nodes cannot possess too much power. Clustering techniques help to minimize this by placing the nodes in groupings that consume less energy. However, much of the existing protocols fail to cluster efficiently or use energy comfortably. This study proposes a protocol that will extend the life of networks and their functionality, namely, the "Improved Energy-Efficient Clustering Protocol (IEECP)". IEECP works by first determining the optimum number of balanced clusters, secondly by generating the clusters stagnately through an energy-balancing implementation of the "Fuzzy C Means algorithm and finally selection" of energy efficient cluster heads based on a new methodology known as selection-rotation. The performance is further improved by two major extensions: the extension 1 (extension 1) that introduces multipath routing to reduce the energy consumption and the quality of transmissions through main and minor channels. The "smaz-py3" library enables the compression of packets that consequently become smaller, occupy less bandwidth and can be transferred within less time with extension 2. Based on the results that were obtained using the conducted experiments, it is apparent that IEECP is a lot superior to traditional protocols in terms of "energy efficiency, network longitude, and latency".

***"Index terms** - Wireless sensor network, Internet of Things, clustering protocol, energy consumption, network lifetime".*

1. INTRODUCTION

The "Internet of Things (IoT)" is a new way of thinking about technology that has changed the way we think about intelligent solutions in areas such as health, agriculture, production and transport. The "wireless sensor Network (WSN)" network is the heart of the "Internet of Things (IoT)". It is a cost -effective and scalable infrastructure composed of sensor nodes that can invent, calculate and communicate across wireless media. It turned out that adding WSN to IoT reduces costs and facilitates everyday life by allowing intelligent scan and real -time data transmission [1], [2].

WSN is already widely used in areas such as "military supervision, environmental monitoring, industrial automation and intelligent transport systems [1]". This integration does not require a major change in the infrastructure that makes IoT -based WSN solutions and easily gets there [2].

WSN have a lot of good points, but they also have many problems. The most important thing is that they don't last too long because they don't have enough energy [3]. Sensor nodes are commonly introduced to places that are difficult to get or have bad weather where it is difficult to change or charge batteries [4]. The energy economy is therefore very important for maintaining networks and getting a maximum of IoT -based equipment. To solve this problem, they organize protocols of clustering sensor nodes into clusters. The designed "cluster head (CH) collects and sends data to the base station (BS)", which reduces the total communication load [5], [6].

However, some are still worried about how well the arrangement of cluster works. If clumping is not done well, this causes uneven energy consumption and poor data direction, which impairs the power and life of the network [4], [7], [10]. Poor clustering can also worsen operations such as data aggregation and routing that are very important to start the network [11]. Therefore, the improvement of cluster structures is very important for WSN to last longer in the IoT environment.

2. LITERATURE SURVEY

The "Internet of Things (IoT)" has quickly become an important technology in many fields, allowing real -time monitoring and intelligent decision making. The "wireless sensor network (WSN)" is in the core of the "Internet of Things (IoT)". It consists of many low -cost sensor nodes limited to resources that can scan and send data. WSN are an important part of the Internet of things because they are cheap to set up and can work in places that are difficult to get or have bad weather. One of the biggest problems with IoT with WSN support is that sensor nodes do not have much energy, which shortens the life of the network [1], [3], [4].

Clustering algorithms have become a popular way to extend networks will last longer and use less energy. To save energy, these protocols aggregated the nodes of sensors into clusters, each of which is under the supervision of the head of the "cluster head (CH)". This reduces the number of direct broadcasts to the "base station (BS)" [5], [6]. Many research focused on ways to improve standard clustering methods. For example, EECRP adds a centro -based routing protocol that includes a head -head rotation with a cluster and a distance of distance communication. This is a major improvement compared to protocols such as "Leach and Geec" [1]. Another method combines energy -efficient clustering with obstacle routing. It uses the "Dijkstra and hybrid metric" algorithm (residual energy and neighboring instrument) to find the best routes in difficult terrains [3].

In addition, clustering methods such as "spectral distribution and fuzzy C-Means" have been designed as a way to deal with problems that cause huge data in WSN. The aim of these algorithms is to find the best number of clusters and ensure that nodes use energy more fairly [4]. Improved cluster models that use "genetic algorithms and K-significant" also showed better energy balance and faster convergence, which means greater permeability and less delay [5]. There are also hybrid approaches that use "k-ways with particle swarm optimization (PSO) and genetic algorithms (gas) to dynamic improvement of CH and cluster selection". These methods are called "KPSO and KGA".

These advanced cluster solutions have the same goal: make IoT assisted systems more reliable and scalable for future applications by improving energy consumption, reducing latency and increasing overall performance.

3. METHODOLOGY

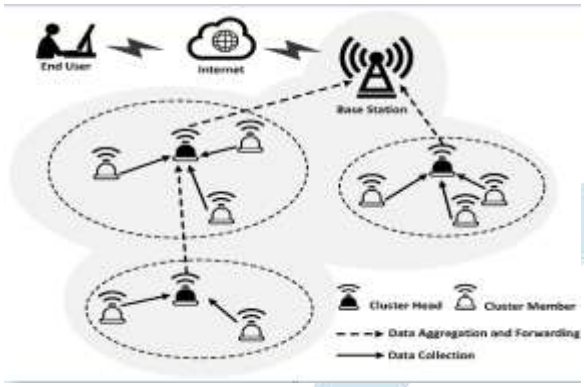
i) Proposed Work:

The proposed system includes an "improved energy -efficient cluster protocol (IEECP)" that will increase the "wireless sensor network (WSN)" more energy efficient and last longer. To start with the best number of clusters for even layout of the nodes. Modified technique "Fuzzy C-Means (FCM)" is used to create static clusters, which takes into account spatial and energy factors. Technique based on rotation is used to select "cluster heads (CHs)", which is most used by location and energy. Two important extensions are added: extension 1 allows you to direct packets after several ways by sending them by main and secondary paths to reduce the energy overload and consumption. Extension 2 uses the library deleting-by3 to compress packets, which reduces them, uses a smaller bandwidth and sends less time. All these improvements work together to improve communication and energy management.

ii) System Architecture:

System architecture (Fig. 1) shows a "wireless sensor network (WSN)" for IoT applications that use less energy. Users send data for data over the Internet, which are then sent to the base station. The basic stations are in charge of obtaining data from "cluster heads (CHS)", which obtain data from cluster members, which are sensor nodes that collect environmental

data. CHS, which were selected for their energy efficiency, analyze data and send it to the basic station. Extension, such as "multipath routing and compression of packets", help save energy and speed up data transfer throughout the network.



"Fig 1 System Architecture"

iii) Modules:

1. Generate WSN Network: This module creates a "wireless sensor network (WSN)" by creating virtual sensor nodes that act as an IoT around the real world. It is a basic layer for the view of how nets work and how energy moves.

2. Find Optimal Cluster Size: This module detects the best number of clusters depending on how many nodes are and how big the network is. It uses an analytical algorithm to make sure that the cluster is balanced so that the nodes are not too busy or are not busy enough. This makes data routing and energy use more efficient.

3. Run Modified FCM: In this case, a modified "Fuzzy C-Means (FCM)" technique is used to construct static clusters. Nodes into groups depending on how close they are to each other in space and how much energy they have. This makes it better to cluster and distribute energy.

4. Rotation Cluster Head Selection: This module uses a technique based on rotation to select "cluster heads (CHS)". SHC collect and send data and select their selection that the energy burden is evenly distributed, which takes longer.

5. Route Packets to Base Station: It builds efficient routes from kennel to the "base station (BS)", which reduces the distance and energy needed for transmission. This module ensures that the data is sent in time and correctly.

6. Multipath Routes to Base Station: Data packets are sent to the main and backup track. Thanks to this additional security layer, the network is more reliable, reduces packet loss and extends energy consumption.

7. Compress Multipath to Base Station: This module uses the deletion of the delete-by3 to compress data before sending it, which reduces packets, uses a smaller bandwidth and takes less time and at the same time consumes less energy.

8. Energy Consumption Graph: It shows how well the protocol works by comparing how much energy it uses with different techniques. The graph shows how much energy is stored and proves that the proposed IEECP paradigm works.

iv) Algorithms:

Modified Fuzzy C Means Algorithm: The "Fuzzy C-Means method (FCM) groups the nodes in the wireless sensor network (WSN)" by inserting each node into one or more clusters with different levels of membership. Nodes that are closer to cluster centers have a higher level of membership. This provides a more flexible and detailed picture of cluster membership than classic hard cluster approaches.

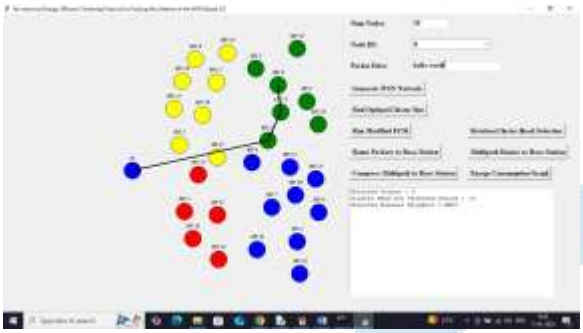
"Fig2 MODIFIED FUZZY C MEANS ALGORITHM"

4. EXPERIMENTAL RESULTS

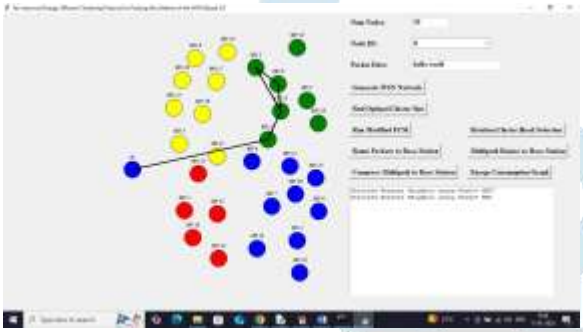
Tapping on "run.bat" to simulate and get a package.

In the first text box on the screen above, enter the number of nodes. Then select the source node, enter the data packet data

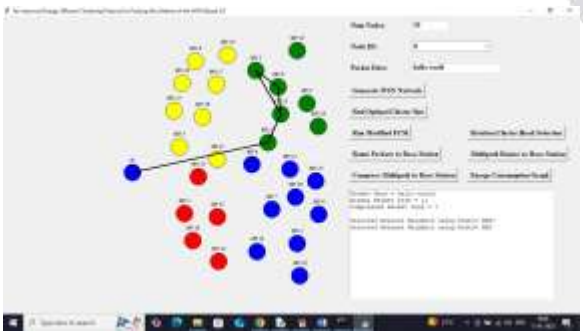
for transmission and compression, click on the first four buttons to assemble the clusters, and then click on "Route packets on the base station" to send the packets along one path.



On the screen above, the packets go in one way. If you want to send in two ways, click "Multipath Trapees to Base Station" and look at the screen below.



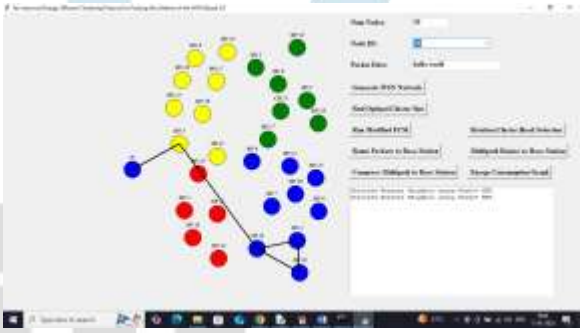
On the above screen, the mobile node adds source 9 packets to the closest head of the cluster 13 and MN2. Mn2 then distributes packets to another neighbor who transmits them to the base station. The head of a cluster with lots of resources could receive multipath packets and send them to the base station. If you want to compress data packet data and send it to the base station, click on "Business multipath at the base station".



The text space above the screen is revealed after a reduction from 11 to 7, the compressed packets are handed over to the base station through several different paths. You can send data to the base station from any source using compression and many ways. If you want to view below, click "Energy Compression Graph".

The above chart shows that expansion of 1 and 2 consume less energy than current and planned techniques.

See the next example of multipath below.



Screens 26 transmits packets to the nearest head of cluster 18 as the primary route and to the nearest neighbor 4 as a secondary route. All packets reach the basic station through the same cluster head.

5. CONCLUSION

"Improved Energy Efficient Clustering Protocol (IEECP)" ensures that "Wireless Sensor Networks (WSNs)" also work better in that they correct the issues relating to energy consumption. Instead, it relies on a fixed setup of the "Fuzzy C-Means (FCM)" technique to locate the optimal quantity of groups and sort the nodes in an energy-saving manner. Use of a rotation based "Cluster Head (CH)" selection process ensures that there is a balance in energy utilization, which prolongs the existence of the network. The addition of

multipath routing in extension 1 channels the packets along the primary as well as secondary channels to reduce energy overhead and packet born delays. The extension 2 exploits the smaz-py3 package so as to compress packets making them small, consuming less bandwidth, and accelerating the communication. This hybrid technique renders the system much more stable, consumes less energy and ensures the network is not heavily congested. The simulations demonstrate that IEECP has an edge in energy saving and overall network performance as compared to the ancient protocols.

Adaptive routing algorithms to maximize instantaneous energy consumption, ML to select dynamic cluster heads and energy consumption prediction, and renewable energy sources such as “solar power” can be used in the future. Mainly, it would be better by adding support to other variants of nodes and large networks to the protocol to improve its “scalability, reliability, and overall quality”.

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