



# CERTAIN INVESTIGATIONS ON CENTRALIZED MOBILITY BASED CLUSTERING PROTOCOL FOR WSN'S

<sup>1</sup>Dr. S. RAJESH, <sup>2</sup>MANOJ S, <sup>3</sup>NAVEEN BALA I, <sup>4</sup>PRAVEENRAJ V

<sup>1</sup>Assistant Professor, <sup>2</sup>Student, <sup>3</sup>Student, <sup>4</sup>Student

<sup>1, 2, 3, 4</sup>Computer Science and Engineering,

<sup>1</sup>Sri Ramakrishna Institute of Technology, Coimbatore, India

**Abstract :** Wireless sensor networks face ongoing challenges in achieving optimal network performance while balancing transmission rates, energy consumption, and control overhead. Traditional distributed clustering methods often fall short in maintaining network stability amidst these complexities. To address these limitations, this paper proposes a novel Centralized Mobility-Based Clustering (CMBC) protocol within the framework of software-defined sensor networks. The CMBC protocol introduces a two-fold approach: firstly, by clustering nodes based on their connection time with mobile nodes (non-cluster head nodes or non-CH) and establishing stable topological structures between non-CH nodes and cluster heads (CH);. The findings reveal significant enhancements in critical network performance metrics including transmission success rates, average power consumption, and average control overhead. This paper contributes valuable insights into optimizing network efficiency.

**Index Terms - Software defined sensor network, Cluster, Node mobility, Centralization.**

## I. INTRODUCTION

Wireless sensor networks (WSNs) represent a vital infrastructure for self-organized ad-hoc networks, facilitating sensing, data processing, and transmission of diverse physical parameters, and transmit data through multi-hop communication. Consequently, the development of topological control mechanisms has emerged as a crucial area of research. Low-Energy Adaptive Clustering Hierarchy (LEACH), which organizes neighboring nodes into clusters based on signal strength, designates a cluster head (CH) responsible for coordinating with other nodes, within the nodes cluster and managing data fusion and forwarding.

## II. PROBLEM STATEMENT

Cmbc protocols often lack adaptability, resulting in suboptimal energy consumption and inefficient data transmission. addressing this challenge analyse and improve the design and implementation of a centralized mobility-based clustering algorithm that intelligently adjusts cluster heads based on node mobility.

## III. SCOPE OF THE PROJECT

By addressing issues with real-time control and managing big networks, this project aims to improve upon the Centralised Protocol for Mobility-Based Clustering (CMBC) in the case of Wireless Sensor Networks (WSNs). The focus will be on enhancing key essential parameters factors such delay in data transfer, convergence time, and convergence rate. Moreover, the project aims to optimize the centralized solution to enable more efficient data routing.

## IV. LITERATURE SURVEY

[1]. Mobility Based Clustering Process. Authors: Cao, B., Deng, S., Qin, H., & Tan, Y. (2021) Distributed clustering is a key component of wireless sensor networks that helps them last longer. Nevertheless, without sacrificing global network stability, it might be tough to achieve optimum performance throughout the entire network, which includes transmission speed, usage of energy, as well as control overhead. The CMBC method sorts nodes according to the amount of time they've spent connected to both the cluster head (CH) and the mobile nodes.

[2]. HETA End-to-End Analysis. Authors: Bhuvaneswari, C., & Ruby, E. D. K. (2021) This system allocates time slots for intermittent data traffic and manages non-intermittent critical traffic delays. Priority and sporadic data transmission to the core Base Station is effectively scheduled using a central sleep scheduling algorithm. When analysing end-to-end latency, this research has taken into account both processing delay and queuing time near the Base Station. According to the simulation findings, the HETA method is more efficient. this leads to a 90% increase in the lifespan of the network and a via putincrease of 3.7 times across all tiers. . Therefore, this system can be a promising solution for managing traffic in wireless networks.

[3]. Towards improved clustering and routing protocol. Authors: Alharbi, M. A., Kolberg, M., & Zeeshan, M. (2021). This researchers observed that several methods handled clustering and routing independently. Energy usage and network longevity were both negatively impacted by these options. Collecting data from Internet of Things (IoT) nodes spread out across a region and linked via wide area network (WSN) is the main topic of this study. In order to solve the problems of large-scale IoT-based WSN, the researchers focus on two related topics: clustering and routing. As a combined solution, they suggest a better clustering and routing methodology. The enhanced routing and clustering capabilities enable node-transmission-range-based area-based clustering. During clustering, cluster-heads are chosen in a manner that ensures routing is fail-safe.

[4]. Mobility aware energy efficient clustering for wireless sensor network. Authors: Singh, V., & Lohani, R. B. (2019). The clustering routing methods are proves to be effective for WSNs especially for the stationary as far as network lifetime and energy productivity. In this paper, the researchers suggested the novel "Weighted Clustering and Routing Algorithms" (WCRA) to address the challenges of the mobile sensor network. The clustering is performed by utilizing the key parameters, for example, node mobility, nodes lingering vitality, and distance are used to effectively to form the more stable clusters and cluster heads (CHS). This protocol works using the sensor nodes key parameters such as mobility, density, and residual energy while clustering formation as well as path formation so that the selected CH and the selected path will sustain longer time in the network. They presented a short survey of grouping based directing strategies and the simulation results also provided to prove that proposed WCRA protocol perform efficiently over the state-of-art protocols.

[5]. Improved Energy-Efficient Routing Protocol for Wireless Sensor Networks. Authors: Yang Liu, Qiong Wu, Ting Zhao, Yong Tie, Fengshan Bai and Minglu Jin, (2019). IEE-LEACH takes a multifaceted approach, factoring in the remaining energy levels of individual nodes as well as the average energy levels across the network. To optimize sensor energy consumption, the protocol meticulously calculates the ideal number of CHs and restricts nodes in close proximity to the base station (BS) from participating in cluster formation. What's more, it introduces a novel thresholding mechanism for electing CHs from the pool of sensor nodes, and deploys a versatile mix of single hop, multi-hop, and hybrid communication strategies to further bolster energy efficiency. Through a series of comprehensive simulations, the authors compellingly demonstrate the superior performance of the proposed IEE-LEACH protocol in comparison to existing methodologies. The results serve as a resounding validation of the protocol's efficacy in significantly reducing energy consumption and enhancing the overall performance of wireless sensor network.

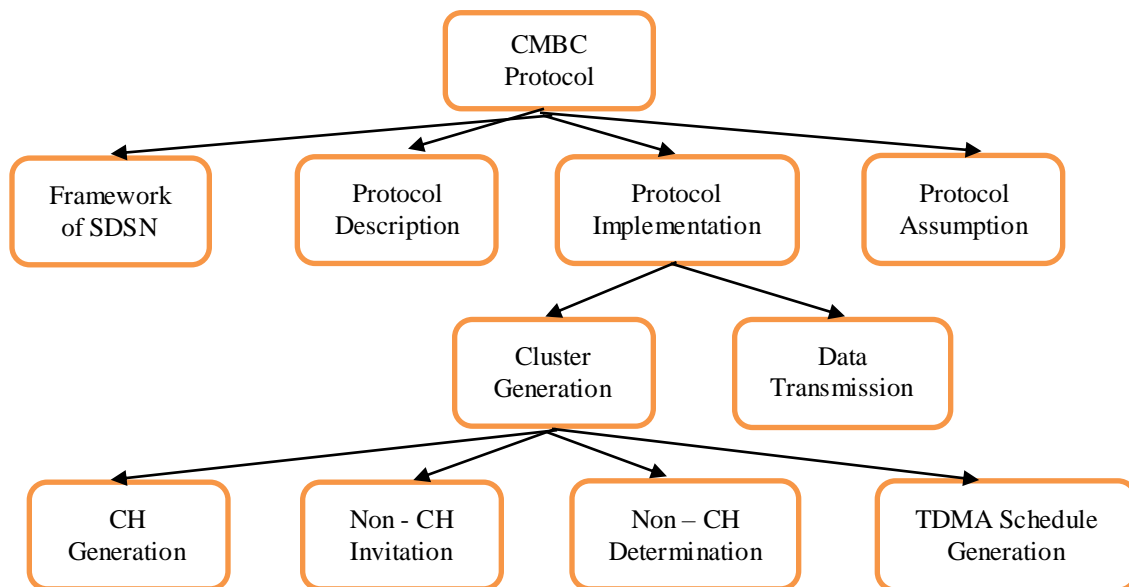
[6]. Fog Computing Approach for Minimization of Latency. Authors: Amit Kishor, Chinmay Chakraborty (2021). In Wireless data transmission, the parameters such as transmission delay, network delay, and computation delay must be reduced as there is a high demand for healthcare multimedia analytics. Fog computing provides processing, storage, and analyze the data nearer to IoT and end-users to overcome the latency. In this paper, the novel Intelligent Multimedia Data Segregation (IMDS) scheme using Machine learning (k-fold random forest) is proposed in the fog computing environment that segregates the multimedia data and the model used to calculate total latency (transmission, computation, and network). With the simulated results, the researchers have achieved 92% as the classification accuracy of the model, an approximately 95% reduction in latency as compared with the pre-existing model. This scheme intelligently segregates multimedia data, optimizing data processing for each specific type and ultimately reducing overall latency. These findings not only validate the efficacy of the IMDS scheme but also herald a new era of transformative improvements in latency-sensitive healthcare applications leveraging wireless sensor networks.

[7]. Energy efficient clustering in WSNs: Challenges and research contributions. Authors: Sharma, R.; Vashisht, V.; Singh, U, (2020). In this paper, the authors delve into the critical importance of wireless sensor networks (WSNs) in enabling efficient data communication within ubiquitous computing environments. They highlight two key objectives: extending the lifetime of WSNs and conserving energy. The study underscores the effectiveness of clustering as an approach to achieving these objectives and emphasizes the need for energy-conscious routing schemes, given the limited resources of sensor nodes. The paper offers a dual contribution. Firstly, it provides an in-depth exploration of the research dimensions of WSNs, drawing on recent real-world findings. Secondly, it offers a comprehensive survey of existing clustering schemes for WSNs, with a focus on metaheuristic techniques. By meticulously surveying literature spanning the years 2000 to 2020, the paper serves as an invaluable resource for scholars in this field.

## V. PROPOSED METHODOLOGY

### 5.1 WORKING OF PROPOSED SYSTEM

The distributed clustering approach is frequently employed to extend the lifespan of conventional wireless sensor networks. However, in terms of factors such as electrical power use, gearbox speed, and control complexity, it frequently comes up short of guaranteeing the optimal possible performance for the whole network. Furthermore, it frequently overlooks how stable the network is overall. For software-defined sensor networks, a new protocol known as A solution to this issue is CMBC, or centralised mobility-based clustering. The CMBC incorporates two approaches inside its workspace for enhancing network stability and performance.



**Figure 5.1 Methodology of CMBC**

## 5.2 FRAMEWORK OF SDSN

The Software Defined Sensor Network (SDSN) comprises three layers from the bottom up, we have The framework level, the administration level, and the application level are the three layers. The SDSN architecture primarily comprises a CMCC and a profusion of software-defined sensor nodes. A general-purpose programmable data transceiver unit and sensor modules make up the framework of the sensor node. The CMCC assigns the appropriate configuration files to every node and configures the network control technologies in a standard fashion. These technologies include routing protocol, topology control, and network coverage. This method is useful for attaining the best possible network performance on a worldwide scale. An important aspect of this design is that the sensor network may be reconfigured at each layer according to user needs and the current condition of the network. To make sure that SDSN covers the whole monitoring region, the CMCC may alter the real-time sensing range of every sensor node once the network is deployed.

One noteworthy feature of this architecture lies in its adaptability. Each layer within the SDSN framework possesses the capability to dynamically reconfigure a network of sensors in response to user requirements and prevailing network conditions. Post-deployment, the CMCC is able to fine-tune the sensing range of individual nodes in real-time, ensuring comprehensive coverage and effective monitoring across the designated area. This dynamic adjustment capability enhances the network's responsiveness to evolving operational needs and environmental changes.

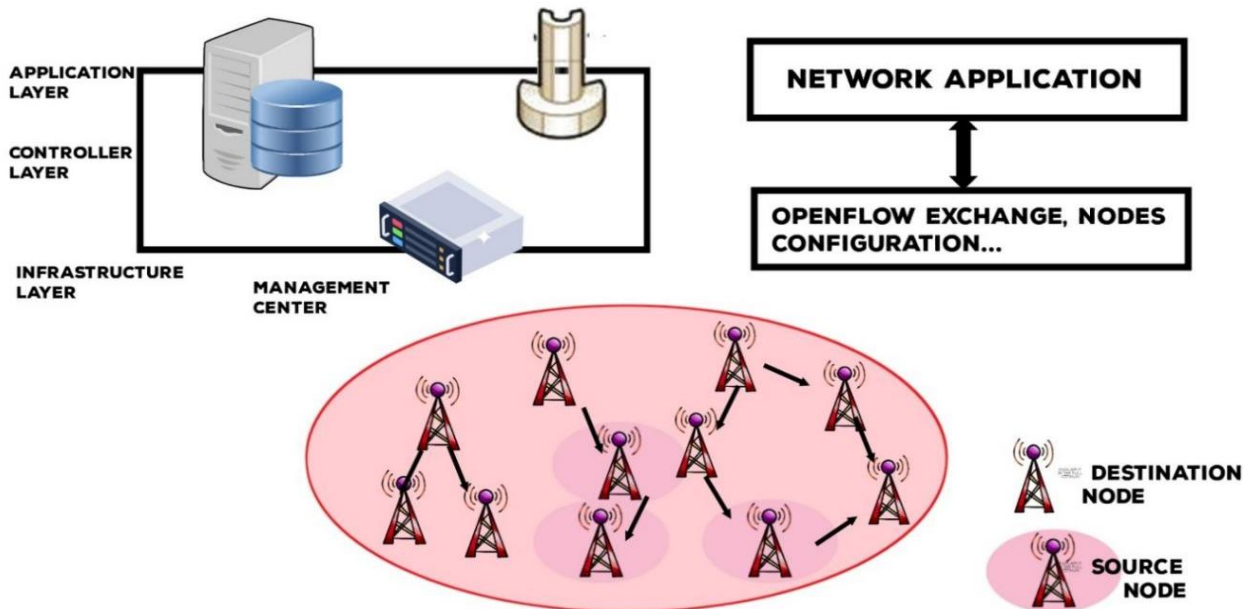


Figure 5.2 Framework of SDN

## VI. SOFTWARE REQUIREMENTS

- Operating System: Windows 7 or Latest Versions
- Simulator Tool: MATLAB Simulator 2023b
- Programming Package: Matlab
- Analyzer : Simulink Data Inspector

## VII. HARDWARE REQUIREMENTS

- Processor: Any Intel or AMD x64 processor
- RAM : Minimum 4 GB and Recommended 8 GB
- Hard Disk: 24 GB for all product installation and an SSD is strongly required
- Input Device: Standard Keyboard and Mouse
- Output Device: VGA and High-Resolution Monitor.

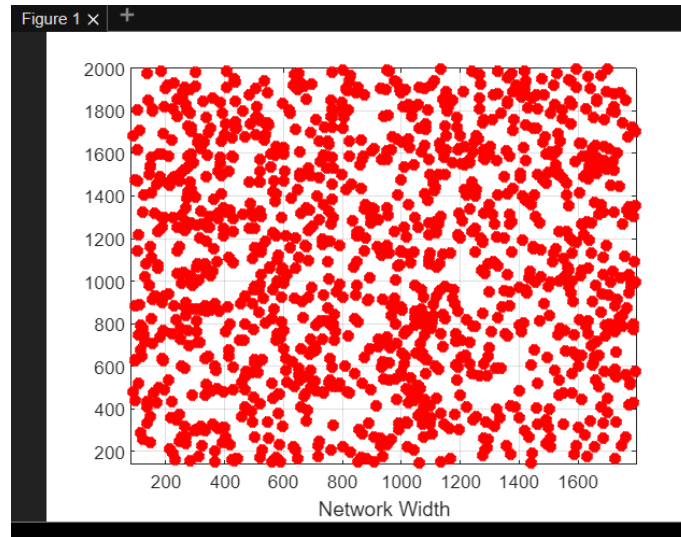
## VIII. RESULTS

The below figure shows the network size taken for demonstrating the protocol in MATLAB simulator. In the below output 1500 sensors are randomly deployed in the two-dimensional area, which is  $2000 \times 2000$  m<sup>2</sup>. The red dots are the indicators of dead nodes. Which will be updated after every timely rounds. Simulation of wireless sensor nodes and Network size is indicated with the help of Graph scale. It will show the Completed Simulation of cluster generation, Where most of the nodes become “Dead nodes” once they exhaust the energy after certain number of rounds.

The clusters will form during each round and the cells with low energy will exhaust slowly at the end of every round and they will become dead. However, Nodes with higher energy still remains, and they still transmit data to the base station with the help of available nodes. The clusters are indicated with Coloured rings in the below simulation result.

### 8.1 DEPLOYMENT OF NODES IN A NETWORK

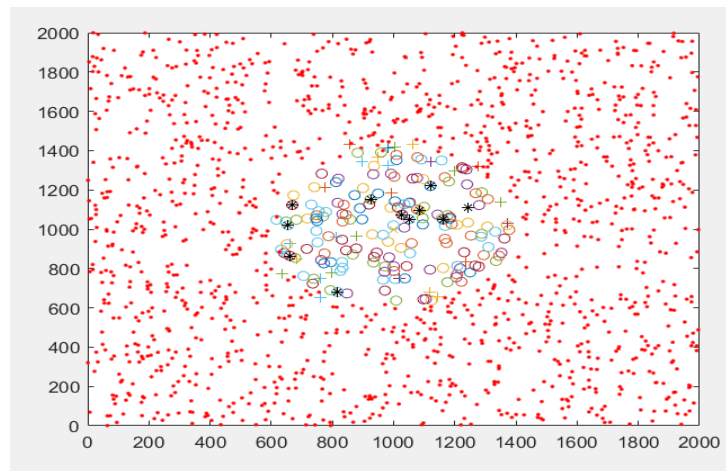
**Figure 8.1** shows the network size taken for demonstrating the protocol in MATLAB simulator. A two-dimensional area of  $2000 \times 2000$  m<sup>2</sup> has 1500 sensors deployed randomly within it. The red dots are the Simulation of wireless sensor nodes and Network size is indicated with the help of Graph scale.



**Figure 8.1 Deployment of Nodes in a Network**

## 8.2 FINAL STAGE OF CLUSTER GENERATION

**Figure 8.2** Shows the Final stage of cluster generation, where most of the nodes become “Dead nodes” once they exhaust the energy after certain number of rounds. They Dead Nodes are indicated in red color.



**Figure 8.2 Final Stage of Cluster Generation**

## IX. ADVANTAGES

- Real-time Environmental Monitoring in Urban Areas
- Efficient Data Exchange for Industrial Automation
- Precision Agriculture for Enhanced Crop Management

## X. DISADVANTAGES

- Resource Intensive Implementation
- Limited Compatibility

## XI. CONCLUSION

In conclusion, with regard to energy conservation, network reliability and overall operational effectiveness, the proposed centralized mobility-based clustering protocol has demonstrated excellent competence. Its ability to manage node energy resources in a prudent manner, thereby prolonging the operational life of the network, has been confirmed by rigorous simulations and experiments. In addition, it demonstrated remarkable resilience in the dynamic network conditions and has been a viable solution for deployment scenarios that are characterized by node mobility.

Overall, the Centralized Mobility Based Clustering Protocol represents a significant leap forward in the optimization of wireless sensor network operations. Its impressive combination of energy efficiency, adaptability, scalability, and fault tolerance make it a valuable asset in the arsenal of network protocols. This protocol not only sets a new standard in performance but also opens up avenues for improved reliability and sustainability in wireless sensor network deployments. Comparative analysis against existing clustering protocols has underscored the superiority of the CMBC protocol across a spectrum of performance metrics and network scales. Its impressive combination of energy efficiency, adaptability, scalability,

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