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Congestion Preventing Clustering [CPC] Model and Routing Protocol in Wireless Sensor Networks

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Abstract: Wireless Sensor Networks (WSNs) have been studied as prevailing disseminated sensors to improve the proficiency of embedded systems and wireless network functions. WSN provides a unique opportunity to lay the basis for leveraging abundant and popular computation, but agonized from numerous problems and challenges, which includes recurrently altering network topology and congestion problem affect the performance and the usage of network. The congestion problem may result in increased latency and packet loss, as well as a large overhead. The key purpose of this review paper is to present a Congestion Prevention Clustering (CPC) protocol to mitigate the congestion problem through the network systems. As a result, this study examines present outcomes that custom clustering systems to handle congestion and routing management difficulties since they provide scalability and lower outlays. Their study also reveals the flaws and benefits of several cluster-based outcomes, which can help researchers to develop a more comprehensive strategy to addressing the underlying challenges of traffic congestion.

Keywords: *Congestion prevention, Wireless Sensor Networks, latency, sensors, packet loss, clustering*

I. Introduction

A WSNs is a communication network consisting of wireless nodes systematized in a topology for connectivity [1]. The acquaintance part of a wireless node that acts as a single network is referred to as the mesh routing. Admittance to this mesh routing relies on a radio node that operates in synchronization with each other to generate a radio link. Mesh networks are consistent and provide redundancy. If one node becomes inoperable, the remaining nodes can interconnect with each other straitly or over one or more transitional nodes. WSN consists of mesh router and a mesh client. In addition to the gateway / bridge function routing feature, which is similar to traditional wireless routers, the mesh router includes other routing features to support the mesh network. WSNs affect our daily lives. It is the seed for intelligent applications and ubiquitous systems. A WSN with a group of internet-connected devices [2], often known as "smart nodes," is equipped with a typical WiFi antenna. It can capture and record the usual and corporal circumstances of the environment, such as moistness, temperature, gravity, and degree of pollution. Because of its elasticity and interconnection abilities, it is probable to use the actual data produced by the mediator devices on virtual layers. Therefore, consistent transmission provided through different promising solutions by using WSN. It has been proven to confirm the sustainability of intelligent applications like Internet of Things (IoT) and armed applications. Smart applications using WSN are shown in figure 1.

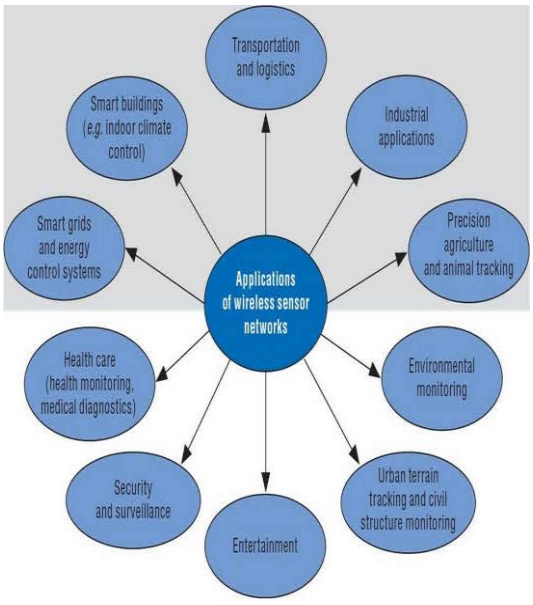

Figure 1 Smart applications using WSN

There are several traditional WSNs available now. Smart nodes can be provisioned dynamically. Mobile Ad Hoc Network (MANET) [3] and Wireless Ad Hoc Network. These radars are separated into a traditional WSN and data centres sync nodes. This introduces 3 core processes (i) accumulation, (ii) dispensation of data, and (iii) contagion of data. In addition, some generic components to achieve is the detection component, a dispensation element and a storing component. Transceiver

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component, control supply component are the data flowed from the WSN which has information centre element over wireless station. WSN's investment is that inevitable consequences of developing countries low cost and poor infrastructure communication channel. However, with increased data loss rate as well as network bandwidth at WSN congestion are still a big challenge. Therefore, quality of service (QoS) requirements can be met. Provides a well-organized directing protocol created on clustering technology will prevent network bottleneck problems through improving the complete network evaluation. The core purpose of this paper is CPC protocol and to improve the system of measurement through throughput, end on latency, delivery rate, and network durability. This study of CPC protocol will determine the process of reducing end-to-end latency and extend the networks lifespan by selecting the appropriate Capital Cluster Head (CCH) and Supplementary Cluster Head (SCH) and to meet the requirements to send the number of packets evenly [4]. The comparative analysis of several clustering protocols proposed by different researchers are discussed. The main objectives of this paper are listed below:

- To study various clustering techniques to develop a novel Congestion Prevention Clustering (CPC) model,
- To compare and contrast the various cluster-based solutions for the network congestion problem, reduction of end on latency and extend network life by choosing the appropriate Capital Cluster Head (CCH) and Supplementary Cluster Head (SCH),
- To reveal some of the strengths and weaknesses of these cluster-based solutions, investigators can develop a wider method to address congestion-specific issues,

II. Literature Review

WSN has accredited a ration of consideration in current years in both academic research and the IT industry. Flexibility and his communication channel. Especially in the case of Long-Term Evolution (LTE) [5] and Terrestrial Trunk Radio (TETRA) [6] is not in operation. Though, WSN has some serious problems and challenges which can harmfully affect latent performance. Frequently altering network topologies, elongated end on delays, and path binding are the issues faced by WSN. Therefore, innovative solution to decrease congestion problems networks aren't just needed to reduce networks not only for power and bandwidth consumption, but also for expanding the network life as long as possible. This section also describes the different existing clustering protocol for congestion prevention.

2.1 Congestion Problem in WSN

K. Singh et al. [7], proposes the detailed description about the problem of congestion. When multiple radar nodes direct information to a sole descend node. At the similar period, there is a high possibility of traffic jams in the communication network. Above all, the core motives are quite constrained bandwidth and limited network volume availability. This phenomenon has two main motives for congestion First, the WSN of the node is congested due to inadequate recall, the processor is slow and inadequate energy of the node. Secondly, due to the nature of the network, WSN congestion is event driven in the network. In WSN, bad possibilities and their types of nodes in wireless channel type, channel interference, and report rate are classified. Therefore, the log developed for WSN must be trivial and ascendable that maximize the life of the network. Congestion arises when the source requirements of network overdo the capacity, channel capacity, and transmission speed available at the physical layer that the network can provide routes. More formally, at any time interval, if the total demand for network sources is greater than the existing dimensions, before the network resource is held to be overloaded at that period of time. Therefore, network performance is highly dependent on these unavoidable normal instabilities.

O. Dergaoui et al., [8], focuses on the congestion control mechanisms. In a resource-shared network where many transmitters contend for link bandwidth, the data rates cast-off by each transmitter must match to avoid overloading the network system. So, too many packets arrive at the network bottleneck, resulting in high packet loss. These dropped packets are consuming a lot of resources because they may already be sent in the network. In addition, lost packets frequently trigger retransmissions. This means that additional packets will be sent to the network. Therefore, network congestion can significantly reduce the throughput of the network. Without proper congestion prevention, network congestion can collapse and data can be delivered almost unsuccessfully. This situation happened on the initial network and led to the expansion of Transmission Control Protocol (TCP) [9] overcrowding controller mechanisms. To ensure constant use of the network at all periods and to decrease the waste of resources cast-off by the lost packets from the unique basis to the clogged protuberance. The mechanism of congestion control of the network is essential to address the threat of network congestion head-on. The main goal of this paper is congestion control is to reduce throughput.

2.2 Existing Congestion Clustering Protocols

Clusters and clustering are commonly used terms in computer networks and denote to diverse executions of

the shared computer resource. Clusters typically consolidate capitals of three or more computing devices. If not, it may function individually for a common purpose. When the wireless network node is grouped into groups by selecting the appropriate Cluster Head (CH) [10], it becomes the normal structure in the network, and even in the presence of mobility. The system performance like throughput and latency can guarantee the basic level of energy resources and numerous mobile nodes. The cluster process divides the system into separate groups of nodes. Each and every group is centred around the cluster head selected. Effective clustering protocol depends on the application in which the cluster head is designed and addresses a variety of design goals. Conferring to the authors [11], the three likely implementation approaches for clustering systems are static, centralized and distributed clustering systems.

There are many research papers on ad hoc network clustering and cluster head assortment approaches. Some of these common algorithms are built on arbitrary standards namely Lowest Identifier (LID) [12], while other clustering systems have a mark of connectivity and enduring battery power [13] may be based on the criteria such as node mobility [14]. The rest of this paper develops and implements related work on clustering algorithms and existing congestion clustering prevention algorithms. They are premeditated and executed with a variety of clustering methods for congestion prevention are listed in table 1 with their advantages and disadvantages.

TABLE 1 EXISTING CONGESTION CLUSTERING PROTOCOLS WITH THEIR ADVANTAGES AND DISADVANTAGES

S. No	Name of the Algorithm	Objectives and techniques used	Merits	Demerits
1	Lowest ID Algorithm [15]	Assigns a unique identifier (ID). A node that only listens to nodes with a higher ID than the problem itself is a cluster head (CH) unless explicitly assigned a role.	Broadcast the list of nodes and CH	Drain the battery and the stability of the nodes are not composed consistently
2	Distributed Clustering Algorithm [16]	The node moves pseudo statically or at actual slow speeds. The DCA customs the weights assigned to the nodes to select the cluster head and assumes that the system topology sees to not modified throughout the implementation of the system.	Higher scalability, less bandwidth cost	Extremely complex to packet loss, deliberate iteration conjunction speed
3	Low Energy Adaptive Clustering Hierarchy (LEACH) [17]	To form the number of clusters control algorithm are used	Performance of the nodes can be improved from 30-60%	Global Positioning System (GPS) device is required for each and every node which consumes more energy.
4	Weighted Clustering Algorithm [18]	Computation costs are reduced as much as probable by the CH selection procedure. This ensures that no CH is laden at any given time with the Load Balancing Factor (LBF).	Helps in congestion prevention and control	Node mobility computation have a significant impact on CH costs, high traffic can cause congestion

5	Cluster Based Congestion Control (CBCC) Protocol [19]	The authors claim that the scheme improves system responsiveness related to end-to-end approaches.	Low delay, high Packet Delivery Ratio (PDR) and high throughput	High CH, computational cost, re-clustering
6	Cluster-Based Routing Protocol (CRP) [20]	This system uses Message Point Portal (MPP) multicast only once all through the path discovery, but all remaining outbound messages use unicast.	Reduces power consumption and helps in improving the network performance	No metrics to prevent congestion
7	DTH-based Cluster Routing Protocol [21]	This method uses a heuristic approach to collect macroscopic network statistics and define a network traffic rate estimate. This helps to perform rate adaptation to control the transmission rate of the basis node. The present congestion edge is well-defined to determine if congestion is present on the traffic route.	It provides overall information of the network topology	Cannot scale up large scale network topology
8	Enhancement Weighted Clustering Algorithm (EWCA) [22]	MANET is the technique used. Mobility is the feature in this clustering.	Less consumption of power supply	Can be used only for the MANET with high overhead and low throughput
9	QoS-aware Node Clustering and based Subcarrier Allocation [23]	Actual station allocation and intrusion switch are significant to enable QoS provisioning and rate reclaim in order to efficiently support the capacity of the multimedia service and expansion system.	High classification throughput and delivers an upright performance balance amongst packet delay of real-time traffic and end-to-end transmission speed.	Does not consider multi-path transmission for congestion prevention
10	Adaptive Clustering Protocol (ACP) [24]	ACP efficiently adapt the to the following network conditions with density (load of node) and the reliability of user requirements	More scalability. less overhead, saves network life, less energy consumption	nil

From the table 1 it is stated that the algorithm comprises of two rational portions, the foremost handles the development of the cluster and the next handles the dynamic reconstruction of the cluster with network system dynamics in mind. Protocol was created on hexagonal padding [25], but the dimension of each hexagonal arm is equal to the reach of the node. This is done to make sure that all the nodes in the groups were inside the transmission series of the node in the centre of the hexagon. Therefore, if the node is not in the optimal position for the strategy, the coverage numbers will be distorted. They can also spread the bias outcome. The main compensations of the protocol are: (1) Scalability [26] to a large sum of groups with a system mass of that

the sum of groups requirement will not rise the mass. (2) The overhead of communication within the node is negligible. But the performance of the algorithm is analogous to added rules. (3) ACP [27] acclimatizes to network settings and handler necessities. It has short overhead, and maintains system life through power balancing. However, the procedure can perform adaptive or dynamic congestion control, and prevention for WSN.

III. Methods And Materials

The basic steps to be followed to improve the traffic congestion [28] are classified as follows:

3.1 Clustering

First, choose the finest probable cluster and cluster head (CH) with fewer communications to exchange and less entire time complication. The anticipated CPC procedure operation comprises of a series of rounds. To each round comprises of a format segment and a broadcast segment. At the start of the first round, a one-time build-up phase run. In this phase, the system zone is separated into level L and sector S to form a fixed cluster.

3.2 Application Dependencies

Various requests can custom these premeditated rules. The connection to each level and each segment generates a group [29], and apiece group has a CCH and a SCH. The enduring round begins with a minor system stage in which the CCH and SCH node roles are switched between the collection of nodes. The outbound phase consists of two layers: intra-cluster routing and intercluster sending of nodes.

3.3 Secure Communication

The setup segment runs only after in a circular when a secure cluster is systematized. The formed cluster remains static for the residual rounds [30], and only revolution of the CCH and SCH parts is executed at the start of each circular node. This is an important idea, specifically for military applications.

3.4 Management

The usage of appropriate Media Access Control (MAC) [31] procedure to attain organization (for example: positioned broadcast arrangements namely Time Division Multiple Access (TDMA)).

3.5 Data Aggregation

Data aggregation is tailored to meet the needs of each application. The system region is segmented into planes and segments at the close of this segment. A group is formed by the junction of each segment. Each segment must also be aware of its group number, which is made up of a nearer number and a subdivision number. A CCH and SCH nodes are required in every group / cluster. During the system phase, the CCH and SCH nodes are chosen based on the remoteness.

IV Conclusion And Future Work

This survey paper attempts to uncover some of the strengths and weaknesses of these current cluster-based routing and bottleneck prevention solutions in WSN. The list is not comprehensive, but it is pre-emptive in the discourse approaching some of these basic systems for clustering. Many of these clustered outcomes conclude that the missing was found when resolving the WSN congestion problem without changing its original format. Some are used to progress routing performances, imposing more overhead, injecting more packets into the network, causing node bottlenecks and network congestion.

In conclusion, the future task is to discover a way to achieve the right level of trade-off amongst computational overhead and high system throughput, and low end on delays. Emphasis on the tendency to use the DCA as the foundation for emerging adaptive intra-cluster and inter-cluster bottleneck prevention schemes for sustainable, operative and effective congestion prevention and control in WSN.

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