# Evaluation and Improvement of Data Availability in WSNs Cluster Base Routing Protocol

Mujahid Tabassum and Dr. Kartinah Zen
*Faculty of Computer Science & Information Technology*
*mujee1983@gmail.com*

***Abstract*—Protocols are one of the main aspect and essential feature of communication. In Wireless Sensor Networks (WSNs) different kinds of protocols and topologies are being used to support data transmission and data reliability issues. Hierarchical Cluster Base Routing Protocols (CBRP) is most famous due to their lower energy consumption and flexible network scalability characteristics. In CBR, the sensor nodes are divided into two kinds of responsibilities such are Cluster Heads (CHs) and Cluster Members (CMs). CH's perform data aggregation and data fusion related tasks while CMs only sense the environmental parameters and forward to their respective CHs. However, the data is only stored on the Base Station (BS). Data availability is one of the main concerns in the CBRP, if any CHs or CMs or BS is damaged due to energy depletion or hardware failure, the sensed data will be loose. In this research paper, we have performed a few experiments to evaluate the data availability related issues in CBR due to interference, network and BS failure. Therefore, we suggest some improvement to ensure data availability in WSNs due to network failure and hardware failure issues.**

***Index Terms*—Wireless Sensor Network; Data Storage; Data Availability; Data Loss; Cluster Base Routing Protocols; LEACH.**

## I. INTRODUCTION

In any communication networks, the network topologies and protocols are responsible to control, transmit and manage the data transmission over wired or wireless medium. Topologies emphasis, how the communication devices or nodes should be deployed within a specific area and protocols control the data communication, data transmission process and ensure the data reliability within a network. Topologies and protocols are used to control various constraints such as energy, latency, computational resources and communication reliability within a network. The network topologies define, routing paths, communication pattern such as unicast or multicast, packet types/size, data aggregation and helps in reducing radio interference. It also helps in controlling the number of nodes within one cluster and constructs the communication network layout. Whereas, the routing protocols are classified into two categories such as flat routing protocols, and hierarchical routing protocols [1]. Both of them have different characteristics and capabilities, and used under various scenarios. Flat routing protocols are mostly used in small networks because all nodes perform identical tasks and contain equal capabilities. In flat routing data is transmitted hop by hop in the form of flooding [1]. Some of flat routing protocols example are Flooding and Gossiping, Sensor Protocols for Information via Negotiation (SPIN), Directed Diffusion (DD), Rumor, Greedy Perimeter Stateless Routing (GPSR), Trajectory Based Forwarding (TBF), Energy-Aware Routing (EAR), Gradient-Based Routing (GBR), Sequential Assignment Routing (SAR) and etc [1, 2]. However, hierarchical routing protocols have different characteristics because of limited energy and storage resources. In a hierarchical network the sensor nodes are divided into two types such as Cluster Heads (CHs) and Cluster Members (CMs) which perform different tasks and are organised into a large number of clusters. The following are the example of hierarchical protocols such as Low-energy Adaptive Clustering Hierarchy (LEACH), Hybrid Energy-Efficient Distributed clustering (HEED), Distributed Weight-based Energy-efficient Hierarchical Clustering protocol (DWEHC), Position-based Aggregator Node Election protocol (PANEL), Two-Level Hierarchy LEACH (TL-LEACH), Unequal Clustering Size (UCS) model, Energy Efficient Clustering Scheme (EECS), Energy-Efficient Uneven Clustering (EEUC) algorithm, Power-Efficient Gathering in Sensor Information Systems (PEGASIS), Threshold sensitive Sensors Energy Efficient sensor Network protocol (TEEN), The Adaptive Threshold sensitive Energy Efficient sensor Network protocol (APTEEN), Two-Tier Data Dissemination (TTDD), Hierarchical Geographic Multicast Routing (HGMR) and etc [1, 2].

A Cluster Base Wireless Sensor Network (CBWSN) is a combination of a large number of sensor nodes, which are connected to a one BS through multiple CHs [2]. CBWSN use Cluster Base Routing Protocols (CBRPs) for communication and data management. In CBWSN, sensor nodes are equipped with a transceiver that assists the in receiving and transmitting the sensed data between CMs, from CMs to CHs and from CHs to a BS. The sensed data is stored on a BS and available for the users' interaction. The sensor nodes are autonomous small devices, which have several constraints such as low power, limited computation capacity, short communication range, prone to interference and small memory space due to their tiny size. These sensor nodes are deployed randomly within a specific area and left unattended for a long period; they are expected to perform their tasks independently and efficiently. As a result, the WSNs have usually varying degrees of sensor node density along its area size. Due to a large deployment of sensor nodes within the specific area; sensor nodes start to die due to limited energy. When nodes start to die, the network becomes less productive and data start to lose.

In CBRPs, each CH broadcast information to its CHs via Code Division Multiple Access (CDMA) and they join the nearest CH. The CHs used Time Division Multiple Access (TDMA) to offer data transmission time slot for every member to send their data which help in minimising and controlling network interference [2]. Similarly, a BS also transmits advertise message for CHs to connect and forward the