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Enhanced Cluster Based Distributer Fault Tolerance Algorithm For Mobile Node In WSN

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Abstract: A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes.

Connecting two or more computers together in such a way that they behave like a single computer that is called clustering. Clustering is used for parallel processing, load balancing and fault tolerance. The clustering technique is used where network organizes around a small set of cluster heads which then gather data from their local cluster aggregate this data and transmit it to the base station. Fault tolerance techniques attempt to prevent lower-level errors from propagating into system failures. By using various types of structural and informational redundancy, such techniques either mask a fault or detect a fault and then effect a recovery process which, if successful, prevents a system failure .In this paper we are reviewing comparison of existing clustering technique by using various performance factors like time complexity, node mobility, cluster count etc.

Keywords: Wireless sensor network, cluster formation algorithm, fault tolerance algorithm

1. INTRODUCTION

A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes. The wireless protocol you select depends on your application requirements.

1.1 APPLICATIONS OF WIRELESS SENSOR NETWORK (WSN)

- Industrial automation
- Automated and smart homes

- Traffic monitoring
- Medical device monitoring
- Monitoring of weather conditions
- Air traffic control
- Robot control

1.2 ADVANTAGES OF WSN

1. Its flexible to go through physical partitions
2. It can be accessed through a centralized monitor
3. It can accommodate new devices at any time
4. It avoid hell lot of wiring

1.3 DISADVANTAGES OF WSN

1. Its damn easy for hackers to hack it as we can't control propagation of waves
2. Comparatively low speed of communication
3. Gets distracted by various elements like Blue-tooth
4. Still Costly at large

2. LITERATURE REVIEW

A. Vinay Kumar , Sanjeev Jain and Sudarshan Tiwari support to maximize network lifetime in Wireless Sensor Network(WSNs) the paths for data transfer are selected in such a way that the total energy consumed along the path is minimized. Clusters create hierarchical WSNs which incorporate efficient utilization of limited resources of sensor nodes and thus extends network lifetime. The some energy efficient algorithms increases the network lifetime. Although every effort has been made to provide complete and accurate state of the art survey on energy efficient clustering algorithms. [1]

B. Sunkara Vinodh Kumar and Ajit Pal proposed method studies on Wireless Sensor Networks during the recent years. As the sensors in the network have limited battery power, enhancing the lifetime of a network is the basic aim of designing an energy efficient routing protocol. Clustering protocols aim to achieve energy efficiency. The whole network is divided into clusters with a cluster head node for each cluster. The data from sensors inside a cluster is aggregated at clu ster head. This eliminates a lot the redundancy in packet forwarding. Low Energy Adaptive Clustering Hierarchy (LEACH) is considered to be benchmark protocol in Clustering/Hierarchical based protocols. Multihop-LEACH, LEACH-MF, MR-LEACH, and Secure LEACH, or M-LEACH are examples of few Clustering Protocols derived from LEACH.[4]

C. Monica R Mundada, Pallavi B. Kamble Dept of Computer Science, T Bhuvaneswari introduced the several approaches. Firstly assumptions regarding the topology are made which simplifies the clustering phase of the network with heterogeneous nodes. The cluster head is chosen in each round as the highest energy node in the cluster unlike LEACH where the cluster head is randomly chosen Wireless sensor networks (WSN) are sophisticated systems that are used to gather data from an unreachable and remote environment. WSN consists of base station and hundreds to thousands of sensor nodes. The main design issues in WSN include efficient energy management and network lifetime.. In this paper we take a realistic approach by considering heterogeneous networks. The clustering mechanism, location of base station and the routing process are crucial to elongate the lifetime of the sensor nodes. The clusters will be formed in different topologies depending on the sensor node deployment. The mobile base station, concept of budget to the sensor nodes and multi hop routing in a sensor network with heterogeneous nodes is used to make the network energy efficient and maximize the network lifetime.[3]

D. R.U.Anitha Department of MCA, Dr. P. Kamalakkannan , introduced the Mobile Wireless Sensor Networks (MWSNs) which is used to help many civilian, military and industrial services. Energy saving is the critical issue while designing the wireless sensor networks. In order to enhance the network life time there are many routing protocols have been developed. One of these is clustering based in which network is partitioned into small clusters and each cluster is examined and controlled by a single node called Cluster Head (CH).In this paper, we propose an enhanced algorithm for Low Energy Adaptive Clustering Hierarchy–Mobile (LEACH-M) protocol called ECBR-MWSN which is Enhanced Cluster Based Routing Protocol for Mobile Nodes in Wireless Sensor Network. ECBR-MWSN protocol selects the CHs using the parameters of highest residual energy, lowest Mobility and least Distance from the Base Station.

The BS periodically runs the proposed algorithm to select new CHs after a certain period of time.[2]

3. CLUSTER FORMATION

In the WSN network structure each cluster has a leader, which is also called the cluster head (CH) and usually performs the special tasks fusion and aggregation, and several common sensor nodes (SN) as members .The sensor nodes periodically transmit their data to the corresponding CH nodes.The BS is the data processing point for the data received from the sensor nodes, and where the data is accessed by the end user. It is generally considered fixed and at a far distance from the sensor nodes. The CH nodes actually act as gateways between the sensor nodes and the BS. The function of each CH, is to perform common functions for all the nodes in the cluster, like aggregating the data before sending it to the BS.

3.1ALGORITHMCLUSTERFORMATION [8]

/*Gateways broadcast a HELLO message consist of node ID, residual energy and distance to the BS. */

Step 1: ComRangeCH(Si) = {};

BackupSet (Si) = {};

Step 2: while (Sir eceiving HELLO message from Gk)

2.1: Si becomes the elements of

COset i k i

ComRangeCH S G

ComRangeCH S = ( ) ∪

2.2 : ( ) endwhile

Step3: if (timeout && no HELLO message received)

then

S i becomes a member of UnCOset .

end if

Step 4: if(Si ∈UnCOset) then

4.1: Si broadcasts a HELP message for backup.

4.2: while (Si receiving reply from Sj)

BackupSet(Si) = BackupSet(Si) ∪ S j

endwhile

4.3: if (BackupSet(Si) ≠ 0)

then

Si uses Sj from BackupSet(Si) as a relay with highest residual energy to send the data to the CH.

Endif

else

4.4: Si calculates cost of all these CHs according to equation 4.4 and joins the CH with the highest cost value.

4.5: if (Si receives any HELP message)

then

Send reply message.

end if

end if

Step 5: Stop.

3.2. OVERVIEW OF ASSOCIATION RULES

1. A set of sensor nodes denoted by S = {S1, S2 ,..., Sn}
2. A set of gateways denoted byG = {G1 ,G2 ,...,Gm}
3. Dist(Si , S j) denotes the distance between two nodes Si and Sj.
4. Eresidual (Si) denotes the remaining energy of Si.
5. ComRangeCH(Si) is the set of all those gateways,which are within the communication range (RS) of node Si. Therefore,

ComRangeCH(Si) = {Gj Dist(Si ,Gj) ≤ RS ∧ Gj ∈G}

6. Neighbor(Si) is the set of all those sensor nodes, which are within the communication range of node Si.

4.FAULT TOLERANCE

Fault tolerance techniques attempt to prevent lower level errors (caused by faults) from propagating into system failures. By using various types of structural and informational redundancy, such techniques either mask a fault or detect a fault and then effect a recovery process which, if successful, prevents a system failure. In the case of a permanent internal fault, the recovery process usually includes some form of structural reconfiguration which prevents the fault from causing further errors. Typically, a fault Tolerant system design will incorporate a mix of fault tolerance techniques which complement the techniques used for fault prevention. Fault tolerance techniques are LEACH, EECH, HEED,DFCA and etc.

4.1 ALGORITHMFAULTTOLERANCE[8]

ALGORITHM/* Fault is detected by the sensor node Si and set itself as uncovered. */

Step 1: Si broadcast a HELP message within its communication range.

1.1: ComRangeCH(Si) = {};

1.2: BackupSet (Si) = {};

Step 2: while (Si receiving reply)

if(reply is from gateway Gk)

2.1: Si becomes the elements of COset iki

ComRangeCH S G

ComRangeCH S = ( ) ∪

2.2 : ( )

else if (reply is from sensor node Sj)

BackupSet (Si) = BackupSet (Si) ∪ S j

endif

endif

endwhile

Step 3: if(Si ∈UnCOset & & BackupSet (Si) ≠ 0) then

Si uses Sj from BackupSet (Si) as a relay with

highest residual energy to send the data to the CH.

else

Si calculates cost of all CHs from ComRangeCH(Si) according to equation 4.4 and joins the CH with the highest cost value.

end if

Step 4: Stop.

Clustering Approaches	Time Complexity	Node Mobility	In Cluster Topology	Cluster count	Clustering process	CHs selection
CLUBS	Variable	Possible	2-hop	Variable	Distributed	Random
FLOC	Constant	Possible	2-hop	Variable	Distributed	Random
RECA	Constant	No	1-hop	Variable	Distributed	Random
HCC	Variable	Possible	k-hop	Variable	Distributed	Connectivity
HC	Variable	Possible	1-hop	Variable	Distributed	Connectivity
MMDC	Variable	Yes	k-hop	Variable	Distributed	Connectivity
EEDC	Variable	No	1-hop	Variable	Centralised	Connectivity
CAWT	Constant	No	2-hop	Controlled	Distributed	Connectivity
GROUP	Variable	No	k-hop	Variable	Hybrid	Proximity

Table 1.1 COMPARISON OF THE PRESENTED CLUSTERING ALGORITHM

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Conclusion and Future Work

In this paper, we analyzed and studied various existing improved clustering algorithm . Mainly common drawbacks are found in various existing clustering algorithm which is improved by using different approaches. It can be applied to many different applications like Military, Health care, Utilities, Remote Monitoring and many others. For the future work, We evaluate the proposed model and compare it with DFCA in terms of network lifetime when the cluster head fail. We will detect common sensor node fault by the selected gateways and detect gateways by base station. Moreover, we will compare performance of existing method with proposed method.

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