Fault-Tolerant Clustering Topology Evolution Mechanism of Wireless Sensor Networks

ABSTRACT

- Wireless sensor networks (WSNs) are often subject to failures caused by energy depletion, software or hardware fault of nodes, environmental events, hostile attacks, and other reasons. It is critical to ensure a WSN application system is available during some presence of fault or interruption. Recent work in topology control has shown that a reasonable topology can improve the robustness of WSN. However, due to the limited resource of sensor nodes, topology control cannot easily tradeoff between fault tolerance and energy saving. To address this issue, we present a regular hexagonal-based clustering scheme (RHCS) and a scale-free topology evolution mechanism (SFTEM) for WSNs, that increases network survivability as well as maintains energy balance.

CONTINUE

- RHCS uses a regular hexagonal structure for clustering sensor nodes, which satisfies at least 1-coverage fault-tolerance. SFTEM combines the reliability of RHCS with scale-free properties to connect clusters to form a robust WSN, which exploits the synergy between reliable clustering scheme and topology evolution, and can tolerate comprehensive faults including random failure and energy failure. In addition, to evaluate the performance of SFTEM, the simulation experiments were carried out to compare three factors including fault-tolerance, intrusion-tolerance and energy balance with other methodsin literature.

EXISTING SYSTEM

- Wireless sensor networks (WSNs) are usually composed of a large number of distributed sensor nodes organized in an ad-hoc pattern to monitor environments . In many applications, it requires high coverage and reliability to accomplish rigorous monitoring tasks, such as military mission, volcanic monitoring , and forest fire prevention . It further exacerbates the design challenge of meeting application requirements. WSNs always operate in unattended or hostile environments . The sensor nodes in WSNs are easy to breakdown caused by energy depletion or natural disaster and deliberate attack . In addition, the failed sensor nodes would reduce the coverage of the network, would split originally connected network, and even lead to an entire global network paralysis.

PROPOSED SYSTEM

- we present a regular hexagonal-based clustering scheme (RHCS) and a scale-free topology evolution mechanism (SFTEM) for WSNs, that increases network survivability as well as maintains energy balance. RHCS uses a regular hexagonal structure for clustering sensor nodes, which satisfies at least 1-coverage fault-tolerance.
- SFTEM combines the reliability of RHCS with scale-free properties to connect clusters to form a robust WSN, which exploits the synergy between reliable clustering scheme and topology evolution, and can tolerate comprehensive faults including random failure and energy failure. A regular hexagonal-based clustering scheme (RHCS) with FT sensor nodes as the vertexes of the hexagon is constructed.

CONTINUE

- We characterize the reliability and fault rate hierarchically at FT sensor node and RHCS using Markov model. Then we obtain the random failure probability (RFP) of RHCS. 2) We discuss the energy failure probability (EFP) of RHCS. Then we combine the RFP and EFP to model the JFP of RHCS. The relationship between the JFP and its important parameters is analyzed by the mathematical method to prepare the theory for topology evolution mechanism.
- 3) A scale-free topology evolution mechanism (SFTEM) based on RHCS is presented. We treat a RHCS as an FT cluster, and evolve the topology based on the FT clusters. The connection strategy combines joint failure probability (JFP) and other characteristics of FT cluster, including node degree, node saturation and the distance between the cluster heads. 4) Comparison of simulation experimental results to demonstrate the superiority of the proposed SFTEM over the existing models.

HARDWARE REQUIREMENTS

- Processor - Pentium –III
- Speed - 1.1 Ghz
- RAM - 256 MB(min)
- Hard Disk - 20 GB
- Floppy Drive - 1.44 MB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA

SOFTWARE REQUIREMENTS

- Operating System : Windows 8
- Front End : Java /DOTNET
- Database : Mysql/HEIDISQL

CONCLUSION

- WSNs are susceptible to failure due to the vulnerability of sensor nodes and attacks from malicious intruders. Hence, the fault-tolerance is an important issue ifn WSN applications. In this paper, we construct a regular hexagonal-based clustering scheme (RHCS) of sensor networks and analyze the reliability of RHCS based on Markov model. Then, we present a scale-free topology evolution mechanism (SFTEM). We also analyze the dynamic characteristics of SFTEM using mean-field theory.

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