Sudan University of Science and Technology
College of Graduate Studies

Performance Evaluation of Hierarchical Routing Protocols in Wireless Sensor Network

تقييم أداء برتكولات التوجيه الهرمي في شبكة الإستشعار اللاسلكية

A Thesis submitted in Partial Fulfillment of Requirements for
The Degree of Master in Electronic Engineering (Computer)

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الأية

قال تعالى: (يَاأَيُّهَا الَّذِينَ آمَنُوا إِذَا قِيلَ لَكُمْ تَفَسَّحُوا فِي الْمَجَالِسِ فَافْسَحُوا يَفْسَحْ اللَّهُ لَكُمْ وَإِذَا قِيلَ انشُزُوا فَانشُزُوا يَرْفَعْ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ(11)) سورة المجادلة.

DEDICATION

To

To my lovely **mother**, **father** and **husband**, to my great brothers and sisters to Dr.OMER with my respect

Marwa

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Praise to Allah, the Most Gracious and Most Merciful, Who has created the mankind with knowledge, wisdom and power.

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ABSTRACT

Wireless sensors nodes are prepared up of small electronic devices which are capable of sensing, computing and transmitting data from harsh physical environments. These sensor nodes majorly depend on batteries for energy, which get exhausted at a faster rate because of the computation and communication operations they have to perform. Communication protocols can be intended to make efficient consumption of energy resources of a sensor node and to obtain real time functionality. A detailed study of most used protocols such as LEACH, PEGASIS, and TEEN has been carried out and comparison tables give an overview of the protocol's performance on some factors such as latency, load in the network and energy awareness. Conclusions have been drawn using the comparison table parameters of how the protocol performs when utilized for any network size and what kind of tradeoff they show using OPNET 14.5 as a simulation environment. The result shows that LEACH protocol is more appropriate in the applications that spread in small network where TEEN is suitable for monitoring sudden changing in the environment. Moreover, PEGASIS is suitable for large network.

المستخلص

تتكون أجهزة الاستشعار اللاسلكية من أجهزة إلكترونية صغيرة قادرة على استشعار البيانات، والحوسبة والإرسال من البيئات الطبيعية القاسية. تعتمد هذه العقد الاستشعارية علي البطارية في الحصول علي الطاقة، و التي تستنفذ سريعاً نسبة لعمليات الحوسبة و الاتصالات التي تجريها هذه العقد فيما بينها. بروتوكولات الإتصالات يمكن أن تكون مصممة لجعل الاستخدام الكفء لموارد الطاقة وللحصول على النتائج في الوقت الحقيقي. في هذا البحث نقدم دراسة مفصله ومقارنة لأكثر البرتوكولات استخداما مثل بروتكول LEACH و PEGASIS وTEEN لإعطاء توضيح لأدائيتها وفقاً لبعض العوامل مثل التأخير و الحمل علي الشبكة و الطاقة. النتائج المرصودة لعمل هذه البرتوكولات في تطبيقات المراقبة بإستخدام برنامج المحاكاة OPNET 14.5.

هذه النتائج أوضحت لنا أن برتوكول LEACH مناسب في التطبيقات التي تتوزع علي شبكة صغيره بينما برتوكول TEEN يناسب مراقبة التغير المفاجئ في البيئة. أما برتوكول PEGASIS فيناسب الشبكات الكبيرة.

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LIST OF ABBREVIATIONS

BS	Base station
CH	Cluster head
CSMA/CA	carrier sense multiple accesses with collision avoidance
FFDs	Full function devices
HEAR	Hop-based Energy Aware Routing
HT	Hard threshold
IEEE	Institute of Electrical and Electronics Engineers
LEACH	Low Energy Adaptive Clustering Hierarchy.
MAC	media access control
OPNET	Optimized Network Engineering Tools
PEGASIS	Power Efficient Gathering in Sensor Information System.
RFDs	Reduced function devices
ST	Soft threshold
TEEN	Threshold sensitive Energy Efficient sensor Network.
WLANs	Wireless Local Area Network
WSN	Wireless Sensor Network.