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Literature Review to Optimize the Energy Consumption in Wireless Sensor Network

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Abstract: This paper focuses on the model to reduce battery overhead and enhance the lifetime of a wireless sensor network, using the concept of Epidemic Model. The monitoring of the network is done by a special node that uses the same protocol for communication and keeps track of the state of the nodes as it is propagated. It can be used on the basis of their positions, continuous sensing, event detection, location sensing etc. It will be achieved in terms of mathematical analysis. The literature is useful to find ways to reduce the battery overhead and enhancing the lifetime of a wireless sensor network.

INTRODUCTION

Wireless sensor networks (WSNs) are self-organizing temporary networks without any established infrastructure or centralized administration, comprising of spatially distributed sensor nodes. WSN is composed of a large number of sensor nodes. Sensor nodes are limited in power, computational capacities and memory. They are small, battery-powered, resource-constrained devices equipped with embedded CPU, sensors, and transceivers deployed over a wide range for monitoring the surroundings, as well as, for information gathering. The collected data are transferred to WSN's external end users. The limited range of each node's wireless transmissions makes a sensor node to depend on other sensor nodes for forwarding packet to destination generally, base station. In addition, the extremely tiny size of the sensor limits the storage space, energy supply and communication bandwidth. Hence managing the sensor node's energy resources efficiently is an issue. Energy imbalance and low efficiency is another problem in the Wireless sensor networks.

Various Applications of WSNs: Military Scenarios: WSN supports tactical network for military communications and automated battle fields. **Data Networks:** WSN provides support to the network for the exchange of data between mobile devices. **Device Networks:** Device Networks supports the wireless connections between various mobile devices so that they can communicate. **Free Internet Connection Sharing:** It also allows us to share the internet with other mobile devices. **Sensor Network:** It consists of devices that have capability of sensing, computation and wireless networking. Wireless sensor network combines the power of all three of them, like smoke detectors, electricity, gas and water meters. **Commercial Sector:** Ad hoc can be used in emergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earth-quake. Emergency rescue operations must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is needed. Information is relayed from one rescue team member to another over a small hand held device. Other commercial scenarios include e.g. ship-to-ship ad hoc mobile communication, law enforcement, etc. **Personal Area network:** Short-range WSN can simplify the intercommunication between various mobile devices (such as a PDA, a laptop, and a cellular phone). Tedious wired cables are replaced with wireless connections. Such an ad hoc net-work can also extend the access to the Internet or other networks by mechanisms e.g. Wireless LAN (WLAN), GPRS, and UMTS. PAN is potentially a promising application field of MANET in the future pervasive computing context.

LITERATURE REVIEW

1."Modeling the Lifetime of Wireless Sensor Networks"

In this paper, we formally define RLIS (Remaining Lifetime of Individual Sensor is defined as the normalized remaining energy of the sensor at moment Nm), RLSN (Remaining Lifetime of the whole Sensor Network as the sum of the weighted remaining lifetime of all sensors in the sensor network) and LSN (Lifetime of Sensor Network). Based on these models we compare two query protocols; both theoretical and simulation results show that IQ balances the load which extends the lifetime of the sensor network. Given the model of the lifetime of the sensor network, we will extend our work in two ways. On one hand, we will extend the model of the lifetime to make it more usable by considering more types of energy consumption such as take the sleep/active dynamics into consideration in our model. On the other hand, we will use this model to guide the development of more suitable protocols and evaluate the efficiency of more proposed protocols. (**Kewei Sha and Weisong Shi et al. 2005**)

2.“Analysis of Virus Spread in Wireless Sensor Networks: An Epidemic Model”

We studied the potential threat of virus spread in wireless sensor networks. Using epidemic theory, we proposed a new SIR-M model to describe the dynamics of the virus spread process from a single node to the entire network. By introducing a maintenance mechanism in the sleep mode of WSNs, our SIR-M model can improve the network’s anti-virus capability and enable the network to adapt to different types of viruses without additional computational or signaling overhead. The proposed model captures both the spatial (e.g., node density, transmission range) and the temporal (e.g., transient responses of S(t),I(t), and R(t)) dynamics of the virus spread process. **(Brian L. Mark et al.2009**)

3. “An energy-balancing clustering approach for gradient-based routing in wireless sensor networks”

Clustering notably decrease the energy consumption of each independent sensor in a wireless sensor network (WSN), and also increases the communication load on cluster heads. Because of the unbalanced energy utilized among cluster heads, the hot spots problem will arise when using the multihop forwarding model for the intercluster communication. Unequal clustering is an effective way to balance the energy consumption of cluster heads. In this paper, we present an Energy-Balancing unequal Clustering Approach for Gradient-based routing (EBCAG) in wireless sensor networks. It partitions the nodes into clusters of unequal size, and each sensor node maintains a gradient value, which is defined as its minimum hop count to the sink. The size of a cluster is decided by the gradient value of its cluster head, and the data gathered from the cluster members should follow the direction of descending gradient to reach the sink. Simulation results show that EBCAG balances the energy consumption among the cluster heads, and significantly improves the network lifetime. **(Tao Liu, Qingrui Li, Ping Liang et al.2010)**

4. “Maximum damage battery depletion attack in mobile sensor networks”

Developing reliable security measures against epidemic of malware will make possible the growth of wireless sensing technologies. The first step toward this goal is to look over potential attack strategies and the size of damage they can incur. The malware at each infective node may seek to contact more susceptible nodes by amplifying the transmission range and the media scanning rate and thereby accelerate its spread. This may however lead to (a) easier detection of the malware and thus more effective counter-measure by the network, and (b) faster depletion of the battery which may in turn baulk further spread of the infection and/or exploitation of that node. We assume the viewpoint of the malware and cast the problem of dynamically selecting the transmission range and media access rate of the infective nodes as an optimal control problem. We utilize Pontryagin's maximum principle to find an optimum solution, and prove that the maximum damage can be attained using simple three-phase bang-bang strategies**.(M. H. R. Khouzani et al. 2011)**

5. "An epidemic model with adaptive virus spread control for wireless sensor network"

We studied the dynamics of virus spread in WSNs using epidemic models. We examine both the traditional SI epidemic model and its modified version for WSNs. The traditional SI model does not provide any anti-virus protection for WSNs due to no anti-virus maintenance mechanism. To overcome this weakness, we proposed a modified SI model by leveraging the sleep mode of WSNs to perform system maintenance. The modified SI model can improve the network anti-virus capability without causing any extra hardware effort and signaling overhead. We derived the explicit solutions for both the traditional SI model and the modified SI model, which can capture both the special and temporal dynamics of the virus spread process. Since the network may be subject to virus attacks with different infectivity at different times, we proposed two adaptive network protection schemes, i.e., TNP scheme and PNP scheme, based on the modified SI model, for securing WSNs against virus attacks. Numerical results and simulations are performed and the following results are obtained:

• by appropriate parameter configuration, the virus spread can be effectively controlled by the modified SI model

• both the TNP and the PNP schemes can achieve network protection with respect to the change of infectivity and they are verified to be feasible**.(Shensheng Tang et al.2011)**

6. "Modeling overall energy consumption in Wireless Sensor Networks."

This paper, presents a new approach for minimizing the total energy consumption of wireless sensor network applications based on the Hierarchy Energy Driven Architecture. In particular, we identified components of each part of HEDA. We extracted a model for each of the constituents and components in terms of their dominant factors (or parameters). We proposed a formulation for the total energy cost function in terms of their constituents. Simulation results for lifetime and residual energy of a sample network with different sensor radius, transmission radius and random and selective networks demonstrated that our model and formulation can be used to optimize the overall energy consumption, determine the contribution of each constituents and their relative significance. The implication is that optimizing the energy of the general model with respect to all constituent parameters will enable one to engineer a balance of energy dissipation among constituents, optimize the energy consumption among them and sustain the network lifetime for the intended application. It should be noted that many important issues are still to be explored. This paper only suggests an outline model for each constituents; a detailed energy model for each of the constituent of HEDA is to be studied. The paper identified a number of dominant parameters of each energy components, however, not all features of WSNs have been taken into consideration and they should be explored and investigated thoroughly. Clearly, the relationship among the energy constituents and their interplay within an application are important; we plan to explore the patterns and the shape of the energy consumption for a generic application and produce a comprehensive map of energy consumption relative to a specific application. Preliminary investigation assumed a weighted linear combination of energy consumption of the constituents, in the future, we plan to produce a more accurate energy cost function which accurately place due emphasis on parameters, components and the playoff factors among components. We believe that a non-linear cost function rather than a simple linear combination would allow the model to adapt better to a specific WSN application.**(NajmehKamyabpour et al. 2011)**

7. "Modeling of Node Energy Consumption for Wireless Sensor Networks"

Current WSN researches focuses more on communication protocols than on energy consumption modeling. Traditional energy analysis method is to deduce the energy consumption statuses of nodes and networks based on the theoretical energy consumption data or theoretical models of system components. Most of the existing energy models only analyze the energy status of communication module, being lack of studying the overall energy consumption from the view of nodes. By modeling the energy consumption of different node components in different operation modes and state transitions, this paper proposes a new node energy model based on the event trigger mechanism. This model can be used to analyze the energy status of WSN nodes and systems, to evaluate the communication protocols and to help to deploy nodes and construct WSN application**.(Hai-YingZhou etal.2011)**

8. "Mathematical model on the transmission of worms in wireless sensor network"

Inspired by the compartmental biological epidemic model, we propose an e-SEIRS-V model for the attacking behavior of worms in sensor nodes. Reproduction number is obtained to understand the spreading and fading of the worms in the sensor field. We establish that the worm-free equilibrium is globally asymptotically stable, if reproduction number is less than one. Runge–Kutta–Fehlberg method is used to solve and simulate the system of equations developed. With the help of MATLAB, an extensive simulation is performed to validate the developed model. A powerful impact of vaccination provided to the sensor nodes is clearly observed over exposed and infectious. Analysis of recovered and vaccinated class with respect to time. If we have a proper vaccination given to the sensor nodes, the susceptibility towards the attack of worms will be very low. The study will help the software organization in developing highly efficient antivirus software to minimize the attack of malicious signals in the sensor nodes. Also the study will give an idea to the end users for proper vaccination and regular use of antivirus software to the sensor nodes in the sensor field for making the defense mechanism strong and to minimize the attacks**.(Bimal Kumar Mishra,NehaKeshri et al. 2013**)

9. "Energy Analysis in Wireless Sensor Network: A Comparison"

WSNs consist of limited battery powered nodes placed to sense the target. Replacing or recharging these nodes is almost impossible as the installed target areas are often difficult to access. The findings show that direct transmission undergo the highest energy followed by multihop communication and clustering. Mobile communication use the least energy compared to other mechanisms. Direct transmission is feasible when the base station and sensor nodes are within close impendence as total energy consumption is proportional to the distance. In a wider network, direct transmission will not be a suitable choice as nodes will be consuming more energy and will eventually die. For wider networks, multihop can be a viable solution as this communication ensures delivery of data to the base station. But one potential problem with multihop communication concerns nodes that are closer to the base station; these nodes tend to be heavily utilized and will eventually cause routing hole near the base station. Clustering is another energy efficient protocol proposed by researchers, where a cluster head is used to relay data to the base station. Clustering performs better than multihop and direct communication in terms of energy utilization. This is because cluster head selection allows other sensor nodes to only sense and relay data to the base station rather than routing data from other nodes (as in multihop). Clustering works efficiently with the rotation of cluster head election and in a smaller network. **(Vasaki Ponnusamy et al. 2014)**

10. "Minimizes the Energy Consumption in Wireless Sensor Networks"

We proposed a holistic approach to minimize the total energy consumed by both mobility of relays and wireless transmissions. Most previous work ignored the energy consumed by moving mobile relays. When we model both sources of energy consumption, the optimal position of a node that receives data from one or multiple neighbors and transmits it to a single parent is not the midpoint of its neighbors; instead, it converges to this position as the amount of data transmitted goes to infinity. Ideally, we start with the optimal initial routing tree in a static environment where no nodes can move. However, our approach can work with less optimal initial configurations including one generated using only local information such as greedy geographic routing. Our approach improves the initial configuration using two iterative schemes. The first inserts new nodes into the tree. The second computes the optimal positions of relay nodes in the tree given a fixed topology. This algorithm is appropriate for a variety of data-intensive wireless sensor networks. It allows some nodes to move while others do not because any local improvement for a given mobile relay is a global improvement. This allows us to potentially extend our approach to handle additional constraints on individual nodes such as low energy levels or mobility restrictions due to application requirements. **(Ravi Chandra Reddy. Et al. 2015)**

11. "Stability Analysis of SITR Model and Non Linear Dynamics in Wireless Sensor Network"

We developed a mathematical model to describe the spreading and controlling activities of malicious signals in wireless sensor network consists of ordinary differential equations to study the effect of treatment dynamics of worm transmission. We derive the expression for basic reproduction R0 for determining the worm dies out completely. The local stabilities of worm free equilibrium and endemic equilibrium are established by using the Jacobian matrix. It is establish that if R0, is less than or equal to one, then worm can be eradicated and the system becomes locally and globally asymptotically stable and when 0 R >1,the endemic equilibrium will be locally and globally asymptotically stable. It is also observed that if the rate of treatment increases the spreading of malicious worms decreases and enhances the life of wireless sensor network. By simulation it is found that performance of proposed model is better in comparison to the SIRS model, infected nodes are quickly removed from the system**.(Awasthi Shashank, Ojha Rudra Pratap et al.2016)**

CONCLUSION:

The study focuses on energy optimizing of various sensor network. Epidemic model is a simplified means of describing the communicable diseases through individual's nodes. It suggests better insights to find various ways to fight against the virus spread in WSN to solve the energy consumption problem.

REFERENCES:

1. KeweiSha and Weisong Shi (2005) "Modeling the lifetime of wireless sensor network" Department of computer science, Wayne state university, 5143 Cass Avenue, Detroit,USA.
2. VasakiPonnusamy(2014) "Energy Analysis in Wireless Sensor Network: A Comparison" Faculty of Integrative Sciences and Technology, Quest International University Perak, Jalan Raja PermaisuriBainun, 30250 Ipoh, Malaysia.
3. Tao Liu, Qingrui Li, Ping Liang (2010) "An energy-balancing clustering approach for gradient based routing" School of computer science and engineering, Southwest University of Nationality, Chengdu, China.
4. Shensheng Tang(2011) "Traffic Flow Analysis of a Multi-hop Wireless Sensor Network Subject to Node Failure" Missouri Western State University, Department of Engineering Technology, 4525 Downs Dr., St. Joseph, USA.
5. Bimal Kumar Mishra,NehaKeshri "Mathematical model on the transmission of worms in wireless sensor network" Department of applied mathematics, Birla Institute of Technology Mesra, Ranchi, India.
6. Shensheng Tang, David Myers and Joson Yuan.Int.J. "Wireless and mobile computing, (2013) Modified SIS epidemic model for analysis of virus spread in WSN" Missouri Western State University, Saint Joseph, MO 64507, USA.
7. Shensheng Tang, Wei Li Int.J.Security and networks,2011 "An epidemic model with adaptive virus spread control for wireless sensor network" Department of Engineering Technology, Missouri Western State University, St. Joseph, USA.
8. Brian L. Mark "Analysis of Virus Spread in Wireless Sensor Networks: An Epidemic Model" Dept. of Electrical and Computer Eng. George Mason University Fairfax, Virginia, USA.
9. Liping Feng[1], Lipeng Song[2], Qingshan Zhao[1], Hongbin Wang[1] "Modeling and stability analysis of worm propagation in wireless sensor network" Department of Computer Science of Xinzhou Normal University, Xinzhou, ShanXi 034000, China. School of computer and control engineering, North University of China, Taiyuan Shanxi 030051, China.
10. M. H. R. Khouzani, *Student Member, IEEE*, SaswatiSarkar, *Member, IEEE*, and Eitan Altman*, Fellow, IEEE "*Maximum damage battery depletion attack in mobile sensor networks"
11. RudraPratapOjha (Galgotias College of Engineering & Technology, Greater Noida) Pramod Kumar Srivastava (Galgotias College of Engineering & Technology, Greater Noida).
12. GoutamSanyal "Stability analysis of SITHR model and non-linear dynamics in Wireless sensor network" National Institute of Technology, Durgapur,INDIA
13. NajmehKamyabpour , Doan B.Hoang "Modeling overall energy consumption in Wireless Sensor Networks." University of Technology, Sydney Broadway, Australia.
14. Amit Sharma (Deptt. of E&C Engg., K.I.M.T., Moradabad, U.P.,India), KshitijShinghal (Department of E&C Engg., M.I.T, Moradabad, India.), NeelamSrivastava (Department of E&C Engg., I.E.T, Lucknow, India) ,Raghuvir Singh (Academic Advisor, Shobhit University, Merrut, India) Energy Management for WSN nodes.
15. G. Ravi Chandra Reddy, Dr. B.TarakeswaraRao, B.Satyanarayana Reddy M.Tech Student, Dept of CSE, Professor, Dept of CSE,Assoc.Professor, Dept of CSE KHIT, JNTUK, Guntur,Ap, India.KHIT, JNTUK, Guntur,Ap, India.KHIT, JNTUK, Guntur, Ap, India "Minimizes the Energy Consumption in Wireless Sensor Networks"
16. Hai-Ying Zhou, Dan-Yan Luo, Yan Gao, "Modeling of Node Energy Consumption for Wireless Sensor Networks" De-Cheng Zuo School of Computer Science and Technology, Harbin Institute of Technology, Harbin, China.

