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Current Challenges and Different Reviews on Wireless Sensor Networks

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Abstract

Wireless sensor networks have critical applications in the scientific, medical, commercial, and military domains. Examples of these applications include environmental monitoring, smart homes and offices, surveillance, and intelligent transportation systems. It also has significant usages in biomedical field. As social reliance on wireless sensor network technology increases, we can expect the size and complexity of individual networks as well as the number of networks to increase dramatically.In the current paper we are going to present different reviews of Wireless sensor network.

Keywords: Wireless Sensor network, WSN, sink.

Introduction

A wireless sensor network (WSN) is a network that is made of hundreds or thousands of sensor nodes which are densely deployed in an unattended environment with the capabilities of sensing, wireless communications and computations (i.e. collecting and disseminating environmental data). These spatially distributed autonomous devices cooperatively monitor physical and environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations. The basic architecture of Wireless sensor Network is shown in Figure1.1

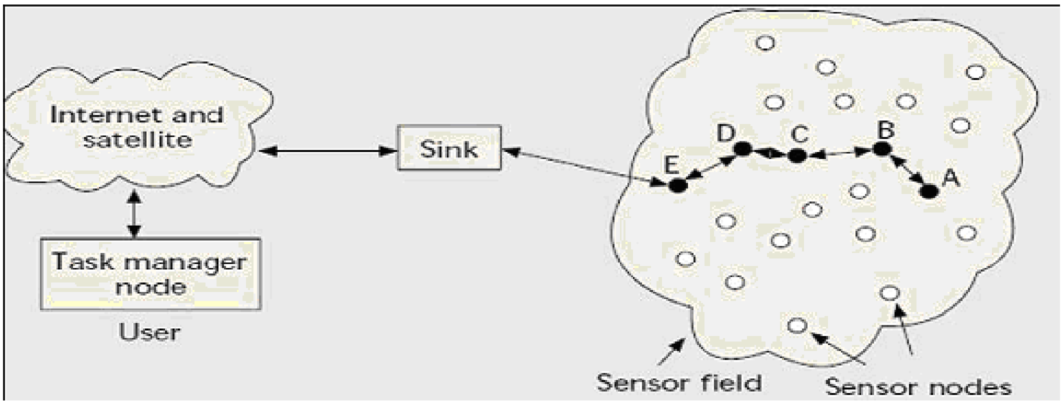

Figure 1.1 Basic Architecture of Wireless Sensor Network.

Each autonomic node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a processing unit which can be a small micro-controller, sensing unit, and an energy source, usually an alkaline battery. Sometimes, a mobilizer is needed to move sensor node from current position and carry out the assigned tasks. Since the sensor may be mobile, the base station may require accurate location of the node which is done by location finding system. The size of a single sensor node can vary from shoebox-sized nodes down to devices the size of grain of dust.

Components of a Sensor Node is shown in Figure1.2

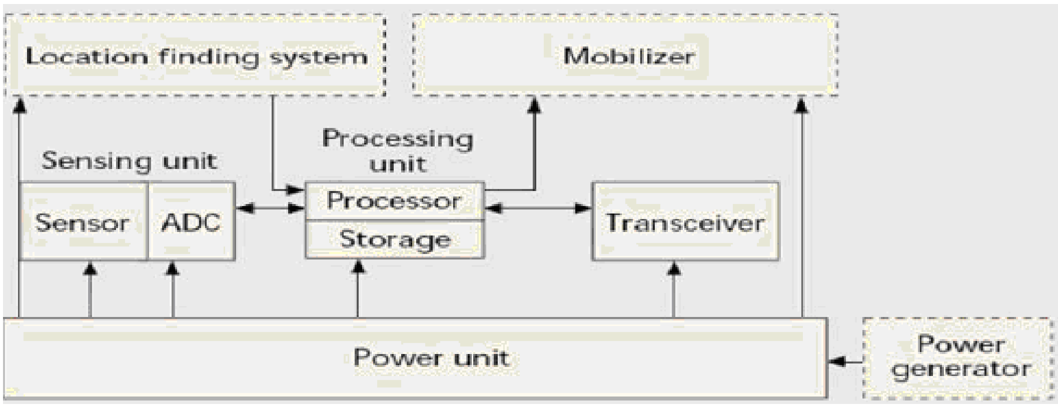

Figure1.2 Components of a Sensor Node

1.1 Requirements and Design factors in Wireless Sensor Network–
Following are some of the basic requirements and design factors of wireless sensor network which serve as guidelines for development of protocols and algorithms for WSN communication architecture.

1.11 Fault Tolerance, Adaptability and Reliability:

Sensor networks are required to operate through adapting to the environmental changes that sensors monitor. The networks should be self-learning. Reliability is the ability to maintain the sensor network functionalities without any interruption due to sensor node failure. Sensor node may fail due to lack of energy, physical damage, communications problem, inactivity, or environmental interference. The network should be able to detect failure of a node and organize itself, reconfigure and recover from node failures without loosing any information.

1.12 Power Consumption and Power management:

One of the components of sensor nodes is the power source which can be a battery. The wireless sensor node being a microelectronic device, can only be equipped with a limited power source. Over the remote inaccessible place with less human control and existence, power sources play critical role in survival of sensor nodes. Power source should be intelligently divided over sensing, computation, and communications phases as per requirement. Sensors can be hibernated when inactive. Lots of current researches are focusing on designing power-aware protocols and algorithms for wireless sensor networks. Recently, solar energy is also considered as an option for empowering remote sensor nodes which are exposed environment.

1.13 Network Efficiency and Data Aggregation:

Flooding raw sensed data over the network can easily congest the network. Some critical applications like intruder detectors require urgent transmission and faster processing of data which may degrade performance and loose reliability due to congestion or latency in the network. Intelligent aggregation of sensed data and elimination of unwanted and redundant information and data compression can be a solution for efficient resource and energy utilization and congestion avoidance. Many algorithms like directed diffusion are proposed to facilitate data aggregation and dissemination within the context of WSNs.

1.14 Intelligent Routing:

In many applications, sensor nodes are moving nodes and can change place dynamically. Routing protocols must be adaptive to these changes and should be self-healing and self-configuring. The information should be persistent in spite of changes in network nodes. Low processing capacity of a node creates many challenges for routing packets throughout the neighbouring nodes intelligently. As discussed above, some applications may require a faster communication and instant response. Routing algorithms should be intelligent to choose minimum hop and minimum distance paths for data transfer.

1.15 Management challenge:

Managing the communication over heterogeneous networks is basic challenge in self-managed system because policies and communication protocols plan an important role in network communication. Also, it is necessary to balance the level of detail the network is providing to the client against the rate at which energy is being consumed while gathering the data. Clearly, it is preferable to have the network automatically do this tuning, rather than requiring manual intervention.

These basic requirements and design goals serve as challenge for current technology. Though current IP routing protocol exist and have significant applications in current networks and Internet, they do not satisfy complete design requirements in Wireless sensor networks because WSN nodes typically has limited computing capacities and less power. So WSN's require a different infrastructure and protocol stack which can be implemented using autonomic computing concept.

Different Reviews

1. ***In August 2001 Mr.Yan Yu and Ramesh Govindan*** has proposed a recursive data dissemination protocol for wireless sensor networks. It was concluded by the Authors that future sensor networks will be composed of a large number of densely deployed sensors/actuators. A key feature of such networks is that their nodes are untethered and unattended. Consequently, they have limited and non-replenishable energy resources. Therefore, Energy efficiency is an important design consideration for these networks. Motivated by the fact that sensor network queries may often be geographical, Authors have designed and evaluate an energy efficient routing algorithm that propagates a query to the appropriate geographical region, without flooding. Their proposed Geographic and Energy Aware Routing (GEAR) algorithm uses energy aware neighbour selection to route a packet towards the target region and Recursive Geographic Forwarding or Restricted Flooding algorithm to disseminate the packet inside the destination region. They have evaluated the GEAR protocol using simulation. They have found that, especially for non-uniform traffic distribution, GEAR exhibits noticeably longer network lifetime than non-energy aware geographic routing algorithms.
2. ***In April 2004 Mr.Kay R¨omer and Friedemann Mattern*** *has proposed* "The Design Space of Wireless Sensor Networks". It was observed by the Authors in the past years that wireless sensor networks have found their way into a wide variety of applications and systems with vastly varying requirements and characteristics. As a consequence, it was very difficult to discuss specific application requirements regarding hardware issues and software support. This is particularly problematic in a multidisciplinary research area such as wireless sensor networks, where close collaboration between users, application domain experts, hardware designers, and software developers is needed to implement efficient systems. In their Research paper, basically they discussed the consequences of the fact with regard to the design space of wireless sensor networks by considering its various dimensions. They have justified their view by demonstrating that specific existing applications occupy different points in the design space.
3. ***In November 2006 Mr. Shan Lin, Jingbin Zhang, Gang Zhou, Lin Gu, Tian He, and John A. Stankovic*** has proposed "Adaptive Transmission Power Control for Wireless Sensor Networks". Extensive empirical studies that have

been presented in this paper confirmed that the quality of radio communication between low power sensor devices varies significantly with time and Environment. This phenomenon indicated that the previous topology control solutions, which used static transmission power, transmission range, and link quality, might not be get effective in the physical world. To addressed the same issue, online transmission power control that adapts to external changes was necessary.

This paper have presented ATPC, a lightweight algorithm of Adaptive Transmission Power Control for wireless sensor networks. In ATPC, each node builds a model for each of its neighbours, describing the correlation between transmission power and link quality. With this model, Authors have employed a feedback-based transmission power control algorithm to dynamically maintain individual link quality over time. The intellectual contribution of this work lies in a novel pair wise transmission power control, which was significantly different from existing node-level or network-level power control methods. Also different from most existing simulation work, the ATPC design was guided by extensive field experiments of link quality dynamics at various locations and over a long period of time. The results from the real-world experiments demonstrated that 1) with pair wise adjustment, ATPC have achieved more energy savings with a fine tuning capability and 2) with online control, ATPC was robust even with environmental changes over time.

4. ***In January 2007 Mr. Xiuzhen Cheng, Ding-Zhu Du and Lusheng Wang*** has proposed "Relay sensor placement in wireless sensor networks". This paper have addressed the following relay sensor placement problem: given the set of duty sensors in the plane and the upper bound of the transmission range, compute the minimum number of relay sensors such that the induced topology by all sensors is globally connected. This problem was motivated by practically considering the tradeoffs among performance, lifetime, and cost when designing sensor networks. In this Paper, Authors have modelled the same problem by a NP-hard network optimization problem named Steiner Minimum Tree with Minimum number of Steiner Points and bounded edge length (SMT-MSP). In this Respective paper, Authors have proposed two approximate algorithms, and have conducted detailed performance analysis. The first algorithm has a performance ratio of 3 and the second has a performance ratio of 2.5.

5. ***In Nov 2008 Mr. Yanjun Sun, Omer Gurewitz and David B. Johnson*** has proposed "RI-MAC Protocol for Dynamic Traffic Loads in Wireless Sensor Networks". The problem of idle listening is one of the most significant sources of energy consumption in wireless sensor nodes, and many techniques have been proposed based on duty cycling to reduce this cost. In their Research paper, they have basically presented a new asynchronous duty cycle MAC protocol, called Receiver-Initiated MAC (RI-MAC), that uses receiver-initiated data transmission in order to efficiently and effectively operate over a wide range of traffic loads. RI-MAC attempts to minimize the time a sender and its intended receiver occupy the wireless medium to find a rendezvous time for exchanging data, while still decoupling the sender and receiver's duty cycle schedules. They have showed the performance of RI-MAC through detailed ns-2 simulation and through measurements of an implementation in TinyOS in a testbed of MICAz motes. They have also compared the prior asynchronous duty cycling approach of X-MAC with RI-MAC. They have also showed that RI-MAC achieved higher throughput, packet delivery ratio, and power efficiency under a wide range of traffic loads. Especially when there are contending flows, such as bursty traffic or transmissions from hidden nodes, RI-MAC significantly improves throughput and packet delivery ratio. Even under light traffic load for which X-MAC is optimized, RI-MAC achieves the same high performance in terms of packet delivery ratio and latency while maintaining comparable power efficiency.

6. ***In October 2010 Vehbi C. Gungor, Bin Lu and Gerhard P. Hancke*** has proposed "the Opportunities and Challenges of Wireless Sensor Networks in Smart Grid". The collaborative and low-cost nature of wireless sensor networks (WSNs) brings significant advantages over traditional communication technologies used in today's electric power systems. Recently, WSNs have been widely recognized as a promising technology that can enhance various aspects of today's electric power systems, including generation, delivery, and utilization, making them a vital component of the next-generation electric power system, the smart grid. However, harsh and complex electric-power-system environments pose great challenges in the reliability of WSN communications in smart-grid applications. This paper have showed an overview of the application of WSNs for electric power systems along with their opportunities and challenges and opened up future work in many unexploited research areas in diverse smart-grid applications. Authors presented a comprehensive experimental study on the statistical characterization of the wireless channel in different electric-power-system environments, including a 500-kV substation, an industrial power control room, and an underground network transformer vault. Field tests have been performed on IEEE 802.15.4-compliant wireless sensor nodes in real-world power delivery and distribution systems to measure background noise, channel characteristics, and attenuation in the 2.4-GHz frequency band. Overall, the empirical measurements and experimental results provide valuable insights about IEEE 802.15.4-compliant sensor network platforms and guide design decisions and tradeoffs for WSN-based smart-grid applications.

Conclusion and future work

A wireless sensor network (WSN) is a network that is composed of hundreds or thousands of sensor nodes which are densely deployed in an unattended environment with the capabilities of sensing, wireless communications and computations.It greater security and power consumption aspects as we have presented from the different reviews of different studies.

In future we are going to present the security controlling and load balancing mechanism in WSN.

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