A DETAILED REVIEW ON EVOLUTION OF WSN

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ABSTRACT

Due to many restrictions, wireless sensor networks (WSNs) offer novel applications and need novel protocol design approaches. Due to the demand for minimal device complexity and low energy consumption (i.e., a long network lifespan), it is necessary to strike a balance between communication and signal/data processing capabilities. This has resulted in a tremendous amount of effort in research, standardisation, and industry investment in this subject during the previous decade. This survey article will provide an overview of wireless sensor network (WSN) technology, major applications and standards, design characteristics of WSNs, and evolutions. The article discusses various unusual applications, such as those involving environmental monitoring, and highlights design ideas; it also includes a case study based on a real-world implementation. The author charts trends and potential evolutions. The IEEE 802.15.4 standard is emphasised, since it offers a wide variety of WSN applications. The performance characteristics of 802.15.4-based networks are shown and described as a function of the WSN's size and the data type to be transferred between nodes.

KEYWORDS: WSN, IEEE, Networks.

INTRODUCTION

Wireless sensor networks (WSNs) have aroused significant attention from industry and scientific perspectives since the turn of the third millennium [1–7]. A WSN may be broadly defined as a network of nodes that collaboratively perceive and perhaps manipulate their environment, hence facilitating interaction between people or computers and their surroundings [8]. On the one hand, WSNs allow new applications and hence new market opportunities; on the other hand, design is constrained by a number of restrictions that need the adoption of new paradigms. Indeed, the activity of sensing, processing, and transmission while operating on a constrained energy budget often necessitates a cross-layer design strategy that incorporates distributed signal/data processing, medium access control, and communication protocols [9]. This article presents an overview of wireless sensor network (WSN) technology, major applications and standards, design aspects of WSNs with a case study, and evolutions. A performance example based on experimental data will be discussed in detail. In contrast to the literature [1, 2, 10], this study does not concentrate only on the uses and characteristics of WSNs, or on the design of WSNs, but rather integrates all of these elements, with an emphasis on technologies and standards.

WSNs have numerous characteristics with wireless ad hoc networks [11], and are sometimes regarded as a subset of them. This may result in incorrect results, particularly when protocols and algorithms developed for ad hoc networks are employed in WSNs. As a result, [11] includes an adequate definition and description of WSN.

[12] categorises the major application areas for WSNs by the kind of information monitored or conveyed by the network. At the top of the stack, applications define criteria that influence protocol and transmission method selection; at the bottom of the stack, the wireless channel imposes limits on communication capabilities and performance. The communication protocols and methods are chosen based on the needs specified by applications and the limits imposed by the wireless channel.

[12] discusses the primary characteristics of WSN design. Specifically, the design of energy-efficient communication protocols is a unique challenge for WSNs, with no parallel in the history of wireless networks. In general, while a node is transmitting, the transceiver consumes far more battery power than the CPU in active mode, the sensors, or the memory chip. The ratio of energy required to transmit and process a piece of information is often considered to be substantially more than one (more than one hundred or one thousand in most commercial platforms). As a result, communication protocols must adhere to energy efficiency principles, although this limitation is less severe for processing activities. Then, designing energy-efficient communication protocols is a particularly odd challenge for WSNs, since it has no parallel in the history of wireless networks. The majority of the research on WSNs focuses on the design of energy-efficient protocols, overlooking the energy spent during data processing inside the node, and concluding that the transceiver is the component that consumes the most energy. On the other hand, data processing in WSNs may need the CPU to execute consuming activities for a significantly longer period of time than the actual time a transceiver spends in transmit mode.

WSN

A wireless sensor network (WSN) may be characterised as a collection of devices, referred to as nodes, that are capable of sensing the environment and communicating the data obtained from the monitored field (e.g., an area or volume) through wireless networks [1–9]. The data is routed, perhaps across many hops, to a sink (sometimes referred to as a controller or monitor) that may either utilise it locally or connect to other networks (e.g., the Internet) through a gateway. Nodes may be fixed or movable. They may or may not be aware of their location. They might be homogenous or non-homogeneous.

This is a conventional single-sink wireless sensor network. Almost every scientific study in the literature makes reference to this definition. This single-sink scenario suffers from a lack of scalability: as the number of nodes rises, the quantity of data collected by the sink rises as well, and once the sink reaches its capacity, the network cannot be expanded. Additionally, due to MAC and routing considerations, network performance cannot be examined irrespective of network size.

USE OF WSN

The applications of WSNs in the real world are almost limitless, ranging from environmental monitoring [14], health care [15], location and tracking [16], through logistics and localization [17]. This section discusses a proposed categorization scheme for applications.

It is essential to emphasise that the application has a significant impact on the wireless technology used. After defining the application's needs, the designer must choose the technology that enables these criteria to be met. To accomplish this goal, familiarity with the characteristics, benefits, and downsides of various technologies is critical.

Due to the critical nature of the interaction between application needs and technologies, we report on some sample needs in this Section and dedicate Sections 5 and 6 to an overview of the most promising WSN technologies.

CONCLUSION

The purpose of this study is to explore many of the most critical challenges with WSNs from an application, design, and technological perspective. Indeed, in order to construct a WSN, we must first specify the most appropriate technology to employ and the communication protocols to deploy (topology, signal processing strategies, etc.). These selections are influenced by a variety of variables, most notably the application requirements. The first section of the article discusses the restrictions that the WSN must meet and the many factors that must be considered while designing a WSN. The second section, on the other hand, is concerned with the actual technological options that may be made. The objective is to assist the designer in selecting the most appropriate technology. The emphasis is mostly on the IEEE 802.15.4 standard, which includes several possible performance levels. Finally, the study presents an outlook on the short- and long-term trends in WSN research.

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