

## Chapter 2.2

# Privacy Preserving Data Gathering in Wireless Sensor Network

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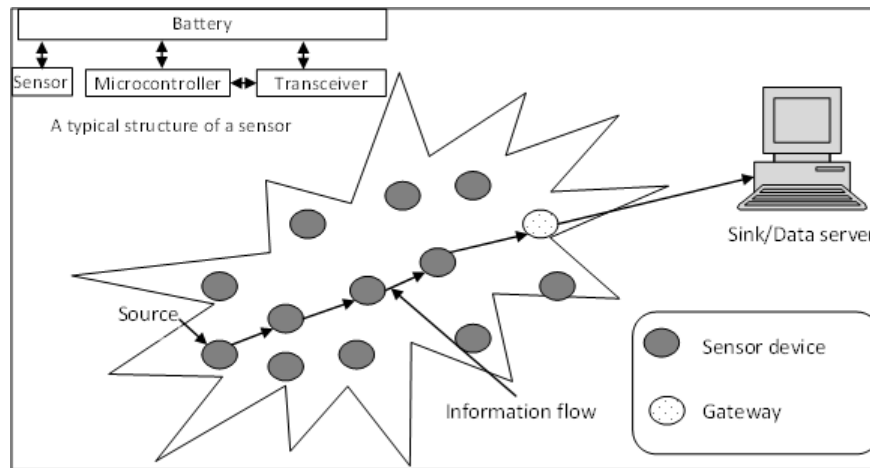
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### ABSTRACT

*Sensor devices provide sophisticated services in collecting data in various applications, some of which are privacy sensitive; others are ordinary. This chapter emphasizes the necessity and some mechanisms of privacy preserving data gathering techniques in wireless sensor network communication. It also introduces a new solution for privacy preserving data gathering in wireless sensor networks. By using perturbation technique in a semi-trusted server model, this new solution is capable of reducing a significant amount of computation in data collection process. In this technique, data of a sensor is perturbed into two components which are unified into two semi-trusted servers. Servers are assumed not to collude each other. Neither of them have possession of any individual data. Therefore, they cannot discover individual data. There are many real life applications in which the proposed model can be applied. Moreover, this chapter also shows a technique to collect grouped data from distributed sources keeping the privacy preserved. Security proofs show that any of the servers or any individual sensor neither can discover any individual data nor can associate any data to an individual sensor. Thus, the privacy of individual data is preserved.*

DOI: 10.4018/978-1-61350-101-6.ch202

Figure 1. Sensor device components' block diagram and the data flow in a wireless sensor network (WSN)



## 1. INTRODUCTION

Wireless sensor network (WSN) consists of sensors scattered in the environment to monitor, sense and control the environment. Each sensor is equipped with reasonable computational and communicational capability. A sensor node consists of a radio transceiver, a small microcontroller and an energy source, usually a battery. Size of a sensor may vary from a shoebox down to a microscopically small particle (Romer, Mattern, and Zurich, 2004). Cost of a single sensor also may vary from hundreds of dollar to few cents (Romer, Mattern, and Zurich, 2004). A typical sensor network with basic anatomy of a sensor device is depicted in Figure 1.

Sensor network can be applied in various applications including but not limited to: environment monitoring, waste water monitoring, vehicle monitoring, agricultural applications, greenhouse monitoring, enemy detection, wild animal monitoring, weather forecasting, scientific research, product tagging in supermarkets, smartcards etc. Ubiquitous computing which connects objects around human is based on the wireless sensor network. Objects in the environment would be equipped with sensors using which they would exchange information with their neighbors. There-

fore, development of information gathering techniques in ubiquitous computing depends on the development of data gathering techniques in WSN.

One of the major obstacles observed in data aggregation is the preservation of privacy. Most individuals disagree to share their information if privacy is not preserved. Therefore, benefits of gathered data cannot be achieved unless the privacy of data is not preserved in a well acceptable manner. Privacy is a fundamental right of human which guarantees other rights such as freedom of association, freedom of expression etc. According to The American Heritage Dictionary privacy means "The quality or condition of being secluded from the presence or view of others". Definition of privacy varies from literature to literature. Governmental privacy commission such as Office of Privacy Commission, Australian Government (Office of Privacy Commissioner) define privacy in a legislative point of view such as personal privacy, location privacy, sensitive information privacy etc. A technical definition might be found in the work of Vaidya, Clifton, and Zhu (2006) which states a privacy-preserving system must ensure: "any information disclosed cannot be traced back to an individual" and "any information disclosed does not constitute an intrusion". Most

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