Chapter 4
Effect of Channel Modeling on Intercept Behavior of a Wireless BAN With Optimal Sensor Scheduling

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ABSTRACT

Body area networks (BANs), a type of Personal Area Networks (PANs), form a significant part of health care applications. This chapter analyzes the effect of channel modeling on the intercept behavior of a wireless BAN while taking optimal sensor scheduling into account. A comparison is drawn between Lognormal and Weibull models for this case. Wireless BANs represent wireless networks of sensors allocated on, in, and around the human body. BANs are basically meant for health care applications where long-lasting and reliable operation is a must. Some healthcare applications carry sensitive information, therefore security is an important issue. A BAN with a sink node and various sensors is considered here along with an eavesdropper. Due to the radio wave propagation's broadcast nature, the wireless communication can be overheard by the eavesdropper. To safeguard the BAN, the propagation channels need to be characterized and modeled for designing reliable communication systems.

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INTRODUCTION

This chapter begins with an illustration of Body Area Networks, their significance, examples of their applications, the various challenges faced by these wireless networks and detailed description of the issues dealt in this research work. Besides that, it gives the organization of the chapter.

Body Area Networks

The usage of wireless links is a fascinating replacement for wired cables coupling various wearable devices. Body area networks (BAN) are a type of personal area networks (PAN). BANs form a significant part of health care applications due to increase in medical expenses. Moreover, the patients suffering from chronic diseases who require only restorative observation need not be admitted to a hospital as this can be easily done via intelligent monitoring of the patient's body using wearable devices. According to Moore's law, the development of small and handheld devices which could be used for communication around human bodies was certain. An example of BANs is pacemaker. Other applications are smart pills for monitoring glucose, deciding on drug delivery and systems for sensing eye pressure. In the same way, wearable computing is an interesting application such as physiological/medical monitoring of temperature, heart rate, and blood pressure, etc. A BAN comprises of a number of sensors that are implanted inside the body, or are simply allocated on and around it along with a hub. The hub or the sink node can be placed on the body itself or alternately near it. The placement of on-body hub is generally done near the torso. BANs are meant for long-term use. To elongate the life of a BAN, low power sensors with a short range are employed. Other methods taken into account for long term usage of a BAN are communication using relays, controlling transmitting power of a sensor and adapting the link between sensors accordingly.

Operational Scenarios for BANs

The various operational scenarios for BANs can be:

- **On-Body:** As the name suggests, in case of on-body BAN, communication will take place from one place on body surface to some other place on the body surface. It is the most widely used operational scenario.
- **In-Body:** The transmissions are generally done from a sensor implanted inside the body to one which is placed on the body. This is because doctors prefer to implant as few sensors inside a body as possible for the obvious

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