Chapter 8
Wireless Communication and IoT Integration in Smart Clothing

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ABSTRACT

This chapter explores the convergence of wireless communication technologies and the Internet of Things (IoT) in the development of smart clothing—intelligent garments embedded with sensors, actuators, and microelectronics for data sensing, processing, and transmission. It presents a comprehensive technological framework, covering wearable electronics, body area networks, and key communication protocols such as Bluetooth Low Energy (BLE), Wi-Fi, Zigbee, and LoRa. The chapter also examines the design and integration of textile-based sensors, flexible antennas, and energy-efficient microcontrollers, addressing critical challenges in comfort, durability, and washability. Reliability, latency, and data security issues are analyzed

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in the context of applications in healthcare, sports, industry, and defense. Current research trends including energy harvesting, AI-based data processing, and 6G-ready textiles are discussed alongside real-world case studies.

INTRODUCTION TO SMART CLOTHING AND IOT

Definition and Scope of Smart Clothing

The Internet of Things (IoT) has emerged as one of the transforming technologies across all the industries and smart clothing is one of the most innovative applications of IoT. Smart clothes combine sensors, actuators and communication in textile material to create the added functionalities for e.g. physiological monitoring, sensing the environment and combining sensing with climate control. Despite the text integration discussing only text of the IoT architectures, but the analysis of the wireless communication protocol has not been already thoroughly studied in most cases, little linear results are available that are in the integration of wearable devices design and the IOT (internet of things) application. In particular, a comparative framework between protocols possibilities and physical and comfort limitation of clothing-based systems is rarely reported even since clothing-based systems are important in producing significant impacts on the results of communicative research.

The chapter helps to incorporate this knowledge gap by presenting systematically hierarchically wireless communications technologies applied in smart clothes, categorizing them as corresponding to the architectural levels and mapping the technologies to technical concerns such as power optimization, data security, wearability, etc. All these provide a technical summary and practical design concepts, in addition to making the work a good source for the researcher and developer involved in the wearable technology domain.