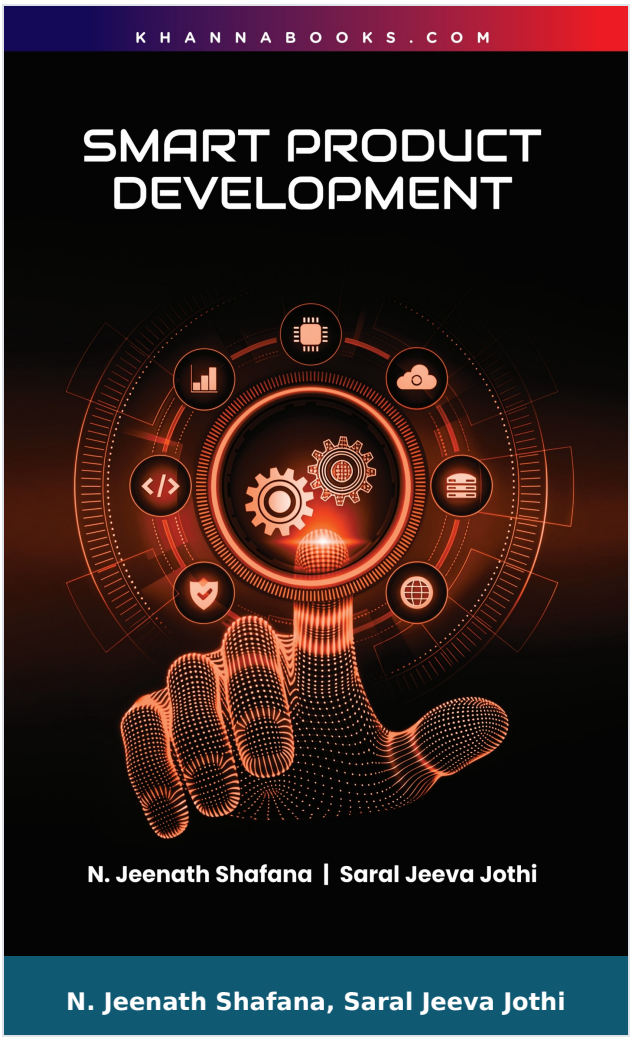

Smart Product Development

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ISBN 13 :	978-93-55384-34-8
ISBN 10 :	9355384343
E-ISBN 13 :	978-93-55384-34-8
Edition :	First
Pages :	132
Type of book :	Physical
Year :	2026
Language :	English
Publisher :	Khanna Publishing House
M.R.P :	Rs 198.00
Categories :	New Arrivals, Computer Science Engineering, Book Store, Sathyabama Series
Condition Type :	New
Country Origin :	India

Khanna Publishing House
4C/4344, Ansari Road, Daryaganj, New Delhi-110002
Email: contact@khannabooks.com | Tel: 011-2324 44 47 - 48 | Mobile: +91-99109 09320

Product Description

This book is an indispensable resource for navigating the rapidly evolving landscape of smart technologies, where the integration of sensors and smart systems is pivotal for advancing functionality across a wide range of industries. Titled SMART PRODUCT DEVELOPMENT, this comprehensive guide is designed to equip its target audience—students, engineers, professionals, and technology enthusiasts—with the foundational knowledge and practical skills needed to master the complexities of modern connected devices.

The core purpose is to provide a deep, structured understanding of sensor devices—the eyes, ears, and nervous system of modern technology—their diverse applications, and their essential interfacing with Microcontroller Units (MCUs). The text begins by introducing fundamental sensor types, including piezoresistive, capacitive, and resonant sensors, detailing their design and real-world use in applications from wearable tech to autonomous vehicles.

Moving beyond hardware, the book thoroughly explores signal conditioning, digital conversion, and advanced control techniques such as state machines, fuzzy logic, and neural networks, showing how to integrate sensors into larger, reliable systems. Critical sections are dedicated to communication protocols (including wireless networks, RF sensing, and automotive standards) and the vital role of IEEE 1451 standards in ensuring system interoperability. Finally, the book connects theory to practice by examining real-world use cases in creating Smart Cities, covering applications in agriculture, health, disaster prevention, and water management, alongside the challenges of implementing AI and IoT at scale. This blend of theory, practical knowledge, and case studies makes it a crucial resource for aspiring engineers and industry experts.

Salient Features:

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• Sensor Fundamentals: Provides comprehensive foundational insights into diverse sensor technologies, covering principles, classifications (active/passive), and detailed working mechanisms for types like piezoresistive and capacitive sensors.

• Microcontroller Interfacing: Focuses on how sensor data is processed, amplified, and conditioned for use, emphasizing Digital Conversion and the essential design considerations for effective MCU control in embedded systems.

• Advanced Control Logic: Explores modern automation and system behavior control using state machines, Fuzzy Logic systems for nuanced decision-making, and sensor control via Neural Networks.

• Communication Protocols: Deep dive into crucial standards for smart sensor connectivity, including wireless networks (Wi-Fi, Zigbee, Bluetooth), RF sensing, Telemetry, and specialized Automotive Protocols.

• Industry Standards: Details the architecture and benefits of the IEEE 1451 standards for smart sensors, ensuring necessary compatibility and interoperability between devices, control systems, and embedded technologies.

• IoT Case Studies: Presents transformative, real-world applications within the Smart Cities paradigm, covering sectors like smart agriculture, health, disaster prevention, and advanced water/waste management.

• AI/ML Integration: Discusses the challenges and solutions for developing AI and IoT systems at scale, covering predictive analytics, data quality, and the ethical considerations necessary for smart product success.

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