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Dong-Seong Kim · Hoa Tran-Dang

Industrial Sensors and Controls in Communication Networks

From Wired Technologies to Cloud
Computing and the Internet of Things

Dong-Seong Kim
Department of ICT Convergence
Engineering
Kumoh National Institute of Technology
Gumi, Korea (Republic of)

Hoa Tran-Dang
Department of ICT Convergence
Engineering
Kumoh National Institute of Technology
Gumi, Korea (Republic of)

ISSN 1617-7975 ISSN 2197-8433 (electronic)
Computer Communications and Networks
ISBN 978-3-030-04926-3 ISBN 978-3-030-04927-0 (eBook)
<https://doi.org/10.1007/978-3-030-04927-0>

Library of Congress Control Number: 2018962922

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Preface

Industrial networks have been promoted increasingly by emerging technologies such as industrial wireless communication technologies, industrial Internet of Things (IIoT), cloud computing, big data, etc. Given the increasing age of many industrial distributed systems and the dynamic industrial manufacturing market, intelligent and low-cost industrial automation systems are required to improve the productivity and efficiency of such systems. The collaborative nature of industrial wireless sensor networks (IWSNs) brings several advantages over traditional wired industrial monitoring and control systems, including self-organization, rapid deployment, flexibility, and inherent intelligent-processing capability. In this regard, IWSNs play a vital role in creating a highly reliable and self-healing industrial system that rapidly responds to real-time events with appropriate actions. At broader scale, IIoT has been recognized primarily as a solution to improve operational efficiency.

In this book, detailed reviews about the emerging and already deployed industrial sensor and control network applications and technologies are discussed and presented. In addition, technical challenges and design objectives are described. Particularly, fieldbus technologies, wireless communication technologies, network architectures, resource managements, and optimization for industrial networks are discussed. Furthermore, industrial communication standards including wired and wireless technologies and IIoT visions are presented in detail. Overall, this book covers the current state of the art in such emerging technologies and discusses future research directions in this field. The book is structured in three parts, each one grouping a number of chapters describing our state-of-the-art researches in actual domains of the technology transformation in sensing and control in future industrial networks.

Part I titled as Industrial Control Networks includes six research proposals covering the fieldbus control networks (i.e., CAN, FlexRay, Modbus). In this part, the latest fieldbus technologies are reviewed to point out the key performance and challenges of technology application in industrial domain. This challenges open potential researches to find out breakthrough solutions. One of them is described in our research proposal, which proposed to use dual fieldbus technology, CAN and

Modbus to meet the significant time delay for the distributed control system of ship engines.

Part II of the book referred as Industrial Wireless Sensor Networks includes 11 research proposals which analyze and evaluate such networks' applications in terms of wireless networking performances. Such aspect is highlighted by key points composed of medium access control (MAC) mechanisms, wireless communication standards for industrial field. In additions, applications of such networks from environmental sensing, condition monitoring, and process automation applications are specified. Designing appropriate networks are based on the specific requirements of applications. It points out the technological challenges of deploying WSNs in the industrial environment as well as proposed solutions to the issues. An extensive list of IWSN commercial solutions and service providers are provided and future trends in the field of IWSNs are summarized.

Part III named as Industrial Internet of Things mentions the state-of-the-art technologies along with accompany challenges to realize such vision. Wide applications of IIoT are summarized in industrial domains. Specially, adopting such technology to the Physical Internet, an emerging logistics paradigm is described in this part.

Gumi, Korea (Republic of)

Dong-Seong Kim
Hoa Tran-Dang

Acknowledgements

We would like to express our gratitude to the publisher, Springer, for accepting this book as part of the series “Computer Communications and Networks”. In particular, we would like to thank Scientific Publishing Services (P) Ltd. in Tamil Nadu, India for their editorial and production guidance.

Our acknowledgment goes to Prof. Patrick Charpentier and Dr. Nicolas Krommenacker at the Research Center for Automatic Control of Nancy (CRAN), University of Lorraine, France, who contributed to the content of Chap. 18. Special thank is due to our colleague, Nguyen Bach Long at University of Newcastle, Australia, who collaborated and contributed to the content of Chap. 17.

We would like to thank the Networked System Laboratory (<http://nsl.kumoh.ac.kr/>), Kumoh National Institute of Technology (KIT) in Gumi, Republic of Korea, which made it possible to write this book. As one of the most educational institutions in technology, we are grateful to be part of this visionary and innovative organization.

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