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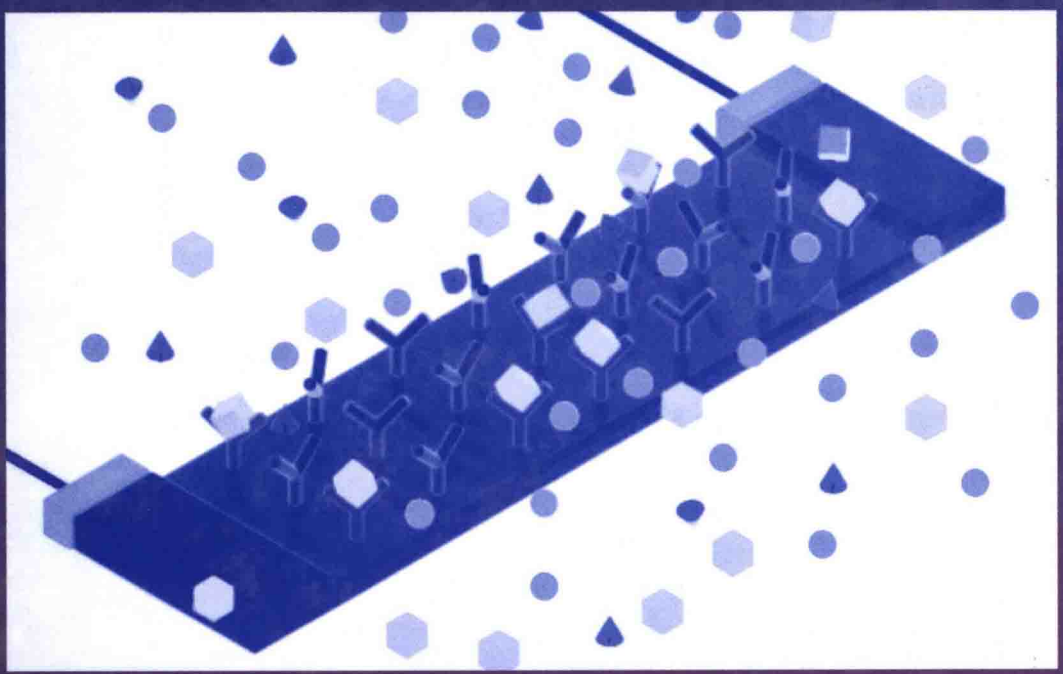

Edited by
S. Sitharama Iyengar
and Richard R. Brooks

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DISTRIBUTED SENSOR NETWORKS

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CHAPMAN & HALL/CRC

A CRC Press Company

Boca Raton London New York Washington, D.C.

Library of Congress Cataloging-in-Publication Data

Catalog record is available from the Library of Congress

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International Standard Book Number 1-58488-383-9
Printed in the United States of America 1 2 3 4 5 6 7 8 9 0
Printed on acid-free paper

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Dedicated to Dr. S.S. Iyengar and Dr. S. Rai of LSU, whose ongoing mentoring has always been appreciated.

— R.R. Brooks

Dedicated to all my former/present Graduate and Undergraduate Students; to Prof. Kasturirangan, former ISRO Chairman, towards his dedication to Space Technology; Prof. Hartamanis and Prof. C.N.R. Rao for their inspiring research, and to Vice Provost Harold Silverman for providing an environment and mentoring me at different stages of my career.

— S.S. Iyengar

Preface

In many ways this book started 10 years ago, when the editors started their collaboration at Louisiana State University in Baton Rouge. At that time, sensor networks were a somewhat arcane topic. Since then, many new technologies have ripened, and prototype devices have emerged on the market. We were lucky enough to be able to continue our collaboration under the aegis of the DARPA IXO Sensor Information Technology Program, and the Emergent Surveillance Plexus Multidisciplinary University Research Initiative.

What was clear 10 years ago, and has become more obvious since, is that the only way to monitor the real world adequately is to use a network of devices. Many reasons for this will be given in this book. These reasons range from financial considerations to statistical inference constraints. Once you start using a network situated in the real world, the need for adaptation and self-configuration also become obvious.

What was probably not known 10 years ago was the breadth and depth of research needed to design these systems adequately. The book in front of you contains chapters from acknowledged leaders in sensor network design. The contributors work at leading research institutions and have expertise in a broad range of technical fields.

The field of sensor networks has matured greatly within the last few years. The editors are grateful to have participated in this process. We are especially pleased to have been able to interact with the research groups whose work is presented here. This growth has only been possible with the support from many government agencies, especially within the Department of Defense. Visionary program managers at DARPA, ONR, AFRL, and ARL have made a significant impact on these technologies.

It is the editors' sincere hope that the field continues to mature. We also hope that the cross-fertilization of ideas between technical fields that has enabled these advances, deepens.

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Overview

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This section provides a brief overview of sensor networks. It introduces the topics by discussing what they are, their applications, and how they are differ from traditional systems.

Iyengar *et al.* provide a definition of distributed sensor networks (DSNs). They introduce many applications that will be dealt with in more detail later. A discussion is also provided of the technical challenges these systems present.

Kumar provides an overview of sensor networks from the military perspective. Of particular interest is a summary of military applications starting in the 1960s. This chapter then proceeds to recent research advances. Many of these advances come from research groups presented in later sections of this book.

Sastry and Iyengar provide a taxonomy of DSNs. The taxonomy should help readers in structuring their view of the field. It also is built on laws describing the evolution of technology. These laws can help readers anticipate the future developments that are likely to appear in this domain.

Brooks describes briefly how DSNs differ from traditional systems. The global system is composed of distributed elements that are failure prone and have a limited lifetime. Creating a reliable system from these components requires a new type of flexible system design.

The purpose of this section is to provide a brief overview of DSNs. The chapters presented concentrate on the applications of this technology and why the new technologies presented in this book are necessary.

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