Preface

If you understand how the universe operates, you control it, in a way.
Stephen Hawking, My Brief History

Pervasive computing describes ICT (information and communication technology) systems that seamlessly enable information and services to be made available everywhere. Other terms, used with approximately the same meaning as pervasive computing, are Ubiquitous Computing, Internet of Things (IoT), calm computing, ambient intelligence, physical computing, smart spaces, and smart environments.

You can write about pervasive computing in a million different ways. This book tells the story from a systems engineering perspective and focuses on smart systems that use pattern recognition to discover their context. My wish is to make you, the reader, feel confident that not only you understand how these systems operate, but you can also build such systems. While reading the book, you will realize, on the one hand, how simple the underlying principles are, and on the other hand, how difficult it is to implement them in practice. Learning how to ride a bicycle is also difficult. And yet, Dutch children learn this skill very early, usually before they reach four. What you have to do as a parent is to run along—over and over—and keep them in balance, until they suddenly get the trick and boost forwards, leaving you behind, out of breath, yet relieved. This book is a guide for exactly this period—of desperately running behind the bicycle. After that, I believe that imagination and talent will drive you toward building the most incredible systems.

This book is crafted around the lecture notes developed for the course Pervasive Computing, taught to computer science (CS) freshmen at the Vrije University in Amsterdam. Upon completion of this course, successful students will be able to:

- Design a realistic smart system with the potential to benefit human lives. The system acquires and processes data from video, audio, acceleration, or EEG sensors and uses pattern recognition to take decisions that affect the environment accordingly.
• Build a simplified version of the real system and program a software agent to control it.
• Work together in a team, collaboratively identifying not only the technical but also the safety or ethical issues with their designs, and then sharing their challenges and discoveries through reports, presentations, and in-class demonstrations.

Although mainly targeted for computer science undergraduate students, I believe this book will be interesting and readable for anyone wondering what happens behind the scenes of these fascinating systems. After reading it, the ones who dream of building their own system should feel one step closer to their goal.

Acknowledgements This book is a result of a collective effort. Maarten van Steen was the first who came up with the idea of designing a pervasive computing course. Countless brainstorm sessions on how to teach it followed, with valuable input from Melanie Rieback, Guillaume Pierre, Michel Klein, and Peter van Lith. The course followed a meandering evolution, toward the version described in this book. I am fortunate to work in the computer science department that owes so much fame to Prof. Andrew Tanenbaum and I am most grateful and honored that he kindly consented to contribute the foreword. We teachers are, in fact, story tellers. The engineering flavor in this book is inspired by my teacher, Mircea Tătulescu, who first told me the story of sensors, data acquisition and signal processing, and irreversibly influenced the way I see the world. Hans van Vliet pointed me out the importance of software testing, and Jaap Gordijn and Patricia Lago helped me to embed software modeling elements in this course. Many thanks go to Wan Fokkink and Spyros Voulgaris, for reviewing the original lecture notes, and to Anton Eliens and Herbert Bos for their encouragements during writing this book. Teaching this course could have been a disaster without my teaching assistants, who supported me over the years, for better or worse, with their awesome ideas, hardworking and enthusiasm. I am indebted to Alyssa Milburn, for her critical, perfectionistic eye set on my writing. Caroline, thank you for your interest in my book and for your time management lessons. I am grateful to my Springer editors, Beverley Ford and James Robinson, for their initial trust and efficient assistance during the manuscript preparation.

I collected many beautiful illustrations in this book. Grateful acknowledgment is made to all those who kindly granted me permission to use them: Roberto Brunelli, Diana Cook, Dariu Gavrila, Daniel Goehring, Horst-Michael Gross, Erico Guizzi, Alex Faaborg, Bob Fisher, Kees Hagen, Johan Hoorn, Mehdi Jayazeri, Phillip Laplante, Alisdair McAndrew, Jim McClellan, Steve McConnell, Thomas Moeslund, Niels Noordzij, Martin Pearson, Mauro Pezze, Dirk van der Pijl, Jozef Pucik, Hanna Reimers, Stuart Russell, Jan Schnupp, Chris Solomon, Ian Sommerville, Jakob Suckale, Sergios Theodoridis, Johannes Trabert, and Michal Young. Many thanks go to Naomi Fernandes and Joachim Levelt from Mathworks, Inc., for their speed in processing my permissions procedure.

Being able to teach and shape your own material is a blessing, and nobody understands this better than my parents. Thank you, dragii mei, for your
unconditional love and for teaching me to respect and care about my students. Undergoing this writing project, especially in its final part, put some pressure on my home front, as well. Fortunately, we survived through all this turbulence, due to Peter, my guide and companion in the journey of life, who seamlessly took over my “ubiquitous” duties. *Oma en opa Silvis, dank voor het faciliteren van al die heerlijke, broodnodige rustmomenten.* Too often, my kids had to miss me without getting too many explanations. They only knew that mama writes a book. “About an adventure?” they asked. “No? Oh, then it must be very boring…” Fortunately, their cynical optimism and young spirit prevented the worst. I hope that one day they will find more answers and be able to forgive. *Dank, mijn liefste.*

Amsterdam, The Netherlands

Natalia Silvis-Cividjian

November 2016
Pervasive Computing
Engineering Smart Systems
Silvis-Cividjian, N.
2017, XVIII, 210 p. 183 illus., 99 illus. in color., Softcover
ISBN: 978-3-319-51654-7