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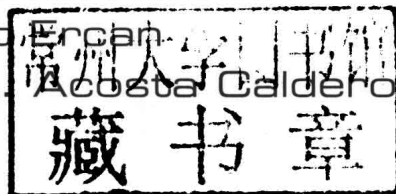
Practical **Robot Design** Game Playing Robots

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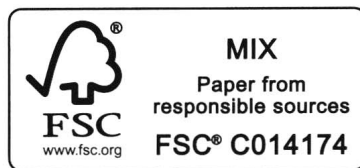
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Practical
Robot Design
Game Playing Robots

Preface

Robotic games and competitions are spawned from mainstream robotics, and they are very popular among the engineering students, robotics enthusiasts, and hobbyists. Over the last decade, hundreds of robotic competitions have been organized in different parts of the world. The interest in robotic games has also reached greater heights with the availability of many affordable parts and components that can be acquired easily over the Internet. Game robotics is a passion and provides great fun and learning experiences.

As in every field of engineering, progress is also inevitable for robotic games. The complexity of the games during the last decade has increased tremendously. Robots developed to compete in such games are becoming more and more sophisticated. Consequently, this makes robotic games not only entertaining, but also a great way of learning engineering concepts and establishing the link between theory and practice. Needless to say, robotics is a multidisciplinary subject. It expands to various engineering and scientific disciplines such as electrical engineering, mechanical engineering, computing, and many more. It is even a unifying platform for different courses taught in one discipline. For instance, electronics, microprocessors, electrical machines, and control theory are all distinct fields taught in electrical engineering. Each of these courses has vast course materials and research opportunities individually. Robotics is an application platform where all these fields converge naturally. However, for students and robotics fans who are designing robots for games and competitions, such a vast sources of material can be overwhelming. Our primary objective in this book is to provide a starting point and immediate knowledge needed for game robotics.

There are many good journals, workshops, books, and online resources for hobby robotics, and they provide many creative ideas. The current state of robotic games is reasonably advanced, as the mentioned competitions are becoming more and more complex. The knowledge and experience required for designing robots for such games also demand good understanding of engineering concepts. Robotic applications such as soccer-playing humanoids or wall-climbing robots not only require expertise in robot intelligence and programming, but also require designing robots well so that they can perform their actions and motions appropriately. Therefore, in this book, we present some of the fundamental concepts and show how they benefit the design process. In particular, we discuss the necessary basics to make the right choices for gears and actuators as well as modeling and low-level controlling of robot motions in Chapters 5 through 9. We present the application of these concepts in game robotics with some case studies in Chapter 10.

The authors of this book have been involved in robotic games and have designed many robots together with their students and colleagues for more than a decade. The book resulted from our earlier notes prepared for a summer course for those students taking up robotic games as their final year project. We hope that this book will empower undergraduate students in terms of the necessary background as well as the

understanding of how various engineering fields are amalgamated in robotics. We hope that students and robot enthusiasts will benefit from this book in their endeavor to build cool robots while having fun with robotic games.

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Acknowledgments

This book is the result of many years of research and development activities in the area of game robotics carried out at Singapore Polytechnic. We are grateful to all our students who spend long hours in labs to design, build, and tune robots for competitions. Their passion and drive naturally got us involved even more, and we share the fun of robotics with them. We are thankful to Jacqueline Oh, Lius Partawijaya, Mohd Zakaria, and Zar Ni Lwin for their interest and expertise in robot design and all the technical support they have provided over the years.

Authors

Jagannathan Kanniah received his BE and MSc degrees in electrical engineering from Annamalai University, India, in 1969 and 1971, respectively. He received his PhD from the University of Calgary, Canada in 1983. He is a senior member of IEEE, a member of IET, and a chartered engineer. He served as an academic staff in various institutions in India from 1971 to 1978. He worked as postdoctoral fellow at the University of Calgary from 1982 to 1983. After leaving Canada, he joined Singapore Polytechnic and rose to the level of principal lecturer. During his service at Singapore Polytechnic, he went as a visiting scientist to Lund Institute of Technology, Sweden, for three months during 1992 and to Massachusetts Institute of Technology, for 3 months during 1999. He has been the section head of the robotics and automation group since 1994 and a technology leader and the manager of the Singapore Robotics Games center since 1996 at Singapore Polytechnic until he retired in 2007. He continued to work until 2011 at the SRG (Singapore Robotic Games) center. His research interests are in the area of power systems, adaptive control, instrumentation, and robotics. He has more than 35 publications, including many journal papers. He has supervised many student groups working on robotics that took part and won many awards in the Singapore robotics game events over the years.

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