Programming Mobile Robots with Aria and Player

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A Guide to C++ Object-Oriented Control

Springer

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This book is dedicated to my family; my son Charlie, my mother Josephine, my sister Squirrel, and the memories of my late brother Steven and late father Ray.

Preface

This book is intended as a comprehensive guide to object-oriented C++ programming and control of the Pioneer class of robots made by MobileRobots Inc. It covers both the native API (ARIA, supplied by the manufacturer for use with all their classes of robot), and the popular and more generic open-source Player server, which can be used with many different makes and models. Hence, although the book is written around the Pioneer robots in particular, the techniques and principles demonstrated are applicable to a wide range of other mobile robots currently in use in academic and industrial robot labs around the world.

The aim is to provide a text that can be used for the practical teaching of object-oriented programming with real robots, and also support researchers using Player and ARIA in their labs. The reader will learn how to install the necessary software, troubleshoot common problems, set up the files needed to describe their robot configuration, and will rapidly be able to get started with the task of creating their own control programs.

The text assumes some prior knowledge of object-oriented concepts since the main focus is instructing the user in the use of the ARIA API and the Player C++ client library. However, the instructions here are given primarily by example and in such a way that the object-oriented concepts themselves are also implicitly explained. Readers completely new to object-oriented programming should therefore have no problems with understanding the text and should find themselves easily getting to grips with object-oriented principles as well as learning how to program their robots.

The book is divided into six chapters. Chapter 1 provides some background information about Pioneer robots and their control including the various client-server programming architectures that can be adopted, the robot devices present and the software that is available to support them. It also quickly covers installation of the ARIA API and various other MobileRobots resources such as ACTS software (ActivMedia Color Tracking System), MobileSim (the ARIA simulator) and Mapper3Basic (software for creating navigation maps). In addition, it explains how to install Player and its simulator Stage. Chapter 2 presents detailed information on the use of the ARIA API for robot programming, showing how to connect to and control

the robot and each of its devices. Chapter 3 is concerned with use of the MobileRobots resources installed in Chapter 1, i.e. ACTS, MobileSim and Mapper3Basic, and Chapter 4 rounds off the ARIA section of the book by explaining how to create and use subclasses with ARIA. Programming with the Player C++ client library is the subject of Chapter 5, and as with Chapter 2, comprehensive details about connecting to and controlling the robot and each of its devices are supplied. Chapter 6 describes the use of Player's Stage simulator and explains how to create world files and configuration files to define virtual robots, their device set-ups and their environments.

The ARIA and Player sections of the book are both fully supported by sample programs, but the reader is also directed to the online supporting materials at http://extras.springer.com, where more detailed and complex programs are available. These additional programs are intended to integrate all of the techniques presented, and they are explained further in the Appendix section.

Finally, please note that this guide is concerned with installing and using ARIA and Player software on Linux-based operating systems only, since Player is not compatible with Windows operating systems.

Nottingham, May 2009 *Amanda Whitbrook*

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