

Modular Development of Mobile Robots with Open Source Hardware and Software Components

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Abstract. Prototyping and engineering robot hardware and low-level control often requires time and efforts subtracted, as a consequence, to core research activities, as SLAM and planning algorithms development, which need a working, reliable, platform to be evaluated in a real world scenario. In this paper, we present Rapid Robot Prototyping (*R2P*), an open source modular architecture for the rapid prototyping of robotic applications, which aims at speeding up their development. R2P is an open source, modular, hardware and software architecture, where off-the-shelf embedded modules (e.g., sensors, actuators, controllers) are combined together in a plug-and-play fashion, enabling the implementation of a complex system in a simple and standardized way. R2P makes people involved in robotics, from researchers and designers to students and hobbyists, dramatically reduce the time and efforts required to build a robot prototype.

1 Introduction

In recent years, several development frameworks [5, 3, 11, 6, 7] have been proposed to assist researchers in the design of robotic applications. While these projects really boosted high-level software development, hardware design and low-level firmware development are still critical tasks, which are often underestimated. To develop a new mobile robot, designers always face the problem of selecting hardware devices, controlling them, and interfacing them with the high-level software. This slows down the progress of robotic research, as prototyping and engineering often requires more time and resources than tasks strictly related to the target application.

To simplify the development of new robotic applications, we developed Rapid Robot Prototyping (*R2P*) [1], an open source hardware and software framework focused on speeding up the prototyping of robotic systems. R2P provides hardware modules that implement basic functionalities needed by common robotic applications, and a lightweight, real-time, middleware to easily write low-level control software. R2P targets span from mobile autonomous robots used for research purposes to entertainment and service applications, such as games, telepresence, and rescue. The real limits of R2P, at the actual stage of development,