

## Chapter 24

# Design and Operation of Two Service Robot Arms: A Wide Surface Printing Robot and an Artist Robot

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### ABSTRACT

*The aim of this chapter is to propose original applications and development in the field of robotics. Also the focus is made on the design and operation of two service robot arms. These robots have been developed in the ROBIOSS team of the PPRIME Institute (UPR 3346 CNRS) from Poitiers University, in the context of two different collaborations with industrial partners. The design procedures for these two innovative applications are detailed: industrial and entertainment. The first application concerns a wide printing application; an international patent (Gazeau, Lallemand, Ramirez Torres, & Zegloul, 2007) was deposited for this device in 2007. The second application was installed in 2006 in the Futuroscope Park: the “artist robot” draws portraits of the visitors every day by using a camera and a pen attached to end-effector.*

### INTRODUCTION

The approach in the design for service robotics begins with the analysis of the role of service robots and with the features that are unique to them. Once the analysis is done, a technical solution is proposed, and problems are solved by using

a philosophy that emphasizes compromise and practicality in design. The final objective is to propose a robot service at a reasonable cost with a high degree of integration and a human machine interface that is as simple as possible.

The purpose of this chapter is to propose, with two significant examples of robotics solutions, an experience feedback in the design of innovative service robots. Both patented service robots were

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developed in the same laboratory for two industrial partners. The intended scope is printing, but the constraints and specifications for each example are very different.

The first example concerns the entire design of a printing robot with an original parallel mechanism. Thus, the presentation focuses on mechanical design and control.

The second example concerns the use of an industrial manipulator for an innovative design application. Thus, the presentation focuses on the integration of an industrial robot in the design of an innovative robotic cell.

Also the two service robot arms proposed in this chapter were designed by considering first the whole functions that the robots would perform. Analysing the prior art was crucial; as an example, many printers are commercially available for wide format printing while other robots use a pen for drawing. So a serious analysis of advantages and disadvantages of existing solutions is necessary.

Also we are now going to detail these two applications developed by the ROBIOSS team within the PPRIME laboratory.

### THE WIDE SURFACES PRINTING ROBOT

#### State of Art

A wide printer can be defined by a printer that prints on large surface, which can range from two to more than 15 meters in width. Such print-

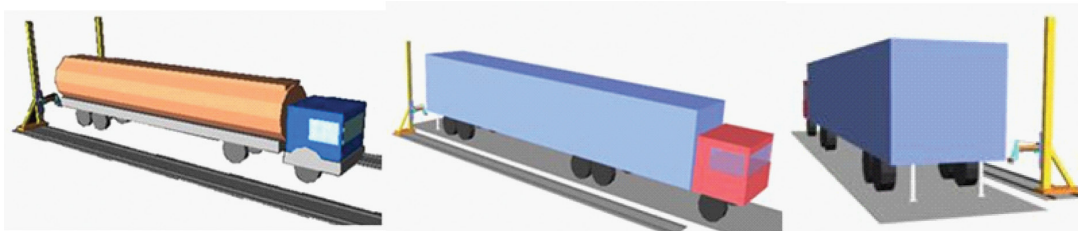
ers typically use inkjet technology to print on a variety of output surfaces, including premium glossy-coated paper for signs and posters, but also PVC, vinyl and textiles. The price ranges of these devices can vary from a thousand dollars to more than a half million.

Only few devices are commercially available to print directly high resolution pictures onto a wide fixed surface. Wide format printers are generally able to print by using a wide consumable (paper, cover, ...). Most of the time, the consumable is unrolled as the printing progresses and the printhead is animated by a uniform rectilinear movement.

With such commercial devices, the surface to be printed moves towards the printer; in the proposed device the goal is to move the printer to surface to be printed.

For the more particular application of vehicle wraps as shown on Figure 1, this printing process requires the immobilization of the vehicle for several days. Once the medium is printed with a classical printer using unrolled consumable or flat consumable (Figure 2), it is then positioned and fixed to the vehicle. This type of printing can be performed in two different ways. It can be achieved manually by a painter directly onto the consumable medium; in this case the cost is obviously high. Or it can be performed digitally, e.g. on the plastic tarpaulin of a trailer which can be dismounted and packed in a roll; and this unrolled consumable is then used with a wide format printer as shown on Figure 2. This way to proceed has numerous disadvantages, in particular a high cost and a high number of operations are required.

Figure 1. A cistern or a trailer wrap to be printed



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