ROBOTS 11

17th INTERNATIONAL SYMPOSIUM ON INDUSTRIAL ROBOTS

Conference Proceedings

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CONFERENCE PROCEEDINGS

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PREFACE

As we move through the 80s, we are becoming increasingly aware that "systems" are where our future lies. And it is more obvious as we tackle assembly systems that "solutions" are a scarce commodity. The manufacturing industries of the world are driving automation systems into assembly areas of their factories. In search of solutions to the problems of assembly automation, we must turn to robotics. Therefore, we have set for our theme of ROBOTS 11, "Systems and Solutions."

Because this is not a unique problem to any one country in the world, it is most fitting that RI/SME is hosting the International Federation of Robotics 17th International Symposium on Industrial Robots in conjunction with ROBOTS 11.

Our search for systems and solutions must be on a global basis. We have made an effort to present a conference and exposition that addresses the problems of the 80s and 90s. The dedication and hard work of those you see, and those you do not see, are the elements that make this event a success. The many contributors to this conference and exposition have addressed solutions from around the world. The IFR National Coordinators are taking an active role in ROBOTS 11. You will see them as honorary chairs of many of the sessions. They have contributed papers to many of the technical sessions and are here to present those papers. Eight of the National Coordinators will give overviews of the State of the Robotics Industry in their countries during the Plenary Session.

It is what you, the attendees, take away from this event that really matters; what you put to use in your workplace in your country is what really counts. You would not have come if your were not searching for solutions to your problems. I urge you to participate fully in the Conference and Exposition. Take an active role in your attendance. Ask questions, request clarifications, build networks with the presenters and attendees. Regardless of the country, industry or language, our problems are truly common. Your thirst for knowledge will never be fully satisfied but a deep drink from the fountain of ROBOTS 11 will be most satisfying for now and you will know where the oases are for future knowledge.

Welcome to the conference and show. I and all who have worked the past 12 months to put on ROBOTS 11 thank you for taking the time and effort to attend. You are the people who make all our work worthwhile.

Paul A. Misegades
Conference Chair
ROBOTS 11/17th ISIR

about RI/SME

A member organization founded in 1980, Robotics International of SME is both applications and research-oriented—covering all phases of research, design, installation, operation and maintenance of industrial robots. In addition, RI/SME serves as a liaison between industry, government and education to determine areas where technological development is needed. RI/SME is the vital link in the chain that connects the individual to the many aspects of robotic-oriented manufacturing.

Members of RI/SME are involved in any of these three categories:

- Planning, selecting and applying robots.
- Research and development leading to the creation or improvement of robots.
- Other creative robotic activities in administration, education or government.

The members of RI/SME update their knowledge and skills through educational programs, chapter meetings, conferences, expositions and publications including *Robotics Today*.

The largest American scientific and educational association exploring the expanding use of robots, RI/SME is an official association of the Society of Manufacturing Engineers and is headquartered in Dearborn, Michigan. RI/SME addresses the informational needs of the engineer involved in the application of robots and provides a forum for discussion among concerned individuals. It is, in a very real sense, industry's partner and a major force in an engineer's professional advancement.

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CHAPTER 1

REMOTE SYSTEMS APPLICATIONS

Autonomous Vehicle Development at the Savannah River Laboratory

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Some process applications performed in the nuclear industry with remote teleoperated vehicles, and approaches of integrating intelligent mobile systems are described. A control hierarchy allows vehicles to autonomously navigate and perform simple tasks in known environments and knowledge-based expert systems are being evaluated to assist in navigation functions, to analyze sensory information, and to simplify operator control. Development work using two research vehicles are developed to demonstrate semi-autonomous operations in process areas. A description of the mechanical equipment, control systems, and operating modes of these vehicles is presented.

INTRODUCTION

Nuclear process operations provide many incentives for applying remote mobile robot technologies. Human operations in certain areas are restricted to short durations due to radiation levels. In addition, operating personnel may be required to wear nuclear contamination protective clothing, which limits their productivity. Traditionally, inspection and monitoring tasks in inaccessible areas (i.e., process rooms of operating reactors) have been difficult to perform, since operating personnel have only had access to fixed mounted cameras, viewing ports, or periscopes. Remote maintenance tasks can require costly process shutdowns before human intervention is allowed. Mobile vehicles provide solutions to many of these problems.

Currently, the nuclear industry is serving as a testing ground for mobile vehicle applications development [1]. White [2] describes a cylindrical, three-wheeled, teleoperated vehicle, which is being tested for inspection tasks in nuclear processes, such as looking and listening for leaks, checking valve positions, and performing radiation and contamination surveys. Whittaker [3] discusses the use of several remote teleoperated work vehicles to perform decontamination, material handling, and decommission work. These vehicles consist of rugged, stable platforms that support a variety of remote manipulators and tools.

Teleoperated mobile vehicles by their very nature have significant drawbacks. Since people are required to guide the vehicles to the worksites, sophisticated camera systems must be used to locate obstacles (i.e., narrow passages and overhead pipes) that might impede motion. When wall-mounted process cameras or windows are not present, human operators have difficulty keeping track of the vehicle position and orientation in the work area. Another drawback is that important sensory and