Revista Iberoamericana de Automática e Informática Industrial
CEA comité español de automática
ISSN: 1697-7912. Vol. 5, Núm. 2, Abril 2008, pp. 129-133
http://riai.isa.upv.es

RESÚMENES EN INGLÉS
ENGLISH ABSTRACTS

SERVICE ROBOTS

Rafael Aracil*, Carlos Balaguer, Manuel Armada*****

**División de Ingeniería de Sistemas y Automática.*
Departamento de Automática, Ingeniería Electrónica e Informática Industrial.
Universidad Politécnica de Madrid. c/ José Gutiérrez Abascal,2, 28006 Madrid
(e-mail: aracil@etsii.upm.es)
***Robotics Lab. Departamento de Ingeniería de Sistemas y Automática.*
Universidad Carlos III de Madrid. Av. Universidad, 30, 28911 Leganés, Madrid
(e-mail: balaguer@ing.uc3m.es)
****Dept. Control Automático, Instituto de Automática Industrial, CSIC*
Ctra. Camporreal, Km. 0,200, La Poveda, 28500 Arganda del Rey, Madrid
(e-mail: armada@iai.csic.es)

Abstract: The term Service Robots appears at the end of 80s as the necessity of development machines and equipments able to work in environments different to manufacturing. Service Robots must be work in non structural environments, in changing ambient conditions and with close interaction with humans. The IEEE Robotics and Automation Society created in 1995 the Technical Committee on Service Robots which defined in 2000 the fields of applications of Service Robots which can be divided in two big groups: 1) non manufacturing production sectors such as construction, agriculture, ship making, mining, medicine, etc. and 2) service sector itself: assistance and personal, cleaning, surveillance, education, entertainment, etc. In this work brief revision of main concepts and applications of service robots had been presented.

Keywords: Service robots, autonomous robots, field robots, educational and entertainment robots, walking robots, humanoid robots.

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 6-13

TELEMANIPULATION AND LOCOMOTION BASED ON SELF-CONFIGURABLE MODULAR ROBOTS FOR SEMI-STRUCTURED ENVIRONMENTS

Juan A. Escalera*, Manuel Ferre*, Rafael Aracil* and Miguel A. Sánchez-Urán**

** Departamento de Automática Ingeniería Electrónica e Informática Industrial,*
Universidad Politécnica de Madrid, C/ José Gutiérrez Abascal, nº2, 28006, Madrid, España
(e-mail: jescalera@etsii.upm.es, m.ferre@upm.es, rafael.aracil@upm.es)
*** Depto. de Ingeniería Eléctrica,*
Universidad Politécnica de Madrid, Ronda de Valencia, nª 3, 28012, Madrid, España,
(miguelangel.sanchezuan@upm.es)

Abstract: This paper is focused on the application of modular robots in semi-structured environments. Manipulation and displacement capabilities are the main advantages of this self-configurable system. Control architecture for modular systems has been specifically designed. Modules are ensemble in order to become more complex mechanisms, called molecules. Molecules work in a similar manner as a common robot and can change their configuration according to task requirements. This system, called RobMAT, includes an advanced interface for teleoperation. It allows guiding modules and molecules, and also calibrating remote environments. Experiments have highlighted the relevance of module synchronization and trajectory control. Synchronization is a critical point for module cooperation, whereas specific trajectory control is required for improving guidance performance.

Keywords: telemanipulation, modular robots, telerobotics, semi-structured environment

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 14-24

AUTONOMOUS MULTIPURPOSE MANIPULATION WITH THE JAUME-2 SERVICE ROBOT

Mario Prats, Pedro J. Sanz, Ester Martínez, Raúl Marín, Angel P. del Pobil

Departamento de Ingeniería y Ciencia de los Computadores,
Universitat Jaume I, Av. Sos Baynat s/n, 12071 Castellón, España
(e-mail: {mprats,sanzp,emartine,rmarin,pobil}@icc.uji.es)

Abstract: This paper presents a modular control architecture that enables a mobile manipulator to compliantly perform manipulation tasks in partially-known everyday human environments. An impedance velocity/force controller that allows the execution of a great variety of tasks under the Task Frame Formalism (TFF) is implemented.
Tasks are represented as a net of basic abilities which are performed by the robot using the impedance controller. Mechanisms for switching between abilities according to the robot's perceptual state are defined.
We show the validity of our approach on the UJI Service Robot, making it to perform a common daily task such as opening a door. Finally, we apply this framework to make progress on the new version of the UJI Librarian Robot, making a great step forward in the way the robot manipulates books.

Keywords: Manipulation; Control Architectures; Service Robotics.

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 25-37

THE ROBOTIC WHEELCHAIR SENA. A HUMAN-MACHINE INTERACTIVE APPROACH

J. Gonzalez, C. Galindo, J.A. Fernandez-Madrigal, J.L. Blanco, A. Muñoz, and V. Arévalo

System Engineering and Automation Department,
Campus de Teatinos, University of Malaga,
29071 Malaga, Spain

Abstract: In our society, the number of physically impaired people who need some type of mechanical aid for mobility is quickly increasing over time. Advances in technology have permitted the development of robotic wheelchairs which are able to relieve users from tedious operations, like manually controlling the wheelchair along corridors or crowded areas.
This paper presents the robotic wheelchair SENA which is the result of a long-term research project at the University of Málaga (Spain). SENA is based on a commercial powered wheelchair that has been endowed with a variety of sensors and devices managed by the user's laptop. Other features of the SENA prototype are the ability for autonomous navigation within office-like scenarios and high-level human-vehicle interaction and cooperation, that is based on a specific software architecture for assistant robotics. This paper describes technical details about both the hardware and software of SENA, illustrates its performance within real scenarios, and gives some conclusions obtained from our experience.

Keywords: Mobile Robotics, Assistant Robotics, Human-Robot Integration

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 38-47

PORTABLE ROBOT FOR DISABLE ASSISTANCE. CONCEPT, CONTROL ARCHITECTURE AND CLINICAL TRIALS

Alberto Jardón, Antonio Giménez, Raúl Correal, Carlos Balaguer

RoboticsLab, Universidad Carlos III de Madrid
Dept. Ingenieria de Sist. y Automatica
Esc. Politecnica Superior. Universidad Carlos III de Madrid
c/ Butarque, 15 28911 Leganes, Madrid
España - SPAIN.

Abstract: Historically the kind of technologies used in homes has been in the form of electrical appliances such as washing machines, ovens, etc. Later was introduced the classic "Home Automation" concept, which involves improvements like computer-controlled devices such as lights, alarms, different sensors, etc. This article presents a next step in home technologies inclusion. The classic devices have always been static, this means they are installed in the house and stay there during all their useful life doing always the same task. ASIBOT robot is a "mobile white appliance" different to traditional mobile robots due its ability to travel around the house between fixed or mobile stations its usefulness to assist motion impaired to perform by themselves a wide variety of tasks: eating, cooking, washing, transportation, etc. Also this paper presents the results of the clinical trials usability assessment of the prototype helping to the severely disabled in DLAs (Daily Life Activities) , developed as part of the ASIBOT Program at the Universidad Carlos III in Madrid in collaboration with the National Paraplegic Hospital in Toledo (Hospital Nacional de Parapléjicos de Toledo).

Keywords: Assistive Robotics, Rehabilitation Robotics, motion impaired, Clinical trials Portable Climbing Robotics Aids

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 48-59

ROBOTICS IN DISABILITY. DEVELOPMENT OF THE MANUS-HAND DEXTROUS UPPER-LIMB PROSTHESIS

R. Ceres, J. L. Pons, L. Calderón, J. Moreno

Grupo de Bioingeniería. Instituto de Automática Industrial- CSIC
Ctra Campo Real Km 0,2 28500- Arganda del Rey (Madrid), Spain
ceres@iai.csic.es

Abstract: Disability and ageing in current societies represent a number of requirements that need to be addressed by personal and collective solutions adapted to maintain care and welfare. The primal roles of science and technology are now accepted as the pillars to improve the human activities and autonomy (Assistive Technologies). In this regard, robotics is beginning to play a main role in diverse human activities and in particular in respect to mobility and manipulation.

In this paper, such assistive robotic systems are analyzed in a wide sense, discussing their interaction with the user. Next, as results of a European project (MANUS-HAND), the design and development of an upper limb prosthesis with high dexterity, modularity and feedback capabilities, are presented.

This work proposes complementary approaches; a control system based on the use of myoelectic signals, adapted to the remaining capabilities of the user; the movements of the artificial fingers coordinated according to four global modes of grasping, complemented by the feedback on the amputee by means of force sensors and a vibratory output, covering the 90% of the natural manipulation abilities. From a mechanical point of view, a specific structure has been developed with three active fingers in flexo-extension and pronosupination of the wrist, including for this different types of actuators (DC motors and ultrasonic) governed with a single EMG channel. All systems are controlled by a distributed a hierarchical electronic architecture.

A training and evaluation platform of the user capabilities completes the system, enabling the customization of the prosthesis by adapting the parameters to the particular capabilities of the amputee.

The system has been tested following an ad hoc protocol with amputees, demonstrating the feasibility of the concepts developed in the project.

Keywords: robotics, disability, prosthesis, rehabilitation, upper-limb, EMG

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 60-68

"ARISCO" A SOCIAL ROBOT WITH INTERACTION CAPABILITY, MOTIVATION AND LEARNING

S. Domínguez * E. Zalama ** J.G. García-Bermejo **

** Fundación Cartif. Parque Tecnológico de Boecillo, parcela 205, 47151 Boecillo, Valladolid, España.*
*** Universidad de Valladolid, ETSII, Dto. Ingeniería de Sistemas y Automática, Paseo del Cauce s/n, 47011 Valladolid, España.*

Abstract: In this paper, the architecture of "Arisco" social robot is described, with particular stress on its interaction, motivation, planning and learning system. Arisco is a mechatronic head with interaction capacity, which includes: large expressivity through gestures, voice recognition and synthesis, visual tracking, information retrieval from Internet, and a learning and motivation system.

Keywords: Social robot, learning, interaction, artificial vision, sound localization.

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 69-78

DESIGN, DEVELOPMENT AND VALIDATION OF A PATHOLOGIC TREMOR SUPPRESSION ROBOTIC DEVICE

E. Rocon∗, A.F. Ruíz ∗ J.M. Belda-Lois ∗∗
J.C. Moreno ∗ J.L. Pons ∗ R. Raya ∗ R. Ceres ∗

∗ Instituto de Automática Industrial - CSIC, Ctra. Campo Real km 0.200 Madrid, España
∗∗ Instituto de Biomecánica de Valencia - IBV, Camino de Vera S/N Valencia, España.

Abstract: The application of robot in the assistance of humans is an active field. There are several factors contributing to increase the activity in this field, such as the ageing of Western population and the demand of adequate medical assistance to disable people. This paper describes the development of an upper limb exoskeleton for monitoring and suppressing pathologic tremor. The device was clinically validated in patients in two hospitals.

Keywords: Rehabilitation robotics, tremor, Human machine interaction, orthotic tremor suppression.

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 79-92

EXPERIENCES IN THE DEVELOPMENT OF A ROBOTIC APPLICATION WITH FORCE CONTROL FOR BONE DRILLING

J.C. Fraile, J. Pérez-Turiel, J.L.González-Sánchez, J. López-Cruzado, J.L. Rodríguez

Technological Center: Fundación CARTIF
Biomedical and Robotic Divisions
Parque Tecnológico de Boecillo. Valladolid, Spain
carfra@cartif.es

Abstract: In computer assisted orthopedic surgery (CAOS), bone drilling performed during long bone fracture repair (in order to stabilize it with plates, screws, or pins) is a complex task that requires a high accuracy while avoiding excessive heating of the bone tissue. Previous work on robot-assisted surgery has mainly used industrial robots (Robodoc, Caspar, Crigos) adapted for surgical environments in order to enhance surgeon capabilities and provide safety and accuracy in performing surgical tasks. The bone drilling process control should take into account several aspects such as bone heating, cutting speed, feed rate and applied forces and torques.
The development of control algorithms that allow to correctly perform a bone drilling task by using a robot, while guaranteeing that the related parameters, previously mentioned, take optimal values under surgeon control, should be very useful.
However, the control architecture of most industrial robots is a closed one, preventing the implementation of external algorithms based on multisensorial feedback (vision, force) for task control.
In this paper we present the design and implementation of a control architecture "build on top" of the existing controller platform of a Staubli robot, that allows for the implementation of force feedback control algorithms suitable for controlling bone drilling tasks. Force feedback is used to provide precision and safety during the bone drilling process. The on-line measured forces and torques are used as input to modify the drilling feed rate and to guarantee that force-defined thresholds are not exceeded during the drilling process. Initial experimental results are obtained under laboratory conditions with a manipulating robot equipped with a force/torque sensor attached to the wrist and a surgical tool (a drill) placed below the force sensor.

Keywords: force/torque sensor, force control, surgical robot, human-manipulator cooperation.

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 93-106

COMPONENT ORIENTED DEVELOPMENT OF ROBOT CONTROL UNITS: SERVICE ROBOTS FOR HULL CLEANING APPLICATIONS

Andrés Iborra, Juan A Pastor, Bárbara Álvarez, Francisco Ortiz, Carlos Fernández

División de Sistemas e Ingeniería Electrónica (DSIE)
Universidad Politécnica de Cartagena. Campus Muralla del Mar, s/n. 30202 Cartagena. Spain
e-mail: andres.iborra@upct.es

Abstract: A critical operation in the ship maintenance is the hull blasting before it is repainted. In the last decade several solutions have appeared in the market that pretends to solve this problem.They are focused on robotizing this operation. Despite it, the hull cleaning operations are usually being carried out by manual means in shipyards. This article presents a robot family that supposes a good solution for the outlined problem.It reasonably satisfies all the requirements related to operatibility, efficiency, safety and environmental protection. For the design of the control systems we have followed an approach based on components, in order to reuse the code and to minimize the development times. The work here presented has been developed inside the EFTCoR project, funded by VFP of the EU.

Keywords: Service robots, teleoperated robots, software architectures, component based development.

RIAI, Vol. 5, Núm. 2, Abril 2008, pp. 107-117