

# ENRICHME: An Interactive Social Robot Capable of Moving Autonomously in an Elderly Person's House

Compiled by: Giuseppe Riva, PhD,<sup>1,2</sup> and Eleonora Riva, PhD<sup>3</sup>

This column will try to describe the characteristics of current cyberpsychology research in Europe. In particular, CyberEurope aims at describing the leading research groups and projects running on the other side of the Ocean.

**F**OR MANY YEARS, European societies have been ageing. The prognoses are indeed unprecedented. For the first time, we are approaching a time when the older members of the population will outnumber the younger. This obviously presents a challenge for all those who intend to provide care for older people within their own homes.

Fewer and fewer people at work, along with increasing numbers of individuals in need of care, combined with limited availability of care professionals—all these factors demand the development and implementation of new, indispensable solutions to alleviate the pressure on caregivers.

These new solutions must also be cost-effective—which makes the use of robots to assist older people living in the community of particular interest. The EU-supported ENRICHME project (<http://www.enrichme.eu>) set out to provide a basis for fundamental change in the delivery of robust, reliable, and sustainable health care in the home through novel academic advances.

## Robots Offer a Route to Independent Living

The ENRICHME system consists of an interactive, mobile robot capable of moving autonomously in an elderly person's house (see <https://www.youtube.com/watch?v=gGOqzk1BvDk>). “This can periodically and discretely monitor the person's activities and some of their physiological parameters,” explains lead researcher Dr. Roberto Rosso. The robot is in constant communication with a smart-home system comprising RFID-tagged objects and various sensors in strategic points of the environment.

Although several multi-sensor solutions exist for human tracking and dynamic pose estimation, much work remains to be done on the long-term representation and semantic interpretation of human motion for activity recognition. In particular, previous approaches have mostly been based on

numerical representations of human (and robot) motion behaviors, although their qualitative description is often the only necessary information for activity recognition.

## New Advances Enabling Greater Interpretative Accuracy

ENRICHME worked in the field of semantic interpretations of complex and long-term human motion behaviors based on recent advances in qualitative representations for robotics in particular by exploiting multi-sensor (i.e., laser and RGB-D) solutions for people tracking and 3D pose estimation. Novel qualitative models of human activities were developed to monitor long-term motion behaviors of people in domestic environments.

“Such representations,” says Dr. Rosso, “can allow for a rich, yet compact, description of complex trajectories characterizing much human motion, like walking between different places or executing physical exercises. They can also enable the recognition of long-term human activities.”

## Learning to Recognize “Your” Human, Even as They Change Over Time

Human recognition is also an essential requisite for social robots, which have to provide user-oriented services and establish long-lasting relationships with their owners. The current research in particular addresses the problem of identity verification with mobile service robots, which is robust in the face of changes over time.

Extending previous work in this area, which exploited the mutual benefit of simultaneous people tracking and recognition, novel algorithms were implemented for long-term human identification, making use of multimodal recognition techniques (i.e., face, body size, and volume) that adapt to typical changes in human appearance over days and weeks.

<sup>1</sup>Department of Psychology, Catholic University of Milan, Milan, Italy.

<sup>2</sup>Applied Technology for Neuro-Psychology Lab, Istituto Auxologico Italiano, Milan, Italy.

<sup>3</sup>Department of Cultural Heritage and Environment, University of Milan, Milan, Italy.

The project also worked on a wide range of interventions to improve cognitive functions through the use of games, exercise, and the social interaction that is fostered by communication with the robot. ENRICHME points out these are all fundamental elements for initiating, maintaining, and regulating interaction with our ageing population.

“User feedback is that independence of elderly people could be greatly improved through the many functions offered by our systems, such as calendar reminders, activity initiation, management of conditions, management of home, maintenance and improvement of cognitive ability,” Dr. Rosso adds.

ENRICHME found that among the oldest people with multiple cognitive impairments, there are those who can be potential beneficiaries of interaction with the robot. “The TIAGo robot was real support for elderly people who want to live independently, by making it possible to increase cognitive, physical and social activity as well as by improving nutrition,” Dr. Rosso says.

Address correspondence to:

*Dr. Giuseppe Riva  
Department of Psychology  
Catholic University of Milan  
Largo Gemelli 1-20123 Milan  
Italy*

*E-mail: giuseppe.riva@unicatt.it*

*Dr. Eleonora Riva  
Department of Cultural Heritage and Environment  
University of Milan  
Milan  
Italy*

*E-mail: eleonora.riva@unimi.it*

Sources: Cordis, European Commission and European Union