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# Robo M.D.: A Home Care Robot for Monitoring and Detection of Critical Situations

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## ABSTRACT

**Motivation** – The use of a Home Care Robot combined with a sensor network could possibly improve or replace current home Tele-healthcare systems that monitor elderly people or other people with health problems. Using robot for this is a new and we want to find out what the advantages or disadvantages could be.

**Research approach** – By using non-invasive wireless sensors the health of the person can be monitored. In case of a possible problem, like when the person has fallen, a robot can autonomously go to the person and ask or check whether help from care-providers would be needed. This check could avoid many false alarms. The robot can call a care-provider by itself. The control of the robot can also be taken over by a care-provider to enable telepresence. By communicating with the person through the robot and seeing through the camera of the robot, the care-provider can then better evaluate the situation and help remotely or send help directly.

**Findings/Design** – The sensors, the robot and the interaction will be designed and evaluated by doing user-tests. Privacy-issues will be investigated too.

**Take away message** – The use of such a Home Care Robot can be very cost-effective because it enables people to live longer in their own home, it can prevent many false alarms for the care-provider and compared to systems that need cameras everywhere it can offer more privacy.

## Keywords

Robot, Care, Home, Privacy, Monitoring, Telepresence

## INTRODUCTION

Home Care Systems, remote care systems and care-providers are currently facing significant challenges. The number of elderly people is increasing rapidly, people naturally get older and the baby-boomers are getting older and are now becoming elderly people themselves. A problem caused by this increase is that

there will be more people needing care while less people can provide this care. Many people prefer to spend their old age in their own home. Currently smart homes and Tele-healthcare systems are being developed and tested to make this possible. The state of the art of these systems (Nourizadeh 2009) uses many sensors and cameras to let care-providers remotely check up on people and some systems can automatically trigger alarms when abnormalities are detected. Currently these systems do not incorporate a robot yet.

The most innovative aspect of our project is to incorporate a robot in such a system that can autonomously check up on people in case of any abnormalities and that can also be remotely controlled by care-providers when needed. Robots already have been applied in different care-giving areas such as assisting patients or giving mental and psychological enrichments through interaction (Shibata 2004, Wada 2004). Depending on the robot it could be possible to combine many functionalities into one home robot. The use of a home robot for the goal and application area of this project is new, so adding this capability could add to the benefits and possible uses of having a personal robot at home. This would not only be useful for elderly people, but also for other people who have health problems and who would like to live as independent as possible and as long as possible in their own home.

Our research has shown that the acceptance of ambient care systems by the users is still a problem and that this can partially be explained by a lack of perceived usefulness (Sponselee 2008). A recent study has shown that elderly people mainly appreciate the sense of reassurance and safety that is provided by the Home Care System (Sponselee 2010). Our project therefore focuses more on detection of critical situations than on stimulation or social contact.

## ROBO M.D. PROJECT

In the project Robo M.D. (referring to Doctor of Medicine) we want to design and develop a system that includes a robot to monitor the person and that is able to detect critical situations and can automatically respond

to that. This project is funded by the European Commission as part of the Innovation 4 Welfare programme, which is co-funded by the Interreg IVC Programme. This is part of the European Territorial Cooperation Objective, which helps regions of Europe work together to share their knowledge and experience. A goal of Innovation 4 Welfare is to generate new solutions in the areas of health and welfare, stimulate cooperation and exchange of experiences, and to turn welfare challenges into business opportunities. The project Robo M.D. has been approved and the starting date is July 2010. The duration of the project is 18 months.

The main European partners working together in this project are the Johannes Kepler University (Institute for Design and Control of Mechatronic Systems) from Austria, the Italian National Research Council (Institute of Electronic, Information and Communication Technologies) from Italy, Fontys University of Applied Sciences from the Netherlands, The University of South Bohemia from the Czech Republic and the University of Tartu from Estonia.

The authors, representing Fontys University of Applied Sciences, will focus on the robot and the Human Robot Interaction, while the other partners will mainly focus on the sensors on the user, the data analysis and the wireless network communications.

## SCENARIO

In this project the target group consists of people with certain health problems that want to live independently in their own home for as long as possible. Instead of needing care-providers around all the time, the proposed solution is to create and provide a Home Care System that can monitor many things and that includes an autonomous robot that can check up on people.

In the scenarios within this project the user wears sensors that can measure physiological data such as blood pressure, heartbeat, skin conductivity or acceleration. These sensors are all wirelessly connected and can transmit to a central computer in their home. Depending on the analysis of the signals from the sensors, the system can directly call for help. In case of doubt and to avoid too many false alarms the system can activate the Home Care Robot to autonomously check up on the user. This robot is wirelessly connected and controlled by the central computer.

An example of a scenario is that the person is alone at home and has fallen. By analyzing the information from accelerometers and possible other sensors the system can decide to activate the robot and go to the person to find out more. The robot can then ask one or more questions. Depending on the response the system can conclude that there is no problem and return the robot, or it can autonomously call the care-provider for help. The care-provider can then remotely control and move the robot to check up on the person. The camera on the robot can be used to look around and the speaker and microphone can be used to communicate, so it can also

be used as a kind of telepresence. In the case the person has fallen and cannot get up the care-provider can then come to help or send help.

## POTENTIAL BENEFITS

The use of a robot can be an alternative to having cameras everywhere in the house. Instead of having the feeling of being observed by cameras all the time, the robot will only look around when the system thinks there could be a problem. Another advantage is that it is flexible and mobile so it can go to and look at many different places when needed, while static cameras would only have limited viewpoints. Having more privacy could be an advantage of this system compared to some other solutions.

How well such a robot would be accepted and what would be the best way of interaction are other questions that are investigated in this project. When this system is successful it would enable people with health problems to be more independent, increase their quality of life and live in their own home for a longer time. By requiring less direct care and by reducing false alarms this makes it also very cost-effective for the health-care system in general.

It will be interesting to compare the ideas, results and user-acceptance of the Robo M.D. approach with other systems and other new projects in this area.

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