

NSF/CCC/CRA Roadmapping Workshop for Medical and Healthcare Robotics

Medical & Healthcare Robotics Workshop ~ Participation Proposal

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Introduction

In common with the workshop organizers, we at Microsoft Research see the worldwide population trending significantly older—particularly in the developed world. We see that doctors are specializing rather than being broader focused medical practitioners—a problem that more greatly impacts underserved and/or rural communities. Meanwhile, robots, sensors and devices are becoming cost effective, powerful, and capable. They are becoming more programmable and accessible. The collision of these trends opens an opportunity to take advantage of these advances in technology to apply to the aforementioned healthcare challenges.

Targeted applications of robotics in eldercare have not always been successful¹. This is due in part to arguably misguided application of these potentially highly useful tools. Instead of deployment in an obvious (“in your face”) way (e.g., medical robots placed in the homes of elderly to facilitate mental interaction), the real benefits may lie in deploying robots and sensors in a way that is both pervasive and non-invasive, at least in the short term.

Our current approach in Microsoft Research External Research has included providing targeted funding to researchers that are exploring pervasive non-invasive deployment of medical robots, devices and sensors to target emerging difficulties in the healthcare/home care space. Instead of using robots for interaction, interaction with them should be a user choice based on need (e.g., specialized wheelchairs) and for situational monitoring or treatment adherence of disabled/special needs/ailing subjects. We have also offered RFPs (Requests For Proposals) in Intelligent Systems for Assisted Cognition² and Human-Robot Interaction³.

We see the important areas of research in medical/healthcare robotics as including (but not limited to):

- Deployments in combination with adjunct/auxiliary sensors and sensornets
- Assistive deployment for elderly or cognitively impaired, with personalization and social appropriateness
- Multiple support roles in hazardous environments
- Health monitoring over distance
- Human computer/device interaction, appropriately contextualized, social, and deployed in realistic trials
- Practical mobile manipulator research platforms at a significantly lower cost than today’s one-off devices, with social capabilities

For our proposed workshop presentation, we plan to present our recent RFP activities as active exemplars of this research agenda. We will explain the rationale for the programs and their ultimate design, and give an overview of the resultant project portfolio and their current status. We believe that research in these areas can serve to inform not only the areas themselves, but many of the research areas listed above – and even surface completely new areas of innovation in medical/healthcare technologies and applications.

Intelligent Systems for Assisted Cognition RFP

The U.S. Department of Health and Human Services and U.S. Department of Labor estimate the number of individuals in the United States who will require paid long-term care services (due to age and disabilities) will likely double from the 13 million in 2000, to 27 million people by the year 2050. Given that medical sensors and personal

¹ <http://robotworldnews.com/100115.php>, <http://robotworldnews.com/100497.php>

² http://research.microsoft.com/ur/us/fundingopps/RFPs/IntelligentSystemsforAssistedCognition_Awards.aspx

³ http://research.microsoft.com/ur/us/fundingopps/rfps/HRI_RFP.aspx

monitoring devices are getting smaller, less expensive and more readily available and deployable there is a logical reason to develop and study systems that can at least partially address this growing need through technological means. The ultimate goal of this research is to enable individuals to live longer, fuller, safer and more independent lives.

Intelligent Systems for Assisted Cognition is an emerging field of research with the goal of improving the lives of the cognitively or sensory impaired. Although initially focused on assisting individuals with special needs, these applications, tools and devices have the potential to enable the development of technologies that may facilitate everyday life for everyone.

This RFP awarded \$300,000 (USD) total to the following research projects/groups:

- [Supporting Alzheimer's Patients through Memory Augmentation](#)
- [Automatic Generation of Adaptive Directions for Wayfinding](#)
- [An Online Community for Teachers to Support, Observe, Collect and Evaluate Assisted Communication with Children with Autistic Spectrum Disorder](#)
- [Mixed-Initiative Visual Vocabulary Application for People with Aphasia](#)
- [Behavioral Imaging Technologies to Support Early Detection of ASD](#)
- [A Software Framework for Domestic Cognitive Training Services](#)

Human-Robot Interaction RFP

HRI is a large field with many active research projects in universities and other labs around the world. But much of the research to date has been focused on the robot and human somewhat in isolation from the broader computing environment around them. Our intention in this RFP is to focus attention on the general paradigm shift from “robots as tools” to “social robots”, and consider HRI in the context of the existence of a plethora of other computing devices deployed in the modern human environment, including PCs, smart phones, and the World Wide Web.

Successful research in this area will lead to such results as practical cognitive models of humans that could be used by the people who are programming robots in this rich information technology environment; tools that programmers could use to assert safe interactions between humans, robots, and these other computing devices; and software design patterns for adaptive human-robot interfaces in such an environment. We expect the state of the art to be raised such that robot developers, both in research and development contexts, will be better able to build robots that interact with humans in real-world environments, performing useful applications, safely, effectively, and efficiently. We even expect the results of this work could be useful to the general Human-Computer Interaction (HCI) field.

We have been pleased to make available a large range of applicable advanced software development technologies for such research. This includes the Microsoft Robotics Studio with its large library of robot services. We hope that one outcome from these projects will be new HRI-related services for the benefit of the wider research community.

This RFP awarded over \$500,000 (USD) total to the following research project/groups, including a number of medical and healthcare projects that we will highlight specifically at the workshop:

- [Snackbot: A Service Robot](#)
- [Human-Robot-Human Interface for an Autonomous Vehicle in Challenging Environments](#)
- [Personal Digital Interfaces for Intelligent Wheelchairs](#)
- [Human-Robot Interaction to Monitor Climate Change via Networked Robotic Observatories](#)
- [FaceBots: Robots Utilizing and Publishing Social Information in FaceBook](#)
- [Multi-Touch Human-Robot Interaction for Disaster Response](#)
- [Survivor Buddy: A Web-Enabled Robot as a Social Medium for Trapped Victims](#)
- [Prosody Recognition for Human-Robot Interaction](#)