# REPORT

*on*

# *Workshop on Societal Applications of Humanoid Robots*

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# *Acknowledgement*

We would like to thank *EU Robotics Forum* to provide this excellent platform for the workshop, and its organizers for their precious support in smoothly conducting the workshop.

We would like to thanks all the speakers, the audience and the active participants to make the workshop interactive, dynamic and interesting. All these helped to achieve the workshop's objectives of getting answered some of the most relevant questions related to societal applications of humanoid robots and to pave the way for the future investigation in the domain.

*On behalf of the organizing committee*
*March 2014*

*Amit Kumar Pandey*
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## 1. Motivation and Kickoff

Humanoid robots are already showing their presence in our everyday life. Past years of research and innovation have led towards a range of applications and ideas in which a humanoid robot could serve to the society. New applications are emerging and the demand is rising. Whether it is to interact and teach the children with autism or to serve as a fitness trainer, companion or co-worker, humanoid robots are showing their merits and potentials.

Hence, this workshop was organized, with the objectives to provide a platform to present, discuss and discover the existing and potential innovative applications of the robots for the betterment of the society, to investigate the needs of the society, to explore the kinds of social intelligent expected from the robots and to identify the associated research challenges.

The workshop started in the afternoon session with an introduction by *Dr. Amit Kumar Pandey*, on the motivation and the core idea behind workshop. He presented a vision of various societal applications a *socially intelligent robot* could serve for and a set of key open questions, which were expected to be answered as the workshop progresses:

- *Are robots already there for the betterment of society?*
  - *If yes, in what sense? What are those societal applications?*
  - *If not yet completely, how far are they?*
- *What are the societal needs?*
- *What are key R&D and Innovation challenges?*
- *And how are we progressing?*

As will be evident from the details below, through the invited talks, panel discussion and the active participations of the audience, workshop was successful to achieve its goal, by having satisfactory answers and interesting pointers relevant to these questions. In addition, some other interesting complementary aspects also emerged during the workshop, such as *need vs. immediate needs*, *user vs. researcher's perspective*, etc.

## 2. Keynotes

The first talk was by *Prof. **Kerstin Dautenhahn***, *University of Hertfordshire, UK*. Her talk was focused on a how the robot can be used as *social mediator,* which has a variety of applications, including treating children with *autism*. She gave awakening insights about *autism* and how can the robot help in developing social interaction capabilities in such children. The motivation behind the work in the robot-assisted therapy was the finding that children interact differently with robots than toys. Further, the diversity in the robot's appearance also matters. So, a *design space* based on robot's *appearance vs. behavior* has been presented. She emphasized the need of simple design of such robots, with only basic facial features. Moreover, it is importance to take into account the individual 'personality', 'preferences' and 'nature' of such children, while designing the robot's behaviors. For example, some children do not like sound, some do not like a particular color, and so on, therefore, the game and the interaction has to be tailored by keeping in mind such factors.

She emphasized that we should keep into mind that such robots should not completely replace the human partner, but should serve as *social mediator* to facilitate them to interact socially with other people, not only with robots. Therefore, the games and the interaction behaviors should be aimed in teaching collaborations, emotions like basic social aspects. The videos and results of *Kasper*, a humanoid child size robot, playing with children with *autism*, interestingly demonstrated the importance and the strength of such societal applications of the humanoid robots.

Followed by this, the second talk was by *Mr. **Rodolphe Gelin***, *Aldebaran Robotics, France*, highlighting the types of societal applications from an industry perspective. He pointed some interesting aspects of such application, such as humanoid robot, *Nao*, companion for children at hospital, which is interacting and entertaining them. He also pointed out the great need and potential of robot assisted therapy for children with *autism*, to motivate such children for social interaction and learning. Moreover, he argued in the favor of feasibility of having robotics assistant at home, with some interesting videos advocating the 'proof of concept'. A series of assistive activities of a companion robot for an elderly person have been shown in day-to-day activities, such as *newsreader, messenger, entertainer*, etc. He argued that robots could also be used to provide *cognitive stimulation* to person living alone or in rehabilitation.

Further, based on studies, he pointed some of the design guidelines and user preferences for developing such human assistive robots in terms of appearance and height of the robot as well as its behavior. It turns out that people prefer a robot with the height at the same level when a person sits on a chair. Further, people do not want the robot to completely do the work the people are capable of. Robot should be more on assistive side, than on replacing side and it should not decide for the person. Then he introduced another humanoid robot *Romeo*, which because of its relatively taller height, compared to *Nao* robot, will be capable of better physical

interaction with people and environment. During discussion, he also pointed out that timing and mutual learning of interaction are important for such robots to be accepted in the society.

Followed by the industrial perspective of societal applications, the third talk by *Dr. **Rachid Alami**, LAAS-CNRS, France*, focused on some of the key ingredients and reasoning capabilities, which the robot should be equipped with, when expected to serve as platform for various societal applications. He particularly insisted on the fact that it is necessary for such robots to take explicitly into account the presence of humans and thus it is needed to re-visit the robot decisional capabilities. The planning and decisional process should explicitly take into account effort, visibility, relative placement constraints. These notions blended with the capabilities of perspective taking are also important for a robot to plan and answer a variety of questions related to *what*, *where* and *when* aspects during human robot interaction. Further, the robot should follow social rules and protocols, and its motion and posture should be legible.

He also discussed how the robot's behavior and autonomy should be shaped. He pointed that the robot's plan should incorporate interaction modalities and should satisfy the rhythm. Robustness and efficiency together with comfort and intentionality should be used as criteria for developing robot's behaviors. Beyond the basic but important aspect of safety, a robot in human environment should also plan, re-plan and adapt simply because of the presence of the human in the environment. All these will be helpful for the better acceptance and adaptation of sociable assistive robots.

## 3. Panel Discussion with Public Participation

This series of motivating and interesting presentations already created the platform for stimulating panel discussion. The theme was,
"***What are the immediate needs of the society from the Humanoid robots?***"
It was moderated by *Dr. Amit Kumar Pandey and* other members of the panel were *Prof. Kerstin Dautenhahn, Mr. Rodolphe Gelin* and *Dr. Rachid Alami*.

The discussion was 'ignited' with the brainstorming around the following aspects:
- *What are key R&D challenges?*
- *And how are we progressing?*
- *Are robots already there for the betterment of society?*
  - *If yes, in what sense? What are those societal applications?*
  - *If not yet completely, how far are they?*

The panel discussion with active participation from the audience successfully identified some important aspects of immediate focus and the pointers towards answering these questions, to help developing socially intelligent robots and their societal application, as summarized below.

### *The need* vs. *the immediate needs*:

One of the interesting aspects emerged during the discussion was on *'the needs'* and *'the immediate needs'*. It turned out that there are needs, which are already there for decades and those might be fulfilled with robots. However, there are other emerging needs, which are becoming more prominent and relevant, because of changes and shifts in social, cultural, economic and technical paradigm. For example,

    - The aging society and the working of both members of a family are raising great concern about taking care of kids and elderly person. This is one of the important area where advancements of humanoid robots can serve for, starting from monitoring the health to providing physical support, and from entertaining to interactively educating.

    - Similarly, the emerging need of safe intervention and assistance for nuclear plants and disasters sites is another immediate area to focus from robotics application perspective, for the safety of the society.

We should identify the short and long-term needs, more prominent and less prominent needs.

### What question should a robot societal application developer ask:

- From a researcher's perspective we should identify, "*what does the robot is expected to do?*"
- However, studies suggest that from a user's perspective what matters is, "*what a robot can do for them*?"
- Therefore, we have to bridge both and fuse R&D and Innovation to bring 'useful' societal applications.

### Some social requirements:

- Emotion
- Trust
- Human 'touch'

### Adaptability issues:

- The robot should be adapted to us.
- But also, we might be required to adapt from our behavior and habit perspectives for such societal applications of robots.

### Design questions to ask for Societal Application development:

- "*Do we have to replace human?*" It is suggested no need to replace human, where it is not necessary.
- We have to ask, "*What do we need from a machine?*"
- We should ask, "*how much and in which way we want to compromise with our own autonomy?*" It should be ok to help if someone is sick, but, is the same level of help 'desired' by a person and by the society, if someone is not sick?

***Suggestions from R&D perspective:***

- Identify and incorporate the human aspect from the beginning, even at the design phase of such robots.
- We have lots of resources, which are not properly used. We are trying to develop same things repeatedly in different places and projects. We have to put more efforts to ensure software re-usability.
- We need robust basic components, such as perception, autonomous navigation in human environment, sound localization, etc.

## 4. Ending the Session

Due to the time constraint, we had to put on hold the interesting ongoing discussion and moved towards closing the session. The closing remarks with a list of take-home messages (already included in this report), based on the talks and discussion have been presented by Dr. *Amit Kumar Pandey*. Following that, the workshop productively ended with thanksgivings and the promises to gather again in the follow up workshops, to continue 'the discussion' and to share the advancements.