

Title: A Discussion About Current Augmented Reality Concepts Which Help Users Better Understand and Manipulate Robot Behavior

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Abstract:

Looking at the active research in robotics it is imaginable that robots will increasingly find their way into private households. Therefore, it seems important that humans without technical background are able to understand the behavior of robots and can control them. One obstacle is that humans and robots have different perceptual spaces which are just partly overlapping. Not every action a human can perform lands in the perceptual space of a robot and a robot cannot reach every form of perception that is available to a human. Furthermore, humans and robots have differing conceptual models of the world; robots use several sensors to collect data of their surroundings and use various routines to interpret it. Sometimes they also need knowledge about the real world which is provided by a knowledge framework. Those different perceptual spaces and different conceptual models of the world are reasons why understanding robot behavior can be difficult for humans.

Augmented reality (AR) can be a tool to widen the overlapping parts of the perceptual spaces of humans and robots, hence make understanding robots easier. By sending information to AR devices robots can bring it into the visual perception of humans and humans can use the interaction possibilities of those devices to send commands to the robot. There are already some instances in which AR in combination with robots is used, for example: Using AR to show sensor data like those of a sonar sensor via an AR head mounted display (HMD) for debugging purposes [1]. Using an AR HMD to visualize future movements of a robot arm to detect collisions [2]. Showing the behavior plans of a robot within an AR app on a tablet to make it more trustworthy [3]. Enabling the ability to change robot behavior represented through a temporal And-Or graph on an AR HMD via hand gestures [4].

As indicated, there are already several articles solving specific problems using AR to improve the understanding of humans about robot behavior. This paper will review a collection of articles about human-robot interaction (HRI) that focus on AR, categorize them and on a theoretical basis discuss how existing concepts could be combined or improved. Furthermore, there will be an attempt to identify existing gaps regarding the potential of AR to further improve the understanding about robot behavior with the intend to tackle those gaps in future work.

References:

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