WYSIWICD: What You See is What I Can Do

Facilitating HRI by Mixed Reality Techniques

Patrick Renner, Florian Lier, Felix Friese, Thies Pfeiffer and Sven Wachsmuth
Cluster of Excellence Cognitive Interaction Technology, Bielefeld University
Bielefeld, Germany
{prenner,flier,ffriese,tpfeiffer,swachsmu}@techfak.uni-bielefeld.de

ABSTRACT

Mobile robots start to appear in everyday life, e.g., in shopping malls or nursing homes. Often, they are operated by staff with no prior experience in robotics. False expectations regarding the capabilities of robots, however, may lead to disappointments and reservations when it comes to accepting robots in ones personal space.

We make use of state-of-the-art Mixed Reality (MR) technology by integrating a Microsoft HoloLens into the robot's operating space to facilitate acceptance and interaction. The MR device is used to increase situation awareness by (a) externalizing the robot's behavior-state and sensor data and (b) projecting planned behavior. In addition to that, MR technology is (c) used as satellite sensing and display device for human-robot-communication.

KEYWORDS

Augmented Reality, Natural Interfaces, Sensor Fusion

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1 INTRODUCTION

Research in robotics has come to a stage where the first robots find their way into our daily life. This process is accompanied by a shift in the targeted user group from researchers or developers to people without prior knowledge about a robot and its capabilities.

Extending on previous ideas of using Mixed Reality (MR) techniques for robotics development [2] and operation [1], we aim at speeding up the familiarization of novice users with robots by enabling them to perceive the world *like the robot does*, and thus also increasing the acceptance of robots in everyday life. Our aim is to not only use a MR headset for visualizing data, but to also integrate its sensor data, giving the user a more direct interface to the robot. This way, on the one hand the user can always be aware of the current robot status and intent. On the other hand, the robot can, e.g., integrate the human's location in the environment as well as sensor data of the MR headset. Moreover, voice instructions can be given remotely, even when the robot is located in another room.

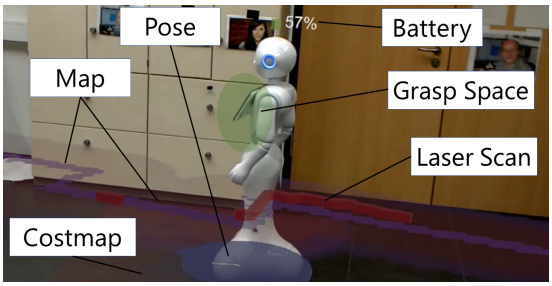

Figure 1: MR projections to improve Situation Awareness.

2 WHAT YOU SEE IS WHAT I CAN DO

Humans are good at using their own body schema to infer the capabilities of others in cooperative tasks in which it is relevant to estimate. The body schema of a robot, even if anthropomorphic, typically is different from that of a human, which renders it difficult to estimate if a path to navigate through is sufficiently free, or the objects covered by the reaching space. The idea is now that MR glasses can visualize relevant aspects, such as the optimal area in which objects should be held during handover, or the reaching area of a robot to communicate the body schema of the robot to the user.

We integrated the Microsoft HoloLens into our robotic framework based on ROS driving a Pepper robot. The essential registration of the coordinate systems is handled by an initial anchoring using a fiducial marker. After that, pose updates are synchronized between the HoloLens and the robot. We use MR in two different ways to facilitate interactions with the robot: Sensor data are visualized to a get a better grasp of the robot's capabilities. We show the map and the robot's localization on it, the costmap and laser scans (Figure 1). The planned path is shown making the user aware of the next movements. The robot can visualize its grasp space when it is not able to reach to an object, committing information which otherwise would not be obvious. Since the HoloLens is integrated with the robot's coordinate system, the robot knows about the user's location. Wherever the user goes, she can instruct the robot by a voice command interpreted by the MR device.

REFERENCES

[1] Mauro Dragone, Thomas Holz, and Gregory M.P. O'Hare. 2006. Mixing Robotic Realities. In *Proc. of the 11th Int. Conference on Intelligent User Interfaces (IUI '06).* ACM, New York, NY, USA, 261–263. https://doi.org/10.1145/1111449.1111504

[2] Koichi Nishiwaki, Kazuhiko Kobayashi, Shinji Uchiyama, Hiroyuki Yamamoto, and Satoshi Kagami. 2008. Mixed reality environment for autonomous robot development. In *IEEE International Conference on Robotics and Automation, 2008.* IEEE, 2211–2212. http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=4543538

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