MITRO: an augmented mobile telepresence robot with assisted control (Demonstration)

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ABSTRACT

We present MITRO: Maastricht Intelligent Telepresence RObot, a custom-built robot system specifically designed for augmented telepresence with assisted control. Telepresence robots can be deployed in a wide range of application domains, and augmented presence with assisted control can greatly improve the experience for the user.

Categories and Subject Descriptors

I.2.9 [**Robotics**]: Autonomous vehicles, Operator interfaces

General Terms

Experimentation

Keywords

Telepresence, autonomous navigation, tele-operation

1. INTRODUCTION

Although the idea of a teleoperated robot for remote presence is not new [4], only recently have so called *telepresence robots* become available to the broader public [2, 5, 6]. The idea of a mobile telepresence robot stems from the inherent limitations imposed by traditional videoconferencing systems, in which interaction is restricted to the meeting room only. Such systems do not allow the user to join the - often important - informal part of meetings generally taking place in hallways and coffee corners. A teleoperated robot can provide means for a mobile teleconferencing system, allowing the user to interact more naturally in the remote office environment.

Various authors have already investigated the use of mobile robots for telepresence. In [6] the authors compare two recently launched commercial products, Anybots' QB and VGo Communications' VGo, with respect to user experience in two scenarios: the scheduled meeting, and the informal hallway meeting. One of their findings is that adding some level of autonomy would enhance the user experience, as it would allow to focus more attention to the conversation and interaction, and less to driving. One possible solution, assisted navigation, is investigated in [5]; the authors conclude that assisted navigation decreases the number of collisions with objects in the environment.

To provide assisted control the robot has to be outfitted with a range of sensors that allow to observe the surroundings and steer clear of obstacles. These sensors can also be used to provide additional information to the remote user or allow for additional functionality. *Augmented telepresence with assisted control* goes beyond the idea of a teleoperated robot simply equipped with a screen and camera. Mapping and localization functionality are used to provide the remote user with a floor map indicating the current location; the map can be annotated (e.g. room numbers) and relevant information is overlaid on the live video feed. Furthermore, the system can autonomously return to its charging location after a meeting or wait ready-to-use at a preset location before the meeting commences. People detection and tracking can be used to automatically follow a person to her office; while face tracking allows to follow a conversation without constant steering corrections to keep the conversational partner centered on the screen.

2. IMPACT

Telepresence robots can be deployed in a wide range of application domains, e.g. in workplaces, the public sector or for home use. Telepresence robots are already being used in hospitals to allow doctors and specialists to give consultations from afar [6]. Assisted living facilities outfitted with telepresence systems can provide 24/7 supervision and assistance through remote caregivers. Family members or friends can use the system to pay a virtual visit when time does not allow to be present in person. Telepresence robots can also be used to give people with restricted mobility a new way to outreach and interact beyond their usual living quarters. In all these domains, augmented presence with assisted control can greatly improve the experience for the user.

3. SYSTEM

We present a custom-built robot system (see Figure 1) specifically designed for augmented telepresence with assisted control [1]. MITRO - Maastricht Intelligent Telepresence RObot - is an ongoing research project at the *Swarmlab*[1], the robotics laboratory at the Department of Knowledge Engineering (DKE), Maastricht University.

Appears in: *Proceedings of the 11th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2012)*, Conitzer, Winikoff, Padgham, and van der Hoek (eds.), June, 4–8, 2012, Valencia, Spain.

[1]For more information visit:
`http://maastrichtuniversity.nl/swarmlab`

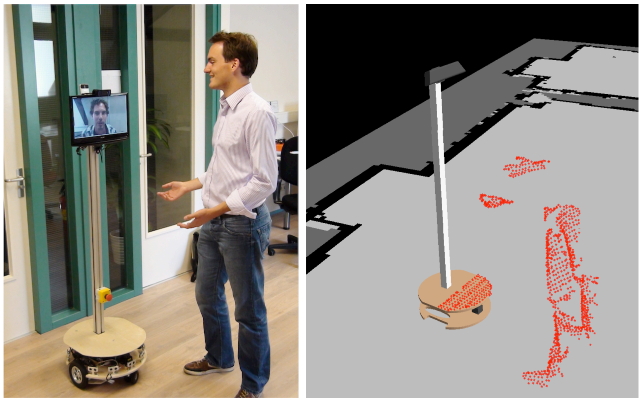

Figure 1: Interacting with MITRO.

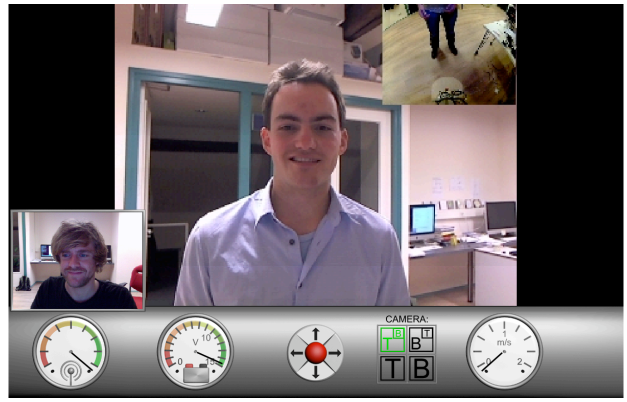

Figure 2: MITRO user interface

3.1 System specifications

The MITRO platform is based on the Parallax Mobile Robot Base kit, which includes the base plate (⌀ 46 cm), powerful motors and 6 inch wheels with pneumatic tires. Additionally, a Hokuyo URG-04LX-UG01 laser range finder is mounted at the front of the base to provide a detailed representation of the environment (240° range; 0.36° resolution; 10 Hz rate, 4m range), used for mapping and localization. A pole is fitted on the base plate and serves as the elevated attachment point for the 14" LCD screen, speakers, two cameras (one pointing forward for conversations, one fish-eye camera pointing downwards for driving), and a Microsoft Kinect sensor. The latter is used for people tracking and obstacle avoidance, and can be used to extract additional features from the environment. The robot has an overall height of 160 cm, the size of a small person, allowing for natural conversation while standing or being seated.

3.2 Software

The MITRO project makes use of and contributes to ROS[2], an open source robot operating system [3]. The modularity and easy extendability of this system makes it an ideal choice for the development of a wide range of robotics applications. ROS fully supports Ubuntu, which makes this the main operating system of choice. In addition to ROS, MITRO makes use of cross-platform video conferencing software and an interface, which enables the user to control the robot, and receive status updates (see Figure 2).

3.3 Capabilities

In order to provide assisted control and augmented telepresence, the robot is able to perform SLAM (simultaneous localization and mapping) to build a map of its environment. This map is used subsequently for localization and autonomous navigation, and can be annotated by the user for convenience. Obstacle avoidance is implemented using a range of sensors, which provides assistance during manual operation or full autonomous navigation if desired. People and face tracking can be used for more natural interactions.

4. DEMONSTRATION

We invite people to engage in a hands-on experience with our MITRO telepresence platform. A laptop computer running the client-side control interface and video-conferencing application allows the user to steer the robot around, take part in conversations and test the assisted control. Additional information (such as an annotated map) is also available. Furthermore, we will demonstrate autonomous drive to a chosen location (e.g. charging station) and people tracking. For more information, visit:
`http://swarmlab.unimaas.nl/papers/aamas-2012-demo/`.

[2]For more information on ROS visit: `http://www.ros.org`

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