Robots for Humanity

An accessible interface for mobile manipulation by the motor impaired

Healthcare Robotics
www.healthcare-robotics.com

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Purpose: To produce an accessible interface which allows persons with severe motor disability to control a fully articulated humanoid robot in performing self-assistive healthcare tasks.

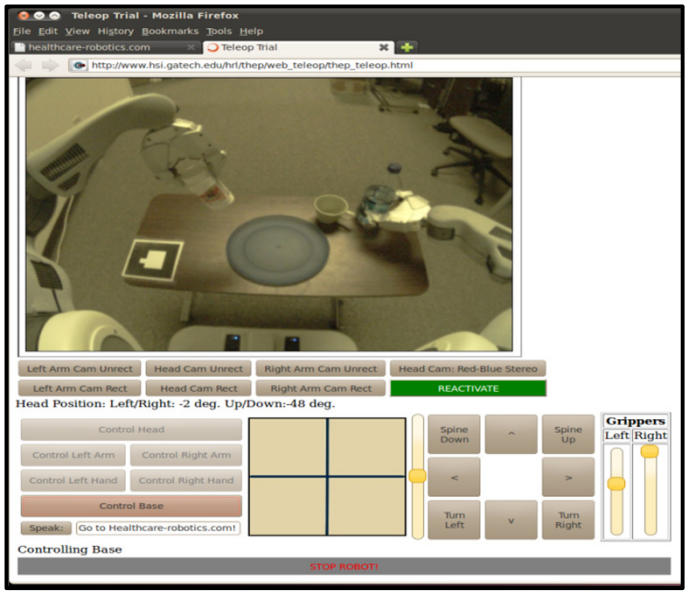
Overview:

This project involves a rapidly iterating, user-integrated design process to produce a user interface and underlying autonomous capabilities, allowing a single quadriplegic user/collaborator to physically interact with his environment through a PR2 robot.

In addition, the user provides a case-study in the needs of the severely disabled with respect to potential robotic solutions. His insight into patient needs and capabilities alike allows for the design of an interface which is both effective and easy to use, and remarkably powerful as a results

Interface:

- Web-based: **Only requires a browser**
- Direct control of all 25 physical DoF's
- Arm movements decomposed into:
  - 3D gripper position
  - Wrist joint configuration.
- Visual feedback from cameras in head and arms
- Text-to-speech
- Low-gain control of compliant, gravity compensated arms – **Safe for contact**
- Roll-over emergency stop to halt all motors.
- Designed from user-specified layout and developed with extensive, frequent user testing and feedback.



Initial Outcomes:

The user has used the interface and robot to:

- Perform remote manipulation tasks
  - Using the GT PR2 from home in California
- Interact and talk with others remotely
- Perform in-person object manipulation
- *Scratch his own face*
- *Brush his own hair and scratch his own head*

Significant need-finding has shown:

- Clear opportunities for Mobile Manipulators
  - Environmental control
  - Many ADL's
- A focus on communication
  - Currently slow, time-consuming
  - Potential for physical social presence

The user seated next to a robot under his control.

With the Web-based interface:

- No software is required
- Remote access is simplified
- Numerous commercial devices allow mouse control for a wide range of disabilities, which can now control the robot

Continuing Goals:

1. **Increase autonomy**
2. **Reduce required effort**

This will include:

- Visualization of 3D sensor data
- Choosing a point on a map for autonomous navigation.
- Point-and-click autonomous grasping and placement (Willow Garage)
- 'Perpendicular Approach' movement primitive
- Improved low-level control

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