Human Pose Imaging as a Control Method for Robotic Assistive Technologies

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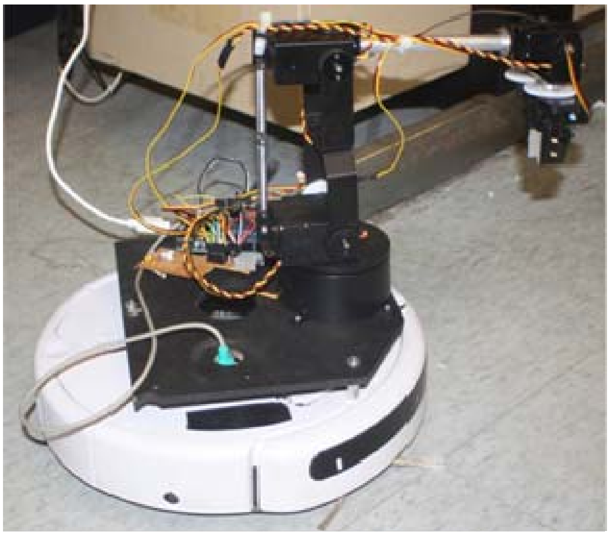
Figure 5. Prototype Testing Platform

INTRODUCTION

The objective of this project is to develop a simple and intuitive control interface for robotic and tele-operated assistive devices that can be easily embedded into existing and future devices. While the potential for future assistive technology is great, the complexity of control interfaces is a hindrance to the technology's applicability and marketability. The deployment of complicated assistive devices, such as a robot, could be facilitated by a significant improvement in the simplification of the control interfaces. This design employs the user's human arm movement to control a mobile robotic arm.

SUMMARY OF IMPACT

The development of this control system will allow for wider deployment and application of assistive technologies. Our survey shows that senior citizens are severely disinclined towards trying to use complicated control systems, and that significantly more are interested in trying to use an assistive device such as a robotic arm if the control interface does not require using levers or buttons but rather allows you to control by moving your arm. The designed control system will bring in simplification in operations, and hopefully make more assistive technologies available to users who would otherwise not consider them due to the control complexity and training limitations. The control system also shows promise for non-assistive applications, such as industrial machine control, robotics, and many other kinematic devices.

TECHNICAL DESCRIPTION

The human positioning system used in the design is the motion capture technology of the Microsoft Kinect™. The Kinect uses structured infrared light to acquire a depth field, which is used to exact a human pose, computing a “skeleton” of coordinates of body parts. This data allows the user to control a robotic arm simply by moving their arm, with the motion of the robotic arm mimicking the motion of the human arm.

The system can be controlled with a single hand and uses both the motion capture technology employed by the Microsoft Kinect™ and the Wii Nunchuck™. This system gathers data from the structured light based depth map of the Kinect™ and the gyroscope of the Nunchuck™, and uses signal conditioning to extract geometrical coordinates of critical points on the user’s arm and body. Then it uses a form of inverse kinematics and other algorithms to generate output instructions for a robotic arm. The system also uses the joystick of the Nunchuck™ to allow for simple control of the mobile platform to which the robotic arm is attached. Buttons on the Nunchuck™ allow for further user control of the system’s processes.

The system was designed to be robust enough that it can be readily adapted to a wide spectrum of kinematic devices. The control system was designed with intuitive, natural motions, safety, and cost as a prominent feature.

The cost of the parts and supplies for this project was about $1000.

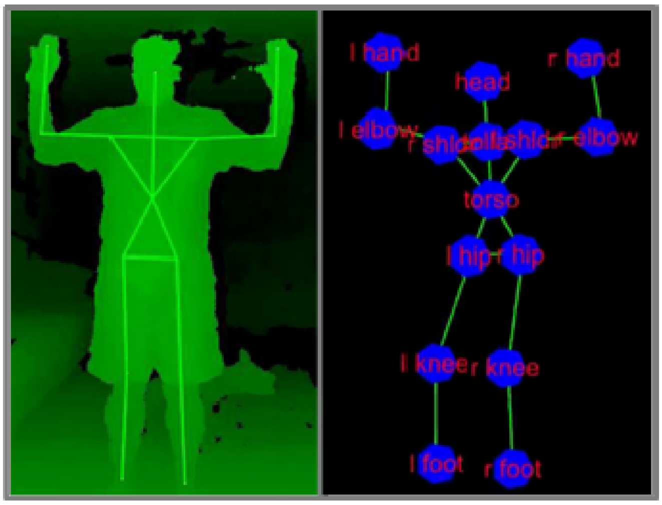

Figure 6. Kinect Motion Capture