



# Variable Compliance Joystick with Compensation Algorithms

(VA Reference No. 02-023)

*Joystick for improved control in the operation of electronic powered wheelchairs*

## Technology

Joystick for improved control in driving electronic powered wheelchairs

## Inventor

Rory Cooper, Ph.D.  
Songfeng Guo, Ph.D.  
Donald Spaeth, ABD, MA, ATP  
VA Pittsburgh Healthcare System

## Key Features

- Compensates for unwanted hand movement
- Mechanically configured to the user
- Limits unwanted motion

## Stage of Development

Reduced to practice with prototype systems developed

## Keywords

- Rehab/Assistive Device
- Electronic powered wheelchairs
  - Joystick
  - Software

## Patent Status

US Pat. Pub. No. 2005/0195166  
US Pat. App. No. 12/353,248  
PCT Pat. App. No.  
PCT/US03/27163

## Contact

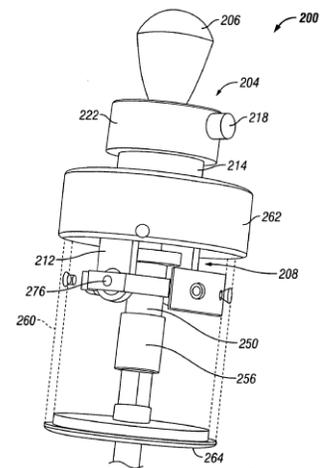
Ken Levin, Ph.D.  
Technology Transfer Program  
Department of Veterans Affairs  
Office of Research & Development  
(12TT)  
810 Vermont Avenue, NW  
Washington, DC 20420  
Phone: 202-461-1713  
Fax: 202-254-0460  
E-mail: [Ken.levin@va.gov](mailto:Ken.levin@va.gov)

## Technology

The Department of Veterans Affairs has developed an improved joystick for driving electronic powered wheelchairs (EPW) and for controlling additional rehabilitation technology.

## Description

The technology enables some of these patients to utilize joystick control by compensating for the unwanted hand movement and corresponding motion of the EPW. The isometric joystick developed by the VA contains an internal microcontroller with memory that uses compensatory algorithms to modify signals generated by the joystick forces on each strain gauge. The algorithms are used to filter and limit the unwanted motion. The joystick can be used in full isometric mode or in a variable compliance mode. The variable compliance mode provides tactile feedback that gives the operator an indication of joystick position, freeing the use of vision for maneuvering the wheelchair.



In addition, a wheelchair - driving simulator is used to customize software and mechanical parameters of the joystick to determine the optimal driving configuration. The simulator uses a computer-generated rendition of a wheelchair course that scores each driving task, enabling the therapist to determine the optimal mechanical and software configuration for the patient.

## Competitive Advantage

The customized joystick for use in EPW can be closely matched to the patient by use of the simulator to optimize software and hardware characteristics of the joystick.

This invention:

- Is mechanically configurable to best adapt to the user.
- Incorporates compensation algorithms to filter and limit the unwanted motion.

## Status

The Department of Veterans Affairs is looking for a partner for further development and commercialization of this technology through a license, and the VA inventors are available to collaborate with interested companies through a Cooperative Research and Development Agreement (CRADA).