Omni-Directional Mobile Platform for The Transportation of Heavy Objects

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"The more that you read, the more things you will know. The more that you learn, the more places you'll go."

Dr. Seuss

Abstract

As the cost of work related injuries continues to rise, it becomes more economically viable to employ robotic help in the workplace. This thesis details the development of a robotic platform for the purposes of aiding in the transportation of heavy objects, specifically hospital beds. Because in most workplaces space is at a premium, it is important for any device to be highly manoeuvrable. As anthropomorphic robots are not at a stage of providing this kind of service, a wheeled platform is the most cost effective option. To maximise the manoeuvrability of such a platform an omni-directional approach is advantageous.

Existing commercial products have been investigated and found to be lacking true omni-directional capabilities. These platforms also rely on lifting the beds, usually with large forklift like mechanisms that encumber bed attachment in small room.

Mecanum wheels have been used to achieve omni-directional movement for this platform. For Mecanum wheels to function correctly all four wheels must be individually powered and must maintain contact with the ground at all times. To achieve this, various suspension systems have been looked at with the most suitable being chosen. Various methods of speed feedback have been investigated and a sensorless method has been compared to a traditional quadrature encoder.

Motor drivers/controllers are necessary to enable the precise control of the motors which is essential for the omni-directional capabilities. Commercial drivers have been investigated but found to be inadequate for the purposes of this project. Therefore a motor driver has been developed, built and tested including the sensorless speed feedback system. The directional user input is handled by a joystick which is interpreted by a microcontroller. This microcontroller controls all the aspects of the platform including the motor drivers, LCD screen, an inclination sensor and another microcontroller for any possible add-on equipment.

The add-on equipment for this project is a bed attachment device. A headboard gripping system provides the most robust, compact and flexible system for bed attachment. A combined microcontroller and motor driver arrangement has been designed for the gripper. The gripper and the platform have been combined with a human interface and the system has been tested as a whole. The system has been fully tested in the lab and is awaiting clearance for field trials.

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