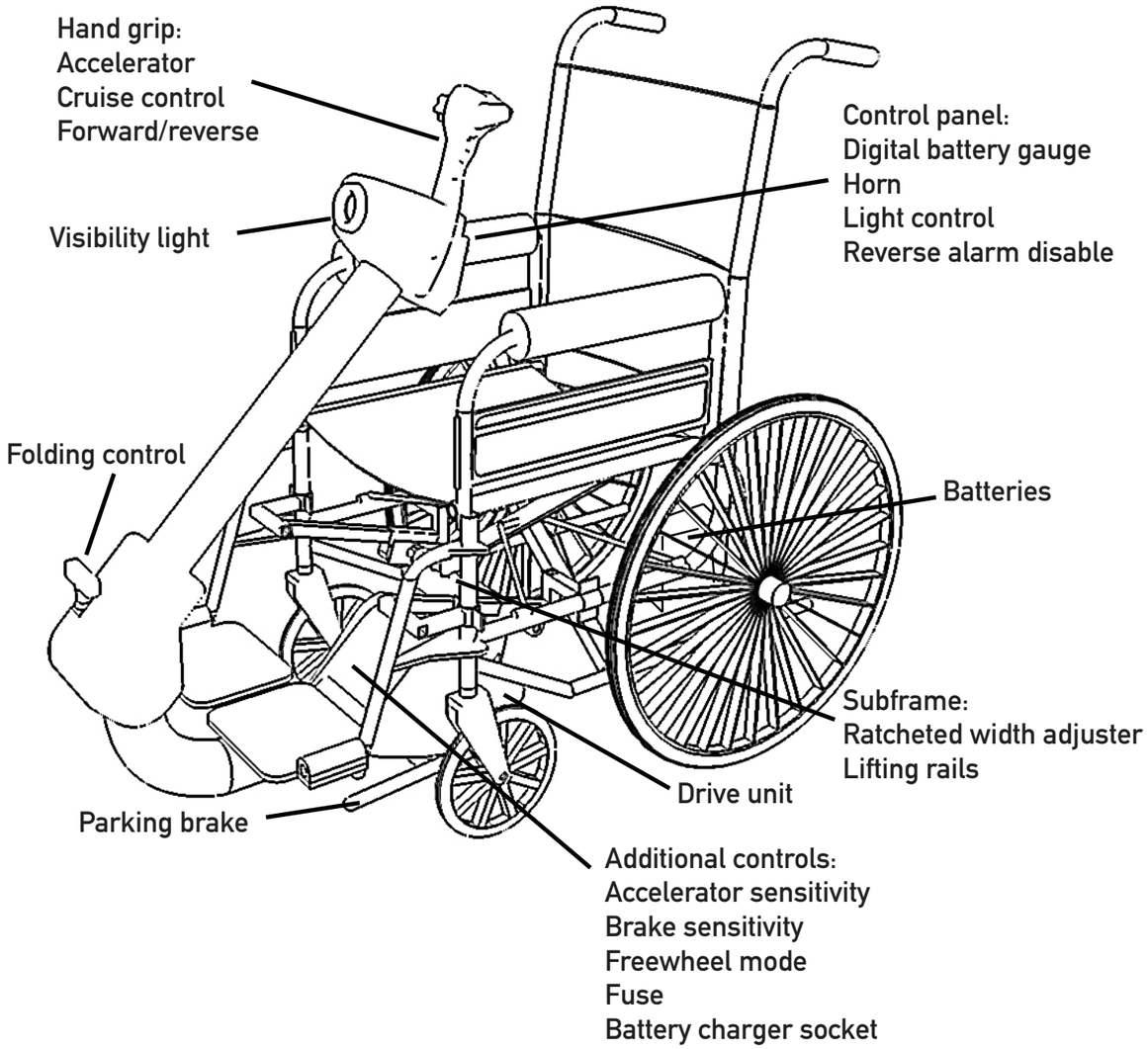

Typical installation on Remploy 8L wheelchair

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Wheelchair Drive

Wheelchair Drive

Electric wheelchairs are expensive and awkward to transport without a specially converted car. Many of the UK's 400,000 manual wheelchair users, both self-propelled and those dependent on an attendant or carer, could benefit from power assistance, but the expenses involved are prohibitive, with the result that the quality of life for many manual wheelchair users and their families is further impaired.

This project involves the development of a lightweight, detachable add-on unit, providing power, steering and braking at a lower cost. The unit is designed to fit around 70% of the UK's manual wheelchairs, including the vast majority of chairs used in hospitals; when detached, the chair can be folded normally for easy transportation, along with the unit itself.

An additional well-being benefit for users and carers is an end to the psychological isolation of being unable to carry on a normal side-by-side conversation: the design of the unit means that an attendant can walk alongside the chair, resulting in a much more pleasant experience for both parties.

Wheelchair users fall into many levels of need and ability, but an assistance unit such as this would be of benefit to a large proportion of users, and with both user control and attendant control modes, this would also ensure enough versatility to make it possible for a single unit to be swapped between chairs of users with very different capabilities-for example in a hospital or nursing home.

Prototypes built so far have tested a range of configurations and motor/drive systems, including advanced, high-efficiency brushless motors, high-torque hub motors and regenerative braking to conserve battery life; battery technology is also, of course, an ongoing area of research. A cruise control system allows the user or attendant to set the maximum desired speed-perhaps the walking pace of a friend or companion-up to the legal maximum of 4 mph for a 'vehicle' of this class. Another development is the ability for a wheelchair user him/herself to fit the drive unit in situ, whilst in the chair, thus ensuring complete independence.

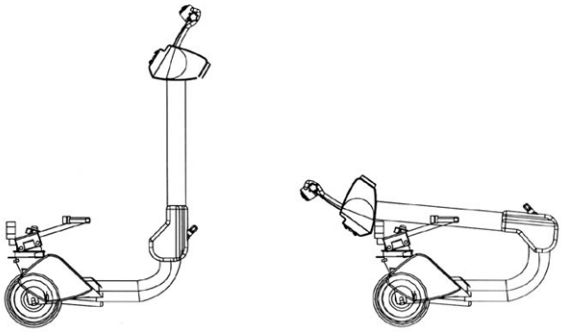
The market in more detail

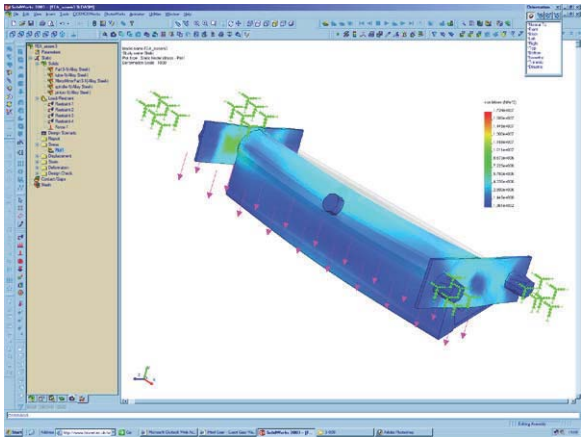
Institutional customers such as hospitals, nursing homes and even supermarkets, airports and exhibition centres may be a sensible group to target, since the versatility and flexibility of the product would allow short-term users with many different needs and abilities to benefit. The ability to swap from user-controlled (independent) mode to attendant control means that a variety of users can be accommodated. The unit could even be quickly attached to users' own chairs when they arrive at, for example, an exhibition centre with steep ramps where assistance would be useful.

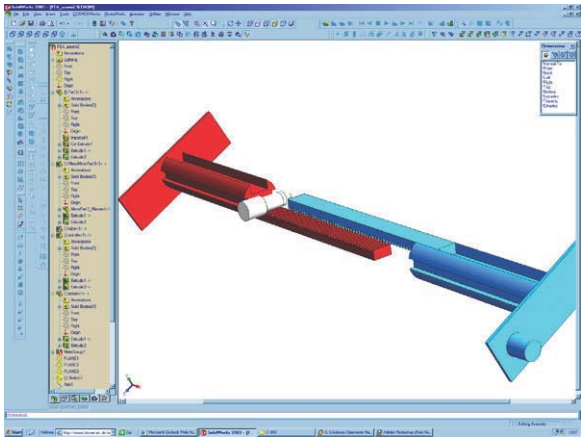
In terms of the users themselves, people requiring an attendant may include the elderly and frail, and stroke victims (the unit is not designed for heavily dependent users who may currently use, for example, a powerchair controlled by a carer). More independent users who would benefit include C7-8 tetraplegics, T1-12, L1-5 and S1-2 paraplegics, users with muscular conditions (MS, muscular dystrophy, cerebral palsy), amputees, users for whom a mobility scooter does not offer the stability desired, and temporary wheelchair users, such as those recovering from accidents. Occupational therapists would advise users on the suitability of the device-it would thus be important to have it included in the Disabled Living Foundation's Hamilton Index, the major reference for disability products and aids.

Future

The aim is to develop the prototype to a stage where it is suitable for rigorous user testing and demonstration to occupational therapists and potential retailers or manufacturers, involving costs in terms of materials and components, along with the use of workshop facilities. It is intended that manufacturing and sales of the finished product would be undertaken by companies with facilities and a customer base in this area, or similar; whether this comes through outright sale of the design, or through licensing, will depend on the progress that can be made towards a viable prototype.







Product specification (based on most recent prototype)

Electric motor drive to fit common wheelchair types and sizes, offering power, steering and braking

- Provides variable speed drive up to 4 mph (legal maximum) - set by the user or attendant (cruise control style)
- Allows wheelchair to climb & descend ramps, lowered kerbs & reasonable gradients safely
- Allows wheelchair to manœuvre easily - ideally to turn 'on a sixpence'
- Controllable easily and safely by wheelchair user or an attendant
- Controllable using one hand only, even by attendant
- Controllable by attendant walking alongside chair, alleviating feeling of isolation
- Can be used occasionally or continuously to suit the user
- Easy to remove and reattach
- Can be transferred between different chairs
- Quiet, smooth operation which will not draw unfavourable attention
- Freewheel function
- Parking brake
- Automatic reversing alarm with half-speed reversing for safety
- 24V, 260W Assembled Products Corporation XTi hub motor with internal 22: 1 epicyclic gearbox; 29 lbf ft stall torque
- 4QD NCC-70-24V Mk. II pulse-width modulated reversing controller incorporating regenerative braking function with current limiter
- 2 × 12 V, 10 A hr Yuasa/Ronway/McNair-type sealed gel lead acid motorcycle batteries
- Will propel a standard Remploy 8L wheelchair, with total load of 15 stone (user plus shopping bags), at 2 mph constant speed, up 1 in 7 slope
- Compliance with BS 6935 / ISO 7176 series
- Planned retail ~ £600

Competitors

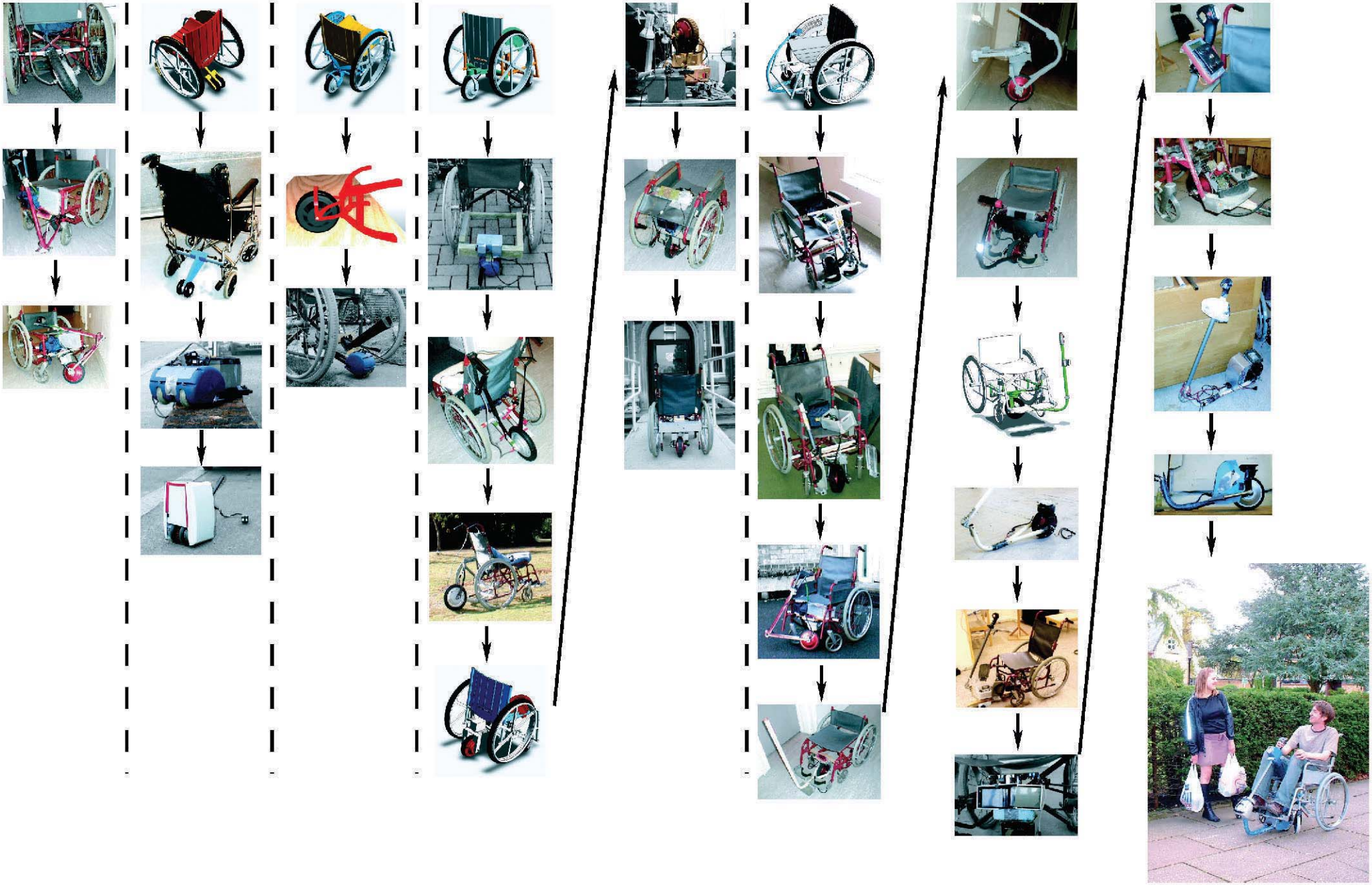
There is nothing on the market in the UK or overseas that shares all the features of the specification in a low-cost package, although there are a number of products which are intended as power assists for attendants (no steering or braking) and some advanced user-controlled power drives are making headway in countries where there is widespread medical insurance, but the costs (£3,000+) are too high for the UK where most such products are bought through the NHS.

Extensive investigations have been carried out, with trials of most of the devices on the UK market, discussions with occupational therapists and mobility specialists and thorough patent searches. It's worth noting that some 'competitors' may be useful partners in terms of bringing this device to market, since this offers a different feature set to their own products. Companies which already utilise sheet metal forming and injection-moulding in their production processes and also have good links in the mobility industry (such as TGA Electric Leisure of Suffolk-manufacturers of some innovative mobility scooters and an attendant-only power assist) may be worthwhile to target.

Background

Dan Lockton is a design engineer, currently undertaking a Cambridge-MIT Institute programme in Technology Policy at the University of Cambridge; he previously studied Industrial Design Engineering at Brunel University. He has particular interest in the field of lightweight transport, having worked for Sinclair Research and Hong Kong's Daka Development on the forthcoming A-Bike (the world's lightest folding adult bicycle), and the SeaDoo Sea Scooter, as well as some lightweight electric vehicles still under development. Experience in the mobility field comes through work (design, user testing, exhibitions) on the Sinclair/Daka ZA20 attendant wheelchair assistance unit-and, directly, through time spent with relatives who use wheelchairs; he has also worked as a product designer for London-based Mayhem UK, a 'gadget' company supplying Argos, Halfords, Gadget Shop, Science Museum and overseas markets as well as charities such as DebRA and Mencap.

Dan is the author of Rebel Without Applause, a history of the Reliant Motor Company (Bookmarque, 2003, ISBN 1870519647), co-editor of Good Thinking, a directory of young product designers and engineers (Nuffield Press/Brunel University, 2004, ISBN 190231641X) and an organiser of the accompanying show, the UK's largest student-run design event.



Evolution of the design through prototype development, ranging from rear-wheel steered devices to current ‘scooter style’ front-mounted unit