Spotlight on
Electronic Technology for Independent Living
How technology can assist disabled and older people

Most of us would not think twice about answering the door when the bell rings and communicating immediately with the visitor. But for some elderly or disabled people these seemingly simple tasks are very difficult, or even impossible, due to impaired mobility or speech. To help combat problems like this, scientists have developed electronic environmental control systems that enable remote operation of front doors and hands-free telephones as well as other household objects and devices like televisions and curtains. Communication aids incorporating synthesised or recorded speech are also available for anyone unable to communicate normally due to physical or mental impairment.

An ability to operate household appliances and communicate readily can greatly enhance the quality of life for disabled and elderly people, and with a carefully chosen electronic solution they can become more independent, reducing or even dispensing with the need for care. Equally important for disabled people unable to use a keyboard or mouse is specialist equipment and software that allows access to computer technology. This can not only facilitate education at all levels, but also enables as wide a range of employment options as possible.

In order to cope with an ageing population and provide solutions for a broader range of disabled people, there is ongoing research into new methods of interaction with computers, and improving existing environmental control systems and communication aids (see figure caption on opposite page). In addition, Telehealth - which can electronically monitor vital signs such as blood pressure and heart rate and feed the results from patients at home to clinicians - looks set to become an integral part of healthcare in the UK, enabling quicker hospital discharges for some patients and less hospital visits for others.

Telecare technology, which acts as an extension of the widely used alarm systems that elderly people can activate for assistance, is already being piloted in the UK. Telecare involves placing wireless sensors around the home and creating a type of ‘smart’ house that can detect, for example, whether the fridge door has been opened during the day, or whether the bed has been slept in. The sensors are monitored by equipment in the user’s home that is programmed to make an emergency call when worrying changes in normal patterns of behaviour are detected.

Since needs vary widely, potential users of electronic assistive technology (EAT) must be assessed by expert staff such as clinical scientists or rehabilitation specialists. In order to provide the best solution to any difficulties, the physical abilities of the user need to be taken into account along with their cognitive abilities and motivation to use an assistive device. The assessor also has to ensure users with progressive diseases such as Motor Neurone Disease are provided with technology that can cope with changes in their needs as their condition deteriorates.

Environmental control systems (see top left) work on the same principle as a standard TV remote control as they send out infra red (IR) signals to switch household devices on and off. They can also emit radio signals to operate alarms and pagers. Some devices like stereos, televisions and even gas fires already have IR control systems because remote operation is an integral part of their design. Other devices such as table lamps need to have a type of ‘smart’ plug fitted to them in order to be operated by an environmental controller.

Individual options on an environmental controller, such as opening up an intercom to the front door, are selected either by pressing buttons on the controller itself or by activating a separate switch connected to the controller. In the latter case, this starts an automatic scanning process in which each option is highlighted in turn, and the user waits until their choice is being highlighted and activates the switch again to make their selection. A variety of separate switches are available, two of which are shown on the left. Although some types of switch need to be pressed, others are designed to accept alternative methods of activation such as sucking or puffing, or eye-blinks. Where a user has visual impairments or cognitive issues, environmental controllers that give an audible indication of which option is being highlighted can be provided.

Some environmental controllers have a permanent screen display, but if more than about 30 control options are required systems incorporating display screens that work in the same way as flat panel computer monitors - and so can change what they are displaying - are recommended. These
Brain injuries, cerebral palsy, Motor Neurone Disease, Parkinson’s Disease and Multiple Sclerosis can all cause a speech disorder known as dysarthria. This often impairs speech to the point where it is unintelligible to the untrained ear, making communication in the workplace, education and social environments extremely difficult for anyone with the condition. Many people with dysarthria use a communication aid that converts manual inputs such as typed text, or selection of pre-stored words, into a synthesized electronic voice. Although effective, these systems can be slow and cumbersome so Barnsley Hospital NHS Foundation Trust, in collaboration with the University of Sheffield, is developing a new type of communication aid that converts impaired speech directly into intelligible synthesized speech. Not only could this allow the user to hold a more natural conversation - in terms of both pace and the ability to maintain eye contact - but the voice output could also be used to operate a PC or control household devices. This picture shows Research Associate Peter O’Neill with a mock-up of the communication aid, which the team plans to build into easily portable existing hardware such as the PDA shown here.

Most communication aids consist of a screen and some sort of interface in the form of a keyboard or switch that allows the user to either type whatever they wish the synthesized voice to say, or select pre-stored letters, words or phrases. Some systems incorporate predictive text generation, which is commonly used on mobile phones, and saves the user from having to input lengthy commands for regularly used phrases and sentences.

Some clinical conditions, for example stroke and head injuries, can leave people with a reduced understanding of language and an inability to recognise words. In cases like this, aids that display common phrases and words in picture form (see left image on front cover) are prescribed. Each symbol can have multiple meanings, which will change depending on the context.

Telecare, Telemedicine and Telehealth Systems

By the middle of this century, the number of people in the UK over 75 years of age is expected to be approximately two-and-a-half times the current figure, so the Government has recently made £80 million available via its Preventative Technology Grant for developing Telecare services.

Telecare systems can include fully automatic gas, flood, smoke, high and low temperature, and motion detectors, along with sensors that can monitor whether internal or external doors have been opened, or if there is the weight of a person on a bed. Data is transmitted from the wireless sensors fitted around the user’s home to an electronic device that links their home via a telephone line to a control centre. By programming the system to look for certain changes in normal patterns of behaviour, such as the fact the bed has not been returned to after a night-time trip to the bathroom, an emergency call can be sent automatically to the centre.

Telemedicine and Telehealth systems, which are already in use overseas, are also likely to be instigated in the UK. These systems encompass remote monitoring of patients’ vital signs, education at a distance for healthcare professionals, and electronic transferral of confidential patient information between healthcare institutions. They also enable examinations by specialists to take place over an Internet link from a GP surgery. In Norway for example, some dermatology patients can have their skin problems digitally photographed by their GP, who sends the image within an electronic referral to a specialist. If necessary a videoconferencing link can then be used for a consultation that allows both patient and GP to be present to answer the dermatologist’s questions, and saves the patient from having to travel long distances for the appointment.

New developments

Manufacturers are starting to produce systems that combine environmental control and communication functions within a single device. Separate manufacturers are also joining forces to combine Telecare with environmental control so all users can access the emergency alarm facility, and problems with the operation of household devices and doors can be automatically reported to the Telecare control centre. Further safety features under development include an automatic response to the detection of dangerous levels of carbon monoxide in the home. This response would involve not only raising an alarm at the Telecare control centre and in the client’s home, but would open windows automatically to reduce the danger level.

Robot aids, such as hands that can grasp a drink, or even carry out more sophisticated mechanical tasks like making a cup of tea, are another area of research both in the UK and internationally. Technology aimed at the older market, such as telephones with large buttons, is also increasingly being used to help younger disabled people.
Electronic assistive technology is facilitating the transfer of healthcare services into the community and has an important role to play in preventative healthcare nationally. In the future the need for Telecare and Telehealth will increase due to the ageing UK population. The number of disabled people who can benefit from other forms of electronic assistive technology is also on the rise, and at present the provision of these technologies varies from region to region. Experts agree that there needs to be better and more uniform access to equipment and specialist services throughout the UK, and suggest that existing centres - where expertise has been built up over many years - should be expanded. The work carried out by these centres also needs to be widely publicised so that both potential service users and health care professionals have a greater awareness of the help available.

Future provision

As different types of assistive technology become integrated, and improvements in existing equipment allow more complex needs to be addressed, multi-agency, multidisciplinary staff training will become essential. For maximum benefit to be gained from any technological developments, increased co-ordination between physicians, speech and occupational therapists, educationalists, carers, and healthcare scientists specialising in assistive technology, will also be required.

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