

Carebots in the Community

Colin Jervis, Director Kinetic Consulting Ltd. and Healthcare and Public Sector Consultant says Carebots, or caring robots, could soon provide support to the NHS as the UK's elderly population grows.

By 2050 one in four of those living in the UK will be over the age of 65. Many of these will sooner or later require chronic care, placing increased demands on an already stretched NHS. To meet this challenge, healthcare and local authority services will need to reconfigure by placing greater emphasis on community care and the effective use of technology. One such technology is robotics.



Clinical Research Fellow and Specialist Registrar Parv Sains is working with Professor Sir Ara Darzi at Imperial College, St Mary's Hospital, Paddington to explore the potential of integrating robotics into medicine and surgical care. His study involves working with In Touch Health's RP (remote presence) 6 robot.

The RP6, which resembles a large vacuum cleaner base carrying a monitor and a camera, is able to mimic the head movements of humans in conversation, helping make face-to-monitor contact with the patient more intuitive. Two-way audiovisuals allow patient and consultant to talk normally - a factor which Mr Sains sees as critical to patient acceptance.

A carebot must be easy to control to allow the caregiver to concentrate on the patient. The RP6, he says, is guided from a console using a joystick and the onboard camera. To prevent collisions, it has sensors at ankle and knee level that allow it to thread its way around objects and staff - though some hospital tables can present a challenge.

The RP6 operates over a secure broadband Internet connection using the 802.11g wireless protocol, preferably operating in both directions at 650Kbps. This enables 25 frames per second video display - equivalent to VHS. Video quality falls off with slower, asymmetric connections.

Mobility differentiates remote presence from existing telecare applications. "Telemedicine hasn't traditionally been very patient centric. For instance, it is not convenient for a patient with abdominal pain to be traipsed on a bed into a teleconference room", explains Mr Sains. "With a robot, though, you can visit that patient on a ward, making the process less disruptive for them."

The overall benefits of the RP6 are yet to be assessed, but it may support earlier patient

discharge and better use of doctors' time. Mr Sains thinks it is feasible for the RP6 to be deployed in the homes of the elderly and chronically ill, though costs, benefits and definite advantages over fixed telemedicine systems would have to be demonstrated.

Japan's population is the most rapidly ageing in the world: 30 million people, accounting for 25% of the population, are over the age of 65. Fortunately, its robots have progressed since the mechanical tea-serving robots or *karakuri* entertained the Victorians. It now has about 44% of the world's industrial robots and is applying its expertise to healthcare.

At a high-tech care home in Kourien, western Japan, robot bears watch over the elderly residents.' The bears monitor patients' response times to questions and to performing various tasks. The soft exterior packs hardware, including a microcomputer connected to the local area network.



Japan's University of Tsukuba at Sankai has developed an exoskeleton called HAL (hybrid assistive limb) 5 that can enable a person barely able to perform an 80kg leg press to do a leg press of 180kg.'

Looking like a suit of armour, HAL 5 uses nerve signals to trigger motors to assist movement. The prototype suit weighs about 15kg, but the heel section bears a high proportion of the weight. HAL 5 could give patients more mobility and help caregivers to lift and move them safely.

Though about 15 years from deployment in healthcare, Honda's ASIMO (advanced step in innovative mobility) is one of the most advanced bipedal robots in the world.

"ASIMO has been created as a new form of mobility. In the long term, it should allow you to execute a task without having to move yourself", says William de Braekeleer of Honda Motor Europe Ltd.

"We see ASIMO as an aid to the nurses, taking care of the heavy aspects of their tasks, allowing them to spend more time with the patient."

Assessment and future use

Robots could assist the elderly and chronically ill in four main ways:

- by making up for cognitive decline (for example, reminding patients to drink, take a medicine or to attend an appointment). Elderly people often need to take multiple medications and noncompliance frequently leads to problems;
- by enabling patients and caregivers to interact more effectively, thereby reducing the frequency of personal visits required;
- by collecting data and monitoring patients, some emergencies (such as heart failure and high blood-sugar levels) could be avoided; and
- by assisting people with domestic tasks - many give up independent living because arthritis leaves them unable to cook, clean or work the washing machine or the microwave.

Most robots work in factories, warehouses and laboratories. They are not yet the walking, talking, intelligent machines of the movies, as even the most powerful computers cannot match the human brain. Nonetheless, three types of healthcare robots are evolving: operational, humanoid and miniature.

Remotely operated operational robots like the Da Vinci are now being routinely used in hospitals like St Mary's, Paddington to perform urological, cardiac and gastrointestinal surgery, as well as for teaching.

Humanoid robots like ASIMO are learning human skills: "The long-term objective for our engineers", explains Honda's William De Braekeleer, "is to create a robot able to help people in their daily lives. It must be able to operate in our environment. So that is why ASIMO has been developed to walk and move just like us."

Miniature robots or nanobots may seem like science fiction, but maybe one day they could be released into our bodies to maintain and repair them. As Stephen Spielberg said: "There is no such thing as science fiction, only science eventuality."

Compared with humans, robots may be quicker to train, cheaper to maintain, easier to refuel and repair and less prone to be bored by repetitive tasks. They could help the elderly and chronically ill to remain independent, reducing the need for carers and the demand for care homes. Perhaps ageing baby boomers may be the real driver for robot development.

References

1. Baltus G, Fox D, et al. Towards personal service robots for the elderly. Computer Science and Robotics. Carnegie Mellon University. <http://www.cs.cmu.edu/~nursebot>.

The picture of the RP6 in action is by kind permission of Imperial College, St. Mary's Hospital, Paddington, London UK.

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