

Service robots at residential care facilities

How technical assistive systems can improve the quality of work

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The impacts of demographic change are becoming especially noticeable in the area of inpatient/residential care (care homes for the elderly and hospitals). While the number of people in need of care is growing, the age of the staff is continuing to rise. Many workers leave the profession early because of the high physical and psychological demands. These high levels of stress are reflected in an average 25 days' sick leave per year and frequent interruptions in work. Service robots can help to relieve the pressure on care staff with regard to both time and physical effort, thereby contributing to improved working conditions.

There are significant consequences from the acute shortage of personnel and resultant lack of time: care staff's capacity is being pushed to its limits. There is often insufficient time for extensive interaction with patients/residents. Therefore, to enable themselves to spend more time with patients/residents, care staff would welcome assistance with their routine day-to-day activities, such as transport tasks and documentation. In interviews with experts, care workers have expressed the need for new assistive systems that also help to reduce their physical workload – especially in relation to the lifting of persons. In addition, it would be helpful if such systems could support and promote the independence of patients/residents.

Logistical helpers

If laundry or food is transported by a robot, this allows care staff to spend more time with patients/residents. While the use of transport robots is already commonplace in large hospitals (with over 600 beds), their economical deployment has, to date, not been possible in smaller hospitals and care homes. To fill this gap, in the research project "WiMi-Care" the CASERO 3 driverless transport vehicle has been developed by MLR System GmbH. Especially small and versatile, the robot is able, for example, to independently pick up and transport laundry containers. Thus, the products can be brought another step closer to the location of use in the patients'/residents' rooms with the robot supporting the so-called "last mile" of the delivery process.



Figures: CASERO used to transport containers in an elderly care facility.

In addition, CASERO 3 can assist care workers on night shift by carrying out patrols for them. If it finds a patient or resident wandering about, it notifies a member of staff.

Automatic provisioning of care utensils

Based on the experience gained with CASERO 3, further research in the “SeRoDi” project has resulted in the concept of an intelligent care cart for automatically providing care staff with the necessary care utensils and also documenting their use. An electronic care management system allows care plans to be displayed on the cart during rounds. Once performed, care activities are quickly and simply documented. In addition, the care cart can be independently restocked in an automated storeroom. This not only saves time, but also reduces the number of storerooms on wards, thus avoiding the stocking of unnecessary care utensils.

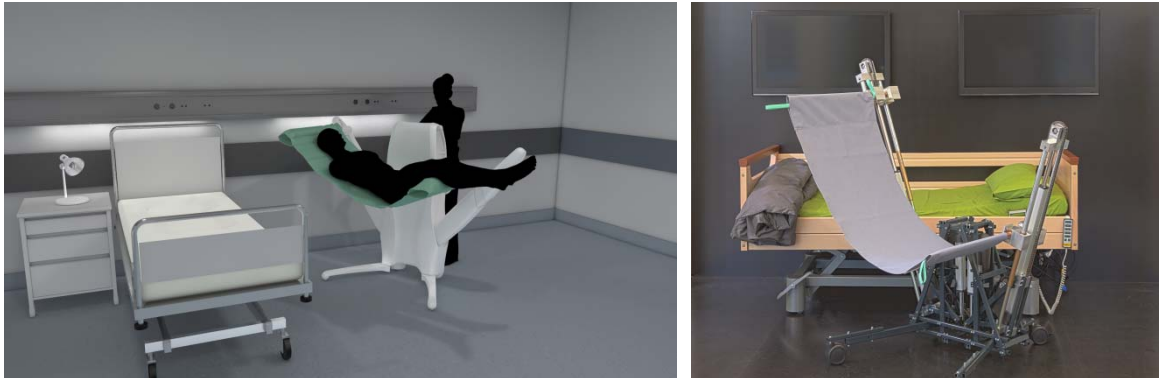


Figures: Intelligent care cart in use, touch screen-based documentation of used utensils

Support with lifting and moving patients/residents

Whether lifting a patient/resident to change the bed linen, moving them to a wheelchair or bathing them: lifting and moving is an elementary part of the care staff’s day-to-day work and can cause them to suffer health problems early on in their career. These activities have conventionally required the use of various person lifts, such as overhead lifts, belt lifts and bath lifts. However, such equipment is suitable only for particular situations and is not always readily available. Frequently, it must first be fetched from another room. To save time, therefore, patients/residents are often moved manually, which, in turn, increases the physical workload of the care staff. For this reason, Fraunhofer IPA has developed the “Elevon” concept, which comprises a new multifunctional lifter equipped with additional assistive features. For example, the care worker is able to electronically summon the lifter, which thereupon makes its own way to where it is needed. It can also simplify lifting a patient/resident. Using sensors, the lifter automatically detects the person who needs moving and can therefore suitably position its lifting system.

Alternative approaches work with body-worn robot systems, so-called “exoskeletons”. In a medical context, these are already used for rehabilitation and also to compensate for disabilities. Similar systems could equally well be employed to assist care staff in physically stressful activities. Using sensors and drives, they reduce the force required and warn staff against ergonomically inadvisable movements. As in all other areas of application, the role of the robot is exclusively an assistive one, for only a human is able to assess whether a person is lying correctly or whether they are in pain.



Figures: Concept and mechanical prototype of robotic lifter “Elevon”

Offering drinks to residents

In addition to service robots interacting primarily with care staff, also service robots for direct interaction with residents can be a relief. These robots can be especially useful in times when the staff is occupied with caring for the patients/residents in their rooms. In order to avoid dehydration, it is especially important for elderly residents in care homes to be offered a drink at regular intervals. Such an activity, however, is highly time-consuming for the care staff. This is where an autonomous robot can be of assistance. In the research project “WiMi-Care”, this scenario has been successfully evaluated in a residential care setting using the robot assistant Care-O-bot 3. By connecting to a database containing the residents’ details, the robot was able to identify and selectively address individual residents and offer them a drink if they had not drunk enough.



Figures: Care-O-bot fetching water from a water dispenser and offering it to a resident

In the currently-running research project “SeRoDi” this application is being transferred to a specialized, close-to-product robot system. The robotic ServiceAssistant can be filled with several drink, yogurt, or snack-laden trays. The nursing staff only needs to fill the robot with the loaded trays, after that the robot is capable of independently serving the residents in the common rooms of a floor. The robot is programmed to have a neutral “nature” and this will not change based on the residents’ mood. This means that the robot remains consistent and predictably calm also in situations that may frustrate people (i.e. having to consistently answer the same questions asked by patients with dementia).



Figures: The robotic ServiceAssistant serving a drink, the robot is easy to fill with trays

Another possible field of application in which the robot would have direct interactions with patients/residents and possibly also visitors at a care home or hospital, is personal guidance. In this field, there are already products in use. Fraunhofer's Care-O-bot®4 is currently deployed as "digital employee" Paul in several Saturn markets. The robot greets customers at the entrance, asks what products they are interested in and leads them to the appropriate shelf. It can recognize its environment as well as orient itself and move freely therein. Dialogues with customers are possible due to a speech-recognition software. Possible application of Care-O-bot®4 as a guide in care homes or hospitals has recently come into discussion. In these environments the robot could be able to, for example, bring patients from the reception or their ward to different outpatient clinics or treatment rooms.



Figures: Shopping assistant "Paul" can also be deployed in clinics or nursing homes

Outlook

At a time when skilled staff are in short supply, it is imperative to give consideration to the use of assistive systems in the care sector. Service robots can make a significant contribution to relieving the pressure on care staff. Although each of the robot systems so far used in real-world applications has been a prototype, it can be predicted that the first products for this area of application will be made available in the coming years – e.g. transport robots or assistive systems equipped with robotic functions and easy-to-use control interfaces. In all cases, these systems are controlled and used by humans. It is not the intention that robots should independently administer care to patients/residents or make their own decisions. Humanity and intuition are key elements of a care professional’s job profile, and they can and will never be delivered by a robot. However, what robots can do is to free up care staff to spend more time with patients/residents. In addition, state-of-the-art assistive systems can reduce the level of physical stress and generally upgrade the care profession – an important prerequisite for staff retention and recruitment: so that all those who feel the calling to care for others are able to enjoy a long career in this profession.

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