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Nursing-Care Assistant Robots and Relevant Research in RTC

Toshiharu MUKAI[a], Shijie GUO[b] , Shigeyuki HOSOE[a]

[a] *RTC, Advanced Science Institute, RIKEN*
[b] *New Business Research and Development Laboratories, Tokai Rubber Industries*
E-mail: tosh@nagoya.riken.jp

With a record-low birthrate and a rapidly-growing elderly population, Japan faces severe demographic challenges, compounded by a chronic lack of nursing care staff. We, RIKEN and Tokai Rubber Industries (TRI), launched RIKEN-TRI Collaboration Center for Human-Interactive Robot Research (RTC) in 2007 to tackle such problems, by cooperatively developing nursing-care assistant robots and its relevant research.

Among nursing care services, patient transfer is one of the most physically taxing tasks. To free caregivers from such physical work, we have so far developed two prototype robots, RIBA [1] and RIBA-II (**Fig. 1**), with human-type arms, designed to interact directly with patients and carry out patient transfer tasks. The robots possess a number of unique features: tactile sensors covering a wide area of its surfaces to detect contact with patients and/or caregivers, the ability to use their full body to lift and move patients, a human-robot interface that makes it easy to issue instructions to the robot by touch, a high power-to-weight ratio (as high as 1:3), and a soft exterior covering the body and joints, guaranteeing safety. RIBA succeeded in transferring a human between a bed and a wheelchair using human-type arms. The maximum weight of the lifted human was 63 kg. Its successor, RIBA-II, is with more improved abilities. It can lift up a human lying on the floor and transfer him or her to a bed or a wheelchair, and vice versa. This is needed because there are patients in nursing-care facilities who sleep on floor-level mattresses to avoid injury from falling. RIBA-II can transfer a human of up to 80kg.

Through the development of these robots, we have carried out relevant research and developed new technologies. Among them, Smart Rubber (SR) sensor [2] (**Fig. 2**), a rubber-based flexible tactile sensor, is important. It detects contact position and pressure as the change of capacitance of its cells composed of the upper and lower rubber-based electrodes. SR sensors are suitable for nursing-care robots and apparatus, because it is soft, flexible, and even stretchable. One of its applications is to put SR sensors on a bed and monitor pressure distribution of a bedridden patient (**Fig. 3**), to predict and prevent bedsore.

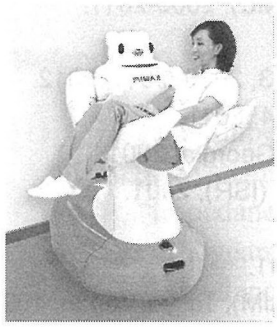

Fig. 1. RIBA-II

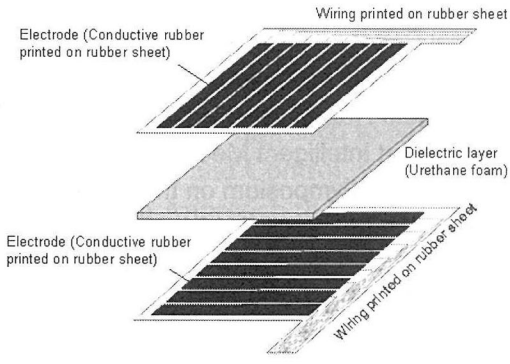

Fig. 2. SR sensor

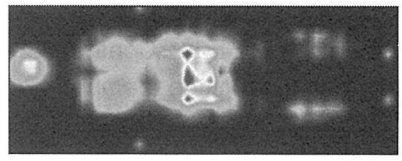

Fig. 3. Body pressure distribution detected by a SR sensor

References

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