Acceptance of Robots in Nursing Environment – Proposed Design of Questionnaire for Nurses

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***Abstract*— Robotics and AI offer many opportunities to make nursing work easier. Those receiving care must accept this support, but it must also fit into the processes of professional care. In this first study, we present the variety of robots and suggest questions for nurses to determine their needs.**

Keywords—social robot, technology acceptance, healthcare

I. Introduction

The health care facilities are experiencing significant staffing shortages, leading to desire for relief for the nursing staff who have a demanding job. The integration of artificial intelligence (AI) and robotics in healthcare is expected to potentially reduce some of the workload but also requiring adaptation to new roles and technologies. At the moment, care robots are mostly still prototypes in research and development that cannot yet meet the high demands of care [1]. Robots in care facilities or hospitals take on the task of transporting medication or documents, serving food or drinks, and can help to explain the course of illnesses or therapies. Therapy robots are used by those being cared for and are therefore also an issue for nursing staff.

The following section presents the variety of robots in the care environment. To get an impression of the possible applications, examples of service robots, so-called companions and therapy robots are presented. The topics for the survey of nursing staff on the acceptance of robots in the work environment are then presented. The topics are derived from the Almere model [2], which was created for the assessment of assistive robots.

This study is the preparation for the survey of nursing staff in German-speaking countries in order to systematically record the requirements for nursing robots and their integration into the nursing processes.

II. Robots in Care Environment

Social Assistive Robots (SARs) are a current trend to increase the acceptance of robots in care [3]. Service robots also offer a human-machine interface, that is intended to arouse emotions or even recognize human emotions and can react to them. We differentiate between service robots, companions and therapy robots, with all three types only affecting a small part of care or peripheral areas. The following selection provides an overview of the variety of robot systems that can be found in households and care facilities (cf. Fig.1).

- Plato [4] is a commercial, mobile cobiot that is offered in restaurants and hotels, but also in care facilities. Food or other materials can be transported on several floors. The destinations for transport can be specified using voice commands. Navigation is autonomous. With a height of just under 1.12 m and a tablet on which eyes are animated, the robot appears friendly to guests and staff.
- Pepper [5] is a 1.20 m tall, humanoid robot system on wheels, which is characterized by a slim, almost elegant figure. A variety of sensors, touch sensors, as well as sensors for locating sounds and the distance to the communication partners allow communication to be appropriate to the situation. The robot system moves its head and eyes in the direction of a conversation partner. With a large display on the upper body, the system can offer entertainment, therapy, information or training with images and videos.
- PIO [6] is a robot designed to look like a parrot. It is designed to support people with dementia. Its functions are powered by artificial intelligence. The program begins with the robot hatching from an egg and continues with the need to care for the “baby” by calming it when it cries, feeding it, dressing it, and putting it to sleep. PIO also offers functions such as encouraging gymnastics, going shopping or playing games.

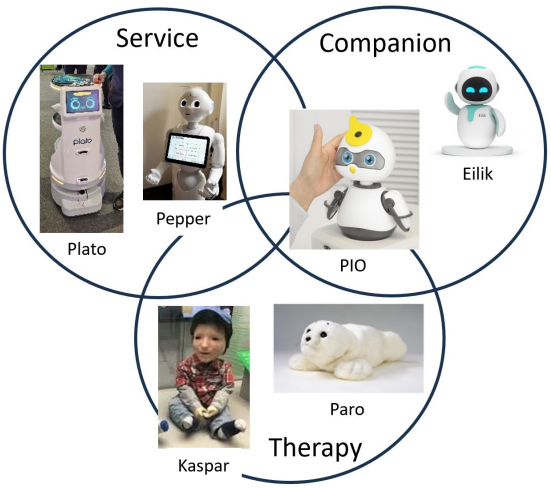

Fig. 1. Overview about variety of assistive social robots in care environment

- Eilik [7] is a small (10.8 cm), non-mobile robot that simulates its own character and, as a toy, provides entertainment with simple games and music. Artificial intelligence allows interaction between

different Eiliks. This new robot serves as an example of intelligent technology that can be used to combat loneliness.

- Paro: This social robot system is based on a baby seal. The robot is used, for example, in the treatment of patients with dementia [8]. The robot system can move its tail and eyes and use touch sensors to sense when it is being stroked, when someone is talking to it, or when it is turned upside down. The reactions to the interaction are reminiscent of a real baby seal, with animal sounds being reproduced via a loudspeaker. Its behavior patterns are both proactive, i.e. acting independently, making movements and playing sounds, and reactive. In addition, PARO is subject to a rhythm, gets tired about every 15 minutes and is not active at night.
- Kaspar is a child-sized humanoid robot with a silicone face mask. The system has 17 degrees of freedom, allowing movements of the torso, arms, head, mouth and eyes. Facial expressions and gestures are highly simplified compared to human communication. This simplified emotional expression of Kaspar makes the system easy to interpret for children with autism spectrum disorder (ASD). Kaspar can also respond to touch. Training sessions with Kaspar can improve collaboration and cooperation with autistic children [9].

The selection shown does not cover all the important properties of the SARs. The size, the possible load-bearing capacity of the hands and the dexterity of the hands or actuators are crucial properties. Other robots offer teleservices like the experimental robot GARMI. It offers remote treatment and telemedicine [10]. The robot Lio uses UV light for disinfection [11] and some robots can vary their height or range.

Together with robotic devices used to assist people with mobility restrictions and paralysis (e.g. robotic wheelchairs or robotic arms), this results in a wide variety of robots that caregivers may encounter or use in their professional activities.

III. Design of Questionnaire

The number and variety in the robot systems that can play a role in care make it difficult to ask about acceptance. The actual care services are also still limited, as physically demanding tasks such as lifting or washing patients are not covered by current robots. Tasks that require a lot of sensitivity, such as wound care, are not yet offered. Most acceptance studies relate to a specific type of robot system and its use by the people being cared for. In order to relieve the burden on nursing staff, robot systems must be integrated into the nursing processes. This requires nursing staff to understand the functions and limits of their use. This is why the questionnaire described below is aimed at nursing staff.

The Almere Model is used in the literature to determine the acceptance of assistive robots among those requiring care, e.g. for the robot GARMI [12] The categories described there form a good framework for the assessment of care robots. The questions have been adapted to the situation of professional caregivers.

Table 1 Questions derived from Almere Model

Code	Construct	Question
		I agree that…
ANX	Anxiety	.. today's robots cannot hurt anyone
		.. robots cannot be damaged by me
ATT	Attitude towards technology	.. it makes sense to work with robots in care
FC	Facilitating conditions	.. I am sufficiently trained and prepared to handle the robots
		.. patients get along well with the robot
		.. defective robots are replaced or repaired by IT support
ITU	Intention to use	.. I can build an emotional relationship with the robot
		.. the robot does not create any additional work
		.. my positive attitude towards robots increases the success of robot application for those in need of care
PAD	Perceived adaptiveness	.. new versions of the robot should be similar to the old one in terms of usage
PENJ	Perceived Enjoyment	.. I enjoy working with the robot
PEOU	Perceived Ease of Use	.. the robot can be easily integrated into the care processes
		.. I can control the robot without having to turn away from the patient (e.g. with speech)
PS	Perceived Sociability	NONE
PU	Perceived Usefulness	.. there will be a lot of useful robotic assistance in the future
		.. the robot can relieve me of some of my workload
SI	Social Influence	.. my employer expects me to use or integrate robots
		.. using robots makes a good impression
		.. care robots improve teamwork
SP	Social Presence	.. robots should be able to respond to my emotions (e.g. anger)
Trust	Trust	... robots handle the data they collect confidentially
		.. robots perform their tasks reliably
Use	Use	NONE

For the survey of professional nursing staff, the language used in the survey was made more objective than at the original Almere Model. This has been done in many categories. Here is just one example: instead of asking whether something is a good idea (item for ATT), we ask whether it is considered to make sense in the context. However, some topics also arise from the fact that certain characteristics of robots are less important for nursing staff or could even be disturbing. For example, social robots can intervene in conversations or interpret emotions, not only of the patient but also of the nursing staff. This is why the

question (item for SP) is added whether this is desired by the nursing staff. Such disruptions can also influence the answers to questions about Perceived Ease Of Use (PEOU). Only robots that can be integrated into the existing or adapted care process are easy to use and thus contribute to acceptance

The questions about acceptance are rounded off by a query about previous experience with robots in a private or professional environment, as well as the desired functionality of the robots. This is important in this environment because it is not about a specific robot and today's robots do not yet cover many of the desired properties.

The following options are available for the question about professional experience with robots:

- Cleaning robots (e.g. vacuum cleaners or mopping robots)
- Robots with displays (e.g. for explanatory videos)
- Robots for entertaining those in need of care (e.g. singing songs)
- Transport robots (e.g. for medication, files)
- Training robots for those in need of care (e.g. memory training)
- Therapy robots (e.g. for dementia, autism)
- Robotic devices (e.g. wheelchairs, arms)
- Other

In case of private experience with robots the following list is given:

- Robot vacuum cleaners
- Robot mops
- Robot lawn mowers
- Robots in school education
- Toy robots
- Other

In order to include the situation of the individual nurse in the evaluation, the place of work is asked:

- Hospital
- Senior residence
- Outpatient care
- Intensive care (1:1)
- Day care
- in various facilities (e.g. as a leasing worker)

The questionnaire will be implemented using the SoSci tool, which allows extensive evaluations.

IV. Summary

The multitude of different robot systems in care requires an acceptance model that takes into account the capabilities of social robots in particular and the distance of nursing staff to robotic devices. The Almere model seems to be well suited for this. The survey and evaluation are still pending.

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