



SPWID 2024

The Tenth International Conference on Smart Portable, Wearable, Implantable
and Disability-oriented Devices and Systems

ISBN: 978-1-68558-152-7

April 14 - 18, 2024

Venice, Italy

SPWID 2024 Editors

Claus-Peter Rückemann, Universität Münster / DIMF / Leibniz Universität
Hannover, Germany

SPWID 2024

Forward

The Tenth International Conference on Smart Portable, Wearable, Implantable and Disability-oriented Devices and Systems (SPWID 2024), held between April 14th and April 18th, 2024, continued a series of international events bridging the concepts and the communities dealing with specialized implantable, wearable, near-body, or mobile devices, including artificial organs, body-driven technologies, and assistive services. Mobile communications played by the proliferation of smartphones and practical aspects of designing such systems and developing specific applications raise challenges for successful acceptance and deployment.

We take here the opportunity to warmly thank all the members of the SPWID 2024 technical program committee, as well as all the reviewers. The creation of such a high-quality conference program would not have been possible without their involvement. We also kindly thank all the authors who dedicated much of their time and effort to contribute to SPWID 2024. We truly believe that, thanks to all these efforts, the final conference program consisted of top-quality contributions. We also thank the members of the SPWID 2024 organizing committee for their help in handling the logistics of this event.

We hope that SPWID 2024 was a successful international forum for the exchange of ideas and results between academia and industry and for the promotion of progress in the field of smart portable, wearable, implantable and disability-oriented devices, and systems.

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Chris Schroerer, Bjorn Naumann, Michele Haink, and Nils Lahmann

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PAge @ Home – A digital Personal Agent for Chronically Sick in the Home Environment

A Project Description

Chris Schröer

HCMB – Institute for Health Care Systems Management
Berlin eG
Berlin, Germany
chris.schroer@hcmb.org

Björn Naumann

Charité – Universitätsmedizin Berlin
Working Group Nursing Research, Department of Geriatrics
and Medical Gerontology
Research Group Geriatrics
Berlin, Germany
Bjoern.naumann@charite.de

Michele Haink

Charité – Universitätsmedizin Berlin
Working Group Nursing Research, Department of Geriatrics
and Medical Gerontology
Research Group Geriatrics
Berlin, Germany
Michele.haink@charite.de

Nils Lahmann

Charité – Universitätsmedizin Berlin
Working Group Nursing Research, Department of Geriatrics
and Medical Gerontology
Research Group Geriatrics
Berlin, Germany
Nils.lahmann@charite.de

Abstract—The various medical technology solutions available on the market are either clinically certified or not certified on the second health market as lifestyle products. Most of them primarily offer solutions for a single health issue. In the research and development project (2023-2026) “PAge@Home”, a system should be developed that consists of the integration and merging of different devices and wearables together with a software that shows combined results and enables telemedical communication and interaction to add further relevant health information. The ergonomic, patient-friendly, accessible system aims to provide individual and useful health information for all relevant stakeholders. Through telemedical connection, the system could reduce frequent hospitalizations and doctor visits by relocating the medical care in the home environment that decreases burden on medical staff and treatment costs.

Keywords: *integrated system, telemedicine, outpatient care, multicomponent system, wearables.*

I. INTRODUCTION

On the market, multiple health-related hardware and software solutions for patients in the home environment are already available. The solutions are either certified medical products or products of the second health market. In most cases, they assess different data of different quality and for only one purpose. The combination of the different systems into one common solution could give a more complete overview about the patient health. In addition, a merged system could help to improve the data quality and reduce artefacts and incorrect measurements. A combined

multicomponent system with a telemedical connection that correctly detects critical health conditions could prevent worse health effects and reduce hospitalizations. Moreover, an inclusive system developed for patients can be empowering the patient’s own health, self-efficacy and transparency of the medical process. A telemedical intervention could reduce the number of on-site doctor visits, relieve medical staff and enable an inclusive care. The research and development project “Page@Home” – a digital personal agent for chronically sick in the home environment – could provide such a solution.

Section II describes the participating scientific and technological partners of the project as well as the problem statement. Section III depicts the overall objectives and the underlying sub-objectives of the project. Section IV describes the planned method and procedure. Section V sketches the expected results of the “Page@Home” project, and Section VI concludes and summarizes the project.

II. BACKGROUND

A. Participating Partners in the Project

The consortium consists of two scientific and two technology partners, supported by two additional technology partners:

- **Charité – Universitätsmedizin Berlin:** Central emergency department and Working Group Nursing Research [1].

- **HCMB – Insitute for Health Care Systems Management Berlin eG** [2].
- **Nexus AG** [3].
- **ID Information und Dokumentation GmbH & Co. KGaA** [4].
- **Ternaris UG** [5].
- **Qolware GmbH** [6].

B. Problem Statement / State of the Art

As in many other fields, digitalization is also making its way into medical technologies. Wearables are becoming increasingly popular in the healthcare sector [7]. Especially since the Covid-19 Pandemic, telemedicine concepts are on the rise in developed, as well as developing countries [8]. Most of the recent studies only investigate the usage of systems that allow the patient to communicate with doctors via video chats, like “WeChat” or similar solutions [9][10].

Furthermore, a system that combines different devices and data into one to provide helpful information about patients exists only for single diseases or health conditions [11], but not for multiple health conditions together. Although combined systems have many benefits, such as improving well-being, reducing hospitalizations and doctor visits, relieving medical staff and lower treatment costs [12], systems, that support chronically sick, enable remote patient-doctor communication and continuously monitor vital signs by the connection of wearables are only gradually becoming more widespread.

III. OBJECTIVES

A. Overall Objectives

The overall objective is to develop a digitally-connected health care system for chronically sick in the home environment. The system should merge relevant data from different devices and ensure the recognition of critical health changes. Focusing on chronically sick patients allows a better

development because the doctor knows their course of disease. The system integrates, validates and monitors all relevant patient data. This should result in relevant and valid patient data for the telemedical connection, e.g., with the ePA (“elektronische Patientenakte” = electronic patient file) and for complex working systems. Additionally, patient interaction with the system should generate more data and give a more specific overview of the patient’s (subjective) health. Figure 1 shows a schematic representation of the “Page@Home” system with all relevant actors (e.g., patient, medical care provider) and their interactions.

B. Subobjectives

1) Subobjective 1: Digital support

Within the project, a frontend should be developed that allows a direct and inclusive access for all relevant stakeholders. Additionally, the tool should also be ergonomic, accessible and customized so that the patient could use it to communicate with the medical staff.

2) Subobjective 2: Digital therapies

The “Page@Home” should monitor the course of treatment, adjust the treatment according to defined limits and set alarms if necessary.

3) Subobjective 3: Integrated care chain

If an inpatient treatment will be necessary, the “Page@Home” intersectorally should accompany the patient through the care process. Additionally, the danger of information loss between the care structures should be reduced. The system could support planning and management of care (case management).

4) Subobjective 4: Structures of a digital health care

The “Page@Home” is open to other projects of digitalization in health. Other medical technology solutions could be integrated into the system.

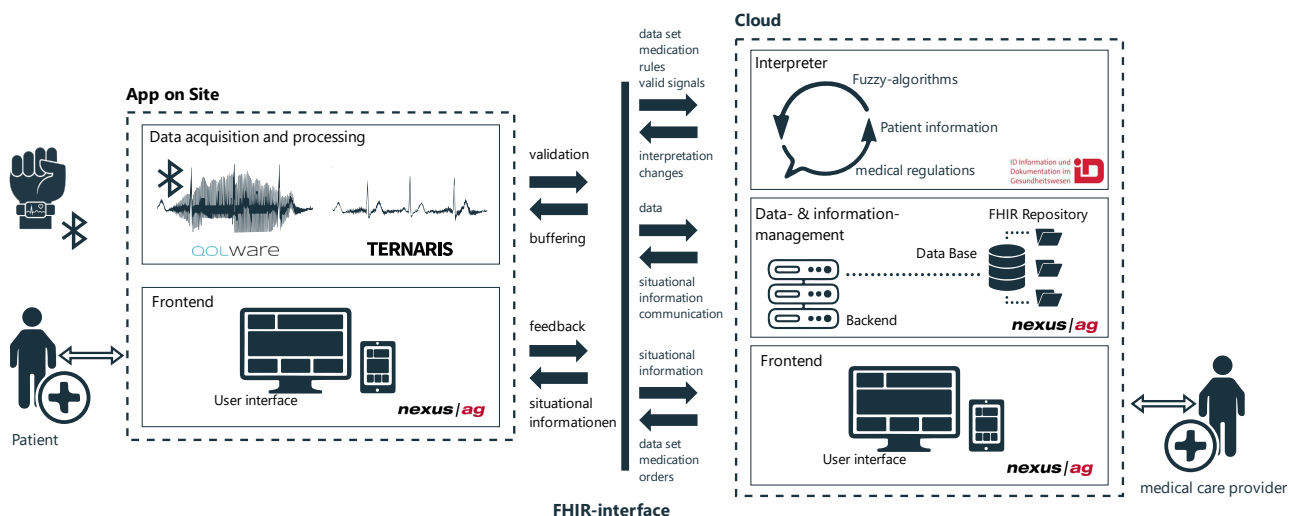


Figure 1. Schematic representation of the “Page@Home” system with all relevant actors and their interactions.

IV. METHOD AND PROCEDURE

The project is divided into two sections. Through the first section, the vital data sets will be checked for their relevance and suitability. In addition, the selection criteria will be investigated for validity, risks and limitations for implementation.

Through the second section, the data will be analyzed and the task distribution will be defined. Treatment risks and intervention will be identified. Ethical and regulative requirements will be determined and checked. Additionally, a training concept for the stakeholders will be created.

The project ends with an evaluation in the real clinical setting if the requirements of the subobjectives will be met.

V. EXPECTED RESULTS

The expected results should include the following elements:

- A usable and user-friendly software that can be used by both medical staff and patients. The software is usable on an end device (e.g., computer, smartphone, tablet).
- Multiple devices and wearables are integrated and merged into one system. The output is presentable on the software.
- The system is able to record relevant data continuously.
- The stakeholders can interact with the software and enter values.
- The data are assessed and saved on the backend in compliance with data protection requirements.
- The artificial intelligence of “Page@Home” can interpret the data to detect pathological health changes.
- Training concepts and concepts for the telemedical connection are created.

VI. CONCLUSION

At this point, the project has been going on for about a year. More results can be expected in the years 2024 and 2025, when the project has moved on further.

If meeting the objectives, the project can deliver a useful starting point for telemedical health care in the home environment, and reducing the burden on the health care

system. Moreover, through the possibility to connect other software and hardware systems with the “Page@Home” system, the currently existing island solutions can become more efficient by being merged into the system. Health care stakeholders can profit from using only a single system that can give a comprehensive overview of their patients’ health.

ACKNOWLEDGMENT

The project “Page@Home” is funded by the German Federal Ministry of Education and Research for a three-year period (02/2023-01/2026).

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