

enabling continuous patient monitoring in clinics infrastructure for automated data capture from wearables

Miro Käch¹, Simon Laube¹, Severin Latkovic¹, Markus Mutke², Noé Brasier², Bianca Hölz²
Prof. Walter Karlen³ PhD, PD Jens Eckstein² MD PhD

¹ Leitwert GmbH, ² Universitätsspital Basel, CMIO Office; ³ ETH Zürich, Institute of Robotics and Intelligent Systems

Project Goal

Development and operation of infrastructure for automated data capture from wearables and other connected biomedical sensors in closed medical environments.

Background

Continuous and reliable data collection is a major challenge in the medical field. Wearable devices offer the opportunity to monitor patients continuously and provide deeper insights into patients health status. However, the abundance of data obtained through these channels require sophisticated data management and processing tools.

The presented infrastructure is built on top of Leitwert's Device Management Server (DMS) and **automates** the readout of wearable devices worn by hospitalized patients using wireless technologies. This renders the system scalable and economically viable.

This system aims to integrate wearable device technologies into the clinical routines in healthcare facilities in order to increase patient safety and efficiency in patient monitoring. It **promotes co-creation and collaboration** across the healthcare ecosystems.

Innovation

The **device agnostic platform** is open to multiple devices from independent manufacturers which are operated on the same infrastructure.

The architecture of the system facilitates the data storage on local servers, therefore transferring the data sovereignty to the healthcare provider who is already a trusted entity and offers maximum **flexibility to comply with local data protection regulations**.

This project paves the way for the **systematic integration of wearable medical devices in clinical workflows** such as continuous measurements of vital signs in hospitalized patients for the assessment of clinical early warning scores. Typically, nursing personnel measures the relevant vital signs manually three times a day. However, depending on the vital parameter and the health condition this can be necessary much more often, e.g. in case of irregular blood pressure. The presented approach increases the quality and efficiency of the monitoring tasks, ultimately **benefiting patient safety**.

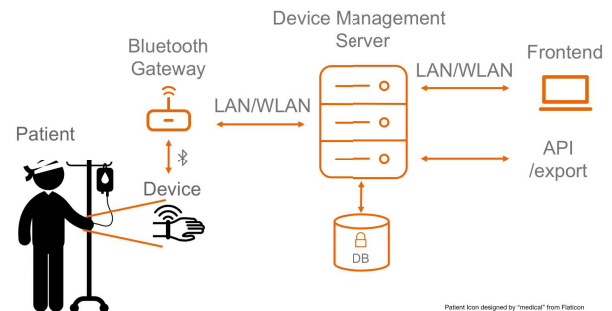
Open Ecosystem

Besides commercially available medical devices, also research devices can easily be integrated. For example, the MHSL Activity Tracker Framework of ETH Zürich^[1] is protocol compatible with the infrastructure. It delivers researchers and clinicians a transparent and easy to configure tool for tracking activity in large cohorts through our system.

^[1] <http://www.mhsl.hest.ethz.ch/Tools/PhysicalActivityTracker.html>

Contact

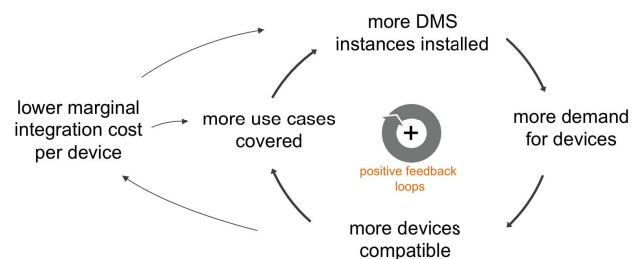
Miro Käch, miro@leitwert.ch
+41 44 512 29 60
www.leitwert.ch, dms.leitwert.ch



How it works: As soon as a device is within the reach of a Bluetooth Gateway, a connection is established to collect the latest data and transfer it to the Device Management Server. There the data is available for further processing directly on the local server or by 3rd party applications via API. The system provides standardized processes for device management, assignment and revocation of devices to patients as well as various patient and device monitoring options. The data is accessible through a frontend over a browser.

Business Potential

The presented DMS setup exhibits the typical architecture of a **platform**: it matches value providers with value consumers and allows 3rd parties to develop use cases based on the platform infrastructure. Platform economics can be boosted by demand side economy of scale which unlock self-reinforcing two-sided positive network effects.



Platform economics can be boosted by positive feedback loops.

For health centres a centralized way to manage fleets of wearable devices is highly desirable. Device Management includes configuration and firmware management, device monitoring (e.g. battery level) and maintenance (e.g. charging, sterilization, ...). With the presented infrastructure this can either be done by the clinic itself, a 3rd party or the device manufacturer.

A single centralized platform to manage devices is economically much more attractive and convenient than managing an entire infrastructure per device type. Additionally, the integration cost of a new device type can significantly be reduced. Finally, by using the DMS as a device agnostic platform, an institution is not locked in with a certain device manufacturer.

For medical device companies the system significantly reduces the barrier to get medical devices integrated into a clinical IT infrastructure. With every instance of the system installed at a healthcare institution, the attractiveness for device manufacturers increases as the demand for devices increases.

Beyond clinics: the DMS technology stack is also well suited as middleware for applications in remote monitoring and home care.

Timeline of the project: the system is operational since April 2018.

Corresponding author: PD Dr. Jens Eckstein, PhD