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Project Results

RM4HEALTH

Advancing remote monitoring for patients and athletes

With innovations in wearables, remote monitoring platforms, data-driven models, and care and training programmes, the ITEA project RM4HEALTH (Remote Monitoring in Health and sports) accelerated continuous monitoring in both healthcare and sports.

Various trends are driving the adoption of remote monitoring. Global populations are ageing and chronic diseases are increasing in prevalence, but healthcare faces workforce shortages and an increasing pressure to reduce costs. There are also pull factors: advances in technology and continuous access to data translate into new opportunities to improve outcomes and experiences for patients and athletes, even while reducing the costs of care and guidance.

Project developments

In recognition of these benefits, RM4HEALTH targeted four core innovations in remote monitoring for health and sports. First, the project worked to advance the metrics that can be derived from the data of existing wearables and sensors. This was achieved while also advancing the sensors themselves to acquire a more varied and accurate range of data. Second, an architecture was developed in which data from different streams can be stored and processed, enabling seamless integration with apps and dashboards. Third, data-driven models were developed for a comprehensive overview of physiological performance, aiming for predictions as well as real-time insight. Finally, these predictions are applied to care and training programmes that visualise trends and support tailored interventions and guidance.

As the successor to the ITEA project INNO4HEALTH, RM4HEALTH had a strong foundation for its technical work and a sense of community already in place. This enabled cross-fertilisation and knowledge-sharing across six use cases, helping to find common denominators between seemingly disparate user groups. In healthcare, the use cases focused on deterioration detection in heart failure and post-operative patients, respiratory disease detection with a digital stethoscope, early detection of heart failure decompensation, and remote monitoring of elderly activities. For athletes, the project worked on physical fitness/performance assessment and exercise monitoring for sports and rehabilitation. As a result, RM4HEALTH demonstrated that its core innovations support a wide range of applications in which users require early detection and guided intervention for undesirable conditions.

Remote patient monitoring

Results so far

RM4HEALTH's impact is, first and foremost, societal. For patients and their treating physicians, the results provide relevant information to support effective clinical decisions and improve outcomes. For athletes and their coaches, information is provided about their health and fitness while training guidance supports them with performance optimisation. These benefits are partly due to advancements beyond the state of the art. For example, wearables previously lacked automatic medication intake detection or remote sleep monitoring and fall detection was based on hourly manual rounds. RM4HEALTH's sleep model achieves 96.53% accuracy, its medication model reaches 99.89% accuracy with pills or 100% without pills, and its fall class precision stands at 85%. These models are applied in a long-term wearable with activity, gait, location analysis and remote access capabilities. Likewise, the project developed a dashboard that provides several parameters simultaneously via video streaming for skills and tactics training. Prior to RM4HEALTH, such training was done mostly via audio and existing systems could not predict the future fitness level of the athletes before a competition. A major contributor to such improvements was the high involvement of end users: over 500 patients tested the software applications, as did ten athletes, three clinical professionals and two professional coaches. Thanks in part to their involvement, several products are

now ready to be exploited by consortium members. Sportbizz's Patient Journey App, for example, is already in use in hospitals as an all-in-one platform for accessible, personal, and sustainable care. By combining personal data to guide people towards a healthy lifestyle, this app allows Sportbizz to open doors in the adjacent market of prevention rather than just care/cure.

Philips, meanwhile, used RM4HEALTH to innovate a remote monitoring platform, thereby scaling the storage and processing capacity and clinically validating the technology at Máxima Medical Centre and Catharina Hospital. Following commercially-oriented research evaluating the remote monitoring technologies with renown partners in the sports domain, this will soon be launched to the market. Similarly, WISEWARE has developed RICO, a market-ready digital health ecosystem for independent ageing and remote care. Having been adopted in the innovative SAD+Saúde Norte pilot initiative for social support and home-based healthcare, this is expected to generate recurring revenues and expand WISEWARE's international market opportunities. Even for partners not yet ready for market, positive results have been felt: 11 master's students, six PhD students and two postdoc students were hired across the consortium. This human capital is a company's most valuable asset when delivering high-quality patient care, as it drives revenue growth and ensures the long-term sustainability of its operations.

Future outlook

This is not the only way that RM4HEALTH is targeting a sustained impact. Alongside dissemination – including 12 scientific publications and two patents – continued clinical studies have been secured. Preliminary analyses are promising, including an expected reduction in the 30-day risk of heart failure deterioration from 20-25% to 10-15% following full validation. Some partners will also participate in ITEA's follow-up project REMO to further develop their remote monitoring solutions in the healthcare domain. Taken together, these activities ensure that RM4HEALTH will continue to support the transition of its solutions into wider practice.

Major project outcomes

Dissemination

- 12 scientific publications (8 conference papers/ presentations, 2 journal publications, 2 journal submissions)

Exploitation (so far)

New products/services

- Patient journey app - new app that combines personal data with data from devices to make personal recommendations to stimulate a healthy lifestyle for healthy people and patients.
- AI for digital stethoscope - Application of AI to stethoscope digital signal for early-recognition of diseases and so, improving (unassisted) remote diagnosis.
- Remote patient monitoring - Remote monitoring platform enabling data acquisition through sensors, (near) real-time processing to extract clinically-relevant information, storage and monitoring through web-based user interface (pending market release).
- Remote Monitoring 4 Elderly - An intelligent ecosystem to remotely monitor and assist elderly people at home or in ambient assisted living facilities, using wearable sensors and smart medical dispensers.
- AR/VR technologies for training athletes – AR/VR technologies to help coaches in getting the situational information from the training session for skills and tactics training

Standardisation

- Organised a workshop with an expert in the data and AI act and the corresponding standardisation ,

Patents

- 2 patent applications filed

ITEA is the Eureka RD&I Cluster on software innovation, enabling a large international community of large industry, SMEs, start-ups, academia and customer organisations, to collaborate in funded projects that turn innovative ideas into new businesses, jobs, economic growth and benefits for society. ITEA is part of the Eureka Clusters Programme (ECP).

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Partners

Finland

- iEmfit Ltd
- Nokia Technologies Oy
- Oy Everon Ab
- Polar Electro Oy
- University of Turku
- VTT Technical Research Centre of Finland Ltd.

Netherlands

- Catharina Ziekenhuis
- Eindhoven University of Technology
- Evalan BV
- MSB de Medici
- Philips Electronics Nederland BV
- Philips Medical Systems Nederland BV
- SportBizz BV

Portugal

- Instituto Superior de Engenharia do Porto (ISEP)
- Santa Casa da Misericórdia de Vagos
- University of Porto Faculty of Medicine
- WISEWARE

Spain

- HI Iberia Ingeniería y Proyectos

Project start

October 2022

Project end

June 2026

Project leader

Roger van Galen, Philips Electronics Nederland BV

Project email

roger.van.galen@philips.com

Project website

https://itea4.org/project/rm4health.html

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