



Project Results

Medolution

An ecosystem for advanced healthcare analysis

EXECUTIVE SUMMARY

By creating a platform to exchange and share data between heterogeneous devices and sensors and patients and care providers, the ITEA project Medolution generates healthcare predictions based on continuous trend analyses. This allows for early alerts and decision support for both patients and doctors.

PROJECT ORIGINS

As healthcare improves, people live longer and wish to remain independent; as people live longer, a rising percentage of the population suffers from chronic diseases. This creates a burden on healthcare in the form of higher treatment costs and a declining quality in services. Simultaneously, the virtualisation of care is developing rapidly and offers new opportunities through huge amounts of heterogeneous, clinically-relevant data. This is becoming increasingly accessible to both health professionals and patients, yet also comes in many forms and from many sources. This information needs to be handled carefully and managed promptly if it is to reduce costs while improving quality of life.

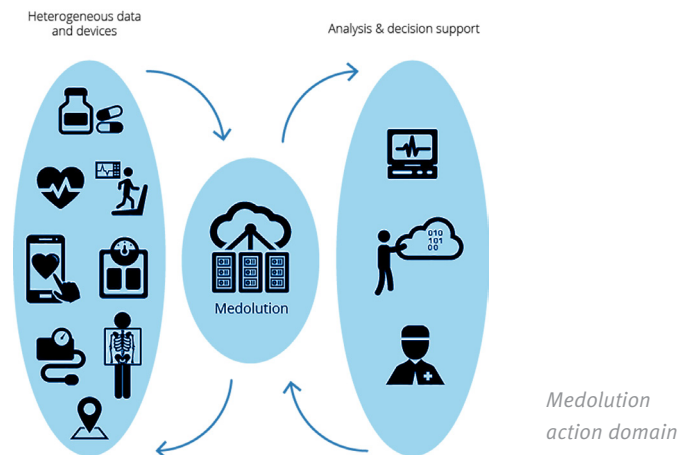
'Medolution' is derived from 'Medical Care Evolution', which refers to a movement away from reactive approaches to healthcare and towards preventive methods. Through a 19-partner consortium, smart environments have been created that integrate professional and user-generated data. This may be imaging or sensor data from medical or consumer devices. While current solutions mainly target one-to-one flow (such as one sensor feeding to one application), Medolution supports flows from a multitude of sensor devices to specialised medical applications, addressing many diseases and patients simultaneously. Historical data, existing databases and the latest medical knowledge are equally vital and have been incorporated to inform and support medical personnel to provide the best care to their patients.

TECHNOLOGY APPLIED

Medolution is not a product in the traditional sense, but a software ecosystem for the advanced analysis of big healthcare data. In 2015, there were several cloud providers, but none were ready to be used in healthcare and all lacked a common architecture approach. Medolution therefore developed a distributed core platform that serves as a Big Dependable System (BDS) for healthcare, deployed and managed in one or more private and public clouds. The core combines Big Networked Systems (BNS), consisting of large sets of devices that quickly react to user demands and technical facilities, and Dependable Systems (DS), which negate the need for special hardware and services. The core platform also provides facilities to build scalable big data analysis software stacks supporting automated deployment anywhere and easy devices integration and management. To ensure security of data, Medolution integrates

protection, control and traceability components at a BDS level and deploys them at a cloud level.

In addition to integrating control of heterogeneous devices and sensors, Medolution adds monitoring and decision support by visualising real-time and long-term image and data analytics. Three use-cases demonstrate this, dealing with left ventricular assist devices (LVAD), strokes and Parkinson's disease. In the case of strokes, for example, visualisation takes the form of a 'universal clock' that displays information from (wearable) sensors, such as time stamps of health changes. It then notifies the stroke team through devices like smartphones or screens in the stroke centre. Based on the results of validated score scales, the most suitable hospital is selected and sent directly to the ambulance, saving valuable time.



MAKING THE DIFFERENCE

Medolution offers a platform to bring the right information to the right people at the right time. This can easily be integrated into commercial services and products. From a healthcare perspective, the three use-cases have shown highly positive results. Stroke solutions, such as hospital visualisation dashboards and in-ambulance video streaming, enable analysis within three minutes and reduce treatment time by an hour, as 30% of issues are established before the patient arrives in hospital. For LVAD, new algorithms can detect thromboses 93 hours earlier and generate an infection score within 30 seconds. Such an efficient turnaround allows 20 patients to receive an LVAD check per day (compared to 5 patients before; and at hospital premises). This can easily be scaled up to 1000s per day. Finally, Medolution has created the first dataset and machine learning algorithms to monitor self-exercises that combat Parkinson's disease. Besides offering real-time coaching and decision support, these have reduced diagnosis errors by 10%.

These results translate into enormous economic benefits. The stroke demonstrator, for example, will decrease the number of nursing home admissions after acute ischemic stroke as a result of improved patient treatment and better clinical outcome. This could save the Dutch healthcare system EUR 705,000 on nursing home care costs alone, in its first year of use. Medolution also provides various ways for organisations to push into new domains and generate new business models. Target Holding

has used its newly-acquired image processing abilities as a starting point for image-related commercial orders, leading to an expected 50% business volume increase. Together with SSK, they will commercialise the demonstrator. SSK, meanwhile, has implemented Germany's first specialised centre for LVAD patients, developed around a smartphone app that enables a continuous exchange of information with the hospital. As early detection might prevent a pump exchange (each exchange costs approximately EUR 200,000), the subsequent 10% decrease in pump thrombosis will ultimately save millions of euros. A knock-on effect occurs in healthcare-related fields: greater survival rates and efficiency in chronic disease follow-up allow insurance companies to lower their premiums while remaining competitive. In relation to Parkinson's disease, Maidis is working with insurance companies and healthcare providers to commercialise its HapiCare portal for storing and handling health records, clinical guidelines and medical ontologies.

Crucially, Medolution is at the forefront of the move towards predictive, personalised healthcare, meaning that its results will open up new avenues in data analytics and interoperability. Best practices have now been identified in the areas of information system management, dependability, scalability and automated deployment. Medical routes have also been defined to manage patient monitoring and automatically generate relevant rules. This provides a foundation for future innovations that will save lives.

MAJOR PROJECT OUTCOMES

Dissemination

- 32 scientific publications, incl. 2 special issues
- 24 presentations at customers and at fairs, 57 presentations at conferences

Exploitation (so far)

- IoT/cloud-platform technology (e.g. Atos CODEX AI Suite; Philips Health Suite Digital Platform; Bull Datalake appliance; Norima DAS data anonymisation; Prologue Pastell-based Interoperability Module; Maidis Hapicare solution)
- Philips Stroke application: predicts Delayed Cerebral Infarction and reduces time between incident and treatment, leading to a better patient outcome for stroke.
- SRDC Health Data Ingestion Stack and Device Connection Component: connects to different healthcare devices
- SSK, a specialised centre for LVAD patients, unique in Germany up to now, introduces daily monitoring of patients with an LVAD in their home

Standardisation & Patents

- 4 standards for ISO/IEC Internet of Media Things (e.g. contribute with major technologies in the field of architecture, data representation / APIs, and reference software for IoMTs, including aggregated systems obtained by combining IoTs and IoMTs)
- 2 patent applications filed

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Medolution 14003

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TU Dortmund

Netherlands

Philips

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Target Holding

Technolution

University of Amsterdam Academic

Medical Center

Turkey

ARGEDOR Information Technologies

SRDC

Project start

December 2015

Project end

May 2019

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