![CATRENE logo](Cluster for Application and Technology Research in Europe on NanoElectronics)

PROJECT RESULTS

CAT408 | Integrated mobile health monitoring and implantable sensor systems focus on quality of life for the elderly and lowering costs
[NexGen]

The Next Generation of Body Monitoring project (also referred to as NexGen) successfully deployed sensor-based technologies to address health and healthcare issues, and to ease the growing burden of treating a sick and ageing population while delivering other significant benefits.

To help better understand the Next Generation of Body Monitoring (NexGen) project – its objectives, activities and achievements – it is important to first review the situation at the start of this project, some three years ago. There were concerns with ageing, and an urgent need for a healthy, active lifestyle (especially since over 60% of the population were showing early signs of metabolic syndrome) in order to bear the increased pension and healthcare costs. Mobile healthcare systems, based on a multitude of different networked sensors (which enable ubiquitous body monitoring), were seen as an important response to chronic diseases, especially multimorbidity (the presence of two or more chronic medical conditions in an individual). They also looked like the answer to improving the quality of medical services and increasing the independence of the elderly. It was also anticipated that new mass-markets would undoubtedly emerge and nanoelectronic-based components become available in securing reasonably-priced mobile medical-solutions.

However, there were certain missing elements, such as sensors and energy harvesters, standardised protocols and security blocks, as well as, integration technologies for biocompatible and implantable solutions, and cloud offerings for the private and professional sectors. These, together with economic risk, market fragmentation and limitations of then-available micro and nanoelectronic technologies, would limit the benefits of eHealth and hinder a swift and successful commercial launch. The big question then was: what can be done to mitigate some of these barriers and obstacles?

Mobile health-monitoring with implantable and wearable sensors

NexGen focused on the development of integrated, sensor-based systems for mobile health-monitoring applications and implantable sensor systems, offering new highly innovative solutions to improve the quality of life, support, especially, an ageing society and reduce healthcare costs.

The goal was to develop key micro-electronic technologies and components for mobile and wearable healthcare-systems, to be used as a platform for a broad spectrum of applications. This included a set of sensors for body monitoring, improved energy-management systems, enhanced communication and biocompatible integration technologies.

The platform developed covers the two hemispheres of clinical and home-health, and fitness devices in practical use for an ageing population suffering from metabolic syndrome. In this context, reference architectures were defined in order to enable system development (from devices to complete mobile medical solutions) and to enable clinical assessment (including medical approval through the cooperation of healthcare providers and hospitals).

For the glucose monitor, a first proof-of-concept was achieved in a lab. Those results created the basis for the project's technical partners to design a dedicated and highly integrated chip for demonstration and testing (including tests on living animals), ensuring the biocompatibility of the demonstrators. The results of these animal tests not only validated the outcome of lab tests, but also the underlying technical and technology approach.

The results of the multi-parameter supply-chain are also most promising. The various sensors were developed to a 'testable state' and some of them were integrated into an innovative printable patch. Positive results from lab tests enabled subsequent tests, on humans in a hospital environment, to be conducted and with good results. In addition to their supply-chain activities, some project partners also worked on firmware as well as a future cloud offering.

The overall conclusion is that NexGen achieved very good results in developing the necessary innovations for the healthcare sector and generating essential knowledge to support future developments. Furthermore, this project has already seen some of its work being successfully implemented commercially.

Demand for glucose monitoring

There are promising markets in which deliverables from NexGen can be exploited. Diabetes is a key area. The International Diabetes Federation (IDF) estimates that in 2015 approximately 415m people had diabetes worldwide, and that by 2040, this will increase to 642m.

PROJECT CONTRIBUTES TO

- Communication
- Health and ageing society
- Digital lifestyle
- Sensors and actuators

PARTNERS

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KEY PROJECT DATES

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An essential part of diabetes management is the testing of blood-glucose levels, which can be carried out in two ways, through:

1. Continuous glucose monitoring systems (CGMS): are devices that determine blood-glucose concentration continuously and over a longer period of time (for example, 30 days). Here, the glucose concentration in the interstitial fluid is measured and used to calculate the concentration in the blood;

2. 2. Self-monitoring of blood glucose (SMBG): refers to the second monitoring approach, where a drop of blood from the finger or ear is used for the measurement. Users must perform their own measurements at regular time-intervals, using SMBG devices. These devices are cheaper and easier to gain approval from health authorities.

The market launch of CGMS is an important breakthrough in diabetic blood-glucose monitoring. Users who suffer from high fluctuations in blood-glucose levels and who need to measure frequently benefit greatly from this new technology. The global CGMS market was valued at US$878m in 2016 and is expected to reach US$13,672m by 2025. The global SMBG market was valued at US$12,481m in 2016 and is expected to reach US$20,563m by 2025. Importantly, these are areas in which NexGen's glucose monitors can compete.

Smart healthcare and wearables

There are other potential markets for NexGen's deliverables, like the multi-parameter supply chain. The rise in the ageing population, especially in developed countries, has resulted in an increase in chronic diseases and a demand for live and effective monitoring of health conditions. The growing application of internet of things (IoT) in healthcare is one of the key trends that will further stimulate smart-healthcare growth. IoT applications, such as mHealth, provide facilities like medication reminders, remote diagnostics and telemedicine services. Telecom companies are playing a crucial role in the mHealth domain by delivering connected solutions. The smart-healthcare-market forecast report predicts that, fuelled by these factors, the market is projected to grow at a compound annual growth rate (CAGR) of over 24% during the forecast period.

Finally, market developments are also being driven by healthcare professionals interested in equipping their patients with wearables. Many of these initiatives are starting to move out of pilot testing into mainstream care. A good example is the use of a fitness tracker in the weeks before surgery, to reduce the recovery period by ensuring the patient is in a good physical condition.

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