



spark works

# Combining Edge Analytics and a Wearable Device for Patient-Centered Healthcare

## Challenge & Solutions

Heart disease and strokes kill about 17 million people every year – approximately one-third of all deaths worldwide, or one every 60 seconds. The only tool available to physicians and cardiologists to evaluate irregular heart rate and heart rhythm and diagnose cardiac abnormalities is an electrocardiography (ECG) system, which monitors the heart's electrical activity. While advances in electronics miniaturization have led to development of wearable ECG devices, they have significant drawbacks. Accuracy and reliability are limited, and they lack remote, real-time monitoring, as well as cloud support and data-processing power. In addition, these devices come up short in user friendliness, i.e. basic usability.

The EuroCPS CARDIO project designed and developed a vest, that combines embedded devices, edge data processing and cloud services to provide on-the-spot, reliable and accurate heart monitoring. Its processing capabilities analyse the heart's electronic signals and identify abnormal activity. The comprehensive healthcare monitoring system is fog-based, enabling cloud computing at the network's edge. But the key innovation enables customization of the system: the device can be programmed remotely by a physician to accurately identify critical events related to each patient. As a result, it is capable of interpreting a large number of heart abnormalities without relying on cloud services and edge resources. In addition, the user-friendly interface, accessed on smartphones, provides clear patient information and options, including where personalized data should be stored and the means of transmitting the data to the patient's doctor.

12-CHANNEL  
HIGH-DEFINITION ECG  
MACHINE  
LEARNING  
BLUETOOTH  
CONNECTIVITY



## EuroCPS Support

Digital Catapult helped identify and resolve legal issues related to privacy and confidentiality of data handled by the system. This included reviewing the developed data architecture in light of General Data Protection Regulation (GDPR) requirements and supporting integration of personal data receipts, a GDPR-compliant tool to increase transparency and understanding for patients on how their data are used. Digital Catapult also helped Spark Works with integration of the developed device with Low Power Wide Area Networks, in particular LoRaWAN™ communication technologies. Intel helped Spark Works develop diagnostic algorithms for a wearable device utilizing the pattern-matching engine of the Intel Curie module.

## Digital Skills

**Spark Works:** IoT Edge Analytics platform, a generic execution environment custom-tailored for low-end IoT devices; diagnosis-grade wearable ECG device.  
**Digital Catapult:** Privacy aspects for IoT and next-generation connectivity labs and demonstrators, open innovation activities.

## Company

The company designs and delivers advanced hardware and software products in the area of ambient intelligence. [www.sparkworks.net](http://www.sparkworks.net)



10 employees

Partners:

Digital Catapult, Intel

CATAPULT  
Digital



## Impact / What's next

By leveraging data analytics and the IoT, the EuroCPS CARDIO project helps deliver on the promise of more patient-centered and patient-controlled healthcare in the digital, hyperconnected era. The project's wearable ensures that doctors can intervene earlier and avoid complications and that patients are re-admitted only when traces of abnormal behavior warrant further analysis. Detecting problems before patients require hospitalization can help prevent expensive procedures and lighten the burden that heart disease puts on healthcare systems. Moreover, patients regain their independence by being able to easily and quickly know if their chest pains are within normal levels or if they are going through an emergency. The patient-centric design approach, taken by Spark Works, guarantees also that patients regain trust in the technology, without perceiving it as intrusive in their daily lives, while also retaining control on their privacy and how their sensitive data are collected and used.

Spark Works forecasts sales of more than 5,000 units of the vest within five years of its 2018 market launch, and revenue of more than €2.5 million. The company also expects to increase its staff to 40 employees during that period.



**EuroCPS**  
Cyber-Physical Systems

**EuroCPS** is an European funded project gathering several design centers in order to boost and initiate synergies between innovative companies, major CPS-platforms and CPS-competency providers.

