# iCARDEA

## An Intelligent Platform for Personalized Remote Monitoring of the Cardiac Patients with Electronic Implant Devices

The **iCARDEA** Project develops an intelligent platform to automate the follow-up of the cardiac patients with implantable devices with adaptable computer interpretable clinical guideline models which seamlessly access data in EHR data resources, CIED data and PHRs using standard interfaces.

## Objectives of the project

According to consensus statement prepared jointly by the Heart Rhythm Society and the European Heart Rhythm Association, more than 800,000 patients in Europe have Cardiovascular Implantable Electronic Devices (CIEDs) for the treatment or secondary prevention of cardiac arrhythmias. In addition, the number of follow-up visits for patients with an implanted cardiac device exceeds 5.8 million visits each year, and that number will continue to increase as more devices are implanted. The exponential growth rate of cardiac device implantation calls for new methods of long-term surveillance with a view to optimizing patient safety and care, alleviating the burden of caregivers, and lowering health care costs through ICT support.

iCARDEA develops an intelligent platform to automate the follow-up of Cardiac Implant

iCARDEA project addresses this challenge by:

- Exposing CIED data through standard interfaces.
- Developing an intelligent platform to semi-automate the follow-up of the CIED patients with context-aware, adaptable computer interpretable clinical guideline models.
- Achieving EHR interoperability by exposing legacy EHR systems through standard HL7 CDA Release 2 interfaces so that information about patients' medical history can be obtained from the patient EHR data and used in the clinical follow-up workflow.
- Developing a Patient Empowerment platform providing feedback, education on patient's health problems and communicating with the care givers.

## Project Description

The major objectives of the iCARDEA project are as follows:

- **Exposing Data from Remote Monitoring Cardiovascular Implantable Electronic Devices through standard protocols in standard formats:** Currently all the major CIED vendors enable remote monitoring capability for their devices. However, patient data is stored in standalone data centres operated by the vendors and presented via secure Web-sites for access to the responsible healthcare professionals. Only in emergency cases, data centres send alerts as email, fax or SMS messages.

  In order to integrate CIED data into healthcare processes executed by care pathways following computer interpretable clinical guideline models, CIED data needs to be exposed through standard interfaces. The focus of iCARDEA is on using and when necessary contributing to international standards. The interfaces of CIEDs from two major manufacturers, namely, Medtronic and St. Jude Medical are exposed through standard interfaces.

- **Providing the Adaptive Care Planner**: In iCARDEA, the remote follow-up of CIED patients is coordinated through the Adaptive Care Planner component. The care processes are defined as care pathways using "computer interpretable clinical guideline models". Clinical guidelines using the information obtained from CIEDs, EHRs and PHRs of the patient interacts with modular healthcare processes e.g. to invoke a service to assess critical situations for early diagnosis to prevent health complications.

### Validation of iCARDEA Results Through a Case Study

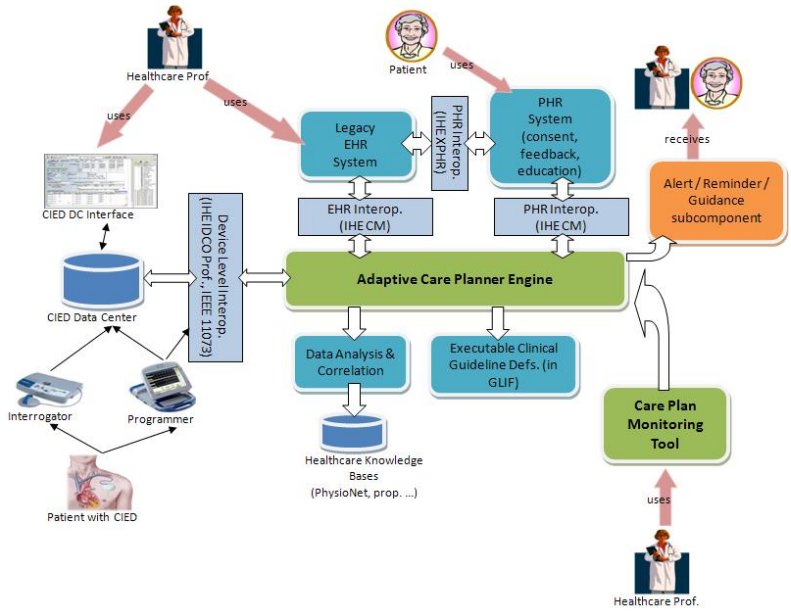
The iCARDEA will be validated through pilot deployment activities in Austria in the clinical settings in two groups of patients. One group of ICD patients with ordinary post-surgical control (twice per year) (group 1), one group of ICD patients with iCARDEA-enhanced remote monitoring (group 2), each group between 20-50 persons. In iCARDEA pilot applications we will address the management of Atrial Fibrillation (AF) and Ventricular Tachycardia (VT) through semi automated care plans. The AF care plan emphasizes the management of oral anticoagulation therapy for preventing thromboembolic events like stroke in patients with AF.

- **Providing information continuity by proving the interoperability of heterogeneous data sources, namely the cardiac devices, Electronic Health Records (EHRs) and Personal Health Records (PHRs) of the patients**: iCARDEA exposes the CIED interfaces based on HL7, ISO/IEEE 11073 and IHE IDCO standards. Furthermore, the EHR data are generally available from legacy systems and iCARDEA makes legacy EHR data available through IHE Care Management Profile. The IHE Exchange of Personal Health Record Content (XPHR) Profile is being implemented in iCARDEA for PHR interoperability.
- **Empowering the Patients with a Personal Health Record (PHR) component:** iCARDEA project provides feedback and education to the patients through a Personal Health Record (PHR) component so that they can gain the benefits of having their healthcare records and CIED data in a format easily accessible to them. The PHR system also helps preserving privacy of the patient by indicating the type of data collected about itself and the purpose for which they are or will be processed.

# Expected Results & Impacts & Preliminary results

iCARDEA will improve the care and follow-up of patients with CIEDs by integrating CIED data to the automated follow up processes through computer interpretable clinical guideline models and adaptable healthcare planners and hence will provide improved disease management at the point of need.

With its clinical guideline based automated analysis and monitoring platform, iCARDEA will reduce the workload of clinical staff in healthcare settings (electrophysiology or other care settings responsible for follow-ups and monitoring) and hence provide economic benefits for health systems using CIEDs.




Early iCARDEA results have been disseminated through the following journal papers:


- *Mustafa Yuksel Asuman Dogac, Interoperability of Medical Device Information and the Clinical Applications: An HL7 RMIM based on ISO/IEEE 11073 DIM, Accepted to be published in IEEE Transactions on Information Technology in BioMedicine.*
- *Gokce B. Laleci, Asuman Dogac , Mustafa Yuksel, Elena Arbelo, Lynne Hinterbuchner, Catherine Chronaki, Marco Eichelberg, The Personalized Remote Monitoring of the Atrial Fibrillation Patients with Electronic Implant Devices, Journal of Healthcare Engineering, Vol. 2, No. 1, 2011*
- *Prof. Dr. Hans-Jürgen Appelrath, Dr. Wilfried Thoben, iCARDEA: EU-Projekt zur optimierten Nachsorge von Herzpatienten, Datawork 2010;48:19*


## iCARDEA

**An Intelligent Platform for Personalized Remote Monitoring of the Cardiac Patients with Electronic Implant Devices**


**Project co-ordinator:**
SRDC Ltd.

**Contact person:**
Asuman DOGAC
Tel: +90312 2101393
Fax: +903122101837
Email: asuman@srdc.com.tr
Website: www.icardea.eu


**Partners:**

- Software Research, Development, Consultation Ltd., Turkey
- OFFIS e.V., Germany
- Salzburg Research Forschungsgesellschaft m.b.H, Austria
- Foundation for Research and Technology Hellas – Institute of Computer Science, Greece
- Salzburger Landeskliniken Betriebsges m.b.H, Austria
- St. Jude Medical Medizintechnik Ges m.b.H, Austria
- Medtronic Ibérica, Spain
- Hospital Clinic I Provincial de Barcelona, Spain


**Timetable:** from February 2010 to January 2013

**Total cost:** € 3,613,448

**EC funding:** € 2,539,833

**Instrument:** STREP

**Project Identifier:** FP7-ICT-2009-4-248240



**KEYWORDS**
Care management, Remote monitoring of cardiac patients, Electronic health records, Personal health records, Cardiac implantable electronic devices.