REACTION

Remote Accessibility to Diabetes Management and Therapy in Operational Health care Networks

REACTION (FP7 248590)

D12-3 Plan for Dissemination and Exploitation of Knowledge

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1 Executive summary

This document presents a plan for dissemination and exploitation of knowledge gained from the REACTION project. It lists 22 exploitable products identified by the project partners and presents joint as well as individual plans for exploitation after project completion, both commercial and scientific.

At the beginning of the project, partners established a dissemination strategy and plan, *ID12-4 Dissemination and exploitation strategy*, with measurable goals to support the dissemination objectives, as well as to coordinate, and thereby optimise dissemination of project outcomes. Partner responsibilities, management, protection of IP-rights and acknowledgement of EU funds were described in detail to ensure a professional dissemination of project results and Key Performance Indicators (KPIs) were decided upon for targeted strategy elements, such as marketing activities, events organised by partners, scientific papers and website activity.

Overall the targets have been met, revealing a considerable amount of dissemination activities performed by all partners. An active website, continuously enriched and updated, has been one of the key communication channels, supplemented by the production of newsletters and posters, flyers and demonstrators for partner dissemination at events and exhibitions. REACTION partners have organised workshops, exhibitions and sessions and participated in major conferences, producing a total of 67 scientific publications, as well as conducting a number of other presentations and talks. All dissemination activities are listed in Appendix 1 - Completed dissemination activities and a list of scientific publications is found in Appendix 2 – List of scientific publications. REACTION partners have attended more than 89 international and national events, raising awareness about the REACTION project in strategic circles of ICT and health care and to a wider audience. On top of this, several meetings and standardisation meetings have been organised and attended.

Powerful scientific standing in professional clusters has been established, as collaborations with other projects have been numerous, peaking with the organisation of the clustering event on Ambient Intelligence Advanced Technologies in Support of Health care and Assisted Living in September 2013 where 25 eHealth projects participated.

The activities to integrate REACTION into existing health environments and the involvement of other stakeholders to promote the early exploitation of the REACTION outcomes have been ongoing. After project completion, partners are planning to continue their dissemination activities, promoting the general results of the project and the outcomes specifically within their own area of expertise. Focus is on traditional, known markets but also on new opportunities in other domains.

At the middle of year four, 22 tangible outcomes were identified and ownership established. It was a process which made knowledge generated in the project concrete, identifiable and easily accessible for partner organisations. The 22 products are described in terms related to unique selling points, current market needs and potential customers. We also list the main contact partner. The list of products feature in a commercial brochure, as well as in a final newsletter, both to be released immediately after project completion and made available on the website.

The exploitation of the products, as well as the scientific knowledge generated in REACTION can be achieved either by individual partners or in a joint venture. The process of establishing IPR schemes to identify project outcomes suggests that the single partners who developed components will be most interested in joint exploitation, thus in making bi-lateral or multilateral agreements with other interested partners. Some partners will also enter into bilateral arrangement for joint ventures.

The individual exploitation plans are described by each partner, stating which products to exploit, which markets to target, how and with whom. The focus is on using REACTION results to enhance existing services/products or to market new ones. Any planned exploitation activities are also listed together with contacts deriving from the project dissemination. For the academic partners, the exploitation of REACTION knowledge will mainly happen in terms of teaching, consultancy and educational activities carried out at the universities and in other projects.

2   Introduction

2.1   Purpose, context and scope of this deliverable

The purpose of this deliverable is to present a plan for dissemination and exploitation of knowledge coming from the REACTION project which aligns with agreed IPR issues and individual partner strategies. The plan also outlines and takes into account all dissemination activities that have been performed during the project lifetime.

2.2   Background

The demographic trend across Europe indicates that life expectancy is increasing every year. Responding in an adequate manner to the growing need for flexible and adaptive health care and social care solutions presents a number of significant challenges to service provision, which REACTION can help to address. The eHealth market is presently estimated at €20 billion, and is experiencing double digit growth, thus creating an extremely important market for the industrial partners and the research institutions.

The EU Members States have already shown their commitment in promoting eHealth strategies and initiatives. By the end of 2005, each Member State has developed a national or regional roadmap for eHealth addressing the challenges of providing citizen-centred health care services. There is therefore great potential for the commercial exploitation of REACTION because it is precisely capable of meeting these challenges.

The deliverable is part of task *T12.3 Exploitation* which is concerned with realising exploitation plans for the results of individual participants and for the consortium as a whole. Exploitation plans are designed to ensure that the developed technologies have a significant impact on the market providing clear benefits to potential users.

Closely related to the exploitation task is *T12.1 Dissemination* which has focused on progressively increasing dissemination efforts as project results were obtained to promote the early exploitation of a REACTION platform and its individual components.

At the start of the REACTION project, a dissemination strategy with measurable goals was made to achieve an active and targeted dissemination. Two years into the project, the dissemination strategy was updated with sections on exploitation. This deliverable builds on the previous documents and extends them by presenting a plan for dissemination and exploitation beyond the end of the project which includes updated information about products and individual partner exploitation plans.

3   Dissemination of knowledge

The main objectives of dissemination in REACTION were to provide an active and professional dissemination of the project results. In particular the objectives are to:

- Define, agree and execute a comprehensive dissemination strategy and coordinate the activities

- Supervise that the knowledge created in the project is properly captured, managed and re-used

- Ensure that the knowledge created in the project and the results are properly disseminated to the appropriate target audiences

- Facilitate that results are being presented to relevant standardisation bodies

3.1   The REACTION dissemination strategy

A dissemination strategy, *ID12-4 Dissemination and exploitation strategy*, was established at the beginning of the project to support the dissemination objectives, coordinate and thereby optimise dissemination of project knowledge and results to stakeholders which share an interest in the scientific results and the applications or are potential service providers of REACTION.

3.1.1   Approach

The strategy is based on an active engagement from partners, disseminating REACTION within their areas of expertise and working together for identifying and carrying out dissemination activities within specific areas, such as conferences and workshops, exhibitions and policy conferences.

As a means to reach the project objectives, a dissemination plan with measureable goals was set for a number of dissemination activities such as scientific papers, organised events, marketing activities and website visits. The goal has been to create strong liaisons with health authorities and establish powerful scientific standing in professional clusters as well as writing academic and technical papers to be presented at conferences and trade shows and published in leading academic and technical journals. This has resulted in an extensive amount of activity as described in Section 3.3 and shown in Appendix 1 - Completed dissemination activities and Appendix 2 – List of scientific publications.

Strong coordination and a targeted approach to selected strategy elements were deemed crucial to maximise the transfer of knowledge to the outside world, as well as within the project consortium itself. To coordinate the dissemination efforts and facilitate cooperation in the best possible way, all activities were reported on a central, private wiki repository which project partners could access[1].

Additionally, dissemination responsibilities, management, protection of IP-rights and acknowledgement of EU funds were described in detail in *ID12-4 Dissemination and exploitation* strategy to ensure a professional dissemination of project results.

How REACTION partners have realised the dissemination strategic objectives is described in Table 1 below. Whereas activities in the initial stages of the project reflect dissemination concerned with project objectives, the last stages of the project show a steady move towards disseminating project results as a preparation for exploitation.

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[1] http://twiki.in-jet.dk

Time	Objective	Methods
Year 1	Create awareness about the REACTION project Dissemination in strategic boards of participants Prepare powerful scientific standing in professional clusters	Publication of support material, flyer and the website Attendance in seminars and congresses Organise European conference on Remote Accessibility Press releases and liaison with health authorities
Year 2	Continue to build awareness of the REACTION results in academic and scientific circles, both within ICT and within health care. Verify opportunities to apply the REACTION components in various health care environments and involve other stakeholders	Aligning events with similar EU or national projects Preparation of pre-commercial brochures Visit to health care communities. Website enrichment Peer reviewed papers in international journals Conference and workshop papers
Be-yond	Prepare to integrate REACTION in existing health environments Promote the early exploitation of a REACTION platform and individual components	Preparation of a commercial brochure Newsletter to potential users Take-up of ePatch components Take-up of CGM sensor components Take-up of semantic services components Demonstration of the REACTION platform

Table 1: Dissemination strategy

3.2 Dissemination responsibilities

All partners engaged in dissemination activities within their areas of expertise. The following table highlights the main dissemination responsibilities for each partner:

Partner	Responsibility
ATOS	Complemented other partners with their expertise in security analysis and distributed security and trust models As project coordinator, general dissemination, and in particular dissemination through the EU channels
CNET	Disseminated technical results related to ICT technologies and infrastructures
DELTA	Disseminated advancements in sensor technology
IMM	Disseminated advancements in sensor technology
FORTH-ICS	Disseminated technical results related to ICT technologies and infrastructures
FHG-SIT	Complemented other partners with their expertise in security analysis and distributed security and trust models
FORTHNET	Disseminated technical results related to ICT technologies and infrastructures
IN-JET	Dissemination manager. Was responsible for coordinating the dissemination activities. Disseminated technical results related

Partner	Responsibility
	to ICT technologies and infrastructures and ethical, legal and regulatory matters. Organised Training Seminar.
ALL	Disseminated biomedical modelling knowledge
MUG	Disseminated clinical and medical results
MSG	Disseminated biomedical modelling and clinical and medical results, as well as advancements in sensor technology and ICT based decision support systems
CHC	Disseminated clinical and medical results
UBRUN	Disseminated clinical and medical results
VUB	Disseminated ethical, legal and regulatory matters
BTS	Disseminated biomedical modelling

Table 2: Dissemination responsibilities for each partner

3.3 Dissemination goals and achievements – an overview

Dissemination and exploitation activities have been completely embedded in the different work packages of the project reflecting the fast transfer of knowledge from the projects research results to public dissemination and commercial exploitation.

To realise the dissemination objectives, several methods and channels have been used and key performance indicators (KPI) have been established to define a targeted approach to selected strategy elements. KPIs included marketing activities, events organised by partners, scientific papers and website usage. An overview of the different KPIs is given below together with short description of the results. A more detailed description of dissemination activities per project year can be found in Appendix 1 - Completed dissemination activities.

Overall the targets have been met, revealing a considerable amount of dissemination activities performed by all partners. An active website, continuously enriched and updated, has been one of the key communication channels, supplemented by the production of newsletters and posters, flyers and demonstrators for project dissemination at events and exhibitions. REACTION partners have organised workshops, exhibitions and sessions and participated in major conferences, producing a total of 67 scientific publications, as well as making a number of other presentations and talks. REACTION partners have attended more than 89 international and national events, raising awareness about the REACTION project and its results in strategic circles of ICT and health care and within a wider audience. On top of this, several meetings and meetings in the context of standardisation events have been organised and attended. All dissemination activities are listed in Appendix 1 - Completed dissemination activities and a list of scientific publications can be found in Appendix 2 – List of scientific publications.

KPI marketing activities

Annual targets were set for newsletters, press releases, flyer, brochure, website enrichment and demonstrators. Overall the targets have been met with some activities replacing others.

Type of activity	Project year 1	2	3	4	Partners involved
Newsletter	1	2	2	2	IN-JET/All
Press release	1	2	2	4	All
Flyer	1			1	IN-JET
Commercial brochure				1	IN-JET
Website enrichment	1	1	1	1	IN-JET

Prototype demonstrator	1	1	1	1	UBRUN/CNET/MSG

Table 3 Annual targets for marketing activities

- Overall six newsletters have been produced whereas the target was set to seven newsletters. A newsletter was issued in November 2010 welcoming readers to the project followed by newsletters in April 2011, August 2011 (most popular, downloaded 666 times), June 2012, August 2013 and February/March 2014. However, news about the project has always been present at the project website and efforts have been directed towards the production of two posters to support partners at events.

- To announce the beginning of REACTION, a press release was launched at project level followed by press releases issued at partner level, targeting the research and scientific community in ICT and/or the medical community. The targets for press releases, at least at project level, have not been met following year 1 due to the fact that results have been communicated better by other dissemination tools, such as the website, articles, newsletters, mail shots, videos and demonstrations. The video on safe glycaemic control in hospital was present on several channels including the EC YouTube channel and Twitter as well as in project newsletter and on the website. It received substantial attention, cementing the strength of visual media content as an excellent tool for dissemination.

- A flyer was produced in year 1, refined in year 2 and updated in year 4, not only meeting but exceeding the set target. The first flyer contained a general introduction to the project with focus on the vision whereas the last flyer focused on the results from the two pilots. On top of this, a project factsheet and ID card were made and delivered to the EC eHealth unit for dissemination through the EU channels.

- Initially, a commercial brochure was planned for year 2, however, it was quickly agreed to postpone it to year 4 to better facilitate early exploitation. It focuses on the technical and medical results of the project and contains a short description of each of the 22 products which have been identified. It has been prepared for release immediately after the project ends.

- The website has been updated continuously with news, deliverables, papers and events and enriched every year with new features such as 'REACTION in the press', 'Scientific papers', 'Online demonstrators', 'Advisory boards', 'Video archive' and a newsletter panel, thus meeting the set target of four enrichments.

- Demonstrators have been developed for every project year and disseminated through newsletters, articles, a video and an online demonstrator on pattern management in diabetes care.

KPI for events organised by partners

Annual targets for events organised by the REACTION project were met in part as is evident in the following overview. In general, it has made sense to postpone the organising of some events a year or two to allow for first results and experiences to emerge.

Type of activity	Year 1	2	3	4	Organised by
Annual conference on "Remote Accessibility in Diabetes Management and Therapy"		1	1	1	Different partners
Clustering event: "Ambient Intelligence in the Support of Healthcare"				1	FORTH-ICS
Training seminars	1		1	2	UBRUN IN-JET
Seminars/workshops, aimed at health care officials, health care providers and the European health care industry		1	1	1	PARTNERS
Session at IEEE/EMBS on continuous glucose monitoring techniques				1	UBRUN
Session at IEEE/EMBS on feedback control of blood glucose				1	UBRUN

Table 4 Annual targets for number of organised events

- The organisation of an annual conference on 'Remote Accessibility to Diabetes Management and Therapy' was originally set as a target with the first one planned for September 2010. This was then postponed until October 2011 where it should have been incorporated with sessions at the IEEE/EMBS. However, with the demise of Solianis, partners were unable to undertake these commitments. More importantly, partners agreed that it was far more appropriate for REACTION to organise sessions or workshops within existing conferences than attempt to organise one from scratch. It was decided to aim for high calibre conferences such as the ATTD, International Conference on Advanced Technologies and Treatments for Diabetes. As a result, partners participated in ATTD 2012, ATTD 2013 and ATTD 2014 with several peer-reviewed abstracts accepted and presented. In ATTD 2013, REACTION partners held a mini-symposium on REACTION; produced a peer-reviewed abstract and had three peer-reviewed poster presentations and three oral presentations.

- REACTION organised a clustering event on Ambient Intelligence Advanced Technologies in Support of Health care and Assisted Living which took place on 26-27th September 2013 in Heraklion, Greece with 25 eHealth projects participating. The event was a success, resulting in further knowledge sharing and collaboration through the establishment of LinkedIn groups. Presentations can be found on the REACTION website.

- The following training seminars took place during the project lifetime

  o A training seminar was held on Hydra Middleware in Bonn in October 2010 with IN-JET participating

  o United4Health, Slovenia, 17-19th June 2013. UBRUN did a workshop for UE project at EU Consortium meeting for technology selection.

  o A workshop for business managers on Implementation of Telemedicine Solutions was organised in Hørsholm, Copenhagen on 13th November 2013 (with IN-JET, DELTA, CHC, MSG, VUB, UBRUN participating)

Several other training sessions have taken place at standards workshops and events throughout the project lifetime.

- Seminars/workshops.

  o REACTION organised a special session 'ICT Platforms and Technologies for the Daily Management of Chronic Diseases and the Support of the Ageing Population' was organised at MobiHealth 2011, the 2nd International ICST Conference on Wireless Mobile Communication and Healthcare, on 5-7th October 2011 in Kos, Greece. The efforts resulted in six paper contributions from REACTION partners. (FORTH-ICS)

  o Workshops have been conducted at several places in the UK

    ▪ UBRUN did a workshop for clinicians at the UK National workshop "Diabetes - a Call for Action", Harrogate International Centre, North Yorkshire, UK, 21st April 2013.

    ▪ REACTION ran a workshop (master class) at the event: Tackling Long-Term Conditions: Meeting the Challenge, London, UK on 16th May 2013. Expert speakers and insightful case studies explored new models of care that can help to improve the quality, productivity and outcomes of the management of long-term conditions. REACTION also had a stand to demo the REACTION platform. (UBRUN, CHC)

    ▪ Seven other workshops by CHC were arranged at: Kings Fund International Conference Telemedicine on 6-8th March 2012; Royal Society of Medicine – International Telemedicine Conference on 30th March 2012; Oxford Telemedicine Institute Seminar on 12th April 2012 (+ DELTA); NHS Direct & Pharma Times Conference for pharmaceutical/telemedicine interests 2nd October 2012; Oxford Telemedicine Seminar, 29th November 2012 and the Healthtec Conference for UK NHS Health IT directors, 3-4th October 2012.

o   A workshop was conducted at the conference eHealth Summit Austria 2013, 23-24th May 2013 by MSG and MUG on the GlucoTab: http://www.ehealthsummit.at/Workshop

- The two sessions at IEEE/EMBS were originally planned for year 2 but were both postponed to year 3 they were arranged as special sessions at IEEE/EMBS in San Diego, 28th August - 1st September 2012, comprising training for 11073 standards and an invited session on uses of the IEEE (PHD) standards (UBRUN). Additionally, UBRUN had another invited workshop on IEEE 11073 standards and a mini symposium on IEEE 11073 standards at the IEEE/EMBS Annual Conference, Osaka, Japan, 3-7th July 2013 (UBRUN).

In addition to the set targets of organising own events, REACTION partners have attended a considerable amount of international and national events and exhibitions.

KPI scientific publications

The overall target of scientific publications was 43:

- In year 1: 1 paper

- In year 2: 9 papers

- In year 3: 14 papers

- In year 4: 19 papers

By the end of the project, REACTION partners have reached 67 scientific publications of which 14 are journal papers; 14 are publications for ATTD conferences; 21 are conference papers and 18 other scientific publications. A complete list of scientific publications is available in Appendix 2 – List of scientific publications.

KPI website

One of the main channels of communication has been the project website which has been active throughout the project with news, downloads, new features, newsletters, deliverables and events.

In order to measure the general interest in the REACTION project, the following table shows the targets set for the website. As shown, the website has had a considerable amount of traffic.

Type of activity	Year 1	Actual 1	Year 2	Actual 2	Year 3	Actual 3	Year 4	Actual 4
[2]Downloads of documents (accumulated number)	100	889	300	5959	1000	10545	2000	33583
[3]Average number of unique IP addresses per month	100	300	150	305	200	733	250	1206
Number of registered users (members)	20	90	50	96	100	102	150	86

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[2] A considerable amount of the download hits are expected to be by web crawlers and robots which make it difficult to estimate precisely how many downloads have been by actual people. The system cannot see who does the downloading, only that it has been asked to deliver a document to an URL.

[3] The Webalizer web log analysis system has been used to give a more detailed idea of the activity on the REACTION website. However, it is still not possible to estimate the number of unique visitors/actual people visiting since web robots remain part of the statistical figures.

The focus is therefore on what comes closest to identifying users which is found in the information about unique IP addresses. The data are based on the source of requests made to the server from a unique IP address. Since many users can appear to come from a single site as well as many IP addresses, the number is a rough gauge as to the number of visitors to the server. Looking in more detail at the IP-addresses, it seems as if around one third of them are not robots or crawlers. This gives a rough average of 1206 unique IP-addresses per month for project year 4.

Number of countries visiting	-		10	11	20	12	30	25

Table 5 KPI for website

As the figures show, there has been much interest in downloading documents and visiting the website and less interest in signing up as a member. Looking at the website, the most popular download is *D5-1 Communication standards within BAN and PAN 1.1* which has been downloaded 2488 times (as per 20th February 2014) and the most viewed news item is the REACTION video with 7168 viewings (20th February).

Already in project year 1, there is considerable traffic on the website with an average of 300 visitors per month and 889 downloaded documents.

3.4 Clustering and concertation activities

The Consortium has participated in several clustering events and conferences organised by the Commission in order to carry out collaboration with other projects. The project also organised its own clustering event on Ambient Intelligence Advanced Technologies in Support of Healthcare and Assisted Living. 25 eHealth projects participated at the event which took place on 26-27th September 2013 in Heraklion, Greece.

The aim of the clustering event was to bring together European projects for demonstrations, presentations of innovative solutions and discussions of potential synergies and cooperation. Focus was on personal health systems for diabetes including social care through robots and personal health systems in general including prevention of falls.

After the workshop, it was agreed to investigate opportunities for further collaboration through networks such as LinkedIn with the possibility of sharing presentations and other documents and exchange knowledge. It was agreed to make all presentations available on the REACTION website where they can now be downloaded.

3.4.1 List of projects that REACTION has collaborated with

From the clustering event on Ambient Intelligence Advanced Technologies in Support of Health care and Assisted Living:

- AP@home: Bringing the artificial pancreas home

- Commodity12: A Smart e-Health Environment for Diabetes Management

- Empower: an intelligent self-management pathway for diabetes patients

- GoCarb: Food Image Understanding: How close can we get? Preliminary results of the GoCARB project

- Dali: exploring new frontiers for assisted living devices

- Accompany: Acceptable robotiCs COMPanions for AgeiNg Years, concept and progress

- GiraffPlus: Combining social interaction & long term monitoring for promoting independent living

- Hobbit: The Mutual Care Robot

- p-Medicine: Smart recommendation services enabling patient profiling and intelligent patient-doctor interaction

- BackHome, BrainAble: Brain Computer Interfaces on track to home to provide active independent living and telemonitoring services to the disabled.

- Care@Home: SmartTV technology as window on the world and eHealth interface

- inCASA: Presenting results from the inCASA Remote Monitoring Platform

- Saapho: Context-aware participation, safety and health care services to foster Active Ageing

- UniversAAL: An enabler of AAL service space

- MovingLife: A roadmap for supporting mHealth wide deployment

- Rempark: Technological approach for Parkinson Disease assessment and management

- Dem@Care: Dementia Ambient Care: Multi-Sensing Monitoring for Intelligent Remote Management and Decision Support

- eHealthMonitor: Knowledge Sharing for Patient Guidance eHealth Services

- Antilope: Adoption and take up of standards and profiles for eHealth interoperability and functionality to establish cross sector collaboration and continuity of care

- MobiGuide: A Ubiquitous Knowledge-driven and Context-aware Clinical Guidance System

- Farseeing: The design of smart and assistive environments that stimulate physical activity and prevent falls

- I-Dont-Fall: An innovative solution to improve fall prevention and detection

- Fate: Experiences on an automatic detection service of falls for elderly people

- e-No Falls: First period results or/and the relation with EIP on Active and Healthy Aging A2 (Fall Prevention)

4   Plan for dissemination after project completion

Dissemination activities during the project execution have been undertaken by the consortium as a whole and by each partner on an individual basis. Dissemination after the project's end is the responsibility of the individual partners in alignment with their established organisational marketing and visibility strategy, combined with the agreed exploitation strategy for the REACTION outcomes.

The post-project dissemination is thus governed by multiple drives and constraints internal and external to the project. In this section, the dissemination drivers and tools that are under the influence of the project will be presented.

4.1   Project contributions to post-project dissemination

Identification of REACTION products

The 22 identified REACTION products[4] serve as a concrete marker of the success of the project. The list of products may encourage the individual dissemination activities after the project because it makes the knowledge generated in the project concrete, identifiable and easily accessible to partner organisations, external communities and the public at large. The list of products will be given a prominent position on the REACTION website and feature in the commercial brochure.

Established IPR schemes

The established IPR schemes allow for easy identification of the exploitable outcomes of the project and with points of contact for further information. Internally to project partners, it will indicate the possibility for exploitation of results whereas external partners will be able to seek contacts for commercial exploitation.

Commercial brochure and newsletter

The project has prepared a commercial brochure to be released at the end of the project to support partners in the exploitation of project results. It focuses on the technical and medical results of the project in the area of diabetes management. The brochure contains a short description of each of the outcomes of the project and a link to the responsible contact partner(s). These outcomes also features in a last project newsletter, issued at the end of the project.

General project marketing material

The project marketing material produced in the course of the project will continue to serve as useful dissemination material. This entails in particular the REACTION flyer and the REACTION posters.

The project website

The project website will be maintained for at least two more years. The website will be alive with regular updates; important events will be reported in the news section and partners are urged to submit their success stories to keep the website attractive. The website will also act as a repository for project documents. After the two year period, a permanent location for the document repository will be found.

The website will be restructured to reflect the identified outcomes of the project which will serve as a guide for visitors. It will provide contextual information and points of contacts for usability.

Initiated demonstration activities

The project's validation activities were broadened to include a set of limited demonstrations to external users. The demonstration activities were part of the process of bringing the project message to a wider community to pave the way for subsequent exploitation of project results by partners.

The demonstration activities were designed to prove the viability of the REACTION platform before it is commercialised, e.g. testing of pre-commercial prototypes. This type of activity goes beyond the validation activities internal to the project, which was based on research prototypes. More information regarding demonstration is given in *D11-1 Feedback from demonstration activities*.

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[4] Terminology used for the promotion of R&D outcomes, methodologies, prototypes, proofs of concept, etc.

The target groups for the demonstrations were health care providers, public and private health care organisations, equipment and device manufacturers and some of the demonstration activities will continue as reference material for continued dissemination.

The following demonstration activities will have an impact after the project ends:

- Demonstration of the multi-protocol gateway and the REACTION SDK

    o The two products were chosen to be implemented in an external demonstration project carried out with IN-JET's LinkWatch telemedicine solution in five outpatient clinics in the Capital Region of Denmark. A total of 55 patients were provided with a Telemonitoring system to do self-assessment at home. IN-JET and CNET collaborated to include the REACTION software in the LinkWatch system. A large amount of data is being processed with the aim of determining the efficacy of the solution, including data on the technical stability of the REACTION SDK software.

- Random Controlled Trials (RCT) of GlucoTab

    o MUG and MSG are planning a multicenter RCT to determine the efficacy of the GlucoTab decision support system in insulin therapy. The RCT is planned to run for the next two years in two or three countries in Europe. IN-JET has worked with MSG to identify a clinical partner for the RCT in Denmark resulting in collaboration with Hvidovre Hospital in the Capital Region of Denmark. If the trial is carried out, it will be a continued driver of dissemination in Denmark.

4.2 Partners and dissemination

Partners perform future dissemination at their own cost and detailed plans for a longer period do not exist or are not available at this time.

However, several partners have already presented plans for their immediate dissemination activities and/or continuation of current activities. The plans are presented in the following table.

Partner	Immediate plans
ATOS	- Dissemination of information related to the project results, including the Notification Handler, but also about the other outcomes (GlucoTab, Multi protocol Gateway, Clinician results) - Internal presentations to other business units of ATOS - Presentations to ATOS customers, including innovation workshops - Public events, such as the World Health Summit
CNET	- Continue dissemination of the REACTION multi-protocol gateway to health care providers - Dissemination of the REACTION multi-protocol gateway towards to National Health Account in Sweden - Dissemination of rule engine and service orchestrator towards other sectors/domains - Dissemination of nutrition app towards diabetes community in Sweden
DELTA	- Continue the dissemination of continuously monitoring different vital signs of diabetic patients using ePatch monitoring systems with multi functionality - Present the possibility in improving the existing telemetric systems and services towards diabetic patients by supplementing blood

	glucose spot measurements with incorporation of continues monitoring of additional parameters
	• Dissemination the benefits of monitoring patients with co morbidities by continues monitoring of ECG, heart rate and activity using the ePatch technology
	• The dissemination activities will be made in 5 different exhibitions in 2014 and in direct contacts and meetings with suppliers of telemedicine system and health care services
IMM	• Continue the dissemination of REACTION glucose sensor development within scientific publications, concerning the results of the clinical trials
	• Present the sensor outcomes to potential industrial partners for further development and exploitation, also based on the generated patents
	• Follow up new ideas generated during the development phase within REACTION based on the knowledge and experience gained in the field of glucose sensor development within new projects
FORTH-ICS	• Continue the dissemination related to the results of the validation of the Long Term Risk Assessment models
	• Continue the dissemination related to the results of the use of the patient portal in CHC
	• Follow up new ideas generated during the development phase within REACTION based on the knowledge and experience gained in the field of web applications/patient portals and health risk prediction within new projects
FHG-SIT	• Continue the collaboration with other projects making use of SIT's access control framework
	• Continue to improve the usability of security components for both developers and end users
	Exploit the knowledge gained from the mobile developments in other development projects as well as in consultancy projects
FORTHNET	• Continue the dissemination of REACTION Network Management System (NMS) through further testing on FORTHNET's private broadband network, in order to be utilised as a small range commercial product in the future
	• Continue the dissemination of the REACTION Short Messaging System component to be fully embedded in FORTHNET's network for customer support and distributed for commercial use, following an extended test cycle
IN-JET	• Continue dissemination of the REACTION multi-protocol gateway together with Patient Portal to health care providers
	• Disseminate results in short term risk assessment and behavioural monitoring to health care providers and municipalities
	• Continue to disseminate GlucoTab through possible RCTs in

	Denmark
	• Disseminate knowledge in ethical, legal and regulatory matters to industrial and health communities
ALL	• Continue dissemination of the integrated risk-driven care concept to health care providers and municipalities
	• Continue dissemination of the short-term risk management component to health care providers
	• Continue to disseminate the Semantic Search technology to health care providers and other markets
MUG	• Continue dissemination of the clinical and medical results of the GlucoTab trials:
	o Disseminate results of the pilot trial ClinDiab-03
	o Disseminate results of the continuous glucose monitoring data
	o Disseminate results of the trial ClinDiab-04
	o Disseminate overall stepwise approach of the GlucoTab development process
	• Support to disseminate results of automatic glucose control
	• Continue to disseminate clinical and medical results of the possible multicenter RCT.
	• Support in commercialising the GlucoTab system
	• Continue to disseminate clinical and medical results of possible GlucoTab development and trials in other settings (GlucoTab@PostICU, GlucoTab@NursingHome)
MSG	• Prepare and perform a multicenter clinical trial to provide evidence on clinical outcomes improved by improved blood glucose control and thus to create a market for the GlucoTab.
	• MSG will disseminate in close cooperation with MUG – see activities above
CHC	• Disseminate the remote patient protocols and workflow that support clinical management at conferences and events
	• Disseminate the results of the patient and clinical portals
	• Establish relationships with stakeholders to disseminate REACTION platform at a wider scale
UBRUN	• Disseminate use of the standards for personal health devices and platforms
	• Disseminate the patient gateway to interested organisations
	• Encourage collaboration with interested organisations to adopt use of the standards
VUB	• Disseminate results of the research on the legal aspects of REACTION at the Health Law Conference in Riga on "Access to

	health care" 28-29th April 2014. • Discuss and disseminate the non-technological implications of the use of REACTION services through mobile technologies • Investigate the issue of professional liability in Telecare as affecting health professionals • In cooperation with partners, disseminate ethical, legal and regulatory matters to industrial and health communities
BTS	• Disseminate model and algorithms as well as their clinical evaluation into the scientific community through contributions to conferences and journals • Disseminate model and algorithms to the health care industry

Table 6: Planned post-project dissemination

5   Exploitation of knowledge

The aim of exploitation in REACTION is to ensure the best possible foundation for an appropriate academic and commercial exploitation of the project results after the project has finished. This is achieved by developing exploitation plans which describe how the results of the project will be exploited. The main objectives in this process are to:

- Identify and describe the innovative components of the REACTION results

- Assess the exploitation potential of these 'products'

- Produce a realistic exploitation plan, solidly anchored in the partners' own strategies

The following section describes how these objectives have been realised: First, the REACTION exploitation strategy is outlined followed by key market considerations. Then, the identified products and project knowledge and their exploitation potential are presented. Finally, an exploitation plan is outlined for the project as a whole and per partner, addressing how the products will be marketed.

5.1   The REACTION exploitation strategy

The exploitation strategy is to create an effective and realistic exploitation for the benefit of the project as a whole and for the individual partners after the project ends. Exploitation is closely linked to the dissemination objectives listed in Table 1 with focus on integrating REACTION in existing health environments and promoting the early exploitation of the REACTION platform and its individual components.

The strategy has been to establish contacts and liaisons to other projects, standardisation organisations, institutions and companies which are beneficial to the project, especially in terms of preparing the market for technology adoption.

5.1.1   Approach

Early considerations on the exploitation potentials of the REACTION platform and its components are important to steer activities in the preferred direction and prepare for exploitation. Before the start of the project, partners therefore defined some joint exploitation targets to bring the REACTION platform and services to the market within 24 month of project completion. Halfway through the project, a questionnaire on exploitation was distributed to partners to follow up on the expectations for exploitation. This was supplemented by a market and competitor analysis (*D12-2*) establishing the foundation for market take-up of REACTION components.

It was concluded that exploitation will most likely be driven by individual partners, in particular the technology partners, with the possibility of involving or becoming joint service providers with other partners.

In the middle of project year 4, the process of identifying the foreground developed in the project and the ownership began to progress towards a possible exploitation of the results. A template was developed to collect the information in various iterations. The result was discussed at the Project Board meeting in September 2013 with a session fully dedicated to the exploitation of the project foreground. After further discussions, partners agreed on the identification of 22 products and ownership as shown in Appendix 3 - List of products and contact information and documented in the final report *D1-5 Final Report* (M48). These products are described in detail in Section 5.3.

To ensure an effective and realistic exploitation after project completion, a project exploitation plan, as described in this deliverable, specifies the industrial as well as scientific partner exploitation strategies and promotion actions, including a list of derived contacts, potential users and exploitation potentials of the results.

5.2   Market analysis and business modelling

The project has been concerned with investigating and defining the project's commercial potential in terms of user needs, market analysis and business models. As a basis for specific exploitation plans, the project has identified the potential market segments. The market analysis was performed mainly by the industrial partners and was documented in *D12-2 Market and Competitor Analysis*. This

deliverable offers information on users/customer needs in order to provide the scientific partners with useful feedback on the marketability of REACTION products and provide a comprehensive background for each partner's individual exploitation and business plan.

The market analysis found that the market segments most relevant for the REACTION products were within the Remote Patient Monitoring markets focusing on diabetes management and related co morbidities for patients with diabetes type 1 and 2 as well as health professionals in hospitals and in primary care. Since the REACTION platform can support medication compliance, adherence to clinical pathways, education and self-management health services for diabetes related conditions, this market segment was, due to the epidemic growth of diabetes type 2, found to offer the greatest potential in the deployment and uptake of closed-loop applications based on the REACTION platform.

It was also found that there is a great need amongst users for REACTION applications on a mobile platform, for example the GlucoTab applications, which provide workflow support and decision support for insulin dosing to the health care professionals. Remote Patient Monitoring mobile platforms in the form of tablets and smartphones have also attracted extraordinary interest.

A list of competing products and services providing remote diabetes monitoring and management platforms for hospital, primary care and patients was compiled. In focus are services offering interoperability between systems/integrating platforms, pointing towards a more formalised data exchange between two or more systems. A SWOT analysis was then provided to determine the strength and the weaknesses of the REACTION platform vis-à-vis its competitors and the opportunities and threats presented by the markets and the market factors in relation to a successful exploitation of the REACTION platform.

An overview of market conditions in 15 EU Member States was publicised in *D9-4 Health care economics and reimbursements*. Further details of the market segmentation and competitor analysis can be found in the deliverable *D12-2 Market and Competitor Analysis*.

With the precise REACTION products defined, the business modelling work moved on to develop specific business models for three differing markets documented in *D9-5 business modelling in diabetes management*. The deliverable outlines three business models chosen to represent various configurations of the final project outcomes. The business models are instantiated with three precise value propositions pertaining to three emerging REACTION solutions: The GlucoTab Diabetes Management System, both in In-Hospital and in homecare settings, and the closed-loop diabetes management platform composed of the single and multi-protocol REACTION gateways in combination with the REACTION Software Development Kit deployed in Primary Care. The three value propositions and typical data about stakeholders have been valorised and the business models have been instantiated in three detailed business cases using the e^{3}value tool (described in *ID9-5 Business modelling concepts*).

A value based business model was used to identify value objects and value exchanges between stakeholders. Since health care provisioning, economic reimbursement schemes and most other circumstances vary widely in the EU Member States, all settings have been placed in Denmark where data and other important information have been readily available to the authors. However, most, if not all, of the principles and suppositions outlined in the Danish examples will apply broadly in the EU and globally.

In a health care system mostly financed with tax revenues, the offering presented by the REACTION solutions may all be very beneficial to patients but they are mostly not willing to pay extra for it. This means that the value transactions of delivering REACTION diabetes management services do not have a direct economic counter transaction. However, the patient is assumed to work and pay income taxes which are then used to fund the services. Moreover, by extending the group of actors with governing entities such as the Ministry of Health, the entire aspect of tax payments and revenues can be included in the business model.

All three business cases offer benefits for the stakeholders in terms of health care savings, short payback times for health care providers and operators and improved outcomes for diabetic patients. These benefits are attractive, even compelling, particularly for the hospital and homecare settings.

The main medical driver for the diabetes management system is better health outcomes for the patients. Better glycaemic control leads to a broad range of health care improving factors: Fewer admissions to hospitals, faster discharge, reduced need for unplanned re-admissions and reduced visits to General Practice. Moreover, on the soft side, it leads to a better quality of life and, happier patients with extra energy to cope with their conditions. All of these improvements represent a value to

the actors in the health care scenario. And value models are able to capture them in the various contexts that they appear in the three business cases.

With some limitations, the three business cases can be escalated to the entire country of Denmark. In the In-Hospital business case, the escalation from one region to the country level yields total annual savings on diabetes hospitalisation of €2.7 million. In the Primary Care business case the total savings are around €4.7 and in the Homecare business case, escalation from one municipality to the country level yields total savings in the order of magnitude €0.9 million. The REACTION services and products thus have the potential for a total saving in health care costs in Denmark alone of €8.3 million corresponding to 0.04% of total health care spending (2011).

Within this market framework, the specific exploitation plans are presented in the following sections with information about potential products, unique selling points and targeted market segments together with marketing plans.

5.3   Commercial exploitation - REACTION products

As part of the process of identifying the foreground developed in the project and the ownership, 22 REACTION products have been identified as possible exploitable elements.

In the following sections we describe the products and their unique selling points in relation to current market needs and potential customers. We also list the main contact partner.

1. REACTION GlucoTab

GlucoTab is a workflow and insulin dosing support system for the glycaemic management of patients with diabetes type 2 at hospital. End users are nurses and doctors at the general ward. The GlucoTab system was designed and developed according to the strict regulatory requirements of the medical device directive within the REACTION project. Three clinical trials have been performed. In the first trial, the basal/bolus insulin titration algorithm was tested in 37 patients using paper. The second and third trials were performed using the GlucoTab system with the REACTION algorithm incorporated. In total 129 patients have been treated with the GlucoTab system and the GlucoTab system was CE marked in November 2013.

Market needs

Observational studies in diabetic subjects admitted to general medical and surgical areas have shown that poor glycaemic control is associated with prolonged hospital stay, infection, disability after hospital discharge and death. In patients with diabetes admitted to general medicine wards, hyperglycaemia is commonly not well addressed. The use of a basal bolus insulin treatment protocol in a multicentre randomised trial has shown that in general medicine patients with type 2 diabetes, glycaemic control was improved without increasing the risk of severe hypoglycaemia.

Unique selling points

The GlucoTab system implements a novel, mobile, tablet based workflow support system which includes a validated basal/bolus insulin titration protocol (REACTION algorithm) to provide decision support for optimal glucose management for nurses and physicians at the ward.

The GlucoTab was validated in two clinical trials including in total 129 patients who were treated with the system. Results show a decrease of the mean blood glucose, NO increase of hypoglycaemic events and high user acceptance. The GlucoTab system was CE marked in November 2013 and can now be used in a clinical routine.

Figure 1: The GlucoTab

Main customers and end users

The main customers are hospitals or hospital trusts as well as local or regional health care providers. The end users are nurses and physicians in general hospital wards.

Other potential markets

Nursing homes/care homes offer another potential market for the GlucoTab. However, certain modifications are required to tailor the GlucoTab to this new area.

Medical device companies and insulin producing companies are also potential customers/ partners.

Contact partners

Frank Sinner (MSG), frank.sinner@joanneum.at and Thomas Pieber (MUG), thomas.pieber@medunigraz.at

2. REACTION Patient Portal

The patient portal allows for collection of patient input data, including the capture of life-style data such as activity and diet, the capture of medication data as well as life-style and compliance questionnaires and manual entry of data extracted from the Electronic Patient Record (EPR) to create a comprehensive diabetes data management system. The patient portal is designed to enable sharing of information between clinicians and patient and supports the patients and informal carers in the self-management of the diabetes.

Market needs

Today, people with diabetes require to be empowered and to have self-management capabilities in the long-term management of their chronic disease. It is very important to have a very user-friendly tool able to run on different mobile and fixed devices that they can use effectively in order to have all the information for being able to self-manage their disease.

Unique selling points

Unique selling points remain to be defined (contacts have been established with SMEs).
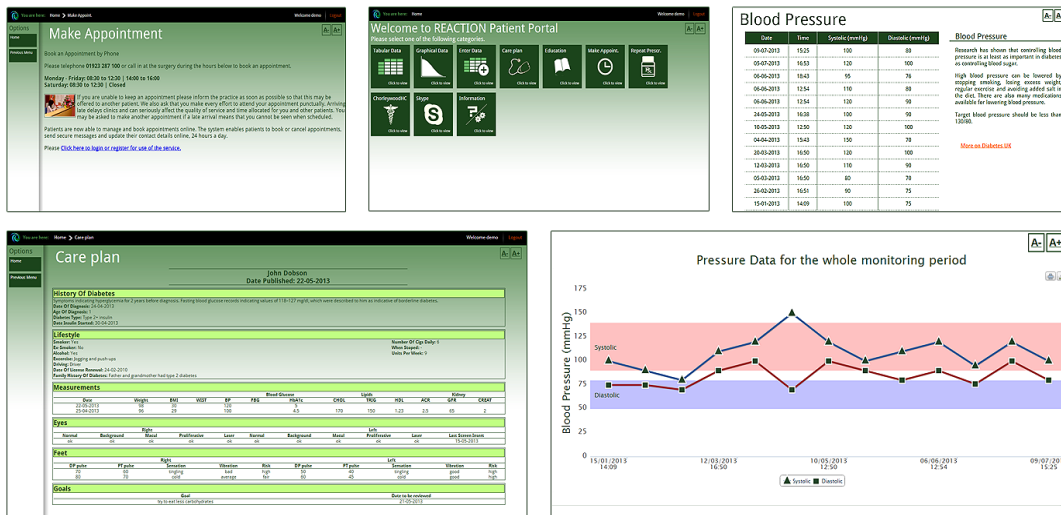
Figure 2: Patient Portal user interface

Main customers and end users

The main customers can be public or private health delivery organisations delivering the service to end users (people with diabetes and their informal caregivers).

Other potential markets

Health care or social care home service organisations (with nurses and/or doctors) might also be interested in this product.

Contact partner

Franco Chiarugi (FORTH-ICS): chiarugi@ics.forth.gr

3. REACTION Clinical Portal

The REACTION Clinical Portal is a software application to manage information collected from sensors, patient portal and care plan in order to provide clinical management of diabetes patients.

Contact partner

Malcolm Clarke (UBRUN): Malcolm.Clarke@brunel.ac.uk

4. REACTION Zigbee Patient Monitoring Platform

The REACTION ZigBee Home Monitoring Platform is a standards based eco-system based IEEE 11073 standards and ZigBee wireless. It includes a wide range of devices to monitor physiological and environmental data. It supports comprehensive monitoring of complex patients in primary care. The platform includes sensors for blood pressure, blood glucose, pulse oximetry and weight, and can monitor PIR motion, bed and chair, and medication.

Emphasis of the design has been on simplicity of use for the user.

The sensors are supported using a general purpose wireless module developed by Brunel University that fits all the sensors and is used in the gateway. It can be integrated to other medical devices to bring new sensors to the platform.

A&D blood pressure monitor with Reaction ZigBee module

	Purpose designed blood glucose docking station for use with One Touch Ultra 2
	Purpose designed pulse oximeter for simple use by elderly patients
	A&D weighing scale with Reaction ZigBee module
	PIR motion sensor with Reaction ZigBee module
	Tynetec bed/chair sensor with Reaction ZigBee module
	Pivotell medication monitor with Reaction ZigBee module
	Home Mains Plug Gateway

Figure 3: Sensors and devices

Unique selling points

Brunel University has developed a ZigBee wireless module that implements the full software stack of ZigBee Health Care Profile and IEEE 11073-20601 for each of the devices. The devices are all fully plug and play interoperable with the gateway. The module integrated to other manufacturer devices.

The devices and gateway are fully integrated with the Reaction database and applications to provide fully turnkey platform.

Contact partner

Malcolm Clarke (UBRUN): Malcolm.Clarke@brunel.ac.uk

5. REACTION Platform Server Backend

The REACTION Platform Server Backend is software running on a backend server on top of one or more databases. It processes incoming observations from various gateways and provides functionality for defining and executing monitoring rules and related actions such as SMS notification. It also provides functionality for defining and executing service orchestrations and event processing and management. A layer of Web Services provides a high level Service Layer for applications to use to access and process patient and monitoring data.

Contact partner

Peter Rosengren (CNET), peter.rosengren.@cnet.se

6. REACTION DCK

The REACTION DCK is a developer toolkit to enable integration of medical devices into eHealth applications. It includes APIs, extensible middleware objects for device connectivity and testing tools for protocol compliance. The main user of this product is a developer. Using the Reaction DCK, the developers will increase their efficiency and be able to quickly deliver new eHealth solutions to their customers.

Contact partner

Peter Rosengren (CNET) peter.rosengren.@cnet.se

7. REACTION Nutrition App

The REACTION Nutrition App is a Smartphone app for entering nutrition information. It provides access to and selection of nutrition-related data such as carbohydrates, calories etc of food contents. It is designed for use with Android phones and exports data to a backend server. It keeps diet information and weekly lists of meals and can export into the REACTION database using the Service Layer. The Nutrition App can be used by system integrators to extend their eHealth solutions with possibilities of managing diet and nutrition data.

Contact partner

Peter Rosengren (CNET) peter.rosengren.@cnet.se

8. REACTION SMS Notification Component

The REACTION SMS Notification Component is a software infrastructure for the delivery of SMS notifications.

Unique selling points

The main objective of the REACTION's SMS service is to provide advanced and targeted alerts and notifications to the end users, with the use of an instant communication method, the Short Messaging System, which is available over GSM networks, to mobile users. The key issues for this service are the advanced user profiling and the cognitive techniques which can be used in order to dynamically compose and send alert and notification messages to the end users of the REACTION platform, depending on their particular personal profile and attributes (carers or patients). Short message service is a globally accepted wireless service that enables the transmission of alphanumeric messages among GSM mobile subscribers. The initial version of GSM's short message service was limited to 160 characters per message. Despite that limit, the service became very popular in Europe as a mechanism to exchange text messages between various devices, such as GSM phones, laptops, tablets, PDAs and others. The fact that SMS messages are being transmitted over data channels means that an active SMS enabled mobile terminal is able to send or receive a short message at any time, independent of whether or not a voice or data call is in progress, while it is possible to deliver a short message even if, due to overloaded network, it is impossible to allocate a voice channel. SMS also guarantees delivery of the message by the network. If the recipient's device is out of range or turned off, or in case that any other failures are identified, the message is stored at the SMSC, until recipient's headset becomes available. SMS marketing and communications cost a fraction of that of traditional methods commonly used to market, promote and communicate with consumers via print

ads, flyers and mailers, etc. giving retailers an innovative way to reach customers at a much lower cost and more importantly in a dynamic and targeted manner.

Main customer and end user

SMS services provide specific advantages not only to the medical domain, as it has been applied in the REACTION project, but also to a large number of domains ranging from targeted information services to advertising. One of the advantages of using SMS services in the medical domain is related to patient failure to attend hospital outpatient appointments, which has a significant impact on the ability of hospitals to provide efficient and effective outpatient services. Not only does a high failure to attend rate result in suboptimal utilisation of clinical and administrative staff, it also reduces revenue opportunities and extends the period of time that patients must wait for an appointment booking. The ease with which large numbers of messages can be customised and sent by SMS text messaging, along with its availability and comparatively low cost, suggests that it is a suitable mean of improving patient attendance. Additionally, in the business domain in general, SMS services provide a number of important advantages, being the most direct form of marketing in today's world, the most cost effective, as well as the most highly targeted way of advertising and promoting products. Considering the above, there is a wide range of potential customers in various domains and an even greater number of end users in numerous domains.

Other potential markets

As mentioned above, the range of potential customers and users is extensive. One example of an existing "customer" is the FORTHNET group of companies which has already integrated some functionalities of the SMS service developed within the REACTION project framework to provide targeted information and notifications to its customers. This service can be promoted and applied to a number of other interested companies in Europe.

Contact partner

Manolis Stratakis (FORTHNET), stratakis@forthnetgroup.gr

9. REACTION Network Monitoring Service for Mobile Devices

The REACTION Network Monitoring Service for Mobile Devices is a java library for remotely monitoring/managing mobile devices using the Simple Network Management Protocol (SNMP).

Unique selling points

The main objective of the Network Management System (NMS) in REACTION is to utilise a Network Monitoring Infrastructure to:

- support network-wide "active" and "passive" measurement data collection and analysis;
- identify end-to-end performance bottlenecks in network paths;
- discover network attacks and
- evaluate Internet traffic characteristics on an ongoing basis

The NMS monitors data traffic and assesses the transmission quality between the Patients' Sphere and the Carer's Sphere, the REACTION backend and other cooperating systems such as the hospital information system (HIS) and EPRs in primary care. Furthermore, it is able to analyse network traffic data and present them in graphical format; to generate email alerts to warn network or system administrators of abnormal network conditions or attacks; and to offer additional analysis about the behaviour of these attacks. With the growing network and the ever increasing network security breaches, the need for a robust and resilient network management system is utmost essential. Since the NMS developed within the REACTION project framework can be considered as a stand-alone application, it provides a number of attributes for any potential customer, such as costs reduction and fewer outages through the automatic process of the system, leading to improved productivity and increased customer satisfaction.

Main customer and end user

The demand for passive network monitoring systems is increasing as network operators prefer to use monitoring systems over traditional protocol analysers. As network operators have expanded their

networks, subscribers have been given a greater choice of providers, which in turn has increased competition in the market.

To tackle this situation, network operators are spending more money on measuring the QoS (quality of service) and QoE (quality of experience) at the subscriber's end. Because CEM systems can provide network operators with these parameters and reduce customer churn, demand for such systems increased significantly in the last years, especially by large and small enterprises, which needed to monitor their networks' traffic and the connected device clients. The convergence of voice, video, and data is also a major factor that is driving the need for network-monitoring systems.

Other potential markets

As mentioned above, potential customers for the NMS include mainly SMEs who are planning to use an integrated approach for their network data collection and analysis, as well as to identify network bottlenecks and discover network-based attacks in real time. The NMS can be applied in a number of businesses, since it can be parameterised according to specific needs.

Contact partner

Manolis Stratakis (FORTHNET), stratakis@forthnetgroup.gr

10. REACTION Long-term Risk Models

The REACTION Long-term Risk Models provides 1) Statistical models for predicting the occurrence of diabetes complications 2) Sets of risk factors of diabetes complications 3) Bayesian networks depicting the statistical relations among diabetes-related clinical parameters 4) Implementation of points 1 -3 as Web-Service components.

Market needs

People with diabetes are subjected to acquire further complications and it is very useful for GPs and endocrinologists to be able to predict the occurrence of complications to adjust treatments, motivate compliance and motivate behavioural and lifestyle changes.

Main customers and end users

The main customers are public or private health delivery organisations where the end users are GPs and endocrinologists. In a not far future the models might be adjusted to be usable directly by people with diabetes and their informal caregivers.

Contact partner

Franco Chiarugi (FORTH-ICS), chiarugi@ics.forth.gr

11. REACTION Glucose-insulin-glucagon Model

The BTS diabetes model describes the pharmacokinetics of glucose, insulin and glucagon via a detailed mechanistic description of administration, distribution and elimination as well as pharmacodynamic interactions of the three substances. This includes processes such as blood flows relevant for distribution on the whole-body level or glucose transporters in different organs as well as insulin receptor binding and downstream events. The model was established using very diverse data and validated on a clinical dataset capturing the blood plasma dynamics of the three substances.

Market needs and unique selling points

The health care and pharma industry is increasingly looking for mechanistic systems pharmacology models to support their R&D process from target identification and lead optimisation to clinical development. Especially in competitive environments such as diabetes systems, a pharmacology approach promises faster and more informed decision making than feasible with experimental approaches only.

BTS has developed a multi-scale model for diabetes with a higher level of physiological details than other models described in literature. The model has also demonstrated strong predictive capabilities. In addition, the model is embedded into a powerful software environment geared towards the needs of pharma R&D. In combination this makes a probably unique tool to support diabetes R&D.
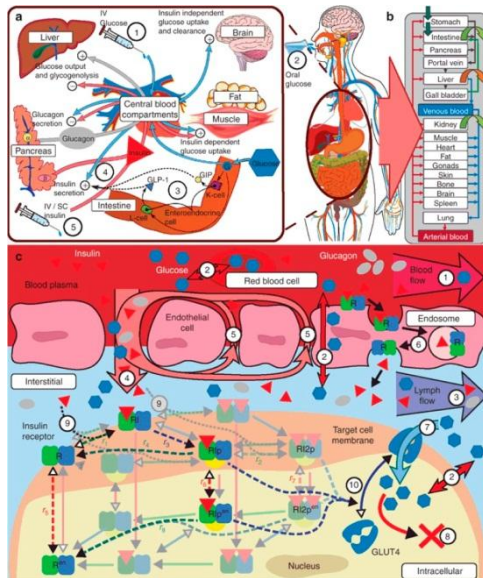
Figure 4: Illustrative model outline taken from www.nature.com/psp/journal/v2/n8/full/psp201340a.html

Main customers, end users and other potential markets

The main customers are research scientists and decision makers within the diabetes pharma and health care industry either through consulting BTS or licensing the software and model. The diabetes device industry could also be targeted as interested in further developing the model as part of an artificial pancreas system. Alternatively, the model could be used to test other control algorithms or artificial pancreas systems as the model can be parameterized to constitute different virtual patients.

Contact partner

Stephan Schaller (BTS); stephan.schaller@bayer.com

12. REACTION Chip-based IR Glucose Sensor

The chip-based IR-CGM sensor combined with micro dialysis is based on IR difference absorption spectroscopy applied to a perfusion solution generated via micro dialysis. Micro dialysis is applied with medically approved dialysis catheters and combined with a disposable polymer chip (based on IMM patent US7894071B2), containing the optical flow through cells, connected to the micro dialysis and a reference liquid. The chip based IR-CGM sensor was used for clinical evaluation of the optical measuring technique to avoid time consuming, pre-clinical and biocompatibility testing within REACTION. The sensor could be used for further demonstration of the method and be improved concerning lag time introduced by the micro dialysis.
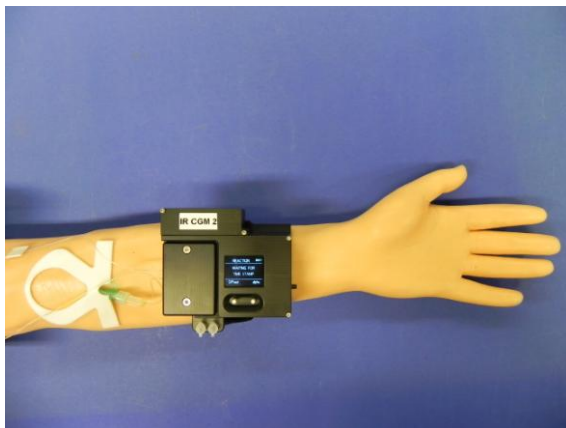
Market needs

Figure 5: A chip-based IMM IR CGM sensor, combined with microdialysis, connected to the forearm of a patient.

For improvement of glycaemic control of diabetic patients, especially also for automatic glucose control, continuously measuring sensors with a high specificity and accuracy are required. These sensors should exhibit a reasonable cost to be applied by large number of outpatients; they should be working for several days without the need of recalibration and should be comfortably wearable by the patients. Ideally the sensor should be non- or minimally invasive, should not require any major consumables and be connectable to a data reader unit or a pump.

Unique selling points

The IR-CGM sensor developed within REACTION is based on IR transmission spectroscopy on glucose containing perfusion solution in comparison to pure perfusion solution. The method does not need any chemicals that are consumed during the measurement, thereby in principle allowing for none-time-limited measurements. The body interface is a medically approved micro dialysis catheter (either subcutaneously or intravenously), representing the time-limiting element (degeneration of the selective membrane). Spectroscopy is carried out into a disposable low-cost polymer opto-fluidic chip that can be inserted into a non-disposable reader unit, wirelessly connected to a PC. Due to micro dialysis an additional lag time is introduced that can be minimised by minimising the fluidic path ways from the catheter to the chip. Ideally the optical cells

might be directly integrated into the catheter, avoiding additional lag time caused by fluidic transport (see fibre based IR CGM sensor, below).

Main customer and the end user

Typical customers for such a sensor device would be companies developing and selling glucose monitoring sensors. These companies should be willing to develop the IR-CGM sensor device further, to make it a real product. So far the sensor has prototype or demonstrator status. Such a product would be used by diabetic patients (Type 1 and Type 2) in everyday life to make trend analysis of their blood sugar values for improving their diabetic management and getting alarms overnight, in case of hypo- and hyper-glycaemic events.

Other potential customers/markets

The principle of optical difference spectroscopy is not restricted to glucose monitoring it could also be applied to other substances present in blood or interstitial liquid. For that the relevant spectral range had to be identified and light sources as well as photo detectors had to be adapted. Applications would be the monitoring of any endogenous bio molecules like e.g. amino acids or exogenous drugs, for which suitable micro dialysis catheters had to be applied. With the present sensor principle such monitoring could be performed on out-patients for post-operative treatment or post-rehabilitation support.

Contact partner

Thomas Klotzbucher (IMM), Thomas.Klotzbuecher@imm.fraunhofer.de

13. REACTION Fibre-based IR Glucose Sensor

The fibre-based glucose sensor is based on IR difference absorption spectroscopy and is integrated into a micro-needle. The measurement principle is the same as with the chip based sensor described above but by integration of the optical cells into a micro needle equipped with a semi-permeable membrane, no fluidic transport is required (diffusion controlled) thereby not introducing any additional lag time. All light sources (LED or SLED) and photo detectors are integrated into a non-disposable, wearable unit from which optical light is transported via optical fibre into the implantable micro needle (patent application pending). Moreover, the application of the optical directly into the tissue environment avoids temperature changes during fluidic transport and problems arising from this (e.g. micro bubble formation).
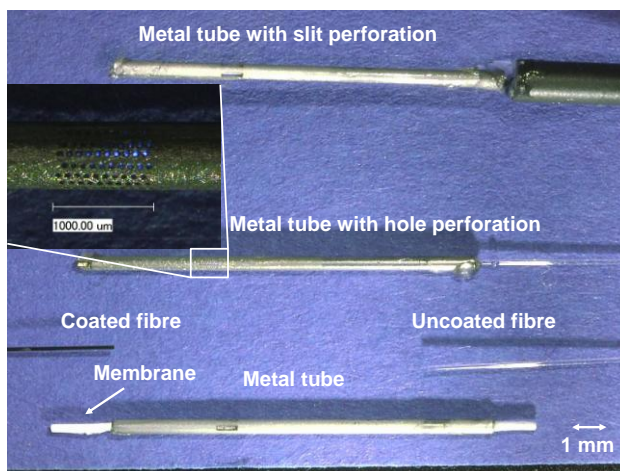

Figure 6: The fibre based sensors were used for laboratory in vitro experiments to demonstrate the concept of optical transmission cell integration into catheter needles. Metal tubes of 1mm diameter (potentially acting as catheter needle) are perforated in two different ways (slits or holes), functionalised with a pore membrane (20 kDalton) at the inner side wall and connected to an optical fibre and a backreflector (made by a piece of coated fibre), forming an optical transmission cell within the needle.

Market needs

For improvement of glycaemic control of diabetic patients, especially also for automatic glucose control, continuously measuring sensors with a high specificity and accuracy are required. These sensors should exhibit a reasonable cost to be applied by large number of out-patients; they should be working for several days without the need of recalibration and should be comfortably wearable by the patients. Ideally the sensor should be non- or minimally invasive, should not require any major consumables and be connectable to a data reader unit or a pump.

Unique selling points

Typical customers for such a sensor device would be companies developing and selling glucose monitoring sensors. These companies should be willing to develop the IR-CGM sensor device further, to make it a real product. So far the sensor has prototype or demonstrator status. Such a product would be used by diabetic patients (Type 1 and Type 2) in everyday life to make trend analysis of their

blood sugar values for improving their diabetic management and getting alarms overnight, in case of hypo- and hyper-glycaemic events.

Main customer and end user

Typical customers for such a sensor device would be companies developing and selling glucose monitoring sensors. These companies should be willing to develop the IR-CGM sensor device further, to make it a real product. So far the sensor has only demonstrator status. For further usage in a first step, prototypes had to be set up and tested intensively, followed by a transfer into a real product. Such a product would be used by diabetic patients (Type 1 and Type 2) in everyday life to make trend analysis of their blood sugar values for improving their diabetic management and getting alarms overnight, in case of hypo- and hyper-glycaemic events.

Other potential customers/markets

The principle of optical difference spectroscopy is not restricted to glucose monitoring but could also be applied to other substances present in blood or interstitial liquid. For that the relevant spectral range had to be identified and light sources as well as photo detectors had to be adapted. Applications would be the monitoring of any endogenous bio molecules like e.g. amino acids or exogenous drugs, for which suitable micro dialysis catheters had to be applied. With the present sensor principle such monitoring could be performed on out-patients for post-operative treatment or post-rehabilitation support.

Contact partner

Thomas Klotzbucher (IMM), Thomas.Klotzbuecher@imm.fraunhofer.de

14. REACTION Short Term Risk Management Tool

The Short Term Risk Management component is a system which contains several beneficial functions, including: Data visualisation with intelligent, adaptive graphical display options; showing daily profile with therapeutic data and providing statistical methods for data processing. In the Short Term Risk Management model, the pattern management approach was applied with pattern recognition and definition functions. Having a pattern detected, it is important to review the possible causes and take appropriate action. The component also has the ability to support health care professionals and patients by suggestions for decision support purposes. A generated report summarises all of the results from the monitoring data processing.

Market needs

The Short Term Risk Management component supports general health care services by analysing monitoring data collected from different medical devices. It is also related to the big data problem where a collection of data sets are so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications. The short term risk management can reveal hidden correlations from the monitoring data with pattern extraction functions. For decision support it is also possible to display suggestions for health care professionals and patients about the possible changes which may be required to optimise the health status of the patient.

Main customer and end user

The main customers and users are health care organisations, health care providers and patients.

Contact partner

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15. REACTION Semantic Search Tool

The Semantic Search technology helps information extraction, data mining from databases, non-structured and structured text. Knowledge discovery aimed at analysing the collected data (e.g. qualitative and quantitative data such as data from real-time observations, direct patient inputs and health history). The formalisation of pre-existing clinical knowledge and the discovery (e.g. with semantic data mining techniques) of new elicited knowledge represent one of the main innovations of this technology. Methods provided for the semantic analysis of natural language texts as well as

methods for discovering new pieces of knowledge on the basis of qualitative and quantitative data, textual and numerical elements can be searched together. The proposed technology provides a goal-oriented solution to the big data problem, where a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications.

Market needs and unique selling points

In order to use unstructured text information for decision support, Semantic Search is a technology for search in natural language texts and databases. It is an efficient tool for handling the big data problem in a goal-oriented way.

Main customer and end user

The main customers and users are health care organisations, health care providers and patients. The range of potential customers can be extended to other market fields as the technology is not health care specific.

Contact partner

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16. REACTION Closed-loop Algorithm using Physiological Model

The closed-loop algorithm by BTS can provide insulin dose suggestions based on frequent glucose measurements (intravenous or subcutaneous) to improve glycaemic control. The algorithm relies on the mechanistic BTS glucose-insulin-glucagon model as a core for model predictive control that is further embedded into a PID-based off-set control for prediction error correction.

Market needs and unique selling points

Automatic glucose control (i.e. artificial pancreas systems) especially for type 1 diabetes patients promises improved glycaemic control and consequently decreased long-term side-effects of the disease. In addition, it can ease the burden of manual self-therapy for patients. Besides an insulin pump and a glucose measurement device, a control algorithm is an essential of such an artificial pancreas. The physiological model basis offers a better prediction kernel for improved glycaemic control, especially over time when trained with enough data.
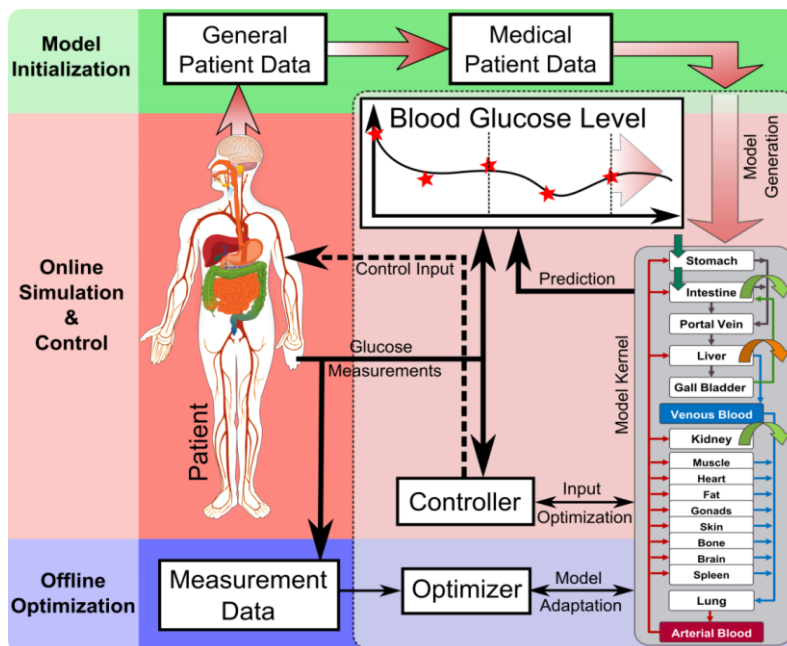
Main customer and end user

The primary customer for the algorithm would be a diabetes device company interested to further develop the model as part of an artificial pancreas system. End user would then be the patient using such a system. The algorithm could also be used as a benchmark for (academic) research.

Figure 7: Schematic of the work- and information flow of the integrated control system within a clinical environment during continuous closed-loop glucose control

Contact partner

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17. REACTION Multi-Protocol Home Monitoring Gateway

The REACTION Multi-Protocol Home Monitoring Gateway is a software-based gateway running on standard PC-platform. It provides uniform access, connectivity, control and interfacing with medical and wellness devices. It supports Continua and other protocols and exports data to different backends.

It is based on open standards but still offers support for commercially available medical devices and offers interoperability and flexibility for the customer to meet the requirements in many different scenarios. Therefore it protects the customers' investments already made into existing devices. The typical customer is a care organisation with a need to provide home monitoring solutions for patients with chronic diseases.

Contact partner

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18. REACTION Primary Care Patient Monitoring Protocols

The remote patient monitoring protocols, workflow and risk stratification are used to support the management of patients with Chronic Diseases.

CHC has developed and validated remote patient protocols and workflow that support the clinician in the management of patients in a way that reduces the burden of reviewing patient data and identifying those patients at risk in order to support timely intervention.

The main customers are health and social care organisations looking to deploy Telehealth and Telecare. Other potential users are commercial entities interested in the management of data and workflow of Telehealth and Telecare data as well as organisations interested in research and development in related areas.

Contact partner

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19. REACTION Wireless Sensor (ePatch) for Heart rate Monitoring

The REACTION Wireless sensor (ePatch) is a miniaturised monitoring system formed as a patch and applied to the skin surface with a skin friendly adhesive. The ePatch primarily records ECG and is intended to be placed on the sternum of the chest as shown in the figure below. The ePatch monitor consists of two parts: A sensor containing all electronics and a re-chargeable battery and having a weight of approximately 15 grams; and an electrode in which 3 skin contacts are integrated along with screened printed wires connecting the individual skin contact points and a special designed connector. Before applying the monitor on a patient, the sensor is inserted into the connector on the electrode. By this, electric contacts are made to the input terminals of the sensor and the sensor is as well mechanically fixed to the electrode. The two parts of the ePatch monitor are shown in the figure below.
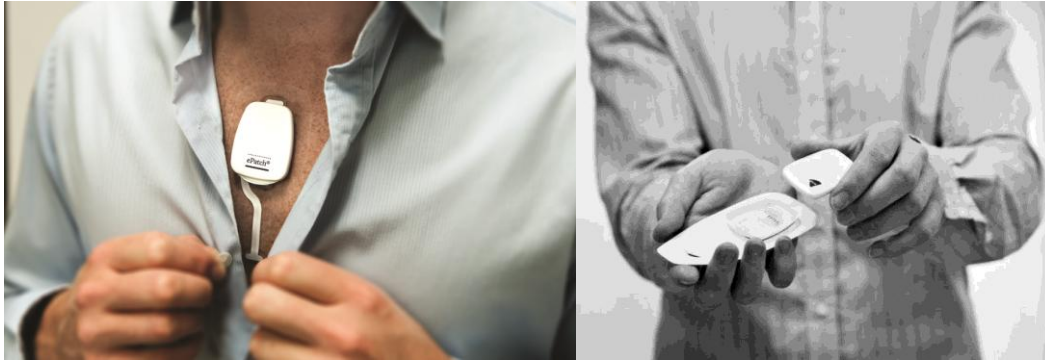
Figure 8: The ePatch

In the REACTION project the ePatch technology has been further develop towards the needs in diabetes treatment. Activity sensors and wireless data communication using Zigbee or Bluetooth have been integrated and the technology has been further developed and matured in general so it is reliable, easy-to-use and can be manufactured at affordable prices.

Short description of markets needs for ePatch monitoring of diabetes patients

The need for medication of diabetes patients varies over the day. It depends on many factors like energy intake and expenditure and the metabolism of the patient. Therefore, continuously monitoring blood glucose levels and giving feedback to the patient on his demand for medication is the long term goal and has also been the goal for REACTION.

Today and in the coming years most diabetic patients will manage their treatment by regularly doing blood glucose levels using spot measurements and not continuously monitoring. For many who lives a stable and predictable life, this monitoring strategy is sufficient for following a medication plan that will keep their glucose levels within safe margins.

But for many diabetics it is difficult to establish and live a stable life. Their need for medication will vary much more because their energy intake and expenditure vary more during the day. The ePatch can give these patients a continuous measure of their activity and important input to adjustment of their medication and give them feedback on the need for more frequent spot measurements of their blood glucose levels.

Other diabetic patients have in addition other chronic diseases like congestive heart failure (CRF) and hypertension. They need to do additional spot measurement during the day (blood pressure and weight), and they could benefit from ePatch data on activity and heart rate variations over the day. The activity measures by the ePatch will in addition give contextual information in the period before the spot measurements are made and give insurance that the results of these spot measurements are valid.

Diabetic patients who are acutely ill or are having a surgery will have large variations in needs of medication. Continuous monitoring of heart rate may indicate how often spot glucose measurement should be made and could be a useful addition data for the health professionals to adjust their medication.

Finally, some diabetic patients have severe difficulties in living a regular life and managing their diabetes. They need help from health professionals like their GP. If wearing an ePatch during the days prior to a GP consultation, both the patient and the GP would be given an objective measure of the patient's variations in activity, sleep patterns and resting. These data would help the GP in advising the patient in pointing out the life style that hinders proper treatment and help the patient in adjustments.

The unique selling points

The ePatch technology provides new opportunities for a patient to constantly follow his health conditions also when he is not aware of it. The diabetic patients, the health professionals and the suppliers of systems and services have different benefits in utilising the ePatch technology.

For the diabetic patient the benefits are:

- Continuously receiving data on his health conditions

- The ePatch is easy-to-use and nearly not noticed while wearing

- It has a robust design and can be worn for 3 days even during showering

- Data are automatically transmitted wirelessly to a gateway at home and stored in the system

In general terms, the patient only have to put on the ePatch every 3rd day and data on his health conditions will flow in without him taking any notice or have to do any more.

Benefits for the health professionals:

- Data on the lifestyle of the patients like activity and sleep patterns are provided

- The new data are objective and give better basis for a dialogue with the patient and helping him in managing his diabetes

- For patients with co morbidities new opportunities are provided in following up on treatment of heart condition and hypertension

Benefits for suppliers of telemedicine systems and health services (the primary customers of the ePatch technology):

- ePatch provides additional value and data to supplement their solution based on spot measurement

- The wireless transmission of data is easy to integrate in telemedicine systems

- The ePatch will open new business opportunities in providing even more valuable solutions to monitoring diabetic patients at home

Customers

The dissemination activities of the ePatch monitoring opportunities are primarily focused on the companies providing telemedicine systems and health care services because they are the primary customer group of DELTA. But much dissemination will also be directed towards health professionals and primary care providers. They are the customers of DELTA's customers and have to embrace the value and new opportunities that an ePatch solution will give them and their diabetic patients. This group will be important key opinion leaders in convincing the system- and service providers to integrate the ePatch into their solutions.

Contact partner

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20. REACTION Security Environment

The REACTION Security Environment is a framework for securing communication between Android devices and Web services, controlling access to Web services based on roles and security tokens (e.g., identity certificates), validating security tokens, and managing user information.

Market needs

Security is expected by users whenever sensitive or private information is to be communicated. In today's world, where mobile devices become a focal point in users' communication habits, it becomes even more important to secure communication lines. Since users seek to stay online, they often connect their devices to many different networks at different places with –often– uncertain trustworthiness. The problem is that network-dependent applications running on the mobile device will not be able to decide whether the device's current network is trustworthy. Therefore, applications simply assume the network is trustworthy, and do not foresee any security measures, or they do and implement their own security with sometimes mixed results – both is undesirable. Ideally, applications would foresee security measures and make use of a central security component that can be used by all applications. This would relieve applications of bringing their own security code and still allow secure client-server communication. It would also make the management of security easier since only one component would need to be maintained instead of many applications' security settings.

Controlling who is permitted to use which service can be seen as a server's take on security in a networked application. In large organisations, such as a hospital, it is common to have an organisational policy stating who is allowed to do what or, in terms of information, who has access to

which data. It is often desirable to extend an organisational policy to network services as they represent the applications that hold the information that is to be accessed. However, since large organisations will have many servers offering multiple services, implementing and enforcing such a policy may become complex. A high-level approach to this is the use of role-based access control (RBAC) where, in a policy, sets of permissions are represented as a role and users are assigned one or more roles with the permissions appropriate to their work. A prerequisite to the practical use of RBAC is the availability of an easily accessible language to formulate policies and enough flexibility to express permissions and services with different levels of granularity that may exist in an organisation.

Unique selling points

The security service for Android devices (SSA), developed in REACTION, runs on any Android device and is a system-wide service providing easily accessible and secure communication from a mobile device to a server. It can be employed by any SSA-aware app running on the same device. Developers of networked applications simply connect their Android app to the security service and will then be offered an easy-to-use API for making web service calls. The SSA has built-in identity management which can be configured by administrators such that different identities can be used for different services.

In REACTION, a RBAC framework was implemented that offers a simple, yet flexible policy language to express roles and permissions appropriate to web service environments. It also enforces compliance to the policies defined, i.e., grants or denies access to services based on a policy's settings.

Main costumer and end user

The security environment is mainly targeted at companies developing client-server based applications for Android devices that require confidential and authentic communication with web services.

The RBAC system is targeted at organisations developing or making use of web services that require restricted access, i.e., web services which should only be accessible by certain user groups. End users of the RBAC system will be administrators responsible for managing the services and access to them.

Contact partner

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21. REACTION Database

The REACTION Database is specifically designed and implemented to take into account the data requests of different REACTION components. The database is built in SQL server 2008 and the data is managed by the Store Procedures which are managed by the web services. It is designed to work with the Observation WS defined within the Continua Alliance architecture and to accept new sensors in an agnostic way without changes. It supports the clinician and patient portals directly.

Contact partner

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22. REACTION Notification Handler

The REACTION Notification Handler is a tool allowing professional staff to assign alerts/notifications based on patient data coming from a patients' database. This application allows the medical doctors to: 1) react ubiquitously to change in the patients' health state and/or environment, 2) perform pre-defined activities or Notifications handling according to pre-programmed rules or through closed loops involving formal and informal carers and 3) combine the orchestration of services with an underlying efficient networked-based event management solution. In principle, the interface should be integrated in a so-called 'clinical portal', where doctors have access to all facilities to manage their patients.

Unique selling points

The Notification Handler has a friendly interface that allows doctors to easily establish rules based on experience. Patients' incoming data (sensors, analyses, etc.) are therefore filtered and shown to the health care professionals in a way that allows to quickly prioritising those that need particular attention.

Figure 9: Personalised Patient Parameters

Figure 10: Global Notification Configuration

Main customer and end user

The main customer is the health centre and the end user is the medical doctor.

Other potential customers/markets

This module can reach the market if delivered in combination with a gateway that collects sensor data and a clinical platform where the patients' data are stored.

Contact partner(s) for this product

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5.4 Scientific exploitation - REACTION knowledge

The following section describes how the academic partners plan to exploit REACTION knowledge scientifically in terms of teaching, consultancy and educational activities carried out at the universities and in other projects.

FORTH-ICS

The data mining/machine learning analysis protocol employed in order to derive the Long Term Risk Assessment Models will be considered as a possible Case Study for academic coursed related to Machine Learning.

FORTH-ICS has achieved some theoretical, methodological and algorithmic advancement in the field of Bayesian Network and Probabilistic Graphical Models, thanks to the work carried out during the REACTION project (Lagani, Tsamardinos, Triantafillou, SETN 2012; Borboudakis and Tsamardinos, ICML 2012). These advancements will be further investigated to improve the proposed methods.

FORTH-ICS has further developed its knowledge in the field of web applications and web services. These advancements will be considered as a possible Application Case Study for academic courses.

MUG

Scientific exploitation will be concerned with the use of REACTION GlucoTab in cooperation with MSG. The plan is also to

- Continue to exploit knowledge of development processes und clinical validation of medical products according to Medical Device Directive, ISO standards and according to requirements of ethical committee and competent authorities at universities for students and junior scientists.

- Continue to exploit evidence based knowledge of safe glycaemic management for health professionals (nurses, physicians) in educational courses.

- Continue to exploit knowledge of efficient and safe in-hospital diabetes management with electronic workflow and decision support to possible stakeholders.

FHG-SIT

Fraunhofer SIT supports its customers during planning and in safeguarding their electronic services, business processes and infrastructures. For this, Fraunhofer SIT offers, e.g., testing of devices and systems with respect to security as well as consulting services. In particular, the demand for expertise in smartphone and mobile device security has grown over the last couple of years. Therefore, the project's decision to choose Android as its mobile platform, even though it was still in its infancy in 2010, proved to be beneficial for SIT. Since nowadays (2014) Android dominates the market for mobile phone operating systems (OS), the knowledge gained from REACTION's developments will be of use beyond the lifetime of the REACTION project. In security consultancy projects, where mobile devices are concerned, knowledge about Android OS is frequently requested when it comes, e.g., to specific assessments on the protection of data on mobile devices or the whole bring-your-own-device theme. Also first-hand experience with respect to capabilities and limitations of mobile devices during the development phase of REACTION will provide valuable input for future projects since the trend to include mobile devices into project scenarios is unbroken.

VUB

VUB intends to continue deepening and enlarging its expertise in the legal and regulatory aspects of eHealth. In particular, the REACTION project has highlighted three areas of interest:

- mobile health technologies;

- professional liability of medical professionals

- education of health care doctors and carers in the use of ICT for health

Concretely, these paths of research will be investigated following the traditional approach, i.e., combining research with teaching.

UBRUN

UBRUN has developed a remote patient monitoring platform that is extensible and flexible. It is purpose designed to be simple to use for all patients and can easily be self-installed by patients. It has been demonstrated to support new approaches to health care delivery. UBRUN exploits the platform to undertake further novel approaches to health care delivery based on remote patient monitoring.

UBRUN will use the platform to develop and test standards based approaches for medical devices and platforms. It will seek partnerships with partners to demonstrate interoperability and integration.

6   Plan for exploitation after project completion

6.1   Joint exploitation plans

To follow up on the expectations for exploitation defined in DoW and refine them, an intermediate questionnaire was made and distributed to partners in January 2012. The questionnaire focused on the exploitable products and services which are likely to be delivered by the REACTION project and on how REACTION partners plan to cooperate in terms of strategic partnership, ownership and licensing. It also dealt with questions on the market in terms of market segments, market size, competitors and the strength, weaknesses, opportunities and threats for REACTION services. The main findings are reported in *D1-4-2 Periodic activity, management and financial reports Y2* and documented in *ID12-4 Dissemination and Exploitation Strategy*.

The most significant result of the exploitation questionnaire and following discussions was that joint exploitation involving the whole of the consortium might not be the most likely option for exploitation. Exploitation will most likely be driven by individual partners, in particular the technology partners, with the possibility of involving or becoming joint service providers with other partners.

The later process of establishing IPR schemes to identify project outcomes suggests that the single partners, who delivered components to the development, will be most interested in joint exploitation, thus in making bi-lateral or multilateral agreements with other interested partners. Partners may also enter into bilateral arrangement for joint ventures. IN-JET and CNET have for example entered into agreement on the exploitation of the REACTION SDK and the REACTION Multi-protocol Gateway and IN-JET and DELTA have plans to market the ePatch for IN-JET's Telemonitoring platform.

In the following sections, each of the partners presents their exploitation plans including any possible cooperation with other partners. The focus is on using REACTION results to enhance existing services/products or market new ones.

6.2   Individual exploitation plans

The following sections contain the individual partner plans for exploitation, describing what products or knowledge partners plan to exploit and how they plan to approach the respective markets. Any planned exploitation activities are then listed together with contacts deriving from the project.

ATOS

ATOS has the intention to continue promoting the project results at national and international levels. In particular, the results of the trials will enhance the credibility of the benefits of the products. When talking to hospital customers, the GlucoTab will be promoted, together with its potential integration with the hospitals' existing EPR systems, which is where ATOS can bring its capacity as integrator. Licensing agreements will be thought with the IPR owners of the GlucoTab. In the case of the REACTION platform for primary care, we plan to promote the mobility part of the system as this seems to be the one which potential customers are interested in. In this case, we also plan to associate with the partners involved in the platform development (CNET, UBRUN, and FORTH-ICS), being ATOS the integrator and main customer interface due to its reputation. We also plan to explore markets beyond Europe, such as Latin America.

Potential users/markets

During the project lifetime, especially after the publication of the press releases, ATOS has been approached by various interested parties, such as hospitals in the UK, the APHP (38 hospitals in Paris) in France, Vodafone Netherlands, Turkey and Spain, Sanofi in France, Novartis and AMIL in Brazil, Bayer in Spain. ATOS is also particularly present in the health market in Germany and Austria.

Unique selling points

REACTION is a flexible umbrella that offers various possibilities of addressing different customers' needs. Although it may require significant integration effort, it can be adapted to existing infrastructures and systems.

How we plan to market the products

Based on the material produced in the project, we intend to produce ad-hoc material for each customer opportunity, trying to match the demand for a solution and the outcomes of the project. The idea is to engage customers in piloting activities, small deployments, relatively limited in terms of budget, but which would help bridging the gap between the prototypes produced for the R&D project and scale them according to the market needs.

List of planned exploitation activities and contacts deriving from the project

- Follow-up meetings with ATOS Vodafone account managers to meet customer demands

- Attend a lan a pilot on mobility and health with APHP in France

- Follow-up meetings with ATOS UK Health & Welfare innovation group

- Preparation of a webinar targeting colleagues responsible for the market in Germany and Austria

- Maintain close relation with partners to enable quick and efficient responses to emerging opportunities

- Contacts include hospitals in the UK, the APHP (38 hospitals in Paris) in France, Vodafone Netherlands, Turkey and Spain, Sanofi in France, Novartis and AMIL in Brazil and Bayer in Spain

CNET

The main products for CNET to exploit have been described above – *Multi-Protocol Home Gateway, Medical Device Connectivity kit, Backend Server* and the *Nutrition App*.

The REACTION Multi-Protocol Home Monitoring Gateway is a software-based gateway running on standard PC-platform. It provides uniform access, connectivity, control and interfacing with medical and wellness devices. It supports Continua and other protocols and exports data to different back-ends.

It is based on open standards but still offers support for commercially available medical devices and offers interoperability and flexibility for the customer to meet the requirements in many different scenarios. Therefore it protects the customers investments already made into existing devices. The typical customer is a care organisation with a need to provide home monitoring solutions for patients with chronic diseases.

The REACTION Platform Server Backend is software running on a backend server on top of one or more databases. It processes incoming observations from various gateways and provides functionality for defining and executing monitoring rules and related actions such as SMS notification. It also provides functionality for defining and executing service orchestrations and event processing and management. A layer of Web Services provides a high level Service Layer for applications to use to access and process patient and monitoring data.

We intend to collaborate with IN-JET as our main partner for the exploitation. Several initial commercial activities have already taken place. We also foresee collaboration with FORTH-ICS on exploitation of the patient portal as well as with ATOS on Rule Engine and Notification handling.

The REACTION DCK will probably be made available as Open Source. It is a developer toolkit to enable integration of medical devices into eHealth applications. It includes APIs, extensible middleware objects for device connectivity and testing tools for protocol compliance. The main user of this product is developers. Using the Reaction DCK the developers will increase their efficiency and be able to quickly deliver new eHealth solutions to their customers.

The REACTION Nutrition App is a Smartphone app for entering nutrition information. It provides access to and selection of nutrition-related data such as carbohydrates, calories etc of food contents. It is designed for use with Android phones and exports data to backend server. It keeps diet information and weekly lists of meals and can export into the REACTION database using the Service Layer. The Nutrition App can be used by system integrators to extend their eHealth solutions with possibilities of management of diet and nutrition data. To exploit this app we will seek collaboration with dieticians, fitness centres and diabetes associations.

DELTA

In the REACTION project, DELTA has matured its ePatch technology and developed it further towards needs within diabetes treatment. The focus has been on developing a monitoring technology that can be used by the patient themselves and be a supplement to the spot measurements of blood glucose. The ePatch continuously measure ECG and activity and can calculate the heart rate and measures for activity and energy expenditure. This data on activity, heart rate and energy expenditure is especially important for diabetic patients who have difficulties in complying with the treatment and have problems in controlling the blood glucose levels within intended limits. These diabetic patients are typically:

- Patients who have additional chronicle conditions like CHF or hypertension

- Patients who have a varying life rhythm and difficulties in planning food intake and energy expenditure, and patients who in general have difficulties in following the planned treatment and need help from health professionals

- Patients who have acute illness and therefore they get into noncompliance

The needs of these patient groups are described further in section 5.3 which also describes that the users of the ePatch is the patient and the health professionals supporting him, and how the ePatch technology can be of benefit to them.

The business model of DELTA is to provide the ePatch technology to business partners who will use it in their solutions whether it is a telemedicine system or a more general health care service. These companies sell their solutions to the primary health care providers. Therefore the suppliers of telemedicine systems and health services should have clear benefits and see new business opportunities in integrating the ePatch technology as part of their solutions. The 3 main selling points towards this group of companies are:

- ePatch provides additional value and data to supplement their solution based on spot measurement

- The wireless transmission of ePatch data is easy to integrate in their telemedicine systems

- Monitoring with ePatches will open new business opportunities in providing even more valuable solutions to monitoring diabetic patients at home

The marketing of the diabetes applications of ePatch will be a natural expansion of the marketing of the ePatch technology DELTA already has established. The main elements in the marketing of the ePatch technology and the segment focusing on diabetes will be:

- Participating in international research projects and using the international research community around new telemedicine technologies and new services of health care to promote the benefits of the ePatch technology.

- Providing ePatch prototyping systems to clinical research groups who will exploit new clinical application of the ePatch technology and establish evidence of its use. And support the publication of these research results.

- Participate in trade fairs to meet potential customers and establish business relationships

- Make an attractive home page (www.epatch.dk) on which potential customers will get clear indications on how they can get to use the ePatch technology in their business.

- Use workshops and congresses to present talks and papers

Further, DELTA will promote the diabetes applications to its existing customers and partners.

As a specific result of the REACTION project, DELTA and IN-JET will collaborate to combine its technologies and present it to potential customers and big partners like IBM. Further, collaboration with Brunel University and Chorleywood Health Centre will be continued to integrate the ePatch technology into the home gateway systems for monitoring of patients with co morbidities.

In 2014 DELTA has planned to promote its ePatch technology and the applications towards diabetics in five international trade fairs.

IMM

Since within the REACTION consortium no industrial partner is involved that could directly exploit the results of the glucose sensor developments, ICT-IMM on the one hand aims to find new industrial partners that could develop the optical glucose sensors further from a prototype to a full product. To offer those partners protection of intellectual property, the fibre optical based IR sensor was applied for a patent (status: IMM internal registration, patent attorney involved, pending). The chip based variant of the sensor is already protected by the formerly issued IMM patent US7894071B2. For that, the major results are going to be presented on fairs, conferences and within direct industrial contacts. On the other hand, knowledge and experience gained within the field of glucose monitoring during the REACTION project, is going to be used to apply for other patents, like e.g. an autonomous sensor system based on state of the art sensor technology combined with new, automatic sampling techniques (status: IMM internal registration).

Potential users/markets

Typical customers for such a sensor device would be companies developing and selling glucose monitoring sensors. These companies should be willing to develop the IR-CGM sensor device further, to make it a real product. So far the sensor has prototype or demonstrator status. Such a product would be used by diabetic patients (Type 1 and Type 2) in everyday life to make trend analysis of their blood sugar values for improving their diabetic management and getting alarms overnight, in case of hypo- and hyperglycaemic events. The principle of optical difference spectroscopy is not restricted to glucose monitoring; it could also be applied to other substances present in blood or interstitial liquid. To do so, the relevant spectral range had to be identified and light sources as well as photo detectors had to be adapted. Applications would be the monitoring of any endogenous bio molecules like e.g. amino acids or exogenous drugs for which suitable micro dialysis catheters had to be applied. With the present sensor principle such monitoring could be performed on out-patients for post-operative treatment or post-rehabilitation support.

Unique selling points

The IR-CGM sensor developed within REACTION is based on IR transmission spectroscopy on glucose containing perfusion solution in comparison to pure perfusion solution. The method does not need any chemicals that are consumed during the measurement, thereby in principle allowing for none-time-limited measurements. The body interface is a medically approved micro dialysis catheter (either subcutaneously or intravenously), representing the time-limiting element (degeneration of the selective membrane). Spectroscopy is carried out into a disposable low-cost polymer opto-fluidic chip that can be inserted into a non-disposable reader unit, wirelessly connected to a PC. Due to micro dialysis, an additional lag time is introduced that can be minimised by minimising the fluidic path ways from the catheter to the chip. Ideally the optical cells might be directly integrated into the catheter, avoiding additional lag time caused by fluidic transport (see fibre based IR CGM sensor, below).

List of planned exploitation activities and contacts deriving from the project

- Presentation of project demonstrators on national and international fairs (e.g. Medica, Compamed, MedTech)

- Further publication of project results concerning clinical trials in national and international journals

- Direct collaboration with national and international companies, making use of REACTION IR-CGM sensor results for further development:

    – Ninta Med, German distributor of Dexcom sensors, is interested in common glucose sensor development projects, most likely within national projects financed by BMBF

    – HumanOptics is interested to make use of the IR spectroscopy technology for glucose monitoring in the eye, non-invasively, demonstration for coupling optics to the human eye have already been made, sensor system is to be developed within a national project

    – MyLife Technologies BV fabricates micro needles for drug delivery and is interested in collaboration for functionality of needles for sensor applications, most likely activities within an EUROSTAR project is foreseen

    – Sanofi Germany is interested in glucose monitoring sensors as a complementary product for their insulin pens, common projects might be foreseen

<u>FORTH-ICS</u>

The long-term risk models and the patient portal described above are the products planned to be exploited by FORTH-ICS at individual level. Furthermore, knowledge in data mining algorithms for the health risk prediction and in web applications and web services design, development and test might be used in applications for new projects and as possible case studies for academic courses.

Potential users/markets

Potential users/markets are public or private health care organisations and home care delivery companies.

How we plan to market the products

Two main directions for marketing products are evaluated: One through existing companies in the field of home monitoring and home care support and the other through the integration of the components in health care products already marketed by FORTH-ICS.

List of contacts deriving from the project

Contacts have been established with UK SMEs, with EHTEL and with other relevant projects and scientific institutions operating in the field of diabetes and long-term chronic care management.

<u>FHG-SIT</u>

In the following, examples are given how Fraunhofer SIT typically exploits knowledge gained from and software developed in projects. Normally, results obtained from one project cannot be directly transferred to another project or product as security components are often highly specialised in order to be effective in a given application context. Since only a limited number of use cases beyond the scope of an initial project can be foreseen at the time of the security components' development, it is common to inherit code or components from one project and to adapt and extend them to the requirements and use cases of another project. Next, it is illustrated how other projects running at Fraunhofer SIT benefited from the work done in REACTION.

Fraunhofer SIT is currently developing OmniCloud, a solution for the secure use of cloud storage services. From the end users' point of view, OmniCloud is an encrypting fileserver that can be configured for organisation-wide use. Since users are typically only allowed to access certain files and directories, access control mechanisms must be in place. The access control component of OmniCloud uses role-based access control for this and is based on the access control component developed for REACTION. OmniCloud will be exhibited at the CeBIT Fair 2014.

The use-case for OmniCloud is frequently encountered in practice with respect to access control. Still, it can be expected that the access control component (ACC) of REACTION will not be marketed as a stand-alone product since the real value of access control will typically come from the application employing it. Hence, it is more likely that the ACC will be integrated in an application requiring access control, like OmniCloud, and marketed as a feature of a product rather than a product by itself. Nevertheless, as part of its security consulting activities, Fraunhofer SIT is also in touch with many companies and would also directly market the ACC to partners when appropriate.

The experience and knowledge gained from the development of the mobile security components and applications was also invaluable in the development of another product developed by Fraunhofer SIT: the MobileSitter app featuring an innovative secure method for storing passwords on Android devices. Although only a few cryptographic building blocks from REACTION's mobile security components could be reused for the MobileSitter, the knowledge gained from the work on mobile security greatly helped in realising the MobileSitter on the Android platform.

<u>FORTHNET</u>

FORTHNET is planning on exploiting both the SMS service and the Network Management System (NMS). Both of these services can be promoted to the market as stand – alone products, or in accordance with other services developed within the REACTION framework.

Potential users/markets

These services can be promoted to small and medium size enterprises, utilised in a number of different ways, as it has already been mentioned in section 5.3. Consequently, both of these services refer to a large number of potential customers, ranging from SMEs to large industries. A number of the SMS service functionalities are already being used by Forthnetgroup, mainly for notifying customers on their account details as well as on new products' promotion.

Unique selling points

The unique selling points of the SMS & NMS services have been described in section 5.3.

How we plan to market the products

The integrated service platform of REACTION which provides remote monitoring and therapy management as well as the individual modules can be promoted to a network of existing and potential FORTHNET customers through the network of FORTHNET shops located around Greece and in cooperation with local and national medical authorities, hospitals and health centres. Both services developed by FORTHNET (SMS & NMS services) can also be promoted as stand-alone products to the market through FORTHNET shops as well as through online campaigns. These services can also serve as additions to existing services provided by FORTHNET.

List of planned exploitation activities and contacts deriving from the project

- Presentation of project results and identified components on national and international business oriented conferences

- Further exploitation of project results through a specified network of existing Forthnetgroup customers

- Direct collaboration with other companies on a national and international level for the promotion of REACTION project results and specific components developed within the project's framework, in order to identify specific collaborations and market promotion

- Direct collaboration with Telemedicine Technologies France, a subsidiary company of FORTHNET group, for promoting project results to related companies and affiliates of the medical domain

IN-JET

IN-JET is delivering a telemedicine service platform called LinkWatch for health care management in cooperation with large players like IBM. The platform is based on the REACTION Multi-protocol Gateway and front-end application developed with the REACTION SDK. For the Telehealth solutions market, IN-JET intends to deploy the REACTION Patient Portal in connection with the LinkWatch front-end. This platform gives IN-JET the opportunity to quickly build new, specific customer as stand-alone applications and services for primary care customers, which easily can be made interoperable with general health care and social care systems. For integrated health and social care solutions for municipalities, IN-JET plans to use the same front-end platform but now integrated with larger vendors' health care systems. Such solutions will benefit from including also REACTION behavioral monitoring algorithms and REACTION risk assessment algorithms. For health care regions and hospitals, IN-JET plans to market the front-end platform with large vendors' HIS systems. Moreover, IN-JET is interested in marketing the REACTION GlucoTab decision support system for hospitals.

Potential users/markets

Scandinavia is in a very advanced stage of eHealth and many services are in place. In Denmark, a national strategy for telemedicine has been adopted by the government and will shortly be implemented. The strategy calls for introduction of cross-sectional telemedicine solutions at all levels and involving all actors. Regional and local strategies will complement the national strategy. A preliminary fund of 10 million € has been allocated to implementation projects in 2013 - 2014. In

Sweden, the government has just decided to deploy Microsoft Healthvault as a national platform for Personal Health Records for more than 9 million citizens.

There are relatively autonomous health care regions in Denmark. The Danish regional health authorities together with the Danish Public Welfare Technology Fund are investing almost 9 million Euros in a telemedicine project, with 2000 patients, running in 2012 - 2013.

Customers are health care providers including hospitals and outpatient clinics, regional health care authorities, local and municipal authorities responsible for home care and social care, and care centers and private service providers in Denmark, all dealing with chronically ill elderly patients or citizens in need of monitoring.

The group of health care commissioning bodies and health care providers includes national and regional health care authorities and hospitals. They are prime customers for Telemonitoring services as part of the overall health care system. The primary health care providers (GPs and outpatient clinics) cannot be regarded as early adopters of Telemonitoring services. The 98 municipalities cover also social care and this segment is the prime target for combined social and health care solutions like the one which ran in the transferability model trial in Skive: www.incasa-project.eu.

Unique selling points

Diabetes Management Platform: The REACTION platform will support adherence to clinical pathways, education, and self-management services for diabetes related conditions. As part of their usual diabetes care, patients will be offered a suite of services providing home monitoring (remote monitoring) of blood glucose, blood pressure, physical activity and diet. Furthermore, clinical intervention for patients can be targeted to those with need; those that are well controlled will have less need for routine check-ups, and those above guidance levels will receive pro-active timely intervention. Devices will be installed in patients' homes, and they will have access to the REACTION Patient Portal for a minimum of two weeks twice per year, typically in connection with their semi-annual reviews.

The main drivers are better management of complex patients, early detection of patients at risk and comprehensive protection against complications and co-morbidities.

Patients with improved control of their disease are the first-line beneficiaries of the offered services, and both doctor and patient will benefit from better management despite fewer physical visits to the practice. With the Danish tax-based health care provisioning regime this will ultimately make the Health care Regions the prime stakeholders. They will reap the advantage of fewer patient visits to the general practitioners and healthier patients in case a hospitalisation need arises.

GlucoTab: The vision is to create a comprehensive REACTION in-hospital diabetes management system with blood glucose measuring and transfer to laboratory systems and a mobile, safe insulin therapy tool based on the GlucoTab system. It will be offered as a combined service platform to be used in hospitals for safe glycaemic management of diabetes patients admitted to general wards.

The main medical driver for the diabetes management system is better health outcomes for the hospitalised patients. Better glycaemic control leads to faster discharge and since patients remain in a better health state after discharge, it also reduces the need for unplanned re-admissions. Overall, the business driver for the glucose management system is thus a reduction in bed days and a reduction in complications which would otherwise lead to further strain on the resources.

The customers for the in-hospital diabetes management system are the stakeholders most likely to be able to economically benefit from the reduction of bed days. Although the hospitals are the primary beneficiaries of the services, it is likely that the regional health care provisioning bodies will decide to invest in the diabetes management system to be used in several hospitals and reap the benefits in terms of cost savings in order to re-distribute the savings to other hospitals or to the management of other diseases. For the present work, we will not engage in a discussion on how savings are to be re-invested, but merely base the model on the economic advantages for the provisioning stakeholder.

How we plan to market the products

The main market focus for the REACTION solutions for diabetes management will be the Danish and Swedish markets. IN-JET and CNET will stride to develop a common platform with the assistance of other REACTION partners as needed. As a technology provider, CNET will contribute most of the technology needed to adapt the platform to the customers whereas IN-JET will use its market

expertise and close cooperation with leading providers of large health care/EPR systems to drive the marketing work.

The revenue model is to charge initial setup fees for hardware, integration and installation followed by a license scheme with various license fees per user depending on functionality. A typical installation costs about 60 k€ to start and between 800 and 1500€ per citizen in hardware cost. The average license fee per user per year is around 250€ increasing over the period due to added functionality.

In Denmark the budget calls for a rapidly increasing number of new platforms installed from one platform in the first year to five new platforms in the last year. Each platform handles between 50 and 300 diabetes patients. At the end of the period, a total of 18 platforms will be in operation with 1.360 citizens being monitored.

In Sweden, we aim to secure pilot projects with two different municipalities during the first year after the project ends. Such a pilot project will typically involve deploying the REACTION solutions into 10-20 diabetes patients' houses for monitoring and reporting back to a backend server hosted at the health centre. During year two, we aim to expand with five more pilot projects and to expand the pilot projects from year one to involve 50 patients. During year three, we aim to convert one of the first year's pilots to real full scale installations and to expand the second year pilots into 50 patients and attract ten new pilots.

List of planned exploitation activities and contacts deriving from the project

IN-JET is working on more than a dozen commercial contacts with large, international companies within the health care and pharmaceutical industries. These contacts are in the initial stage but are developing very positively not the least because of the strong features provided by the REACTION SDK in terms of interoperability and scalability.

IN-JET and CNET are also working with a global leading supplier of Personal Health Systems platforms to provide mobile platforms to diabetes patients for data collection.

In Denmark, IN-JET and CNET are working with the country's largest supplier of care systems for municipalities, again with a view to provide front-end platforms for data collections. In this cooperation arrangement, the Danish Market Entry fund has funded a project to make the product market ready, including certification. In this phase, the product is being tested with diabetes management in two municipalities outside Copenhagen.

Finally, IN-JET is undertaking commercial discussions with several Danish and global suppliers of systems and solutions for the health care providers.

ALL

What we plan to exploit

- The Short term risk management component

- The Semantic Search technology

Potential users/markets

The targeted market is health care organisations, health care providers and patients. For the Semantic Search technology the range of potential customers can be extended to other market fields as the technology is not health care specific.

Exploitation activities

- The applications will be shown on different exhibitions

- Potential customers will be contacted

- Direct marketing

MUG

Scientific exploitation will be concerned with the use of REACTION GlucoTab in cooperation with MSG. Please refer to section 5.4 for a full description.

MSG

We plan to exploit the GlucoTab, for details on markets and unique selling points, please refer to GlucoTab chapter in section 5.3

How we plan to market the products

- Acquisition of reference customers who are members of a large RCT (for proving the cost-effectiveness of the GlucoTab system) in different European countries (Austria, Germany, Denmark, UK, France).

- Provision of clinical and economical evidence of the GlucoTab for industry professionals

- Cooperation with established industry partners in terms of marketing and sales activities (Spin-off is an option if RCT results are promising)

List of planned exploitation activities and contacts deriving from the project

- Presentation of GlucoTab at hospital in Austria, Germany, Denmark, UK, France (contacts are already established; first meetings were held)

- Presentation of GlucoTab at large insulin producing companies (Novo-Nordisk, Sanofi-Aventis)

- Presentation of GlucoTab at large medical device companies (Roche, B.Braun)

- Presentation of GlucoTab at prestigious conferences and medical specialist bodies (ATTD, ADA, EASD, Royal Society of Medicine)

- National and international follow-up research project

CHC

What we plan to exploit

Learning from the primary care field trial including:

- Pathway redesign

- Workflow Management

- Risk Stratification

Potential users/markets

- Health and social care organisations looking to deploy Telehealth and Telecare

- Commercial entities interested in the management of data and workflow of Telehealth and Telecare data. In addition, organisations interested in research and development in related areas

Unique selling points

CHC has developed and validated remote patient protocols and workflow that support the clinician in the management of patients in a way that reduces the burden of reviewing patient data and identifying those patients at risk in order to support timely intervention.

How we plan to market the products

- Establish working relationships with EMIS

- Joint Clinical work John Radcliffe and Great Ormand Street Hospitals

- Join with Hertfordshire Valleys Care Commissioning Group to establish a Reaction Platform at scale

List of planned exploitation activities

Conferences

- Kings Fund, International Digital Health and Care Congress, 10th-12th September 2014. Abstract Submitted.

- Royal Society of Medicine 34th General Practitioners Forum, 15th-19th September 2014, Presentation.

Publications:

- Journal of Telemedicine and Telehealth – Paper to be submitted March 2014

UBRUN

Please refer to Section 5.4.

VUB

VUB will be engaged in scientific exploitation of REACTION results. See Section 5.4. REACTION knowledge will also be used in future projects. VUB will be engaged in an eHealth project funded by the Brussels Capital Region and concerning (2014-2017) Interoperable platform for Remote monitoring and Integrated e-Solutions (IRIS). IRIS will create an open source and secure ICT eHealth platform for interoperable collection and management of multi-media medical data in stroke disease.

In addition, VUB is competing in H2020 calls on personalised health care.

BTS

The physiological diabetes model shall be exploited either within scientific consulting projects to support pharma R&D or sold together with the software environment as diabetes modelling platform.

Potential users/markets

Customers are pharma companies involved in drug development for diabetes treatment.

Unique selling points

BTS has developed a multi-scale model for diabetes with a higher level of physiological detail than other existing models described in literature and the model demonstrated strong, predictive capabilities. In addition, the model is embedded into a powerful software environment geared towards the needs of pharma R&D. In combination this provides a unique tool to support diabetes R&D.

How we plan to market the products

The physiological diabetes model is brought to the attention of the relevant scientific community through publications and conference contributions. In addition, BTS will approach its existing pharma customers and use its established marketing routes for further distribution.

List of planned exploitation activities and contacts deriving from the project

Within the REACTION project a link to Roche was established who became an associated partner in the project and who can be considered a potential customer. Promising confidential contacts to other pharma companies are being established through existing and targeted BTS marketing routes not related to the REACTION project.

7   List of figures and tables

7.1   Tables

8 Appendix 1 - Completed dissemination activities

This appendix summarises the various dissemination activities undertaken by the Consortium partners individually or jointly in each period during the execution of the project. The list is not necessarily exhaustive since partners also make a number of presentations of the purpose and scope of the REACTION project as part of their normal awareness raising activities as well as making reference to the project on their websites. These activities are not necessarily recorded at project level

8.1 Activities undertaken in the first project year (M01-M12)

Coordination tools, marketing material and media activities

The following was achieved:

- An internal knowledge management system and wiki for coordination of dissemination activities were created. These have been continuously updated throughout the project period.

- A dissemination strategy based on measurable targets for dissemination activities from marketing, conferences to papers and website visits

- A project website as a main dissemination channel with project activities, news and events, papers and deliverables documented in the deliverable D12-1 Project Website. The website was continuously updated with news and features throughout the project.

- A project logo and different project presentation templates to maintain a strong, coherent, visual project identity.

- Press releases about the start of the project

    o A press release template about the start of the project was circulated and distributed online by IN-JET on 13th April 2010 followed by press releases issued at partner level, targeting the research and scientific community in ICT and/or the medical community.

    o IN-JET issued a Danish version of the press release which was sent to relevant media channels and contacts on 13th April resulting in press coverage in an electronic news magazine: www.elek-data.dk

    o IMM posted the press release and an article in German on their website on 25th May 2010 and presented the REACTION project in its newsletter IMMage Sep. 2010

    o ATOS made a note in the internal ATOS bulletin about the start of the project in May 2010, followed by a note on the corporate website in July 2010. News about the project also featured in website articles on webwire.com and consultant-news.com in July 2010.

- A general flyer and poster to support partners at conferences and exhibitions

- One newsletter on November 2010

- FHG-SIT made a presentation of REACTION which was published in the quarterly newsletter (2/2010)

- REACTION was added to Wikipedia by CNET in December 2010

- A project fact sheet and ID-card were created by IN-JET and ATOS and sent to the EU eHealth unit early July 2010.

- Official appearances were undertaken at conferences with poster and workshop presentations, other partners presented the project as part of their routine marketing

Dissemination events

1. **The Institute for Information Transmission Problems of the Russian Academy of Sciences**, Dept. of the Medical Partner Systems in Moscow, Russia on 16th -23rd May 2010. Partner ALL made a presentation on *Medical informatics in chronic care* discussing the possible use of REACTION application system in diabetes care of the Russian health care.

Moreover, ALL also discussed several subjects which are important for the REACTION project such as (i) methodology of model- and knowledge-based decision preparation and decision support, (ii) the descriptive modelling methods to represent individual health status using the functional information from measuring vital parameters, and (iii) model-based interpretation and evaluation of various medical parameters.

2. **RESEARCH 2010**, www.researchaustria.at/ in Graz, Austria on 11-12th June 2010. The event is a national exhibition on research undertaken by universities, institutes and companies in Graz. MUG exhibited and presented the REACTION project.

3. **Royal Society of Medicine: GP forum** in London on 16th September 2010. CHC presented aspects of the REACTION Platform.

4. **ICT 2010: Digitally driven** in Brussels on 27th September 2010. Partner CNET was selected as one of 20 selected innovative European SMEs to exhibit as part of the SME Village where CNET presented REACTION.

5. **East Midlands Clinical Commissioning Group** in Nottingham on 26. October 2010. CHC presented aspects of the Reaction Platform.

6. **Joint ZMF & Doctoral Days,** a local conference at the Medical University of Graz, Austria on 5-6th November 2010. MUG and MSG did an abstract and a poster presentation on REACTION in relation to improving in-hospital glycaemic control. The aim of the conference is to stimulate interdisciplinary discussion and it offers the opportunity to researchers to present their results and discuss them. Approximately 250 people joined the event.

7. **Diabetes Technology Meeting** in Bethesda, MD, USA from 11-13th November 2010. SOLIANIS participated.

8. **The National Telecare and Telehealth Conference 2010** in London on 15-17th November 2010. The conference is the largest UK event focusing exclusively on Telecare and Telehealth. Partner CHC presented aspects of the REACTION Platform at one of the workshops.

9. **Two focus groups** in Thessaloniki, Greece (19th November 2010) and Florence, Italy (29th November 2010). FORTH-ICS promoted the REACTION project and participants were given the newsletter subscription.

10. **The eHealth and Telemed Conference 2010** in London on 13th December 2010. The eHealth and Telemed conference is organised by the Royal Society of Medicine with the aim to promote education and research into the development and application of all forms of information and communication technologies for the purposes of improving health care. Partner CHC presented aspects of the REACTION Platform.

11. **Continua European Symposium 2011** in Brussels on 17-18th January 2011. Continua Health Alliance is hosting a two-day Personal Connected Health solutions symposium. The symposium brought health care professionals, researchers, world-class companies, entrepreneurs, policy makers, health ministries and other stakeholders together for an in-depth look at a variety of Personal Connected Health solutions and how these tools and services will fit into Europe's current and future model of health care. The symposium specifically targeted Chronic Condition Management, Ageing Independently and Health & Wellness topics. Partner CNET exhibited at the symposium with a poster presentation.

12. **Rapid Innovation Seminar** in Copenhagen on 13th January 2011. The seminar was organised by the Capital Region Health care Innovation Centre and IN-JET participated and made a presentation on REACTION.

Publications – scientific and other
1. One scientific paper was submitted in February 2011 (and later accepted) for the International Conference of the European Federation for Medical Informatics - MIE2011 in August 2011.

    a. Hoell, B.; Spat, S.; Plank, J.; Schaupp, L.; Neubauer, K.; Beck, P.; Chiarugi, F.; Kontogiannis, V.; Pieber, R. T. & Holzinger; *Design of a mobile, safety-critical in-hospital Glucose Management System* (MUG, MSG and FORTH-ICS)

8.2 Activities undertaken in the second project year (M13-24)

Marketing and media activities

The following was achieved:

- The website was enriched and continuously updated with news, deliverables, papers, events. New features included a menu 'Reaction in the press' for any press coverage as well as a 'Scientific paper' download menu.

- Updated flyer, refining mainly the text.

- Two newsletters were issued in April 2011 and August 2011 (Over 400 website downloads of the August 2011 newsletter) focusing on the results of the first project year such as the in-hospital prototype, the concept demonstrator and sensor development. The newsletters were produced by IN-JET in collaboration with different partners providing input (MSG, FHG-SIT, IMM, CNET). Partners distributed the newsletters to their relevant contacts.

Dissemination events

13. **ACoP 2011, American Conference on Pharmacometrics**, San Diego, USA on 3-6th April 2011. BTS made a poster presentation with the title: *Prediction of food-related changes in gastric emptying function on the pharmacokinetics of orally administered drugs*.

14. **eHealth Week 2011**, Budapest, Hungary on 10-13th May 2011. The event is a collocation of the European Commission's High Level Ministerial Conference and the World of Health IT Conference & Exhibition. It was in 2010 hailed as Europe's largest pan-European conference: an all encompassing event focusing on leadership and the continuum of care – health care from the home to the hospital. Partner UBRUN was on the educational planning committee for the event and planned one of the sessions on standards. Partner ALL did a speech on integrated care space for chronic diseases and presented demos of primary care applications in REACTION.

15. **eHealth 2011**, Vienna, Austria on 26th May 2011. The conference's motto and program target on building a bridge from research to application of information and communication technology in health care. Although papers can be submitted and presented in English as well, a considerable number of presentations - as well as most parts of the homepage - will be in German, which is the official conference language. Partners MSG and MUG submitted a conference paper titled *Design einer mobilen Anwendung für das stationäre Glukosemanagment.*

16. **Two focus groups** in Nicosia, Cyprus (26th May 2011) and Paris, France (30th May 2011). FORTH-ICS promoted the REACTION project and participants in the focus groups were given the newsletter subscription.

17. **Sensor and Test Fair 2011**, Nuremberg, Germany on 7-9th June 2011. IMM exhibited with a REACTION poster.

18. **Medical Informatics Europe** (MIE2011), Oslo, Norway on 28-31st August 2011. MSG, MUG and FORTH-ICS presented the paper: *Design of a mobile, safety-critical in-hospital Glucose Management System*.

19. **Örebro University and Karolinska Institute,** Stockholm, Sweden on 26th August 2011. CNET presented REACTION

20. **MobiHealth 2011**, Kos, Greece on 5-7th October 2011. Partner FORTH-ICS organised the Special Session "ICT Platforms and Technologies for the Daily Management of Chronic Diseases and the Support of the Ageing Population" The organisation included the session logistic, the management of the review process, the review of some papers for the special session, the creation of the acceptance list and the chairing of the special session. The efforts resulted in six paper contributions from REACTION partners.

21. **International Scientific Committee of the Third European Conference on Health Law**, Leuven, Belgium on 6-7th October 2011. VUB and FHG-SIT made an oral presentation based on the paper: PRIVACY IN E-HEALTH PUT TO PRACTICE: THE CONCEPT OF CONCIERGE AS A PHYSICAL AND TECHNICAL INTERFACE. The paper discussed and presented REACTION as a research programme.

22. **39. Jahrestagung der ÖDG (Austrian Diabetes Association)**, Salzburg Austria, 17-19th November 2011. MUG had a peer-reviewed abstract accepted at the congress: *Erhebung des stationären Blutzuckermanagements bei nicht-kritisch kranken PatientInnen*.

23. **International Hospital Diabetes Meeting**, Barcelona, Spain, 17-19th November 2011. MUG and MSG had a poster presentation with the title: *Assessment of In-Hospital Glycaemic Management in Non-Critically Ill Patients*.

24. **The Dynamics of Disease Workshop 2011**, Manchester, UK, 30th November 2011. BTS made a conference talk with the title: *Multi-Scale Modelling in Medicine and Pharmacology*

25. **ATTD 2012: Advanced Technologies and Treatments for Diabetes**, Barcelona, Spain, 8-11th February 2012. MSG, MUG and FORTH-ICS had an abstract accepted for oral presentation on the mobile in-hospital application and BTS and MUG made a poster presentation on closed-loop insulin delivery using a physiology-based pharmacokinetic /pharmacodynamic model kernel.

    a. Abstract for oral presentation: *A mobile in-hospital application supporting insulin dosing for patients with diabetes type 2*

    b. Poster presentation: *Closed-loop insulin delivery using a physiology-based pharmacokinetic /pharmacodynamic model kernel*

26. **Standards meetings in year 2**

    c. A session on standards at the eHealth Week 2011, Budapest, Hungary, 10-13 May 2011 (UBRUN)

Publications – scientific and other

13. Poster presentation at ACoP 2011, American Conference on Pharmacometrics, San Diego, USA on 3-6th April 2011.

    a. K. Thelen, K. Coboeken, J.B. Dressman, S. Willmann*: Prediction of food-related changes in gastric emptying function on the pharmacokinetics of orally administered drugs.* (BTS)

2. Peer-reviewed conference paper for eHealth2011, Vienna, Austria, 26-27th May 2011.

    a. Hoell, B.; Spat, S.; Plank, J.; Schaupp, L.; Neubauer, K.; Beck, P.; Pieber, T. R. & Holzinger, A; *Design einer mobilen Anwendung für das stationäre Glukosemanagment*. (MUG and MSG)

3. Conference paper for MobiHealth 2011, Kos, Greece

    a. Stephan Spat, Bernhard Höll, Peter Beck, Franco Chiarugi, Vasilis Kontogiannis, Manolis Spanakis, Dimitris Manousos, Thomas R. Pieber*; A Mobile Android-based Application for in-hospital Glucose Management in compliance with the Medical Device Directive for Software*. (FORTH-ICS, MUG, MSG)

4. Conference paper for MobiHealth 2011, Kos, Greece

    a. Jesper Thestrup, Tamas Gergely, Peter Beck; *Exploring new Care Models in Diabetes Management and Therapy with a Wireless Mobile eHealth Platform*. (IN-JET, ALL, MSG)

5. Conference paper for MobiHealth 2011, Kos, Greece

    a. Emmanouil G. Spanakis, Franco Chiarugi; *Diabetes Management: Devices, ICT Technologies and Future Perspectives*. (FORTH-ICS)

6. Conference paper for MobiHealth 2011, Kos, Greece

   a. Angelina Kouroubali, Franco Chiarugi; *Developing advanced technology services for diabetes management: User preferences in Europe.* (FORTH-ICS).

7. Conference paper for MobiHealth 2011, Kos, Greece

   a. Lefteris Koumakis, Franco Chiarugi, Vincenzo Lagani, Angelina Kouroubali, Ioannis Tsamardinos; *Risk assessment models for diabetes complications: a survey of available online tools.* (FORTH-ICS).

8. Conference paper for MobiHealth 2011, Kos, Greece

   a. Matts Ahlsén, Stefan Asanin, Peeter Kool, Peter Rosengren, Jesper Thestrup; *Service-Oriented Middleware Architecture for Mobile Personal Health Monitoring.* (CNET and IN-JET).

9. Peer-reviewed abstract published in Wiener Klinische Wochenschrift, in proceedings of 39. Jahrestagung der ÖDG (Austrian Diabetes Association), Salzburg Austria, 17-19th November 2011.

   a. Neubauer, K; Plank, J; Schaupp, L; Buttinger, M; Schneeberger, M, Höll, B, Spat, S; Beck, P; Tschapeller, B; Pieske, B; Pieber, T; *Erhebung des stationären Blutzuckermanagements bei nicht-kritisch kranken PatientInnen.* (MUG and MSG).

10. Peer-reviewed abstract published in Journal of Diabetes Science and Technology in proceedings of the International Hospital Diabetes Meeting where it was presented, Barcelona, Spain, 17-19th November 2011.

    a. Neubauer, K; Plank, J; Schaupp, L; Hoell, B; Spat, S; Beck, P; Buttinger, M; Schneeberger, M; Pieske, B; Pieber, T; *Assessment of In-Hospital Glycaemic Management in Non-Critically Ill Patients.* (MUG and MSG)

11. Peer-reviewed journal paper published in Journal of Pharmaceutical Sciences Vol.100(12), December 2011.

    a. Thelen, Kirstin; Coboeken, Katrin; Willmann, Stefan; Burghaus, Rolf; Dressman, Jennifer B.;Lippert, Jörg; *Evolution of a Detailed Physiological Model to Simulate the Gastrointestinal Transit and Absorption Process in Humans, Part 1: Oral Solutions.* (BTS). http://onlinelibrary.wiley.com/doi/10.1002/jps.22726/abstract

12. Peer-reviewed abstract for ATTD 2012 - 5th International Conference on Advanced Technologies & Treatment for Diabetes, Barcelona, Spain, 8-11 February 2012

    a. Spat S., Höll B., Plank J., Schaupp L., Neubauer K., Chiarugi F., Beck P., Pieber T.R. *A mobile in-hospital application supporting insulin dosing for patients with diabetes type 2.* (MSG, MUG and FORTH-ICS)

13. Poster presentation for ATTD 2012 - 5th International Conference on Advanced Technologies & Treatment for Diabetes, Barcelona, Spain, 8-11 February 2012

    a. Schaller S., Eissing, T., Schaupp L., Pieber T.R., Schuppert A., Lippert J. *Closed-loop insulin delivery using a physiology-based pharmacokinetic/pharmacodynamicmodel kernel.* (BTS and MUG).

8.3   Activities undertaken in the third project year (M25-M36)

<u>Marketing and media activities</u>

The following was achieved:

- A video "REACTION in-hospital prototype" on safe glycaemic control was made by MUG, presenting the in-hospital demonstrator prototype developed by partners MUG, MSG, FORTH-ICS and FHG-ICS. The video was added to the REACTION website by IN-JET and distributed to the eHealth channels (eHealth newsletter, Facebook, the EC YouTube channel.) The video was recorded on 14th May 2012.
  Link: http://www.reactionproject.eu/articles.php?article_id=13
  http://www.youtube.com/user/JRHEALTH
  http://www.youtube.com/watch?v=teq1wnO9Jpg
  http://www.youtube.com/watch?v=72rhpP4onW0

- In-hospital poster, September 2012

- An online demonstrator was provided by partner ALL, demonstrating a pattern recognition tool in diabetes care for online risk assessment and decision support available on the REACTION website. The demonstrator was added to the REACTION website by IN-JET.
  Link: http://www.reaction-project.eu/articles.php?article_id=14

- A newsletter was produced and distributed in June 2012 by IN-JET to all relevant contacts. It deals with the primary care and in-hospital field trials and features REACTION events, news and deliverables: http://www.reaction-project.eu/newsletters/June2012.html

- The website has been continuously updated with news, deliverables and events and enriched with a video and demonstrator section as well as news feed from the European Commission's eHealth forum. This work has been performed by IN-JET. Unfortunately, the REACTION website was hacked in February 2013 and as a consequence IN-JET had to restore all the files in order to get it up and running again.

- Project templates have been updated, returning to the use of the EU emblem instead of the new EC logo after advice from the DG COMM Visual Identity Team. Also the new eHealth logo was added. The Wiki has been continuously updated with papers and events. The work was performed by IN-JET.

Dissemination events

27. **IVAM workshop** at IMM premises in Mainz, Germany on 1st March 2012. IMM presented the sensor technology. http://www.ivam.de/calendar/Stammtisch0103
28. **Kings Fund International Conference – Telemedicine** on 6-8th March 2012. CHC did a presentation/workshop.
29. **Royal Society of Medicine – International Telemedicine Conference** on 30th March 2012. CHC did a presentation/workshop
30. **Oxford Telemedicine Institute Seminar**, on 12th April 2012. CHC and DELTA did presentations/workshop
31. **Photonics Europe Conference 2012**, Brussels 16-19th April 2012. IMM had a conference paper accepted and the IR CGM sensor concept and first results were presented during the conference. Title: *A minimally invasive chip based near infrared sensor for continuous glucose monitoring*.
32. **Bio-IT World Conference & Expo 2012**, Boston, USA, 24-26th April 2012. BTS made a conference talk: *A Computational Systems Biology Software Platform for Multiscale Modeling and Simulation: Integrating Whole-Body Physiology, Disease Biology, and Molecular Reaction Networks*
33. **National Exhibition** "Lange Nacht der Forschung", Graz, Austria, 27th April 2012. MUG had a workshop on how using a tablet can help improve diabetes treatment in hospital.
34. **Sensor and Test Fair 2012,** Nuremberg, Germany, 20-24th May 2012. IMM had a poster presentation and demonstrator
35. **SETN 2012**: **The 7th Hellenic Conference on Artificial Intelligence**, Lamia, Greece 28-30th May 2012. FORTH-ICS presented their paper: *Learning from mixture of experimental data: a constraint–based approach*.
36. **PAGE 2012**, Venice, Italy, 5-8th June 2012. BTS made a conference talk: *A physiologically-based PK/PD model to capture population variability for diabetes research and automatic blood glucose control* and a poster presentation: *Dynamically Simulating The Effect Of Food On Gastric Emptying Using A Detailed Physiological Model For Gastrointestinal Transit And Absorption*.
37. **72nd American Diabetes Association scientific sessions, Philadelphia**, USA, 8-12th June 2012. MUG and MSG had a peer-reviewed abstract accepted with the title *Persistent Hyperglycemia in Hospitalized Patients with Diabetes Despite Considerable Operating Expense*
38. **ICML 2012 - 29th International Conference on Machine Learning**, Edinburgh, Scotland, 26th June to 1st July 2012. FORTH-ICS carried out original research activities on how to incorporate causal prior knowledge into causal models. The results of this research were then finalised in the paper *Incorporating Causal Prior Knowledge as Path-Constraints in Bayesian*

Networks and Maximal Ancestral Graphs, accepted and presented at the prestigious conference.

39. **European Summer School on Health Law and Bioethics,** Riga, Latvia, July 2012. VUB made a presentation.

40. **The 8th IFAC Symposium on Biological and Medical Systems**, Budapest Hungary, 29-31st August 2012. MUG and MSG had a conference paper accepted with the title: *A new Perspective on Closed-Loop Glucose Control using a Physiology-Based Pharmacokinetic / Pharmacodynamic Model Kernel* and had also a peer-reviewed oral presentation.

41. **IEEE/EMBS** conference in San Diego, 28th August - 1st September 2012. UBRUN had special sessions including training for 11073 standards and an invited session on uses of the IEEE PHD standards (UBRUN)

42. **TransMed Infinity3 meeting 2012**, Braunschweig, Germany, 16-21st September 2012. BTS made a conference talk/oral presentation: *The REACTION* platform -- Improving long-term Management of Diabetes -- Personalized Diabetes Therapy and Automatic Blood Glucose Control* (Stephan Schaller, Dr. Michael Block, Dr. Thomas Eissing)

43. **NHS Direct & Pharma Times Conference** for pharmaceutical/telemedicine interests, 2nd October 2012. CHC made a presentation/workshop.

44. **Healthtec Conference for UK NHS Health IT directors**, 3-4th October 2012. CHC made a presentation/workshop

45. **7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12**, Heraklion, Greece, 4-6th October 2012. FORTH-ICS had seven poster presentations (one of these won the best poster award). Several scientific algorithmic, theoretic, and applied results were presented at the conference.

46. **Third Annual International Hospital Diabetes Meeting** in Cambridge, Massachusetts, USA, 11-13 October 2012. MUG had two peer-reviewed poster presentations

47. **Europe Innova 2012** in Copenhagen, Denmark, 23-24th October 2012. REACTION was represented at an exhibition organised by IN-JET.

48. **The national conference '40. Jahrestagung der ÖDG – 2012',** Salzburg, AUSTRIA, 15-17th November 2012. MUG made two peer-reviewed poster presentations.

49. **MobiHealth 2012, Paris**, France 21-23th November 2012. Two conference papers submitted by REACTION partners were accepted, one by CHC and FORTH-ICS and one by CNET, FORTHNET and ATOS)

50. **Oxford Telemedicine Seminar**, 29th November 2012. CHC made a presentation/workshop.

51. **WHO Forum on health data standardisation and interoperability** in Geneva, 3-4th December 2012. ATOS attended

52. **EHTEL Symposium,** Brussels, Belgium, 6-7th December 2012. CHC made a presentation: *Evidence on large scale telemonitoring and its impact on service design*

53. **ATTD 2013, 6th International Conference on Advanced Technologies & Treatment for Diabetes,** Paris, France, 27th February to 2nd March. ATTD 2013 is the Sixth International Conference on Advanced Technologies and Treatments for Diabetes. The conference brings together the world's leading researchers and clinicians for a lively exchange of ideas and information related to the treatment and prevention of diabetes and related illnesses. ATTD has become synonymous with top calibre scientific programs that have provided participants with cutting edge research and analysis into the latest developments in diabetes-related technology. REACTION partners held a mini-symposium on REACTION (UBRUN); had three peer-reviewed poster presentations and three oral presentations (1st: MUG, MSG. 2nd: MUG and BTS).

54. **Meetings with companies about clinical trials with the GlucoTab system** (MUG)

55. **Standards meetings/activities year 3** (UBRUN)

a. Special sessions at IEEE/EMBS in San Diego, 28th August - 1st September 2012, 2012 including training for 11073 standards and an invited session on uses of the IEEE PHD standards (UBRUN)

b. HL7/IEEE 11073, 10-14th September 2012

c. IEEE 11073 PHD, 11-13th October

d. IEEE 11073, 12-16th November

e. HL7/IEEE 11073, Phoenix, 14-18th January 2013

f. IEEE invited presentation on IEEE booth at Consumer Electronics Show, Las Vegas, January 2013, displayed REACTION platform

Publications scientific and other

14. Conference talk at Bio-IT World Conference & Expo 2012, Boston, USA, 24-26th April 2012.

a. T. Eissing*: A Computational Systems Biology Software Platform for Multiscale Modeling and Simulation: Integrating Whole-Body Physiology, Disease Biology, and Molecular Reaction Networks* (BTS)

14. Conference paper for Photonics Europe Conference 2012, Brussels 16-19th April 2012 published by the SPIE in May 2012.

a. Ben Mohammadi, L.; Sigloch, S.; Frese, I.; Stein, V.; Welzel, K.; Schmitz, F.; Klotzbücher, T.; *A minimally invasive chip based near infrared sensor for continuous glucose monitoring*. Biophotonics: Photonic Solutions for Better Health Care III. Proceedings of the SPIE, Volume 8427, article id. 84270K, 11 pp. (2012). DOI: **10.1117/12.922381**. (IMM).

15. Conference paper for SETN 2012, Lamia, Greece: The 7th Hellenic Conference on Artificial Intelligence, 28-30th May 2012.

a. V. Lagani, I. Tsamardinos, S. Triantafillou*, Learning from mixture of experimental data: a constraint–based approach*. The paper contains scientific results on how to analyse data during integration which are originated in different experimental conditions, lecture notes in Computer Science, 7297:124 – 131, 2012. (FORTH-ICS)

16. Conference talk and poster presentation at PAGE 2012, Venice, Italy, 5-8th June 2012 by BTS

a. S. Schaller, S. Willmann, L. Schaupp, T. Pieber, A. Schuppert, J. Lippert and T. Eissing: *A physiologically-based PK/PD model to capture population variability for diabetes research and automatic blood glucose control*

b. Poster presentation: K. Thelen, K. Coboeken, Y. Jia, J.B. Dressman, S. Willmann: *Dynamically Simulating The Effect Of Food On Gastric Emptying Using A Detailed Physiological Model For Gastrointestinal Transit And Absorption.*

17. Peer-reviewed abstract for 72nd American Diabetes Association scientific sessions, Philadelphia, USA, 8-12th June 2012

a. Neubauer K., Mader J., Plank J., Schaupp L., Beck P., Augustin T., Narath S., Pieske B., Pieber T.R. *Persistent Hyperglycemia in Hospitalized Patients with Diabetes Despite Considerable Operating Expense*, Diabetes Volume: 61 (6) Suppl: 1 A628, 2012. (MUG, MSG)

18. Conference paper in proceedings of the 29th International Conference on Machine Learning, (ICML), 2012, Edinburgh, Scotland, 26th June to 1st July 2012.

a. *Incorporating Causal Prior Knowledge as Path-Constraints in Bayesian Networks and Maximal Ancestral Graphs* (FORTH-ICS)

19. Conference paper for the 8th IFAC Symposium on Biological and Medical Systems, Budapest Hungary, 29-31st August 2012.

a. *A new Perspective on Closed-Loop Glucose Control using a Physiology-Based Pharmacokinetic / Pharmacodynamic Model Kernel.* (BTS, MUG)

20. Invited article for Deutsches Ärzteblatt (2): 4-7, 2012 with the title

    a. *Sicheres elektronisches Glukosemanagement* (MUG, FHG-SIT)

21. Conference talk at TransMed Infinity3 meeting 2012, Braunschweig, Germany, 16-21st September 2012.

    a. S. Schaller, M. Block, T. Eissing*: The REACTION platform–Improving long-term Management of Diabetes-Personalized Diabetes Therapy and Automatic Blood Glucose Control.* (BTS)

22. Poster presentation for 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012.

    a. Vincenzo Lagani, George Kortas and Ioannis Tsamardinos. *Biomarker signature identification in "omics" data with multi-class outcome.* (FORTH-ICS)

23. Poster presentation for 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012.

    a. Sofia Triantafillou, Ioannis Tsamardinos, *Predicting associations from multiple "omics" data sets using causal discovery*. (Winner of Best Poster Award) (FORTH-ICS)

24. Poster presentation for 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012.

    a. Giorgos Borboudakis, Ioannis Tsamardinos, *Incorporating Causal Prior Knowledge in Causal Models* (FORTH-ICS)

25. Poster presentation for 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012.

    a. Konstantinos Kerkentzes and Ioannis Tsamardinos, *A feature selection algorithm for identifying high-order interactions in high-dimensional biological data* (FORTH-ICS)

26. Poster presentation for 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012.

    a. Dimitris Vainas, Oluf Dimitri Røe and Vincenzo Lagani. *Comparative evaluation of Affymetrix and Illumina genome-wide expression data in Pleural Mesothelioma* (FORTH-ICS)

27. Poster presentation for 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012.

    a. Giannis Papadakis, George A. Garinis and Vincenzo Lagani. *Analysis of mouse gene expression data in ageing: a temporal clustering approach* (FORTH-ICS)

28. Poster presentation for 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012.

    a. Oluf Dimitri Rø and Konstantinos Kerkentzes, *Differentially expressed genes of major lung tumour subtypes and normal lung tissue.* (FORTH-ICS)

29. Peer- reviewed poster presentation for Third Annual International Hospital Diabetes Meeting in Cambridge, Massachusetts, USA, Proceedings A31-32, 2012

    a. Mader J., Neubauer K., Schaupp L., Plank J., Pieber T.R. *Influence of blood glucose transcription errors on insulin dosing using a control algorithm in hospitalized type 2 diabetes patients* (MUG)

30. Peer- reviewed poster presentation for Third Annual International Hospital Diabetes Meeting in Cambridge, Massachusetts, USA, 11-13 October 2012, Proceedings A31-32, 2012

    a. Höll B., Spat S., Petritsch G., Beck P., Mader J.K., Neubauer K.M., Plank J., Pieber T.R. *GlucoTab: A portable glucose management system supporting in-hospital glycaemic control for patients with type 2 diabetes* (MUG)

31. Peer-reviewed poster presentation for the national conference '40. Jahrestagung der ÖDG – 2012', Salzburg, AUSTRIA, 15-17th November 2012

    a. Mader JK., Neubauer K., Aberer L., Spat S., Höll B., Schaupp L., Plank J., Pieber, TR.: *Einfluss von Blutzuckerübertragungsfehlern auf die Insulindosis bei Verwendung eines Kontrollalgorithmus bei hospitalisierten Patienten mit Typ 2 Diabetes*, Wiener Klinische Wochenschrift 124 (Sup.1):13-13 (MUG)

32. Peer-reviewed poster presentation for the national conference '40. Jahrestagung der ÖDG – 2012', Salzburg, AUSTRIA, 15-17th November 2012.

    a. Neubauer KM., Made, JK., Plank J., Tschapeller B., Buttinger M., Schneeberger M., Schaupp L., Pieber TR.: *Kenntnisse, Einstellungen und Wünsche der Pflegepersonen zu Blutzuckermanagement im stationären Bereich: eine Fragebogenerhebung*, Wiener Klinische Wochenschrift 124 (Sup.1):2-2 (MUG)

33. Conference paper for MobiHealth 2012, Paris, France, 21-23rd November 2012
    a. Karatzanis I., Kontogiannis V., Spanakis E.G., Chiarugi F., Fursse J., Jones R.W. *Empowering Patients through a Patient Portal for an Improved Diabetes Management*. International Workshop on "Advances in Personalized Health care Services, Wearable Mobile Monitoring, and Social Media Pervasive Technologies" (APHS 2012) (CHC, FORTH-ICS; accepted for oral presentation)

34. Conference paper for MobiHealth 2012, Paris, France, 21-23rd November 2012
    a. Asanin S., Rosengren P., Broden, T., Martins I.R.M., Barca C.C., Perez M., Montandon L., Stratakis M., Louloudakis S.; *Adopting Dynamic Declarations and Rule-based Executions in SOA-oriented Remote Patient Monitoring Platform using an Alarms and Alerts GUI*. International Workshop on "Advances in Personalized Health care Services, Wearable Mobile Monitoring, and Social Media Pervasive Technologies (APHS 2012) (CNET, FORTHNET, ATOS)

35. Presentation at EHTEL Symposium 2012, Brussels, 6-7th December 2012.
    a. *Evidence on large scale telemonitoring and its impact on service design* Russell Jones, Jo Fursse and Malcolm Clarke

36. Peer-reviewed abstract for ATTD 2013, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris, France 27th. February to 2nd March 2013
    a. M. Hajnsek, F. Sinner, M. Rumpler, L. Ben Mohammadi, I. Frese, S. Sigloch, K. Welzel, V. Stein, T. Klotzbuecher; *Novel Continuous Glucose Monitoring Techniques within REACTION* (IMM,MSG for oral presentation)

37. Peer-reviewed poster presentation for ATTD 2013, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris, France 27th. February to 2nd March 2013
    a. Schaupp L., Neubauer K.M., Mader J.K., Augustin T., Spat S., Hoell B., Beck P., Plank J., Pieber T.R. *Continuous glucose monitoring in hospitalised patients at the general ward* (MUG, MSG)

38. Peer-reviewed poster presentation for ATTD 2013, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris, France 27th. February to 2nd March 2013
    a. Neubauer K.M., Mader J.K., Plank J., Schaupp L., Buttinger M., Hoell B., Spat S., Tschapeller B., Beck P., Pieber T.R. *Nurses' experiences on implementing the REACTION algorithm for glycaemic management at a general ward*

39. Peer-reviewed poster presentation for ATTD 2013, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris, France 27th. February to 2nd March 2013
    a. Mader J.K., Neubauer K.M., Schaupp L., Augustin T., Spat S., Hoell B., Beck P., Pieber T.R., Plank J., *User adherence to dosing advice of an algorithm for basal-bolus insulin therapy in hospitalised patients with diabetes mellitus type 2* (MUG, MSG)

40. Peer-reviewed oral presentation for ATTD 2013, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris, France 27th. February to 2nd March 2013

a. Schaller S., Willmann S., Schaupp L., Pieber T.R., Schuppert A., Lippert J., Eissing T., *Development and application of a physiology based prediction model for closed loop glycaemic control* (MUG, BTS)

41. Peer-reviewed oral presentation for ATTD 2013, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris, France 27th. February to 2nd March 2013
    a. Pieber T.R., Schaupp L., Neubauer K.M., Mader J.K., Augustin T., Spat S., Hoell B.; Beck P., Plank J.; on behalf of the REACTION consortium *REACTION algorithm as an improved protocol for in-hospital management of type 2 diabetes* (MUG, MSG)

42. Journal paper published in Interactive Journal of Medical Research, i-JMR. The paper is based on the consortium conference papers at Mobihealth 2011.
    a. Spanakis, E.G., Chiarugi, F., Kouroubali, A., Spat, S., Beck, B., Asanin, S., Rosengren, P., Gergely, G.T., & Thestrup, J. (2012). *Diabetes Management Using Modern Information and Communication Technologies and New Care Models*. i-JMR Interactive Journal of Medical Research. 1 (5). http://www.i-jmr.org/2012/2/e8/. (FORTH-ICS, MSG, CNET, ALL, IN-JET)

43. Presentation at Cardiotechnix 2013: Algarve, Portugal 20-21st September 2013
    a. Saadi DB, Fauerskov I, Osmanagic A, Sheta HM, Sorensen HBD, Egstrup K, Hoppe K. Heart rhythm analysis using ECG recorded with a novel sternum based patch technology – a pilot study. In: Cardiotechnix 2013: Proceedings of the International Congress on Cardiovascular Technologies. 2013;15-21 (DELTA)

44. Journal paper in International Journal of Diabetes and its Complications. The contents of the REACTION Deliverable D6.1 were reelaborated and summarised in a scientific publication.
    a. Lagani V., Koumakis L., Chiarugi F. and Tsamardinos I. *A systematic review of predictive risk models for diabetes complications based on large scale clinical studies*. International Journal of Diabetes and its Complications, http://dx.doi.org/10.1016/j.jdiacomp.2012.11.003, 2012 (FORTH-ICS)

8.4   Activities undertaken in the fourth project year (M37-M48)

Marketing and media activities

- A newsletter was issued in August 2013 by IN-JET featuring articles by several partners on: The start of the primary care pilot offering 203 diabetes patients access to a range of REACTION health services; the decision support system, GlucoTab for doctors and nurses to improve hospital workflow and optimise insulin therapy; In-hospital authorisation and access control and mathematical models of the glucose insulin metabolism. It can be found at http://www.reactionproject.eu/newsletters/August2013.html

- An updated REACTION flyer was developed for distribution in delegate bags for the EHMA conference 2013 in Italy on 26-28th June 2013

- The website has been updated continuously with news, deliverables and papers adding citation details. A dedicated section of the website has been made for collaboration with other projects in the field of ICT in Support of Health and Ageing. (IN-JET). Also a Linkedin closed group has been established for collaboration (FORTH-ICS)

- A commercial brochure was prepared with a short description of technical and medical results, listing each of the outcomes and a link to responsible contact partner

- A final newsletter was prepared for release after project completion with focus on the outcomes

Dissemination events

56. **Pflegesymposium 2013**, Netzwerk Pflege, Graz Austria, 2nd April 2013. MUG made a conference talk (non-scientific).

57. **Biomedical Engineering and Medical Informatics and the European Federation of Medical Informatics (EFMI) Special Topic Conference (STC),** Data and Knowledge for Medical Decision Support, Prague, 17–19th April, 2013. MUG and MSG had a conference paper accepted.

58. **UK National workshop "Diabetes - a Call for Action",** Harrogate International Centre, North Yorkshire, UK, 23st April. Workshop for clinicians. (UBRUN)

59. **American Telemedicine Association (ATA) Annual Meeting**, Austin, Texas, 4-7th May 2013. CHC and UBRUN had a booth and poster presentation to demonstrate REACTION.

60. **DDG 2013, Diabetes Kongress**, Leibzig, Germany, 8-11th May 2013. MUG and MSG had a peer-reviewed abstract accepted with the title: *Anwenderakzeptanz von Insulindosierungsvorschlägen eines auf Basis-Bolustherapie basierenden Algorithmus bei hospitalisierten Patienten mit Diabetes mellitus Typ 2*.

61. **Tackling Long-Term Conditions: Meeting the Challenge**, Birmingham, UK, 16th May 2013. Expert speakers and insightful case studies explored new models of care that can help to improve the quality, productivity and outcomes of the management of long-term conditions. REACTION ran a workshop (masterclass) and had a stand to demo the REACTION platform. (UBRUN, CHC).

62. **Atos UK Health & Welfare Market - Innovation Forum**, London, UK, 22nd May 2013. ATOS presented REACTION in a meeting

63. **eHealth Summit Austria 2013**, 23-24th May 2013. MSG and MUG did a conference workshop: http://www.ehealthsummit.at/Workshop

64. **Visit at the UK Consulate**, Boston, USA on 4th June 2013. UK High level ministerial visit (UBRUN)

65. **United4Health**, Slovenia, 17-19th June 2013. UBRUN did a workshop for UE project at EU Consortium meeting for technology selection.

66. **ADA 2013, 73rd American Diabetes Association scientific sessions**, Chicago USA, 21-25th June 2013. MUG and MSG had a peer reviewed abstract accepted. The American Diabetes Association's Scientific Sessions brings together scientists and health care professionals from around the world who are involved in diabetes research and care. The five-day meeting will feature the most timely and significant advances in the prevention, diagnosis, and treatment of diabetes.

67. **IEEE/EMBS Annual Conference**, Osaka, Japan, 3-7th July 2013. UBRUN had an invited workshop on IEEE 11073 standards and a mini symposium on IEEE 11073 standards.

68. **Researcher symposium; FORTH premises**, Heraklion, Greece, 12-13th July 2013. FORTH-ICS had a REACTION poster presentation.

69. **UAI2013 - Conference on Uncertainty in Artificial Intelligence**, Bellevue, Washington, USA, 12-14th July 2013. The conference is the premier international conference on research related to representation, inference, learning and decision making in the presence of uncertainty within the field of Artificial Intelligence. FORTH-ICS presented a conference paper.

70. **GMDS 2013, 58. Jahrestagung der Deutschen Gesellschaft für Medizinische Informatik, Biometrie und Epidemiologie**, Lübeck, Germany, 1-5th September 2013. MUG and MSG had a peer reviewed abstract accepted with the title: *GlucoTab: Ein tablet-basiertes, mobiles Entscheidungsunterstützungs- und Workflowmanagementsystem zur Behandlung von Diabetes Typ 2 auf der Allgemeinstation*.

71. **Philips meeting** 18th September 2013, Einthoven, Netherlands. Presentation on Reaction platform to support remote management of devices. (UBRUN)

72. **Clustering event on Ambient Intelligence Advanced Technologies in Support of Health care and Assisted Living**, 26-27th September 2013 in Heraklion, Greece. 25 eHealth projects participated in the clustering event organised by REACTION and FORTH-ICS. The aim of the clustering event was to bring together European projects for demonstrations, presentations of innovative solutions and discussions of potential synergies and cooperation. Focus was on personal health systems for diabetes including social care through robots and personal health

systems in general including prevention of falls. After the workshop it was agreed to investigate opportunities for further collaboration through networks such as Linkedin with the possibility of sharing presentations and other documents and exchange knowledge. It was agreed to make all presentations available on the REACTION website where they can now be downloaded.

73. **Diabetes Technology Meeting**, San Francisco, USA, 31st October to 2nd November 2013. MUG and MSG did an oral presentation on efficacy and usability of a workflow-integrated algorithm for basal-bolus insulin therapy in hospitalized type 2 diabetes patients.

74. **European ZigBee Developers Conference,** 6-7th November 2013, Munich, Germany. Booth and invited presentation on Reaction platform. (UBRUN)

75. **ICT2013**, Vilnius, Lithuania, 6-8th November, 2013. REACTION exhibited at this major EU ICT-event where more than 4000 researchers, innovators, entrepreneurs, industry representatives, young people and politicians participated. ATOS made the arrangement to have a stand where all REACTION prototypes could be demonstrated. ATOS also prepared the promotional material requested by the conference organizers (including a 'piece of art') and by the Commission to be selected and obtain the stand. At the REACTION stand partners demonstrated how vital data such as blood glucose, weight and blood pressure are collected from patients and presented to clinical staff in primary care to help monitor and make decisions on treatment. It was also possible to see the workings of GlucoTab.

76. **Workshop on Implementation of Telemedicine Solutions,** Hørsholm, Copenhagen 13th November 2013. IN-JET organised a training workshop for business managers in collaboration with DELTA who also provided the facilities. Presentations were given by key stakeholders from different health and research organisations as well as from private companies and included topics such as sustainable business models, health technology assessment, ethical and product liability issues as well as the EU Medical Device Directive. The event attracted 30 participants from the private and public sector in Denmark and Sweden. The various presentations spurred very lively discussions among the participants and the feedback was predominantly favourable, with the majority of ratings in the Good/Very good categories. About seventy percent of the audience thought that telemedicine would be instrumental in reducing health care costs in the future. After the workshop several of the applications developed in the REACTION project were demonstrated.

77. **Connected Heath Symposium,** 24-26th November Boston, USA. DELTA and REACTION exhibited at this annual symposium focusing on new technologies and services of telemedicine.

78. **Medica 2013**, 20-23rd November 2013, Düsseldorf, Germany. REACTION exhibited at this the world's largest medical marketplace. (UBRUN and DELTA)

79. **The EHB conference, IEEE International Conference on eHealth and Bioengineering**, 21-23rd November, Iasi, Romania. REACTION partners FORTH-ICS, CHC and UBRUN have submitted a conference paper which was accepted for oral presentation. Title of the paper: *First Results about the Use of a Patient Portal by People with Diabetes in a Rural Area*.

Authors: Dimitris Manousos, Franco Chiarugi, Vasilis Kontogiannis, Ioannis Karatzanis, Angelina Kouroubali, Emmanouil G. Spanakis, Kostas Marias, Joanna Fursse, Shona Thomson, Russell W. Jones, Vivek Verma, Malcolm Clarke.

80. **ÖDG 2013**, **41. Jahrestagung der ÖDG**, Austrian Diabetes Association, Salzburg Austria, 21-23rd November 2013. MUG and MSG had two poster presentations and one oral presentation.

81. **Esundhedsobservatoriet, (The eHealth Observatory)** Odense, Denmark, 2-3rd December 2013. The event is one of the most important eHealth conferences in Denmark. IN-JET and DELTA exhibited, demonstrating REACTION services such as the GlucoTab and ePatch technology. Partner IN-JET also had a paper accepted on the need for revised care models when incorporating telemonitoring which was presented at the conference.

82. **CES, Computer Electronic Show,** 7-10th January 2014, Las Vegas. USAIEEE invitation to promote 11073 standards and Reaction as demonstrator on IEEE booth, booth on ZigBee Alliance stand. (UBRUN)

83. **National health conference, KL Sundhedskonference,** Kolding Denmark, 21st January 2014. The conference is organised by Local Government Denmark and for the 98 local governments in Denmark. IN-JET exhibited with a REACTION stand.

84. **Presentation Copenhagen Business School**, 31st January 2014. Jesper Thestrup from IN-JET gave a presentation on REACTION as a cloud solution for diabetes management to 35 international students.

85. **British Consulate**, 5th February 2014, Vienna, Austria. UK Trade and Industry event for Central Europe Health (UBRUN)

86. **ATTD 2014**, **7th International Conference on Advanced Technologies and Treatments for Diabetes,** Vienna, Austria, 5-8th February 2014. Reaction booth (UBRUN). IMM had a poster presentation with the title: *A chip based near infrared sensor for continuous glucose monitoring*. Additionally, 1 abstract and oral presentation by MUG, MSG, SIT, FORTH-ICS were made together with 2 peer reviewed abstracts for oral presentation by MSG and MUG and 2 peer-reviewed abstracts for poster presentations by MSG and MUG.

87. **CEBIT** 10-14th March 2014, Hannover, Germany. UKTI funded booth to demonstrate Reaction platform (UBRUN)

88. **SPIE Photonics Europe 2014**, Brussels, 14-17th April 2014. IMM has submitted a conference paper with the title: *In vivo evaluation of continuous glucose monitoring using a chip based near infrared sensor*

89. **Standards meetings/activities year 4**

   a. HIMSS, IEEE 11073 PHD, 4-8th March 2013, New Orleans, USA.IEEE invitation to promote 11073 standards and Reaction as demonstrator on IEEE booth.

b. Continua meeting on 11-15th March 2013, Portland, USA. Demonstration of Reaction (UBRUN)

c. IEEE 11073 PHD, Edinburgh 25-28th June 2013. Demonstration of Reaction at Continua meeting (UBRUN)

d. Invited Workshop on IEEE 11073 standards and Mini symposium on IEEE 11073 standards and Reaction as demonstrator at IEEE/EMBS Annual Conference, Osaka, Japan, 3-7th July 2013 (UBRUN)

e. Continua meeting, 9-11th October 2013, Taipei, Taiwan. Demonstration of Reaction (UBRUN)

f. IEEE 11073 PHD, 28-30th October, Geneva, Switzerland, meeting on device standards

g. Standards Institution Israel, 3rd February 2014, Tel Aviv, Israel. Workshop on IEEE 11073 standards (UBRUN)

h. IEEE 11073 PHD, 24-27th February 2014, Geneva, Switzerland. Meeting on device standards (UBRUN)

Publications – scientific and other

45. Journal paper in Journal of Diabetes Science & Technology, 1st March 2013

a. Neubauer K.M., Schaupp L., Plank J., Augustin T., Mautner S.I., Tschapeller B., Pieber T.R.: *Failure to control hyperglycemia in non-critically ill diabetic patients despite standard glycemic management in a hospital setting*, Journal of Diabetes Science and Technology Vol 7(3): 402-409, 2013 (MUG)

45. Non-scientific conference talk at Pflegesymposium 2013, Netzwerk Pflege, Graz Austria, 2nd April 2013

a. Neubauer K., Buttinger M., Schaupp L., Glawogger B., Piere T.R. *Forschung trifft Praxis: zukünftiges stationäres Blutzuckermanagement mit einem Tablet-PC*

46. Poster presentation at the American Telemedicine Association (ATA) 18th Annual Meeting and Tradeshow, Austin, Texas, 5-7th May 2013.

a. *The Reaction Project – total management of a whole population of diabetes patients in primary care*, Malcolm Clarke, Joanna Fursse, Russell Jones (CHC, UBRUN) http://www.americantelemed.org/ata-2013/program-overview

47. Peer reviewed abstract for DDG 2013, Diabetes Kongress, Leibzig, Germany, 8-11th May 2013

a. *Anwenderakzeptanz von Insulindosierungsvorschlägen eines auf Basis-Bolustherapie basierenden Algorithmus bei hospitalisierten Patienten mit Diabetes mellitus Typ 2* (MUG, MSG)

48. Conference workshop at the eHealth Summit Austria 2013, 23-24th May 2013

a. Beck P. Neubauer K., Spat S., Höll B., Schaupp L.: *Entscheidungsunterstützung im Klinikalltag – Erfolgsstory eines Software Medizinprodukts* (MSG, MUG)

49. Peer reviewed abstract for ADA 2013, 73rd American Diabetes Association scientific sessions, Chicago USA, 21-25th June 2013.

a. Mader J., Neubauer K.M., Schaupp L., Augustin T., Beck P., Spat S., Höll B., Treiber G., Fruhwald F., Pieber T.R., Plank J.; *Efficacy, usability and sequence of operations of a workflow-integrated algorithm for basal-bolus insulin therapy in hospitalized type 2 diabetes patients* (MUG, MSG)

50. Conference paper for UAI2013 - Conference on Uncertainty in Artificial Intelligence, Bellevue, Washington, USA, 11-15th July 2013

a. *Scoring and Searching over Bayesian Networks with Informative, Causal and Associative Priors* (FORTH),

51. Journal paper in International Review of Law, Computer & Technology, 1st July 2013

a. *mHealth & Data Protection – The Letter & the Spirit of Consent Legal Requirements*, Eugenio Mantovania & Paul Quinn DOI:10.1080/13600869.2013.801581 (VUB)

52. Journal paper in CPT: Pharmacometrics & Systems Pharmacology, published 14th August 2013

    a. Schaller S., Willmann S., Lippert J., Schaupp L., Pieber T.R., Schuppert A.,Eissing T.: *A generic integrated physiologically-based whole-body model of the glucose-insulin-glucagon regulatory system, Pharmacometrics and Systems Pharmacology* (BTS, MUG)

53. Journal paper in Diabetes, Obesity and Metabolism published 29th August 2013

    a. Mader J., Neubauer K.M., Schaupp L., Augustin T., Beck P., Spat S., Höll B., Treiber G., Fruhwald F., Pieber T.R., Plank J.: *Efficacy, usability and sequence of operations of a workflow-integrated algorithm for basal-bolus insulin therapy in hospitalized type 2 diabetes patients*, in Diabetes Obesity and Metabolism. *2014; 16(2): 137-146.* (MUG, MSG)

54. Journal paper in Datenschutz und Datensicherheit – DuD, published August 2013

    a. *Sichere Nutzung von Cloud-Speicherdiensten*, Lukas Kalabis, Thomas Kunz, Ruben Wolf (SIT)

55. Peer reviewed abstract for GMDS 2013, 58. Jahrestagung der Deutschen Gesellschaft für Medizinische Informatik, Biometrie und Epidemiologie, Lübeck, Germany, 1-5th September 2013.

    a. *GlucoTab: Ein tablet-basiertes, mobiles Entscheidungsunterstützungs- und Workflowmanagementsystem zur Behandlung von Diabetes Typ 2 auf der Allgemeinstation* (MUG, MSG)

56. Conference paper for Cardiotechnix 2013: Algarve, Portugal 20-21st September 2013

    a. Saadi DB, Fauerskov I, Osmanagic A, Sheta HM, Sorensen HBD, Egstrup K, Hoppe K. Heart rhythm analysis using ECG recorded with a novel sternum based patch technology – a pilot study. In: Cardiotechnix 2013: Proceedings of the International Congress on Cardiovascular Technologies. 2013;15-21 (DELTA)

57. European Health Law Conference in Coimbra, Portugal in October 2013. Paul Quinn from VUB made a presentation on the legal protection available to individuals who use apps that have not been officially recognised as medical devices.

58. Conference paper for the EHB conference, IEEE International Conference on eHealth and Bioengineering, 21-23rd November, Iasi, Romania.

    a. *First Results about the Use of a Patient Portal by People with Diabetes in a Rural Area.* (FORTH-ICS, CHC, UBRUN) DOI: 10.1109/EHB.2013.6707375

59. Oral presentation at Diabetes Technology Meeting, San Francisco, USA, 31st October to 2nd November 2013.

    a. *Efficacy and usability of a workflow-integrated algorithm for basal-bolus insulin therapy in hospitalized type 2 diabetes patients* (MUG, MSG)

60. Journal paper for Computational and Structural Biotechnology Journal, 2013

    a. *Biomarker signature identification in "omics" data with multi-class outcome* (FORTH-ICS)

61. In preparation: Journal paper (peer-reviewed) for JAMIA, Journal of the American Medical Informatics Association, BMJ Journals

    a. *Performance of a tablet based workflow and decision support system* (MUG, MSG, ClinDiab 03 trial)

62. Journal paper (peer-reviewed) for Biosensors and Bioelectronics, published 15 March 2014, http://dx.doi.org/10.1016/j.bios.2013.09.043

    a. Lhoucine Ben Mohammadi, Thomas Klotzbuecher, Susanne Sigloch, Knut Welzel, Michael Göddel, Thomas R. Pieber, Lukas Schaupp*; In vivo evaluation of a chip based near infrared sensor for continuous glucose monitoring* (IMM, MUG, MSG)

63. Poster presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5-8th February 2014

    a. *A chip based near infrared sensor for continuous glucose monitoring* (IMM)

64. Poster presentation at 41. Jahrestagung der ÖDG, Austrian Diabetes Association, 21-23rd November 2013

    a. Neubauer, KM; Mader, JK; Plank, J; Schaupp, L; Buttinger, M; Höll, B; Spat, S; Beck, P; Pieber, TR; *Implementierung des Reaction Algorithmus für stationäres Blutzuckermanagement- Erfahrungen der Pflegepersonen,*

65. Poster presentation at 41. Jahrestagung der ÖDG, Austrian Diabetes Association, 21-23rd November 2013

    a. Schaupp, L; Neubauer, KM; Mader, JK; Augustin, T; Spath, S; Höll, B; Beck, P; Plank, J; Pieber, TR; *Kontinuierliches Glukosemonitoring bei hospitalisierten Patienten mit Typ 2 Diabetes während Basis-Bolus-Insulintherapie*

66. Conference talk at 41. Jahrestagung der ÖDG, Austrian Diabetes Association, 21-23rd November 2013

    a. Mader, JK; Neubauer, KM; Schaupp, L; Augustin, T; Beck, P; Spat, S; Höll, B; Treiber, G; Fruhwald, FM; Pieber, TR; Plank, J; *Effektivität, Anwendbarkeit und Anwenderakzeptanz eines in den Arbeitsablauf integrierten Algorithmus für Basis-Bolus-Insulintherapie bei hospitalisierten Patienten mit Typ 2 Diabetes.*

67. Scientific publication: Mantovani, E., Quinn, P. et al.(2013). eHealth to mHealth – A Journey Precariously Dependent Upon Apps? European Journal of epractice, number 21. http://www.epractice.eu/journal/volume/21

68. Conference paper for SPIE Photonics Europe 2014, Brussels, 14-17th April 2014

    a. *In vivo evaluation of continuous glucose monitoring using a chip based near infrared sensor* (IMM)

69. Conference paper for Biomedical Engineering and Medical Informatics and the European Federation of Medical Informatics (EFMI) Special Topic Conference (STC), Data and Knowledge for Medical Decision Support, Prague, 17–19th April, 2013; published in Stud Health Technol Inform. 2013;186:187-91.

    a. Spat S, Höll B, Petritsch G, Schaupp L, Beck P, Pieber TR: *Automatic system testing of a decision support system for insulin dosing using Google Android.* (MSG, MUG)

70. Abstract and oral presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014

    a. P. Kardas, P. Beck, S. Bromuri, F. Chiarugi, M. Enzmann, B. Höll, O. Keller, S. Lane, J. Mader, O. Marchesini, S. Mougiakakou, K. Neubauer, T.R. Pieber, M. Plößnig, S.G. Puricel, L. Schaupp, S. Spat. *7th Framework Program - Funded eHealth Systems for Diabetes.* (MUG, MSG, SIT, FORTH)

71. Peer-reviewed abstract and oral presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014

    a. K. Donsa, K.M. Neubauer, J.K. Mader, B. Höll, S. Spat, B. Tschapeller, P. Beck, J. Plank, T.R. Pieber, L. Schaupp. *Are we missing something? Continuous glucose monitoring compared with POCT among hospitalized type 2 Diabetes patients on basal-bolus insulin therapy.* (MSG, MUG)

72. Peer-reviewed abstract and oral presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014

    a. J.K. Mader, K.M. Neubauer, L. Schaupp, F. Aberer, T. Augustin, S. Spat, B. Hoell, P. Beck, J. Plank, T.R. Pieber. *Evaluation of glycemic control using an algorithm for*

basal bolus insulin therapy in hospitalised patients with diabetes mellitus type 2. (MUG, MSG)

73. Peer-reviewed abstract and poster presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014

    a. B. Höll, S. Spat, P. Beck, K.M. Neubauer, J.K. Mader, L. Schaupp, F. Chiarugi, T.R. Pieber. *GlucoTab – Automatic decision support for treatment of patients with diabetes type 2 in hospital.* (MSG, MUG)

74. Peer-reviewed abstract and poster presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014

    a. K.M. Neubauer, J.K. Mader, L. Schaupp, B. Höll, S. Spat, T. Augustin, P. Beck, M. Buttinger, J. Plank, T.R. Pieber. *Tablet-based workflow and decision support of in-hospital glycaemic management—perceptions of nurses and physicians.* (MUG, MSG)

9 Appendix 2 – List of scientific publications

The following presents all scientific publications produced by REACTION partners, organised according to type.

Peer-reviewed journal publications

1. Thelen, Kirstin; Coboeken, Katrin; Willmann, Stefan; Burghaus, Rolf; Dressman, Jennifer B.;Lippert, Jörg; *Evolution of a Detailed Physiological Model to Simulate the Gastrointestinal Transit and Absorption Process in Humans, Part 1: Oral Solutions*, published in Journal of Pharmaceutical Sciences Vol.100(12), December 2011. http://onlinelibrary.wiley.com/doi/10.1002/jps.22726/abstract

2. Spanakis, E.G., Chiarugi, F., Kouroubali, A., Spat, S., Beck, B., Asanin, S., Rosengren, P., Gergely, G.T., & Thestrup, J. (2012). *Diabetes Management Using Modern Information and Communication Technologies and New Care Models*. i-JMR Interactive Journal of Medical Research, http://www.i-jmr.org/2012/2/e8/

3. Enzmann M., Franke F., Spat S., Beck P., Schaupp L.: *Sicheres elektronisches Glukosemanagement*, Deutsches Ärzteblatt (2): 4-7, 2012 (invited article)

4. Lagani V, Koumakis L, Chiarugi F, Lakasing E and Tsamardinos I. *A systematic review of predictive models for diabetes complications based on large scale clinical studies*. Journal of Diabetes and its Complications, July 2013, doi:10.1016/j.jdiacomp.2012.11.003

5. Mader J., Neubauer K.M., Schaupp L., Augustin T., Beck P., Spat S., Höll B., Treiber G., Fruhwald F., Pieber T.R., Plank J.: *Efficacy, usability and sequence of operations of a workflow-integrated algorithm for basal-bolus insulin therapy in hospitalized type 2 diabetes patients*; Diabetes, Obesity and Metabolism, published 29. August 2013, DOI: 10.1111/dom.12186

6. Neubauer K.M., Schaupp L., Plank J., Augustin T., Mautner S.I., Tschapeller B., Pieber T.R.: *Failure to control hyperglycemia in non-critically ill diabetic patients despite standard glycemic management in a hospital setting*, Journal of Diabetes Science and Technology Vol 7(3): 402-409, 2013

7. *mHealth & Data Protection – The Letter & the Spirit of Consent Legal Requirements*, Eugenio Mantovania & Paul Quinn in International Review of Law, Computer & Technology, 1st July 2013, DOI:10.1080/13600869.2013.801581 (VUB)

8. Schaller S., Willmann S., Lippert J., Schaupp L., Pieber T.R., Schuppert A.,Eissing T.: *A generic integrated physiologically-based whole-body model of the glucose-insulin-glucagon regulatory system, Pharmacometrics and Systems Pharmacology* (BTS, MUG) in CPT: Pharmacometrics & Systems Pharmacology, published 14th August 2013. DOI: 10.1038/psp.2013.40

9. Lukas Kalabis, Thomas Kunz, Ruben Wolf*; Sichere Nutzung von Cloud-Speicherdiensten*, in Datenschutz und Datensicherheit – DuD, published August 2013, DOI: 10.1007/s11623-013-0209-8

10. Vincenzo Lagani, George Kortas, Ioannis Tsamardinos, *Biomarker signature identification in "omics" data with multi-class outcome*, Computational and Structural Biotechnology Journal 2013. DOI: http://dx.doi.org/10.5936/csbj.201303004 in proceedings of the 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics, October 2012).

11. Lhoucine Ben Mohammadi, Thomas Klotzbuecher, Susanne Sigloch, Knut Welzel, Michael Göddel, Thomas R. Pieber, Lukas Schaupp; *In vivo evaluation of a chip based near infrared sensor for continuous glucose monitoring* in Biosensors and Bioelectronics, available for download, 27. September 2013, published 15 March 2014. http://dx.doi.org/10.1016/j.bios.2013.09.043

12. Mantovani, E., Quinn, P. et al.(2013). eHealth to mHealth – A Journey Precariously Dependent Upon Apps? *European Journal of epractice*, number 21. http://www.epractice.eu/journal/volume/21

13. M. Hajnsek, F. Sinner, M. Rumpler, L. Ben Mohammadi, I. Frese, S. Sigloch, K. Welzel, V. Stein, T. Klotzbuecher; *Novel Continuous Glucose Monitoring Techniques within REACTION*, in proceedings of ATTD 2013, published in DIABETES TECHNOLOGY & THERAPEUTICS, Volume 15, Supplement 1, 2013, Mary Ann Liebert, Inc.DOI: 10.1089/dia.2012.1221.

14. In preparation: *Performance of a tablet based workflow and decision support system* in JAMIA, Journal of the American Medical Informatics Association, BMJ Journals, submission planned for March 2014.

Conference papers

1. Hoell, B.; Spat, S.; Plank, J.; Schaupp, L.; Neubauer, K.; Beck, P.; Chiarugi, F.; Kontogiannis, V.; Pieber, R. T. & Holzinger, *Design of a mobile, safety-critical in-hospital Glucose Management*, in proceedings of International Conference of the European Federation for Medical Informatics - MIE2011, 28-31 August 2011. (submitted in February 2011)

2. Hoell, B.; Spat, S.; Plank, J.; Schaupp, L.; Neubauer, K.; Beck, P.; Pieber, T. R. & Holzinger, A., *Design einer mobilen Anwendung für das stationäre Glukosemanagment*, eHealth2011, Vienna, Austria, 26-27th May 2011.

3. Stephan Spat, Bernhard Höll, Peter Beck, Franco Chiarurgi, Vasilis Kontogiannis, Manolis Spanakis, Dimitris Manousos, Thomas R. Pieber; *A Mobile Android-based Application for in-hospital Glucose Management in compliance with the Medical Device Directive for Software*. MobiHealth 2011, Kos, Greece.

4. Jesper Thestrup, Tamas Gergely, Peter Beck; *Exploring new Care Models in Diabetes Management and Therapy with a Wireless Mobile eHealth Platform*. MobiHealth 2011, Kos, Greece

5. Emmanouil G. Spanakis, Franco Chiarugi; *Diabetes Management: Devices, ICT Technologies and Future Perspectives*. MobiHealth 2011, Kos, Greece

6. Angelina Kouroubali, Franco Chiarugi; *Developing advanced technology services for diabetes management: User preferences in Europe*. MobiHealth 2011, Kos, Greece

7. Lefteris Koumakis, Franco Chiarugi, Vincenzo Lagani, Angelina Kouroubali, Ioannis Tsamardinos; *Risk assessment models for diabetes complications: a survey of available online tools*. MobiHealth 2011, Kos, Greece

8. Matts Ahlsén, Stefan Asanin, Peeter Kool, Peter Rosengren, Jesper Thestrup; *Service-Oriented Middleware Architecture for Mobile Personal Health Monitoring*. MobiHealth 2011, Kos, Greece

9. V. Lagani, I. Tsamardinos, S. Triantafillou, *Learning from mixture of experimental data: a constraint–based approach* in proceeding of the 7th Hellenic Conference on Artificial Intelligence (SETN 2012), Lecture Notes in Computer Science, 7297:124 – 131, 2012.

10. Borboudakis G and Tsamardinos I. Incorporating Causal Prior Knowledge as Path-Constraints in Bayesian Networks and Maximal Ancestral Graphs. ICML 2012 (international, peer-reviewed conference)

11. Lagani V, Tsamardinos T, Triantafillou S. Learning from mixture of experimental data: A constraint-based approach. SETN 2012 (international, peer-reviewed conference)

12. Schaller S., Willmann S., Schaupp L., Pieber T.R., Schuppert A., Lippert J., Eissing T.: *A new Perspective on Closed-Loop Glucose Control using a Physiology-Based Pharmacokinetic / Pharmacodynamic Model Kernel*; 8th IFAC Symposium on Biological and Medical Systems, Budapest, Hungary, August 29-31, 2012 (conference paper and peer reviewed oral presentation)

13. Karatzanis I., Kontogiannis V., Spanakis E.G., Chiarugi F., Fursse J., Jones R.W. *Empowering Patients through a Patient Portal for an Improved Diabetes Management*. International Workshop on "Advances in Personalized Health care Services, Wearable Mobile Monitoring, and Social Media Pervasive Technologies" (APHS/MobiHealth 2012)

14. Asanin S., Rosengren P., Broden, T., Martins I.R.M., Barca C.C., Perez M., Montandon L., Stratakis M., Louloudakis S. *Adopting Dynamic Declarations and Rule-based Executions in SOA-oriented Remote Patient Monitoring Platform using an Alarms and Alerts GUI*. International Workshop on "Advances in Personalized Health care Services, Wearable Mobile Monitoring, and Social Media Pervasive Technologies" (APHS/MobiHealth 2012)

15. A minimally invasive chip based near infrared sensor for continuous glucose monitoring, Photonics Europe Conference 2012, 16-19 April 2012 (IMM)

16. Borboudakis G and Tsamardinos I*.; Scoring and Searching over Bayesian Networks with Informative, Causal and Associative Priors* in proceedings of the 29th Conference on Uncertainty in Artificial Intelligence - UAI 2013, July 12-14, 2013, Washington, United States: http://auai.org/uai2013/prints/papers/47.pdf

17. *First Results about the Use of a Patient Portal by People with Diabetes in a Rural Area.* Authors: Dimitris Manousos, Franco Chiarugi, Vasilis Kontogiannis, Ioannis Karatzanis, Angelina Kouroubali, Emmanouil G. Spanakis, Kostas Marias, Joanna Fursse, Shona Thomson, Russell W. Jones, Vivek Verma, Malcolm Clarke for the EHB conference, IEEE International Conference on eHealth and Bioengineering, 21-23rd November 2013, Iasi, Romania. DOI: 10.1109/EHB.2013.6707375 (accepted for oral presentation)

18. *In vivo evaluation of continuous glucose monitoring using a chip based near infrared sensor*. Conference paper for SPIE Photonics Europe 2014, Brussels, 14-17th April 2014. Proc. SPIE 8427, Biophotonics: Photonic Solutions for Better Health Care III, 84270K (June 1, 2012); doi:10.1117/12.922381

19. Spat S, Höll B, Petritsch G, Schaupp L, Beck P, Pieber TR. *Automatic system testing of a decision support system for insulin dosing using Google Android.* Stud Health Technol Inform. 2013;186:187–91. (MSG, MUG) for Biomedical Engineering and Medical Informatics and the European Federation of Medical Informatics (EFMI) Special Topic Conference (STC), Data and Knowledge for Medical Decision Support, Prague, 17–19th April, 2013.

20. Paul Quinn, Presentation on the legal protection available to individuals who use apps that have not been officially recognized as medical devices, at the European Health Law Conference in Coimbra, Portugal in October 2013.

21. Ann-Katrin Habbig, Presentation on Privacy, data protection and medical apps - a threat to patient safety?. The presentation looks at the data protection and privacy implications of the increasing use of Apps for medical device to monitor physiological parameters.

Publications/presentations ATTD 2012, 2013, 2014

1. Schaller S., Eissing, T., Schaupp L., Pieber T.R., Schuppert A., Lippert J.; *Closed-loop insulin delivery using a physiology-based pharmacokinetic/pharmacodynamicmodel kernel,* 5th International Conference on Advanced Technologies & Treatment for Diabetes, Barcelona, Spain, 8-11 February 2012

2. Spat S., Höll B., Plank J., Schaupp L., Neubauer K., Chiarugi F., Beck P., Pieber T.R; *A mobile in-hospital application supporting insulin dosing for patients with diabetes type 2*, 5th International Conference on Advanced Technologies & Treatment for Diabetes, Barcelona, Spain, 8-11 February 2012.

3. M. Hajnsek, F. Sinner, M. Rumpler, L. Ben Mohammadi, I. Frese, S. Sigloch, K. Welzel, V. Stein, T. Klotzbuecher; *Novel Continuous Glucose Monitoring Techniques within REACTION*, ATTD 2013 (peer-reviewed abstract, accepted for oral presentation)

4. Schaupp L., Neubauer K.M., Mader J.K., Augustin T., Spat S., Hoell B., Beck P., Plank J., Pieber T.R. *Continuous glucose monitoring in hospitalised patients at the general ward*, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris France, February 27- March 2, 2013 (peer-reviewed poster presentation)

5. Pieber T.R., Schaupp L., Neubauer K.M., Mader J.K., Augustin T., Spat S., Hoell B.; Beck P., Plank J.; on behalf of the REACTION consortium *REACTION algorithm as an improved protocol for in-hospital management of type 2 diabetes*, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris France, February 27- March 2, 2013 (peer-reviewed oral presentation)

6. Schaller S., Willmann S., Schaupp L., Pieber T.R., Schuppert A., Lippert J., Eissing T., *Development and application of a physiology based prediction model for closed loop glycaemic control*, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris France, February 27- March 2, 2013 (peer-reviewed oral presentation)

7. Neubauer K.M., Mader J.K., Plank J., Schaupp L., Buttinger M., Hoell B., Spat S., Tschapeller B., Beck P., Pieber T.R. *Nurses' experiences on implementing the REACTION algorithm for glycaemic management at a general ward*, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris France, February 27- March 2, 2013 (peer-reviewed poster presentation)

8. Mader J.K., Neubauer K.M., Schaupp L., Augustin T., Spat S., Hoell B., Beck P., Pieber T.R., Plank J., *User adherence to dosing advice of an algorithm for basal-bolus insulin therapy in hospitalised patients with diabetes mellitus type 2*, 6th International Conference on Advanced Technologies & Treatment for Diabetes, Paris France, February 27- March 2, 2013 (peer-reviewed poster presentation)

9. Ben Mohammadi, L.; Sigloch, S.; Frese, I.; Welzel, K.; Goeddel, M.; Klotzbuecher, T.; *A chip based near infrared sensor for continuous glucose monitoring,* ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5-8th February 2014 (poster presentation)

10. P. Kardas, P. Beck, S. Bromuri, F. Chiarugi, M. Enzmann, B. Höll, O. Keller, S. Lane, J. Mader, O. Marchesini, S. Mougiakakou, K. Neubauer, T.R. Pieber, M. Plößnig, S.G. Puricel, L. Schaupp, S. Spat. *7th Framework Program - Funded eHealth Systems for Diabetes.* Abstract and oral presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014

11. K. Donsa, K.M. Neubauer, J.K. Mader, B. Höll, S. Spat, B. Tschapeller, P. Beck, J. Plank, T.R. Pieber, L. Schaupp. *Are we missing something? Continuous glucose monitoring compared with POCT among hospitalized type 2 Diabetes patients on basal-bolus insulin therapy*. Peer-reviewed abstract and oral presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014.

12. J.K. Mader, K.M. Neubauer, L. Schaupp, F. Aberer, T. Augustin, S. Spat, B. Hoell, P. Beck, J. Plank, T.R. Pieber. *Evaluation of glycemic control using an algorithm for basal bolus insulin therapy in hospitalised patients with diabetes mellitus type 2.* Peer-reviewed abstract and oral

presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014.

13. B. Höll, S. Spat, P. Beck, K.M. Neubauer, J.K. Mader, L. Schaupp, F. Chiarugi, T.R. Pieber. *GlucoTab – Automatic decision support for treatment of patients with diabetes type 2 in hospital.* Peer-reviewed abstract and poster presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014.

14. K.M. Neubauer, J.K. Mader, L. Schaupp, B. Höll, S. Spat, T. Augustin, P. Beck, M. Buttinger, J. Plank, T.R. Pieber. *Tablet-based workflow and decision support of in-hospital glycaemic management—perceptions of nurses and physicians.* Peer-reviewed abstract and poster presentation for ATTD 2014, 7th International Conference on Advanced Technologies and Treatments for Diabetes, Vienna, Austria, 5th February 2014.

Other scientific publications

1. Neubauer, K; Plank, J; Schaupp, L; Buttinger, M; Schneeberger, M, Höll, B, Spat, S; Beck, P; Tschapeller, B; Pieske, B; Pieber, T; *Erhebung des stationären Blutzuckermanagements bei nicht-kritisch kranken PatientInnen.* Peer-reviewed abstract published in Wiener Klinische Wochenschrift, in proceedings of 39. Jahrestagung der ÖDG (Austrian Diabetes Association), Salzburg Austria, 17-19th November 2011.

2. Neubauer, K; Plank, J; Schaupp, L; Hoell, B; Spat, S; Beck, P; Buttinger, M; Schneeberger, M; Pieske, B; Pieber, T; *Assessment of In-Hospital Glycaemic Management in Non-Critically Ill Patients.* Peer-reviewed abstract published in Journal of Diabetes Science and Technology in proceedings of the International Hospital Diabetes Meeting where it was presented, Barcelona, Spain, 17-19th November 2011.

3. Neubauer K., Mader J., Plank J., Schaupp L., Beck P., Augustin T., Narath S., Pieske B., Pieber T.R; *Persistent Hyperglycemia in Hospitalized Patients with Diabetes Despite Considerable Operating Expense.* American Diabetes Association 72nd Scientific Sessions 8-12th June, 2012, Philadelphia, USA, Diabetes Volume: 61 (6) Suppl: 1 A628, 2012 (peer reviewed abstract)

4. Mader J., Neubauer K., Schaupp L., Plank J., Pieber T.R. *Influence of blood glucose transcription errors on insulin dosing using a control algorithm in hospitalized type 2 diabetes patients* 3rd Annual International Hospital Diabetes Meeting, 11-13th October, 2012, Cambridge Massachusetts, USA, Proceedings A31-32, 2012 (Two peer-reviewed poster presentations)

5. Vincenzo Lagani, George Kortas and Ioannis Tsamardinos. *Biomarker signature identification in "omics" data with multi-class outcome.* 7th Conference of the Hellenic Society for Computational Biology and Bioinformatics: HSCBB12, Heraklion, Greece, 4-6th October 2012 (poster presentation)

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10 Appendix 3 - List of products and contact information

	Identification of Foreground knowledge, products and concepts	Short description of the exploitable Foreground
1	REACTION GlucoTab	In-hospital decision and workflow support system for diabetes management. A secure system with an Android-based front-end and a backend based on web services for the daily management of patients with diabetes in a hospital ward.
2	REACTION Patient Portal	The patient portal allows for collection of patient input data (including the capture of life-style data (activity, diet), the capture of medication data as well as life-style and compliance questionnaires) and manual entry of data extracted from the EPR to create a comprehensive diabetes data management system. The patient portal is designed to enable sharing of information between clinicians and patient, and supports the patients and informal carers in the self-management of the diabetes.
3	REACTION Clinical Portal	Software application to manage information collected from sensors, patient portal and care plan in order to provide clinical management of diabetes patients.
4	REACTION ZigBee Home Monitoring Platform	Mains plug mounted home gateway with ZigBee local wireless network and GPRS WAN sending data from ZigBee enabled sensors to backend database.
5	REACTION Platform Server Backend	Software running on backend server on top of one or more databases. Processes incoming observations from various gateways. Provides functionality for defining and executing monitoring rules and related actions such as SMS notification, functionality for defining and executing service orchestrations and event processing and management. A layer of Web Services provides a high level Service Layer for applications to use to access and process patient and monitoring data.
6	REACTION DCK	Developers Toolkit to enable integration of medical devices into eHealth applications. Includes APIs, extensible middleware objects for device connectivity and testing tools for protocol compliance. Produces a REACTION DCK runtime engine.
7	REACTION Nutrition App	Smartphone app for entering of nutrition information. Provides access to and selection of nutrition-related data such as carbohydrates, calories et c of food contents. Designed for use with Android phones. Exports data to backend server. Keeps diet information and weekly lists of meals. Can export into REACTION database using the Service Layer
8	REACTION SMS Notification Component	Software infrastructure for the delivery of SMS notifications.
9	REACTION Network Monitoring Service for Mobile Devices	A java library for remotely monitoring/managing mobile devices using the SNMP protocol
10	REACTION Long-term Risk Models	1) Statistical models for predicting the occurrence of diabetes complications 2) Sets of risk factors of diabetes complications 3) Bayesian networks depicting the statistical relations among diabetes-related clinical parameters 4) Implementation of points 1 -3 as Web-Service components
11	REACTION Glucose-insulin-glucagon Model	Physiological glucose-insulin-glucagon PK/PD model.
12	REACTION Chip-based IR Glucose Sensor	Chip-based glucose sensor combined with micro dialysis and based on IR difference absorption spectroscopy.
13	REACTION Fibre-based IR Glucose Sensor	Fibre-based glucose sensor based on IR difference absorption spectroscopy and integrated into a micro-needle.

	Identification of Foreground knowledge, products and concepts	Short description of the exploitable Foreground
14	REACTION Short Term Risk Management Tool	The short-term risk management tool is used to control the adjustment of the care plan in a cyclic process way, based on a pattern management approach.
15	REACTION Semantic Search Tool	The Semantic Search tool enables the user to search for information from databases and textual bases. It strengthens the functions of the STRM tool by supporting to find heterogeneous patterns in the history of the actual patient, similar cases and relevant information materials.
16	REACTION Closed-loop Algorithm using Physiological Model	Closed-loop algorithm using physiological model
17	REACTION Multi-Protocol Home Monitoring Gateway	Software-based gateway running on standard PC-platform with or without user interface. Provides uniform access, connectivity, control and interfacing with medical and wellness devices. Supports Continua and other protocols. Exports data to different back ends.
18	REACTION Primary Care Patient Monitoring Protocols	Protocols and algorithms for monitoring behaviour and recording need for intervention.
19	Wireless sensor (ePatch) for Heart rate monitoring	A technology platform (ePatch_AMOR VERSION 3) for wireless monitoring of physiological vital signs of a patient. The ePatch AMOR version 3 consists of a sensor unit with electronics and a rechargeable battery, and an electrode that picks up electrical vital signs and is attached to the sensor unit. When the sensor unit and the electrode are attached, they can be applied to the skin of the patient by an adhesive layer on the electrode.
20	REACTION Security environment	Framework for securing communication between Android devices and Web services, controlling access to Web services based on roles and security tokens (e.g., identity certificates), validating security tokens, and managing user information
21	REACTION Database	Database specifically designed and implemented to take into account the data requests of different REACTION components. The database is built in SQL server 2008 and the data is managed by the Store Procedures which are managed by the web services.
22	REACTION notification handler	Tool allowing professional staff to assign alerts / notifications based on patient data coming from the REACTION database. This application allows the Medical Doctor to: 1) react ubiquitously to change in the patients' health state and/or environment, 2) perform pre-defined activities or Notifications handling according to pre-programmed rules or through closed loops involving formal and informal carers and 3) combine the orchestration of services with an underlying efficient networked-based event management solution.

	Foreground (product)	Owner/s	Contact Person	email
1	REACTION GlucoTab	MSG, MUG, FORTH	Frank Sinner, Thomas Pieber	frank.sinner@joanneum.at; thomas.pieber@medunigraz.at
2	REACTION Patient Portal	FORTH, CHC, UBRUN	Franco Chiarugi	chiarugi@ics.forth.gr
3	REACTION Clinical Portal	UBRUN, CHC	Malcolm Clarke	Malcolm.Clarke@brunel.ac.uk
4	REACTION Zigbee Home Monitoring Platform	UBRUN	Malcolm Clarke	Malcolm.Clarke@brunel.ac.uk
5	REACTION Platform Server	CNET, ATOS,	Peter Rosengren	peter.rosengren@cnet.se

	Backend	UBRUN, FORTHNET		
6	REACTION DCK	CNET	Peter Rosengren	peter.rosengren@cnet.se
7	REACTION Nutrition App	CNET	Peter Rosengren	peter.rosengren@cnet.se
8	REACTION SMS Notification Component	FORTHNET	Manolis Stratakis	stratakis@forthnetgroup.gr
9	REACTION Network Monitoring Service for Mobile Devices (java library)	FORTHNET	Manolis Stratakis	stratakis@forthnetgroup.gr
10	REACTION Long-term Risk Models	FORTH	Franco Chiarugi	chiarugi@ics.forth.gr
11	REACTION Glucose-insulin-glucagon Model	BTS	Stephan Schaller Thomas Eissing Martin Hobe	stephan.schaller@bayer.com thomas.eissing@bayer.com martin.hobe@bayer.com
12	REACTION Chip-based IR Glucose Sensor	IMM, MUG	Thomas Klotzbucher	Thomas.Klotzbuecher@imm.fraunhofer.de
13	REACTION Fibre-based IR Glucose Sensor	IMM	Thomas Klotzbucher	Thomas.Klotzbuecher@imm.fraunhofer.de
14	REACTION Short Term Risk Management Tool	ALL	Tamas Gergely	gergely@all.hu
15	REACTION Semantic Search Tool	ALL	Tamas Gergely	gergely@all.hu
16	REACTION Closed-loop Algorithm	BTS	Stephan Schaller Thomas Eissing Martin Hobe	stephan.schaller@bayer.com thomas.eissing@bayer.com martin.hobe@bayer.com
17	REACTION Multi-Protocol Home Monitoring Gateway	CNET	Peter Rosengren	peter.rosengren@cnet.se
18	REACTION Primary Care Patient Monitoring Protocols	CHC, UBRUN	Russell Jones	russell.jones@brunel.ac.uk
19	REACTION Wireless sensor (ePatch) for Heart rate monitoring	DELTA	Jens Branebjerg	jab@delta.dk
20	REACTION Security environment	SIT	Matthias Enzmann	info@sit.fraunhofer.de
21	REACTION Database (db)	UBRUN, FORTH	Malcolm Clarke	Malcolm.Clarke@brunel.ac.uk
22	REACTION Notification Handler	ATOS	Blanca Jordan Lydia Montandon	blanca.jordan@atos.net lydia.montandon@atos.net