newsletter

The Newsletter of the Patient Empowerment through Predictive Personalised Decision Support (PEPPER) Project

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pepper.eu.com

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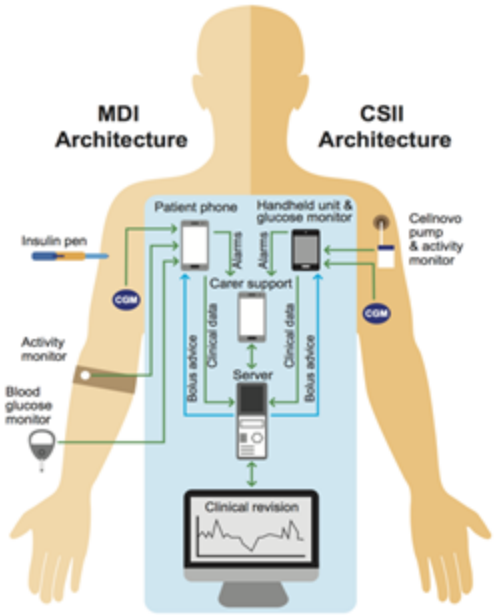

I - Introduction

Welcome to the first issue of the Patient Empowerment through Predictive Personalised Decision Support (PEPPER) Project newsletter. This project aims to improve the lives of people with Type 1 diabetes by providing decision support for day-to-day self-management. It is funded by the European Commission's Horizon 2020 Work Programme. In this issue you will find an introduction to the project as well as news of some of the events that have taken place since the launch in February 2016. There are six partners involved, each of which is introduced briefly here. There is also an outline of some of our plans for the future. We hope you enjoy this inaugural issue of our newsletter. If you would like to offer us any feedback please contact pepper_project@googlegroups.com

Dr. Clare Martin, Project Coordinator

THIS EDITION'S TOP STORIES

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II - About PEPPER

The PEPPER project brings together computer scientists, clinicians and industry leaders to create a personalised decision support system for diabetes management.

Diabetes is a widespread health condition that lasts for life. According to the World Health Organisation, there are about 60 million people with diabetes in the European Region. Type 1 diabetes often appears in childhood, but it can also occur in adults. For example the UK Prime Minister, Theresa May, discovered that she had it in 2012.

People with Type 1 diabetes traditionally manage their condition by drawing blood from their fingertips several times a day to test their blood sugar levels in order to calculate a dose of insulin to inject. If the dose is too large it can be fatal however.

The advent of wearable technology offers hope both to adults and parents of young children with the condition. A growing number of people now administer their insulin via a wearable pump, and many also wear continuous glucose monitors. The PEPPER project is utilising such technology, together with artificial intelligence, to give people freedom from daily decision-making.

The PEPPER team is developing a personalised decision support system using case-based reasoning combined with predictive computer modelling. The system will make predictions based on real-time data in order to empower individuals to participate in the self-management of their condition. The design involves users at every stage to ensure that the system meets patient needs and raises clinical outcomes by preventing adverse episodes and improving lifestyle, monitoring and quality of life. The project is also examining the extent to which human behavioural factors and usability issues have previously hindered the wider adoption of

such personal guidance systems. It is being developed and validated initially for people with diabetes on basal-bolus insulin therapy, but the underlying approach can be adapted to other chronic diseases.

There is a strong emphasis on safety, with glucose predictions, dose advice, alarms, limits and uncertainties communicated clearly to raise individual awareness of the risk of adverse events such as hypoglycaemia or hyperglycaemia. The outputs of this research will be validated in an ambulatory setting and a key aspect will be innovation management. All components will adhere to medical device standards in order to meet regulatory requirements and ensure interoperability, both with existing personal health systems and commercial products. The resulting architecture will improve interactions with healthcare professionals and provide a generic framework for providing adaptive mobile decision support, with innovation capacity to be thereby increasing the impact of the project.

The project runs from 1 February 2016 until 31 January 2019 and includes the following partners: Imperial College London, University de Girona, Girona Biomedical Research Institute, Romsoft SRL and Cellnovo Ltd.

II - PEPPER News

ECAI Workshop on Artificial Intelligence for Diabetes

The first ECAI Workshop on Artificial Intelligence for Diabetes (AID) took place on 30 August 2016. It was held in conjunction with the 22nd European Conference on Artificial Intelligence (ECAI 2016, http://www.ecai2016.org/) at the Hague. The workshop was organised by Beatriz López, Pau Herrero Viñas and Clare Martin from the PEPPER team and brought together eighteen international researchers. The invited speaker, Prof. Riccardo Bellazzi, from Università degli Studi di Pavia, spoke about lessons learned from previous and current research projects as well as future directions for research in this area. The remaining presentations covered a broad range of topics including the use of ECG and respiration rate to predict glycaemia, social robotics to support self-management in children, and enhancements to an existing artificial pancreas system. Authors of selected presentations will be invited to submit extended versions of their papers for a special issue of the Journal of Artificial Intelligence.

The primary goal of the workshop was to facilitate discussion among different researchers actively engaged in finding Artificial Intelligence-based solutions to problems associated with diabetes. To this end, the presentations were followed by a discussion about future plans. It was agreed that the organisers would consider holding a subsequent workshop in 2017 as part of the Sixteenth Conference on Artificial Intelligence in Medicine (http://aime17.aimedicine.info/). The ECAI conference is a biennial event, and so it was also agreed that a third workshop will be organised at ECAI 2018 in Stockholm. The group will also create an indexed website of resources to support research into Artificial Intelligence in Diabetes. The intention is that this would operate in a similar way to the established repository for Artificial Pancreas research (http://thedoylegroup.org/apdatabase/).

To conclude, this inaugural meeting of the AID research group was an enormous success, and generated much enthusiasm and energy for future projects. Please see the website for moreinformation (http://tinyurl.com/ecai2016).

PEPPER meetings in Spain and Wales

The consortium held its second and third project meetings in Girona, Spain and in Pencoed, Wales.

The second meeting took place three months after it was launched in Oxford in February 2016 and was hold at the Institut d'Investigació Biomèdica de Girona Dr. Josep Trueta. Attendance by sixteen participants representing the six partner institutions in the consortium was recorded. Partners were pleased to celebrate the successful completion of the first milestone, which was the gathering of requirements for each of the components for the distributed development of this intelligent adaptive decision support system. User needs have been gathered from patients, clinicians and carers who will be involved at every stage of this patient-centric development. The next step is the research and development of the first prototype system which will be iteratively refined during a prolonged feasibility study prior to clinical trials.

The third PEPPER project meeting was hosted by Cellnovo at the Sony UK Technology Centre in Pencoed, Wales on 21-22 July. It was agreed that the project is on target for the launch of the feasibility study of the first prototype in February 2017. The next six months will be spent integrating the Cellnovo handset with the artificial intelligence and predictive computer safety model, together with wearable components such as a continuous glucose monitor. Extensive usability studies will be conducted before and after the feasibility study.

Don't forget to subscribe to our news feed on pepper.eu.com

Other Related News

Imperial College London is awarded £1.3M to develop an adaptive, real time, intelligent system to enhance self-care of chronic disease (ARISES). The project is led by one of the PEPPER Innovation Manager: Dr. Pantelis Georgiou. <> tinyurl.com/icl-arises </>

Artificial Pancreas Gains FDA Approval: Medtronic, based in Dublin, Ireland, has received U.S. Food and Drug Administration (FDA) approval for its MiniMed 670G hybrid closed-loop insulin delivery system.
<> tinyurl.com/medtronic-pancreas </>

Cellnovo files for 510(k) approval with the US Food and Drug Administration (FDA) for its mobile, connected, all-in-one diabetes management system. <> tinyurl.com/cellnovo-fda </>

Gluci-Chek is awarded mHealth Quality: Gluci-Chek, from Roche Diabetes Care France, counts the carbohydrates in more than 500 single or mixed dishes and saves glucose results and insulin doses.
<> tinyurl.com/gluci-check </>

Guardian Article: Health hackers: the patients taking medical innovation into their own hands: Tired of waiting for a monitor for his diabetes, Tim Omer made his own. He is one of a growing number of patients circumventing medical companies in favour of a homemade healthcare revolution. <> tinyurl.com/guardian-health-hacker </>

BBC News article on diabetes: The DIY diabetes kit that's keeping us alive: Alistair Samuelson uses open source code to track the blood sugar levels of his son George.
<> tinyurl.com/bbc-diabetes-kit </>

III - Partner Introductions

brookes.ac.uk

Oxford Brookes University is one of the UK's leading modern universities and enjoys an international reputation for teaching excellence and innovation. It has been named the best modern university in England by the Sunday Times University Guide eleven years in a row and employs approximately 2500 staff of which 1300 are academic.

imperial.ac.uk

Imperial College London embodies and delivers world-class scholarship, education and research. It has a reputation for excellence, consistently rated amongst the world's best universities. Founded 1907, it now has about 13,000 full-time students and 6000 staff, with 14 Nobel Laureates.

udg.edu

The University of Girona participates in the project through the research group eXiT (Control Engineering and Intelligent Systems Group - http://exit.udg.edu). The main research activity of the eXiT group is focused on the application of data mining and knowledge discovery principles for decision support and process monitoring tasks.

idibgi.org

Institut d'Investigació Biomèdica de Girona Dr. Josep Trueta (IDIBGI) is a public foundation dedicated to non-profit research. The research carried out mainly focuses on four areas: Metabolism, Diabetes and Inflammation, Haematology and Oncology, Cardiovascular Disease, and Neurosciences. IDIBGI is among the top 10 Biomedical Institutions of Spain.

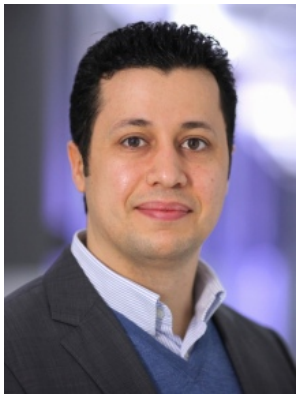
cellnovo.com

Cellnovo is a leading innovator in mobile diabetes management technology. The unique Cellnovo System is the first of its kind with mobile connectivity able to provide immediate, wireless data updates, displaying real-time clinical information to patients, caregivers and healthcare professionals.

romsoft.eu

RomSoft SRL is a software development company headquartered in Iasi, Romania. The company specialises in the research and development of software for the medical industry, including medical laboratories, telemonitoring, medical devices, and software for business processing for medical entities, web applications and networks.

IV - Innovation Advisory Board (IAB)



Dr. Pantelis Georgiu
Imperial College London

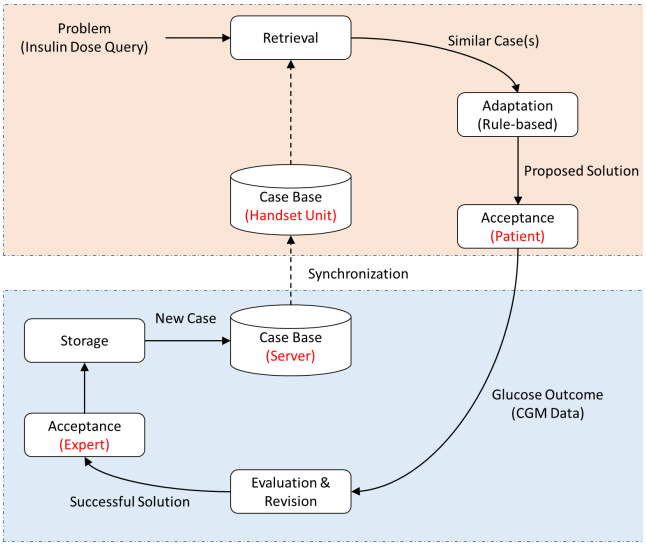
Dr. Julian Shapley
Cellnovo

The Innovation Advisory Board (IAB) is a group of representatives drawn from key stakeholders including patient organisations, clinical experts, carers and industrial representatives to provide advice, knowledge and guidance concerning innovation aspects, from scientific, technical and user points of view. Their joint understanding of both the market and technical problems provides a crucial contribution to the innovation management tasks related to the exploitation of the project outputs and maximising their impact.

The innovation managers are Pantelis Georgiou (left) from Imperial College London and Julian Shapley (right) from Cellnovo. The board meets once per year, in conjunction with project meetings or dissemination activities. The board members and their affiliated organisation, if applicable, have been listed below.

Mr. Jaume Oriell	Associació de Diabètics de Catalunya	**Dr. Imma Grau**	Fundación iSYS
Sir Kurt GMM Alberti	Diabetes UK	**Ms. Carol Wheeler**	User (UK)
Dr. Manuel Puig Domingo	Sociedad Española de Endocrinología y Nutrición	**Ms. Cristina Comas Bedmar**	User (Spain)
Ms. Rachel Connor	Juvenile Diabetes Research Foundation (JDRF)	**Dr. Goretti Mallorquí Fernández**	User (UK)
Mr. Víctor Bautista	Founder of SocialDiabetes	**Mr. Tim Omer**	User (Spain)

V - Profile - Dr. Beatriz López



Beatriz López is a senior lecturer at the University of Girona. She graduated in Computer Sciences (CS) from the Autonomous University of Barcelona in 1986, and received her Ph.D. in Computer Science from the Technical University of Catalonia in 1993. She also received the degree of Information System from the Open University of Catalonia in 2003.

After receiving her CS degree, Beatriz López joined the Artificial Intelligence Research Group of the Spanish Scientific Research Council where she carried out the work *"Case-base reasoning of strategic plans"*. From that point on, her research interest has always been around case-based reasoning and planning and scheduling, now including optimization and learning in distributed environments. She was associate professor from 1992-1995 and 1998-2000 at the Rovira Virgili University and has served as a Computer Science Engineer in several private companies. In February 2011, she co-founded Newronia, a spin-off company from the University of Girona. Since 2000, she has been a senior lecturer in the Department of Electronics, Electricity, and Automation Engineering at the University of Girona. Taught courses include Artificial Intelligence and Machine Learning. She is member of the Catalan Association for Artificial Intelligence (member of ECCAI) and several scientific committees.

Beatriz's research interests include: decision support systems (case-based reasoning); machine learning, data mining, knowledge discovery (feature learning, sequence learning); optimization methods for resource allocation (auctions, heuristics, meta-heuristics). Beatriz is involved in various applications of this work including: medicine and healthcare (coordinating eXiT/Health); business process (workflows), energy-aware management, sustainability.

VI - Dissemination

January 2016 <> February 2017

1. **PEPPER: Patient Empowerment Through Predictive Personalised Decision Support**
   Authors: **Pau Herrero[1], Beatriz Lopez[2] and Clare Martin[3]**
   [1]Imperial College London, [2]University of Girona, [3]Oxford Brookes University
   Conference: **European Conference on Artificial Intelligence (ECAI) 2016**
   Presented by: Dr. Clare Martin, Oxford Brookes University

2. **User-Centred Design of Technology to Support Self-Management of Type 1 Diabetes**
   Authors: **Arantza Aldea, Dan Brown, David Duce, Rachel Harrison, Clare Martin, Marion Waite**
   Oxford Brookes University
   Conference: **Internet of Personal Health (IOPH) Workshop, part of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2016)**
   Presented by: Dr. Clare Martin, Oxford Brookes University

3. **Evaluación de un Sistema Personalizado de Soporte de Decisiones de Autogestión de la DM1**
   Authors: **M. Wos et al.**
   Conference: Abstract submitted to **SED (Sociedad Española de Diabetes - Spanish Diabetes Association)** in Jan 2017.

4. **Personalised Clinical Decision Support for Diabetes Management Using Real-Time Data**
   Authors: **C. Martin et al.**
   Conference: Abstract accepted for **ATTD (Advanced Technologies and Treatments for Diabetes)**
   Presented by: Dr. Clare Martin, Oxford Brookes University

Future Events

You can find us at the following events:

14, 15 February 2017 <> Paris, France <> The next meeting will be co-located with the 10th International Conference on Advanced Technologies & Treatments for Diabetes (ATTD) in Paris, France. http://attd2017.com/

June 2017 <> Vienna, Austria <> We hope to host a workshop on Artificial Intelligence in Diabetes at the Conference on Artificial Intelligence in Medicine. http://aime17.aimedicine.info/

READ MORE ON OUR WEBSITE:
pepper.eu.com

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PEPPER Consortium