



ANNUAL REPORT 2014

Associação Fraunhofer Portugal Research

Research of Practical Utility lies at the heart of all activities developed by Fraunhofer Portugal.

Founded in 2008 – as a result of the long-term Portuguese-German collaboration in Science and Technology – Associação Fraunhofer Portugal Research focuses on companies as customers and partners to promote innovative product development by delivering applied research results in an international context.

Adopting the well tested – and undisputedly successful – model operated in Germany by Fraunhofer-Gesellschaft, Fraunhofer Portugal supports economic development and social well-being by contributing to the population's quality of life.

Currently, Associação Fraunhofer Portugal Research (Fraunhofer Portugal) owns and operates the Fraunhofer Portugal Research Center for Assistive Information and Communication Solutions (Fraunhofer AICOS) – a partnership between Fraunhofer-Gesellschaft and the University of Porto – focusing on Ambient Assisted Living (AAL) and Information and Communication Technologies for Development (ICT4D).

Acknowledged by the Portuguese Government as an 'Entity of Public Interest', Associação Fraunhofer Portugal Research was named after Joseph von Fraunhofer (1787-1826), the illustrious Munich researcher, inventor and entrepreneur.

A investigação de utilidade prática está no centro de todas as atividades desenvolvidas pela Fraunhofer Portugal.

Fundada em 2008 – e resultando de uma colaboração de longo prazo em Ciência e Tecnologia entre Portugal e a Alemanha – a Associação Fraunhofer Portugal Research mantém um enfoque nas empresas como parceiros, promovendo e desenvolvendo atividades de investigação aplicada num contexto internacional.

Adotando o bem-sucedido modelo de negócio operado na Alemanha pela Fraunhofer-Gesellschaft, a Fraunhofer Portugal apoia o desenvolvimento económico e promove o bem-estar social, ao contribuir para a melhoria da qualidade de vida das populações.

Neste momento, a Associação Fraunhofer Portugal Research (Fraunhofer Portugal) detém e opera o Fraunhofer Portugal Research Center for Assistive Information and Communication Solutions (Fraunhofer AICOS) – uma parceria entre a Fraunhofer-Gesellschaft e a Universidade do Porto – dedicada às áreas de "Ambient Assisted Living" (AAL) e de Tecnologias de Informação e Comunicação para o Desenvolvimento (ICT4D).

Reconhecida pelo Estado Português como Pessoa Coletiva de Utilidade Pública, a Associação tem o nome do famoso cientista, inventor e empreendedor Joseph von Fraunhofer (1787-1826), originário de Munique, Alemanha.

ANNUAL REPORT 2014



Fraunhofer Portugal: Riding the Perfect Wave!

After the very strong increase of our external revenues in 2013 of 72%, we planned for a consolidation phase in 2014. But once more and despite the excessive delay of the PT2020 programme which, in the form of the QREN programme in the past has been a major source of the revenues related to the Portuguese industry, we increased our external revenues by 24% to a total volume of 1,6M€. That also includes an increase of our industry revenues by 16% to a total of ~665K€.

Due to the delay of PT2020, we have been growing our team organically and thus slightly below plan, leading to fulfilling or exceeding all the performance indicators of our organization. With our total operational costs only rising by 16%, and in combination with the significantly stronger increase of external revenues, we were able to achieve a global performance ratio¹ of 62%, which exceeds the demanding plan we had for 2014 by 2% and results in an absolute increase of another 4% compared to 2013!

However, and very much like our cover photo implies, the waters we are surfing are rough and do not hold only pleasant surprises for us. During a long time, almost two years, the main financial instruments to finance R&D projects in Portugal were not available, mainly due to the transition of the QREN framework programme, and therefore we had to compensate this limitation by adopting new business development strategies.

Being aware of this problem we already started in 2014 to address more intensively international clients, but we are facing mixed results. We were able to keep and partly even increase the planned business volume with existing customers and were also able to win new customers. But the individual contract volumes and durations are comparably low and thus do not contribute significantly to the medium and long term planning predictability.

In addition we indirectly suffer from the decreasing oil price as one of our planned larger international projects is related to a client with Angolan roots in the public safety services sector and that required the project being put on hold.

On the other hand, we do work on a couple of realistic and larger business opportunities with international clients from Germany, the US and Africa. Thus we trust in some of those becoming projects and allowing us to once more increase our external business volume in 2015 by more than 10%.

Disruptive to this development might become the planned deployment of our 'Precise Indoor Location' (PIL) Intellectual Property Rights (IPR), which would lead to additional R&D activities on our side.

With regards to PIL, one of the major activities of the highly successful ON.2/FCT financed 'Fall and Activity Monitoring Competence Center' (FCC), we were filing another patent in 2014 and will participate in the international Microsoft Indoor Localization Competition - IPSN 2015 in Seattle in April 2015.



With the initial financing from ON.2 and FCT, both our Competence Centers, the above mentioned FCC and the 'ICT for Development Competence Center' (ICT4DCC), were able to create a vast pool of highly focused activities in both areas which, to a large extent already led to sustainable operations and many highly qualified jobs. The technologies developed in the FCC could already be applied in projects with industry related to the areas AAL and health (GoLive Phone), indoor positioning (cloud based indoor tracking in retail), safety and security (tracking of field operatives) as well as sports (surfing and sailing performance and safety). The flagships of the ICT4DCC are related to agriculture (hydroponic farming using the IoT² technology), connecting the unconnected (Internet & GSM³), health (Malaria, epidemic surveillance), social interaction (crowd sourced information system) and e-Government (electronic interaction between citizens and administrations).

The results of both Competence Centers will also contribute in the future to extend the activities of Fraunhofer AICOS. We hope that their success will lead to the creation of similar effective and efficient investment instruments by the Portuguese Government in the future!

Due to the very strong and efficient development of AICOS as well as by the continuing support of Fraunhofer Portugal through the joint base funding of FCT and Fraunhofer -Gesellschaft for the financing period 2014-2018 and although in absolute (-13%) and especially in relative volume (-67%) being significantly lower than in the first period, Fraunhofer Portugal was able to prepare its extension towards Lisbon. By mid 2015 we will open an additional branch office of AICOS, prepared to become the home of up to more 30 scientists, all financed out of our regular cash-flow and without the need for any additional base funding.

All in all, we are facing a year that will pass by on the fly and which is going to be full of changes and opportunities with a significant impact on the years to come. But in order to achieve the best possible results for our stakeholders, and to jointly catch the perfect wave, it requires a strong team spirit! Fraunhofer Portugal is ready to go!

Dirk Elias

- 1** *The ratio between our contract revenues and operating expenditures (OPEX).*
- 2** *IoT – Internet of Things.*
- 3** *GSM – Global System for Mobile communications.*

Fraunhofer Portugal: Apanhar a Onda Perfeita!

No seguimento do notável crescimento de 72% nas receitas externas em 2013, planeámos para 2014 uma fase de consolidação. Uma vez mais, e apesar do excessivo atraso do programa PT2020 que foi no passado uma das maiores fontes de receitas relacionadas com a indústria portuguesa sob a forma de Programa QREN, aumentamos as nossas receitas externas em 24% atingindo um volume total de receitas de 1,6M€. Este valor inclui um aumento de 16% nas receitas de projetos com a indústria, que aumentaram até um total de ~665K€.

Devido ao atraso do PT2020, a nossa equipa tem crescido de forma orgânica, e como tal ligeiramente abaixo do planeado, mas mesmo assim conseguimos cumprir, e até superar, os parâmetros que são utilizados como métrica da eficiência da nossa organização. O custo total da nossa operação cresceu apenas 16% o que, em combinação com o forte aumento das receitas externas, permitiu que conseguíssemos alcançar uma performance global¹ de 62%, o que excede em 2% o exigente plano que tínhamos para 2014 e resulta num aumento absoluto de 4% quando comparado com 2013!

Contudo, e tal como a fotografia da capa sugere, as águas em que navegamos são encrespadas e não proporcionam apenas surpresas positivas, em especial quando olhamos para 2015. Durante um longo período de tempo, cerca de dois anos, o principal instrumento de financiamento para projetos de I&D em Portugal não esteve disponível, essencialmente devido à transição do programa QREN. Como tal, tivemos que compensar esta limitação com a adoção de novas estratégias de desenvolvimento de negócios.

Cientes deste problema, começamos já em 2014 a abordar mais afincadamente clientes internacionais, mas deparamo-nos com um mix de resultados. Conseguimos manter, e até parcialmente aumentar, o volume de negócios planeado com cliente atuais, e em simultâneo conquistar novos clientes. Mas os volumes individuais contratados, bem como a duração dos contratos, são comparativamente menores, e como tal, não contribuem significativamente para manter as previsões definidas no planeamento de médio e longo prazo.

Adicionalmente, sofremos de forma indireta com a queda do preço do petróleo, uma vez que um dos nossos maiores projetos internacionais planeados está relacionado com um cliente com ligações ao sector dos serviços de segurança pública em Angola, o qual solicitou que o projeto seja mantido em espera.

Por outro lado, estamos a trabalhar em algumas oportunidades de negócios reais de maior dimensão, com clientes internacionais da Alemanha, Estados Unidos e África. Como tal, confiamos que algumas destas oportunidades se vão converter em projetos, permitindo-nos uma vez mais aumentar o nosso volume de negócios externo em 2015 em mais de 10%.

Um fator disruptivo para este desenvolvimento poderá estar relacionado com a implementação de pilotos relacionados com os nossos dos Direitos de Propriedade Intelectual associados à tecnologia de Precise Indoor Location (PIL), algo que poderia originar um acréscimo significativo das nossas atividades de I&D.



No que respeita ao PIL, uma das atividades mais importantes do bem-sucedido Fall and Activity Monitoring Competence Center (FCC) financiado pelo ON.2/FCT, submetemos um novo pedido de patente em 2014 e vamos participar no evento internacional, o *Microsoft Indoor Localization Competition - IPSN 2015*, que decorrerá em Seattle em Abril de 2015.

Com o financiamento inicial vindo do ON.2 e FCT, ambos os nossos Centros de Competências, o acima mencionado FCC e o ICT for Development Competence Center (ICT4DCC), foram capazes de criar um vasto conjunto de atividades bastante focadas em ambas as áreas, as quais, em larga escala, já conduziram à criação de operações sustentáveis e de diversos empregos qualificados. As tecnologias desenvolvidas no FCC foram já aplicadas em projetos com a indústria, relacionados com as áreas de AAL e de saúde (GoLivePhone), localização *indoor* (monitorização *indoor* suportada na *cloud* para o retalho), proteção e segurança (monitorização de operacionais no terreno) bem como atividades desportivas (performance e proteção no surf e na vela). Os projetos de referência do ICT4DCC estão relacionados com a agricultura (cultura hidropónica utilizando a tecnologia IoT²), conectar o desconectado (Internet & GSM³), saúde (Malária e vigilância de epidemias), interação social (sistemas de informação *crowdsourcing*) e e-Governança (interação eletrónica entre cidadãos e entidades administrativas).

Os resultados de ambos os centros de competências irão também contribuir para, no futuro, alargar as atividades do Fraunhofer AICOS. Esperamos que o seu sucesso leve à criação de instrumentos financeiros similarmemente efetivos e eficazes, por parte do Governo Português, no futuro!

Devido ao forte e eficiente desenvolvimento do AICOS, bem como pelo contínuo suporte à Fraunhofer Portugal através do financiamento base concedido conjuntamente pela FCT e pela Fraunhofer-Gesellschaft para o período 2014-2018, e apesar de em absoluto (-13%) e especialmente em volume relativo (-67%) ser significativamente mais baixo do que no primeiro período, a Fraunhofer Portugal foi capaz de preparar a sua expansão para Lisboa. Em meados de 2015 abriremos uma extensão do AICOS, a qual permitirá acolher uma equipa que pode chegar aos 30 cientistas, inteiramente financiada através do nosso *cash-flow* regular sem ser necessário financiamento base adicional.

Em suma, enfrentamos presentemente um ano que irá passar rapidamente e que estará repleto de mudanças e oportunidades com impacto significativo nos próximos anos. Mas para alcançarmos os melhores resultados possíveis para os nossos *stakeholders*, e em conjunto apanharmos a onda perfeita, é necessário um forte espírito de equipa! A Fraunhofer Portugal está pronta para este desafio!

Dirk Elias

¹ Performance global – rácio entre receitas de contractos de investigação e despesas operacionais (OPEX).

² Internet das “Coisas” (IoT – Internet of Things).

³ Sistema Global para Comunicações Móveis (GSM – Global System for Mobile communications).





REPORT OF THE EXECUTIVE BOARD

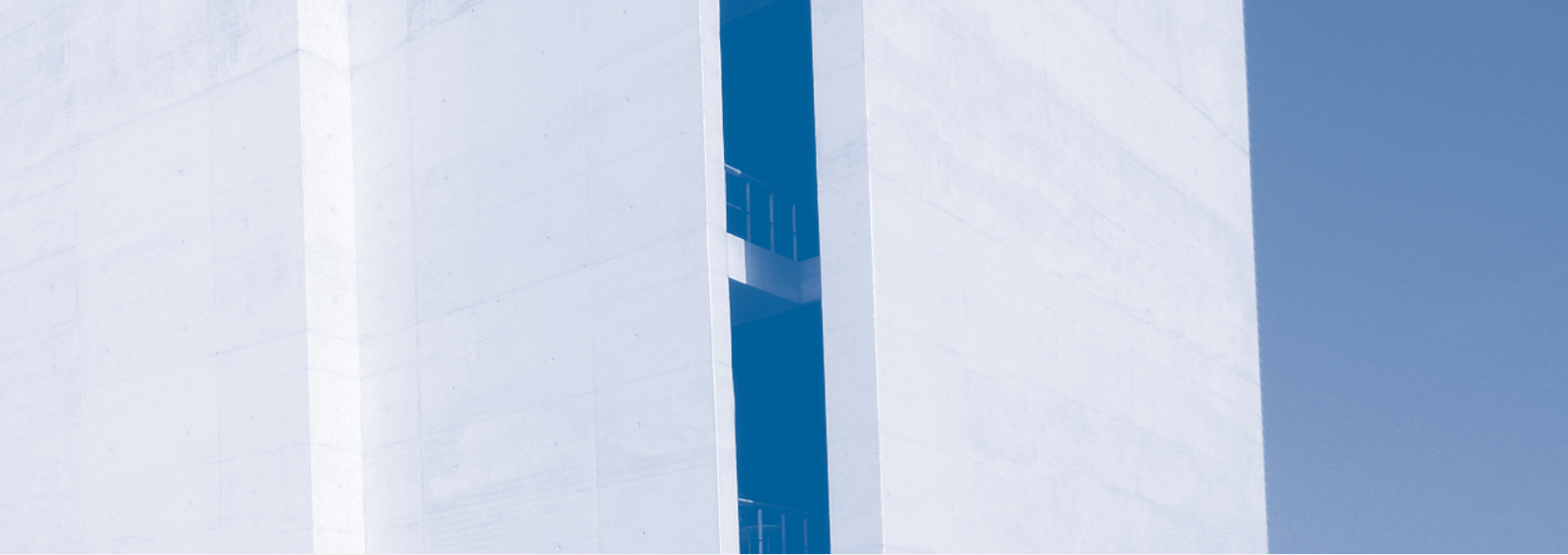
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REPORT OF THE EXECUTIVE BOARD



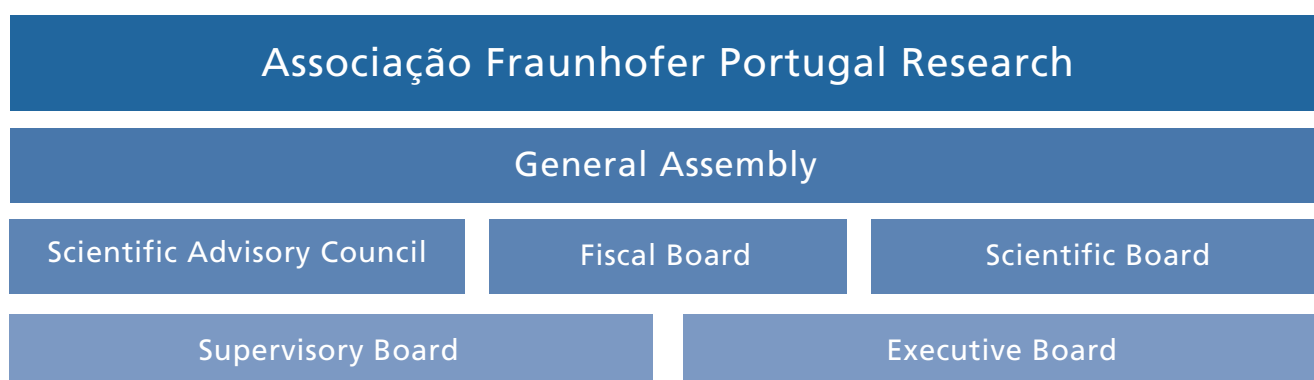
GOVERNANCE & MANAGEMENT

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MANAGEMENT REPORT 2014

GOVERNANCE & MANAGEMENT

GOVERNANCE STRUCTURE



We seek to follow the best practices in every area of the Association's governance by reflecting such practices in our organization, principles and transparency.

The Associative Structure of Fraunhofer Portugal clearly distributes functions, duties and responsibilities among its board members.

Management

Fraunhofer Portugal management is a shared responsibility of both the Supervisory Board (with broad assessment powers) and the Executive Board (responsible for daily management and current management actions).

SUPERVISORY BOARD

President
Georg Rosenfeld
Director Research
Fraunhofer-Gesellschaft

Deputy President
João Paulo Oliveira
Board of Directors
Bosch Termotecnologia, SA

Member
Paulo Simões
Board of Directors
Sonae SR, SGPS, SA



EXECUTIVE BOARD

Dirk Elias 1

President of the Executive Board

With a professional career ranging from R&D activities to entrepreneurial experiences and management, Dirk Elias is a Dipl. Ing. in Electrotechnical Engineering by the Technical University of Munich, and holds a PhD from the Technical University of Berlin.

Functional Assignments: General Administration, R&D Planning, Business Development, Facilities.

Pedro Almeida 2

Executive Board Member

With a professional career that started with R&D activities through to the full innovation cycle with the creation of a spin-off of a prestigious University in Portugal, Pedro Almeida holds a MSc in Electronics and Telecommunications Engineering by the University of Aveiro, and holds a post-graduation in Advanced Management for Executives also from the same university.

Functional Assignments: Business Development, Planning & Control, Accountancy & Finances, Human Resources, Legal, Facilities.

Berthold Butscher 3

Executive Board Member

With a career highly oriented towards R&D, both in industry and in R&D institutions, Berthold Butscher holds a Dipl. Ing. in Electrotechnical and Computer Engineering from the University of Applied Sciences of Konstanz and from the Technical University of Berlin.

Functional Assignments: R&D Planning Support.

OVERVIEW OF FRAUNHOFER PORTUGAL

Vision

A Driving Force in Innovation

Fraunhofer Portugal proposes a radical change regarding technological innovation in collaboration with scientific institutions in Portugal, and aims at creating scientific knowledge capable of generating added value for its clients and partners, exploring technology innovations oriented towards economic growth, social well-being and the improvement of the quality of life of its end-users.

Mission

Research of Practical Utility

Fraunhofer Portugal promotes applied research of direct utility to private and public institutions and of broad benefit to society, by managing and coordinating the cooperation of its research centers with:

- Other Research Institutions – such as universities and other relevant Portuguese or non-Portuguese research institutions, as well as Fraunhofer Institutes and other research centers integrated in the Fraunhofer-Gesellschaft knowledge network;
- Industry Partners – clearly perceived and understood as our main customer group, we are developing partnerships and cooperation agreements with private and public enterprises, as well as participating in business associations;
- Supporting Partners – Government Institutions and other Institutional partners.

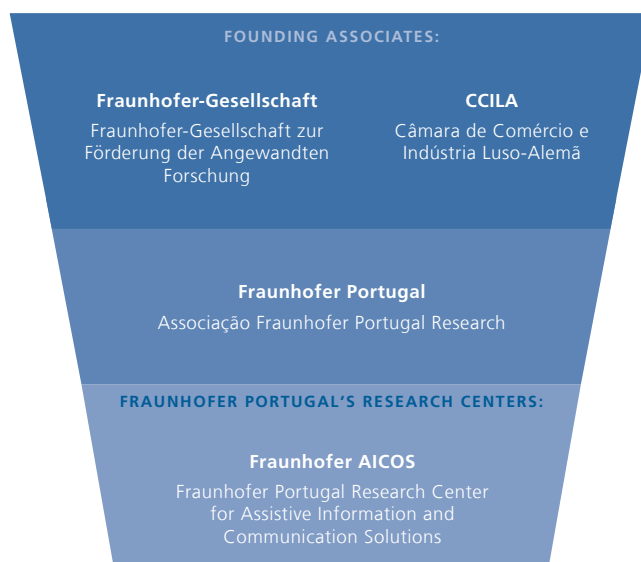
Funding Model

Fraunhofer-Gesellschaft and the Portuguese Foundation for Science and Technology (FCT) agreed on a tripartite funding model similar to the one used by Fraunhofer-Gesellschaft.

At Fraunhofer Portugal, our scientists and engineers work with a budget financed by external revenue (projects and licensing) and institutional funding provided by FCT and Fraunhofer-Gesellschaft.

The base line for this type of funding determines that it will be granted in progressively smaller amounts over the initial years, encouraging the implementation of an efficient business model mainly financed by external revenue.

External revenue should be guaranteed through research projects, development projects, contracts signed with third parties within Fraunhofer Portugal's fields of activity, intellectual property rights and licensing of the commercial optimization of products and services resulting from Fraunhofer Portugal's R&D results.



Fraunhofer-Gesellschaft

Research of practical utility lies at the heart of all activities pursued by the Fraunhofer-Gesellschaft. Founded in 1949, the research organization undertakes applied research that drives economic development and serves the wider benefit of society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration.

At present, the Fraunhofer-Gesellschaft maintains 66 institutes and research units. The majority of the nearly 24,000 staff are qualified scientists and engineers, who work with an annual research budget of more than 2 billion euros. Of this sum, around 1.7 billion euros is generated through contract research. More than 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. Almost 30 percent is contributed by the German federal and Länder governments in the form of base funding, enabling the institutes to work ahead on solutions to problems that will not become acutely relevant to industry and society until five or ten years from now.

International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development.

With its clearly defined mission of application-oriented research and its focus on key technologies of relevance to the future, the Fraunhofer-Gesellschaft plays a prominent role in the German and European innovation process. Applied research has a knock-on effect that extends beyond the direct benefits perceived by the customer: Through their research and development work, the Fraunhofer Institutes help to re-inforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by

promoting innovation, strengthening the technological base, improving the acceptance of new technologies, and helping to train the urgently needed future generation of scientists and engineers.

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop the professional and personal skills that will allow them to take up positions of responsibility within their institute, at universities, in industry and in society. Students who choose to work on projects at the Fraunhofer Institutes have excellent prospects of starting and developing a career in industry by virtue of the practical training and experience they have acquired.

The Fraunhofer-Gesellschaft is a recognized non-profit organization that takes its name from Joseph von Fraunhofer (1787–1826), the illustrious Munich researcher, inventor and entrepreneur.

CCILA

German-Portuguese Chamber for Industry and Commerce

With over 1000 associates in Portugal and Germany, the objective of the Chamber is to enhance and promote the economic relationships between the two countries.



Associação Fraunhofer Portugal Research

Founded in 2008 – within the framework of a long-term Portuguese-German collaboration in Science and Technology – Associação Fraunhofer Portugal Research (Fraunhofer Portugal) promotes applied research that drives and encourages economic development and serves the wider well-being of society. The Association's services are sought out by customers and contractual partners in industry, the service sector and public administration.

Currently, Fraunhofer Portugal owns and operates the Fraunhofer Portugal Research Center for Assistive Information and Communication Solutions (Fraunhofer AICOS) – a partnership between Fraunhofer-Gesellschaft, Fraunhofer Portugal and the University of Porto – focusing on Ambient Assisted Living (AAL) and Information and Communication Technologies for Development (ICT4D).

Fraunhofer Portugal's development strategy accommodates the option to establish additional research units whenever a sustained demand for R&D services applied to a specific area of scientific knowledge is detected in the market.

Services

Fraunhofer Portugal's Research Services, rendered through the research institutions it operates, provide three different types of collaboration to industrial customers, also provided within public funded project participations:

- R&D Contract;
- R&D Consulting;
- Living Labs.

Fraunhofer Portugal is committed to building a reputation of excellence within different service dimensions such as knowledge, credibility, professionalism, creativity, flexibility, response time and cost.

Fraunhofer AICOS

Fraunhofer Portugal Research Center for Assistive Information and Communication Solutions

Incorporated as a partnership between Fraunhofer-Gesellschaft and the University of Porto and focusing its activity on Ambient Assisted Living (AAL) and Information and Communication Technologies for Development (ICT4D), Fraunhofer AICOS is the first research institution operated by Fraunhofer Portugal.

Extending the Reach of the Information and Knowledge Society

Fraunhofer AICOS aims to enhance people's living standards by offering intuitive and useful technology solutions, capable of facilitating their access to the Information and Communication Technologies, and in this way assisting in the integration of an increasingly larger sector of the population in the Information and Knowledge Society.

Remarkable Technology, Easy to Use

Fraunhofer AICOS' mission is to generate Remarkable Technology, Easy to Use. This means offering specialised competences centered on the improvement of end-user experience and usability of applications, generating applied research solutions capable of contributing to the market success of our client's products and services.

Collaboration plays an essential role in enabling the center to fulfil its mission. Therefore, Fraunhofer AICOS strongly promotes and consolidates partnerships and cooperation with key players and decision makers in its strategic research areas, namely:



- Association européenne pour la maladie de Parkinson (Belgium): charitable organisation that brings together several national Parkinson organisations from Europe. Collectively, these organizations have more than 250.000 members in 36 countries and advocate for the rights and needs of more than 1.2 million people with Parkinson's and their families;
- Center of Excellence for Dematerialization of Transactions: leading entity that coordinates a network of knowledge and competences in the dematerialization of transactions in Portugal;
- Charité - Universitätsmedizin Berlin (Germany): with more than 300 years old, it is one of the largest university hospitals in Europe. At the university, approximately 3.700 doctors and scientists heal, do research and teach at the top international level. More than half of the German Nobel Prize winners in medicine and physiology come from the Charité, among them are Emil von Behring, Robert Koch and Paul Ehrlich;
- Eduardo Mondlane University (Mozambique): the oldest and largest university in Mozambique which focuses on producing and disseminating scientific knowledge, as well as promoting innovation through research, educating generations to face challenges to benefit society's development, namely in the scientific fields of Biology, Agronomy, Engineering, Human Sciences and Linguistics;
- Faculty of Economics of the University of Porto: with a long and prestigious history in the teaching of Economics and Management in Portugal, it is considered the best Portuguese University according to most international rankings;
- Faculty of Engineering of the University of Porto: a top-level faculty that awards degrees in several engineering fields, such as, computer engineering, mechanical engineering, chemical engineering, etc.;
- Faculty of Medicine of the University of Porto: well renowned faculty that promotes teaching and provides scientific research of excellence and medical support activities to the community;
- Fraunhofer FOKUS (Germany): Fraunhofer Institute, based in Berlin, operates closely in related scientific fields, in this way pooling expertise in interdisciplinary collaborative projects as well as facilitating Fraunhofer AICOS' seamless integration with Fraunhofer-Gesellschaft in different institutional aspects;
- Fraunhofer IDMT (Germany): Fraunhofer Institute focused on developing cutting-edge solutions in the digital media domain, consistently designed to meet user requirements and expectations;
- Fundación Privada Cetemmsa (Spain): technology centre with over 19 years of experience in carrying out applied research on Smart Materials and Smart Devices that bring new uses and experiences to a wide range of economic sectors;
- Health Cluster Portugal: organization which focuses on the promotion and implementation of initiatives and activities leading to the creation of an innovative and technology-based national cluster;



- ISCTE - Lisbon University Institute: a public university that pursues teaching, research and community service activities, in areas such as, business, sociology, public policy, social sciences, technology and architecture;
- National Health Institute Dr. Ricardo Jorge: public organization of the Ministry of Health, endowed with scientific, technical, administrative, financial and property of its own, that plays a triple role as State Laboratory in the Health Sector, National Reference Laboratory and National Health Observatory;
- Nelson Mandela Metropolitan University (South Africa): a dynamic African university offering professional and vocational training for leadership in generating cutting-edge knowledge for a sustainable future, specialised in the scientific fields of Health, Engineering, Business and Economics and Law;
- Polytechnic University of Catalonia (Spain): a public institution dedicated to higher education and research, specialised in the fields of engineering, architecture and science;
- Portuguese Institute of Oncology: the largest national institution dedicated to the research, diagnosis, treatment, prevention, study and teaching of areas within the domain of oncologic diseases;
- Professional Rehabilitation Center of Gaia: an association focused on the rehabilitation of people affected by accidents or diseases, which also assists young people with disabilities in their transition from school into an active life;
- University of Limerick (Ireland): distinctive, pioneering and connected university that undertakes world-class research and delivers innovative teaching in the fields of Science and Engineering;
- University of Porto: our primary and distinguished university partner offering access to university know-how and infrastructures, as well as privileged contact with students interested in enrolling in advanced training at Fraunhofer AICOS labs. We have closer cooperation with some of its faculties, namely the ones described above;
- UPTEC: official Science and Technology Park of the University of Porto that fosters the creation of technology-based companies and the establishment of national and international private R&D centers, supporting an effective knowledge and technology transfer between academia and the market.

Strategic Research Agenda

Fraunhofer AICOS constitutes a new approach to Information and Communication Technologies through Fraunhofer-Gesellschaft and contributes to the creation and development of competences in activities of great relevance for the future, addressing two main business fields: Ambient Assisted Living (AAL) and the emerging field of Information and Communication Technologies for Development (ICT4D).

- AAL includes methods, concepts, (electronic) systems, devices and services that are providing unobtrusive support for daily life, based on the context and the situation of the assisted person. The technologies applied for AAL are user-centric,



i.e., oriented towards the needs and capabilities of the actual user. They are also integrated into the immediate personal environment of the user. Consequently, the technology is adapted to the user rather than the other way around. In order to share relevant information between systems and services, technologies for AAL should ideally be based on modular and interoperable concepts.

Fraunhofer AICOS intends to mainly address the needs of the ageing population, to reduce innovation barriers of forthcoming promising markets, but also to lower future social security and healthcare costs. This goal can be achieved through the use of intelligent products and the provision of remote services, including care services that extend the period during which senior citizens can live in their home environment. The services envisioned and developed by Fraunhofer will increase the individual's autonomy and assist them in carrying out their daily activities.

- ICT4D is a general term which refers to the application of Information and Communication Technologies (ICT) within the field of socioeconomic development or international development. ICT4D focuses on the direct application of information technology approaches to contribute to poverty reduction and to reduce the digital divide.

Fraunhofer AICOS currently intends to focus its ICT4D activities on the African continent, with special emphasis on Mozambique and Angola. The primary target user group will be ICT users in rural and developing areas, and the objective is to provide solutions for mobile device services and applications which meet the local users' demands, contributing to a more positive user experience which, in many cases, may be their first contact with ICT.

Among the significant diversity of topics related to AAL and ICT4D, Fraunhofer AICOS focuses on a reduced set of business sub-fields that our customers consider relevant and that are directly related to our core competences.

In the AAL business field, Fraunhofer AICOS currently covers the following sub-fields:

- Fall and Activity Monitoring;
- Chronic Diseases and Well-Being Management;
- Assistive Environments.

With regards to the emerging ICT4D business field, one sub-field has currently been defined:

- ICT4D on Mobile Devices.

Additionally, Fraunhofer AICOS supports the creation of scientific knowledge capital in three key areas that define the Center's core competences developed to date:

- Human-Computer Interaction (HCI): focusing on User & Social Experience, Mobile & Future Devices and Evaluation & Usability;
- Information Processing (IP): focusing on Content Retrieval, Context Awareness, and Multimodal Information Fusion;
- Autonomic Computing (AC): focusing on Remote Management, Control and Configuration.

MANAGEMENT REPORT 2014

Summary of Key Figures

	2014	2015 (Plan)
Total Budget	2.791.572	3.402.815
Staff Costs	1.946.861	2.129.466
Non Personnel Costs	659.306	758.739
Industry Revenues	664.748	885.000
Public Revenues & Others	961.475	959.347
Base Funding	1.165.348	1.558.468
FTE (Full Time Equivalent)	52,3	52,0

Economic and Political Background

- Portuguese economy recovers after period of financial assistance.
- Transition of framework programmes delayed R&D investment of national SMEs.
- Portuguese Government approves the funding for 2014-2018.

After the application of the Economic and Financial Assistance Programme (EFAP), which conditioned the development of the Portuguese economy from May 2011 to May 2014, the first signs of economic recovery appeared throughout the year. Current projections point to a gradual recovery of activity during 2014 which should translate into an annual average rate of change of Gross Domestic Product (GDP) of 0.9% in 2014 and 1.5% and 1.6% in 2015 and 2016 respectively, implying an average growth in this period slightly above the one projected for the euro area.

Along with the economic recovery, we observed that we have received a higher amount of project contracts with Portuguese companies which were funded directly by their own money, but due to the lack of funding mechanisms to support innovation the overall volume of contracts was less than it could have been.

At a macro-economic level, the signs that came from Europe tended to be not as positive as desired, especially as the EU economy recovery remained subdued for longer than expected. In terms of the Global Market, we also faced some constraints. One of these constraints had to do with the crisis in oil prices, as the main market of one of our clients is Angola; another constraint resulted from the degradation of the business relationship between Oi⁴ and Portugal Telecom which indirectly impacted some active R&D project proposals planned to be implemented with both organizations. Nonetheless, we consider that the impact of these external factors on the development of Fraunhofer Portugal during the year of 2014 was limited and we were capable of developing our activity without any major constraints.

The transition of the framework programme associated with the EU structural funds that support the funding of R&D and innovation activities in Portuguese SMEs was an extremely important factor to guarantee a smooth and continuous growth of our operation during 2014 and for future years. According to the information available at the beginning of 2014, our initial expectation was that the first calls associated to the new framework programme - Portugal 2020 (PT2020) - would be available in the last quarter of 2014. Unfortunately, this is not what happened. The delay had a direct impact on the Portuguese R&D and innovation ecosystem and, therefore, also conditioned the natural evolution of our organization.

⁴ Telecommunications Operator of Brazil that merged with Portugal Telecom in 2014.



The end of the QREN programme and the excessive delay in the effective start of the PT2020 programme created an artificial investment vacuum for innovations in Portugal. This situation led to an intensified direct investment activity of Portuguese companies in innovation activities, although in terms of volume it is still at a low level. A positive effect of these constraints was the increasing amount of companies that started to carry out fully business opportunity driven investment decisions, which clearly contrasts with the subvention driven investment cycles that were fostered by QREN and its predecessors. During that period many good ideas of Portuguese companies got stalled for 6-12 months waiting for the appropriate calls and their related decisions, which evidences the little understanding of the funding entities of the market dynamics. All this contributed to the Portuguese economy being weaker in terms its innovation capacity, which reduced the national competitiveness when compared with other countries that have different layouts to support their economy in terms of innovations.

In terms of the Political background, the Portuguese Government continued to reduce public expenditure throughout 2014. This reduction culminated in budget cuts in practically all the Ministries, and naturally the budget associated to R&D expenditure at national level was no exception. Nevertheless, the Portuguese Government reinforced its commitment to fund Fraunhofer Portugal's R&D activities by authorizing the contract between FCT and Fraunhofer Portugal related to the period of the second phase of implementation: 2014-2018.

Therefore, we value and continue to trust the solid partnership established with the Portuguese Government, which allowed our institution to secure the requested and necessary funding for the following period of operation.

Still at the political level, it is relevant to mention that the former Executive Director of Fraunhofer Portugal, Miguel Barbosa, was invited to join the National Innovation Agency Board (Agência Nacional de Inovação – ANI), the national institution responsible for the management of a significant part of the PT2020 programme, especially concerning R&D and innovation projects developed by SMEs. For Fraunhofer Portugal it is an honour to have a previous Executive Director assuming this position and we hope his experience at Fraunhofer Portugal can also contribute to reinforce the importance of research of practical utility at the national level and can therefore contribute towards the increase of competitiveness of the Portuguese R&D ecosystem and economy in general.

Business Evolution

- Fraunhofer Portugal continues on its growth trajectory.
- Overall efficiency gain in the organization.
- National and EU R&D projects for 2015 practically secured.

During 2014 the main driver of our organization was to increase the number of applied research and development (R&D) projects in economically relevant areas related to our Strategic Research Agenda and, once again, we were able to grow and increase the impact of our operation! In terms of R&D projects with Industry clients, we experienced some 'turbulence' throughout the year, partially due to the external constraints previously explained that conditioned the natural evolution and contracting cycle of Industry R&D projects at national level. Nevertheless, we were able to improve the performance of our organization and we have continued the growth trajectory aligned with the goals established for the 2014-2018 period. For the first time, revenue streams surpassed the value of 1,6M€ in R&D contracts, allowing us to achieve a growth of 24% in terms of global revenues. Business Volume also registered an increase in 2014 reaching a total value of ~2,8M€, representing a growth of 17% when compared with the previous year. Finally, it is important to mention that, despite the crisis and the unfavourable external economic environment, the good results achieved in 2014 were only possible due to the contribution of all the members of the organization and their commitment to develop 'Remarkable Technology'!

Business Development

Regarding Business Development, the year of 2014 brought significant challenges in terms of our ability to create R&D contracts with Industry. One of the factors that had a strong influence at this level was the poor outcome of the QREN R&D Industry project proposals submitted during 2013, which was particularly unsatisfactory: from a total of 9 proposals submitted, only 2 projects were approved. We found the reasoning behind the failure of the other 7 proposals disappointing, as after reading the reports of the evaluators, we have strong reasons to believe that the evaluation of the proposals did not follow the expected and required standards. One of the projects that has not been approved involves one of the probably best cardiologists and most respected scientists in this specific area in Portugal. Despite his personal engagement and scientific contribution to the project, the evaluators considered the proposal 'not innovative', which corroborates our opinion of the poor evaluation process associated to the QREN programme! In other two specific projects, we formalized appeals with the remaining members of the consortiums but, unfortunately, the course of the evaluation remained unchanged and the projects also failed to obtain funding.

As mentioned at the beginning of the Management Report, another aspect that affected our dynamics in contracting R&D projects with Industry, especially at the national level, was the delay in the transition of the old QREN programme to the new PT2020 framework programme. Contrasting with our initial expectation, the new calls for projects were not published in 2014, which affected our ability to submit joint proposals with Portuguese SMEs along the year.



Due to this limitation, we had to increase our efforts to obtain direct industry contracts, i.e. without any funding from QREN, and we were able to do so in 2014 (7 vs. 2 in 2013). Typically, these projects had a smaller duration (up to 6 months) and a lower revenue volume (between 20K€ and 50K€). However, in most of these projects we have been using existing Background Knowledge, so it is clear that our ability to generate industry revenues from results achieved in previous internal or public funded projects has increased and we have been able to successfully deliver more innovative technologies to industry clients.

The year of 2014 was also an important year in terms of contacts for future projects with Industry. With the support from the Fraunhofer Portugal New Business Development team, one of our clients, Gociety, was able to establish an important contact with a European Telco company and, together, we were able to successfully negotiate the market introduction of the GoLivePhone solution, which is based on the results of our internal project Smart Companion. Initially, there was a plan to launch a branded solution by the end of 2014 but, due to marketing capacity reasons, the Telco company decided to delay the market introduction of this new product. Nevertheless, this initiative led to additional developments in the GoLivePhone solution, which resulted in additional R&D industry contracts for Fraunhofer AICOS. Besides these contracts, we are also preparing additional proposals for our client in order to further develop the ecosystem of applications and devices related to the GoLive solution.

Another important initiative fostered in 2014 was the one related to the creation of a cooperation project with a company in the US associated to the Precise Indoor Location technology. Although several negotiation meetings occurred during 2014, the developments at the end of the year were still ongoing. Further meetings are already planned for 2015 to mature the conclusions of the negotiation process.

In terms of National projects, our activity remained focused on the development of innovative projects that can leverage opportunities with industry clients. The two Competence Centers created last year, the Fall Competence Center – FCC and the ICT4D Competence Center – ICT4DCC, continued to stand for the majority of the revenues associated to National projects, representing 79% of the National revenues. One important result achieved in terms of Business Development during 2014 was the ability to generate Industry revenues based on the result of internal projects being developed in the Competence Centers. In the case of the FCC, in two specific business cases, Precision Indoor Location and Safety, we were able to sign R&D contracts to implement proof of concepts for industry clients. In terms of the ICT4DCC, we initiated important contacts with the World Bank in Mozambique and we believe, based on the current development of the ongoing conversations, that there is a strong potential to generate new R&D projects related to mGovernment in 2015.

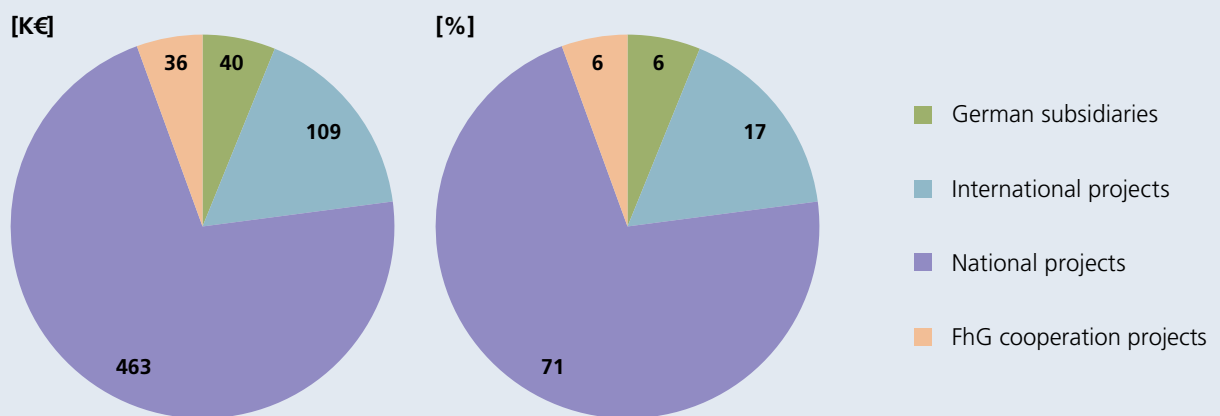
After some initial meetings with the World Bank, we were invited to participate in a project related to the extension of a crowdsource platform for the monitoring and evaluation of solid waste collection services in the Municipality of Maputo, which is called Ntxuva. In the first half of 2014, we were also able to finalize the contract extension of a National project, AAL4ALL, until February 2015. As a result of this extension, Fraunhofer AICOS had to increase its effort in the project and, therefore, the associated revenues also increased. An important fact to mention is that with the signing of this contract we have automatically secured 100% of the goal of National revenues for 2015.

Regarding EU projects, the year of 2014 was particularly positive! Not only were we able to achieve 100% of the goals defined for 2014, but we have also practically secured the goal for 2015. Although Fraunhofer AICOS is still a young organization, it is already recognized as one of the top expert R&D Centers developing innovative solutions in the area of Ambient Assisted Living. Our organization has been involved in projects related to the Ambient Assisted Living Joint Programme (AAL JP) since its first edition and, since 2012, we have been proposing, in the role of coordinator, R&D projects associated with this theme. Once again, we were able to contract one more project in 2014, Clockwork, although the negotiation related to this project was particularly difficult. One of the members of the consortium is from Hungary and, due to reasons related to the negotiations with their National funding entity, the project was almost cancelled. In 2014, we also submitted two proposals for new projects related to the ALL JP; by the end of the year we received a positive evaluation of the SmartBEAT project, which is currently in the process of getting contracted.

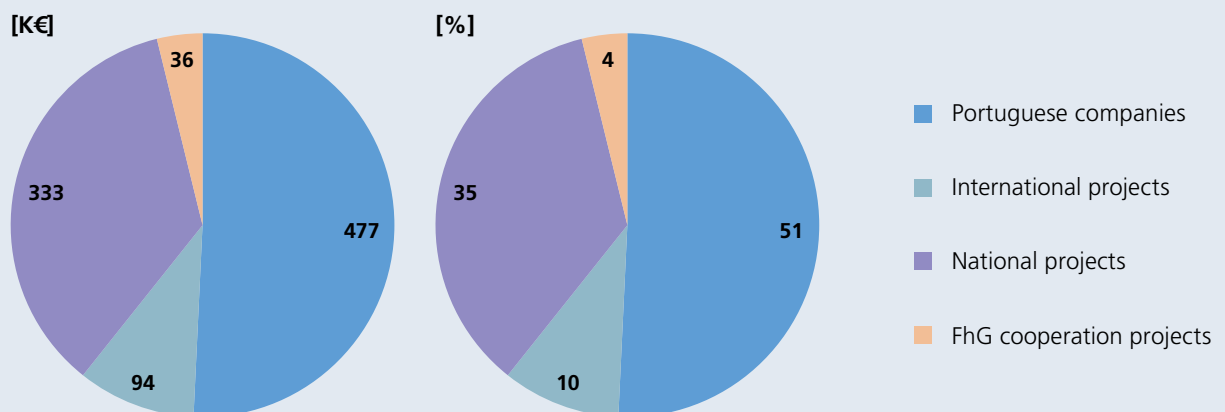
Another important Key Performance Indicator (KPI) related to our activity is our ability to involve German and Portuguese partners, either as contractors or partners, in the projects that we develop at Fraunhofer AICOS. During the period 2009-2014 we were able to generate 5M€ of revenues in projects that involve German or Portuguese partners, which reveals our strong commitment to work together with German and Portuguese institutions and in this way contribute towards strengthening the economic relationship between Portugal and Germany.

In 2014, we generated revenues of 40K€ with German subsidiaries in industry projects, 109K€ with German institutions in international projects, 463K€ in national projects that include the participation of two Fraunhofer Institutes – Fraunhofer FOKUS and Fraunhofer IMDT – and, finally, 36K€ related to a project contracted by a Portuguese SME that involves Fraunhofer FOKUS. Regarding Portuguese partners, in 2014 we generated 477K€ of revenues in projects that involve Portuguese companies, 333K€ of revenues in national R&D projects, 94K€ of revenues in international R&D projects that involve other Portuguese organizations and, finally, 36K€ of revenues in projects with Portuguese organizations that directly involve Fraunhofer-Gesellschaft's institutes.

Revenues Involving German Partners 2014



Revenues Involving Portuguese Partners 2014



Scientific Results & Corporate Development

- Consolidation of R&D activities.
- New patent submission related to Precise Indoor Location algorithms.
- New Fiscal Board for the period 2014-2015.

In terms of Scientific Results, the year of 2014 allowed us to consolidate and strengthen our position in terms of the development of several technologies and algorithms that we believe are of high interest to industry partners. A significant part of these developments is being carried out within the activities of the Competence Centers, as they aim to support the improvements of existing scientific activities developed at Fraunhofer Portugal. One of the best examples that illustrates the relevance of the Competence Centers, and which clearly justifies why they were always classified as 'strategic projects', is related to the improvement of the Precision Indoor Location algorithms being developed at Fraunhofer AICOS.

After an initial manifestation of interest demonstrated by a multinational company to license this technology, which later evolved towards the potential creation of a cooperation project, we have proudly received several visits of high ranking directors of the above mentioned multinational company and its associated companies. These visits were organized to demonstrate the results that can be achieved with this technology and the feedback received from our guests was extremely positive. As far as we know, due to a unique approach that was described in a patent submitted in 2014, our technology has several advantages over other existing solutions developed worldwide. The market demand for this

specific technology is currently very high and our strategic vision and previous investments might allow us to seize this opportunity at the right time, with the right partners.

Also within the scope of the Competence Centers, more precisely in the Fall Competence Center, we have improved and adapted existing algorithms of activity monitoring and fall detection for use in other fields not directly related to senior care. Two areas that were recognized as a priority are Safety & Security and Extreme Sports. In the first case, Safety & Security, Fraunhofer AICOS developed a project which aims at creating an assistive ICT based solution for field operatives. In this project, SAFETY, smartphones are used to monitor the activity of the operatives in the field and, in the event of the detection of an uncommon movement, e.g. an agent who falls down or several agents running in the same direction, the system allows sending automatic alerts to a command center. If requested, it also allows to establish a direct video/audio link between the operatives and the command center. This particular project attracted the attention of various industry clients and we have actually been contracted to implement a small prototype for one of them in order to demonstrate the system for the Angolan National Police. In the area of Extreme Sports, we have been working on the adaptation of the existing activity monitoring algorithms to nautical sports. Presently, we have already achieved the first results in terms of sports such as sailing, surf and windsurf. At the end of the year, an initial contact was established with a company specialized in the production of kayaks, which is particularly interested in using our technology.



As initially highlighted, during the process of submission and approval of the Competence Centers, the funding associated to the FCC and ICT4DCC would be an important instrument to leverage research activities that could lead to the creation of scientific results with a strong potential to be transferred to Industry clients. The above mentioned examples give us the confidence that we are moving in the right direction and we hope that, in a near future, we will be able to present additional cases of success that corroborate our initial expectation. It is also our belief that this effect will extend to projects related to the ICT4DCC and, therefore, we will be able to demonstrate that similar results are also possible within the scope of activities developed with African countries. In our opinion, current progresses illustrate the importance of having the base funding available to finance strategic activities, as well as the pre-competitive research developed by our organization. Only by doing so is it possible to meet the requirements that guarantee that Fraunhofer Portugal remains competitive both at national and international levels.

In terms of scientific developments related to the ICT4D Competence Center, during 2014 we have been actively developing projects in the areas of mAgriculture, mHealth, mGovernment and ICT for Very Small Enterprises (ICT4VSE). In the area of mAgriculture, we have initiated a project focused on the needs of South African farmers, which has the primary goal of creating an Assistive Environment for Hydroponic Farming. The envisaged system is based on a low cost solution for mobile monitoring of hydroponic farms and, within the scope of this project, we have set up a small indoor hydroponic garden in our premises to demonstrate and test current results. In the area of mGovernment and ICT4VSE, we initiated the development of the OurMoz project.

OurMoz is a mobile, citizen centered, platform that provides real-time geotagged information of what is happening within the cities. This platform is also expected to assist the boost of small commerce and enhance the engagement between citizens and other local stakeholders, therefore contributing to the benefit of very small enterprises in Africa. In terms of the mHealth area, after the initial developments with the MalariaScope project in 2013, we reached some important milestones in 2014. The first one being our ability to test our image based Malaria parasite recognition algorithm with extremely positive results. The second important milestone was that we were able to finalize the first version of a device prototype that can perform image analysis on blood smears and detect the *Plasmodium falciparum* parasite at the *trophozoite* evolution stage. These results are very promising as we can envisage a full and successful implementation of a full set of algorithms for identifying the remaining parasites at the three different evolution stages. We are currently in the process of preparing additional proposals to funding entities, e.g., Bill & Melinda Gates Foundation and UnitAID/Malaria Consortium, in order to be able to fully develop the MalariaScope device and test its performance according to the World Health Organization golden standard. Still within the area of mHealth, we have started a project with a Portuguese SME, Critical Software, which aims at: a) collecting structured clinical data on isolated populations in developing countries using mobile devices and b) analysing correlated data to detect, monitor and predict outbreaks and epidemics of infectious diseases, such as Malaria and HIV/AIDS. The role of Fraunhofer AICOS in this project is to provide its PostboxWeb framework to collect data in locations where there is no network coverage and transmit it whenever network is available.



With the approval of the ICT4DCC, we were able to directly engage scientists from Mozambique and South Africa in our projects and, during 2014, for the first time, we had the pleasure of hosting two senior researchers, one from each country, that worked together with our team in the development of innovative solutions for Africa.

Based on the scientific developments already achieved in the ICT4DCC, we were able to leverage important contacts with external organizations during 2014. Two organizations worth mentioning are the World Bank (WB) and ARCTEL-CPLP. The first entity, the World Bank, is a well-known entity that finances and supports several large scale projects in developing countries. After some initial contacts with a WB consultant from Mozambique, we have been invited to join a proposal of a WB project to be implemented in Mozambique. The second, ARCTEL-CPLP, is a non-profit association that gathers the telecommunications regulators of the *Comunidade dos Países de Língua Portuguesa (CPLP)*⁵ which is engaged in the development of projects in developing countries, especially at the CPLP level, where telecommunications can bring an important contribution to leverage the impact of project results, especially in rural communities. Since telecommunication is one of the bases of ICT, we would say that there is a perfect match between their interests and the projects we develop at Fraunhofer AICOS. For this reason, we expect to have the first results of this cooperation during the year of 2015.

With regards to European projects, we maintained our focus mostly on the development of initiatives related to the Ambient Assisted Living Joint Programme (AAL JP) and the implementation of the ACP Street Libraries project.

In terms of the AAL JP, after some initial problems related to the consortium of the Clockwork project, which led to a significant delay of its kick-off, the project is now planned to start in the first quarter of 2015. Within the scope of this project, we will be leading an initiative that involves different R&D institutions, companies and final users. The project itself aims to create a healthy and comfortable work environment by supporting middle-aged to older adults in the improvement of their circadian rhythms. Another positive news received during 2014 was the approval of a new project proposal submitted to the AAL JP, SmartBEAT, which aims to address the needs of senior Heart Failure patients, and their formal and informal caregivers, by offering an integrated solution to leverage patient self-care through autonomous condition monitoring and real-time feedback to their caregivers.

Also related to the AAL JP, once again, Fraunhofer Portugal participated in the AAL Forum 2014 with one of the largest stands of the event. Some of our researchers had the opportunity to demonstrate and present Fraunhofer AICOS' projects such as AAL4ALL, ChefMyself, COLABORAR, Fall Competence Center and Smart Companion. The presence of Fraunhofer Portugal was greatly noticed, especially due to the show cooking sessions in which the ChefMyself equipment was used to prepare some healthy meals. This specific project attracted several participants, both from the general public and from other stands, who were presenting projects associated with related areas such as health, well-being and nutrition.

⁵ Community of Portuguese Speaking Countries which includes: Angola, Brazil, Cape Verde, East Timor, Equatorial Guinea, Guinea-Bissau, Mozambique, Portugal and São Tomé e Príncipe.



The Fraunhofer Portugal Challenge completed its fifth edition, reinforcing our high profile position within the Portuguese Academic institutions. In 2014, we achieved our highest results ever. In this edition we were able to attract the interest of post graduate students who responded to our challenge with outstanding scientific research work. Evidencing this statement are the numerous visits to the Challenge's website (over 4.000) and the numerous applications submitted from 12 universities country-wide, encompassing a wide array of courses, but in line with the scientific activities of Fraunhofer AICOS. As an example, the 6 finalists came from courses as varied as Bioengineering Systems, Biomedical Engineering, Computer Engineering, Digital Media and Microelectronics. These results are even more impressive when considering that the number of applicants, 74, more than tripled compared with the previous edition, 21. In the PhD category we received 31 applications (vs. 4 in 2013) and in the MSc category we received 43 applications (vs. 17 in 2013).

In terms of the results achieved in the scientific domain, the following table provides a summary of AICOS' activities with an important impact:

Scientific Activities

Papers	28
Master's Theses	13
Patents filings	1

One of the strategic decisions planned for 2014 was the creation of a branch office in Lisbon. The first action concerning this objective was to find a person with the right skills to coordinate the R&D team to be allocated to this new extension. Fortunately we quickly managed to achieve this goal and since May 2014 Prof. Doutor Hugo Gamboa has taken on this responsibility. A first period of adaptation was set up and Prof. Gamboa has been working jointly with our team in Porto to gain a deeper understanding of our *modus operandi*. Also related to his activity as a professor, at the end of 2014, Prof. Gamboa proposed two different topics for master theses to be jointly developed by Fraunhofer Portugal and his university, Universidade Nova de Lisboa - Faculdade de Ciências e Tecnologia and, since September 2014, we have two new students from Lisbon engaged in topics related to our scientific research.

In terms of the branch office location, we expect to conclude the negotiation process in order to have an extension of our R&D team in Lisbon by mid 2015.

Regarding the composition of the Boards of the Fraunhofer Portugal Association, a new Fiscal Board for the years 2014 and 2015 was appointed in the first quarter of 2014, now being composed by the following members: Dr. José Coutinho (as President), Prof. Amândio Antunes and Dr.^a Adelaide Neves (representing KPMG & Associados - Sociedade de Revisores Oficiais de Contas, SA).

Business Performance

- Business Volume circa 2,8M€.
- Project revenues surpassed 1,6M€.
- Performance of the organization increased by 4%.

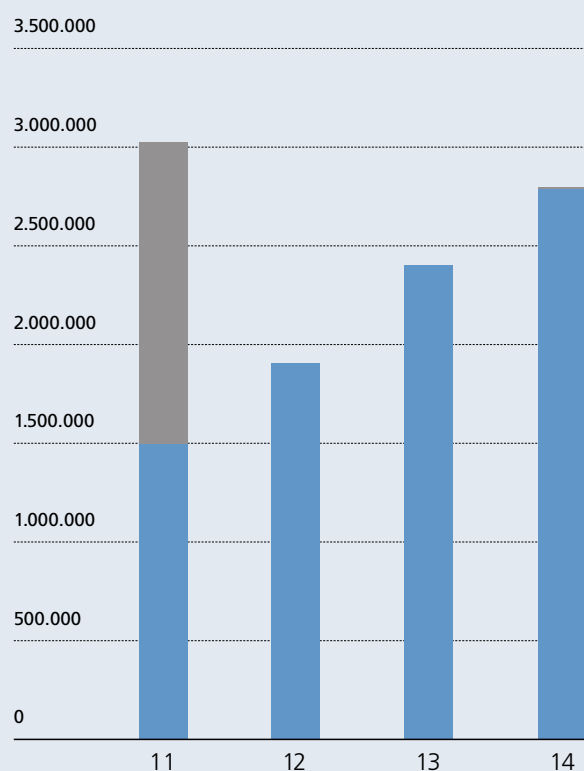
In 2014, Fraunhofer AICOS maintained its growth trajectory and improved the performance of its activity. With the delay of PT2020, the planned expenses of the organization were slightly adjusted, which led to an organic growth of our team. By the end of the year, the total Business Volume was circa 2,8M€, representing a growth of 17% compared with the previous year, which was slightly below the initial plan.

The total project revenues surpassed 1,6M€ representing a total increase of 24% when compared with the previous year. All revenues increased and we achieved an individual growth of 16% in industry projects revenues, 19% in national projects revenues and 51% in EU project revenues.

As a result, and in combination with lower expenses, our organization was able to fulfil or exceed all KPI that measure the volume of revenues over the total operational costs. With our total operational costs only rising by 16%, in combination with the significantly stronger increase of the external revenues by 24%, we achieved a global performance (total external revenues / total operational costs) of 62%, exceeding the demanding plan we had for 2014 by 2%, which resulted in an absolute increase of another 4% compared to 2013!

Once again, and contrasting with the evolution of the Portuguese economy in 2014, our achievements allowed us to be aligned with our growth plan and, therefore, we consider this year an important step in the success story of our operation.

Total Business Volume (cash basis) 2011–2014 [€]



	2011	2012	2013	2014
Major Infrastructure Capital Expenditure	1.522.082 €	-10.000 €	0.00 €	10.000 €
Contract Research (Total Expenses and Research Capital Expenditure)	1.504.012 €	1.903.541 €	2.386.466 €	2.781.572 €

Major Infrastructure Capital Expenditure

Contract Research
(Total Expenses and Research Capital Expenditure)

Contract Research

- Staff costs increased due to organic team growth.
- Non-Staff costs and CAPEX consistent with activity growth.

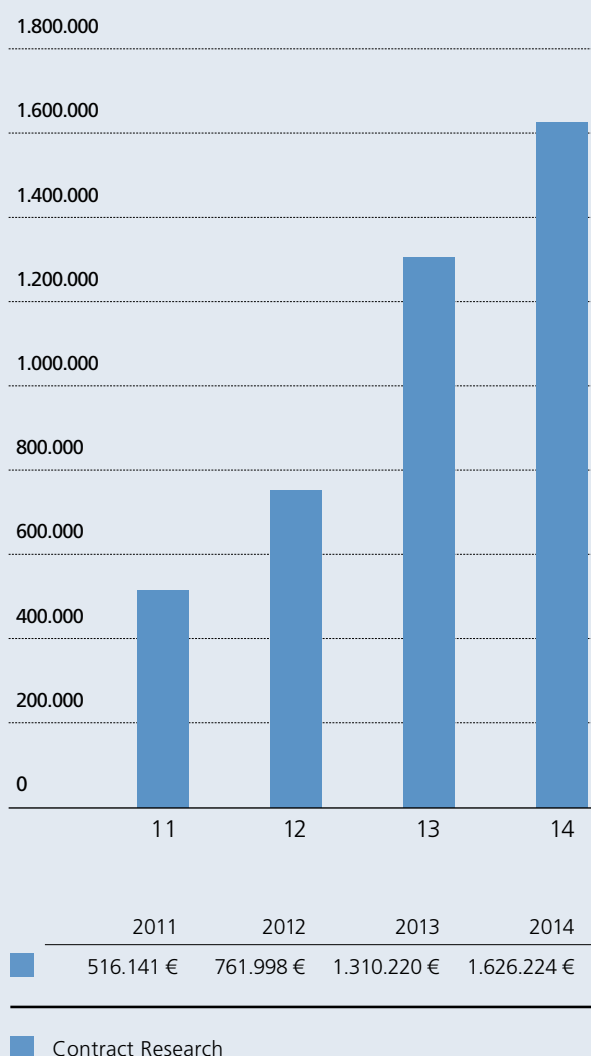
Personnel expenses for contract research increased 14%, and represented 75% of our total operational cost in the financial year of 2014. As we were able to generate a 24% increase in the Operational Revenues resulting from an increase in productivity, this indicates an excellent organic growth. The increase in the Operation Revenues also led to the fulfilment of our Revenue objectives.

Non-personnel costs increased by 23%, as a result of requirements of the projects. This is explained by the increase in the Outsourcing Costs and Travels vs. 2013, representing the service fees of the partners of the ICT4DCC, travels to and from Africa and services contracted to Fraunhofer-Gesellschaft.

Capital expenditure with R&D contract research rose by 25% when compared with 2013. This evolution is a direct consequence of AICOS' current project investment profile.

Once again, Fraunhofer AICOS significantly improved its revenues in 2014, this time by 24%. Since 2011, our compound annual growth rate⁶ is 46,6%, which is even more impressive when we take into account the economic situation of Portugal since 2011.

Contract Research Revenue Evolution 2011–2014 [€]



⁶ Compound Annual Growth Rate (CAGR) is a geometric average growth rate over a period of several years.

Our Industrial revenue increased to 664,7K€, which represents more than our entire Project Revenues in 2011. In terms of geographical distribution, 23% is obtained from international clients. When compared with our Total Revenues, Industry revenues now account for 24%.

Revenue from national projects increased 19% when compared to the last year. The projects were mainly driven by the Competence Centers and the AAL4ALL project, which was reformulated in the first half of 2014.

Revenue from EU-funded research projects also evidenced a considerable year-over-year increase, rising 51% since 2011, EU revenue has grown 91%.

Employees

- Increase of our team by 19% with a total headcount at year end of 82 collaborators.
- Peak of 86 collaborators in the second quarter of 2014.
- Increase in the number of doctorates (10 vs. 6 in 2013).

Fraunhofer Portugal's success and its Human Resources policy is based on the respect for human values, merit, pro-activity, observance of the law, and on knowing how to reach the goals we propose, in order to build a motivated team united towards innovation.

During 2014, we were able to increase our team in 19%, closing the year with a total headcount of 82 collaborators (regular staff, grant holders and external collaborators) corresponding to 52,3 FTE (Full Time Equivalent). Also worth mentioning, we have outnumbered our previous year's number of PhD with a total of 10 doctorates (vs. 6 in 2013), the highest number since the beginning of our activity. This significant growth has been accomplished in a sustainable way, always guaranteeing optimum working conditions for the team, both in terms of office facilities and IT equipment.

All in all we operate a young talented team, and we managed to maintain a significant gender distribution as we achieved, by the end of the year, a ratio of 23% of female collaborators. Furthermore, we run a highly qualified team, as 95% of our staff members have a university degree, 63% are MSc and 12% have a PhD degree.

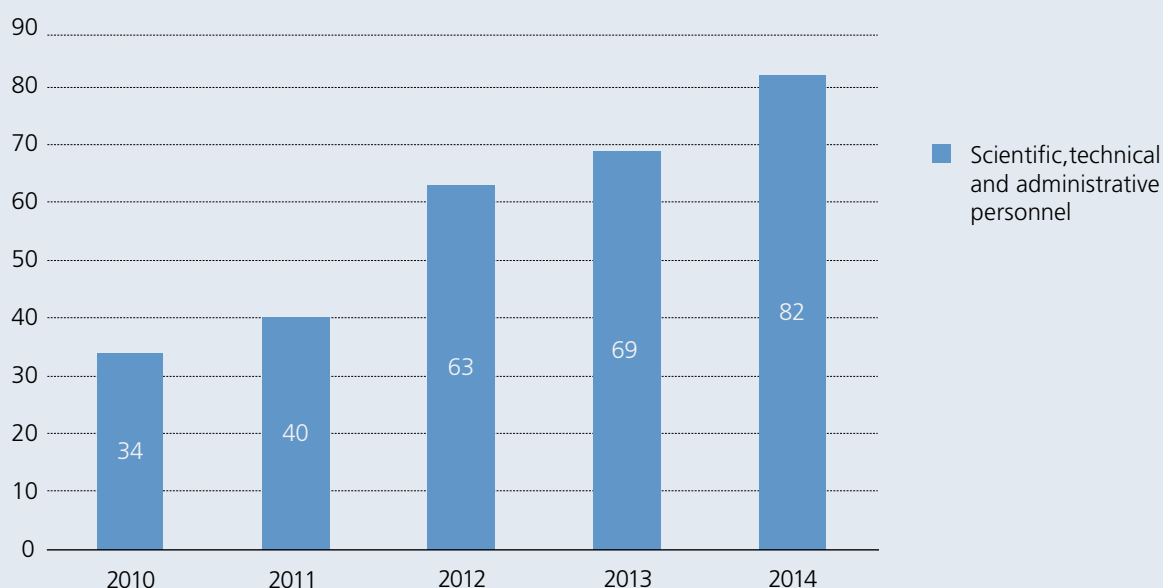
The headcount evolution changes throughout the year due to the profile of our activity and the collaboration with students. We have therefore registered a peak of 86 people during the second quarter of 2014, and the average number of people throughout the year was 82.

The positive evolution of Fraunhofer AICOS headcount registered in 2014 is a direct consequence of the rising number of research projects and contracts, evidencing that the Center's reputation among its clients and partners is becoming more solid and indicating that year after year we are building an image of professionalism and quality as an R&D institution of excellence.

Also, during 2014, some collaborators left Fraunhofer Portugal, as they were offered working contracts in the industry sector. This is a result of the training and technical skills acquired at Fraunhofer AICOS and, once again, proves that we are accomplishing our mission to increase the innovation pace of the Portuguese Economy, by contributing to the qualification of highly skilled individuals that are of interest to industry.

Regarding Human Resources activity, and following our vision to motivate the team and promote merit and pro-activity of all collaborators, in the second quarter of 2014 we proudly announced the winner of the Entry Level Excellence Award, dedicated to a young researcher who achieved outstanding results: Manuel Monteiro.

Headcount Evolution 2010–2014





Outlook and Strategic Development

With the transition from QREN to the PT2020 framework programme the calls for new R&D projects promoted by Portuguese SMEs were closed and therefore the current number of projects proposals with national SMEs is limited.

Although this is certainly a challenge for our own planning, it is actually related to a very positive effect: with the end of the QREN programme and due to the strong delays in starting with PT2020 an artificial investment vacuum for innovations has been created by the Portuguese Government. Although still at a low level, this has been leading to an intensified direct investment activity of companies in innovative activities. Finally, an increasing amount of companies are carrying out fully business opportunity driven investment decisions, in contrast to the often strong subvention driven investment cycles that have been fostered by QREN and its predecessors. Many good ideas of Portuguese companies in that time got stalled for 6-12 months due to waiting for the appropriate calls for funding and the related decisions and typical administrative delays of the funding agencies, which had little understanding of and interest in the market dynamics. At the end this contributed to the Portuguese economy being weak concerning innovations compared to other countries that do have a more competitive layout with regards to the support of the economy for the creation of innovations.

Thus it would be fatal for this in its core positive development, if the new subventions and related programmes originating from PT2020 will once more hamper this business and market driven decision making of innovative companies in Portugal that is needed so much.

Therefore, it is key to support this development, which also helps to avoid funding of artificial activities that in the past often just existed due to the pure availability of subventions.

Clearly one of the continuing obstacles for many of the innovative SMEs in Portugal is the lack of liquidity and the limited access to financing.

Also it is important to understand that subventions per se are not to be considered always negative! But they need to be placed well and on time to have the best possible positive effect!

With the creation of the IFD (better known as 'banco de fomento', a bank with similar goals like the German KfW) and the reorientation of ADI in the form of the ANI, the Portuguese Government can make the difference to the past if the instruments of both institutions are getting aligned and integrated to the benefit of Portuguese companies. In addition, the Portuguese Government can attract more national and international investments in innovation through tax benefits for companies that significantly invest in innovation in Portugal.

For the next year, 2015, we have decided to increase our efforts to win international customers in areas where we are already active and have results from our internal R&D activities. This includes the ongoing effort to leverage a cooperation project with a company in the US but also to analyse the European players with regards to industries we have been successful to win clients in Portugal (innovations in retail, sports equipment, m-health, AAL) already. At the same time we are in a process with our African partners from the ICT4DCC to define the roadmap with regards to marketing the outcome of the different projects we conducted together.



With regards to our internal R&D, we continue to invest in our future by running projects in the domain of ICT for health, well-being (AAL), sports and nutrition. We are also putting a new focus on the mobile related IoT⁷, meaning the deployment of mobile devices (smartphones) as a hub (physical, logical and in aspects of the HMI⁸) to integrate 'things', specifically sensors and actuators in the environment of the users. After the IoT being in the process to become a reality in the real life of consumers, integrating them over the Internet and to become in combination with big data technologies the 'eyes, ears and hands' of the machines is a natural evolution of our current and past activities. It will help us to have results and solutions when the industry is demanding them once more.

Our extension towards Lisbon is also an important element in this strategy as it will give us more space to grow our team of experts and a closer proximity to the potential clients we have identified.

All the above is to be well prepared to ride 'the perfect wave' that fits our profile best on time.

⁷ IoT – Internet of Things.

⁸ HMI – Human Machine Interface.



Perspetivas e Desenvolvimento Estratégico

Com a transição do QREN para o programa-quadro PT2020, a abertura de concursos para novos projetos de I&D promovidos por PME portuguesas foram encerrados, como tal, o número atual de propostas de projetos com PME nacionais é limitado.

Embora este seja certamente um desafio para o nosso planeamento, na verdade está relacionado com um efeito muito positivo: com o fim do programa QREN e com o significativo atraso no arranque do programa PT2020, um vazio para investimento em inovação foi artificialmente criado pelo Governo Português. Embora ainda a um nível reduzido, isto levou a uma intensificação das atividades de investimento direto das empresas em atividades de inovação. Por último, um crescente número de empresas está a executar decisões de investimento motivadas por verdadeiras oportunidades de negócio, contrastando com os habituais fortes ciclos de investimento gerados pelas subvenções disponíveis, que até agora foram fomentadas pelo QREN e seus antecessores. Muitas boas ideias de empresas portuguesas ficaram suspensas entre 6 a 12 meses durante este período, por estarem à espera dos concursos adequados e das respetivas decisões de aprovação, ou devido aos típicos atrasos das agências de financiamento, que tinham pouco conhecimento e interesse na dinâmica de mercado. Como consequência, tudo isto contribuiu para que a economia portuguesa ficasse mais fraca no que diz respeito ao ecossistema de inovação, quando comparada com outros países que têm um quadro económico mais competitivo no apoio à criação de inovações.

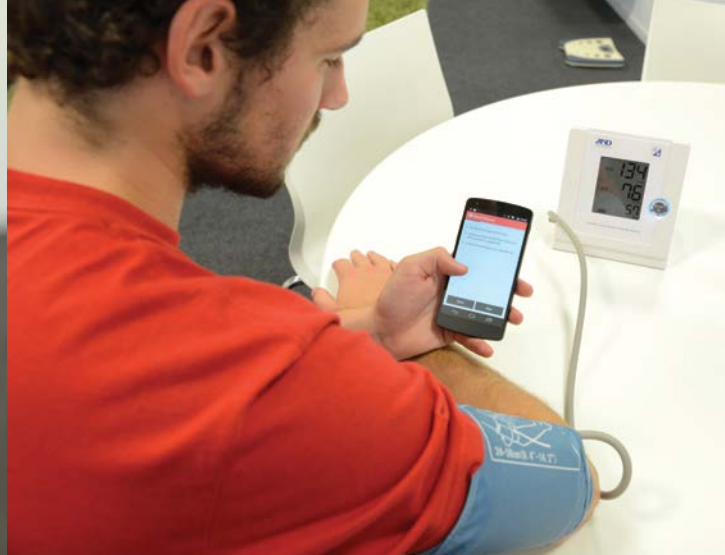
Assim sendo, será contraproducente para uma evolução positiva desta situação, se as novas subvenções e respetivos programas gerados pelo PT2020 venham uma vez mais dificultar os negócios e a tomada de decisões orientadas ao mercado das empresas inovadoras em Portugal, pois estas carecem bastante deste mecanismo.

Por conseguinte, é crucial apoiar este desenvolvimento, uma vez que também ajuda a evitar o financiamento de atividades artificiais, que no passado muitas vezes existiram devido à pura disponibilidade de subvenções.

Claramente, um dos obstáculos persistentes para muitas das PME inovadoras em Portugal é a falta de liquidez e o limitado acesso ao financiamento.

É também importante perceber que subvenções por si só não são para considerar sempre como negativas! Mas têm que ser bem aplicadas e na hora certa para garantirem o melhor efeito positivo possível!

Com a criação da IFD - Instituição Financeira de Desenvolvimento, (conhecida como “banco de fomento”, um banco com objetivos similares ao banco Alemão KfW - Banco de Desenvolvimento Alemão) e a reorientação da ADI na forma de ANI, o Governo Português pode marcar a diferença para o passado se os instrumentos de ambas as instituições se integrarem e alinharem para o benefício das empresas portuguesas. Adicionalmente, o Governo Português pode atrair mais investimento nacional e internacional em inovação através de benefícios fiscais para empresas que de forma significativa investem em inovação em Portugal.

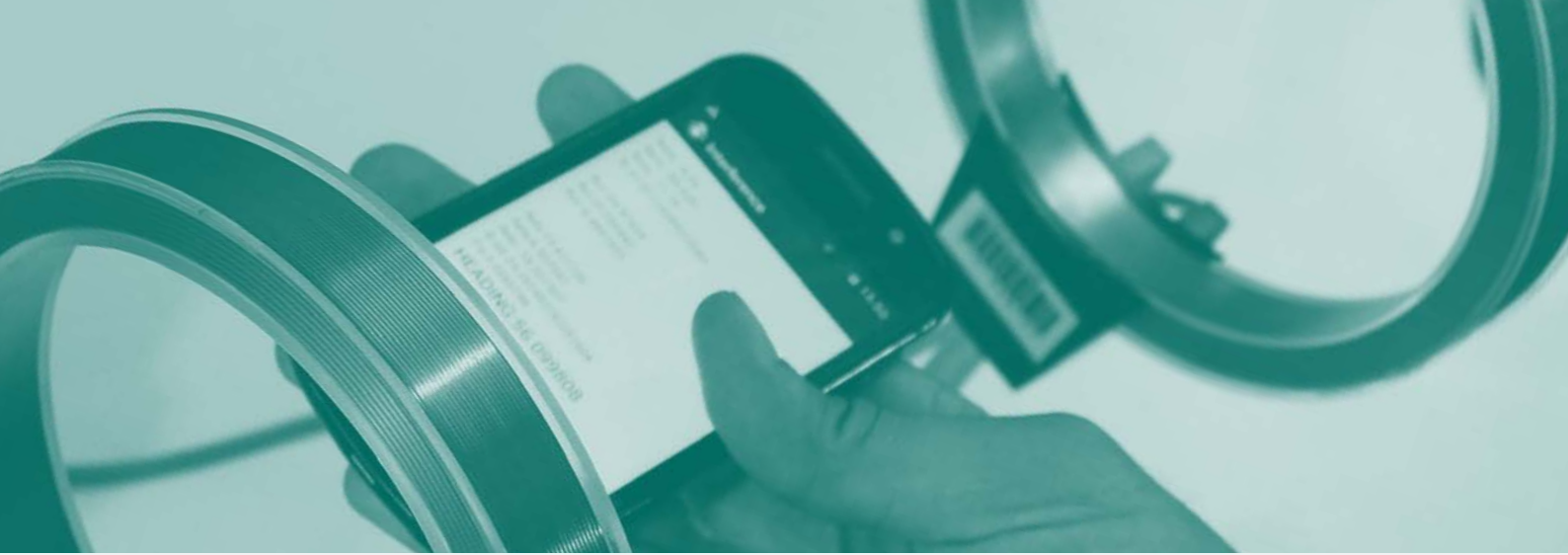


Para o próximo ano, 2015, decidimos incrementar os nossos esforços para conquistar clientes internacionais em áreas nas quais já estamos ativos e temos resultados das nossas atividades internas de I&D. Aqui se inclui o esforço atual para alavancar um projeto de cooperação com uma empresa nos Estados Unidos bem como analisar os protagonistas Europeus no que concerne a indústrias nas quais já conseguimos, com sucesso, conquistar clientes em Portugal (inovação no retalho, equipamentos desportivos, saúde *mobile* e AAL). Em simultâneo, estamos em conversações com os nossos parceiros Africanos do ICT4DCC, para definir o guião para a comercialização dos resultados dos diferentes projetos que desenvolvemos em conjunto.

Relativamente à nossa atividade de I&D interna, continuamos a investir no nosso futuro, ao desenvolver projetos nos domínios de ICT para a saúde, bem-estar (AAL), desporto e nutrição. Estamos também a expor um novo foco sobre o *mobile* relacionado com IoT (*Internet of Things*, em Português internet das “coisas”), ou seja a utilização de dispositivos móveis (smartphones) como uma plataforma (física, lógica e como suporte à Interação Homem Máquina) para integrar “coisas”, mais especificamente sensores e atuadores, no ambiente dos utilizadores. Após a IoT se tornar uma realidade na vida real dos consumidores, integrá-los através da internet e torná-los, em combinação com tecnologia *big data* (processamento de grandes quantidades de informação), nos “olhos, ouvidos e mãos” das máquinas, é uma evolução natural das nossas atividades presentes e passadas. Tal irá ajudar-nos, uma vez mais, a ter resultados e soluções prontas quando a indústria necessitar.

A nossa extensão planeada para Lisboa é também um elemento importante nesta estratégia, uma vez que trará mais espaço para aumentar a nossa equipa de peritos, assim como uma maior proximidade aos potenciais clientes que já identificamos.

Tudo o que foi descrito acima serve para mostrar que estamos bem preparados para, no momento certo, apanharmos “a onda perfeita” que melhor se encaixa no nosso perfil.



REVIEW OF FRAUNHOFER PORTUGAL RESEARCH



STRATEGIC RESEARCH AGENDA

PROJECTS AND RESULTS 2014

STRATEGIC RESEARCH AGENDA

AS FRAUNHOFER PORTUGAL CURRENTLY ONLY OPERATES ONE RESEARCH CENTER (FRAUNHOFER AICOS), ITS STRATEGIC RESEARCH AGENDA IS DICTATED BY FRAUNHOFER AICOS' INTERESTS AND ACTIVITIES.

Business Fields

Fraunhofer AICOS addresses two main business fields: Ambient Assisted Living (AAL) and the emerging field of Information and Communication Technologies for Development (ICT4D).

Ambient Assisted Living

Ambient Assisted Living (AAL) includes methods, concepts, (electronic) systems, devices and services that are providing unobtrusive support for daily life, based on the context and the situation of the assisted person. The technologies applied for AAL are user-centric, i.e. oriented towards the needs and capabilities of the actual user. They are also integrated into the immediate personal environment of the user. As a consequence, the technology is adapting to the user rather than the other way around. In order to share relevant information between systems and services, technologies for AAL should ideally be based on modular and interoperable concepts.

A main driver for the development of AAL technologies is the increasing number of ageing population and the inversion of the demographic pyramid that is occurring in developed countries. AAL technologies can be instrumental in tackling the massively increasing cost of healthcare and social security. Another driver is the rising number of single person households together with rising expectations towards the quality of life. AAL technologies also cater towards the increasing demand of safe and comfortable living environments, as well as the increasing demand for communication and stronger social interaction with others.

Fraunhofer AICOS intends to mainly address the needs of the ageing population, not only to reduce innovation barriers of forthcoming promising markets, but also to lower future social security costs. This can be achieved through the use of intelligent products and the provision of remote services, including care services that allow the time senior citizens can live in their home environment to be extended, while guaranteeing adequate comfort, safety and quality of life. These services will increase their autonomy and assist them in carrying out day-to-day activities.

The research and development of Ambient Assisted Living solutions by Fraunhofer AICOS aims at a primary target user group – the Ageing and Elderly – with the purpose of:

- Extending the time people are able to live in their preferred environment by increasing their autonomy, self-confidence and mobility;
- Maintaining health and functional capability of elderly individuals;
- Promoting a better and healthier lifestyle for individuals at risk;
- Enhancing security and safety, to prevent social isolation and to help maintain the multifunctional network around the individual;

- Supporting caretakers, families and care giving organizations;
- Increasing the efficiency and productivity of resources used in ageing societies.

Information and Communication Technologies for Development

Information and Communication Technologies for Development (ICT4D) is a general term used to refer to the application of Information and Communication Technologies (ICT) within the field of socioeconomic development or international development. ICT4D focuses on directly applying information technology approaches to reduce the digital divide and therefore contribute to poverty reduction in developing countries.

Fraunhofer AICOS intends to focus its ICT4D activities on the African continent, specifically on Mozambique and Angola. The primary target user group will be ICT users in rural and developing areas, and the objective is to provide solutions for mobile device services and applications matching the local users' demands and contributing to a more positive user experience which, in many cases, may be their first contact with ICT.

One of the most dominant differences between ICT usage in industrial and developing countries is the type of devices and technologies used when interacting with ICT. In industrial countries, interaction with ICT is made primarily via PCs, while in developing countries the mobile phone has taken over the role of primary device of access and interaction with ICT.

Mobile devices, like smart(er)-phones and Mobile Internet Devices will continue to play a dominant role in developing countries in terms of growing widespread usage. In developed countries, the same tendency occurs, although the current use of PCs potentially slows down this trend when compared to developing countries.

Business Sub-Fields

Due to the large amount of topics related to both fields, and our comparably small R&D team, we have chosen to focus on fewer subfields that our customers consider relevant and which, over the first period of operation, we were capable of creating, taking into account our core competences which clearly differentiate us from our competitors.

In the AAL business field we currently cover the following subfields:



Fall and Activity Monitoring

For frail and elderly individuals, falling can have serious consequences including injury, psychological damage, limitations on mobility and reduced quality of life. Technology addresses this issue following two different perspectives: providing a better emergency response after a fall has occurred and allowing for detection and prevention of falls, through continuous monitoring of senior adult activity. Despite the market potential, current technological solutions are cumbersome and are not inclusive, focusing only on formal caregivers, they present cost obstacles and are, in general, hard to handle and maintain. Fraunhofer AICOS' approach to fall prevention, detection and activity monitoring focuses on the development of solutions for smartphones which have several clear advantages: cost effectiveness, user friendliness and inherently manageable.

Chronic Diseases and Well-Being Management

Along with an ageing population comes the higher incidence of different chronic diseases. In high-income countries, chronic diseases are the greatest cause of early death and disability and also a major source of costs for social security systems. Fraunhofer AICOS partners with relevant entities (companies, health care providers, public entities, etc.) in an attempt to help society improve the services for chronic disease management, by creating valid prototypes and contributing to the standardization effort through several different existing solutions, or solutions which are yet to come.

Assistive Environments

As the world's population is ageing, there is a growing need to support independent living conditions for elderly individuals. Assistive environments incorporate the latest pervasive and ubiquitous technologies and provide a viable alternative to traditional assistive living solutions. One of the aims is to enhance the user comfort. Comfort can be an essential or fundamental benefit for people with disabilities or elderly individuals. Environments equipped with these solutions are able to compensate some disabilities of the senior users by simplifying daily routines and reducing the elderly individual's dependency on other people by taking advantage of the functionality of the environment by themselves, reinforcing their independence and personal freedom and allowing them to remain in their usual surroundings for longer time. Fraunhofer AICOS' approach is to simulate assistive environments as closely as possible by taking advantage of its Living Lab and to create applications that enable the consolidation of this vision.

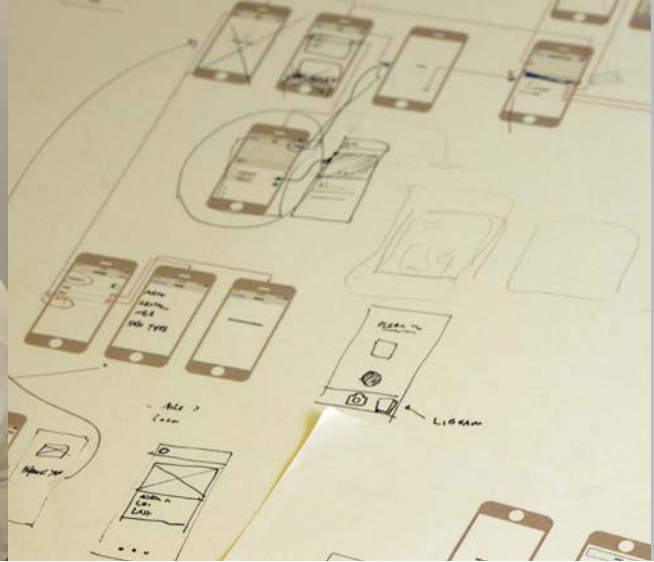
With regard to the emerging ICT4D business field, one subfield has currently been defined:

ICT4D on Mobile Devices

The above mentioned subfield consists of mobile ICT solutions jointly developed with African partners for user groups in rural and developing areas in order to enhance the living standards of those groups. In the beginning, the solutions will target four application areas which were identified as the most market relevant in the next years: agricultural production chains (mAgriculture), micro-enterprises (ICT for Very Small Enterprises), mobile health (mHealth) and mobile Government (mGovernment).



Usability Tests



Core Competences

Fraunhofer AICOS' core competences are strongly related to the demands of our customers in the above described business fields. Some competences have been specifically created based on the request of a specific customer, but the vast majority is related to our prediction of a future demand from the side of our customers. In order to gain competences, we are using internal projects that will ideally lead to existing results and competences when a customer requires them. In this case, we can successfully transfer an internal project into an external industry project. In other cases, we are able to convince customers with results from internal projects that do not yet completely match the requirements of our competence to achieve the desired result on time and with high quality. Thus, the selection process for internal projects is very important, as any competence that we create and which is not used afterwards within a reasonable time needs to be considered as holding academic value only and as an investment without return.

To date, Fraunhofer AICOS has developed the following core competences:

Human-Computer Interaction (HCI)

At Fraunhofer AICOS, designing products and services that are adapted to our specific target audiences and which meet their needs is a main goal to be addressed. The HCI team is responsible for performing user research, designing solutions according to its results and iterating them through evaluations with both experts and final users. As such, the group is expected to ensure the significance and usability of any solution developed at the institute. The research performed within the HCI core competence is focused on the following subfields:

- User & Social Experience, associated with research on users' characteristics as well as their environments and context. It provides the knowledge required to create meaningful solutions that meet users' demands;
- Mobile & Future Devices, a research field that includes the discovery of new technologies with the goal of enhancing users' interaction with current and novel systems;
- Evaluation & Usability, focuses on evaluating the extent to which developed solutions fit users' expectations. It includes systematic evaluation tests with both HCI professionals and end-users.

FROM RAW DATA... TO MEANINGFUL INFORMATION



Information Processing (IP)

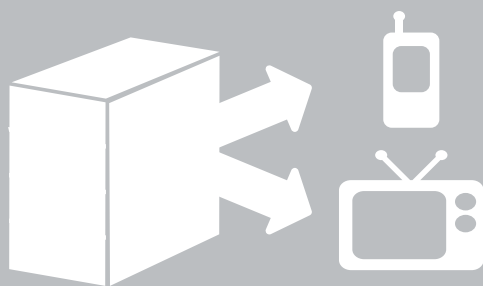
This core competence has originated from the demands imposed by our business fields and provides us with the capability to generate algorithms to solve the problems that arise in our projects. Advances in information and communication technology have triggered an exponential growth in the amount of data available. IP scientific area is related to the methods developed to cope with these vast amounts of information ranging from simple sensor events, over natural language to complex multimedia content. The IP core competence has been divided, according to our main activities, into three main subfields:

- Content Retrieval, a research field concerned with the search of information within multiple contexts. It is mainly related to the development of algorithms to extract and process the data retrieved from the different sources available;
- Context Awareness, focuses on the development of ubiquitous solutions that use unconventional sensor data and combine it with environmental context information, such as the users' location or even meteorological and other geographical information;
- Multimodal Information Fusion, concerned with the combination of the information retrieved by different sources. It is mainly applied in Fraunhofer AICOS to fuse the information retrieved by different sensors in order to replace external sensors by software for smartphones.

Autonomic Computing (AC)

Fraunhofer AICOS aims to create solutions adapted to people's needs and competences. However, the variety of communication technologies, Operating Systems and networked devices creates complexity in the daily life of non-technical people. The AC core competence addresses the aforementioned complexity by proposing solutions capable of adapting to time changing conditions while hiding the intrinsic complexity from the non-technical people. Moreover, due to the specific requirements of Fraunhofer AICOS business fields, there was the need to focus on one specific AC subfield:

- Remote Management, Control and Configuration, a research field consisting of reusing and extending remote management protocols and service discovery standards as well as implementing modular and adaptive software architectures. It is mainly applied at Fraunhofer AICOS to cope with the lack of interoperability between devices and applications and the reduced remote management capabilities in AAL and ICT4D.



SMARTER MACHINES: LESS CONFIGURATION & MAINTENANCE

As a consequence of the work we carried out in the business subfield 'Fall and Activity Monitoring' related to the very interesting achievements regarding the related competences in 'Multimodal Information Fusion', we decided to increase our activities in order to prepare for the predicted market demand through the creation of a Fall Competence Center (FCC). The FCC concentrates our efforts and extends the scope to go beyond the current focus on fall detection and fall risk prediction to the two additional application fields of falls in extreme sports and incident detection for security and safety personnel. Likewise, we extended our activities in the emerging business field ICT4D through the creation of the ICT4D Competence Center (ICT4DCC), which concentrates all the competences required to develop and assess solutions for mobile devices in the application fields of mAgriculture, mHealth, mGovernment and ICT for Very Small Enterprises (business solutions for the growing micro-enterprises in developing countries). It also allows us to form an international team with guests from Africa and Europe that have the potential to create a joint melting pot for the related activities of Fraunhofer in Germany.

PROJECTS AND RESULTS 2014

EXTERNAL PROJECTS

In accordance with the Fraunhofer Business Model, two thirds of Fraunhofer Portugal's income should be generated by external projects which can have one of two formats: Industry Contract Research, i.e. projects having industry partners as clients, or Government Contract Research, i.e. projects resulting from the participation in national and EU publicly funded programmes. This section describes the external projects that are being developed at Fraunhofer AICOS.

AAL4ALL – Primary care standard for AAL services

Description: The goal of the AAL4ALL project is the mobilization of an industrial ecosystem of products and services within the scope of AAL (Ambient Assisted Living), focused on the definition of specific standards. Only by assuring interoperability between products and services is the mitigation of investment risk possible in this emerging area, thus creating a better offer of products and services.

Partners: Microsoft Portugal MLDC (coordinator); Associação CCG/ZGDV - Centro de Computação Gráfica; Be Artis - Conceção, Construção e Gestão de Redes de Comunicações; Casa de Saúde de Guimarães; CASO - Consultores Associados de Organizações e Informática; CeNTITVC - Centro de Nanotecnologia e Materiais Técnicos, Funcionais e Inteligentes; CITEVE - Centro Tecnológico das Indústrias Têxteis e do Vestuário de Portugal; Conforto em Casa; Critical Health; Escola Superior de Educação de Paula

Frassinetti; Exatronic - Engenharia e Electrónica; FCTUNL - Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa; FEUP - Faculdade de Engenharia da Universidade do Porto; Glintt - Healthcare Solutions; HCP - Health Cluster Portugal - Polo de Competitividade da Saúde; INOV - Inesc Inovação - Instituto de Novas Tecnologias; Inovamais - Serviços de Consultadoria em Inovação Tecnológica; IPN - Instituto Pedro Nunes - Associação Para a Inovação e Desenvolvimento em Ciência e Tecnologia; ISCTE - Instituto Superior de Ciências do Trabalho e da Empresa; ISEP - Instituto Superior de Engenharia do Porto; Optimus Comunicações; Plux - Engenharia de Biosensores; ProcessNet - Sistemas de Informação; PT Inovação; PT Prime - Soluções Empresariais de Telecomunicações e Sistemas; UBI - Universidade da Beira Interior; Universidade de Aveiro; Universidade do Minho.

Outcome: Definition of reference models for different environments that will reduce the investment risk and time-to-market of the products and services and establish solid partnerships with the national industry.

ACP Street Libraries – Culture for all 1

Description: The main objective of the ACP Street Library project is to contribute to the development of culture in ACP (African, Caribbean and Pacific Group of States) countries mainly by promoting the creation of new Street Libraries and the modernization of existing ones. The partners involved in the project also plan to develop a set of activities related to the ACP Cultural sector promotion and consolidation mainly by encouraging the preservation of local cultures that are currently only transmitted in oral format.



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There are four specific objectives associated to the project implementation, namely:

- Increase the number of ACP Street Libraries;
- Increase the number of books available for oral reading in ACP Street Libraries;
- Improve existing databases of ACP countries local culture;
- Improve ACP countries discussion and cooperation platforms.

The key stakeholders of the project will be actual and future cultural entrepreneur's, who will benefit from project or to promote and disseminate their artistic work; NGOs (Non-Governmental Organizations) and private and public institutions, who will benefit from the project by building the necessary capacity to create new Street Libraries and cultural projects; universities and research centres, who will benefit from the new project results by promoting technology transfer to the local students, local partners and international ACP members; and finally, the local population, children and young people of ACP countries, who will have access to more cultural resources and who will be able to preserve their local legends and histories for the future generations. All the actions developed in the project will comply with user centred design methodologies, being the end-users always directly involved in all the project activities.

Partners: Fraunhofer AICOS (coordinator); ASRAD - Appui Solidaire Pour Le Renforcement De L'aide Au Developpement; Microsoft Portugal MLDC; VPWA - Volunteer Partnerships for West Africa; YCWL - Youth Crime Watch of Liberia.

Outcome: This project aims at the creation of a set of actions, services and features supported on mobile technologies, that will allow actual and future cultural entrepreneurs, NGOs and private and public institutions, to leverage Street Libraries in ACP Countries, developing this cultural action at regional, national and international levels as well as maximize its impact on local populations, especially in children and young people.

ChefMyself – Assistance solution for improving cooking skills and nutritional knowledge for independent elderly people 2

Description: The main goal of the ChefMyself project is to develop a customizable, open and extensible ICT (Information and Communications Technologies) service ecosystem built around an automatic cooking solution to support elderly people in the preparation of meals and maintenance of healthy eating habits. A food processor with an accessible interface, specially tailored for older adults, will encourage elders' self-care, according to their particular nutrition requirements. Simultaneously, a social network, focused on the topic of healthy ageing and eating, will become a motivational tool for this user group to remain active, while encouraging existing social relationships and fostering new ones. The target group is composed of independent senior individuals with no severe illnesses or disabilities, not excluding those with some form of mobility or mild cognitive impairment.

Partners: CETEMMSA - Fundació Privada Cetemmsa (coordinator); ASM Market Research and Analysis Centre; Istituto Nazionale di Riposo e Cura per Anziani; Me.Te.Da.; Polne SL (Taurus Group); Unie KBO.

Outcome: The envisioned ChefMyself system can be divided into three main components – Cloud Services, User Interface and Food Processor – each interacting with the others over a set of secure, open and standardized interfaces. The proposed system will follow the cloud computing paradigm, ensuring security, scalability and reliability.

Clockwork – Smart System for the Management and Control of Shift Workers’ Circadian Rhythms

Description: The main goal of the Clockwork project is to create a healthy and comfortable work environment by supporting middle-aged to older adults in the improvement of their circadian rhythms. Particularly, the solution will target shift workers, such as healthcare professionals, who are greatly affected by chronodisruption, which can thus lead to health issues, long absences or early retirement.

This objective will be achieved through the enhancement of external synchronizers that will help older adult workers maintain a healthy and robust day and night rhythm by introducing some imperceptible modification in their environment.

To do this, three main tools will be used: an activity monitoring device, a feedback and support application framework and an innovative environmental circadian empowering system module, which includes the design of a lighting device, a wireless sensor network and actuators to regulate the environment. The feedback and support application framework is not only the platform that communicates with the user, but it is also responsible for managing the information gathered by the sensors and controlling the different devices to adjust the environmental conditions to the person’s needs.

Partners: Fraunhofer AICOS (coordinator); Ab.Acus; BCB Informática y Control; Grado Zero Espace; KOHS PIMEX; PT Comunicações; RK Tech; Università degli Studi di Ferrara.

Outcome: User activity monitoring and smart home environment to control users’ circadian rhythm.

EnAware – Domestic Energy Awareness 3

Description: The rising costs of energy and the increasing consumer awareness with regards to their ecological footprint, poses new challenges to industry. Especially in a domestic context, consumers demand energy efficient products and solutions that can be seamlessly integrated and which are easy to use. Moreover, the slow, but steady, introduction of the Smart Grid requires more intelligent domestic devices to enable Demand Side Management / Demand Response scenarios. The EnAware project addresses these challenges by developing an ecosystem of smart devices that are orchestrated by a home server. By allying the capabilities of the Advanced Metering Infrastructure (AMI) with Home Automation and domestic Intelligent Electronic Devices (IEDs), this project aims to innovate the way in which residential consumption data is presented and analysed in order to improve user comfort and, at the same time, motivate sustainable changes of behaviour.

Partners: EFACEC Engenharia e Sistemas (coordinator); Bosch Termotecnologia; EFAPEL - Empresa Fabril de Produtos Eléctricos.

Outcome: The EnAware system is composed of four main components: A household smartmeter provided by EFACEC, Zigbee-enabled smart-plugs and panels provided by EFAPEL, a Zigbee-enabled heatpump provided by Bosch, and the HomeServer developed and provided by Fraunhofer AICOS. The HomeServer is fully modular, being the main service developed using the OSGi (Open Service Gateway initiative) specification, and is able to interact with all the equipment, collect and report consumptions, define and execute schedules, create and execute scenes, define goals, etc. The HomeServer is also able to run pluggable data analysis engines that provide data aggregation for faster query response times,



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consumer behaviour analysis, energy efficiency rating, etc., and provides a comprehensive and intuitive web portal that raises energy consumption awareness.

E-NO FALLS – European Network for Fall Prevention, Intervention and Security 4

Description: The main goal of the E-NO FALLS Thematic Network is to integrate and bring together knowledge, experiences and best practices acquired at the European and international level in the area of fall prevention, intervention and safety, with the purpose of coordinating on-going activities and creating the necessary conditions and consensus on action plans, standards and specifications to ensure the widest future replication and co-deployment of innovative solutions (with special emphasis on Information and Communications Technology - ICT based ones).

Partners: Universitat Politècnica de Catalunya (coordinator); Ana Aslan International Foundation; Charite - Universitaetsmedizin Berlin; COOSS Marche ONLUS; Emergency Response; Fondazione Santa Lucia; FORTH-ICS; CETEMMSA - Fundació Privada Cetemmsa; Fundació TicSalut; MCRoberts BV; National University Ireland Galway (NUIG); Nordforce Technology AB; SeniorNett Norge; Siveco; Stichting Nederlands Normalisatie Instituut; Stichting Smart Homes, Nationaal Kenniscentrum voor Domotica & Slim Wonen; University of Limerick.

Outcome: The E-NO FALLS thematic network will be a forum for all stakeholders within the value chain (such as industry, user organizations, formal and informal care providers, public authorities, investors, housing and insurance companies and service providers across Europe) to share knowledge, expertise, resources, best practice experiences and to build consensus to highlight the remaining obstacles to be overcome and to eventually provide guidance for ICT-enabled solutions and their roll-out.



4

Epidemiologic Surveillance Platform

Description: The Epidemiologic Surveillance project led by the Portuguese company Critical Software aims to collect structured clinical data on isolated populations in developing countries, using mobile devices on low coverage networks, and relate it with geo-location and earth observation data. Through the analysis of correlated data and applying methods of business intelligence, the solution will allow detecting, monitoring, predicting outbreaks or epidemics, and acting to minimise the consequences of infectious diseases such as Malaria and HIV/AIDS.

Fraunhofer AICOS will collaborate in this project by providing its PostboxWeb framework to collect data in locations where there is no network coverage and transmit them whenever network is available. Fraunhofer AICOS will contribute with the technical and scientific knowledge in its areas of expertise, namely: information and communication technologies for development; mobile solutions; and interface design in human-computer interaction. In the course of the project, mobile applications will be developed together with a set of front-ends, for Malaria and HIV/AIDS, which will have an interface aiming at the massive use of a channel for health screening, and also featuring the automatic inference of the geographic locations where the clinical information is gathered.

Epidemiologic Surveillance also aims at the development of an interoperable health care monitoring system to allow the surveillance of the infectious diseases, generating estimates of the HIV/AIDS and Malaria in demarked regions, while assuring the interoperability with external health information systems.

Partners: Critical Software (coordinator); CINTESIS - Center for research in health technologies and information systems.

Outcome: In the course of the project, mobile applications will be developed together with front-ends, for Malaria and HIV/AIDS, which will have an interface aiming at the massive use of a channel for health records screening.

euPAmHealth – Eu Preciso de Ajuda - Sistema de Monitorização de Saúde e Localização de Emergência por GPS

Description: euPA Sistemas intends to develop a Caretaker Server that collects all the information from monitored patient's sensors and shows the information to the patients and to formal and informal caretakers.

Such server will rely on their (already developed) sensors and mobile application to collect health data about its users. We must ensure the system supports, among other features:

- Individualized access for patients, doctors and informal caretakers;
- Management of medical appointments;
- Historical registry of data collected by several sensors;
- Support for diverse sensors, including ECG (electrocardiogram);
- Wiki area for collecting frequently asked questions.

These developments will be split in two phases, a first one focused in the server's API (Application Programming Interface) and web interface, and a second focused on interactive features on the web application (wiki, position tracking, etc.).

Fraunhofer AICOS will reuse the technology developed in the eHealthCom project, which consists on a caretaker server that already has some of the features required in this context. However, additional developments are needed to fully comply with euPA's expectations.

The idea is then to improve eHealthCom's caretaker server with a new UI (User Interface), improved core API functionalities and integrate it with euPA's system.

Partner: euPA Sistemas (coordinator).

Outcome: The main outcome from this project is to enhance the caretaker server developed in the eHealthCom project. These outcomes can be summarized as:

- A more coherent and robust JavaScript Object Notation (JSON) API;
- Decoupling the API from the UI, which results in increased flexibility;
- Responsive UI, which works great both on large screens and smartphones;
- Streaming sensor data support.

Furthermore, at the end of this project, euPA might be interested in pursuing this further, with additional features on the backend.



FCC – Fall Competence Center 5

Description: The Fall Competence Center (FCC) aims to investigate in-depth all fall-related aspects, including activity monitoring and human motion analysis. The knowledge gathered in the FCC will be applied to viable solutions not only for fall detection, but also fall risk prediction and fall prevention. These technological developments are based on smartphones, since these devices are of easy access and continuously used in daily life. The new solutions have a great potential of being transferred to industry and converted into valuable solutions.

There are some specific groups presenting higher risks of fall and damage, the FCC target groups are:

- Elderly people;
- Patients with specific illnesses;
- Extreme sports athletes;
- Security Field Operatives.

Frequently these high risk individuals act/live alone and, after a fall, they are not able to ask for help and receive fast and efficient assistance, increasing the risk of serious injury after a fall. These groups clearly benefit from strategies to automatically send an alert and call for help when a fall occurs. Additionally to these reactive strategies, falls can be prevented by modifying some specific risk factors.

Preliminary research results suggest that wearable inertial sensors can be a major strategy both to predict and detect falls and these topics are gaining attention from the research community. However, these strategies are not yet widely implemented, which makes falls an under-addressed health issue.

The new fall management solutions resulting from the FCC will allow to improve the efficiency of the assistance provided upon a fall and consequently minimise injuries, psychological damage, limitations on mobility and reduced quality of life. Therefore, these solutions are expected to have an important impact not only for individuals at higher risk of falling, but also in terms of improving the sustainability of health care systems.

Partners: Fraunhofer AICOS (coordinator); Fraunhofer IDMT; University of Limerick; Universitat Politècnica de Catalunya.

Outcome: Within the duration of 30 months, three key results are targeted:

- Development of four advanced prototypes dedicated to three different target groups (elderly people & patients with specific illnesses, extreme sports athletes and security guards) based on mobile devices;
- Application for at least two patents to secure the Intellectual Property Rights outcome and to support the commercialization efforts;
- Sustainable operation of the FCC after the funding period according to the Fraunhofer Model and collaboration with other international partners besides Fraunhofer IDMT.



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The FCC will help to create 15 new research positions for students and researchers at Fraunhofer AICOS and, due to its international background, will also attract experts from outside of Portugal. The goals of the FCC have been endorsed by a number of leading international research institutions in the field, such as Fraunhofer IDMT, University of Limerick and Universitat Politècnica de Catalunya and are also in line with the strategy defined by the Health Cluster Portugal. Fraunhofer Portugal will make all the efforts to ensure that knowledge and results obtained will be disseminated into the related industry, reinforcing one of the main cluster objectives.

GameFoundry 6

Description: The main goals of this project are the implementation of a new platform for knowledge management and monitoring of human behaviour based on the use of network games. It is intended to give the users the possibility to play games in different environments and on different platforms. Also, it allows publishers to independently create a set of games with proprietary contents, accessible over the network, supplying each of them on all supported platforms: web, mobile, Facebook, Google+ and TV. A data warehouse is set up to store all gaming data and on which new data-mining and statistics algorithms will be applied to provide useful and meaningful data to the publishers, becoming a useful decision making support tool for marketing actions.

Partner: Ubbin Labs (coordinator).

Outcome: New data-mining and social-mining algorithms for the extraction of information and automatic pattern recognition of the gaming experience for the characterization and classification of users based on personal data and interests retrieved from social networks accounts, as well as other geographic and demographic data.

GRA ICT4D – Green and Low-Cost Wireless Communication Network for Africa

Description: The GRA ICT4D project runs under the auspices of the GRA (Global Research Alliance), an international organization promoting the application of science and technology to solve large scale issues in developing countries. The goal is to develop a green and low-cost wireless communication network and mobile applications for rural Zambia. Fraunhofer AICOS contributes with mobile software solutions which will be piloted on top of the developed communication infrastructure.

Partners: Fraunhofer AICOS (coordinator); CSIRO - Commonwealth Scientific and Industrial Research Organisation; CSIR Meraka; Fraunhofer FOKUS; Macha Works; VTT Technical Research Centre of Finland.

Outcome: GRA ICT4D will further refine Fraunhofer AICOS ICT4D (Information and Communication Technologies for Development) strategy as it follows AICOS A4D (Android for Developing) approach. Pre-commercial software toolkits for mobile devices will be developed to support the acquisition of external projects in the future, e.g. the project will use and further extend PostboxWeb.

ICT4DCC – ICT4D Competence Center

Description: The ICT for Development Competence Center (ICT4DCC) is an evolution of the highly successful Android for Developing (A4D) project that Fraunhofer AICOS carried out in 2009/2010 with partners from industry (SAP Research, South Africa; PT Inovação, Portugal) and science (Centro de Informática da Universidade Eduardo Mondlane, Mozambique).

The goal of the ICT4DCC is to set up a team of international experts at Fraunhofer AICOS that are dedicated to the field and that will, within the related project, work with international partners from Mozambique (Centro de Informática da Universidade Eduardo Mondlane), South Africa (Nelson Mandela Metropolitan University), Germany (Fraunhofer FOKUS) and Portugal (Center for Economics and Finance of the Faculty of Economy of the University of Porto) to develop dedicated pre-commercial ICT (Information and Communications Technologies) solutions for:

- Production in Agriculture (mAgriculture);
- Very Small Enterprises (VSE);
- mHealth;
- mGovernment.

These activities will be accompanied and the solutions will be based on a set of transversal activities related to:

- Socio-Economic Impact of ICT4D (Information and Communication Technologies for Development);
- Local Requirements and Key Performance Indicators (KPI) assessment;
- Human Computer Interaction (HCI) and User Experience (UX);
- Low Cost Networks;
- Knowledge Transfer.

The main objective of the ICT4DCC is the investigation of all aspects and challenges of the application of state of the art of ICT in developing countries, with an initial focus on the African Sub-Saharan region namely Mozambique and South Africa. In addition, the Competence Center will focus on the development of several activities that will bring a sustainable benefit to the developing countries and the European partners.

Partners: Fraunhofer AICOS (coordinator); CIUEM - Centro de Informática da Universidade Eduardo Mondlane; FEP-CEFUP - Center for Economics and Finance at the University of Porto; Fraunhofer FOKUS; NMMU - Nelson Mandela Metropolitan University.

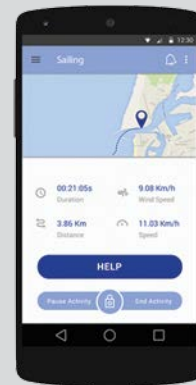
Outcome: The key objective of the project is to supply pre-commercial ICT solutions for the populations of developing countries in the fields: mAgriculture, ICT for Very Small Enterprises, mHealth, mGovernment.

The results of the dedicated activities will be pre-commercial software solutions that fit the demands of the different fields, are iteratively tested and trialed and will be ready for deployment by enterprises that will need to customize, operate and maintain them. Depending on the solution, the enterprise will also need to provide specific content (e.g. expert know-how on crops, illnesses, etc.).

All in all the outcome of the project will be dedicated tool-boxes in order to start a rapid commercial deployment. Thus the result of the project will help to increase the growth of the ICT sector in Mozambique and Sub-Saharan African countries and will provide additional opportunities to Portuguese enterprises to participate, either as business partners of the ICT companies, or as indirect beneficiaries from the business sectors that profit from the ICT solutions.



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mWaterSafety – Mobile Water Safety System 7

Description: The mWaterSafety project will enable the development of a new technological solution aiming to increase safety in nautical activities dedicated to fishing communities and watersports athletes, such as sailing and windsurf practitioners.

This solution is based on coupling smartphones and external sensors to vessels to obtain information about their positioning and routes. This information will be processed in real-time by an independent alarm management framework that will identify high risk situations and automatically send notifications to the community or trigger the intervention of rescue teams. In the case of watersports the solution will additionally enable to obtain performance metrics that can be shared with coaches and colleagues and used to improve training techniques.

Partners: PontoC (coordinator); Associação Náutica da Gafanha da Encarnação; Clube de Vela da Costa Nova; Direcção-Geral da Autoridade Marítima (DGAM); PT Comunicações (PT); Sporting Clube de Aveiro.

Outcome: The main outcome will be an information system that receives information from several sensors (smartphones and other external sensors) carried by the sailors and boaters during their nautical activities.

At the security level, an alarm management framework will be developed, which will allow the detection of abnormal events that might generate an alert, such as a boat that is upside down or a boater who is moving away from his boat. This framework is intended both to nautical sports organization entities (sailing clubs, yacht clubs, windsurf associations) and fishing communities wishing to ensure the highest levels security for their members.

On sports performance, data from sensors will be collected to monitor several performance metrics such as: routes, travelled distances, average speed and the height of a jump. It will also be possible to share this information with coaches, friends, clubs and communities.

NST – Health Sensor Gateway Demonstrator

Description: The Portuguese company Exatronic is developing its vital sign sensor gateway and requested the development of a first prototype for a demonstrator. This demonstrator is able to communicate with two vital sign sensors and interact with a PHR (Personal Health Record) in order to store measurements. Also, the included HMI (Human Machine Interface), a touch panel, is supported and used to interact with the system.

In the scope of this project, Fraunhofer AICOS developed a FW (Firmware) image for the forthcoming sensor gateway from Exatronic. The FW for the gateway supports txxxxxhe integrated HMI and includes all the Managers developed in the scope of the eCAALYX and CAALYX-MV projects (Sensor Manager, Configuration Manager and Backend Manager). The prototype for the demonstrator supports two vital sign sensors and is able to send measurements to a PHR. Fraunhofer AICOS also developed the mock-ups for the GUI (Graphical User Interface) and was in charge of implementing them.

Partner: Exatronic - Engenharia e Electrónica (coordinator).

Outcome: Improvement of some components developed in eCAALYX and CAALYX-MV.

Involvement in firmware development of Exatronic's NST solution, potentially leading to a licensing model if the solution reaches the market.



OUTSIDE – Outage Management System for Improved Distribution Networks Efficiency

Description: The goal of this project is to develop an Outage Management System that will improve the operational management of a power distribution system, therefore reducing the occurrence of blackouts.

The system should be interoperable with existing solutions like SCADA (Supervisory Control and Data Acquisition), DMS (Distribution Management System), WOM (Work-Order Management), CIS (Customer Information Systems), IVR (Interactive Voice Response) enabled Call Centers, WFMS (Work Force Management Systems), GIS (Geographic Information Systems) and MDM (Meter Data Management).

Current solutions are very limited in what interoperability is concerned and do not support the widely spreaded power metering tools. This solution will allow a real-time knowledge about planning, development and conclusion of corrective interventions in the power distribution network, based on the Smart Grids paradigm. The INOVGRID sub-network will be used for testing and demonstration.

Partner: EFACEC Engenharia e Sistemas (coordinator).

Outcome: A simulator of outages on the power distribution network, allowing a better understanding of their impact on the network, a better planning of interventions and providing useful data for analysis. The simulator should have interfaces with the aforementioned existing solutions and will also be used for demonstration purposes. The major goal of this project is to have a better efficiency of the power distribution network, lowering power wastage and therefore improving the environment.

REMPARK – Personal Health Device for the Remote and Autonomous Management of Parkinson’s Disease 8

Description: The specific and ultimate goal of the REMPARK project is to develop a Personal Health System (PHS) with closed loop detection, response and treatment capabilities for management of Parkinson’s Disease (PD) patients at two levels:

- At the first level, the project will develop a wearable monitoring system able to identify, in real time, the motor status of PD patients and evaluate ON/OFF/ Dyskinesia status with a sensitivity level greater than 80% and a specificity level greater than 80% in operation during ambulatory conditions. It will also develop a gait guidance system that is able to help the patients in real time during their daily activities;
- At a second level, the system will provide intelligent analysis of data, fed by the first level, and will be supported by a disease management system. This will allow neurologists to access accurate and reliable information to make better informed decisions about the treatment that best suits the patient, improving the management of their disease, in particular to adjust so called therapeutic window.

To achieve this global goal, four main objectives need to be achieved:

- Identification of motor status in real time;
- Development of a gait guidance system;
- Development of a user interface to collect direct feedback from the patient;



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- Development of a server to allow interaction with the doctor in charge and track the evolution of the patient's condition.

REMPARK system will be tested in 60 real patients from four medical centres. The consortium is formed by medical and technical renowned specialists; PD patients are represented through the participation of the European Parkinson's Disease Association.

Partners: Universitat Politècnica de Catalunya (coordinator); Association européenne pour la maladie de Parkinson; Centro Médico Teknon; Fondazione Santa Lucia; M&M Qualtech; Maccabi Healthcare Services; National University Ireland Galway (NUIG); Neusta Mobile Solutions Group; Nordforce Technology AB; Telefonica Investigacion y Desarrollo.

Outcome: Specification and development of a mobile gateway communication service for interconnection of the sensors and actuators. Smartphone user interface development for management of Parkinson's disease.

S4S – Smart Phones 4 Seniors 9

Description: Smartphones for Seniors (S4S) is a QREN project that aims to create smartphone applications that improve the quality of life of older adults, by fostering their autonomy, promoting their social interaction and providing tools that unobtrusively monitor their health.

The World population is growing older and it is estimated that, by 2060, 30% of the population in Europe will be over 65 years old (Eurostat, 2011). Simultaneously, trends suggest that smartphones will be the dominant status quo. Hence, and due to the current stepping into retirement of the Baby Boom Generation, smartphones will soon enough reach seniors.

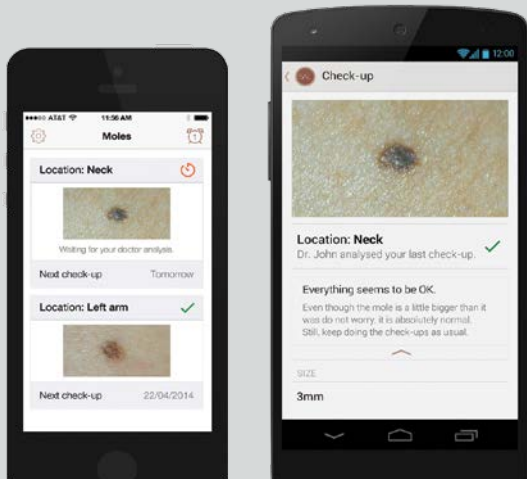
Nowadays, smartphones are not inclusively designed to bear in mind older adults' needs. However, if designed with and for older adults, smartphones have the potential to be central in three main areas:

- Prevention of isolation;
- Promotion of autonomy and enhanced quality of life;
- Improvement of health conditions.

The S4S project was devised to tackle the unsolved problems and boost the potential benefits of smartphones in older adults' lives by creating a set of applications tailored to seniors' needs. To do so, project partners have engaged in user research and used the knowledge gathered in it to create a set of applications for Windows Phone 7: a game for fall prevention, easy web search using natural language, social interactions (e.g. easy access to social networks), checking phone balance, activity register, appointments and reminders, medication management and alerts.

Partners: Microsoft Portugal MLDC (coordinator); DevScope - Soluções de Sistemas e Tecnologias de Informação; FCUL - Faculdade de Ciências da Universidade de Lisboa; OPTIMUS - Comunicações; Universidade de Aveiro; WIT Software.

Outcome: Development of applications for the Windows Phone environment in the areas of health/well-being and leisure/recreation (Dance. Don't Fall! for Windows Phone).



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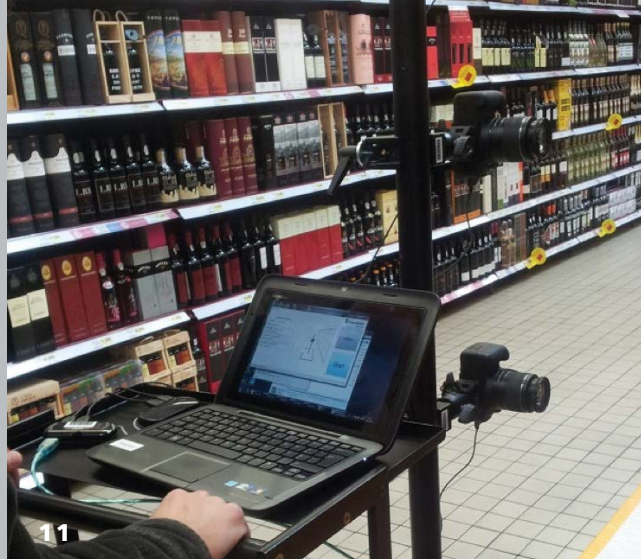
SAL – Service Assisted Living 10

Description: The Service Assisted Living project (SAL) is an Applied Engineering project that will study the application of Service Engineering and the adoption of Ambient Assisted Living technologies in the construction and operationalization of Complex Integrated Systems, namely the new Information and Communication Technologies in Health.

In Portugal, some of the new technological challenges are already well known, as the recently implemented e-Prescription. Other technological innovations are already scheduled as, for example, the Health Data Platform. Despite the large number of challenges that the Portuguese Health Ministry faces in the ICT (Information and Communications Technologies) domain for the next two years, to which this project intends to answer, the internationalization of the partners' activity and the exportation of the products resulting from the project is their main goal.

With the Industrial Research and with the resulting innovation, SAL will design and develop products in four specific areas, namely, skin lesions risk evaluation and skin cancer prevention; healthcare for Melanoma patients, haemophiliacs and hypo coagulation patients; component for the blood chain at the national and regional level; and component for transfusion security and blood surveillance in hospital internal blood services.

The SAL project will be developed in partnership by Glintt HS, the Engineering Faculty of the University of Porto and Fraunhofer AICOS, through the integration of the competences of the three entities for the research, innovation and consequent design of New Technical Solutions for Health.



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Partners: Glintt - Healthcare Solutions (coordinator); FEUP - Faculdade de Engenharia da Universidade do Porto.

Outcome: The research results and Industrial Innovation that will result from SAL will be applied in the design and construction of marketable products, that answer the questions and challenges faced in the new paradigm in which the Citizen/ End User/Patient has a central and active role in Health Management.

ShopView 11

Description: Planning the shop layout is one of the most crucial tasks in the retail business nowadays. The right placement of products in a modern supermarket determines significantly the number of sold items. To maximize the overall income, supermarkets optimize the shelf layout and put products with a high profit margin on prominent places in the aisles. The manufactures of the products are willing to pay the supermarkets a so called shelf rent, in order to influence the shop layout and to promote their own goods. The wrong placement of a product might therefore not only result in worse revenue, but also in contractual penalties. As the shop layout changes frequently, there is a permanent need for control which involves high costs since currently the task must be manually performed.

Partners: WeDo Consulting - Sistemas de Informação (coordinator); Modelo Continente Hipermercados.

Outcome: The aim of the ShopView project is to automate the task of controlling the implementation of planograms, by creating a system which uses state of the art image processing technology to recognize misplaced products. The system will consist of a semi-automatic device to take images of the supermarket and software which performs the image processing and compares the real world data with the information stored in the planning software of the supermarket. The ShopView system will significantly decrease the rate of wrong product placements while decreasing costs of control at the same time.

SMARTSKINS – A novel framework for Supervised Mobile Assessment and Risk Triage of Skin lesions via Non-invasive Screening

Description: This project aims to design and effectively develop and implement a framework of risk triage of skin cancer, which uses a new generation of mobile devices in its architecture to capture the images. The framework is going to automatically pre-process and segment mobile-acquired skin moles images, as well as perform image registration and extraction of significant features for risk assessment and Melanoma pre-diagnosis purposes. The automatic risk assessment will be based on machine learning methods using extracted features, cross-correlation analysis, additional information available submitted by the patient and an adaptive reference atlas of classified skin lesions. The images that make up the reference atlas are previously classified by dermatologists and are used to provide a highly reliable triage of lesions based on images acquired by low cost devices such as smartphones.

Partners: INEGI-LAETA (coordinator); Instituto Português de Oncologia.

Outcome: Development of pre-processing computational techniques for image enhancement and illuminance corrections of mobile-acquired images.

Development and implementation of a segmentation method specifically designed for skin lesion images acquired from mobile devices.

Selection and effective extraction of significant features from mobile-acquired skin images, for risk assessment purposes.

Development of machine learning approaches for the automatic classification of skin lesions. The machine learning classifiers will be trained with an adaptive reference atlas of skin lesion images.

Design and implementation of the Mobile Risk Triage Framework prototype, which automatically pre-processes, segments and extracts significant features for skin cancer pre-diagnosis and risk assessment of mobile-acquired skin images.



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INTERNAL PROJECTS

In order to foster core competence building and to enhance our team's experience, we frequently assess ideas and launch internal project initiatives.

ExerGames – Multi-sensor interactive games for physical activity, rehabilitation and fall prevention 12

(Associated with the FCC)

Description: The ExerGames project aims at developing interactive games for physical activity and rehabilitation, as well as for fall prevention, in which the user's movements are monitored using sensors. The selected approach is to design and implement a multiplatform framework that provides all the needed software interfaces for the games (sensor data, user profile management, etc.), which can be developed without being tied to specific equipment or service, thus achieving maximum modularity.

The framework already supports a wide array of motion sensors, which are commercially available and low-cost, such as Microsoft Kinect, Leap Motion, Orbotix Sphero or even smartphones and smartwatches. All game session data, including sensor data, may be stored for further analysis.

Partner: Centro de Reabilitação Profissional de Gaia (CRPG).

Outcome: A multiplatform (desktop/mobile/web) solution for featuring several interactive serious games focusing on physical rehabilitation for patients that suffered stroke or other neurological accident, as well as on fall prevention, with games promoting exercises that are known to reduce the risk of fall by improving balance, muscular strength, mobility and flexibility.

Fall Detect – Smartphone-based Fall Detection

(Associated with the FCC)

Description: The Fall Detect project aims at developing a smartphone-based fall detection solution to identify dangerous fall events and consequently alert emergency contacts when the user does not recover.

The data from the smartphone built-in accelerometer is continuously screened and upon the detection of a fall event, the user's location is tracked and SMS and email notifications are sent to a set of contacts.

Outcome: Smartphone app capable of screening the user's movement, detect falls and notify emergency contacts.

Fall Risk Assessment – Smartphone-based Fall Risk Screening 13

(Associated with the FCC)

Description: The Fall Risk Assessment Tool is a smartphone-based tool aiming to assist healthcare professionals on the execution of the fall risk evaluation tests, based on the smartphone built-in inertial sensors, both at seniors' homes and clinical environments.



Another tool, the My Fall Risk Meter aims to provide the elderly users with the means to monitor their fall risk factors continuously over time. This tool is meant for a daily-basis, unsupervised assessment of fall risk factors. The smartphone built-in inertial sensors are used to continuously assess the mobility of elderly users, as they perform their usual daily activities. Specific mobility impairments are assessed using exercises or serious games. Smartphone-based questionnaires are used to assess behavioural and environmental factors.

Partners: Escola Superior de Tecnologia da Saúde de Coimbra (ESTeSC); Escola Superior de Tecnologia da Saúde do Porto (ESTSP).

Outcome: Smartphone app for the execution of standard fall risk assessment tests by healthcare professionals.

Smartphone app for continuously self-assessment of fall risk factors over time.

FUSAMI – Fraunhofer Usage Mining (Associated with the ICT4DCC)

Description: The Fraunhofer Usage Mining (FUSAMI) system offers smartphone developers and HCI (Human Computer Interaction) specialists a cloud platform to perform advanced analytics on real-time usage data. The system helps developers to get a better insight into the user's interaction and to unveil usability issues. It observes the user's interaction in a real application and applies state of the art analytical algorithms to find and visualize hidden patterns in the user interaction. Thus, FUSAMI draws attention to possible design issues which could have negative impact on the User Experience.

Outcome: A system which can be easily integrated into nearly any existing Android application through a simple API (Application Programming Interface) that is able to collect and analyse usage data to find hidden patterns and provide insight into user's usage habits.

Heart Failure Clinic Internal 2014 14

Description: Heart failure is a serious condition associated with high mortality and morbidity rates. Heart failure is also one of the most expensive medical conditions to treat, mainly due to the high levels of hospitalization and readmission rates associated with these patients. Despite recent advances in therapy, heart failure patients still suffer from repeated hospitalizations which are mainly due to the progression of their disease, low commitment to diet and medical therapy and to limited access to medical care. The Heart Failure Clinic project goal is the development of a remote monitoring system which enables daily contact with healthcare experts and thus facilitates regular short-term evaluation of the disease status and early detection of decompensation signs and symptoms.

Partner: FMUP - Faculdade de Medicina da Universidade do Porto.

Outcome: By using a mobile application and a set of associated monitoring devices, patients are able to measure several vital signs and symptoms, determined as relevant by a group of cardiologists currently collaborating with the project. The information related to the patient's pulse rhythm, heart rate, blood pressure, weight, bio-impedance, presence or absence of crackles and the answer to simple questionnaires with symptom related questions, is stored on the patient's smartphone and sent to a remote server. This server processes the vital signs of each patient and, according to pre-established



rules and medical patterns, classifies the patient status and notifies a physician in case of need. The Heart Failure Clinic application contributes to a timely intervention on the patient's disease.

Hydroponics – Assistive Environment for Hydroponic Farming 15

(Associated with the ICT4DCC)

Description: The Assistive Environment for Hydroponic Farming project aims to analyse the requirements of hydroponic farms in South Africa and Mozambique and suitably develop a mobile solution for farmers in order to improve the level of management, control and production of hydroponic farms. This approach makes possible for farmers to get to know the conditions in the hydroponic farm without physically visiting the farm, thereby saving time and reducing labour intensity while collecting accurate data.

Hydroponic farming is a means of precision agriculture where plants are grown in mineral nutrient solution instead of soil. Since it offers a controlled environment, this type of farming became popular in South Africa, making agriculture more practicable in lands with poor soils or recurrent droughts and floods. The effective management of hydroponic farming requires constant monitoring of inside and outside parameters: monitoring temperature, humidity, turbidity of the nutrients' solution, watering, among others. Currently, the whole process of monitoring the conditions in the hydroponic environment is done by manual systems, which are time consuming, labour intense and prone to inaccuracies.

The primary goal of this project is to develop a low cost mechanism for mobile monitoring of hydroponic farms. This includes the development of WSNs (Wireless Sensor Nodes), as well as a mobile application to be easily and effectively used by farmers to reduce the time involvement required to monitor a hydroponic culture. The envisaged solution will allow real time monitoring of environmental factors (ambient temperature, ambient humidity, hydroponics bags' water level, pH, lighting, etc.), as well as provide graphical data, crop statistics and equipment fault warnings.

Local hydroponic farmers from South Africa are the main target of this project since they will see their system optimized, saving time and money in their cultures.

Partner: NMMU - Nelson Mandela Metropolitan University.

Outcome: The result will be a prototype of a wireless sensor node based Android application to accurately monitor the essential variables for optimal plant growth in hydroponic environments. The system is expected to maximize crop yield with minimum resources. Globally, the initiative aims to boost farming markets in developing countries in sub-Saharan Africa.

IZIDoc – Digital channel for administrative processes *(Associated with the ICT4DCC)*

Description: The IZIDoc project targets the simplification of Mozambican administrative acts that require personal attendance at service provider's facilities (administration, police, pharmacy, bank, etc.). A mobile solution is being developed to inform citizens of the availability and status of the requested goods or services. This will save time and avoid useless dislocations. From the service provider point of view, this solution will also reduce queuing and will optimize customer service.

When a citizen needs to obtain an official document (Identification Document, Passport, Visa, criminal record, statements, certificates, etc.), it is advantageous to know, among others, the requirements for getting it, the place, the price and the time it will take. The lack of information leads many people to the service provider's facilities, usually waiting a lot of time in long queues. Especially in developing countries, a notification mechanism to alert citizens about the status of document's procurement would have many advantages for both citizens and service providers.

The project focuses on the development of a mobile application that allows to search information related to different types of documents addressing service requirements, places where to go (with map visualization), timetables, costs, average waiting times, document processing times, among others. It will also allow to search for people or friends who have already dealt with the same type of document. Furthermore, a notifications module will alert citizens when the document is ready to be collected.

Similar ideas are already implemented in developed countries, where this type of service is usually integrated within a web platform of the entity that emits the documents. However, in Mozambique, this project will have a special impact since IT (Information technology) and Internet services have still little presence. The innovation of this initiative relies on a mobile platform for Mozambicans, integrating different administrative services / institutions in one application.

This project wants to provide Mozambican citizens quick and easy access to official administrative acts' information, giving real-time notifications about the status of their request.

Governmental Institutions (e.g. Conservatories, Criminal records, etc.) will also benefit from the optimization effort and reduction of waiting queues.

Partner: CIUEM - Centro de Informática da Universidade Eduardo Mondlane.

Outcome: This project will first be implemented in the secretariat services of a Mozambican University aiming to leverage awareness on the advantages of this kind of products and to influence other service providers to adopt the solution.

MalariaScope – Digital Analysis of Malaria Infected Blood Smears via Mobile Devices 16

(Associated with the ICT4DCC)

Description: Malaria is a leading cause of death and disease in many developing countries, where young children and pregnant women are the most affected groups. In 2012, there were an estimated 207 million cases of Malaria, which caused approximately 627.000 Malaria deaths. Around 80% of Malaria cases occur in Africa, where the lack of access to Malaria diagnosis is largely due to a shortage of expertise, being the shortage of equipment the secondary factor. This lack of expertise for Malaria diagnosis frequently results on the increase of false positives, since prescription of medication is based only on symptoms. Thus, there is an urgent need of new tools that can facilitate the rapid and easy diagnosis of Malaria, especially in areas with limited access to quality healthcare services.



MalariaScope is a project included in Fraunhofer AICOS Information and Communications Technologies for Development Competence Center (ICT4DCC), in cooperation with the infectious diseases department of the Instituto Nacional de Saúde Dr. Ricardo Jorge. This project aims to create a mobile-based solution that can provide an effective pre-diagnosis of Malaria to be used in medically underserved areas. It is intended to use the new generation of cellular phones in the system architecture, which exhibit significant improvements in terms of image acquisition and image processing and that are becoming widespread worldwide, even in developing countries. Moreover, this project aims to create a magnification gadget that can be connected to the smartphone and provide the necessary magnification capability. Thus, the project is divided into three main components: the optical magnification component, the image processing and analysis component, and the smartphone application component.

Partner: Instituto Nacional de Saúde Dr. Ricardo Jorge.

Outcome: Optical Magnification - the project aims to develop a cheap alternative to the current microscopes, that can easily be adapted to a smartphone and to be used in the field. The aim is to use the smartphone built-in camera to capture the images for further analysis. The process will be to place the smartphone in the adapter along with the blood smear, and have the smartphone image sensor to record a set of magnified images. This collection of images will then be processed, analysed and provide an analysis report of the blood smear. It is expected that the step for recording the several images to use a fixed magnification factor, discarding the need for a complex mechanical mechanism (currently available in a typical microscope). It will be a bonus to obtain a self-powered motorized automated stage system that can move the blood smear and allow the automatic capture of several snapshots of the sample.

Image Processing and Analysis - for the automatic detection of Malaria parasites, this project aims to investigate computer-aided methods that can be used for the successful automatic analysis of Malaria-infected blood smears. The main objective of this component will be the development of an image processing and analysis module designed for: (1) The determination of the parasite density in a blood sample image; (2) The identification of the species (currently with major focus for the *Plasmodium Falciparum*) and life-cycle stage of the detected parasite (currently with major focus to the trophozoite stage).

Smartphone Application - the MalariaScope solution is envisioned to be used by technical personnel without specialized knowledge in Malaria diagnosis. The user collects and prepares a blood sample of the patient, introducing it in a slot in the optical magnification prototype. Using the companion mobile application, installed in a smartphone that is coupled to the optical magnification prototype, the user can create new patients and add new samples (and the corresponding views) to a specific patient. The user can then take pictures of the sample using the smartphone's camera, while using the stage XY axes controllers on the prototype to change the magnified views. The captured views can then be sent to analysis through the mobile app, which returns a report indicating the parasite density of each sample, so the correct procedures and medication can be administered.



Mover – Smartphone-based Activity Monitoring 17

(Associated with the FCC)

Description: Physical inactivity has been identified by the World Health Organization (WHO) as the fourth leading risk factor for global mortality. Mover is an application aiming to track all the movements of the user resorting exclusively to the built-in accelerometer from the smartphone. Mover is able to monitor the users' physical activity, motivating them to become more active.

Partner: Centro de Investigação em Actividade Física, Saúde e Lazer (CIAFEL) - Sports Faculty of University of Porto (FADEUP).

Outcome: Smartphone app to classify in real-time ambulatory activities and postures of the user and compute number of steps and speed of walking or running.

OurMoz online – Crowdsourcing platform to provide information based on the need of citizens

(Associated with the ICT4DCC)

Description: OurMoz online aims to be a mobile platform that provides real-time geotagged information of what is happening within Mozambican cities, everything obtained through citizens' contribution. The purpose is to combine the social network concept with citizen reporting and eCommerce. Information is thus collected and shared, being available for everyone. Associated parameters such as the lifetime of information, number of similar reports, number of positive feedbacks, etc., will provide consistency and credibility to the platform.

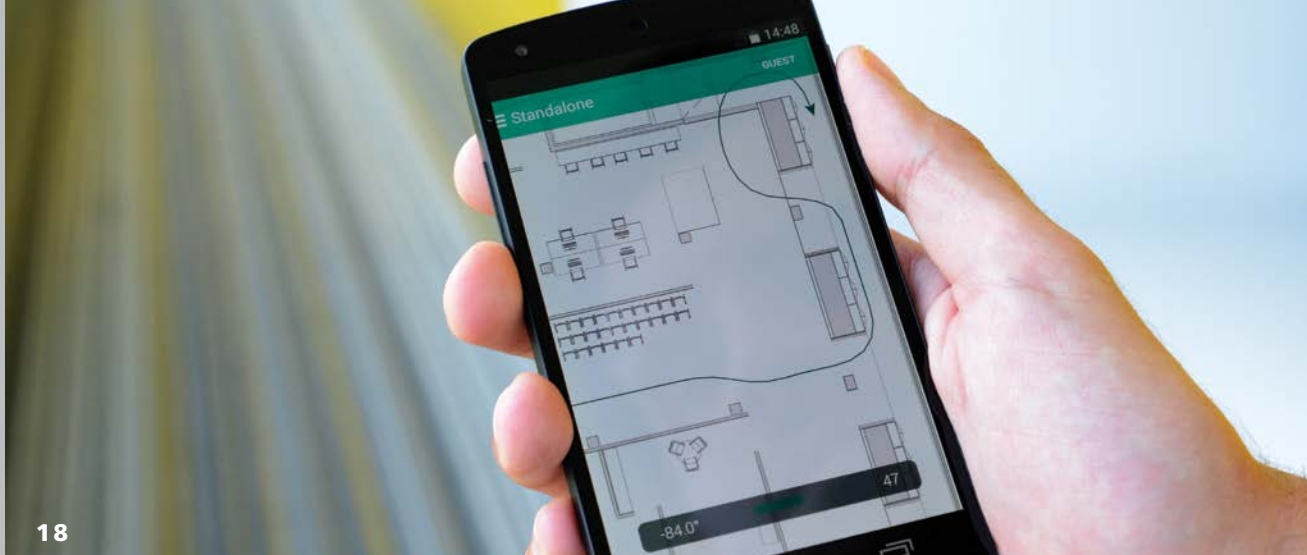
Citizens of developing countries have little access to information and poor involvement in what is related to local businesses, community services or institutional entities. The increasing adoption of smartphones in Mozambique opens thus an opportunity for mobile crowdsourcing platforms, which allow real-time gathering of contributions from a large local community. When used to enhance city services, it can be very useful, letting citizens play an active role in their community.

The objective is to create a mobile application to collect, report, share and search for information about all things that matter to citizens: from businesses' opening hours and promotions, to community problems, important events, advice and much more. Registered users (reporters/scouts) can provide geotagged facts and occurrences, while unregistered citizens can only add temporary information and see what happens in their neighbourhood. Institutional consumers can visualize stats or anonymous reports (e.g. a broken tube in a road, a leak in the roof of a school, etc.), which might be extremely valuable to promptly react to eventual problems.

This initiative is fully citizen centered: information is relied from citizens to citizens. The innovation lies in the combination of different types of services, namely eCommerce, social network and citizen reporting, in one platform tailored to developing countries.

Partner: CIUEM - Centro de Informática da Universidade Eduardo Mondlane.

Outcome: The first deployment of the mobile platform will be more focused on eCommerce and business directed information. It is anticipated that this platform will boost small commerce and enhance the engagement between citizens and other local stakeholders.



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PIL – Precise Indoor Location 18

(Associated with the FCC)

Description: Indoor location systems are an important enabling technology for applications such as indoor navigation, public safety and security management, ambient intelligence, as well as provide huge potential around advertisement and retail businesses.

Because of the lack of reliable GPS (Global Positioning System) signals inside buildings, the so-called pedestrian navigation systems (PNS) have been emerged as a solution for the indoor positioning unsolved problem. These systems rely on dead reckoning algorithms based on fused data provided by an Inertial Measurement Unit (IMU).

Since smartphones embrace always-on and sensor fusion was already a topic studied at Fraunhofer Portugal, under the scope of FCC, using these devices as IMUs seemed to be the obvious solution to achieve a highly accurate indoor location system at very low cost.

Dead reckoning based on the fused data provided by IMU on the smartphones can then be used to evaluate one's current position by using a previously determined position. Location-based sensor fusion will become a standard feature in next generation smartphones.

Since dead reckoning is subject to cumulative errors, navigational aids are needed in order to give accurate information on position. This aided information can be gathered from any system that can provide reference points with increased resolution.

In order to evaluate the accuracy of this location-based sensor fusion, Fraunhofer Portugal approach relies on the Ultra Low Frequency Magnetic Communication (ULF-MC) system as a navigational aid. ULF-MC is a communication technology developed at Fraunhofer Portugal in 2012, that when combined with a last fix from a Global Navigation Satellite System (GNSS) will lead to absolute coordinates.

Outcome: This project will result in a service which maps navigational aids on a real-world indoor map model and project the path information, retrieved by the smartphone, over it.

PostboxWeb – A framework for occasionally connected and shared Android smartphones

(Associated with the ICT4DCC)

Description: The African mobile market is the fastest growing mobile market worldwide, and prices for related technologies, including smartphones, are falling rapidly. The number of mobile device users is growing so fast that there are predictions that those countries will miss the PC (Personal Computer) era and will accomplish all their needs through smartphones and alike. Many people have adopted mobile phones for daily tasks, which range from basic communication with relatives to small family business support, either for communicating with customers or receiving service requests. However, missing or intermittent network coverage and low available bandwidth still pose serious barriers to mobile applications which rely on the Internet, especially in rural areas. Additionally, even though mobile phones and even smartphones' entry prices are quickly falling, shared phone usage in developing countries remains a very common reality.



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Taking these two facts into account, a framework called PostboxWeb has been developed and tested for Android which addresses the aforementioned issues. On top of this framework, a developer is able to create offline-capable native Android applications linked to REST (Representational State Transfer) services, which synchronize their data with the network only when sufficient connectivity is available. The framework supports data caching, multi-user access and sensitive data protection. The framework allows interested parties to adapt to these countries' realities as it is multi-user-capable with the possibility to manage users and possesses an incorporated personal data storage space that corresponds to each user, thus taking into account the prominent reality that shared phones are a common usage model in developing countries. There is also the possibility of profiling the users and logging their network traffic volumes to support a paid business model thus creating an additional new model for communications and phone rental.

In addition to this, the increased processing power and available sensors in the smartphone (e.g., GPS - Global Positioning System) provide an excellent way to manage and collect information for applications like medical surveillance, which can be tailored to developing countries.

Outcome: A simple, stable and developer-friendly API (Application Programming Interface) was developed and tested, and is viable in real scenarios, offering:

- Offline support;
- Automatic data synchronization with 3rd-party REST services;

- Geolocation data retrieval;
- Multi-user support with traffic and session management;
- Multiple data collection applications support;
- Data transfer support between devices via Bluetooth and NFC (Near Field Communication);
- Sensitive data encryption.

SAFETY – A Solution for Field Operatives and Operations Management 19

(Associated with the FCC)

Description: In the SAFETY project a smartphone-based system is being created to assist in operations management. The aim of the project is increasing the safety of Field Operatives and allow them to document their activities easily.

This solution is meant to support and simplify operations that need to have several operatives widely deployed in the field and a remote operations manager. While having operatives widely deployed on the field, it is difficult for managers to keep updated with real-time information, thus the aim of this solution is to enable Operation Managers to always have access to the latest information, allowing them to more effectively manage and take timely and informed decisions.



The solution consists of three main modules:

- Field Operatives Device: a smartphone is attached to the operative's chest, for example in the vest, with the camera facing forward to enable the video streaming of the operative's field-of-sight to the operations manager. Moreover, the smartphone is used for activity monitoring and detection of other relevant events in the safety context (e.g. falls, impacts, path/route). When available, connecting a heads-up display unit to the smartphone may enable the operative to receive visual information;
- Backend Server: creation of a backend server that is able to centralise information from all operatives, and send/receive data;
- Operations Manager Visualization Tool: this tool will be able to present the information regarding all the Field Operatives in a single screen, delivering direct information regarding user states (OK, Alerts, etc.) on top of a custom designed interface.

Outcome: Development of a prototype system including a smartphone-based solution for Field Operatives, a Backend Server and control solution for Operation Managers. The prototype system will be able to let the Operation Managers track and monitor the operatives' location, state and activity at all times, as well as see what they see in real-time in emergency situations.

Smart Companion

Description: Smart Companion is an Android customization that was specially designed to address seniors' goals and needs. It aims to be a permanently available companion to support seniors in their daily activities, through a number of tools, from messaging to medication reminder applications. Smart Companion intends to create two ecosystems: a technological one where seniors can use multiple different gadgets like smartphones, tablets, TVs, bracelets, external sensors, weight scales, multimedia car systems, etc. And on the other side Smart Companion wants also to support a social ecosystem where all the three levels of users can interact between each other:

- Primary User (Seniors);
- Secondary User (Informal Caregivers: children, family, friends);
- Tertiary User (Formal Caregivers: doctors, nurses, physicians).

The Smart Companion makes it simple for inexperienced users to master general mobile phone features, such as making calls and sending voice and text messages. It also enables its users to receive medication reminders and to call the emergency line from the home screen in just one step. The main objective of Smart Companion is to develop a 'Swiss Army Knife' type of solution that is supposed to become a powerful and versatile companion for all everyday situations that matter.

Outcome: Development of prototype for Android phones with a set of specific services, such as making calls and sending voice and text messages. Possibility of extending the design to new applications developed for smartphone.



SmartFeet – Exergames for Fall Prevention 20

(Associated with the FCC)

Description: A general decline in physical function and balance problems make older people more prone to falls. Exercises for balance control, mobility and flexibility are effective strategies for fall prevention, however, older people lack motivation to perform these exercises at home, in a daily-basis.

In the SmartFeet application these exercises are implemented as interactive games, in a user-friendly way. Inertial sensors are used to evaluate the performance of the person during the game as well as the movement quality.

Partner: Escola Superior de Tecnologia da Saúde de Coimbra (ESTeSC).

Outcome: Interactive games and exercises for fall prevention that are assessed in terms of performance and quality of movement by inertial sensors.

SmartSurf – Surf Performance Monitoring

(Associated with the FCC)

Description: Surf performance evaluation is often qualitative. The aim of this project is to analyse the surf performance quantitatively using inertial sensors and GPS (Global Positioning System). The inertial sensors are embedded in a waterproof smartphone or dedicated device and may be attached to the surfboard or surf suit. The system collects several measurements and computes metrics such as the number of waves surfed per session, time and distance on each wave or the maximum and average speed. Moreover, it detects and gives information on manoeuvres, like the 'cut-back', which can be used to improve the surfer's technique.

Partners: Surf School Onda Pura, Portuguese Surf Federation and Faculty of Human Kinetics (FMH) from the University of Lisbon.

Outcome: Smartphone app and data collection device to obtain quantitative information on surf performance.

SousChef – Mobile recommender system for older adult nutrition

Description: Older adults often struggle with making the right decisions regarding meal preparation, healthy diets or groceries shopping. Studies also suggest that many older adults neglect nutrition and are more inclined to do so if they happen to live alone. Furthermore, under financial restrictions, which older adults often find themselves in, balancing healthy eating habits with money saving can become a complicated task.

SousChef is intended to act as a nutrition companion that will guide older adult users into making wise decisions regarding food management and healthy eating. For this purpose, SousChef will be created as a meal and produce recommender system running on users' mobile devices. The target audience will be people over 60, independent at BADLs (Basic Activities of Daily Living). The system should be able to do the reasoning by overlaying best practices in nutrition for old age with other relevant aspects, e.g. ingredient price, seasons, available bio-markers that will provide data from the users' health status, or others.

Outcome: A smartphone application capable of gathering nutritional values of ingredients from collections of data and with a recommender system to help elderly plan their diets taking into consideration different bio-markers, ingredients price, seasons, etc.



UserNetwork2014 – Colaborar, Collaborate, Kollaborieren, Colaborare, Collaborer 21

Description: The User Network (Colaborar) aims at establishing a network of users to take part in user research for Fraunhofer AICOS' projects. It began as a network of older adults and in 2013 it opened up to international collaborators. This will not only allow Fraunhofer AICOS to access users from different countries, but will also help build a network for European projects.

The User Network provides Fraunhofer AICOS' researchers the conditions for user research and usability testing, by arranging protocols with specific institutions and finding specific users as demanded by internal and external projects. It serves as a communication channel between Fraunhofer AICOS' researchers and real users, after which researchers are responsible for conducting their planned activities with users.

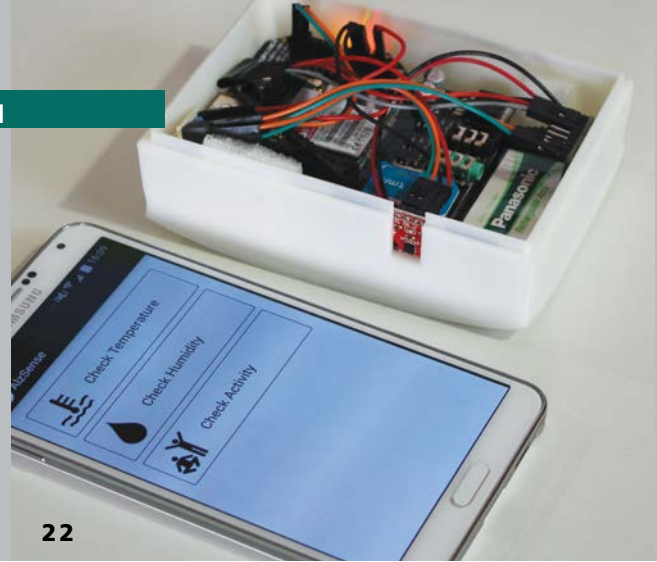
As such, Fraunhofer AICOS' projects should take into account the services provided by the User Network.

For 2014 the main goals were:

- To enlarge the international group of individual and institutional collaborators;
- To optimize the internal CRM (Customer Relationship Management) application;
- Build up the platform for external access of registered users in the network to access specific white papers/reports and perform queries;
- To have a new mobile app specifically developed for surveys for our researchers to use;

- To have a Colaborar mobile app that will allow users in the network to fill in questionnaires, send videos, or any other relevant info to us.

Outcome: Currently, the User Network aggregates 32 institutions with signed collaboration protocols, including senior universities, adult day-care centres, living centres and healthcare institutions. So far, it has supported over 1.000 user research and testing activities.



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ACADEMIC ACTIVITIES

Regarding academic activities, it is worth highlighting that the Director of Fraunhofer AICOS is an invited Professor at the Faculty of Engineering of the University of Porto and AICOS is responsible for proposing a set of topics for MSc theses. The MSc students join Fraunhofer AICOS team to work on applied research projects and also in their own thesis. The topics proposed for theses are aligned with the Strategic Research Agenda defined by the Scientific Board of Fraunhofer AICOS.

AlzSense – Environment-Aware System for Alzheimer’s Patients 22

Description: As people get older, they experience physical and cognitive declines which are natural and expected. Unfortunately, these conditions also make people more likely to be affected by dementia.

Despite research efforts, Alzheimer’s disease (AD) continues to be the most common type of dementia, affecting a large percentage of the older adult population. Because this neurodegenerative condition is swift, caregivers, especially informal, need to dedicate a great deal of their personal strength and time to care for their afflicted relatives.

Mobile devices have become ubiquitous, combining a great deal of functionality that allows researchers to collect knowledge from data and leverage various tools as a means of attempting to monitor and stall AD’s advances. However, with the advent of Bluetooth low energy, there are new ways to explore the advantages of external sensors and use them to keep track of AD-affected people, transparently and in a non-intrusive way.

In this project, we position the dementia-affected person at the forefront of advances and developments to try and monitor the disease’s condition and minimize its reach. The main goal was to explore the possibility of using (and possibly building) a custom sensor device, such as a necklace or belt, integrating with it useful sensors such as: temperature, humidity, pressure, accelerometer, gyroscope, magnetometer, GPS (Global Positioning System), GSM (Global System for Mobile) and Wi-Fi.

By taking advantage of these (and other) sensors, we explored the possibility of tracking sleep patterns and changes (which is important in AD-affected people, because their condition causes sleep disturbances), measuring temperature in various divisions of the home or day care center, to alert caregivers for the fact that there may be extreme heat (e.g., forgot to turn off the oven) or freezing temperatures (which may cause hypothermia), among others.

Outcome: Sensor for people with Alzheimer’s dementia that includes GPS, GSM, Wi-Fi, accelerometer, humidity and temperature data. Companion Android application that retrieves and analyses data from the sensor and helps caregivers in taking more helpful and informed decisions regarding the people they look out for.



DepSigns – Depression Signs Detection through Smartphone Usage Data Analysis 23

Description: Even though people are generally more aware of physical age-related changes due to their external visibility, psychological age-related changes are equally, if not more, important. Events that occur with age and in seniors' daily life – retirement, the loss of loved ones, increased isolation, and medical problems – can lead to serious problems like depression. In fact, the prevalence of depressive disorders in the elderly on the United States alone adds up to 6.5 million American aged 65 years or older.

Depression symptoms include, among others: insomnia or excessive sleeping, weight loss, fatigue and loss of energy, sadness, trouble thinking and concentrating or isolation. These can often be ignored or mistaken with normal age-related behaviour, but with proper information and monitorization, early signs of depression can be detected allowing the patient to promptly receive proper care.

Currently we have a mobile integrated solution that already collects data regarding daily life activities of seniors: communications, activity, navigation and localization and mood swings. Using this information it is possible to discover behaviour patterns and, consequently, significant changes to that patterns that may indicate signs of depression, such as a decrease in communications with friends and family, lack of activity and exiting their home, or variations in mood swings.

Outcome: A web-based data visualization tool for caregivers. Algorithms to create behavioural patterns, detect depressive symptoms, and classify users as potentially depressed.



EDIS – Efficient Database Image Search 24

Description: The goal of this thesis is to implement an efficient content based image database retrieval. The first stage of this project is to match a particular image to a database which might contain thousands of images. The advanced stage is to match an image region from a video frame to an image on a database, in real-time if possible.

The choice of image representation and image matching is key for the efficiency of this algorithm, the matching will not be done using the whole image data (pixels). At an initial stage, the image database might be local to the image retrieving device, in order not to account for data transmission latency. The outcome of the algorithm might be a small set of the most similar images.

Outcome: The outcome of this project is key to scale an application which needs to query a database of images and fetch a small set of very similar images, if they are present.

The expected result is a component which receives an image representation extracted from a video frame and outputs a list of similar image representations present in a database. The component must do this task as efficient and as accurate as possible.



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GestureMetrics – Optimizing the interpretation of FUSAMI data for usability analysis 25

Description: There is plenty of documentation and instructions on how to use and interpret data recorded through eye-tracking equipment: eye-movement metrics. These help researchers analyse the data and extract meaning from users' actions (e.g. long fixations, fixation special density, gaze, saccades, scanpaths, transition matrixes, etc.).

The proliferation of mobile devices gave rise to different tools to record users' interaction with the applications. Rather than relying on eye-gaze, these tools rely mostly on the record of users' gestures. Alas, all these new tools still lack studies to provide support in interpreting the data, and researchers do not yet know what specific sequences or patterns of gestures mean.

The goal of this project is to combine the use of FUSAMI (a web-based platform to perform advanced analytics on real-time mobile applications usage data) with qualitative research to extract meaning from gesture patterns and begin defining new gesture-metrics for usability evaluation.

Outcome: Initial set of gesture metrics for touchscreen gesture interaction. Identification of distinctive patterns of interaction that can be used as gesture metrics to infer user's behaviour through remote gesture log visualization analysis.



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GSenses – Smartphone serious games for senses evaluation 26

Description: Falls are the second leading cause of accidental injury deaths worldwide. Each year, many older people fall and this frequently leads to injury, suffering, fear, loss of independence and reduced quality of life.

Falls are often caused by a number of factors, and interventions such as physical therapy, adjusting medications or behaviour change can reduce the elderly fall rate. Determination of fall risks is therefore needed in order to identify who may benefit from interventions.

There are specific tests and questionnaires which can be used periodically to assess fall risks at clinics. However, changes in fall risk may occur more suddenly and clinic visits may not occur frequently enough to detect these changes.

The main goal of this project is to allow users to perform some of the tests by themselves at home, so that the tests can become more regular and therefore more responsive to sudden changes. We are not aiming to replace clinic visits, but offer users the means to continue the tracking of their fall risk from home, so that if dangerous readings are detected the users can be immediately directed to the clinic.

In this project, the fall risk factors targeted are the visual function and the hearing loss. Being so, a set of clinical visual acuity and hearing capacity tests were studied, so that we could replicate them resorting to an Android smartphone. With this it is possible to track the continuous evolution of the users' visual and hearing capacity, easily detecting any anomalies.

Another goal of this project is to provide this evaluation through serious games, so that this task can be as pleasant as



possible and therefore get the user to perform the evaluation more frequently.

Outcome: Set of clinical tests for visual acuity that are replicable with a smartphone. Set of clinical tests for hearing loss that are replicable with a smartphone. Android application with several visual and hearing tests. Performance reports from the comparison between the clinical tests and the ones performed with the smartphone.

ICT4Dgui – Graphical User Interface recommendations for ICT4D

Description: Smartphones are thriving in developing countries and a bit throughout rural communities. Many populations have skipped computers or laptops and are experiencing their first contact with Information and Communication Technologies (ICT) through smartphones. Furthermore, these are regarded as crucial in creating opportunities for human development, namely through new work opportunities or access to health services and information.

Nevertheless, there is still little research about how human diversity specifically affects the way in which elements in Graphical User Interfaces (GUIs) are perceived. Understanding prototypical images, visual references and the principles of how different cultures regard and interpret graphic elements (e.g., colour, shapes, human figures or gestures) is crucial to be able to design accessible and usable solutions which moreover do not risk going against or offending cultural values.

Researching these values and creating a repository along with guidelines for best practices in this domain would help bridge the gap between technology and humans within technology illiterate users and help boost the positive impact that ICT could have in rural communities.

Outcome: To conduct thorough research on visual aspects to inform the design of GUIs suited to different cultures and literacy levels. To conduct thorough research on polite/offensive manners in different cultures, and to translate these into guidelines for visual compositions. To create and test different examples of iconography often used in GUIs. To create a repository of recommended and avoidable GUI elements.

MagRef4PIL – Magnetic Reference for Accurate Indoor Tracking 27

Description: Indoor navigation is an important enabling technology for applications such as navigation aid, location-based information and advertisement, as well as to provide enhanced emergency response.

Several approaches have been proposed in recent years but none of them was able to achieve meter-level accuracy. More recently, a new approach has emerged as a solution for the accuracy issue. This approach relies on inertial sensors to track a user by continuously estimating displacement from a known position. Most recent smartphones are equipped with several sensors (e.g.: accelerometer, gyroscope, magnetometer) that provide the necessary hardware for this indoor navigation systems based on inertial sensors.

As previously stated, these indoor navigation systems, based on inertial sensor, define the actual position estimating displacement from a previously known position. On the other hand, these systems rely on low-cost sensors that can be extremely noisy. Noisy sensors will introduce position errors due noise itself but also drift (from gyroscope) and magnetic interference (from magnetometer). Eventually, these cumulative errors will lead to an erroneous estimation current position.



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In order to correct positional errors, several solutions for aided indoor navigation have been proposed, e.g.: GPS (Global Positioning System) signals (when available), Wi-Fi fingerprinting, light patterns, structural magnetic fingerprinting, RFID (Radio Frequency Identification) check-points.

This MSc topic goal was to develop magnetic position references for an accurate indoor tracking system.

The main ideas was to study and develop a set of ultra-low frequency antennas that can interact with compass enabled phones in order to give them accurate references, with less than one meter precision.

Outcome: This project was a follow-up from the previous work developed under Ultra Low Frequency Magnetic Communication (ULF-MC), a wireless communication solution based on artificial magnetic references.

Two important results were expected from this work. On the one hand, theoretical models for magnetic elements should be investigated in order to develop a systematic procedure to project and build new types of magnetic antennas (different shape and size). On the other hand, an algorithm that is able to provide direction and orientation on human movement based on artificial magnetic fields should also be developed.

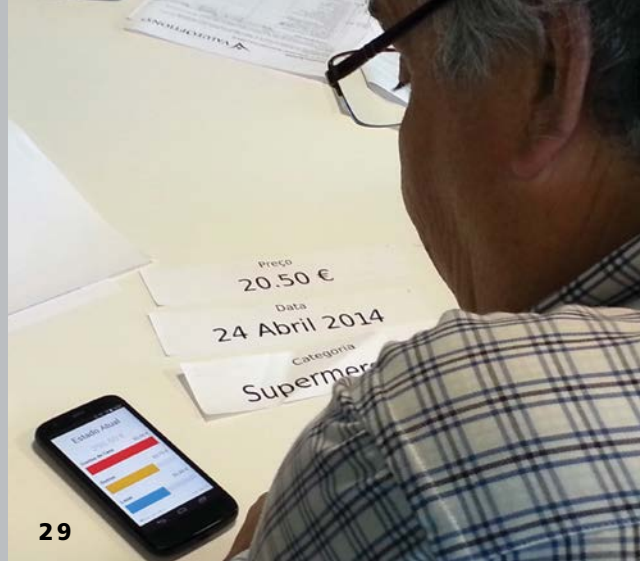
The aforementioned results were partially achieved and the core concepts are being considered in the on-going work developed under Fraunhofer AICOS' Indoor Location related projects. Include the outcomes on other Indoor Location related project was also one of the most important outcomes for this MSc topic.

Finally, a proof of concept was implemented. The developed algorithms resulted in a new solution that was able to provide information on the heading, in order to correct Indoor Location system's misplacing errors, despite the fact that the results were not so accurate as expected.

MicroStage – Motorized microscope stage for smartphone 28

Description: Every year Malaria kills millions of people because the time between a blood test and the result is too much to allow an effective treatment. To respond to this limitation Fraunhofer AICOS presented the idea of creating a fast, cheap and autonomous system, fully replicable in third world countries, and capable of giving a preliminary result to this test by analysing 100 spots in the blood smear (as recommended by World Health Organization). This translated to a project where a smartphone was used as the brain and controlled a XY axis table while taking the necessary pictures of the smear. This thesis focused in the table part. It needed to be capable of under 500mm steps in each direction and be fully powered by the USB connection of the smartphone.

The goal of this thesis was to develop a motorized XY axis microscope stage driven by a smartphone. The development had three major components: 1) Exploring Stepper/Piezoelectric motors; 2) Development of a drive circuit, with possibility to use an Arduino board; 3) Allow the smartphone to control the device. The communications between the Arduino and the smartphone was done through USB, and it was implemented a controller application in the smartphone so that a blood smear in the microscope slide would follow a predetermined route to be scanned using the smartphone camera, or navigate through the slide using a joystick smartphone alike application.



Outcome: Several actuators were studied and tested and two solutions were presented: one based in piezoelectric benders and other based in common DC (Direct Current) motors. Both solutions feature Arduino based electronic drivers and are fully controlled by an Android smartphone application, components fully developed during this thesis.

To allow the replication, a 3D printer was used to produce most of the parts for the solution. The DC motor solution used old CD (Compact Disc) drives and was capable of steps under 300mm. The piezoelectric solution featured a novel design fully 3D printed and featured steps below 250mm.

MoverGami – Gamification on Users Daily Activities

Description: Gamification relies on the use of game elements in everyday scenarios in order to drive engagement and interest to usually more boring tasks.

Considering the solutions already developed by Fraunhofer AICOS, the Mover application, we are currently able to track user's activity levels and even identify some of the activities performed. Being so, we believe that the usage of gamification methodologies can add some extrinsic motivation to the user, getting the users to become even more active.

The purpose of this project was to develop a gamification framework for Mover, performing a detailed study on the impact it would have in the user's daily living. This gamification framework includes badges, rankings, goals, achievements and social networking. The framework also includes some machine learning techniques in order to automatically generate challenges according to the user's activities.

Outcome: Android app able to apply game elements (badges, achievements, challenges, rankings, etc.) in Mover data. Backend where the gamification framework can be managed (create badges, etc.).

PersonalFinancesApp – Personal finances mobile application for seniors 29

Description: Older adults often take great cautions with their savings and the management of their everyday finances. Ageing impairments, however, may convert this self-management into a difficult and cumbersome process. At the same time, older adults often find it hard to trust others to do this management for them.

Smartphones may help overcome these problems and may assist older adults by allowing them to always carry the information with them and be able to update it at any time.

However, studies are required to understand what current routines older adults have, what are their needs and expectations and how such a solution needs to be designed so that it will be engaging, easy to use and so that it encourages older adults to manage their own finances using mobile devices.

This project addressed these issues through qualitative research, followed by the iterative design and development of a useful, accessible and user-friendly solution of a personal finances application for seniors.

Outcome: The design of a smartphone application that allows older adults to manage their day-to-day finances in a simple way.



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QuadAALper2 – The Ambient Assisted Living Quadcopter (Phase II) 30

Description: Quadcopters are interesting pieces of engineering, accessible to the general public since the introduction of radio controlled and small-scale Unmanned Aerial Vehicle (UAV) models. Since then, major developments regarding size, stability, autonomy, control, Artificial Intelligence, hardware & software development tools, etc., have been introduced by academia and enthusiast community. Nevertheless, the vast majority of the application purposes given to these machines still fall into the recreational scope.

Recently, some have tried to exploit more 'useful' purposes for these machines, e.g. a brain-controlled quadcopter for the disabled, a quadcopter tower-building task force or surveillance tasks.

The goal of this thesis is to further explore the applicability of quadcopters to Ambient Assisted Living (AAL) scenarios, namely as an alternative to solutions such as Thought Controlled Quadcopter or AAL DOME0 showcased in the latest AAL Forum editions. This MSc thesis intends to continue with the preliminary results achieved by a previous QuadAALper thesis, in which the basics – quadcopter setup (an Arducopter), wireless connectivity, basic interaction with mobile devices, etc. – have been established.

We would be particularly interested in a further integration of the quadcopter with smartphones (or a dedicated system running Android) as an interesting solution for a quadcopter 'brain boost' (i.e. using the smartphone on the quadcopter, making it its brain, something like DroneltYourself but with your smartphone as its brain. Some use cases can be explored to determine the feasibility of such solution in AAL scenarios, described below:

- Response to voice commands (using Siri for iOS or Jeanni for Android);
- Detection of alarm situations (burglars, temperature, CO₂ - Carbon Dioxide saturation, etc.);
- Activity monitoring, 'follow-me' modes for indoor guidance (i.e. the quad should also be capable of indoors autonomous guidance), additional inputs for fall detection solutions, etc.;
- Applications needing user-authentication (taking advantage of facial recognition features);
- Project images and video call on the wall.

Outcome: The goal of this thesis is to further explore the applicability of quadcopters to Ambient Assisted Living (AAL) scenarios. The outcome of the work should be a functional prototype, capable of carrying out at least one of the use cases previously described.

SleepDiary – Sensor based sleep patterns and nocturnal activity analysis

Description: Everyone has already experienced trouble sleeping at one time or another. This is normal and usually temporary, frequently due to stress or other outside factors. When this becomes a regular occurrence, then probably the person is facing any kind of sleep disorder.

Complaints of sleep difficulty are more common among older people. A reduced sleep quality due to sleep deprivation or fragmentation may cause reduced vigilance, attention and information processing ability, which ultimately may result in trips and falls. In general, the lack of sleep quality has negative impacts on energy, balance and health.

Several devices referred to as 'actigraph units' are currently available to monitor human rest and activity cycles. Sleep actigraphs are generally worn on the wrist and, by capturing periods of activity and inactivity based on the wrist movement, they are able to determine sleep-wake patterns and circadian rhythms. More specifically, they can estimate sleep latency, total sleep time, number and frequency of awakenings and sleep efficiency.

The purpose of this research is to develop a system able to analyse sleep patterns and nocturnal activity autonomously based on information acquired from the smartphone (e.g. movement, noise, brightness) and external sensors (e.g., accelerometer, gyroscope, temperature, oximetry) attached to a dedicated position of the body. Sleep efficiency must be considered towards an analysis of risk, in order to predict the occurrence of falls. Moreover, the system must be able to collect and analyse data continuously, during several nights, in order to detect fluctuations/changes on the normal sleep-wake patterns, which may be indicative of problems, such as physical disability, depression or inadequate medication. The system must also be able to detect every time a person gets up at night.

External sensors will be connected to the smartphone and will continually record the movement someone undergoes (at night), as well as other vital signs considered relevant for sleep stages evaluation. The history of each night will be recorded in order to provide a longitudinal analysis of data, including the evaluation of insomnia, circadian-rhythm disorders and excessive sleepiness. The smartphone will warn the person every time an increased risk of falls is detected.

Outcome: The goal of this thesis is to develop a system that will quantify sleep quality and efficiency based on data acquired from sensors during the night-time frame. The system will be developed as an Android application running on the smartphone, connected with external sensors attached to the user. It will explore the combination of different inputs, so that different setups can be considered, including the possibility of using the smartphone individually as a sleep analysis tool. The system will detect fluctuations in normal sleep-wake patterns and warn the person each time an increased risk of falls is detected.

SmartCueing – Smartphone Based Closed-Loop Auditory Cueing System

Description: Rhythmic auditory stimuli, or cueing, are known to be effective to modulate the rhythm or cadence of people performing different activities. By providing an adequate rhythm, coordination and rhythmicity of movements, as well as the amplitude of movements, can be improved.

Rhythmic auditory cueing are known to be effective to regulate and overcome typical gait problems that occur in patients with Parkinson's disease and other neurodegenerative diseases. Auditory cueing can also act as a rehabilitation strategy, for example, after doing some orthopaedic corrective treatments. Cueing can also be used during training sessions to improve the athletic performance of a competitor. Sounds can therefore be applied in several different situations, including therapeutic sessions, gait guidance and training.

Several types of sounds can be used as a cueing strategy, including metronomes, music or both types joined together. Sounds can be manipulated in order to change their rhythm in real time, using appropriate time stretching techniques.



The purpose of this research is to explore the use of the smartphone and its sensors to detect several movement measures in real time, including gait measures, like cadence and velocity. Particularly, the study is focused on the detection of gait problems that typically occurs in people with Parkinson's disease, including bradykinesia, small steps, reduced speed, variability and freezing of gait episodes, which must be detected in real time based on smartphone sensors' information.

The project also explores the use and manipulation of music to act as cueing during different activities. Sounds can be triggered manually (for rehabilitation or training purposes) or automatically, based on walking pattern of the person (for gait guidance). Characteristics of sounds (including their rhythm) are adapted to the specific needs of the user, considering their walking patterns and their response to the sounds delivered.

Outcome: The purpose of this research is to explore the use of the smartphone and its sensors to detect movement measures and motor symptoms in patients with Parkinson's disease. Additionally, the project explores the use and manipulation of music to act as cueing, adjusting the characteristics of sounds to the patients' needs, taking into account the information sensed by the smartphone.

SmartNS – Smartphone Noise Suppression 31

Description: One of the main physiopathologic mechanisms of chronic heart failure symptoms is pulmonary congestion, characterized by the accumulation of fluid in the lungs, often detected on physical examination by pulmonary auscultation. Crackles, crepitations or rales are characteristic noises that may be present in one or both lungs, frequently heard during inspiration or expiration.

Assessment of the presence of pulmonary congestion is done by auscultation of the patient's respiratory sounds using a stethoscope connected to the smartphone, which records the sounds through the microphone input and stores it in a digital audio file. The aim of such solution falls within a remote health monitoring system, where patients are able to self-auscultate and use mobile devices to send relevant data to a physician.

Early results with this approach revealed a large amount of external noise in the audio files obtained through auscultation. This issue induces the need for applying noise suppression techniques in order to obtain a clearer signal of the auscultation. The goal of this master thesis is to research on a range of possible techniques to mitigate the described issue, implement a prototype of the most balanced solution and test its effectiveness against a set of collected samples. This prototype should be integrated with an Android application connected to the stethoscope, so a real usage scenario can be tested.

Outcome: One of the major symptoms of chronic heart failure is pulmonary congestion. To assess its presence, previous work has been made on using a stethoscope connected to the smartphone, recording the sounds through the microphone input and storing it in a digital audio file. Early results revealed a large amount of external noise in the audio samples. This issue induces the need for applying noise suppression techniques in order to obtain a clearer signal of the auscultation.

The goal of this work is to research on a range of possible techniques to mitigate the described issue, implement a prototype of the most balanced solution and test its effectiveness against a set of collected samples. The prototype should be integrated with an Android application and ultimately complement the Heart Failure Clinic internal project.

SunPet – Real-time Sun Exposure Monitorization using Smartphones

Description: The rise in the incidence of skin cancers over the past decades is strongly related to increasingly popular outdoor activities (recreational exposure to the sun) and history of sunburn, which are factors that lie within each individual's own responsibility.

In this work, we proposed the development of a solution that empowers and motivates the users to actively manage their behaviour regarding sun exposure. The goal was to develop an Android application that detects in real-time risky behaviours by merging information from GPS (Global Positioning System) location, UV (Ultraviolet) radiation and exposure time. Moreover, the most differential factor of this work (and also the major breakthrough) was to find a suitable way to merge information from GPS, UV radiation and exposure time in order to create reliable metrics for risk assessment of sun exposure.

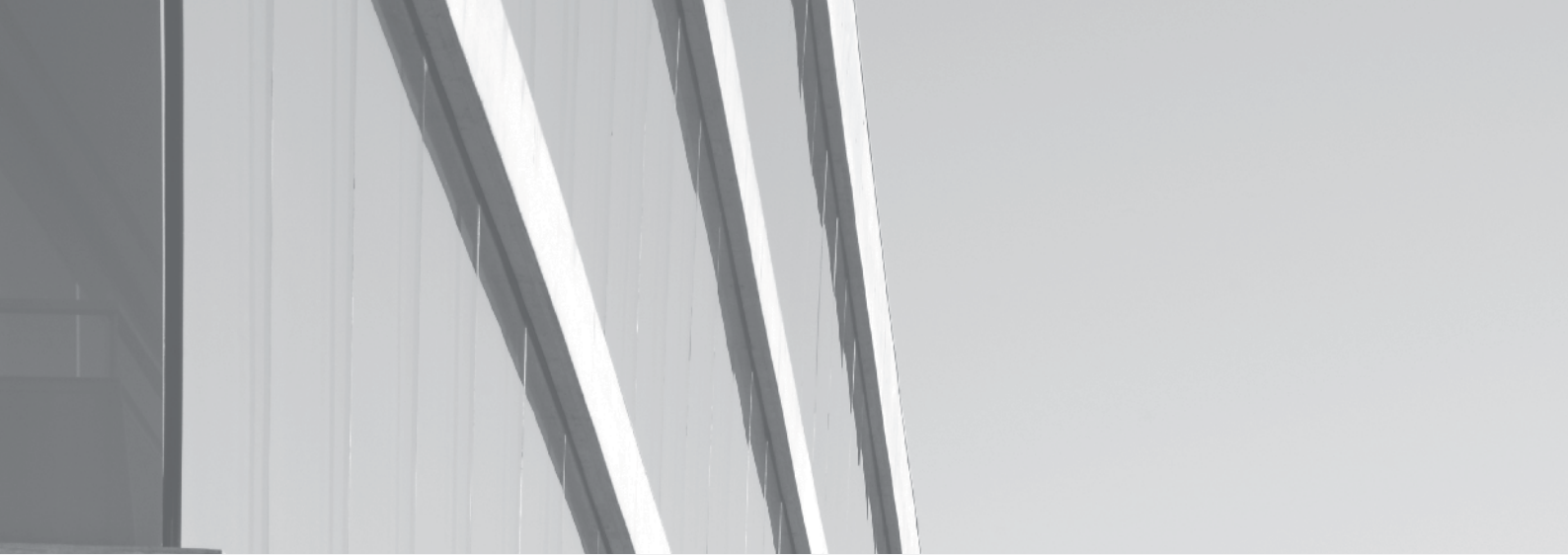
Outcome: Development of an Android application that detects in real-time risky behaviours by merging information from GPS location, UV radiation and exposure time.

Implementation of several additional features that turns the developed mobile application into a more robust solution, such as: the implementation of a personal sun exposure history; the creation of a warning system to monitor the user's behaviour; the adoption of an user-friendly layout that captures the user attention.

TouchSense – Complement the touch information given by the smartphone's capacitive screens with the information received by the accelerometer and gyroscope

Description: The goal of this project is to complement the information given by the smartphones touch screen with information given by the accelerometer and gyroscope. Although using sensors to detect touches is not a new idea, as there are already research which use the smartphone accelerometer to infer which keystrokes were made on a touch screen, and use the accelerometer information to know when there was a tap on the smartphone's screen is made even before the touchscreen detects it, this project aims to use that information to accomplish other objectives. Manly gather new information on a touch event in order to extend the smartphone's touch capabilities with data such as tap strength, smartphone's holding position while tapping (if it is on the users hands or laying on a hard surface) and process that information in order to be useful to the user or the developer party.

Outcome: The goal of this work is to get additional data from the input of the actual smartphone's touch screens. The current input from capacitive screens is very accurate detecting where the user taps but lacks on getting more information about the performed action. This work focuses on extracting those additional features, such as strength of the tap, if either the user is tapping holding the phone with his own hands or using it in a still stand, and more. Despite this information could be perceived as trivial at first it could be useful to improve the overall user experience, for example adapting an interface depending in which way the user is holding the device or by detecting frustration of the user taps, if the user is acting too frustrated the interface could be programmed to show helpful hints.



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