FRAUNHOFER AICOS
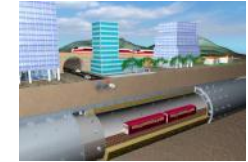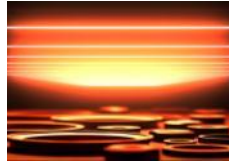
Research Center for Assistive Information and Communication Solutions

APPLIED SCIENCE BY FRAUNHOFER – MADE IN PORTUGAL

Fraunhofer
PORTUGAL

1. Fraunhofer Portugal
Fraunhofer-Gesellschaft (worldwide)

67 Institutes

> 80 Research Units

> 23.000 employees

€2 billion R&D budget

(>€1,7 billion from contract research)

7 Groups

- Information and Communication Technology
- Life Sciences
- Light & Surfaces
- Microelectronics
- Production
- Materials & Components
- Defense & Security

Fraunhofer
PORTUGAL

1. Fraunhofer Portugal
Institutional Background

Fraunhofer Portugal is a Non-Profit Research Institution of Public Common Interest

2. Fraunhofer AICOS
Vision

"Extending the Reach of the Information and Knowledge Society"

- Fraunhofer AICOS vision is to **enhance people's living standards** by offering them intuitive and useful technology solutions capable of **facilitating their access to ICT**;

- This way we are helping specific groups (like seniors and population in remote regions or developing countries) to be integrated in the **Information and Knowledge Society**.

Fraunhofer
PORTUGAL

2. Fraunhofer AICOS
Mission

"Remarkable Technology, Easy to Use"

- Offering **specialized competences** centered on 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 and increasing its value for their customers.
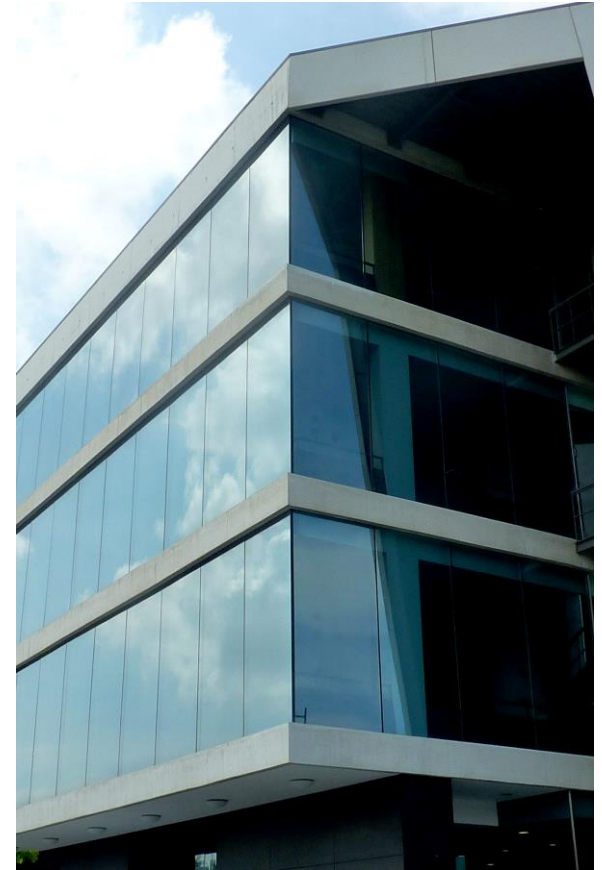
Fraunhofer
PORTUGAL

2. Fraunhofer AICOS
Operational Goals

A leading R&D partner for Industry!

- **Technology Transfer:** project results and brains!

- Implement an operation with **~100 people**;

- Implement the **"Fraunhofer Operational Model"**

  - Achieve a well balanced project mix

    - **~1/3 revenues from direct industry contracts;**

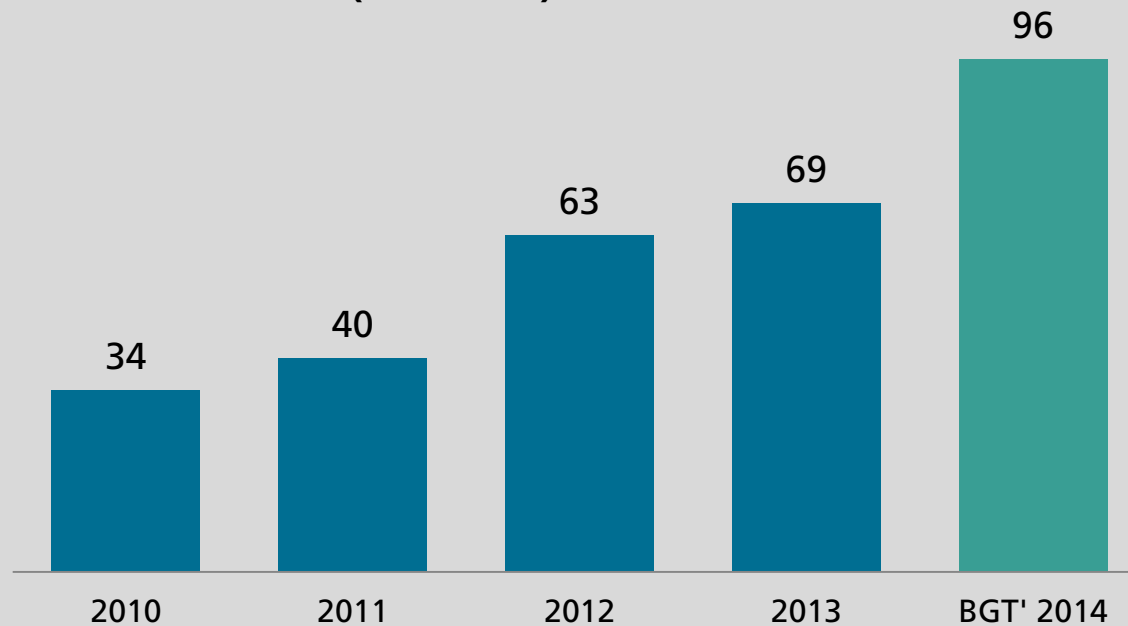   - ~1/3 national/international R&D Programs;

    - ~1/3 based funding.

Fraunhofer
PORTUGAL

2. Fraunhofer AICOS
Evolution – Human Resources

Our team has been growing steadily!

Human Resources Evolution (2010-2014)

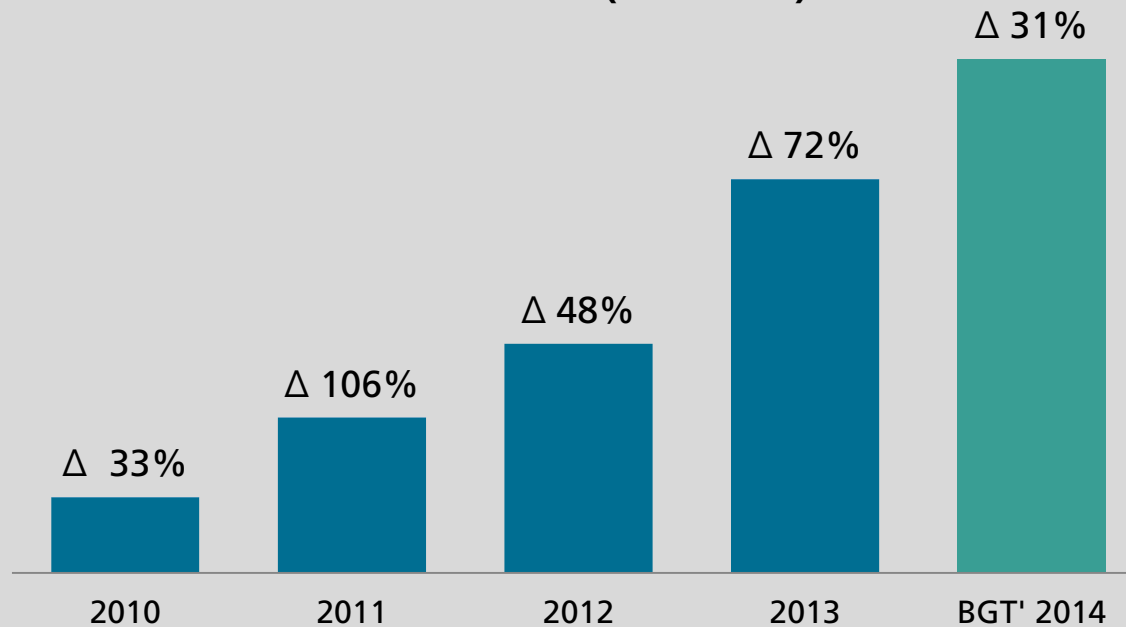| Year	Value
2010	34
2011	40
2012	63
2013	69
BGT' 2014	96

Fraunhofer

PORTUGAL

2. Fraunhofer AICOS
Evolution – Revenue Growth

Our revenues have been sharply increasing!

Revenues from Research Activities Growth (2010-2014)

△ 31%

△ 72%

△ 48%

△ 106%

△ 33%

| 2010 | 2011 | 2012 | 2013 | BGT' 2014 |

Fraunhofer
PORTUGAL

2. Fraunhofer AICOS
Achievements

Mover	AlzNav	Smart Companion	Dance! Don't Fall	Postbox Web	AlzNav	ULF-MC	Melanoma Detection
5th Place	1 of 3 Finalists	2nd Place	Top-25 Apps	Honorable mention	Portugal Nominee by APDC [2]	1st Place	European Young Researcher of the Year
2009 2nd Android Developers Challenge	2011 Vodafone Smart Accessibility Awards	2011 Zon Prémio Criatividade	2012 CES [1] Mobile Apps Showdown	2012 Vodafone Mobile Data Challenge	2012 World Summit Awards	2012 ESNC [3] European (Galileo Master Award)	2012 AAL Forum

[1] **CES:** Consumer Electronics Show

[3] **ESNC:** European Satellite Navigation Competition

[2] **APDC:** Portuguese Association for the Promotion of Communications

9

Fraunhofer
PORTUGAL

2. Fraunhofer AICOS
Headquarters

- Our **Headquarter** in UPTEC was voted **"Building of the Year 2011"** in a competition hosted by **ArchDaily.com** and provides **the most inspiring environment to our team**!

- **94% of our collaborators** answered in a survey they were fully satisfied with their work environment and considered it **optimal to achieve top notch results**;

- **100% of our collaborators** are of the opinion that **women have the same career opportunities** as their male colleagues.

Fraunhofer
PORTUGAL

2. Fraunhofer AICOS
Fraunhofer Portugal Challenge | 5th Edition

- **Promote "Research of Practical Utility"**

  Among Portuguese university students and researchers;

- **Idea contest for MSC and PhD Theses**

  Already on its 5th edition, the Challenge is based on MSc and PhD theses from Portuguese universities;

- **Scientific Prizes for the Best Ideas**

  Winning participants are awarded monetary prizes and get media coverage of their work.

3. Fraunhofer AICOS

Strategic Research Agenda: Focus Areas

AAL **(Ambient Assisted Living)**	**ICT4D** **(ICT for Development)**
Key Target Groups:	
Ageing & Elderly (including their relatives, caregivers and communities)	**Populations in Rural & Developing Areas**
Subfields:	
Fall and activity monitoring Chronic diseases & Well-Being Management Assistive environments	mGovernment mHealth mAgriculture ICT for Very Small Enterprises

Fraunhofer
PORTUGAL
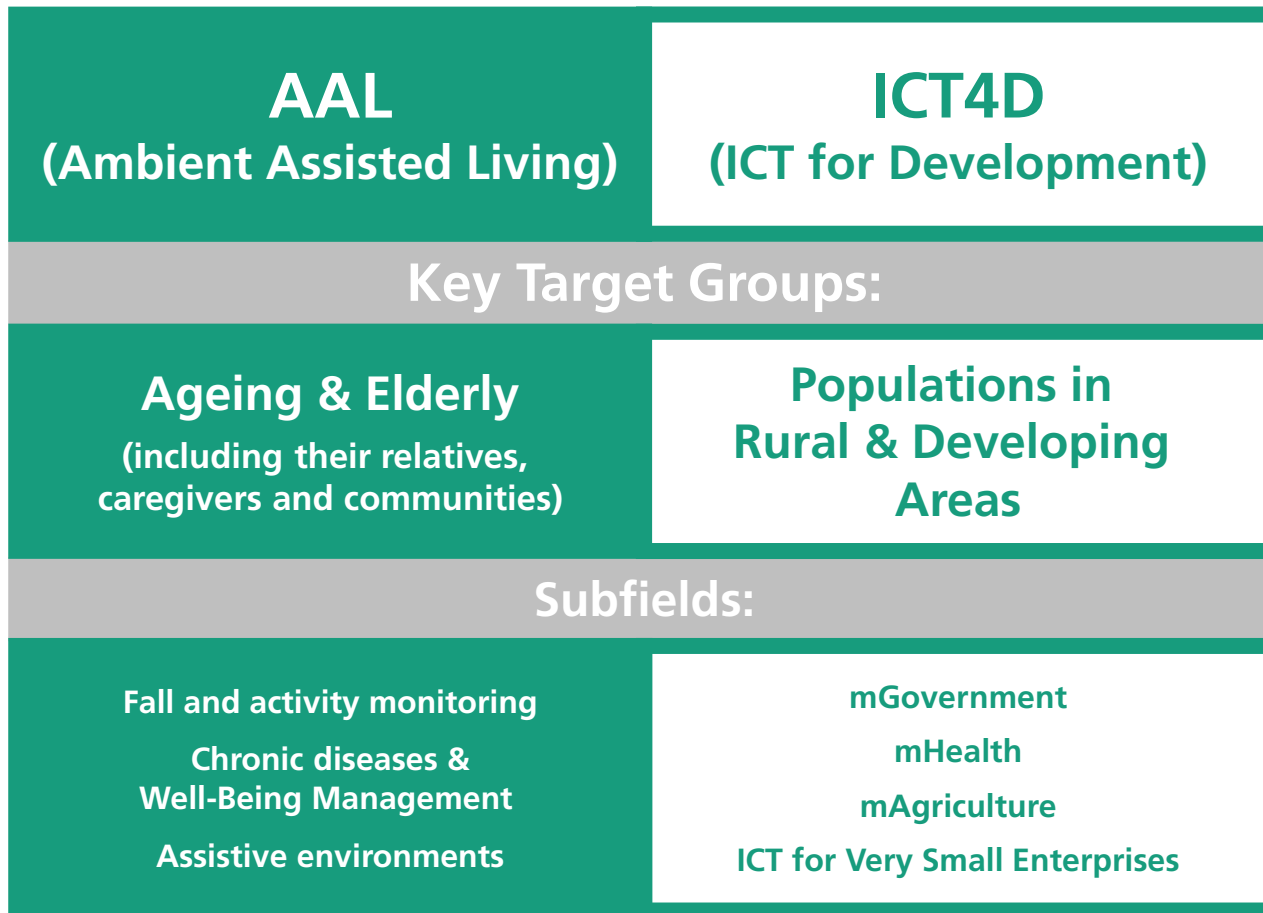
3. Fraunhofer AICOS
Strategic Research Agenda: AAL

AAL - Ambient Assisted Living

- Foster the **creation of innovative ICT-based real products** that **support ageing and elderly people** in the process of ageing well at home, in the community and at work;

- Contribute to the design of **sustainable business cases** that enable the improvement of the **quality of life**, **autonomy**, the **participation in social life**, **skills** and the **employability** of elderly people;

- Focused on **end users, caregivers**, **family** and **related people**;

- Promote **cost reduction of health and social care**.

Fraunhofer
PORTUGAL

3. Fraunhofer AICOS
## Strategic Research Agenda: ICT4D

ICT4D **- Information and Communication Technologies for Development**

- Investigation of user demands for mobile ICT solutions in the fields of **agriculture, urban micro enterprises, m-health** and **e-government** and their potential socio-economic impact in developing countries;

- Joint development of **locally relevant solutions** which might get incubated **into new businesses**;

- **Knowledge transfer** to ensure a sustainable benefit for an independent and uprising ICT industry in the partner countries;

- Enabling **long-term partnerships** between the developing countries and the European partners.

Fraunhofer
PORTUGAL

3. Fraunhofer AICOS
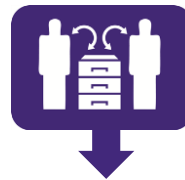## Strategic Research Agenda: Scientific Areas

Human-Computer Interaction
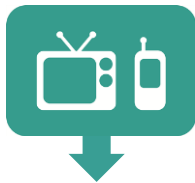
Adapting **interaction** to **specific user needs**

- **User & Social Experience**
- **Mobile & Future Devices**
- **Evaluation & Usability**

Information Processing

From **raw** data …
To meaningful information

- **Content Retrieval**
- **Context Awareness**
- **Multimodal Information Fusion**

Autonomic Computing

Smarter machines: less configuration & maintenance

- **Remote Management, Control and Configuration**

Fraunhofer
PORTUGAL

3. Fraunhofer AICOS
Strategic Research Agenda: Competence Centers

- In 2013 Fraunhofer AICOS started to develop two Competence Centers in order to **build interdisciplinary teams working** on:

  - **Fall and Activity Monitoring**;

  - **Information and Communication Technologies for Development (ICT4D)**;

- The goal is to **develop innovation for projects with industry**, based on the **background knowledge** obtained during the start-up phase;

- The Competence Centers are a platform to create **teams with expertise from different countries** and from **different relevant scientific fields** such as medicine, physics, electronics, ICT, HCI, etc.

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

Ambient Assisted Living (AAL)

Fall and Activity Monitoring

Fall Competence Center (FCC)

E-NO FALLS

ᵐ WATER SAFETY

REM PARK

EyeTracking4ALL

Precision Indoor Location

SavEnergy

Chronic Diseases & Well-being Management

S4S smartphones for seniors

eCAALYX

SAL

COLABORAR

SMART COMPANION

AlzNav

Assistive Environments

En Aware

AAL4ALL Ambient Assisted Living for All

ChefMyself

ShopView

Mobile CCTV

Fraunhofer PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

Fall Competence Center (FCC)

- The FCC aims to investigate in depth the **human motion, activities** and **falls.** Core competences will be applied to viable solutions and converted in valuable products;

- Advanced prototypes under development are dedicated to:

  - Fall Detection, Fall Risk Assessment and Fall Prevention;

  - Promotion of Physical Activity and Exercise Games;

  - Sports Performance Measurement;

  - Safety and Security.

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

ICT for Development (ICT4D)

ICT4D Competence Center (ICT4D-CC)		
	ACP Street Libraries	Malaria Scope
	FUSAMI	OurMOZ online
	GRA ICT4D	Syndromic Surveillance
	Hydroponic Farming	Postbox Web
	IZIDoc	

Fraunhofer
PORTUGAL

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

ICT4D Competence Center (ICT4D-CC)

- The main objective of the ICT4D-CC is investigate 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,** and develop dedicated pre-commercial ICT solutions for:

  - mGovernment;
  - mHealth;
  - mAgriculture;
  - ICT for Very Small Enterprises (VSE).

6. Fraunhofer AICOS
Our Services: **What can we do for you?**

- **R&D Consulting**
  - We propose **new solutions and ideas** for evolving products and services;

- **Proof of Concepts**
  - Initial implementation for proving that **new ideas really work**;

- **Prototype Implementation**
  - Architectural specification; System implementation; System testing and validation;

- **Easy access to German Fraunhofer Institutes** in other areas of competence;
  - 7 Research Groups, 80 Research Units, 67 Institutes;

- **Member of National Scientific and Technology System**
  - Eligible to participate in **public incentive R&D programs**.

Fraunhofer
PORTUGAL

7. Fraunhofer AICOS
Contacts & Location

Address: **Rua Alfredo Allen 455, 4200-135 Porto**

Phone: **+351 220 430 300**

Website: **www.fraunhofer.pt**

E-mail: **info@fraunhofer.pt**

Facebook: **facebook.com/fraunhoferportugal**

LinkedIn: **Fraunhofer Portugal**

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

AAL4ALL

AAL4ALL
Ambient Assisted Living for All

- **Mobilization of an industrial ecosystem** of products and services in the scope of Ambient Assisted Living;

- Focus on the definition of **specific standards**;

- Ensure interoperability between products and services to **mitigate investment** risk in this emergent market;

- **34 partners** involved, mainly from industry.

COMPETE
PROGRAMA OPERACIONAL FACTORES DE COMPETITIVIDADE

QREN
QUADRO DE REFERÊNCIA ESTRATÉGICO NACIONAL
PORTUGAL 2007/2013

UNIÃO EUROPEIA
Fundo Europeu de Desenvolvimento Regional

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS

Key Project Initiatives – Ambient Assisted Living

AlzNav

- Application for **older adults** and persons in **initial state of dementia**, as well as their **caregivers**;

- **Very simplified navigation system**: easily guides the user to a known and safe place;

- Allows to define a **predetermined safe zone**: caregiver is alerted when user leaves this area.
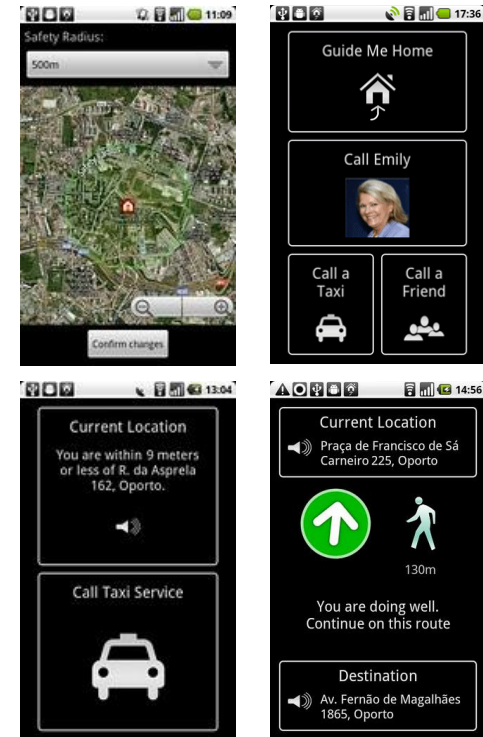
Nominated by APDC to represent Portugal in the World Summit Award

Finalist in World Summit Awards 2012

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

ChefMyself   ChefMyself ▶

- Automatic **cooking solution** to support elderly in preparing daily meals and **maintaining healthy eating habits**;

- Support for groceries shopping;

- Social network to promote **healthy eating habits**, recipe exchange and interaction amongst seniors;

- Open and extensible ICT service with three main components: **tablet device, cooking robot and cloud services**.

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

GOBIERNO DE ESPAÑA MINISTERIO DE INDUSTRIA, ENERGÍA Y TURISMO
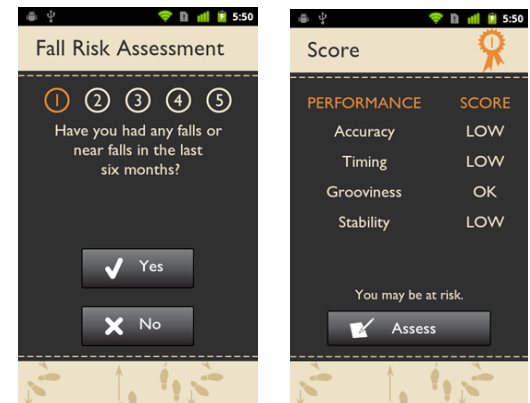
AAL AMBIENT ASSISTED LIVING

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

Dance! Don't Fall

- Users can **monitor and actively reduce the risk of falling,** while having fun!

- Works like a game: the user **follows the dance steps** with audio and video cues;

- Provides **feedback on the risk of falling**.

**Reached the final phase (Top 25) of the CES 2012 Mobile Apps Showdown**

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

eCAALYX

- eCAALYX – **EU** AAL Joint Program;

- Holistic solution that improves quality of life of **older adults with chronic conditions**;

- Increase **autonomy**, reduce hospitalization costs;

- AICOS: **Home Gateway and Set-Top Box**;

- **Pilot tests** in Spain, Netherlands and Italy.
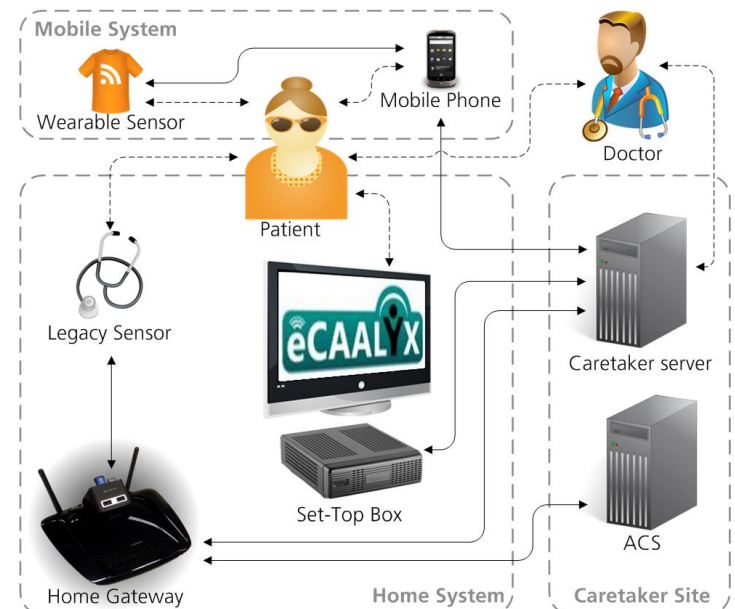
4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

EnAware (Domestic Energy Awareness)   En Aware

- **Reduce energy consumption in homes** by monitoring the energy consumption, raising energy awareness and enabling smart grid scenarios;
- Composed of a smart energy meter, several smart devices, a heat pump and a **home server**;
- Consumers can control and manage the smart devices and **review their energy consumption**;
- **Data mining** services for optimizing power consumption (behaviour patterns, anomaly detection, stand-by mode detection, etc.).

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

E-NO FALLS

- European Network for FALL Prevention, Intervention & Security;

- **E-NO FALLS thematic network** is a forum for all **stakeholders** to share knowledge, expertise, resources and best practice experiences;

- Build consensus to overcome the remaining obstacles to provide guidance for **fall prevention** and **fall detection** ICT-enabled solutions.
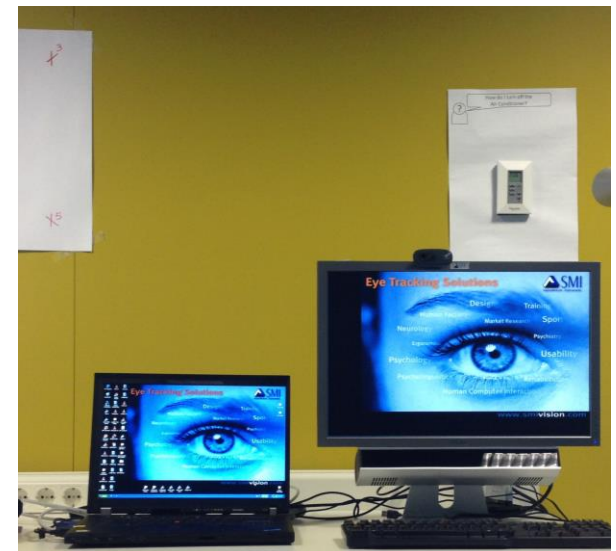
4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

> **EyeTracking4ALL**

- Creation of a Human-Computer Interaction Lab Web Platform, capable of systematizing Fraunhofer's HCI procedures regarding the observation, analysis and evaluation of the User Experience in all types of devices and ambiences;

- Use of **eye tracking equipment** (head-mounted and remote), and professional observational software (Observer XT) to **support the usability studies** conducted at the institute.

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

Heart Failure Clinic

- Mobile based telemonitoring system that allows the generation of **multi-dimensional health patterns**;

- Remote Patient Monitoring system enabling a **daily contact** with healthcare experts;

- Provides regular short-term evaluation of the disease status, allowing user-centered approach on the patient;

- Will optimize quality of care, reduce costs, reduce the number of readmissions and ultimately **reduce mortality**.
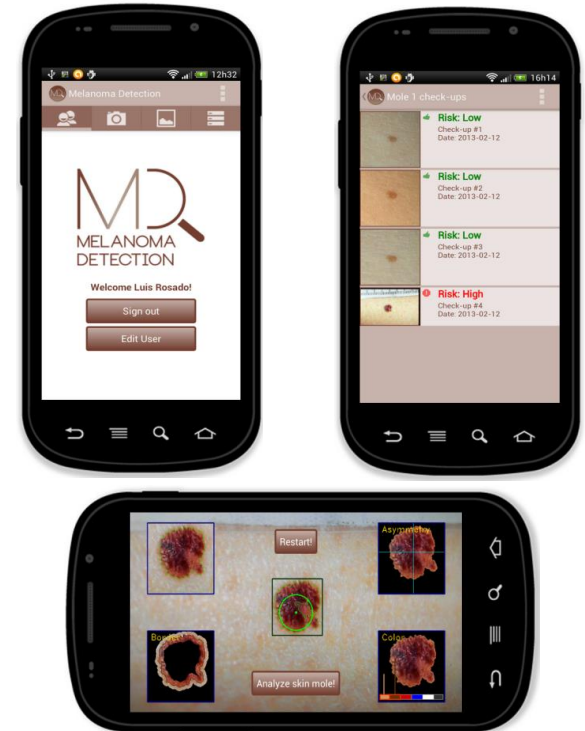
Fraunhofer
PORTUGAL

4. Fraunhofer AICOS

Key Project Initiatives – Ambient Assisted Living

Melanoma Detection

- Self-monitoring system that **analyzes skin lesions using a smartphone**;

- An Android app **takes photos of skin moles** and sends them to a server to be **stored and analyzed**;

- The **automatic supervised classification** of the skin lesions is based on the **ABCD Rule** (cooperation with the **Portuguese Institute of Oncology of Porto**);

- Aims to **alert users** to the presence of risk signs.

European Young Researcher of the Year AAL Forum 2012

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

Mobile CCTV (Closed-Circuit Television)

- Enhance a **Supervisory Control and Data Acquisition** (SCADA) system with mobile support;

- Fraunhofer AICOS developed a **mobile infrastructure** that interfaces with a Central Server;

- It receives **events, notifications and alarms** that are forwarded to mobile clients in the field.
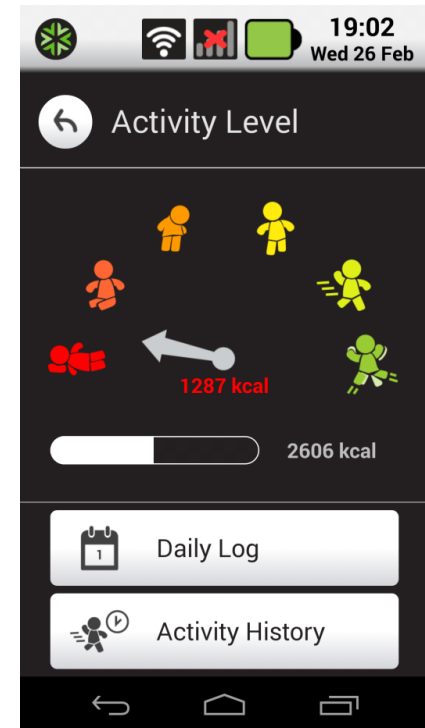
4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

Mover

- Development of integrated solutions for **activity monitoring, fall detection, fall risk prediction** and **security**, targeting older people living in the community;

- **Detects user's falls** and sends a **SMS or e-mail alert** to a pre-defined contact – a very useful feature for older people and their caregivers.

5th place in the 2nd Android Developers Challenge, "Lifestyle" category

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

mWaterSafety

- New technological solution using smartphones and external sensors that aims to increase the **safety in nautical activities**;

- By tracking the vessels activity, positioning and routes it is possible to generate alarms upon abnormal events, increasing the level of **security**;

- This information is also used to improve the **sportive performance** of watersports athletes.
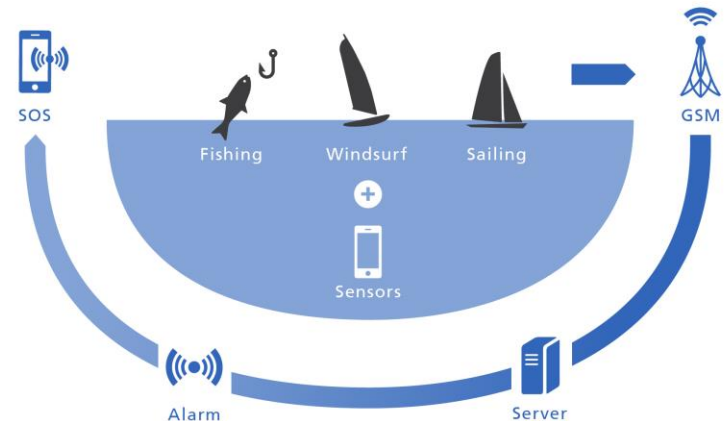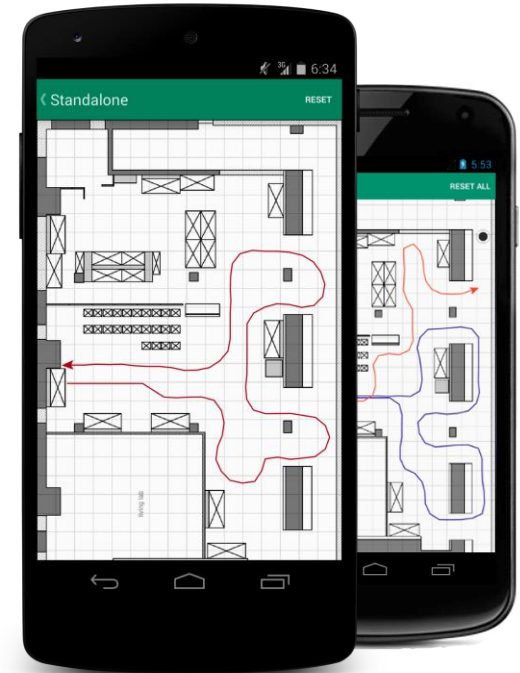
4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

Precision Indoor Location

■ A solution that allows **accurate indoor navigation** using an existing smartphone;

■ **Precision Indoor Location** relies on:
- Human walking model-based **motion tracking** algorithms;
- External references for absolute position provided by **ULF-MC**;

■ Targeted for **real usage scenarios** (pocket, in call, texting…) and **different applications** (indoor navigation, emergency, user behaviour analysis…).

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

REMPARK

- **European Project:** 11 partners from 8 countries;

- Develop a **Personal Health System for Parkinson's Disease patients**;

- System will – in real time – **identify ON/OFF/Dyskinesia states,** detect Freezing of Gait and register falls;

- Will **include a smartphone** to collect information and communicate with the clinical team.

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

S4S (Smartphones for Seniors)

- External project originated from the outcome of **Smart Companion**;

- Industrial customers: **Microsoft Portugal** and **Optimus**;

- **Redesign smartphones software** having in mind older adults' needs, in order to make it easier for them to be **integrated in the information society**.
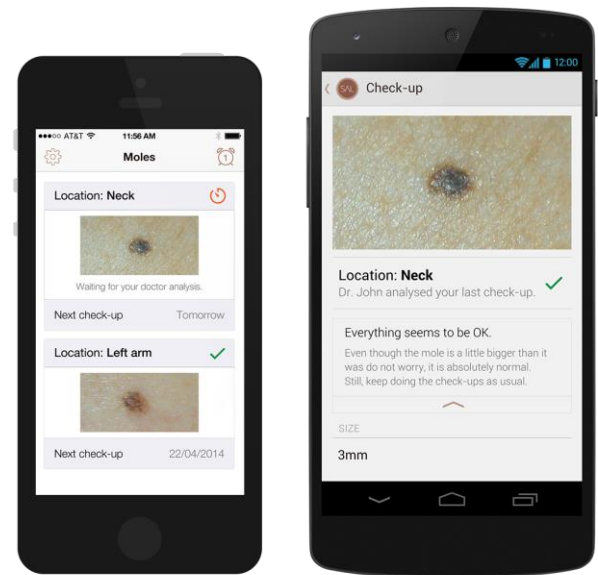
Fraunhofer
PORTUGAL

4. Fraunhofer AICOS

Key Project Initiatives – Ambient Assisted Living

SAL – Service Assisted Living

- Conceive innovative and **integrated** technological solutions that enable an **active collaboration** and **management** by the patient of his own **health**;

- SAL will design and develop products in the area of **skin lesions risk evaluation, healthcare for Melanoma patients, blood surveillance** in hospital internal blood services and hemophiliacs and hypo coagulation;

- A joint project between **Fraunhofer AICOS, Glintt HS** and **FEUP**.

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

SavEnergy (Autonomic Computing Activities)

- **Reuses the platform** developed for health monitoring – eCAALYX – **in a completely new environment**;

- **Optimize energy efficiency** of cellular antenna installations (BTS sites);

- **Remote monitor and manage** BTS sites with **autonomous decision capacity**;

- **Tests running** on 5 active commercial BTS sites.

4. Fraunhofer AICOS
Key Project Initiatives – **Ambient Assisted Living**

Shopview

- A project that allows **virtual navigation inside a grocery store for micro space control**;

- The solution allows to **plan and control product placement** within the grocery store shelves;

- A Kart will be built to allow **taking pictures from the store shelves** and **to navigate and display the shop shelves in a web based app**;

- Automatically detect invalid and misplaced products.
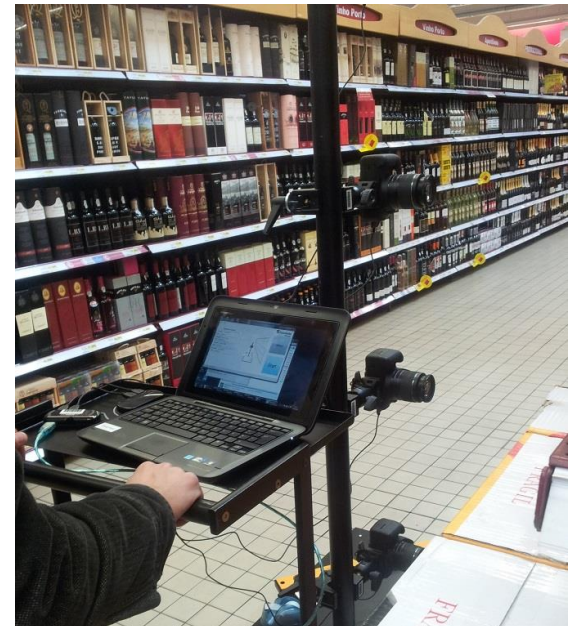
4. Fraunhofer AICOS

Key Project Initiatives – Ambient Assisted Living

Smart Companion

- Result of **internal research project**, already **licensed** to an industrial customer;

- Android customization for the **ageing and elderly**;

- **Highly simplified interface**, which allows it to be easily used and adopted by senior population;

- Includes many useful features, like **medication reminders, pedestrian navigation, fall detection** and easy sending of voice messages.
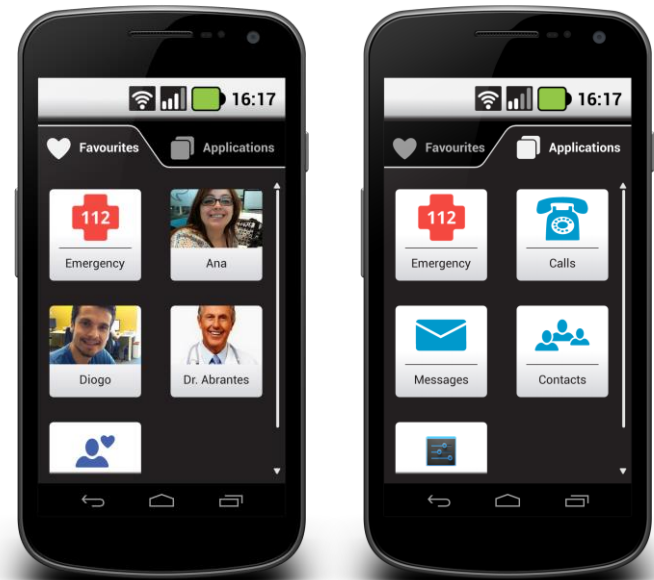

2nd place in the "Zon Prémio Criatividade 2011" Contest

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

ULF-MC

- A solution that allows **accurate indoor navigation with your existing smartphone**;

- Smartphones incorporate electronic compass, based on a **3-axis hall sensor**;

- Sensor capable **to receive information embedded in low frequency artificial magnetic fields**;

- The **infrastructure** is **very simple** and thus **cost effective**.
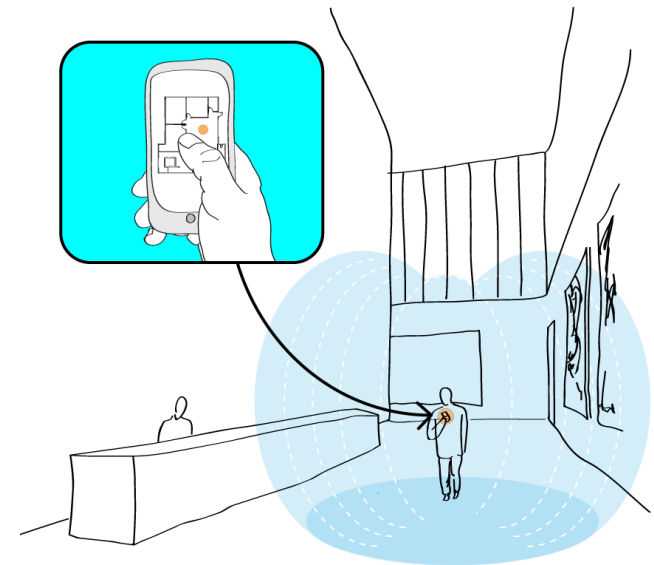
1st place in the "Galileo Master Award" European Satellite Navigation Competition 2012

Fraunhofer
PORTUGAL

4. Fraunhofer AICOS
Key Project Initiatives – Ambient Assisted Living

User Network

- Network to assist several projects regarding user **research** and **usability studies,** in sessions conducted either within Fraunhofer's **Living Lab,** or offsite;

- Ever growing. Now comprising over **400 users and over 30 institutions** (day-care centres, hospitals…);

- Platform for over 1000 activities (tests, focus groups…);

- Website for voluntary enrolment:
  www.colaborar.fraunhofer.pt
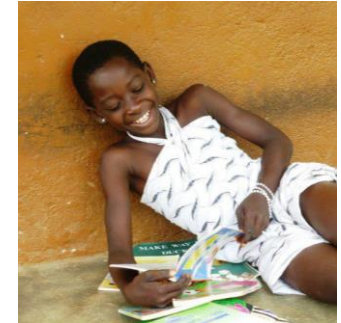
Fraunhofer
PORTUGAL

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

ACP Street Libraries

- Aims to contribute to the **development of culture in ACP countries** mainly by promoting the creation of new Street Libraries and the modernization of existing ones;

- **Specific objectives:**

    - Increase access to conventional Books;
    - Create and increase access to eBooks;
    - Cultural Heritage Collection;
    - Cultural Artists and Entrepreneurs;
    - Creation of Street Libraries.

ACP-EU Support Programme to ACP Cultural Sectors

With the Financial contribution of the European Union (European Development Fund) and the assistance of the ACP Group of States.
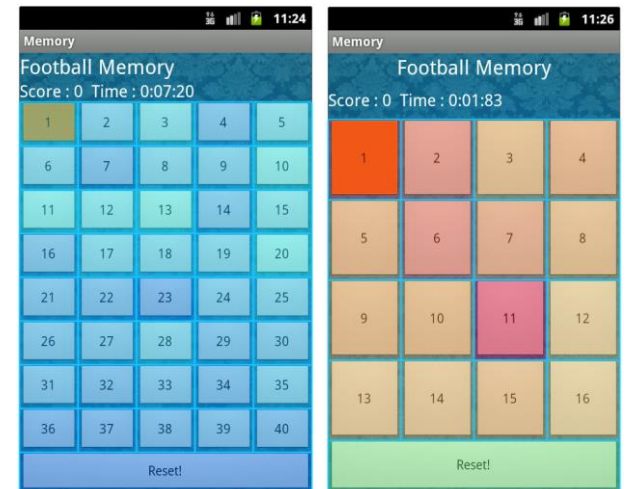
Fraunhofer
PORTUGAL

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

FUSAMI (Fraunhofer Usage Mining)

- System which offers smartphone developers and Human Computer Interaction specialists a web based platform to **perform advanced analytics on real time usage data**;

- Interaction data is displayed through intuitive visualization tools;

- The FUSAMI system can be easily integrated into any existing Android application.

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

GRA ICT4D (General Research Alliance ICT4D)

- Develop a **green and low-cost wireless communication network** for developing countries;

- Involves Fraunhofer AICOS and **partners from Europe, Africa and Australia**;

- Fraunhofer AICOS contribution is the development of **software solutions for mobile devices** which will address local demands.

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

Hydroponic Farming

- **Low cost** mechanism for **mobile monitoring** of hydroponic farms in South Africa and Mozambique;

- **Improves farm management** through **monitoring and control** of **environmental parameters**;

- Real time **alarms,** short **monitoring** cycles and automated **reports** leading to **increased performance**;

- **Partnership** with the Nelson Mandela Metropolitan University (NMMU) in South Africa.

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

IZIDoc

- **Mobile solution** to **simplify the administrative acts** that require personal attendance at service provider's facilities (administration, police, pharmacy, bank, etc.);

- Provides citizens with **information** about the status of **requested goods or services**;

- Optimization of the **customer service**;

- **Partnership** with the University Eduardo Mondlane (UEM) in Mozambique.

ON.2 O NOVO NORTE
PROGRAMA OPERACIONAL
REGIONAL DO NORTE

QREN QUADRO
DE REFERÊNCIA
ESTRATÉGICO
NACIONAL
PORTUGAL 2007.2013

UNIÃO EUROPEIA
Fundo Europeu de
Desenvolvimento Regional

Fraunhofer
PORTUGAL

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

Malaria Scope

- Preform automatic detection of *P. falciparum* parasite using **image processing techniques and smartphones** (cooperation with the **National Health Institute Dr. Ricardo Jorge**);

- Develop a mobile-based solution for **diagnosis of malaria** in medically underserved areas;

- Create a **low cost alternative** to the current microscopes;

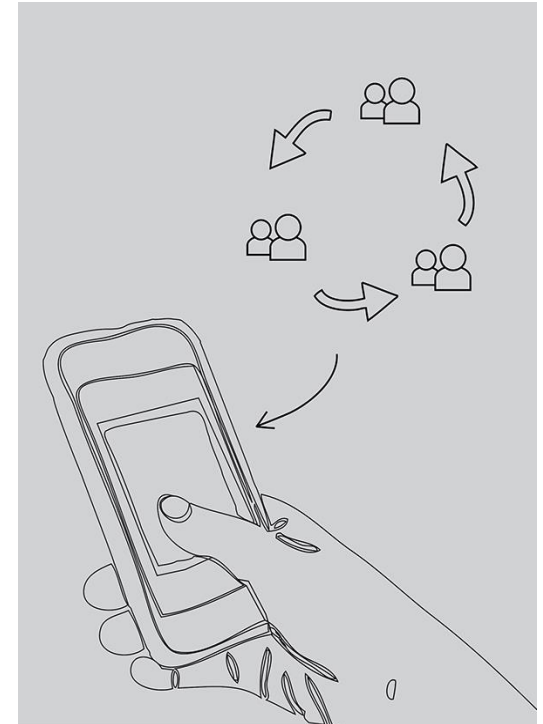- First triage framework to provide the **correct medication**.
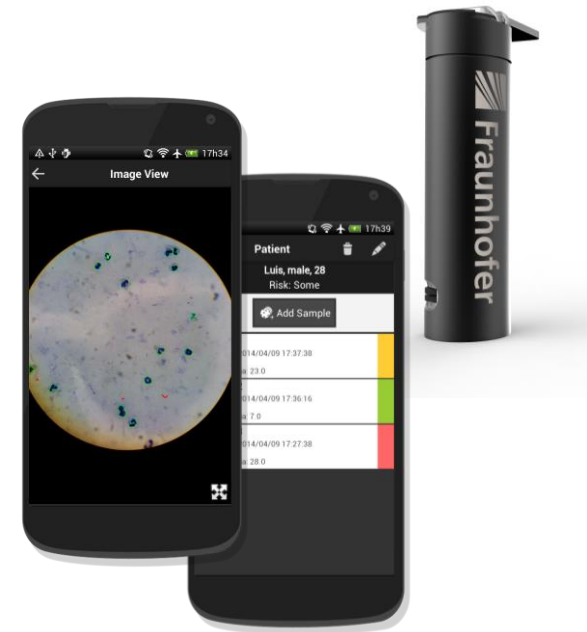
5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

OurMOZ online

- Citizen centered **mobile platform** which provides **real-time geotagged information** about Mozambican cities;

- Combines the **social network concept** with **citizen reporting** and **eCommerce**;

- This platform aims to **improve small commerce** and enhance the engagement between **citizens and other local stakeholders**;

- **Partnership** with the University Eduardo Mondlane (UEM) in Mozambique.

ON.2 O NOVO NORTE
PROGRAMA OPERACIONAL
REGIONAL DO NORTE

QREN QUADRO
DE REFERÊNCIA
ESTRATÉGICO
NACIONAL
PORTUGAL 2007.2013

UNIÃO EUROPEIA
Fundo Europeu de
Desenvolvimento Regional

Fraunhofer
PORTUGAL

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

POSTBOX WEB

- The Postbox Web Framework enables **offline-capable data-heavy Internet services** for occasionally connected Android smartphones;

- It allows a **secure sharing of smartphones** through a personal, password-protected and encrypted data storage for each user of the phone and each application.

Honorable mention
Vodafone Mobile Data Challenge 2012

5. Fraunhofer AICOS
Key Project Initiatives – ICT4D

Syndromic Surveillance

- **Clinical data collection** on isolated populations in developing countries using **mobile devices** with **lack of continuous network connectivity**;

- **Objectives:**

  - Relate collected data with earth observation data to predict outbreaks or epidemics;

  - Prevent spread of infectious diseases: **Malaria, HIV/AIDS**;

  - Secure data storage of sensitive information;

  - Multiple community health workers sharing a mobile device.