These pilots show the complete set of SOFIA solutions around smart environment applications and services in the contexts of Smart City, Smart Indoor Spaces & Personal Spaces.

**SOFIA PILOTS OVERVIEW**

The SOFIA project is building new innovative applications and services for every-day working and living environments, by making “physical world information” easily available for smart services - connecting the physical world with the information world.

SOFIA is a three-year ARTEMIS project involving eighteen partners from four EU countries. The common target is to enable and maintain cross-industry interoperability, to foster innovation while ensuring the value of existing legacy, as well as creating new user interaction and interface concepts to enable users to benefit from smart environments.

Moreover, a promising SOFIA Community for developers is growing up and will continue this vision beyond the SOFIA project.

The project outcomes bring new smart environment applications and services in the context of Smart City, Smart Indoor Spaces and Personal Spaces.

A set of seven large scale pilots across four different locations in Europe, will publicly exhibit SOFIA’s technologies great benefits during 2011.

This brochure contains general information about the SOFIA pilots set, making special emphasis on the applied technologies and associated benefits.
A mobile user is able to seamlessly consume a particular media from different devices while moving around different locations and use the resources of each personal environment. For instance, the user at home may be listening to a particular radio channel or music recording.

The user leaves home and plugs mobile phone’s earpieces, and automatically the media starts to play on this new device. Then, when entering the car, the car’s stereos continue to play the same radio channel or music track.

The user will have a more pleasant experience, since there is no time wasted on adjusting devices in new environments to start playing a particular media.

When an important message, SMS or Twitter feed, is received while music is playing, the device pauses as the message content is read out. Music is set to resume playing after the message is ended.

Another smart device is simultaneously running the navigation application. Car facilities, such as voice commands and steering wheel buttons, have then to be shared also not only for the controlling of the navigation, but also as a mechanism to query and define location based information.

## BENEFITS
- **The value for the user** is summarized in the notion that the user always has the best resources available for particular tasks in Personal domain.
- **The value for the manufacturers** is to be able to efficiently build multiple and diverse use cases over existing infrastructures, which can currently be easily benefited from as well as in the future.
- **The selected use cases** provide the possibility to show how contentions of resources within personal environments are managed, while different applications (media player, navigation, use cases, SMS, Twitter feed) are simultaneously running.

## TECHNOLOGIES

Several domains are addressed: Automotive, Mobile devices, multimedia entertainment

Technologies adopted in the Multi-Domain scenario are:
- **Shared Information Store:** RDF based
- **Semantic Information Broker (SIB)** with notify capability (Smart M3, Open Source SOFIA Interoperability component: http://sourceforge.net/projects/smart-md)
- **Reasoning Engine:** Smodels
- **Ontologies:** Geo, QuestionAnswer, Activity, Car
- **Multi-Wireless Connectivity:** Bluetooth, WiFi, 3G
- **Multi-Language Agent Programming:** C#, Python, QT
- **Multi-Vendor Platforms:** On Board Unit, N900
- **Speech Technology**

## MEDIA FOLLOWS USER

**PROVIDED SERVICES**
- Semantic Information Broker (SIB) service implementations and their access libraries for various platforms and languages
- RIBS is a SIB for resource limited devices with little dependencies and KPILow access libraries
- Steering wheel input service
- Audio input service (speech recognition)
- ILProxy, multimedia rendering pipeline
- Messaging service
- Text-to-speech service

The SOFIA Community crew will host projects around four general technical groups:

1. **Ontology:** Everything related with the definition of domains and the ontologies used will be covered by this group.
2. **ADK:** The focus of this group is on generating the necessary tools.
3. **Core:** The core group is the base implementation of any Smart Space based on SOFIA. There are several implementations for different operating systems, programming languages and transport protocols.
4. **Architecture:** This group is responsible for the design of the SOFIA architecture, protocols and standards.

The SOFIA Community has already been promoted within both, the Eclipse Foundation and PROMETEO (Spanish Technological Platform for Embedded Systems), and it is currently in contact with manufactures and distributors of devices, (e.g. sensors) operating within Smart Environments in order to incorporate SOFIA technology within its products by default.

It is relevant to mention that during the project lifetime, other ARTEMIS projects have already benefited by utilizing the results SOFIA has made available. European projects such as SMARCOs (Smart Composite Human-Computer Interfaces) & CHIRON (Cyclic and person-centric Health management) are already using the SOFIA platform and tools. This Community is backed up by the ARTEMIS-JU recognition, as SOFIA project has been awarded twice as best ARTEMIS Embedded Systems project, 2009 and 2010.

For more information please visit:

http://www.sofia-community.org/

SOFIA looks forward to a lively community of players in the embedded systems area, who will extend SOFIA technology and adopt it as a novel way of enriching their solutions.
SOFIA project has met all its desired objectives: a viable reference architecture applicable to many scenarios, the development and implementation of a framework suited to any domain and user interactions methods for all types of friendly environments.

In order to ensure the maintenance and update of the SOFIA technology life cycle after December 2011, the SOFIA Community offers the project outcomes and smart open source applications for developers as well as for end-users.

This Community is willing to mobilize developers from various domains beyond the project, who will have access to the common application development framework, which has proven to be scalable and flexible for any domain.

Having been born under this wide and rich background, the SOFIA Community is already working on the growth of its outcomes by creating the SOFIA Community.

Welcome to the Smart Objects Community

Embrace the change

http://www.sofia-community.org/

SOFIA is seeking for a Community to last after the project is finished, willing to build on the project findings. Therefore, the following characteristics are vital for the future of this Community.

Open Source

We do not want to wall up technology. All the results coming from this community are open source. Collaborate, and help us improving our results.

Multi-Domain

The aim of the project is to be useful for any domain, so if your domain is not already included, propose new ones. The more the merrier.

Multi-Platform

Are you programming for Windows, Linux, Android, iOS, TinyOS? Probably your platform is already targeted in the project. If not, please collaborate to include yours.

Multi-Language

We are developing in several programming languages: C, C++, C#, J2SE, J2ME for several platforms. We would like to have an implementation of SOFIA for each one.

Communication Agnostic

Whether your device communicates by Bluetooth, ZigBee, tcp/ip, ... it is not an issue. The project is flexible to include new ones as plugins.

Smart Engineering/Tooling

One of ours goals is to develop better and faster. We are developing a SDK with several tools which help you reduce the time-to-market dramatically.

In the domain of Facility Management, Smart Maintenance is a novel concept to approach complex building management when multiple actors (maintenance company, operators, clients and tenants) and multiple technologies are involved, interacting with the environment and providing new services. This pilot was designed by CCC - Italian Consortium of Construction Companies, EUROTECH, and the University of Bologna with the contribution of CONANTE, NKP and VTT.

The SOFIA Platform, that together implements a Smart Indoor Space. The pilot shows how a WSN infrastructure in an indoor space may detect anomalous conditions and trigger an alert to a building maintenance company which publishes in real time, after a human mediation, a call for intervention to mobile maintenance operators. Operators may accept the task via their mobile device and may be supported during their maintenance intervention activities. The maintenance company monitors the building status, manages the intervention and supervises all the process activities, while office tenants and visitors are automatically informed about the existence of a maintenance intervention, and the availability of spaces and services.

SOFIA Platform that together

- Smart M3 Open Platform
- Semantic Information Broker (SIB) with subscribe/notify capabilities
- RIBS
- Shared Information Store: RDF based Information Level Protocols: Smart Space Access Protocol (SSAP)
- SOA Oriented Architecture
- Multi-mode Wireless Connectivity: WiFi, J2, ZigBee
- Language Agent programming: C#, Python, Java, Prolog, C

This added value could be resumed by the following factors:

- Introduction of a channel for providing digital services in physical locations through different devices
- Extension of both, functionality and services, provided by existing and new products
- In long term, evolve an information based service development, aggregate information

Provided services:

- Automatic fault detection
- Fault notification to multiple actors (operators, office tenants, maintenance companies)
- Intervention request to selected domain actors (operators, office tenants, maintenance companies)
- Support for maintenance operator’s activities on the field (intervention acceptance, intervention management, spaces deciphering, faulty entity identification, etc.)
- Support for maintenance company process flow control
- Maintenance operator and maintenance activities logging
- Supervision of the entire maintenance process

Innovate education with new models, architectures & business models

- Introduce new business models to support multi-actor environments
- New functionalities & services for Facility Management companies
- Access to new & uncoventional markets
- Improved end-user comfort & use of space
- Native support for the integration with legacy systems

Construction Industry:

- New functionalities & services for Facility Management companies
- Maintenance procedures optimization & Interventions speed-up
- Improved end-user comfort & use of space
- Native support for the integration with legacy systems

Telecommunication Industry:

- Access to new & unconventional markets
- Introduce new business models to support multi-actor, environment-based data applications

Hardware device manufacturers:

- Multivendor device interoperability
- Possible exploitation of common SOA oriented platform
- Native support for the integration with legacy systems

Education and academics:

- Innovate education with new models, architectures & design styles
### Smart Maintenance on the Move

Smart maintenance on the move, is an example of European joint research in ICT, where industries from different sectors and academic institutions, cooperate to define the principles of a new class of professional services, which add value to the core business of traditionally non-interacting industries.

Specific to these services is the involvement of many actors with different profiles and the interaction with the environment. They are expected to bring in new levels of effectiveness while reducing overheads and resource requirements.

This pilot was designed by NOKIA, Centro Ricerche FIAT, CCC (Italian Consortium of Construction Companies) and the University of Bologna, with the contribution of Eurotech and VTT.

It shows how sensors in an office space may trigger an alert to a building maintenance company which publishes the work item to mobile maintenance operators.

The operators may accept the task via mobile devices. If the operator is in a car, the task can be accepted using the car speech recognition facilities and can be driven to the location guided by the mobile device map program. The office tenants are automatically kept informed of the repair progress by SMS.

This demonstrates the capability of the underlying ontology driven by the SOFIA open information framework to provide environmental-centric information services and integrate functionalities of separated systems and use cases.

### Provided Services

- **Automotive malfunction detection** (e.g. tire pressure monitoring system)
- **Fault notification to multiple actors** (operators, office tenants, maintenance companies)
- **Intervention request sent to selected maintenance operators**
- **Order acceptance from operator even while driving a car**
- **Support for a sequence of maintenance operator’s actions** (e.g. job acceptance and multiple reporting)
- **Hands-free speech based operator interface** in the car for job notification, job acceptance, job site guiding, place tagging
- **Notifications to office tenant via SMS** (job scheduled, intervention started and completed)

### Benefits

**Car Industry:**
- **Customer Specific Services** (demonstrated for maintenance operators) may be virtually extended to any Semantic Service available on passengers’ vehicles (doctors currently being considered)

**Construction Industry:**
- **Paradigmatic change in quality, efficiency and speed of maintenance processes**
- **Support for incremental growth of supported maintenance functions**

**Telecommunication Industry:**
- **New market and new business models to support multi-actor, environment-based data applications**

### Smart Home

Please meet Mark and Dries. When Mark and Dries arrive home, their presence is detected, and the lighting system is switched on. When they start listening to music, they think that it will be nice to have some visual lighting effects to accompany the music. Exploring the smart space, they discover that the bonding device can render these light effects.

They make a connection between the music player and the family bonding device through the interaction tile, while at the same time the decorative wall-wash lights in the room automatically dim to make the bonding device stand out more.

At the same time, the light pattern also starts being rendered on the remote bonding device, therefore Mark’s sister SOFIA can observe the same light effects in her own house. Now at SOFIA’s house, she gets curious after a while to learn what music Mark and Dries are listening to. She uses the spotlight navigation device to make a connection from the bonding device to the stereo.

**End Users:**
- **Playback music**
- **Rendering light via smart luminaries (functional and mood lighting)**
- **Novel user interaction functionality**
- **Interactivity tiles**
- **Means to control of light**
- **Ambient experiences**
- **Bonding device (to aid in the “awareness” connection between two parties)**

### Provided Services

- **Playback music**
- **Rendering light via smart luminaries**
- **Interaction tiles**
- **Means to control of light**
- **Ambient experiences**
- **Bonding device (to aid in the “awareness” connection between two parties)**
**VIRTUAL GRAFFITI**

Virtual Graffiti is a SOFIA based implementation that demonstrates user generated content and smart information services for users in various public environments.

**TECHNOLOGIES**

- Arduino SSAP Interpreter
- SSAP message protocol
- Wireless Sensor Network (WSN) integration
- Ontologies:
  - Sensor Measurement (provided in ADK)
  - Smart City domain
- Programming languages: Python, C++
- Platforms:
  - Symbian 3.0 Maemo, MeeGo (Nokia N8, Nokia N9, Nokia N900)

The Virtual Graffiti will be piloted with test users during the SOFIA pilots exhibition in Bologna and at the ARTEMIS & ITEA2 Co-Summit, Helsinki. Users will be able to easily and instantly share personal content and official information, get instant and up-to-date information, relevant on user’s locational context. These services can be extended with added value to 3rd party services. Basic services at different places can be offered for free, since there are no search and data transfer costs.

**BENEFITS**

- **TECHNOLOGIES**
  - Several programming languages: C, Java, Python, Qt
  - Multi-Vendor Platforms: Nokia NB, C7, N900; Google Nexus S, Samsung Galaxy Tab, etc.

**SUM-SS (SEAMLESS USAGE OF MULTIPLE SMART SPACES)**

Anna is sleeping. She can relax because she trusts her personal smart space and home smart space that everything will be ok for her early meeting. Her personal smart space takes care of her schedule, the time she needs for getting up and be prepared ready for the trip from home to the meeting.

The smart home takes care that her morning is relaxing: home automation, e.g. lights and air conditioning, are set according to the state she prefers during early wake-ups. Reading and modifying the states of the home appliances require different authentication and security levels. Smart home also takes care that coffee is ready and she has morning news and meeting material ready for reading. She checks out of the home with her NFC key. The smart home checks that all appliances and devices are in safe operation modes and windows and doors are locked. If not, Anna’s personal smart space notifies the situation and asks her to reconfigure the appliances to correct states.

**TECHNOLOGIES**

- RIBS (RDF Information Base Solution)
- NFC Access control
- Run-time security and performance management: mechanisms for security and performance monitoring, analysis, reasoning and adaptation
- Cam®Home Open Platform providing cloud services:
  - Office services – meeting agenda, additional material for meetings
  - Service discovery
- Home network:
  - Energy consumption monitoring
  - Light controlling system
  - Movement identification sensors
  - Wall socket control
- Connected by the LON network and controlled by the OPC server

**SERVICES**

- RIBS (RDF Information Base Solution)
- NFC Access control
- Run-time security and performance management: mechanisms for security and performance monitoring, analysis, reasoning and adaptation
- Cam®Home Open Platform providing cloud services:
  - Office services – meeting agenda, additional material for meetings
  - Service discovery
- Home network:
  - Energy consumption monitoring
  - Light controlling system
  - Movement identification sensors
  - Wall socket control
- Connected by the LON network and controlled by the OPC server

**BENEFITS**

- **SERVICES**
  - RIBS (RDF Information Base Solution)
  - NFC Access control
  - Run-time security and performance management: mechanisms for security and performance monitoring, analysis, reasoning and adaptation
- **TECHNOLOGIES**
  - Several programming languages: C, Java, Python, Qt
  - Multi-Vendor Platforms: Nokia NB, C7, N900; Google Nexus S, Samsung Galaxy Tab, etc.

**BENEFITS**

- **TECHNOLOGIES**
  - Several programming languages: C, Java, Python, Qt
  - Multi-Vendor Platforms: Nokia NB, C7, N900; Google Nexus S, Samsung Galaxy Tab, etc.

**TECHNOLOGIES**

- Arduino SSAP Interpreter
- SSAP message protocol
- Wireless Sensor Network (WSN) integration
- Ontologies:
  - Sensor Measurement (provided in ADK)
  - Smart City domain
- Programming languages: Python, C++
- Platforms:
  - Symbian 3.0 Maemo, MeeGo (Nokia N8, Nokia N9, Nokia N900)
SMART VIDEO-SURVEILLANCE

In the Smart Video Surveillance pilot, six European industries and SMEs from diverse sectors of video surveillance, system integration, networking and communications, monitoring and public advertisement devices have collaborated to define a common communication architecture and integration of services related to the surveillance and monitoring of public areas and infrastructures.

Public areas are places where operators and end users live together, the first ones performing their work there and the second ones spending their time in the same places for personal or social reasons. Therefore, in a smart city it will often be the case where the same devices are designed and used for differentiated services, based on the users who will be the target of the service itself.

The pilot shows an occurrence of the use of the same set of devices - easily interconnected in the same heterogeneous network- which are devoted to provide services for final users and for operators, and whose functions may be varied according to context situations, e.g. emergencies.

Digital video cameras are under control of operators to detect abnormal or emergency situations, so that when one of these situations occurs, surveillance operators activate a protocol prompting verification and, if needed, emergency evacuation of the area. In the pilot, different devices of the system interact to put security operators on alert, to help users and operators evacuate the dangerous area in security, and to keep operators informed of emergency developments.

The pilot -designed by Selex Elsag (former Elsag Datamat), Conante, Eurotech, INDRA, Nextworks and WMC- demonstrates how the SOFIA information open framework and the ontology designed for these scenarios allows full interoperability among different systems of monitoring and alerting within the infrastructure.

PROVIDED SERVICES
- Video surveillance via remotely controlled digital cameras
- Prompt communication to security operators ranging in proximity
- Remote guidance of selected proximate security operators toward the location of interest
- Multi-level anomaly management, involving proximate security operators and a control center (possibly office tenants, other operators, external teams)
- Exchange of secure information messages among security operators and the control center via wearable devices
- Notification of alerts/events to users and other operators in the public area via bluetooth
- Specific information messages sent to selected display devices, usually used for other aims (advertisement, information, news)
- Access and emergency doors opening and closing control

TECHNOLOGIES
- SSAP message protocol
- Android 2.2 and 2.3 (HTC desire, Samsung Galaxy S2)
- Arduino Mega (AT Mega 1280 microcontroller Board)
- Sensor Measurement (provided in ADK)
- Wireless Sensor Network (WSN) integration

BENEFITS
- Video-surveillance: Easy management and configuration of cameras in the system, with no interest in the manufacturer and in technology behind. Easy remote control of heterogeneous devices
- Monitoring: Easier monitoring of devices and systems, after adding their properties to the ontology and using the SIB as the interpretation core. Avoiding the design of tightly coupled modules in terms of communication. Emergency management: Support for emergency management, with involvement of different public alert systems to show the best path for exiting and to give advice to users
- Telecommunication Industry: New market and new business models to support multi-actor, environment-based data applications

VIRTUAL WALL

Virtual Wall is a SOFIA based implementation that demonstrates SOFIA capabilities around Smart Information Services within Smart environments. Design by INDRA, NOKIA and MWW, Virtual Wall benefits can be easily applied to multiple and diverse use cases across different industries (transport, public administrations, health, human resources, leisure...).

During the SOFIA pilots demonstration, Virtual Wall will benefit Madrid transport users. Bologna citizens and the ARTEMIS & ITEA2 Co-Summit 2011 audience at Helsinki, enabling them to easily visualize, generate and publish virtual notes and commercial ads, check or download native information provided by the entity managing the services and access to real time environmental information.

In these locations, the Virtual Wall System will identify the mobile device of the user and offer the Virtual Wall Application (to be downloaded via Bluetooth Fi). Specific real-time information will be also available on a display.

Once the user downloads the Virtual Wall application, he/she will have just to choose from the different offered options:
- Available services, e.g.: buses arrivals times, pharmacies, banks, etc
- Entity news and general information
- Virtual notes and ads visualization, generation and publication
- Environment quality real time information from sensors: CO2, Temperature, Humidity
- Virtual Wall commercial ads publication can be managed via SMS or webform by the interested entities.

TECHNOLOGIES
- Virtual Wall pilot applies the following technologies:
  - Arduino SSAP Interpreter
  - SSAP message protocol
  - Wireless Sensor Network (WSN) integration
  - Ontologies:
    - Sensor Measurement (provided in ADK)
    - Smart City domain
  - Programming languages: C, Java
  - Platforms:
    - Arduino Mega (AT Mega 1280 microcontroller Board)
    - Legacy LED Screen (HP Electronics Display)
    - Android 2.2 and 2.3 (HTC desire, Samsung Galaxy S2)

BENEFITS
- Managing entities:
  - Offer a more dynamic and attractive space: happier clients/users
  - Open, social and more active information manager supporting users content (virtual notes)
  - B3C Application - new advertising channel: high visibility, segmentation, easy to use and manage including virtual notes & ads moderation capabilities
  - Low investment and easy integration with other interoperable architectures, legacy and upcoming technologies/devices
  - Reduction of smart cities landfill (e.g. around bus stops or information points)

End users:
- Real time info. free access within own devices
- Social & smart information services boosting user participation

PROVIDED SERVICES
- Virtual Notes & Ads visualization
- Virtual Notes & Ads generation
- Virtual Notes & Ads publication
- Easy integration with WSN real time information
- Virtual Notes & Ads Moderation Application
- Information management and control of contents to be shown on displays
- Free & easy checking or download of native information provided by the entity managing the service