SmartProducts Annual Report

SmartProducts aims at helping customers, designers, and workers to deal with the ever increasing complexity and variety of modern products by fostering the idea of “smart products”. These are products that are able to “talk”, “guide”, and “assist” their users in dealing with them. Within this project we contribute to this vision by providing a platform that facilitates the development of such products. The platform leverages proactive knowledge, that is knowledge about how to interact with users, how to communicate and co-operate with other smart products and how to integrate into the environment surrounding the product. The platform is accompanied by tools supporting developers in maintaining proactive knowledge that emerges throughout the lifecycle of the smart product. In addition we investigate the socio-economic impact of such products by performing a detailed business analysis to understand the business value. SmartProducts investigates in the aircraft manufacturing, automotive, and consumer products domains as application areas and spans the entire product life cycle from product conception over production to product use and end of life.

Summary of Activities (ca. 150 words)

- Major achievements (e.g. key scientific / technical innovations, progress beyond the state of the art, expected impact / take-up, completion of market and user requirements survey, completion of demonstrator design or implementation)
- Finish with a statement on where the project is ‘positioned’ for the next year.

The goal of SmartProducts is to provide an industry-applicable lifecycle-spanning methodology with integrated tools to support the construction of smart products. Within its second year, the project focused on:

- The implementation and evaluation of the technical concepts and sub-components of the platform which were specified in the first year of the project.
- The integration of these components and theoretical insights into the overall SmartProducts platform, and the development of various demonstrators.
- A refinement of the requirements for smart products and proactive knowledge based on the lessons learned from the product design activities and scenario descriptions in the application domains.
- A qualitative and quantitative business analysis of all three application scenarios.

<Important work area>

- For each substantial and important area of work completed/started, make a short section. This should be tailored for the reader rather than being orientated around work package names.
As a rough guide each section should be only **150 words** long. However, topics such a project **demonstrator** should be given more space and detail.

- It is expected that a project can justify at least three such sections, and not more than six, typically **covering** items such as:
  - market prospects, user requirements and resulting “product” profile
  - technology outlook and innovative features
  - the demonstrator and results of field tests

- The choice of topics is obviously dictated by the current stage within the project's lifecycle. Some projects will typically report on their demonstrator and acceptance/field tests, others may concentrate on research and system specifications. Resource projects should be able to provide quantified information on the advances made in the compilation of data.

- Thematic networks, accompanying measures and other non-research projects should report on their achievements – development of standards, roadmaps, conferences, community-building, clustering etc.

Proactive knowledge and knowledge modelling:
The SmartProducts ontology has been completed and contains concepts for describing all major aspects of proactive knowledge. Among these are a conceptualization of context events and a conceptualization of interaction devices, based on the CC/PP standard. This knowledge will be used in the SmartProducts platform, enabling smart products to understand and make sense of these environments through semantic reasoning. This capability guarantees that smart products can integrate in open environments.

Interaction and user modelling:
We finished the implementation of the first version of the Interaction Manager component of the SmartProducts platform, which allows us to test the theoretical concepts with real users. The Interaction Manager comprises the Methexis Workflow Engine, which controls the overall dialogue between the smart product and the user and the smart product and other smart products in the environment. The Workflow Engine is context aware, meaning that it can detect certain events in the environment and progress in the workflow accordingly. The integration of context awareness with a conventional workflow engine is a major achievement of the project, as it enables proactive behaviour of smart products, i.e., smart products initiate interaction with the user based on context events without being explicitly triggered by the user.

Infrastructure and tools:
The MundoCore middleware and all other components have been ported to the OSGi platform, thereby making it easier for others to reuse them. The infrastructure has been tested in various demonstrators (see below) and technical prototypes. These show that the SmartProducts platform addresses the requirements elicited in the first project year. We expect some further improvements in the third project year, when the feedback from the application trials is analysed and incorporated in the final version of the SmartProducts platform.

Refinement of application scenarios:
We were able to complete the system design for two of the application scenarios, smart kitchen and smart vehicle. We have defined prototype systems that are currently being developed based on the SmartProducts platform. These prototypes will be extended in an incremental fashion to the final application trial systems, always providing timely feedback to the technical work packages on any findings. The focus of the design activities is now on the third application scenario (smart aircraft manufacture), where a final suggestion for a prototype is expected shortly.
Demonstrators:
We implemented several demonstrators, integrating software and hardware. The main goal of the demonstrator development was to gain hands-on experience of the problem space and to prove the technical feasibility of the anticipated solutions. The following demonstrators have been developed:

- **Cooking guide**: The Cooking Guide guides the user through preparing non-alcoholic cocktails using a number of smart kitchen appliances: a coffee machine for coffee cocktails (such as Irish Coffee), a scale for weighing ingredients, and a blender for mixing them. Users can select from a variety of cocktail recipes. They are then walked through the preparation of the selected cocktail by displaying textual and graphical instructions. The Cooking Guide and other smart appliances monitor and display the progress of the preparation. The Cooking Guide is context sensitive and adapts to user preferences. That is, users pre-modelled taste preferences and the currently available ingredients are accounted for in the choice of suggested cocktail recipes.

- **Smart wrench**: the user is asked to screw a component to an engine block. The component needs to be attached in several locations with specific combinations of screws and nuts, each by applying a pre-defined torque. To do so, the user uses a Smart Torque Wrench and is guided through the process by a Smart Instruction Manual, that is, a handheld tablet PC or mobile phone. The Smart Instruction Manual displays step-by-step instructions and interacts with the torque wrench to monitor progress. If an error is detected in the process, the Instruction Manual instructs the visitor how to fix it. After the procedure is complete, the visitor will be provided with a quality report and the work result (i.e., the engine block with the component fixed to it) is displayed in a 3D representation.

**User Involvement, Promotion and Awareness (ca. 150 words)**
Focus on project-level activities, including:
- the project user/industry group, its membership and activities;

**SmartProducts developer community**
The SmartProducts developer community was launched in October: [https://trac.tk.informatik.tu-darmstadt.de/projects/SmartProductsCommunity/SmartProductsPlatform/wiki](https://trac.tk.informatik.tu-darmstadt.de/projects/SmartProductsCommunity/SmartProductsPlatform/wiki)
The goal of the platform is to transform the results of the SmartProducts project into a self-sustaining community and thus to increase the impact of the project. An active online community centred around the SmartProducts platform provides support for users of the platform and also develop additional functionality for the platform.

**Standardisation activities**
SmartProducts partners have developed plans for contributions to the following existing standards respectively standardization groups:
- XPDL
- EMMA
- UPnP
- Semantic Sensor Network incubator group
Furthermore, SmartProducts is engaged in the W3C incubator group on Object Memory Modeling: [http://www.w3.org/2005/Incubator/omm/charter](http://www.w3.org/2005/Incubator/omm/charter).

- activities that have significantly raised the profile and visibility of the project (for instance presentations at international events, publications, press and media coverage)

**Highlight**: ICT 2010 Conference in Brussels
Two demonstrators of SmartProducts were presented at ICT 2010 (information and communication technologies) in Brussels. The Cocktail Companion developed by TU-Darmstadt guides users making Cocktails and the Smart Wrench Demonstrator developed by SAP helps engineers to tie up screws in the right order and with the correct axial force.

**Further Conferences and Workshops 2010**

- Mathieu d'Aquin, Andriy Nikolov, Enrico Motta. How much semantic data on small devices? 17th International Conference on Knowledge Engineering and Knowledge Management (EKAW 2010).
- Ziqi Zhang, Victoria Uren, Fabio Ciravegna. A comprehensive solution to procedural knowledge acquisition using information extraction. In the International Conference on Knowledge Discovery and Information Retrieval (KDIR 2010).
- Marcus Ständer, Bridging the Gap between Users and Smart Products, PhD-Forum at the Eighth Annual IEEE International Conference on Pervasive Computing and Communications (PERCOM2010). [PDF]
- Andriy Nikolov, Enrico Motta. Capturing Emerging Relations between Schema Ontologies on the Web of Data. Workshop on Consuming Linked Data (COLD 2010), 9th International Semantic Web Conference (ISWC 2010), Shanghai, China.

**Future Work or Exploitation Prospects, as appropriate (ca. 150 words)**

Include a brief summary of major activities to come. This can include development, but other events/actions that might be of interest to the reader are especially relevant, for example longer-term RTD prospects in the sector, prototype becoming available, field tests about to start, etc.
Exploitation is the process of ensuring that research output is put to good use and brings with it, if effectively managed, additional financial and other rewards. The SmartProducts consortium's exploitation strategy focuses on the results produced over the course of the SmartProducts project and efficient transfer of the gained knowledge as value-creating additions to existing projects or engagement in new innovative endeavours. Within the second year of the project, our focus was on actively executing exploitation activities within each partner and on the development and evaluation of common exploitation prospects. Various stakeholder workshops took place at SAP, EADS, CRF, TUD and USDF. The events cover company-internal knowledge sharing and education sessions, contributions to conferences with industry attendance (such as demos, dedicated workshops) and establishment of special interest groups to foster exchange on SmartProducts related topics.

Further Information
List here whatever you deem appropriate, using in particular Web references.