Innovative Retail Laboratory

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Abstract. The Innovative Retail Laboratory (IRL) is an application-oriented research laboratory of the German Research Center for Artificial Intelligence (DFKI) run in collaboration with the German retailer GLOBUS SB-Warenhaus Holding in St. Wendel. In this living lab, we conduct research in a wide range of different domains, mostly related to intelligent shopping assistance. Our demonstrators range from an instrumented shopping cart employing indoor navigation to several intelligent shopping consultants, ambient information services and an automated checkout system.

Key words: living lab, instrumented environment, shopping assistance, RFID

1 Vision and Goals

In our lab, we investigate new ways of customer interaction with products in a retail environment. Different types of interaction and interfaces are developed and tested for usability not only in our lab but also in a real retail store. The range of our demonstrators encompasses personalized shopping assistants and 'talking products' [1] as well as intelligent shopping carts, which plan and show the way through the store according to a shopping list. Furthermore, the assistants can provide personalized recommendations taking into account interesting recipes or health information. They compare products, point out special offers in a personalized way and give additional information about the production processes of goods.

However, the IRL does not only focus on concepts and technologies regarding the self-service store of the future as a place for shopping. The relation between the store and its customers begins way before entering the physical store. It starts with an individual shopping preparation and a personalized presentation of offers at home, continues with shopping assistance in the supermarket and finishes with information about purchased products and their use. As a whole, research at IRL aims to improve both the shopping experience of customers and the development of products by taking into account feedback at the various stages along a products lifecycle. At the beginning of 2009, research activities at

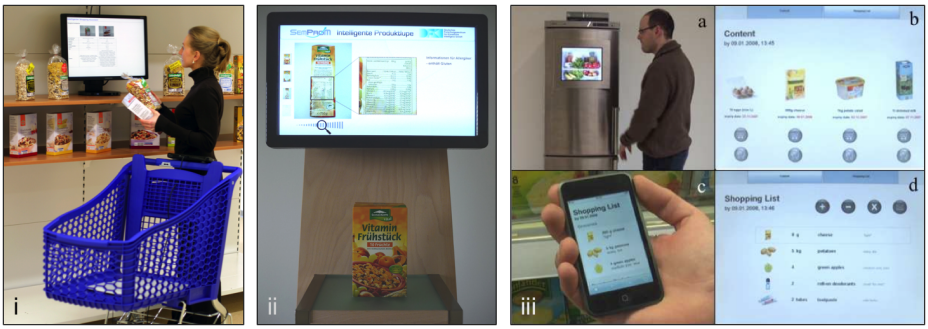

Fig. 1. Demonstrators at the Innovative Retail Lab: (i) Cereal Assistant; (ii) Intelligent Product Lens; (iii) Smart Fridge: (a) refrigerator instrumented with a touch panel; (b) visualization of fridge content; (c) electronic shopping list on a mobile device; (d) interface for shopping list creation

IRL have just recently started and some prototype demonstrators have been built to gather first experiences with novel shop interfaces and assistive technologies in the retail environment.

2 Scenario & Demonstrators

As we consider shopping as a comprehensive experience, in our research environment, the shopping process starts and finishes at home. The *Smart Fridge* in our home environment offers customers the possibility to create their individual *electronic shopping lists*, which can be managed by several persons, and gives an overview of the products inside the fridge and the corresponding best-before dates. For this purpose, the fridge is instrumented with RFID antennas and a touch panel integrated in the front door (see figure 1 (iii)). In this context, the fridge serves as an interface to the *Semantic Product Memory*, which collects all relevant information of each product's lifecycle in a meaningful way [2]. Figure 2 illustrates the stakeholders of a product's lifecycle (bright arrows) who can interact with the digital product memory (dark arrows). The IRL focuses mostly on research in the areas *storehouse*, *retail store* and *consumers* (highlighted area). In order to cope with security issues, the information stored in the object memory has to be encrypted. By means of a role-based access management, different user groups should be enabled to read or write on predefined parts of the memory.

The electronic shopping list can be accessed by means of a smart phone or be transferred to an *instrumented shopping cart* in the supermarket. This cart is equipped with a small touch screen integrated in its handle, on which the shopping list is displayed after the customer has identified himself by means of e.g. his finger print. Subsequently, the customer can start a navigation routine by clicking on a product in the shopping list. The *indoor localization* of the shopping cart is realized using an RFID antenna mounted at the lower part of the cart, which recognizes RFID tags placed in a grid under the flooring of our retail lab. The

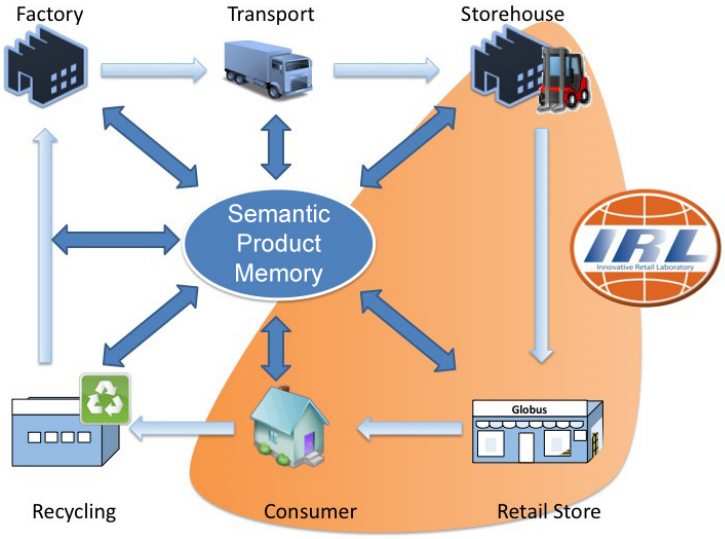

Fig. 2. Schema of a product's lifecycle (bright arrows) and the communication with the Semantic Product Memory (dark arrows)

product basket of the shopping cart is also fitted with an RFID antenna, which is used to recognize products placed in the cart. As soon as a product is put inside the shopping cart, a small icon of it is added to the list of recognized products at the left side of the interface, and if the product belongs to a category specified in the shopping list, then the corresponding entry is checked and shifted to the end of the list. In this way, items that are still missing remain in focus. Moreover, the total price of all products in the cart is displayed. During his shopping tour, the customer can be supported by several shopping assistants, like e.g. the *Cereal Assistant*, which helps comparing different types of muesli based on their ingredients and their nutritive values (see figure 1 (i)), or the *Digital Sommelier*, which assists customers in finding the right wine for a specific occasion. Both assistants use RFID technology in order to recognize user interaction with the products [3]. Additionally, the bottles of the Digital Sommelier are fitted with temperature and light sensors, which observe their current storage. Acceleration sensors attached to the bottle packages offer a further interaction option based on the orientation in which the customer is holding the product. Thus, if looking at the back side of the product, more detailed information is provided than when looking at the front side. By means of their mobile phones or a stationary kiosk, customers can explore the *semantic memories* of their products and hence get detailed information about the production, the transportation or the storage of each specific product item [4]. An additional *Intelligent Lens* application running on the kiosk system, facilitates the reading of text printed on the product package by enlarging a certain part of it, which is selected by the customer using the

touch screen (see figure 1 (ii)). Moreover, the application provides explanations about food additives denoted by E numbers and hints about possible allergens contained in the product [5]. An interactive *Clothing Consultant* recommends shirts whose colors best suit the customer's natural coloring according to the color seasons approach. In the instrumented changing room, the customer can register using his customer card on which his personal coloring profile is stored. The changing room also recognizes which shirts the customer has chosen (using RFID technology), and corresponding information about them is displayed on a touch screen, with which the customer can interact. The fitting room nicely bridges the digital and the physical world by suggesting additional textiles corresponding to the customer's season type that are available in the store but have not been brought to the fitting room. At the end of the shopping tour, the customer can simply walk through the *Easy Checkout* zone and hence, the products in his shopping cart are recognized automatically and sent to the cash desk. In this way, the customer only needs to approve the purchase, which can be again accomplished using a fingerprint sensor.

3 Conclusion & Outlook

In this paper, we presented our Innovative Retail Lab (IRL). Our goal is to investigate new ways of customer interaction with products in a retail environment. In our further work, we want to focus on ambient and seamless interfaces [6] in more detail to improve the shopping experiences for the users as well as the conditions of employment in the store.

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