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ABSTRACT

Food information is predestined to become an important part of eHealth systems and the technologies needed for this are already available. In future, food information might be retrieved location and time independent at the point of need (i.e. in shops, restaurants) with the use of mobile devices, such as mobile phones or ultra mobile computers, or with stationary devices having incorporated access to the Internet such as tables with touch screens in restaurants or shopping assistants in shops. At the moment, however, issues related to the real-time linking of food items at the point of need with food items stored in food composition databases need to be resolved before a large scale implementation of food information in eHealth systems will happen on a sustainable basis.
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1 Introduction

Food composition databases (FCDB) are one of the fundaments of nutrition science (1). Its use, however, is far from being limited to the field of nutrition science and the public health domain, food industry, legislation, policy development, agriculture or consumers all need and/or use data on food composition as well (2).

Many current or future uses of FCDB will rely more and more on information and communication technologies (ICT) and the speed at which such uses will be implemented will likely depend on a standardised accessibility of FCDB. The need for standardising FCDB has been recognised for long and the European Commission accordingly funded projects such as the COST Action 99 – EUROFOODS "Food Consumption and Food Composition Data" from 1995 to 1999 (3) and the ongoing Network of Excellence EuroFIR (2005-2009). The standardisation and harmonisation of FCDB across Europe resulting from EuroFIR will not only be of great benefit for the classical uses of FCDB, which have been outlined in the 2nd EuroFIR synthesis report (2). Together with improved data quality, increased accessibility to and better compatibility between FCDB they will certainly also increase the application of ICT to FCDB and open gates for new FCDB uses. Since FCDB are already used for different health-related purposes, the upcoming eHealth area will certainly become an important field for future FCDB uses.

The aim of Task Group 4 on Data Interfaces of EuroFIR’s Work Package 1.8 is, therefore and generally speaking, to demonstrate how FCDB could be used in the future and who will be their users. Specifically, this report will focus on existing innovative tools within the eHealth area which already include food information or in which food information might be included. The follow-up report (D1.8.12) will then concentrate on new FCDB uses or users and contain, as an Annex, a proposal on overcoming the problems of linking food products with FCDB food items.

2 eHealth and Food Composition Databases

The European Commission (EC) defines eHealth as the application of ICT across the whole range of functions that affect the health sector, from the doctor to the hospital manager, via nurses, data processing specialists, social security administrators and - of course - the patients (4). Furthermore, the EC specifies that eHealth systems include tools for health authorities and professionals as well as personalised health systems for patients and citizens as, for example, health information networks, electronic health

records, telemedicine services, personal wearable and portable communicable systems, health portals, and many other ICT-based tools assisting disease prevention, diagnosis, treatment, health monitoring and lifestyle management (4). In particular the so called Personalised Health Systems shall, according to the EC, empower citizens to become involved in healthcare processes and enjoy better interaction and relationship with healthcare providers (5).

The integration of high quality FCDB into the eHealth sector may have an impact on many healthcare aspects. Using ICT consumers will be able to retrieve information of food/nutrition independent of time and/or location (home, supermarket, restaurant, classroom...). Together with further individual medical information/advises transmitted by a healthcare professional over the Internet the consumer will have access to personalised (tailored) information assisting in the selection of adequate foods to cover the individual needs. Access to more and more FCDB available in the Internet, the upcoming tendency of personal electronic health records and the awareness of consumers about health issues such as possible health effects of food will likely all drive the need/wish to use food information not only more often, but also by using innovative tools.

To sum up, the general idea of eHealth is to provide location and time independent, individually tailored access to health sensitive information to the citizens that will help them making informed choices at the point of need. It is, therefore, easy to foresee that eHealth will become a major driving force for future FCDB uses.

3 Innovative Technologies/Tools for Uses of Food Composition Databases

Information and communication technologies differs from other methods of communication in many ways such as speed (written messages are delivered instantaneously and can be read at the recipient’s convenience), permanence (messages disappear when deleted or can be stored for years on disks or in standard files), accessibility or usability (innovative technologies enable an easy, location independent man-machine interaction) (6). Although printed food information will still be used in different situations, the access to FCDB using ICT is predestined to become increasingly important in the dissemination of food information.
There are probably two major ICT that can accommodate tools or applications using FCDB for eHealth purposes, if the access needs to be location independent: the Global System for Mobile Communications (GSM) and the Internet. The distinction between GSM and Internet is not so straightforward, because some applications such as accordingly equipped mobile or smart phones can make use of both communication ways. Both GSM and Internet can also be used whenever access to FCDB is location dependent as for example in restaurants or shops. In these situations, however, a purely wired access to FCDB through a local area network is also possible.

One of the ideas of eHealth is that information shall be provided to the user whenever there is need for information. Therefore, for the purpose of this report it was decided to classify the innovative technologies/tools that already are used to access FCDB or that might be used in future to access FCDB according to user's needs, i.e. where and when the user will access the information.

### 3.1 Location and Time Independent Access to Information

The access to FCDB independent of time and location is possible by the use of mobile devices. Such handheld devices are mobile phones, smart phones, Ultra-Mobile PC, and perhaps also notebooks (though notebooks might already be too large to be considered as a handheld device).

#### 3.1.1 Global System for Mobile Communications (GSM)

The GSM is an open, digital cellular technology used for transmitting mobile voice and data services (7). As a wireless communication standard it is supported by more than 200 manufacturers and used by more than 700 mobile phone operators across nearly 220 countries of the world (8). All in all, two billion customers are served, representing more than 80 % of all mobile phone users worldwide (8). New technologies are already part of the GSM family, allowing a continuous adaptation to changing customer needs. These technologies comprise GPRS, EDGE, 3GSM, HSPA and IPI, which will or already do allow much faster connection speeds (up to 7.2 Mbps compared to 9.6 kbps of the classical GSM (9)) or transfer of new data formats (e.g. video or TV).

Mobile and smart phones are the tools/devices that already can be used to access FCDB by now. A couple of corresponding projects that have been completed or are under progress right now will be presented in the following chapters.
The Barcode Recognition Toolkit (BaToo) has been developed at the Institute for Pervasive Computing at the ETH Zurich (10). BaToo is a freely available EAN-13 barcode recognition and information system that is both lightweight and fast enough for the use on camera-equipped mobile phones. The EAN-13 barcode recognition and resolution toolkit contains two parts: the barcode recognition component running entirely on J2ME enabled mobile phones that support the MMAPI9 (Mobile Media Application Programming Interface) extension and the Java based information server component, which is located on a separate server, to which the detected product code is transmitted via a GPRS connection. The provided client provides functionality to recognize an EAN13 code, communicates with the server and displays the results. The information server uses a plug-in architecture, allowing to quickly adding various services and online information sources (represented as so called “service connectors”). Although this process could also be located on the phone itself, performing them on an external server provides a greater extendibility, higher flexibility and better performance.

One of the prototypical applications implemented in BaToo is the Allergy Assistant (Fig. 1). Based on the recognition of the barcode of a packaged food product the information on the allergen potential of the food could be retrieved from an appropriate database (stored on a server or locally on the mobile phone). One could also imagine retrieving other food information such as for example energy density, content of a specific micro-nutrient or presence of certain ingredients (e.g. pork meat in a composite dish).
**TIVIK pilot project**

In the TIVIK project of the VTT Technical Research Centre of Finland a pilot system was developed to deliver personalised food product-specific information to the consumer (11). Similar to the BaToo, a barcode reader software application was created and patented within the project. However, TIVIK not only consists of the barcode reading handheld device, but it is a complete personalised information system with a web based portal including food diary, exercise calculator or shopping list creator (Figure 2).

![Architecture of the TIVIK pilot system](image)

**Figure 2. Architecture of the TIVIK pilot system (11).**

In a field test performed with 100 consumers over two to four weeks the entire system was rated positively and 84 of the subjects would have been willing to pay for using the system. The use of the mobile phone was initially considered as novel and excellent idea, but then described as troublesome "due to technical problems – the reading of the barcodes was sometimes difficult with the mobile device, the connection could collapse several times when trying to reach the data from the server and carrying the ex-
tra device around was awkward” (11). Thus, provided that no technical problems occur and access to a sufficient number of food items is granted, one could expect that barcode reading mobile phones might indeed be used by consumers.

**Personal Digital Assistant Access to FCDB**

Smart phones or other personal digital assistants (PDA) can also be used to access FCDB without barcode reading tools. The USDA database, for example, is freely available for use with a Palm handheld device (12). There, the database is downloaded to the device and can be searched without the need to connect to the database. The Japanese FCDB at the Sugiyama University, in contrast, can also be searched with a mobile phone or PDA, but there you need to connect with the database stored on a server accessible through the Internet (13).

### 3.1.2 Mobile Internet Access

Although the public started becoming aware of the Internet only some 15 years ago, today a good part of the industrialised world uses the Internet. For example, according to Internet World Stat the Internet penetration by the end of June 2007 was on average 70 % in North America and 60 % in Europe (14). The obvious trend is that more and more people not only get access to the Internet, but they will get or already have location independent access to the Internet at high speeds allowing an easy transfer of increasingly larger amounts of information wherever needed.

The internet can be accessed either wired through local area networks (LAN) or wireless through wireless access points (WAP) or hotspots that usually are connected to a wired network. The coverage with WAP/hotspots is by far not as extensive as with GSM, but there are several movements going on right now with the aim to offer (free) wireless Internet access to entire cities. Google, for example, provides free wireless for the city of Mountain View, where Google's headquarters are located (15) and is about to do same for San Francisco (16). The city of St. Gallen in Switzerland aims at providing free wireless access to its citizens and the Dutch city Leiden already has implemented an inexpensive, fast wireless network for the city and surroundings (17).

In terms of technology for FCDB use, the Internet might (still) have some advantages over GSM. The data transfer rate is higher and one can use devices that have larger displays than mobile / smart phones or other PDA. Thus, it is easy to foresee that the Internet, both wired and wireless, is predestined to become a major technology for dif-
different FCDB uses. Next to mobile / smart phones and PDA, the Internet can be accessed with portable computers (Ultra-Mobile PC, notebooks) or wearable computers.

**Portable Computers**

Notebooks have the complete functionality as their larger counterparts, the desktop computers, with the exception that they are portable. However, only smaller notebooks with a mass of perhaps less than 1.5 kg can be considered conveniently portable. Heavier notebooks might not be carried around in all situations like one carries mobile phones. In contrast, a new generation of computers, the Ultra-Mobile PC (UMPC), can certainly be considered a handheld devices and, therefore, they might be better suited as tools for FCDB uses than notebooks.

Ultra-Mobile PC have a touch screen of a size of 7 inches or less. For example, the smallest available UMPC is the OQO Model 2 with a 5 inches wide touch screen and it weighs about 500 g (18) (Fig. 3). The OQO is described as compact enough to be carried around in a jacket pocket or purse. Another feature of some UMPC will be a new text input method: DialKeys. It consists of two rings of keys around the lower corners of the screen that will be used with the thumbs (Fig. 4). Extended battery lives of UMPC might reach 8 to 9 hours.

![OQO Model 2 Ultra-Mobile PC.](image1)

![DialKeys.](image2)

**Wearable Computers**

Computers that are worn on the body are called Wearable computers. They can, for example, be incorporated in the cloths or worn on the wrist like a watch. Although at the moment even the newest devices such as the Zypad from the US company Parvus
Corporation can not really be considered very usable (Fig. 5), in future Wearable computers might become interesting tools for FCDB uses.

Wearable computers incorporated in cloths might also be used to constantly track body functions such as temperature, movements or other health related parameters and give individualised and prompt feedback to the user. However, at the moment it is difficult to imagine how FCDB might be of added value for such Wearable computers except if these computers are used as a classical computer (Fig. 6).

The production of Wearable computers might get boosted by a large scale production of flexible displays. The first prototypical applications with such displays are already available (e.g. Readius from Polymervision (19), Fig.7), but they do not look very appealing at the moment.
3.2 Location Dependent and Time Independent Access to Information

All the devices that can be used to access information both location and time independent (wireless access) can also be used to retrieve information at defined places such as restaurants, shops or at home. If the information shall always be retrieved at defined places, i.e. if it is location dependent, then also wired solutions can be applied and devices can have larger displays compared to their handheld counterparts, though this is not a necessity. The next chapters give examples of devices that can be used location dependent.

3.2.1 At Home

A simple example about the incorporation of food information in a device used in the household setting is the food or dietary scale (Fig. 8). Different companies already have implemented FCDB in theirs scales (e.g. the Swiss FCDB in the Soehnle Food Control Scale).

![Dietary Computer Scale](image)

Fig.8. Dietary Computer Scale from Salter (left) and Food Control Scale from Soehnle (right)

More futuristic examples of kitchen appliances that could use FCDB are refrigerators, microwave ovens and cooker hoods. A cooker hood with integrated TV and DVD player is already available from Siemens (LC8M950, Fig. 9). Similarly, Samsung (Fig. 9), LG, Electrolux and Siemens have fridges on sale with incorporated TV or Internet (Fig. 10).
Fig. 9. Siemens Cooker hood LC8M950 (left) and Samsung Smart Zipel refrigerator (right)

Fig. 10. Refrigerators from Electrolux, Siemens and LG (from upper left to right, clockwise).
3.2.2 *In Shops*

The use of innovative ICT in shops can be shown best with the Future Store Initiative of the METRO Group (20). The METRO Group believes that "forward-looking technologies make shopping easier and more convenient for customers. New applications in the stores provide them with background information and ensure the constant high quality of products and services. Companies will be able to offer their customers tailor-made services and an enhanced shopping experience".

A selection of devices is used in the Future Store to help the consumer making informed choices directly at the place of decision. Information Terminals on or next to shelves "offer that certain extra: recipes and wine recommendations as well as details on the foods, including their origin and nutritional value" (Fig. 11). Smart scales recognise food items to be weighed (Fig. 12), so that food information easily could be displayed together with the weight of the food item.

One core component of the Future Store is the Personal Shopping Assistant (PSA). The PSA is a small mobile computer with a touch screen and barcode scanner attached to the shopping trolley (Fig. 13). It offers a variety of functions – including an individualized shopping list, comparative offers and an overview of what has already been purchased, the scanned products in the trolley. The PSA can also be used to access additional product information and simplify the payment procedure.
A PSA is also part of the different devices used in the PIPS project funded by the European Commission. The main goal of PIPS (Personalized Information Platform for Life and Health Services (21)) is to create a new health and life knowledge and services support environment for protecting the health of the individual. PIPS is a complex system of services that also relies on high quality food information (Fig. 14).

Fig. 14. Overview of the PIPS system
3.2.3 **In Restaurants**

Restaurants are locations where food information might be welcomed by the consumers by obvious reasons. Although it is far from being a standard that restaurants offer a broad palette of food information to the consumers, some already have started providing such services. At Boston’s Legal Test Kitchen in the USA, for example, customers use innovative technology right at their tableside. Using portable plasma touch screens at their tables they can access the Internet and so get food information if wanted (22). In Zurich, the Yooji’s Sushi Bar went one step further. Next to Internet access with computers with touch screen installed in front of every seat, one can also retrieve information about the food that is offered in the bar (Fig. 15).

![Fig. 15. Yooji's Sushi Bar in Zurich](image)

One device that could be of great interest for the use of FCDB or food information in general in the restaurant setting is Microsoft Surface (23). Microsoft Surface is a large touch screen computer integrated in a table (Fig. 16). Food information, either of items to be ordered or of items put on the table, could be directly displayed on the table itself.

![Fig. 16. Microsoft Surface](image)
4 Concluding remarks

The potential use of food information with innovative tools within (or also outside) the eHealth area opens a new and fascinating area for FCDB. It is perhaps for the first time ever that food information can be delivered to the consumers whenever and wherever they want it and this at a high speed. The technologies to make this possible do not need to be invented. They are already available.

However, some issues / barriers need to be addressed to achieve a successful and sustainable integration of food information with the innovative tools described above. A major issue will be to real-time link the food items available in a shop, restaurant, etc. with food items stored in FCDB. EuroFIR WP 2.2/2.1b has already done some important work in this field (see Presentation on "Food Industry Sustainable Data Transfer" in the Annex) and a proposal on how this issue could be solved with LanguaL will be part of the next Deliverable of WP 1.8 TG4 (D1.8.12).

5 References


6 Annex

Hodgkins C, Krines C, Raats M. Food Industry - Sustainable Data transfer. Presentation held at the Sustainability Task Force Workshop, 13-14th June, ETH, Zurich.