The context sensitive shopping list

Andreas Pirali, Niklas Klein, Sian Lun Lau, Klaus David

Chair for Communication Technology (ComTec), Universität Kassel

1 Introduction

With the introduction of the digital world in all areas of life new appliances were also installed in cars. In the past, the radio and the cassette player were the main means for infotainment in a car. Today, the car navigation systems have taken over the dominant position of modern car infotainment. Current off-the-shelf navigation systems feature a satellite navigation device, media player, radio and TV reception. The idea to connect a car with the web is more than 10 years old (Lind et al. 1999), cars with a web connection are available meanwhile (Gafron 2008).

Another convergence that has taken place is the increasing usage of mobile phones in the car world. Hands-free sets allow mobile phone usage while driving, offering different ways of communication and more.

Nevertheless, all these exciting technologies and available functionalities are only first steps towards what will be possible in the future through the usage of a web connection in the car.

The idea of using web services while driving around seems to be promising as shown in the following examples, which are not limited only to automotive but can also be used by a driver. Based on a text-to-speech engine, the German provider talkingNote[1] offers to read texts from various web sources, such as Twitter messages, RSS feeds, Google Notebook and Calendar, websites and emails, to a recipient using a phone connection. This is of course possible with a mobile phone in a car. The service provider Jott[2] offers a similar service like talkingNote, and it additionally provides the possibility of posting entries to popular web services like Twitter, Facebook, Toodledo, Wordpress and many more (Jott 2009).

In co-operation with a major OEM (Original Equipment Manufacturer) our goal was to develop a social network application for cars based solely on web services. The application chosen, from a jointly developed overview of possible applications, was a social network enhanced, context sensitive shopping list.
What makes this application attractive and why it is useful for cars explains the following scenario.

[1] http://www.talkingnote.de

[2] http://jott.com (service available only in the USA and Canada)

1.1 Scenario

Imagine a family whose father Max is working in his office in the city while his wife Mary keeps the household and looks after the three children. During the day Mary realizes that the family ran out of milk, bread and several other items. She adds these items to her shopping list on her mobile phone. This shopping list is synchronized with the family shopping list stored at online.

Max is also really busy but during the lunch break he plans the construction of a new dollhouse. This would be a perfect gift for his daughter's birthday in a few days. He remembers that he needs some screws and a new saw blade and he also puts these items on the shopping list using his office PC.

When Max is driving home in the evening the car's infotainment system reminds him to buy the respective items of the family shopping list, as he approaches a super market and later a do-it-yourself store. Now he can conveniently shop for the required items without forgetting anything.

1.2 Requirements

Therefore, the research question was how to transfer the concepts of web services and social networks to the automotive context. How could these concepts be integrated into a car that way that the driver has an added value?

For the evaluation, a special car PC – a prototype of a standard PC whose form factor allows the seamless integration into cars - was used to interact with the driver and a permanent broadband web connection was available. How this web connection is assured, was not the focus of our research.

We specified a set of requirements the shopping list application had to fulfil:

1. Accessibility: The shopping list should be accessible via mobile phone, car infotainment system and standard PC.
2. Attracting the driver's attention as less as possible: Therefore the application should work as autonomous as possible.
3. Visualisation and Interaction: The car PC must be used for visualisation and interaction.
4. Focus on web services: The complete processing work has to be done by web services. This includes also the Car PC; the car PC has to work as a web server offering the cars GPS data as a web service.
5. Reuse of web services: Another development goal was to re-use as many existing web services as possible to avoid reinventing the wheel.
6. Functionality: The shopping list demonstrator should have the following functionalities:
   - add and remove items from a shopping list from home and on the move,
   - find appropriate shops for the items on the shopping list,
   - locate these shops,

- locate the car and
- inform about shopping possibilities/needs while driving around.

1.3 Outline

In the next section we will present current shopping list solutions. Section 3 will explain our approach, the conceptual architecture and the implementation of the architecture. Section 4 will present the evaluation results from a discussion in the public at the Cebit 2009 about the acceptance for such an application, based on the presentation of the implementation. Section 5 will discuss further work for the developed service while Section 6 will conclude this paper.

2 State of the art

Consecutively, we give an overview about the diverse software approaches concerning shopping lists. Right now there is no solution for car infotainment systems or at least the explicit operation in cars as we pointed out in chapter 1. Therefore we investigated applications which address the same issues in the area of applications for mobile phones.

The classical way to use a shopping list is to write down on a paper sheet over a period of time what is missing and needed in a household and what should be bought next in a specific shop. When the shopping day arrives, the shopping list is picked up and used during the shopping process.

It is obvious that this is a useful case for a mobile application. For example, it is not surprising that the Apple App Store offers more than 35 applications when we searched for the German term "Einkaufliste" (shopping list).

Because of the huge amount of applications with nearly the same functionality, we will mention a selection which includes a comprehensive overview of the functionalities of such an application. We distinguish between device-only applications and applications which synchronise with web services. The former are not synchronised or updated via a web connection.

2.1 Device-only applications

There are many apps like "Quickshop[3]" that offer the simple functionality of a list to which items can be added or removed: The list can be sorted alphabetically or by category. A special idea of this app is that lists can be sent via SMS to other people.

"Foodle[4]" has an integrated dictionary with a lot of product items. Based on this dictionary words are completed automatically so that typing one or two letters is often all what is necessary to add a new item to the list. "Foodle" is location-aware so that when an item is checked off from a list, the application remembers the GPS location for future reference. When a user returns to that location, a cross-hair is shown in that item's checkbox to indicate the item is nearby. The list can be sorted in such a way that the nearby items are shown on top of the list while the checked ones dive to the bottom of the list.

Figure 1: Store locator from the „iFood Assistant"

The "iFood Assistant[5]" is a shopping list with a store locator offered by the grocery producer Kraft. Based on recipes from the application provider, a shopping list can be put together and the software also shows the directions to nearby stores.

2.2 Connected applications

"Einkaufsliste-mobil[6]" allows the user to put items via a web site on web based shopping lists. As a special service the special offers from large supermarkets are available and by simply clicking on the special offers these items can be stored in the shopping list. The composed lists can be synchronised with a mobile Java application. While shopping, the items can be marked off.

[3] http://www.ittrend.de/quickshop.html
[4] http://anythinghonest.com/foodle/
[5] http://www.kraftfoods.com/kf/iFood.aspx
[6] http://www.einkaufsliste-mobil.de

The "Grocery Gadget[7]" for the iPhone offers additional functionalities like

- images: take photos of items and describe them that way
- cost calculation
- sharing of lists over a web portal within a group to get the same shopping lists on every device of family members

Other functions like sorting (Alphabetic, by Category, manual, Checkbox), categories (Bakery, Baby products …) and to send the lists by email are also available.

"Economy Shopping[8]" is not connected to the web but can be synchronised with tables stored on a PC. This application remembers the order of the last shopping trip so that when a shop is chosen which was visited previously, it sorts the list based on the checking of the items from the last time.

2.3 Summary

Some of the applications (e.g. Foodle) offer context sensitive functionalities like the storage of GPS data for the items checked off the shopping list or by showing near shops (e.g. iFood Assistant) regarding items on the list, but it is not possible to let a car driver (or a pedestrian) be informed while driving around about the shops that are on his shopping list. The combination of accessibility by a group of persons, permanent updating and checking of the list in the background and the prompt information about close shops regarding the items on the list is completely new. Functionalities like the storage of GPS data for items are interesting and can be added to the application later. For the first implementation they are not necessary and expedient.

3 Implementation of the shopping list service

3.1 Approach

To meet the requirements specified in chapter 1.2 regarding accessibility we decided to use websites as interfaces for the shopping list. Also the information on the screen of the car PC, that shows the driver near shops, is realized as a website.

Context awareness (Schilit 1994) became the key concept to automate functionalities as much as possible. To give location based recommendations while driving around is in principal not a new idea as there have been approaches like hybrid, context sensitive recommender systems (Brocco et al. 2008) and others. Our approach is to use web services which recommend Points of Interest (shops) based on the actual position of the car. The shops that should be searched are specified

[7] http://www.grocerygadgets.com

[8] http://www.innobytes.com/en/apple.aspx

by the items on the list. The shopping list itself is part of a social network where the members manage the items on the list.

The usage of several existing web services is detailed below. For graphical representation of maps, Google Maps[9] and its easy to use and comprehensive Maps APIs[10] were used. This allowed us to concentrate on the ideas and the implementation of the processes below the interfaces.

3.2 Implementation

Besides the Google Maps API that is used for graphical representation, we used several state of the art web technologies. Figure 2 depicts the basic architecture of our implementation. There are three external data sources that were aggregated to derive a more valuable service:

- GPS data from Car PC
- Shoppinglist from Toodledo[11]
- Shops located in users proximity from Google local search[12]

The first data source, GPS, was under our own control. Due to its limited resources in relation to server hardware, we do not use a complete JEE compliant

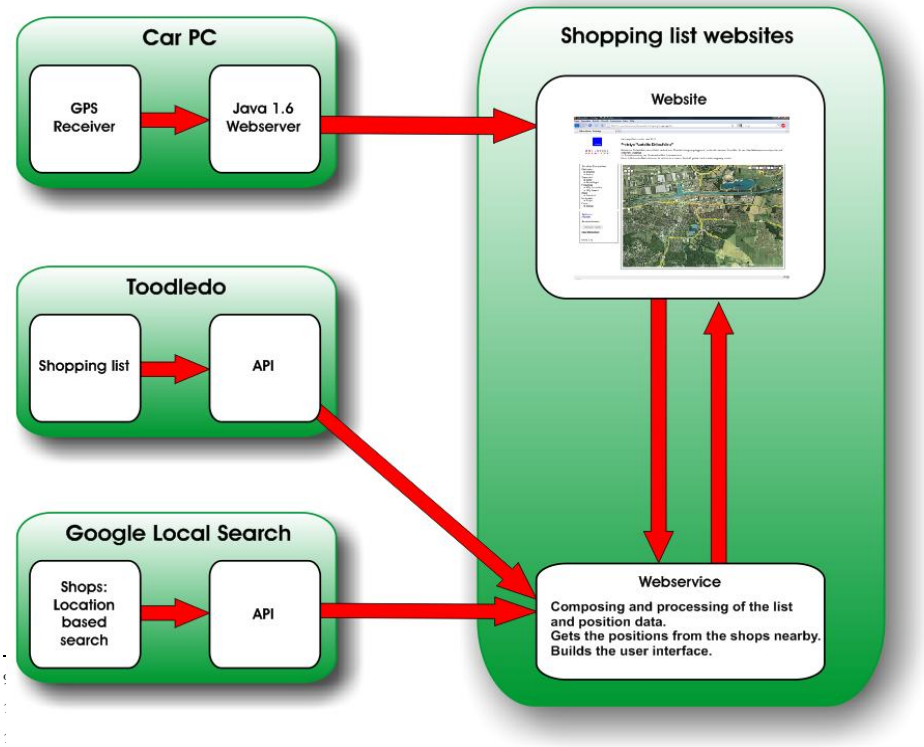

Figure 2: Architecture of the context sensitive shopping list

server. Therefore we used the Java 1.6 build in webserver to expose the GPS data as SOAP webservice.

The shopping list from Toodledo as well as the Google Search API offers REST (Fielding 2000) interfaces. Toodledo serves answers to HTTP get requests as XML, while Google Local Search provides JSON.

The reason why the Toodledo online to-do list service was used was again the comprehensive APIs[13]. There are also applications by Toodledo for mobile phones available so that it is easily possible to add and remove shopping list items with mobile phones. The possibility to tag items was used to categorise the items.

The data from Toodledo and Google Local Search is merged into a more useful representation of a list of shops in the users' proximity along with shopping list items and GPS location for the shops. This data is returned as XML over a REST web service to the representing website.

The calculation results are brought to a website which can be displayed in the car. On the display of the car PC within a browser the website will be shown. The website informs the driver visually about the nearby shops selling the items on the shopping list.

4 Evaluation

We implemented the shopping list as explained in chapter 3. Figure 5 shows the car PC interface with the actual position of the car which is received in an adjustable time interval (Figure 3). From the car's position there is a route proposal shown (blue line) which connects the shops that are listed on the left in the second box (Figure 5). The first box on the left shows the items on the shopping list.

Figure 3 shows the options of the application e.g. the IP address of the shopping list service, login data for the Toodledo account and the list id. The actual position can be set by clicking on the map, by filling in coordinates in the "Lat" and "Long" boxes or by receiving the position from the car PC. Therefore the car PC IP has to be set.

It is possible to manage the items on the shopping list with Toodledo. Figure 4 shows a screenshot of the iPhone web interface displaying the shopping list. Access to the Toodledo list is of course also possible via a browser with PC and car PC.

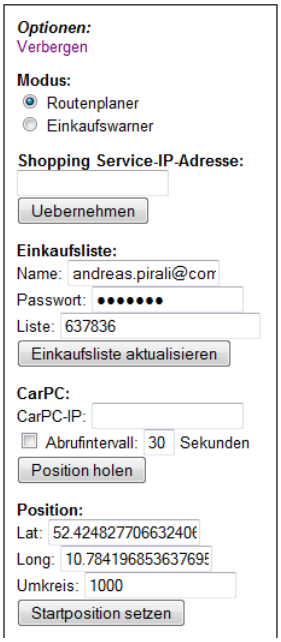

Figure 3: Options

[13] http://www.toodledo.com/info/api_doc.php

So far, the shown implementation is a demonstrator. It was presented to the public at the CeBit 2009 in Hannover (Universität Kassel 2009) and received positive feedback from the technical interested audience. The demonstrator was shown to more than 250 people.

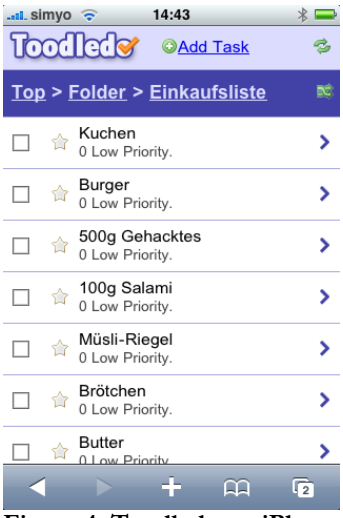

Figure 4: Toodledo on iPhon

Despite the usual criticism levelled against new technologies (e.g. scepticism about observation and loss of the ability to remember simple things like shopping list items) the application approach obtained warm responses especially from families. Some women commented that this application has a good chance to be a practical solution in their households. The use case mentioned in the scenario was often commented upon. Another main point of the feedback was that the interface hast to be improved comprehensively that way that the driver doesn't have to look on the car PC screen.

Overall the feedback from the polled persons was mostly unanimous (even from the sceptics) that this application gives us an impression of the things to come. So far it is not the case that everybody needs it, but for special user groups

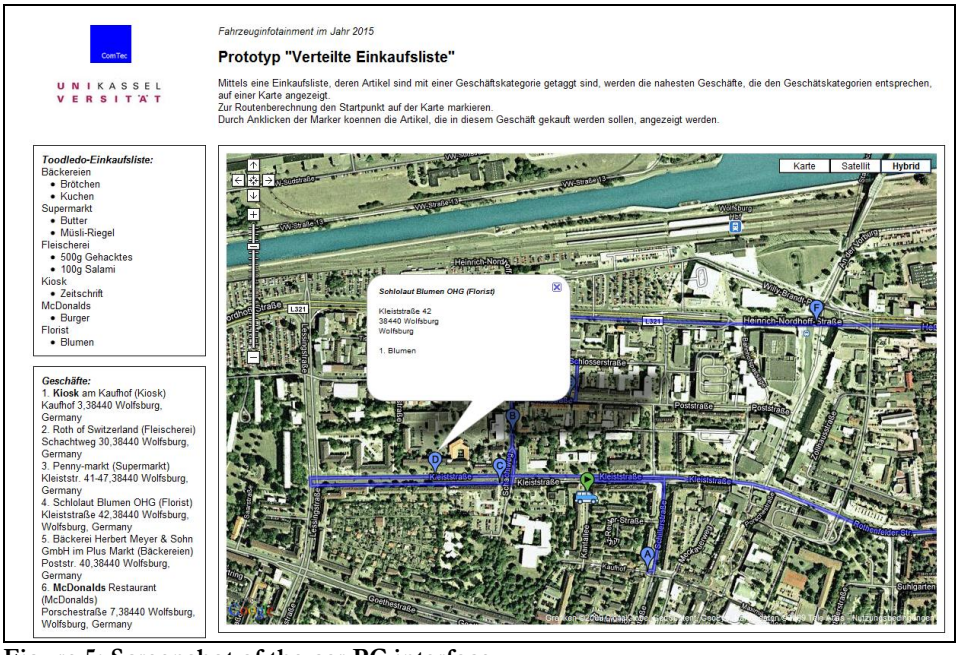

Figure 5: Screenshot of the car PC interface

like families it seems to be a good help and many asked persons are also open for such an application. This is of course not a formal user evaluation but gives us a first impression of user acceptance.

5 Further work

5.1 Further Research

There should be research about different approaches for the architecture of this service. For example it should be investigated where to process the GPS data: directly in the car PC or on the web server. There should be a comparison between these two different approaches done.

Besides these technical research questions the user acceptance should be evaluated. Aside of this question it has to be proofed that such an application doesn't distract the driver from his proper task.

Another research topic is the inclusion of more web services. At the moment, only information about shops is used from a web service (besides the shopping list) but the inclusion of additional information can be useful for recommendations. Currently, the information used is already available in many modern navigation systems. However, when one wishes to have up-to-date information such as actual inventories, special offers etc. included, the local calculation approach may not be the most economic solution because of more data traffic between the car and the web.

5.2 Software Development

The first improvement should be the interface. This includes an improved output on the display as well as the implementation of acoustical notifications. The representation for the display of the car PC and also the user interface have to be optimized. There have to be acoustic warnings that are not in competition with the street and the traffic. Visual information, especially on a separate display, attracts the visual as well as the mental attention of the driver (Rössger 2005, p. 50-61). In contrast to the visual channel, the auditory channel is relatively unburdened (Meroth Tolg 2008, p.2) and seems to be the better solution for such a function.

The inclusion of the shopping list service in a navigation system should also be done in the next steps to direct the driver towards shops he wants to go to.

Based on discussions at the Cebit, a necessary improvement for usability is to include favourite shops and shops to avoid. Also the integration of more Web 2.0 approaches (O'Reilly 2004) seems to be promising. Recommendations and pricing information for articles (entered by shops or users) would allow a great advancement of the service.

Also to mash up the shopping list with other web services like Qype[14] would help us to benefit from existing ratings and recommendations. A reliable database for shop addresses and the shop's business would go along with such a "mashup". Another important information to be included is the shop opening-hours so that no one drives to a shop to find it closed.

6 Conclusion

With this paper we have shown how the existing concepts of social networks, context awareness and web services can be introduced to cars and how they can be used while driving around. Using the example of the web service "context sensitive shopping list", it was demonstrated how new ways of communication and easy to use applications can extend car infotainment systems. The cars' infotainment system plays the role of an assistant who assumes tasks that the driver need not concentrate on while driving the car.

The impact of a stable broadband web connection and the adoption of web services for cars cannot be overestimated. In the scenario discussed an impression can be gained as to how these web services can change our daily, automotive lives.

References

Brocco M, Eigner R, Wörndl W (2008) Ein hybrides, kontextsensitives Recommender System für mobile Anwendungen in vernetzten Fahrzeugen. In: Tagungsband der Multi-Konferenz Wirtschaftsinformatik 2008 - Teilkonferenz "Automotive Services", München.

Fielding R T (2000) Architectural Styles and the Design of Network-Based Software Architectures. Doctoral Thesis. University of California, Irvine.

Gafron S (2008) Fernsehen und Internet erobern das Auto. http://www.welt.de/webwelt/article1911322/Fernsehen_und_Internet_erobern_das_Auto.html. Last viewed on 2009-07-28.

Jott (2009) More Jott links. http://jott.com/jott/jott-links.html. Last viewed on 2009-07-29.

Lind R, Schumacher R, Reger R, Olney R, Yen H, Laur M, Freeman R (1999) The Network Vehicle-a glimpse into the future of mobile multi-media. In: IEEE Aerospace and Electronic Systems Magazine 14 (9): 27-32.

[14] http://www.qype.com

Matheus K, Morich R, Paulus I, Menig C, Lübke A, Rech B, Specks W (2005) Car-to-Car Communication - Market Introduction and Success Factors. Held at ITS 2005: 5th European Congress and Exhibition on Intelligent Transport Systems and Services, 1 - 3 June 2005, Hannover. http://www.itsforum.gr.jp/Public/E4Meetings/P04/6.1_Rech_VSC_050531.pdf. Last viewed on 2009-08-20.

Meroth A, Tolg B (2008) Infotainmentsysteme im Kraftfahrzeug. Vieweg, Wiesbaden

Naone E (2009) Web applications on call. http://www.technologyreview.com/communications/22166/page1/. Last viewed on 2009-07-29.

O'Reilly T (2005) What is web 2.0?. http://www.oreilly.de/artikel/web20.html. Last viewed on 2009-07-28.

Rössger P (2005) Die Mensch-Maschine-Schnittstelle von Fahrerinformationssystemen. In: Winner H (Hrsg), Landau G (Hrsg) Tagungsband des Darmstädter Kolloquiums Mensch und Fahrzeug: Cockpits für Straßenfahrzeuge der Zukunft. Ergonomia, Darmstadt

Ruppenthal S, Lück D (2009) Jeder fünfte Erwerbstätige ist aus beruflichen Gründen mobil. Berufsbedingte räumliche Mobilität im Vergleich. In: Informationssystem Soziale Indikatoren (ISI) 42: 1-5.

Schilit B N, Adams N L, Want R (1994) Context-Aware Computing Applications. In: Proceedings of the Workshop on Mobile Computing Systems and Applications. Santa Cruz, CA

Pressemitteilung (2009) Uni Kassel auf CeBIT mit Ausgründung Yatta Solution und 'Web 2.0 im Auto' präsent. http://cms.uni-kassel.de/unicms/index.php?id=6666&pmid=802. Last viewed on 2009-08-05.

Urbanski A (2009) "Wireless Wolfsburg" - ein vermaschtes Funknetz. iX 4/2009:111-113