Navigation for Vehicles, Bicycles, and Pedestrians

NAFFF

Dr. Thomas Schöberl [1], Dr. Stefan Baumann [2],
Christian Reinhard [3], Dr. Thomas Eymann [4]

[1] Robert Bosch GmbH, Hildesheim, Germany, Thomas.Schoeberl@de.bosch.com
[2]Telematica e.K., Linden, Germany, sbaumann@telematica.de
[3]3Soft GmbH, Erlangen, Germany, Christian.Reinhard@3soft.de
[4] Robert Bosch GmbH, Hildesheim, Germany, thomas.eymann@de.bosch.com

Abstract - **The project "NAvigation für Fahrzeuge, Fahrradfahrer und Fußgänger – NAFFF" (Navigation for Vehicles, Bicycles, and Pedestrians) investigates the future integration of portable navigation devices with mobile In-Car-Systems. The overall objectives of NAFFF are the development of a concept for the integration of the three mentioned applications, the realisation and implementation of a pre-functional demonstration system, and the evaluation of the system under realistic conditions. This paper will present user requirements for the identified applications, results of system and sensor testing, and the architecture of the NAFFF-system.**

1 Introduction

Future traffic telematics services and portable terminals will consist of onboard systems and also of offboard systems and components. Onboard systems are devices integrated in the vehicle and offboard systems are mobile devices for vehicles, bicycles, or pedestrians. This trend has already begun (e.g. central traffic guidance on PDA basis) and numerous developments are started within the range of personal mobility. Future services will support e.g. location based services, emergency call (E112), indoor navigation, pedestrian navigation, bicycle navigation, special applications for handicapped persons, seniors, risk patients, children, etc.

2 Motivation

Due to these developments in the future the integration of different types of portable terminals into vehicle navigation systems will be evaluated. A goal of the project NAFFF was to investigate the integration potential. The common use of digital maps plays a central role by the different systems.

3 Digital Map

The onboard unit of the vehicle navigation system offers the possibility of reproaching a large number of digital special maps which will then transfer if necessary to the mobile terminal (with limited memory and arithmetic performance) [Fig. 1].

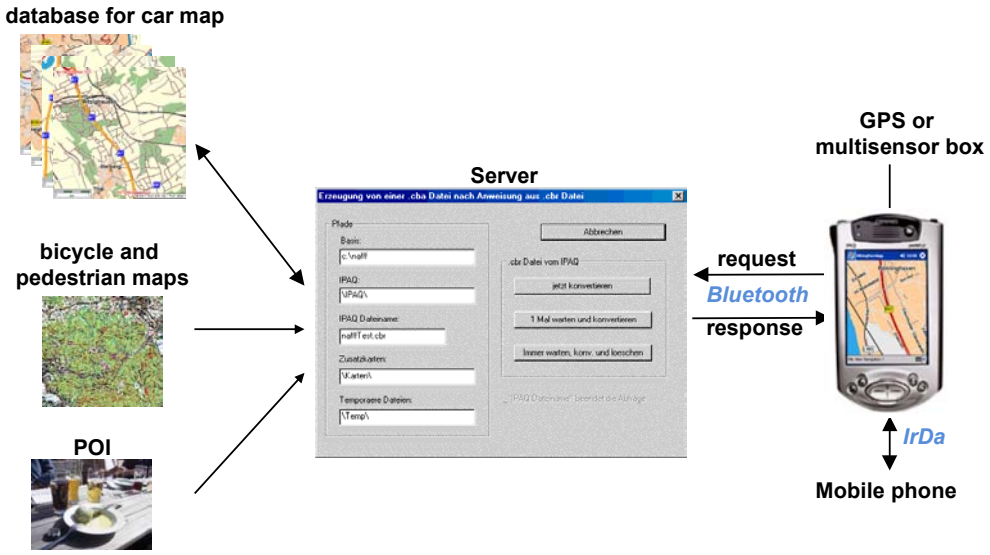

Figure 1: NAFFF functional model

The limited resources of a PDA ends in a display conflict with the available car map. The PDA cannot display the map because the PDA display has a lower resolution and smaller size display. To avoid this conflict the car map will e.g. divided into nine maps, see figure 2. The advance of the defined maps is that the PDA can now display the maps in a high quality.

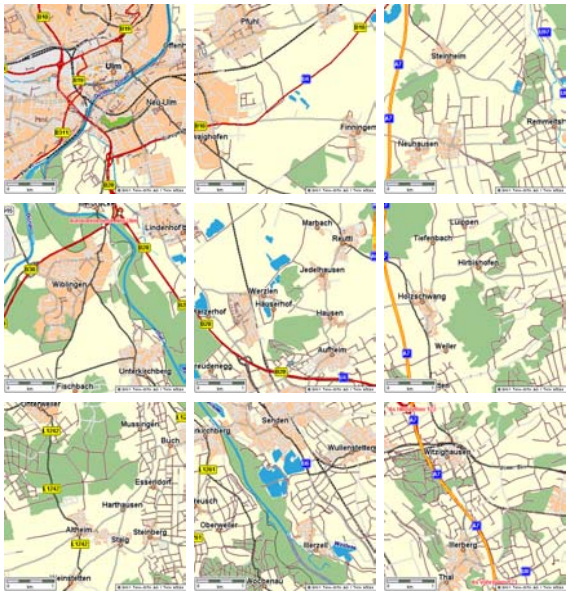

Figure 2: NAFFF functional model

For the data exchange between the car navigation and the PDA an exchange format and protocol was developed the so-called cbr & cbh protocol.

For example the PDA request a map with the following parameter:

- Type of map: => CARMAP
- Center position in WGS84 => 47,700000°, 11,800000°
- Size of map in [m] => 1000
- Map ID => -1
- Number of partial view: 9 => 2
- Resolution: 400x400 pixel (fixed)
- output format: 256 bmp (fixed)

The car navigation system calculates the requested cut of the maps and sends them to the PDA via Bluetooth, WLAN, IrDa.... The sample data of the defined request in the cbr format is:

cbr: NAFFF#MAP#CARMAP#47700000#11800000#1000#-1#2#EOFFF

The car navigation system starts to calculate the cut view of the map and store it in bitmap files. The result will be send with the cbh protocol format, e.g. sample bitmaps and data:

<MAP-ID> # <NumberOfBitmaps >

 # <Bitmapname$_1$> # <Bitmapsize$_1$> # <Bitmap$_1$>

 # <Bitmapname$_2$> # <Bitmapsize$_2$> # <Bitmap$_2$>

...

 # <cbh-Filesize> # <cbh-File>

An other interesting future of the CBH format is the definition of Points of Interest (POI). If the user wants to find a hotel or restaurant he sends a request to the in-car navigation system. The car navigation system sends back the POI definition of the available hotels or restaurants in the defined area around the current position. The chb-file format is:

```
#POIDEFINITION %
KATEGORIE       = ”HOTEL”;
NAME            = ”Cityhotel”;
WGS84_LAT       = ”48234567”;
WGS84_LON       = ”11123456”;
STREET          = ”Bahnhofstraße”;
HOUSENUM        = ”13”;
LOCATION        = ”Mainz”;
POSTCODE        = ”34234”;
EMAIL           = ”info@hotel.de”;
HTTP            = ”www.hotel.de”;
```

```
PHONENUM        = "06234/2345";
VIEW            = "cityhotel.png";
%
KATEGORIE       = "RESTAURANT";
NAME            = "Goldener Schwan";
WGS84_LAT       = "48234567";
WGS84_LON       = "11123456";
STREET          = "Im Grünen Winkel";
HOUSENUM        = "13";
LOCATION        = "Ulm";
POSTCODE        = "89079";
EMAIL           = "info@goldenerschwan.de";
HTTP            = "www.goldenerschwan.de";
PHONENUM        = "0731/2345";
FAXNO           = "0731/2346";
```

Now the user can be routed to the request destination for example the hotel.

4 NAFFF architecture

An open application model was developed and tested in the context of the NAFFF project. Based on the current position of the mobile user (PDA) an inquiry ask the map server (navigation system) [Fig. 3] for available maps. The server sends a selection list of available maps (road, bicycle, mountain bike, pedestrian map) to the PDA, see chapter Digital map. After selecting of a map it is transferred via Bluetooth to the PDA. The position of the user is determined continuously by GPS and displayed on the map [Fig. 4].

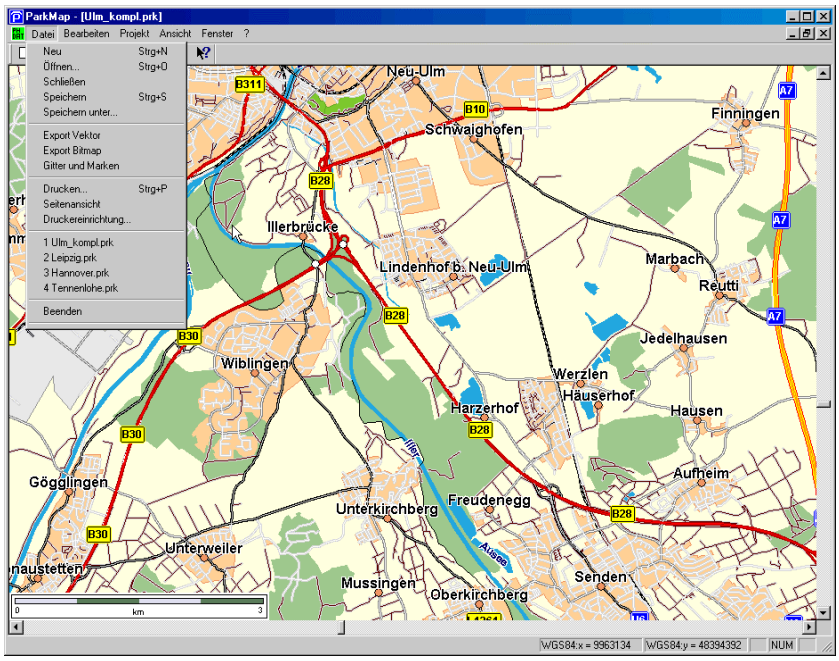

Figure 3: Car map on the server

Information about points of interest in the local area can be requested from a service provider and down loaded by mobile phone. The data connection between the PDA-navigation system is realized via an infrared communication link. The points of interest are hyperlinked with the web site of the appropriate service provider.

Figure 4: Car map and bicycle map on the PDA

5 Conclusion

The project NAFFF demonstrated the high potential of the integration of onboard and offboard navigation systems. The result is the common use of the digital maps by onboard and offboard navigation units. The use cases pedestrians, bicycles and vehicles was investigated. Due to the limited memory resources and display capability of a PDA the NAFFF architecture for downloading the database, maps, and information of POI's from the onboard system was introduced and allows to show the potential for further developments.

6 Acknowledgement

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References:

[1] "Navigation für Fahrzeuge, Fahrradfahrer und Fußgänger, NAFFF", final report, Oct. 2003, Robert Bosch GmbH, Telematica e.K., 3soft GmbH

[2] "GNSS-Services and Modules in 2010 (G-SAM2010)", final report, Dec. 2001, Robert Bosch GmbH, Telematica e.K., gedas Telematics