Noppa
Navigation and Guidance for the Blind

NOPPA personal navigation system is developed in a three-year pilot project that is part of Ministry of Transport and Communications Finland's Passenger Information Programme (HEILI). The estimated size of the project is 500,000 Euro. Project started in June 2002 and ends December 2004. Project is funded by Ministry of Transport and Communications Finland, VTT, Helsinki Public Works Department, The City of Espoo, Finnish Federation of the Visually Impaired (FFVI), Arla Institute, Helsinki Metropolitan Area Council, Finish Rail Administration, Finish Road Administration and Helsinki City Transport. Companies that have supported the project with components and software are Lingsoft, Timehouse, Microsoft and VTI Hamlin.

The system is designed to offer public transport passenger information and pedestrian guidance for the visually impaired. Noppa is based on available personal navigation components and services. Modularity enables constant development of the system.

Using public service databases over Internet ensures that the information is up-to-date. Combining passenger information from various information sources and creation of general-use interfaces has high importance in the project.

Noppa is currently able to offer basic route planning and navigation services in Helsinki, Espoo, Vantaa, Kauniainen and Tampere. A more accurate demonstration including high-detail maps will be carried out near Itäkeskus, Helsinki, where a new service centre for the visually impaired is being built at the moment, and near Arla Institute, Espoo, which is a vocational training and development centre. Several public transport lines connect these areas.

Main features of Noppa personal navigation system are

- **Public transport information**
  - Time tables
  - Route planning
  - Real time passenger information

- **Navigation**
  - Outdoor and indoor positioning
  - Personalised route planning
  - Route guidance
  - Heading information
  - Roadwork warnings

- **Local information**
  - Short range radio communication (Bluetooth)
  - Areas and points of interest (AOI, POI)

- **Communication**
  - PDA or 3G phone

- **Speech user interface**

- **GPRS server connection**

- **SMS messages**

- **News services**

- **Accessories (optional)**
  - Collision warning device
  - Video camera

The Information Server (figure 1) is an interpreter between the user and Internet information systems. It collects, filters and integrates information from different sources and delivers the results to the user. The server handles speech recognition (e.g. from 13200 street and destination names) and functions requiring either heavy calculations or large data transfer from the Internet. The data transfer between the server and the client is kept in minimum. The client terminal holds speech synthesis, user interface, positioning and most of route guidance. The user interface is menu-based and selections are done with hardware buttons and speech input.
NOPPA terminal software with speech synthesis needs to be installed on the device, completely replacing the underlying operating system's user interface. If the operating system supports a screen reader for example, more functions (such as phone calls, SMS and MMS) can be left to original software.

![Noppa architecture](image)

**Figure 1. Noppa architecture.**

**Results**

As a result of the project we have shown, that the concept is feasible and it is possible to build a guidance system without large investments to the infrastructure. We have suggested modifications to present information systems, which make their use with mobile devices easier and information more suitable for pedestrian users.

The Noppa prototype system currently has the following characteristics:

- Speech recognition and synthesis
- 6 simultaneous users per single server computer (a 2 GHz PC) for speech processing time limits
- Access to three route planners (commuter and intercity traffic both bus and train, also a possibility to calculate car navigation type of routes)
- Guidance and route following during a trip
- Personal in-vehicle stop announcements
- Roadwork information (connection to a city's database)
- Access to some bus, tram and train real time information systems (only early development)
- Flight departure information at the largest airport in Finland, real time
- Several news services, local weather
- Watch
- Memo
- GSM phone and SMS services (basic implementation)
- Bluetooth and GPRS connectivity (also WLAN possible)
- GPS and GSM positioning, optional pedometer and compass unit
- Indoor navigation features based on Bluetooth, WLAN positioning or compass/pedometer
- Own recorded walking routes, basic GPS functions
- Search of current address
- POI (Point of Interest) and AOI (Area of Interest) databases

The Noppa terminal (see Figure 2) is built on Windows Mobile (Pocket PC) based Qtek 2020 mobile phone together with GPS receiver.

The prototype fulfils the most of the initial design characteristics.

Figure 2. Noppa prototype

Even though a main goal of the project was using commercial terminal devices, one concept design was made in University of Arts and Design. Designer Paula Löppönen created MUKANA smart clothing (see Figure 3) that utilises Noppa hardware and software. This concept studies the usability and it leaves hands free for the use of white cane and guide dog, for example.

Figure 3. MUKANA smart clothing in use.