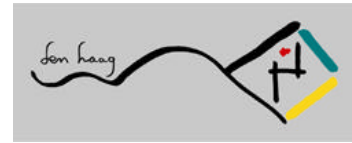




Gemeente Den Haag



The Hague Smartline: support for the visually impaired

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Abstract

In The Hague, the third largest city in the Netherlands, many visitors and local inhabitants need to visit a location between the Central Railway station and the Dutch Parliament. The local council aims to increase the accessibility of the city, and has started up the SmartLine initiative. The SmartLine guides visually impaired people along this track. The application consists of the combination of an epoxy line for walking and “push” and “pull” information provided for the user during his or her walk anywhere on the track. The information provided involves navigation information and information on the buildings and the public transport platforms alongside, and is presented on audio channel via a smartphone or PDA. A user panel has provided information on user requirements. A prepilot was organized to test the reliability of the system, and a pilot study has recently been carried out to evaluate the functionality and usability of the system. In the paper, the functionality and roadmap to realise of the SmartLine is reported. The outcomes as well as the design of the pilot study will be presented in an other session.

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1. Introduction

In the city The Hague, an innovation in the field of support for the mobility impaired has been developed and realized.

1.1 The city of The Hague

The Hague is the third large city of the Netherlands, residence of the National Government and the Royal family. The International Criminal Court, The Peace Palace, the International Criminal Tribunal for the former Yugoslavia and Europol are just a few of the organizations which contribute to The Hague's reputation as the International City of Peace and Justice. The city attracts tourists, both from the Netherlands, but also from all over the world. Furthermore there is a considerable amount of visitors to the city who need to pay visits to one of the ministries, the parliament or any of the (international) offices. Thirdly, of course there are the local people needing to visit the main city buildings. And all of them wishing to be able to walk around, do shopping and find The Hague an accessible city.

1.2 Visual impaired in the city centre

For all those people with limitations in eye sight, there are considerable problems in finding their way safely and effectively. There is a spacious pedestrian area from the central railway station to the City Hall but it is made out of special stones that make it a plane area without clear markers that might be used as a reference. Currently, a physical system made of epoxy lines is being developed to guide them from the central railway station to the Dutch parliament, passing various main public buildings. These buildings include the ministry of Health, Welfare and Sport, the ministry of Housing, Spatial Planning and the Environment, the ministry of Internal Affairs, Ministry of Justice, the City Hall, a Concert Hall and the City Library.

2. The Smartline

The Smartline is aimed to support visually impaired people by an electronic guideline: to be aware of their environment – to “see” in a virtual way, to make a choice where to go and to access the buildings / sites of their interest. The Smartline specifically is aimed at guiding visually impaired people from the Central Station in The Hague to the buildings of the Dutch Parliament in order to allow them

to visit the meetings of the House of Commons. Next to these track five ministries, the town hall, the city library and a concert hall are situated (fig 1.).

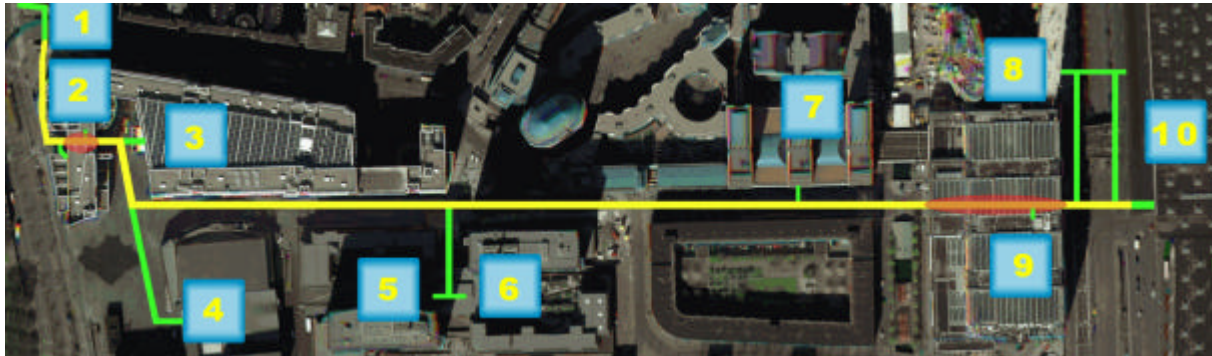


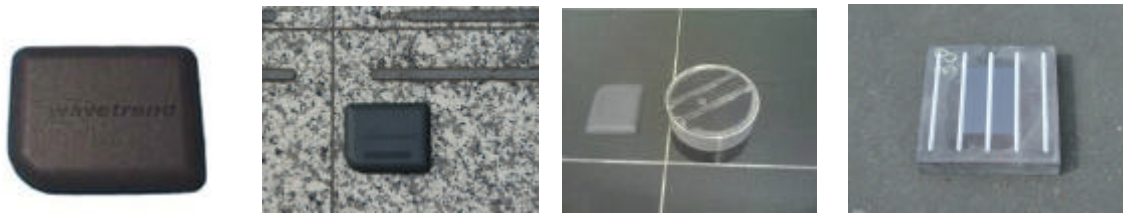
Figure 1. Guideline for visual impaired, between national parliament (left) and central station (right). Aerial view: yellow line is guideline, green line are sideways to buildings (1= National Parliament, 2= City Library, 3= City Hall, 4=Concert hall, 5= Ministry of Justice, 6=ministry of Internal Affairs, 7= ministry of Health, Welfare and Sport, 8=ministry of education, culture and science, 9=ministry of Housing, Spatial Planning and the Environment and 10=central station)

Only using the combination of main track and side tracks on a physical guideline will become too complicated, so electronic assistance will be added to tell people where they are. The possibility of using standard PDA's or smart phones makes it possible testing the concept of the Smartline. The technology of DGPS is used for accurate positioning in combination with RFID for covered parts (orange coloured) and other parts of route as well as indoors where DGPS-reception is not possible. The Smartline incorporates the following modules:

- Location Based Services (LBS) with PDA, using GPRS/UMTS/HSDPA for communication
- GPS module standard in PDA, extra feature: RFID transmitter;



- special external loudspeaker-set
- RFID tags on the Smartline



- Website with accessibility information of all public buildings linked to server system

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Figure 2: Screen shot from the website with information on accessibility; for different items (e.g. parking, entrance, toilet, facilities for visual or hearing impairment) a label indicates the level of accessibility (from green/4 boxes = good accessible to red/1 box = not accessible); the boxes are used for people with colorblindness.

The service to the visual impaired user is branded RouteOnline and will be provided and marketed by ConnexIP.

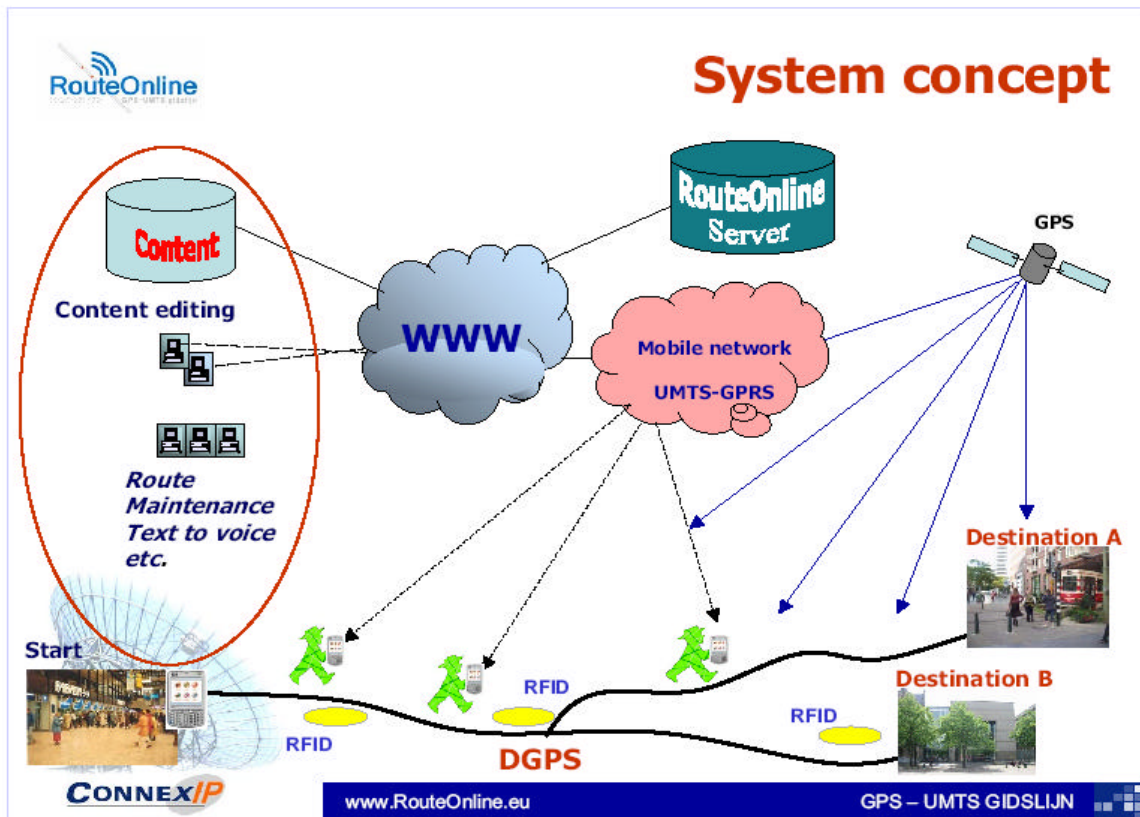


Figure 3. System concept of the Smartline. The user carries a mobile UMTS /GPRS device which connects to the mobile platform with local information. Via RFID tags accurate positioning for additional information is provided.

The information can be updated at any moment and according to the latest changes. For instance, actual information on delays of busses or trams, tickets for museum or discounts of shops can be presented to the user. The user himself can decide the ‘depth’ of the information he receives.

In order to manage the information, ConnexIP has developed a user-friendly content management system (CMS). New and updated content can be stored, routes can be created, updated and mutated. Integration of value added services, webservices and push-information is possible.

2.1 The development procedure for Smartline

The development of the Smartline is performed as follows :

- Internal discussions with the City Council, ASK-It partner, technical partners and society for the blind: This local stakeholders group defined the scope of the project organisation and established the project organisation.
- Start technical development: A feasibility study is held in order to decide what technology (or combination of technologies) is suitable for the specific technical needs of the project.
- Reviewing deliverable on UI elements and metaphors, developed by USTUTT: From the ASK-It Use Case elements a range of UC's is chosen to incorporate in the Smartline Application Scenario.
- Exploring the needs with a group of potential users: On-track field test of specific user needs to implement in the system.
- Pre-pilot: A 2-day Field Test Trial with approximately 10 potential users on a small part of the track to test technical specifications of the Smartline system.



- Establishing a user panel: Select approximately 20 potential users for the pilot phase.
- Adjustments and further technical development: Evaluation of pre-pilot test results.
- Pilot: Official ASK-IT Test for the Smartline system in The Hague starting June 2008.
- Adjustments: Evaluation of Pilot test results.

In the current paper, the focus is particularly on the phase of development and realization of the SmartLine in order to be able to carry out the final pilot tests.

2.1.1 Development of the functionality of the Smartline

The development started with the design of a virtual storyboard. Below, the functionality for the Use Case: “Find current position” is shown.

- ASK-IT Pre-pilot Storyboard – *Find current position*
- PDA screen displays map (stored on server) with = default screen
 - current position
 - trajectory
 - POI nearby
- PDA screen displays updated map (stored on server) every time the user moves
- PDA plays alert signal tone on map changes (stored on device)
- User is able to zoom, scroll, select POI options using keypad
- Note: not relevant to blind users

2.1.2 Development of the user interface of the Smartline

The development started with the design of a virtual storyboard. Below, the user interface for the Use Case: “Identify POI nearby” and “Get info on POI (point of interest)” is shown.

- ASK-IT Pre-pilot Storyboard – *Identify POI nearby*
- PDA plays alert signal (stored on device)
- PDA screen displays navigation information and POI options (stored on server)
- PDA plays voice message with navigation information and POI options (stored on network, text to speech)
- User is able to scroll and select POI options using keypad

- ASK-IT Pre-pilot Storyboard – *Get info on POI*
- User selects POI option with navigation keys
- PDA plays confirmation signal (stored on device)
- PDA screen displays information on POI option (stored on server)
- PDA plays voice message with information on POI option (stored on network, text to speech)
- User is able to scroll and select POI options using keypad



3. Realization of the SmartLine

Initially the SmartLine route was projected between The Hague Central Station and the Parliament in the city centre. For this route GPS coverage and RFID tag positions were defined, based on experiences from the pre-tests. For each RFID-tag messages were composed for information to the user walking along the SmartLine, in both directions. This messages contain information about position, direction to follow and, in case of reaching a destination, accessibility of the object.

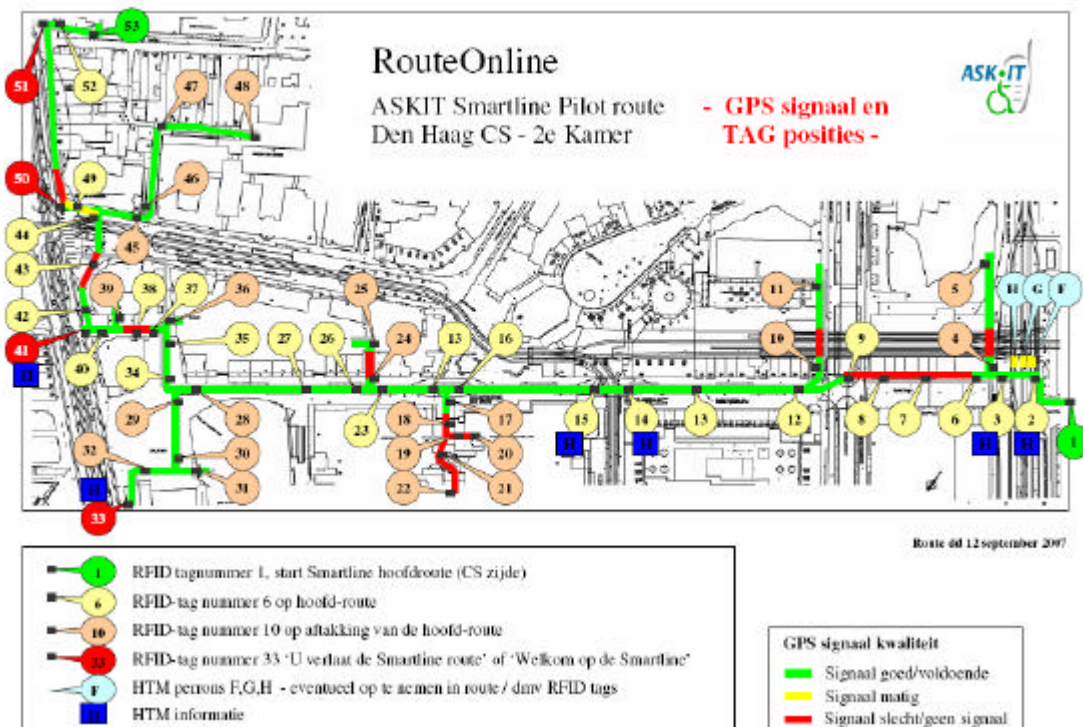


Figure 4: Indication of GPS coverage and RFID-tag positions on the SmartLine track

3.1 Project limitations

During the process in order to step into the phase to actually build the SmartLine, some necessary changes had to be made.

First of all it was not possible to find a sustainable solution for putting the physical tactile line with epoxy onto the surface of the Turfmarkt route. Results from the pre-tests show that for some reason the line is eroding, what means that navigating on Turfmarkt was not possible.



This problem will be solved when the Turfmarkt route is renovated within 2 years. A sustainable solution for the tactile line will then be integrated.

Secondly the budget for realizing the complete SmartLine from Central Station to Parliament was not sufficient to cover all the predicted cost for the total project.

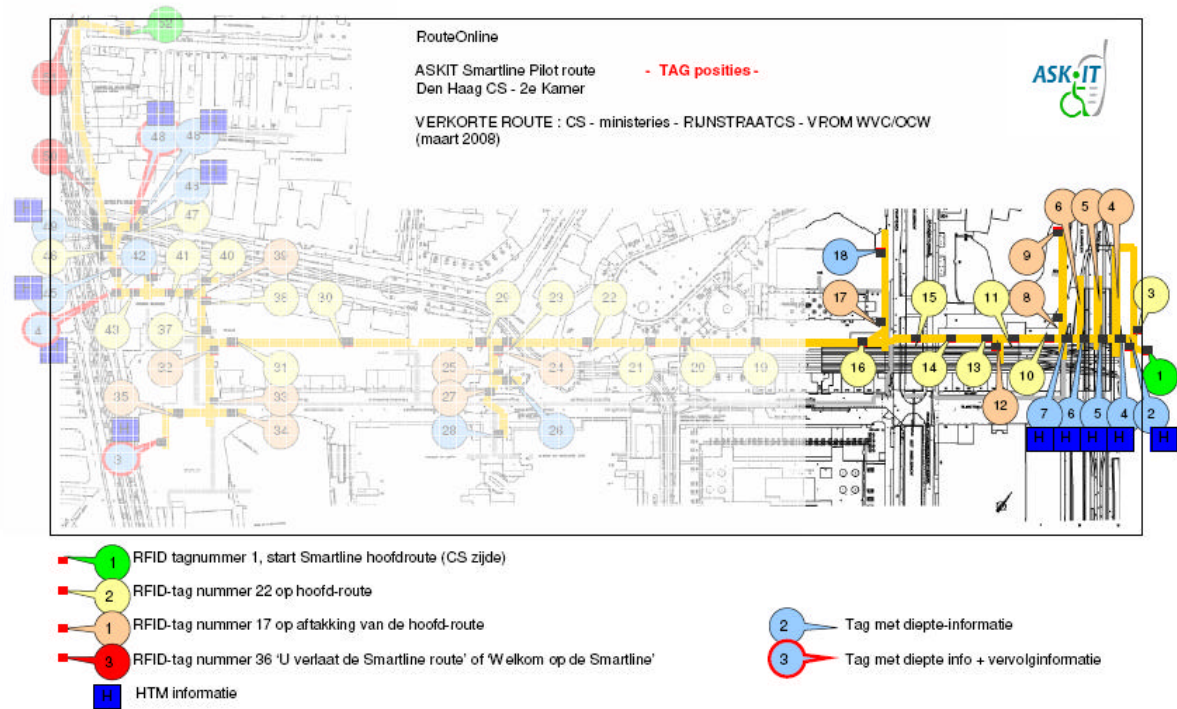
It was decided to reduce the SmartLine to a part of the track where implementation was feasible and the budget could cover the costs. On this part of the SmartLine the ASK-IT pilot tests are kept.

3.2 ASK-IT Pilot SmartLine

The SmartLine for the ASK-IT pilot test is now situated on a third of the original track between The Hague Central Station and the ministry of Health, Welfare and Sport. The test site exists of approximately 500 meters of guideline for the visual impaired, including 4 tram stops and a taxi stand near the railway station.

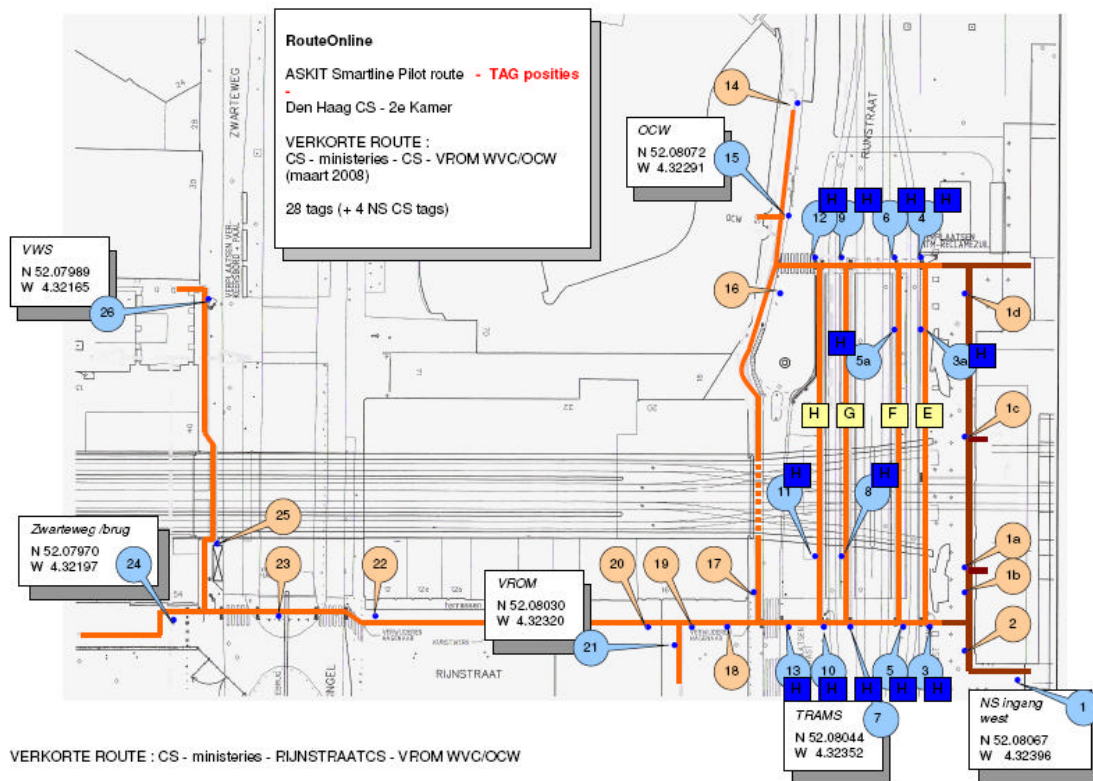
Along the SmartLine there are 4 destinations: Central Station; ministry of Housing, Spatial Planning and Environment; ministry of Education, Culture and Science; ministry of Health, Welfare and Sport. In order to give the user directions on the Smartline to one of these destinations or a tram stop or taxi stand, there are 32 RFID tags needed.

As indicated in figure 4, most part of the test site track is covered, so GPS signals can not be received and therefore positioning by RFID is very important.



VERKORTE ROUTE : CS - ministeries - RIJNSTRAATCS - VROM WVC/OCW

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Apart from the part of the track in the ministry of Housing building, where still the epoxy line will be used, the SmartLine tactile track is build from prefab tiles. Also the RFID-tags are glued into tiles and integrated in the tactile line.





The SmartLine for the ASK-IT Pilot tests is now ready for use. Test are held in the first week of June and will continue in September 2008. The tests will be done with 16-20 visual impaired users and results will be presented separately.

Demonstrations of the SmartLine project and RouteOnline service are given at the ASK-IT Local Event in The Hague on June 12th 2008. This event was organized by the City of The Hague and POLIS and was attended by approximately 40 delegates and stakeholders from The Hague and The Netherlands, together with some foreign visitors.

