# ASSISTANT - Creating a Smartphone App to assist older people when travelling

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**Abstract**

ASSISTANT is a three-year project, funded jointly by the European Commission's Ambient Assisted Living Joint Programme (AAL JP) and the national funding agencies of Austria, Finland, France, Spain and the UK. The project's objective is to create a smartphone app that can help older people to travel independently by public transport, in comfort and with confidence. The target group for the commercial product that will be developed by the project is more mobile older people. This is in order to make the product appealing to the largest market sector possible, for when the app enters the market, in 2017. However, because the app will be highly personalised, and provide the user with the facility of audible and haptic, as well as visual, feedback, it will be appropriate for use by people who are blind and partially sighted, people who are deaf or hard of hearing, and people who have difficulty with oral communication. This paper describes progress made in the Concept Phase of the project, during ASSISTANT's first year, and outlines some of the ways in which the ASSISTANT app will be tailored to meet the needs of a variety of users, in a variety of public transport contexts.

**Introduction**

The theme of the Fourth Ambient Assisted Living Joint Programme is "ICT based solutions for advancement of older persons' mobility". The ASSISTANT Project's contribution to this objective is to produce an app which provides accessible support for older people when using public transport. This app will provide an online facility for trip planning, guidance during multi-step journeys on public transport vehicles – which will include assistance with transfers from one vehicle to another, and between different means of transport – and navigational guidance from the user's last stop on the public transport network, to his or her final destination.

As such, ASSISTANT addresses common, everyday concerns that many older people have with not being able to find the correct stop, with not knowing which vehicle to board, with failing to get off the vehicle at the correct location, and, ultimately, with getting lost. The app will seek to bridge this confidence gap during the planning and making of a journey by public transport, and will also provide a personalised "safety net" feature that will enable the user to readily summon help from a relative or carer of his or her choice, if necessary. Ultimately, the

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contribution made by ASSISTANT will be to encourage the mobility, and thus the social participation, of older people in Europe, enabling them to freely access important goods and services, and fulfil their social and cultural needs, using more sustainable means of transport.

The main target group of the ASSISTANT project is more mobile older people, particularly those travelling to unfamiliar places or who might, say, be using public transport after losing the ability to drive. The decision to concentrate the project's design efforts on this sector of the population was taken for commercial reasons, to ensure that the project's end-product would be attractive to as large a market as possible. However, because the app will be highly personalised, and provide the user with the facility of audible and haptic, as well as visual, feedback, it will be appropriate for use by people who are blind and partially sighted, people who are deaf or hard of hearing, and people who have difficulty with oral communication. This high level of accessibility is made possible by the fact that smartphones already have the functionality of allowing people with a range of sensory impairments to customise their 'phone to suit their particular needs. If, for example, the smartphone user is blind, and has a screen reading device that enables him or her to read web pages using the smartphone, then this will enable this user to interact with the ASSISTANT app in the same way.

In terms of the business model to be adopted, ASSISTANT will be a software product that is purchased once, either through an online shop, or at a retail outlet. Technology Platform Providers will customise the app, whilst service operators will run the backend components of the system, ensuring the smooth running of all of the system components.

**The ASSISTANT online application (app) - Technical characteristics**

Whilst the design of the ASSISTANT app will have innovation at its core, its use will be designed for, and based on, tried and trusted devices, namely the home Personal Computer and the smartphone. This provides the system with a robust and reliable basis. The user's smartphone will be the medium through which information is presented, and the application running on a PC will enable route design. ASSISTANT will be of use even on well-known routes, since the haptic mode reminder of arrival at the desired destination or transfer point can allow the user to read or relax when travelling, removing the need to constantly check the progress of the vehicle.

ASSISTANT will create a web server based application that will function by retrieving continually updated data in the form of maps and schedules. This will be part of a three-tier system architecture, consisting of a web based route design interface, a web server layer implementing the application and a database of system data. User-specific data will also be stored on the smartphone, which will have the capability to act as a Personal Navigation Device and mobile interface for the user. The route editor interface will enable users to update their profile data, and to create and edit a list of favourite locations to visit, and design pathways to them.

An important characteristic of the ASSISTANT product will be the high degree to which it can be personalised according to the user's ability levels, and contextualised according to the situation in which he or she is in, during any part of the journey. ASSISTANT will provide a high level of contextualisation by only providing information that is relevant to the user, at the right time and in the appropriate format. This is achieved by filtering available data, using pre-set information about the user's preferences, and then communicating these data to the user via audio, visual and haptic cues.

The product will provide further personalisation through its error trapping and remediation functionality, since it will be designed to be responsive to the user's physical, cognitive and mental capacities and preferences. The definition of an "error", in this context, is an unplanned situation caused by the user not getting off the bus at the correct stop, for example, or getting lost or anxious when searching for a bus stop. "Error trapping" describes the process of detecting that the user is not following the route intended, (Schank & Abelson, 1977). ASSISTANT's "design for failure" approach to design relates to both the possibility of human error, and the failure of system components, and so acknowledges the fragility of mobile devices, the brittleness of digital information and the limitations of location information provided by Global Positioning System (GPS) technology. The app will use location, system state, and user interaction behaviour as a basis for Artificial Intelligence based error detection. Once an error type has been detected, the user model will determine the appropriate mediation strategy. Such mediation will be based on user-specific replanning of routes, in the event of divergence from the planned route, using pre-set personalised strategies.

**Human Factors considerations in relation to the Target Audience**

A major effort will be made to ensure that the user interfaces, and functionality, of the ASSISTANT system are as suitable as possible for older people. An important component of ensuring accessibility of the product will be the filtering of data to enable the user to be provided with only the information that is necessary, given the context in which the information is provided, and the user's stated personal preferences. Furthermore, information will be presented in an accessible manner, being designed with an uncluttered screen, larger buttons, an intuitive representation of screen elements and a reduction in the number of menus and drop-down elements that are usually associated with smartphones. Maximum accessibility will be achieved through the involvement in the project of volunteers representing the device's target population group, at each stage of the product's development.

In terms of the type of information that the user will require, it is acknowledged that older people require the same information when travelling, as anybody else, although, in addition, the client will be provided with information on potential physical barriers to travel, on the accessibility of specific platforms and stations, and on staffing levels and the availability accessible toilets etc., as far as data availability allows.

**The involvement of end-users in the design of the ASSISTANT app**

A fundamental aspect of ASSISTANT's design approach has been to involve primary end-users in the process from the beginning of the project, engaging with older people in iterative evaluation trials in three cities: Vienna, San Sebastián and Paris. The same "panel" of end-users is to be involved in evaluations for each successive phase of the project, i.e. the Concept, Pilot and Prototype phases. The same group of volunteers, in each country, took part in a focus group, at the beginning of the project, designed to gain insights into their use of both public transport, and current assistive technologies, particularly mobile 'phones and smartphones. An important goal of this early phase of the research was to investigate the use of mobile communications technologies by older people in their daily, travel-related routines. It was important to establish the priorities, needs and acceptance factors of this diverse group of people, so that design of the app can be guided from a user's perspective, using a needs framework.

The sample of 30 people, over three countries, was structured so that at least 90% of the participants were public transport users – with half of the sample being frequent users – and at least 50% of the sample used a mobile 'phone. All participants were aged 55 or over, reflecting the envisaged market for the ASSISTANT app, and there was an even gender split.

The objective of the concept phase evaluations was to inform the redesign of the ASSISTANT user interface, with there being the opportunity for similar adjustments to be made after each feedback loop, up to the use of low fidelity prototypes in the third, and final, year of the project. These evaluations were carried out using a focus group format, with the aid of "life-size" mock-ups of user interfaces presented on a computer screen. Figure 1 provides examples of these user interface mock-ups.


*Figure 1. Example of user interface mock-ups used during the Concept Phase.*

These mock-ups enabled participants to interact with each interface in much the same way that they would interact with the touchscreen of a smartphone, with the clicking of the various "buttons" provided taking them to a different screen. Using this approach, it was possible for the participants to, for example, plan hypothetical journeys by public transport.

**Findings from Qualitative Research and User Evaluations conducted to date**

A common issue for users with less familiarity with computers, (not just older users), is at the intersection of two computational systems. A typical example of this is linking the use of a digital camera with a PC. The ideal solution to this issue is to prevent less experienced users from having to perform complex configuration tasks by providing a single application that provides all the functionality needed to connect the two devices. ASSISTANT will address this potential barrier to use of the project's app by making sure that both the PC and the smartphone are easy to use, with seamless data transfer and transparent user interfaces.

Another strong theme to emerge from the sample of potential users was people's concern for personal security when carrying and using an expensive item of equipment such as a smartphone. There was particular concern at the prospect of conspicuously using such a device on some urban public transport networks, especially at night. This represents encouraging feedback, in as much as a major selling point of the ASSISTANT system will be the facility for it to be used, with its options for tactile and/or audible output, whilst safely concealed in a pocket or a hand-bag.

Another reservation expressed by some participants was the requirement for the system's GPS function to be active continuously, as this gave rise to some concerns for privacy.

A general conclusion that was drawn from the evaluation of alternative user interface designs was that there was a preference for a simple, uncluttered screen. For the app's personal navigation function, the majority of participants expressed a preference for step by step, text instructions, although there were some who appreciated the facility to switch to a map display. Where a map is used, requests were made for a blinking "You Are Here" symbol indicating the user's position. Furthermore, there was a general preference for two levels of zoom, whereby an overview map is followed by more detailed instructions.

Negative feedback received from the evaluations included complaints about having to switch to using reading glasses for accessing on-screen information, and having to hold a smartphone device in the hand whilst travelling – but participants acknowledged that the facility to obtain audible instructions, using a Bluetooth headset, was a solution to both problems. However, the issue of not being able to read small icons and text without the use of reading glasses is one which is very relevant to the envisaged market sector at which ASSISTANT will be aimed, and so this is something that will be considered during the design of the visible user interface. Some participants complained that the touchscreen was too sensitive to

light touches which might be involuntary, and so this is an additional design factor that will be taken into account.

There was also a fairly negative reaction to having photos of the vicinity of a bus stop or destination, accompanying a text instruction. Such illustration was seen as being superfluous and potentially confusing and, in cases where the illustrating photo was not of the stop itself, it was felt that it might be misleading.

There was a marked preference for the actual name of a stop to be specified, whenever it is identified as the stop where the user should get off the vehicle, (with compass directions never used); when the app indicates that the user should board a vehicle, it was felt that the app should always indicate to the user the name and number of the vehicle, and its direction of travel or ultimate destination. There was evidence to suggest that some people were not comfortable with instructions being given in terms of metres to a required vehicle or destination.

Issues raised with reference to the route editing function of the system, which will be designed to be executed using a home PC, included the legibility of text for street names on map displays. This highlighted the importance of text remaining of sufficient size to be legible once the user has changed the scale of the display. There was also evidence among the sample of participants that there was a preference for using an address expressed as text as a means of specifying a desired destination, as opposed to selecting a point on a map display. The least preferred mode of input was the use of coordinates. The participants found some of the terminology used in the mock-up of the route editor to be confusing – including words such as "font" – so care will be taken to use plain language in subsequent designs. Generally, there was an appreciation for the facility to adjust parameters such as font size, colour and contrast, as well as output such as volume and haptic cues. Another preference expressed was for alternative travel times to be expressed according to whether the user is a fast or slow walker.

The evaluations presented some very interesting design conundrums, which are currently the subject of intense discussion among the ASSISTANT Project partners. For example, there was some confusion surrounding buttons labelled "Help", since it was not clear whether the button should be used to obtain fairly low-level information on how to perform tasks on the smartphone, or was for calling for help in an emergency. Further work is required on defining the optimum label for such functions, the challenge being one of devising labels that are unambiguous and describe a function precisely, whilst at the same time fitting comfortably in the space that is available on the screen. Feedback from participants suggested that any terms and/or icons used should be either familiar or intuitive, to avoid any learning curve that might be required with new constructs.

**Next steps**

The next step for the ASSISTANT Project will be to proceed, during 2014, to the Pilot Phase. Further development of the system will proceed, taking account of the findings of the qualitative questionnaire survey and the Concept Phase evaluations outlined above. System modules, including the route editor and the personal

navigation facility, will be evaluated as stand-alone components, given that complete system integration is not due to be achieved before the Prototype Phase. Evaluations conducted during the Pilot Phase will feature more advanced tasks and more detailed user interfaces, and will also focus on ergonomic, rather than utility, aspects.

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