The Assistant Project
Creating a Smartphone App to Assist Older People When Travelling by Public Transport

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Abstract: This is a Position Paper, in the form of a short report on progress of the three-year ASSISTANT project, which is 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. ASSISTANT's objective is to create a system that older people can use, on a smartphone, to help them 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. 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 should also be appropriate for use by people who are partially sighted, people who are hard of hearing, and people who have difficulty with oral communication. This paper describes progress made during the first two and a half years of the project's life, 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.

1 INTRODUCTION

The ASSISTANT Project's objective is to produce an effective, and commercially viable, system 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 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. ASSISTANT was developed with the goal of providing a system for smaller transport agencies that do not have the resources to create their own.

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 partly for commercial reasons, to ensure that the project's end-product would be attractive to as large a market as possible, but also to facilitate the use of public transport for as many people 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 should also be appropriate for use by people who are partially sighted, people who are hard of hearing,

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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 has a screen reading device, designed for blind and partially-sighted people, that enables him or her to read web pages using the smartphone, then the device will enable this user to interact with the ASSISTANT app in the same way.

An important aspect of the work of this three-year project has been the on-going process of “horizon scanning” for new apps and devices having similar functions and objectives to those of ASSISTANT. This was to continually position the project’s app in the market.

For example, for the iPhone, the HopStop app provides directions for the user when making journeys by public transport, on foot and by bicycle, but this service is restricted to specific cities. Although the app can be used in some 100 cities, including London and Paris, the majority of these cities are in North America.

Android users can use the SMART-WAY app for planning trips by public transport. This app also derives information form the GPS capability of the user’s ‘phone in order to ascertain the user’s current position, which is needed in case of having to plan an alternative route to a destination, or if the destination is changed. Android is also responsible for GeorgiePhone, which is a family of apps specifically aimed at older people and blind and partially-sighted people. Georgie is able to give information on the user’s location and the direction in which he or she is travelling, as well as advice on which public transport vehicle to board, and when to get off. Similarly, the RATP, which oversees public transport in Paris, has developed an app for the city’s Métro system, which advises the user on which vehicle to board, and on which door to alight from in order to minimise walking distance.

Some public transport-related apps have been developed by individual cities and transport operators. For example, Traveline Scotland provides a free app which enables users to plan trips by any mode of public transport, anywhere in Scotland.

In technical terms, a Unique Selling Point (USP) of the ASSISTANT system will be the high degree to which the product will be able to be personalised according to the user’s ability levels. Information provided by the app will also be contextualised according to the situation the user is in, during any part of the journey. A further important feature of the product will be 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.

2 TECHNICAL CHARACTERISTICS OF THE ASSISTANT APP

2.1 Hardware and Platforms Required

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 helpful even on routes that are familiar to the user, 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 journey.

ASSISTANT is a web service 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 (see Figure 1). User-specific data will also be stored on the smartphone. 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.

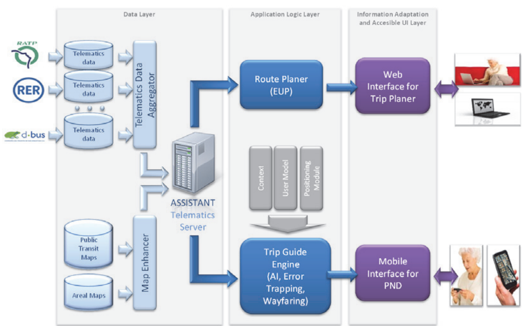

Figure 1: ASSISTANT system architecture.

2.2 Personalisation, Contextualisation and Error Trapping

The ASSISTANT product will be capable of achieving a high degree of personalisation, according to the user's ability levels, and will be able to be contextualised according to the user's situation. This contextualisation will take the form of only providing information that is relevant to the user, at the right time and in the appropriate format. This will be achieved by filtering available data, using information about the user's preferences that the user can set, and then communicating these data to the user via audio, visual and haptic cues. The app will achieve this by taking account of the user's context at any point in time, which will be defined by their location, the stage they are at in the journey, their mode of transport and the user's stated personal requirements and preferences.

The product will provide further personalisation through its error trapping and remediation functionality. 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, for instance, the process of detecting that the user is not following the route intended. ASSISTANT's "design for failure" approach 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.

3 HUMAN FACTORS CONSIDERATIONS

A major effort has been made, during the project, to ensure that the user interfaces and functionality of the ASSISTANT system are designed to be as suitable as possible for its target user group - older people. An important component of ensuring the accessibility of the product has been the filtering of data to ensure that the user is provided with only the information that is necessary, given the context in which the information is provided, and the user's stated personal preferences. Care has been taken to ensure the provision of an uncluttered screen, larger buttons and an intuitive representation of screen elements, and the design has also included a reduction in the number of menus and drop-down elements that are usually associated with smartphones. As an example of the ASSISTANT app's user interface, Figure 2 shows two smartphone screenshots, taken during the Prototype Phase.

Figure 2: Illustration of alternative means of providing navigational information – compass-based (left) and map-based (right).

The maximising of the accessibility of the product has been made possible through the involvement in the project of volunteers representing the device's target population group, at each stage of the product's development, i.e. the Concept Phase, the Pilot Phase and, looking ahead to 2015, the Prototype Phase. This has taken the form of successive evaluation trials carried out in three cities: Vienna, San Sebastián and Helsinki.

3.1 Evaluation Trials with End Users

A sample of 30 people, over the three cities, 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 focus of the Concept Phase evaluations was the design of the ASSISTANT user interface, with there being the opportunity for further adjustments to be made after each subsequent feedback loop, up to the use of prototypes in the third, and final, year of the project, (2014-15). Concept Phase evaluations were carried out with the aid of "life-size" mock-ups of user interfaces presented on a computer screen. 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.

During the Pilot Phase, evaluations of a pilot version of ASSISTANT were carried out, using smartphones, in the three cities, in June 2014. The main objective of this second wave of evaluations was to gather feedback, from representatives of the target user group, on the usability and the usefulness of the system.

Each participant in the evaluation was asked to create a route for a journey by public transport, using the ASSISTANT route planner. The participant was then asked to make the planned journey, which entailed walking "the first kilometre" to the bus or tram stop, then travelling using the selected means of public transport, and then walking "the last kilometre" to the selected destination. During this task, a test facilitator "shadowed" the participant, ensuring that the ASSISTANT system functioned correctly, and being available to help in case of problems. At the end of each evaluation session, feedback on the participant's experience with the ASSISTANT system was obtained by means of a semi-structured interview and an evaluation questionnaire.

In terms of the type of information that the user will require, it has been acknowledged that older people require the same information when travelling as anybody else. However, in addition, the user 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.

Prior to these evaluation trials, a qualitative questionnaire elicited demographic information about the participants, and details of 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 gain insights into 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 the design process could be guided from a user's perspective, using a needs framework.

3.2 Findings from Qualitative Research and User Evaluations, to Date

A strong theme to emerge from evaluations involving potential users has been people's concern for personal security when carrying and using an expensive item of equipment such as a smartphone. Particular concern has been noted 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.

Issues were also observed, among the research participants, with performing tasks at the intersection of two computer systems. Specifically, this occurred when participants were asked to plan a route on their PC, and then execute it using a smartphone. 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 between the two and transparent user interfaces.

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

Negative feedback received from the evaluations has 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 this issue has since been addressed by the use of Bluetooth earpieces. Furthermore, the rate of providing spoken information to the user has been slowed down to one of 80% of "standard" speech, in order to make it more accessible to older people.

Some participants have complained that the touchscreen is too sensitive to light touches, which might be involuntary, and so this is an additional design factor that will be taken into account during the creation of the prototype.

A marked preference has been noted 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. When the app indicates that the user should board a vehicle, it has been noted by some participants that the app should always indicate to the user the name and number of the vehicle, and its direction of travel or ultimate destination, (and appropriate changes have been made to the system, in time for the Prototype Phase evaluations taking place in May 2015). There has been evidence to suggest that some people are 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, have included the legibility of text for street names on map displays. This has highlighted the importance of text remaining of sufficient size to be legible, once the user has changed the scale of the display, and this is an issue that has been taken on board in the design of the prototype system. A preference has also been noted 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 has been demonstrated to be the use of coordinates.

Participants found some of the terminology used in the initial mock-up of the route editor to be confusing – words such as “font” – so care has been taken to use plain language in the design of subsequent versions of the app. Generally, there has been an appreciation for the facility to adjust parameters such as font size, colour and contrast, as well as output such as volume and haptic feedback.

4 THE MAIN CHALLENGES RELATED TO THE SUCCESS OF ASSISTANT

The main technical challenges for developing the app have been concerned with the very basic functions of ASSISTANT’s navigation feature, particularly pin-pointing the user’s precise location at any time and providing accurate routing instructions in real time. In the context of the pedestrian environment, positioning is particularly difficult, given the challenges of “urban canyons” and the fact that the device does not have the structure of a road or rail network as a guide to where the user might be. However, ASSISTANT addresses the issue of intermittent reliability of positioning information through its use of three complementary means of guidance – map, compass and distance tether. The app will also be constrained according to the functional capabilities of chips and other items of equipment that are commercially viable for use in a smartphone.

An important finding from user evaluations to date has been volunteers’ requests for being able to create and change routes “on the hoof”, using their smartphone, which, they felt, would constitute a useful improvement to the app.

The provision of accurate and up to date information on public transport services is another prerequisite for the app’s viability, and this will, in turn, depend upon the extent to which the local transport operator is prepared to provide such information for commercial use. How many city authorities are prepared to embrace the “open data” concept will determine how widely the ASSISTANT app can be rolled out, which will be important to its commercial viability.

5 SUMMARY

Evaluations of the ASSISTANT app have been carried out using both Concept Phase mock-ups on a computer screen, and a fully functional pilot version of the system using smartphones. These evaluations have featured samples of volunteers aged 65 and older in Finland, Austria and Spain, with the objective of assessing the usability and the usefulness of the system for the target end user population, but also with the aim of detecting system bugs and errors. The data collected during these evaluations have been crucial in helping ASSISTANT’s technical partners to specify and fine-tune the system to ensure that the final product will meet the target population’s expectations and needs.

Generally, the feedback gathered during the Concept and Pilot Phases has been positive, and participants have indicated that ASSISTANT would be very helpful in enabling them to more easily and more comfortably use public transport. Evaluations using a pilot version of the app have indicated that the ASSISTANT system can provide a helpful service for older people when using public transport. The general reaction has been that the system is relatively easy to use, in the context of both the personal for initially planning the route, and the smartphone with the ASSISTANT app during the journey.