Aalborg

T8.1 Travel Smart Card in Aalborg

Nordjyllands Trafikselskab
July 2011

Project no.	TREN/FP7TR/218940 ARCHIMEDES
Project Name	ARCHIMEDES (Achieving Real Change with Innovative Transport Measure Demonstrating Energy Savings)
Start date of the Project	15/09/2008
Duration:	48 months
Measure:	8 Travel Smart Card in Aalborg
Task:	2.2 Travel Smart Card
Deliverable:	T 8.1 Travel Smart Card in Aalborg
Due date of Deliverable:	14th September 2010
Actual submission date:	14th July 2011
Dissemination Level	Public
Organisation Responsible	Nordjyllands Trafikselskab
Author	Flemming Bundgaard Christensen
Quality Control	Alan Lewis
Version	1.0
Date last updated	8th July 2011

Contents

1. Introduction

1.1 Background CIVITAS

CIVITAS - cleaner and better transport in cities - stands for CIty-VITAlity-Sustainability. With the CIVITAS Initiative, the EC aims to generate a decisive breakthrough by supporting and evaluating the implementation of ambitious integrated sustainable urban transport strategies that should make a real difference for the welfare of the European citizen.

CIVITAS I started in early 2002 (within the 5th Framework Research Programme);
CIVITAS II started in early 2005 (within the 6th Framework Research Programme) and
CIVITAS PLUS started in late 2008 (within the 7th Framework Research Programme).

The objective of CIVITAS-Plus is to test and increase the understanding of the frameworks, processes and packaging required to successfully introduce bold, integrated and innovative strategies for clean and sustainable urban transport that address concerns related to energy-efficiency, transport policy and road safety, alternative fuels and the environment.

Within CIVITAS I (2002-2006) there were 19 cities clustered in 4 demonstration projects, within CIVITAS II (2005-2009) 17 cities in 4 demonstration projects, whilst within CIVITAS PLUS (2008-2012) 25 cities in 5 demonstration projects are taking part. These demonstration cities all over Europe are funded by the European Commission.

Objectives:

- to promote and implement sustainable, clean and (energy) efficient urban transport measures
- to implement integrated packages of technology and policy measures in the field of energy and transport in 8 categories of measures
- to build up critical mass and markets for innovation

Horizontal projects support the CIVITAS demonstration projects & cities by:

- Cross-site evaluation and Europe wide dissemination in co-operation with the demonstration projects
- The organisation of the annual meeting of CIVITAS Forum members
- Providing the Secretariat for the Political Advisory Committee (PAC)
- Development of policy recommendations for a long-term multiplier effect of CIVITAS

Key elements of CIVITAS

- CIVITAS is co-ordinated by cities: it is a programme "of cities for cities"
- Cities are in the heart of local public private partnerships
- Political commitment is a basic requirement
- Cities are living 'Laboratories' for learning and evaluating

1.2 Background ARCHIMEDES

ARCHIMEDES is an integrating project, bringing together 6 European cities to address problems and opportunities for creating environmentally sustainable, safe and energy efficient transport systems in medium sized urban areas.

The objective of ARCHIMEDES is to introduce innovative, integrated and ambitious strategies for clean, energy-efficient, sustainable urban transport to achieve significant impacts in the policy fields of energy, transport, and environmental sustainability. An ambitious blend of policy tools and measures will increase energy-efficiency in transport, provide safer and more convenient travel for all, using a higher share of clean engine technology and fuels, resulting in an enhanced urban environment (including reduced noise and air pollution). Visible and measurable impacts will result from significantly sized measures in specific innovation areas. Demonstrations of innovative transport technologies, policy measures and partnership working, combined with targeted research, will verify the best frameworks, processes and packaging required to successfully transfer the strategies to other cities.

1.3 Participant Cities

The ARCHIMEDES project focuses on activities in specific innovation areas of each city, known as the ARCHIMEDES corridor or zone (depending on shape and geography). These innovation areas extend to the peri-urban fringe and the administrative boundaries of regional authorities and neighbouring administrations.

The two Learning cities, to which experience and best-practice will be transferred, are Monza (Italy) and Ústí nad Labem (Czech Republic). The strategy for the project is to ensure that the tools and measures developed have the widest application throughout Europe, tested via the Learning Cities' activities and interaction with the Lead City partners.

1.3.1 Leading City Innovation Areas

The four Leading cities in the ARCHIMEDES project are:
- Aalborg (Denmark);
- Brighton & Hove (UK);
- Donostia-San Sebastián (Spain); and
- Iasi (Romania).

Together the Lead Cities in ARCHIMEDES cover different geographic parts of Europe. They have the full support of the relevant political representatives for the project, and are well able to implement the innovative range of demonstration activities.

The Lead Cities are joined in their local projects by a small number of key partners that show a high level of commitment to the project objectives of energy-efficient urban transportation. In all cases the public transport company features as a partner in the proposed project.

2. Aalborg

The City of Aalborg, with extensive experience of European cooperation and having previously participated in CIVITAS I (VIVALDI) as a 'follower' city, is coordinating the consortium and ensures high quality management of the project. The City has the regional public transport authority (NT) as a local partner, and framework agreements with various stakeholder organisations.

Aalborg operates in a corridor implementing eight different categories of measures ranging from changing fuels in vehicles to promoting and marketing the use of soft measures. The city of Aalborg has successfully developed similar tools and measures through various initiatives, like the CIVITAS-VIVALDI and MIDAS projects. In ARCHIMEDES, Aalborg aims to build on this work, tackling innovative subjects and combining with what has been learned from other cities in Europe. The result is an increased understanding and experience in order to share with other leading cities and learning cities.

Aalborg has recently expanded its size by the inclusion of neighbouring municipalities outside the peri-urban fringe. The Municipality of Aalborg has a population of some 194,149, and the urban area a population of some 121,540. The ARCHIMEDES corridor runs from the city centre to the eastern urban areas of the municipality and forms an ideal trial area for demonstrating how to deal with traffic and mobility issues in inner urban areas and outskirts of the municipality. University faculties are situated at 3 sites in the corridor (including the main university site). The area covers about 53 square kilometres, which is approximately 5 % of the total area of the municipality of Aalborg. The innovation corridor includes different aspects of transport in the urban environment, including schools, public transport, commuting, goods distribution and traffic safety. The implementation of measures and tools fit into the framework of the urban transport plan adopted by the Municipality.

Figure 1: The ARCHIMEDES Corridor in Aalborg

3. Background to the Deliverable

This deliverable provides information about the implementation of ARCHIMEDES task 2.2.

In the measure a smart travel card system, an innovative national project with a core system at the forefront of technology - is being implemented in Aalborg. The core system and two new ground-breaking facilities are part of the demonstration in Aalborg.

Existing ticketing systems with zone structures and fare calculation rules that, whilst mathematically logical, are not easily understood by customers constitute a barrier to the use of Public Transport. So do the barriers to trip chaining, characterised by different ticketing and pricing systems in different regions.

Together with the fact that the existing ticketing equipment throughout most of Denmark is worn out and ready for replacement, this has made it a clear task to initiate a national travelcard project, where the entire country adopts the same ticketing system based on the most up to date technologies for ticketing in buses, trains and metro.

The aim of introducing the Travel Card System in Aalborg is to further develop an optimal and user-friendly environment for public transport users and thereby counteracting the decreasing numbers of passengers. The idea is to encourage people to use collective public transport by making it easy, for the benefit of passengers and for improved economic and environmental efficiency of public transport.

The deployment of the "Travel Smart Card light" version in tele-taxis[1] will increase area coverage and contribute to build an integrated PT system.

Another aim of the measure is to secure the working environment of bus drivers. The integration of the Travel Card System with the BusPC System will ensure that the driver will only have to respond to one ITS system. This will also secure the integrity between data in the two systems.

As a spin-off benefit of implementing a joint national travel card project, public transport authorities will receive data that can be used actively in the planning of public transport. It will give the providers of public transport a much better overview of revenue and a better picture of where and when passengers are travelling. At the same time the systems contributes to improving the image of public transport as a modern means of transport thereby helping public transport to appear as an attractive alternative to car use.

In the national travel card project, Aalborg is part of the project in collaboration with Nordjyllands Trafikselskab (NT) (Public Transport Authority of North Denmark).

This deliverable provides information about the implementation of ARCHIMEDES task 2.2.

---

[1] Tele-taxis are small vehicles (Taxis) used in areas with only few passengers – either as an replacement for normal bus service during the evening and weekends or areas where NT offers public transport on demand.

3.1 Summary Description of Task

The measure implements a Travel Card System in 80 buses and introduces two new facilities for the travel card in Aalborg, including design and implementation.

- Integration in the buses between the Travel Card Unit and the busPC system. ARCHIMEDES contributes to the design of this integrated system.

- A light version of the travel card to expand the use of electronic ticketing to public transport taxis. ARCHIMEDES contributes to the design of this light version system.

4. Travel Card in Aalborg

4.1 Description of Work Done

4.1.1 Planning Phase and Development

The Travel Card in Aalborg is part of a nationwide project combining all means of public transportation in one payment system. Besides implementing the core system in 80 buses, the intention of the ARCHIMEDES measure has been to design and implement two new, untested facilities. These are:

- Integration in the buses between the Travel Card Unit and the busPC system.
- a light version of the travel card to expand the use of electronic ticketing to public transport taxies.

To test these facilities the Public Transport Authority of North Denmark, NT installs the travel card system in 80 buses running in the ARCHIMEDES corridor.

The interface between the travel card equipment and the busPC was found to be desirable and beneficial, both for the drivers, customers and the Public Transport Authority, NT. ARCHIMEDES contributes to the design, ideas and knowledge about the integration between the two systems. The light version ensures a complete system without expensive installations in small vehicles.

The planning and purchase of the complete travel card system started several years ago. All the public transport authorities formed a common company to handle the whole project. The work with the two ARCHIMEDES features started in 2008 by forming a local working group with representatives from the Travel Card Company, the system provider and the provider of the BusPC

Implementing a travel card system is a large and complex project. Together with the rest of the organisation at NT (planning department, sales, marketing and other groups) the working group has been involved in many activities concerning testing, preparing topology and fare data, preparing education and introduction towards customers.

4.1.2 Implementation

Installation of equipment in buses started in April 2010. Parallel to this work wireless access points at the bus depots were prepared for delivering and receiving data to and from the buses. A complete connection with data from the central system and into the first bus was

established in the beginning of September 2010 and since then the system has been ready to handle check in and check out and to sell tickets from the travel card system in the buses.

It was the intention to start the demonstration of the ARCHIMEDES parts of the project on 10th October 2010 in Aalborg. Both as a technical test of the equipment in the buses and also towards the customers (bus passengers). Everything was ready for this, but due to some contractual disagreements between the nationwide travel card organisation and the supplier, the roll out of the system had to be temporarily stopped. In December 2010 the parties agreed on a new amendment to the contract and the roll out continued from there.

After reaching agreement on the amendment to the contract the process had to be restarted. Drivers had to be trained and the communication process to the customers had to run. This delayed the ARCHIMEDES demonstration, but on 16th May 2011, the pilot project started with 45 buses in the first phase. The agreed ARCHIMEDES demonstration was expanded to include a local commuter train line that is running through the ARCHIMEDES Corridor. In October 2011 the remaining 35 buses in the ARCHIMEDES project will be included in the demonstration and at the same time the rest of the city buses will be included in the travel card system. The installations in the buses are completed but to ensure successful implementation this two-step strategy has been chosen

4.2 Specification of the integration and of the light version.

4.2.1 Specification of the integration between the busPC and the travel card unit

After specification requirements from NT and the national travel card company, the travel card supplier East-West/Thales and the busPC supplier FARA developed the interface for the two systems. The principles for the open communication interface between an onboard travel card system and the onboard computer system, the busPC, is seen in Figure 2
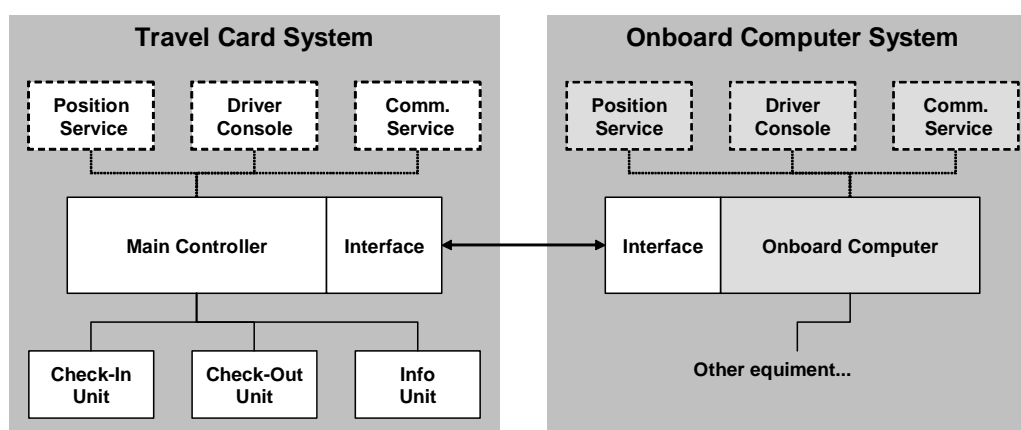

Figure 2 Integration. Travel card system and BusPC.

For operational reliability reasons it was decided after all, that both systems should have own position systems, drivers consoles (the driver screen) and communication systems. Data are shared through the common interface. If there is a problem in any of the two systems, the other system can continue to function autonomous in the bus.

In the first version of this integration, introduced in the pilot in May 2011, the integration is limited to a single-log-on. The bus drivers only have to make a logon procedure on the Travel Card Drivers Console. This log-on is automatically transferred to the BusPC so the driver does not have to make a parallel log-on on the busPC Drivers Console.

Figures 3 and 4 show the separate Drivers Consoles, for the two systems.

Figure 3: Travel Card Drivers Console

Figure 4: BusPC Drivers Console

Figure 5 shows the two separate, but integrated IT systems in the bus IT-cabinet. If the cable between the two systems is removed or any other problem causes lack of communication between the systems, they can continue to function separately.

Figure 5 The two IT Systems in a bus

The travel card system controls the sale of cash tickets and the smartcard system in the bus. The busPC is part of the total real time system, among other things provides Real Time

Passenger Information to customers at bus stops, terminals, Internet, On-Bus TripAdvisor Traveller Information (Measure 69) and Pre-trip and on-trip information phone (Measure 68).

When the driver starts his trip he/she logs on to the travel card system. Then he/she will be prompted for line and trip. Once he has chosen line and trip the line/trip information is automatically transferred to the busPC. In figures 6 and 7, the same line and trip is visible on both systems on the driver's consoles.

Figure 6: Line and trip in the travel card drivers console

Figure 7:Line and trip in the busPC drivers console

This single sign-on process where the driver only has to confront one system, makes life their much easier, and at the same time this single logon also helps providing customers with improved passenger information. All drivers have to logon to the travel card system, otherwise they cannot sell tickets. But the driver can omit to log on to the busPC, because it does not have a direct impact on the driver's work. Previously some drivers have previously opted out of this. By integrating the two systems, the driver is automatically logged into both systems when logging into the Travel Card System, and a higher degree of service to passengers is achieved by always being able to give passenger information on the bus (ARCHIMEDES measure 69) and RTPI will be available on the Internet and phones (ARCHIMEDES measure 68).

4.2.2 Specification of light version of the travel card equipment

As part of measure 8, the intention is to introduce a light version of the travel card to expand the use of electronic ticketing in public transport. The intention is to use this equipment in taxis and small buses and in this way to integrate the travel card system into parts of public transport where it would otherwise not be technologically, and especially economically, feasible to make it possible to use the common travel card system.

Rather than to develop a separate piece of hardware for this purpose, it was decided to reuse the hand held terminal for the ticket inspectors, make some adjustments in the software and then use this as a light version of travel cards equipment.

The necessary additions to the software have been made, so the equipment can now be used easily by the bus driver so that passengers can easily do the check-in and check-out on the equipment.

It was the intention to test the travel card light solution as a part of the demonstration project in Aalborg, but at the moment the functionality of the solution is not satisfactory and – as a part of the process of agreeing on the contract amendment, mentioned previously, - it had to be accepted to postpone this part to 2012. The software is acceptable, but the hardware is not satisfactory. The selected device, an HP 2790, proved to be too unreliable for daily use as a ticketing machine.(Figure 8). It can be used by inspectors for checking the ticket, but it would be too risky to introduce this equipment as ticketing equipment. The main problems found were:

- that the mobile device periodically loses the connection to the card reader and
- the mobile device doesn't have enough power for a whole day of service and unfortunately it's not possible to make check-in and check-out while charging.

A positive approach to the system from bus drivers is very important and they will not be comfortable with a system that is unstable and requires rebooting serveral times a day.

A more stable version will be available from March - April 2012. A Motorola MC75 (Figure 9) will be used for both ticket inspectors and as a platform for the light version of the travel card. At the latest, the light version on the new platform will be part of the second phase of large travel card roll-out in North Denmark, starting October 2012.

Figure 8 The travel card light equipment. HP2790

Figure 9 The travel card light equipment. Motorola MC75

4.3 Communication and Evaluation

Communication and marketing of a new national ticketing project is very important and of high priority.

Communication and marketing of travel cards in Aalborg was originally intended to be a part of ARCHIMEDES task 2.1 Measure 1, but because of the delay in the national project, causing the demonstration in Aalborg to be rescheduled from October 10th 2010 to May 16th 2011, it was decided that ARCHIMEDES should not contribute to this part of the introduction of the travel card system in Aalborg. Instead the resources in task 2.1 originally, partly allocated to a campaign for, among other measures, the travel card, were shifted to a campaign for other public transport measures in the Aalborg part of the ARCHIMEDES project. ARCHIMEDES has therefore not contributed to the travel card roll out campaign in Aalborg. Instead, the marketing and communication effort has been running according to the national concept.

To give the demonstration project some volume in terms of customers, NT and the train company (DSB), have offered the first 500 pilot customers a travel card on very special conditions. All passengers can get a travel card but the first 500 receive a card with travel-rights for 500 Dkr. for the price of 20 Dkr.

Several campaign elements have been carried out and in less than 3-4 weeks the first 500 cards were sold, and 500 customers were registered in the system. These pilot customers are now travelling – along with new customers - and are providing the basis for evaluation which is helping to reveal problems and identify solutions.

Figure 10: Customer material from the pilot campaign

Before the large scale roll out in October 2011, NT will perform an evaluation of customer satisfaction with the travel card system in Aalborg among the 'pilot customers'. It is planned that this shall be done through a series of focus group interviews with passengers who have used the travel card in the pilot.

The focus group interviews will be held in August and September 2011 and input from the focus group interviews, will be taken into account before the roll out in October 2011.

Figure 11 : A whole bus is covered with Travel Card advertisement. A very visible advertising for the Travel Card and the ARCHIMEDES project

4.4 Problems Identified

The national project is a large, advanced technology project. It seems to be a trend that these large IT projects get delayed. The national project, and thus the ARCHIMEDES demonstration in Aalborg, has been delayed due to contractual disagreements between the nationwide travel card organisation and the supplier caused by severe problems with the supplier's ability to deliver the ordered product according to the contractual timescale. However, since December 2010, the project has been on track and the demonstration project started in Aalborg on 16th May 2011.

As described previously, the software in the Travel Card Light solution has been developed but it has been necessary to postpone the demonstration of this facility until 2012 to ensure an optimal and smooth implementation and roll out of the system.

4.5 Future Plans

When the better version of the travel card light hardware is available (March/April 2012), the light version of the travel card will be introduced, as originally planned, in the roll out, October 2012.

Following the introduction of the travel card light equipment, there will be an evaluation involving drivers, to ensure that the equipment is user friendly and can continue to function as ticketing equipment in small buses and taxis.

The integration between the Travel Card System and the BusPC works both ways. When the Travel Card system is implemented in the whole region, the integration will be used in all 80 buses. This integration opens many opportunities for data communication and interaction with other systems in the bus and in the back-office system. The Travel Card System is an "off-line" system and the buses are only communicating with the central system at the garage

(depot). However, by having the integration NT can monitor the travel system from the BusPC and thereby ensure that all trips are being serviced by the travel card system. It will also be possible to send and receive real-time data from the travel card system to the back office system via the BusPC. It could be important updates such as card blacklists (for example cards noted as lost or stolen). The central system can send instructions to the driver and give the passengers information on the infotainment monitors.

Appendix 1 Glossary and Abbreviations

busPc: An on-board computer in PT buses. Controlling the passenger related function in the bus including GPS position to RTPI systems and bus priority at intersections.

Measure 1: Biofuels in Aalborg. A parallel measure in the ARCHIMEDES project in Aalborg.

Measure 8: Travel Smart Card in Aalborg.

Measure 68: Pre-trip & On-trip Mobile Phone Information in Aalborg. A parallel measure in the ARCHIMEDES project in Aalborg.

Measure 69: On bus Traveller information in Aalborg. A parallel measure in the ARCHIMEDES project in Aalborg.

NT: Public Transport Authority of North Denmark

RTPI: Real Time Passenger Information

PT: Public Transport.