REAL-TIME MANAGEMENT AND CONTROL OF A BUS PUBLIC
TRANSPORT NETWORK: THE STCP EXPERIENCE

Jorge Freire de Sousa, Jorge Rocha Teixeira and José Barreira Ferreira
STCP, SA
Porto, Portugal
Email: jorgefreire@step.pt

SYNOPSIS
STCP is the main bus operator in Oporto Metropolitan Area. The experimental phase of using fleet tracking and management systems fitted on public transport began in the late eighties, but only in 2002 the current system (SAEI) involved all the buses of the company. Nowadays, these systems are integral company management systems. In this paper, the experience of a bit more than six years is related. The main reasons for the use of such systems are detailed, the architecture and functionalities are described and the importance of accessing real-time information together with subsequent analysis of the data obtained is underlined.

INTRODUCTION
Public Transport is faced with the challenge to respond to the increasing exigency of passengers namely by providing adjusted timetables and attractive services at the same time. Real-time and accurate passenger information, improved passenger safety, better monitoring and automated management control are some of the factors which are critical for the success of transport companies (Goel, 2008; Mazzon, 2002).

In order to improve service regularity through planning, STCP launched in 1999 an international tender for the acquisition of an Operational Control System (SAEI), providing automatic vehicle location through GPS (Murphy, 2004) and using a mobile communications TETRA network, enabling more efficient network management and improved security for passengers and crew, and also integrating a real time information system, providing the public with information on next bus times at the main stops.

MAIN OBJECTIVES
In short terms, the main goals of the system were to achieve effective control of the fleet, to optimize available resources, to improve the working conditions of drivers and inspectors, to obtain more and better information about the service, to enhance the process of planning and to provide a service of better quality.

ARCHITECTURE
The four components of the system (Figure 1) are the mobile communications network, the onboard equipment, the dispatch centre and the information system. All these subsystems work to provide the necessary data to the controller.
The mobile communications network is based on TETRA, a digital communications system that allows voice and data in the same channel.

The onboard equipment is the responsible for determining the location of the vehicle, the communications with the dispatch centre, the multimedia passenger information, and the ticketing integration. The main equipment is the onboard computer and the TETRA radio. All the necessary data for the system’s work are resident in the onboard computer and are downed in the beginning of the service. This reduces the quantity of data flowing through the communications network.

The dispatch centre (Figure 2) incorporates the heart of the system, a master computer that receives all the information from the other subsystems and has a resident database with all the parameterization and still stores all data for future use. Linked directly by a LAN Ethernet at 100 Mbit/s there are eight dispatch workstations, one configuration and statistics workstation and one video wall (Figure 3). Additionally, as a support for the activity of the controller, there are video signals from the streets throughout the town-hall equipments.

The information system is located onboard and at some stops and allows the passengers to receive information of the next stop, the waiting time for the next bus and the visual and sound information sent by the company.

**FEATURES**

The SAEI system provides a complete range of control, management and regulation functions for passenger information and services and enables integration with other existing systems in the company.
The real-time fleet management allows actions such as improving the distribution of passenger by buses, reducing the waiting time for customers in stops, minimizing the loss of travels, obstructing buses running too close together in time and adjusting the supply of service in light of unforeseen occurrences.
The messaging service, both for drivers and passengers, the configuration and historical record of operation data, the regulation in the control center and onboard, the hidden emergency alarm (with recording of image and sound environment, audible in the dispatch center), the passenger information inside and outside the bus, the counting of incoming and outgoing customers at each stop, and the back-office management of the occurrences and complaints are just some of other features of the system.

Another important additional feature is the information given to the clients through mobile phone – the next buses passing at a stop or, for a specific line, which will be the passing time for the next buses – obtained by means of an algorithm developed on the basis of data like the location of the bus and its speed during a certain period time preceding the call. This information can also be given to blind clients through specific software developed for mobile phones. Moreover, this feature allows a blind client to know the time he will have to wait for the bus of a particular line, alert him when 1 minute is missing for the bus to arrive and yet inform the driver that a blind client is waiting for the bus in that stop.

CONCLUSION

The SAEI at STCP provides real-time management and control of its bus public transport network, with the additional possibility of adapting diverse systems which provide added-value. In this way, through this system, several developments were made, guaranteeing adaptation to current and future projects. The SAEI also supplies data management systems for analyzing services, passengers and fares, allowing comparative graphs with historical files, among many other possibilities (Zeimpekis, 2007).

REFERENCES


