

Cybercars for Sustainable Urban Mobility - A European Collaborative Approach

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Abstract

We know that the existing urban transport systems based on the private vehicle (necessarily relying mostly on fossil fuels) are not sustainable in terms of energy and land needs. On the other hand, public transportation systems are also not very efficient and do not provide a good service anywhere and anytime.

Over the last twenty years, a new concept has emerged through strong cooperation between researchers, automotive companies, suppliers and transit operators. It is the concept of a co-modal systems. This means well-designed systems that will combine the use of various transportation modes and in particular the individual vehicles and the mass transit systems. A key element of such a system is the Cybernetic Transportation Systems (CTS), which are based on fully automated urban vehicles. This paper will present these CTS and how they have emerged through a European collaborative approach.

These environmental friendly novel systems offer far-reaching solutions that will drastically mitigate or solve the problems that we encounter in current urban transportation systems. They will yield much more effective organisation of the urban mobility, with a more rational use of motorised traffic; less congestion, pollution noise and CO₂ emissions and better accessibility and safety. The result will be a higher quality of living, an enhanced integration with the spatial and also societal development and advancement towards sustainability.

Cybernetic Transportation Systems (CTS)

The Cybernetic Transportation Systems (CTS) concept has emerged in the early 1990's as a researcher dream: to bring

fully automated clean urban vehicles as an attractive alternative to the use of private cars (1). These vehicles were meant to be operated by a public transport supplier and fully integrated in an information system that would give the users the best choices in their travel demands through a mix of soft modes (walking, biking), mass transport and individual transport.

The first step towards this goal was the development of a carsharing systems based on electric cars and information management. This was the French Praxitele project (2) which took place between 1993 and 1999 with a large scale demonstration in the city of Saint Quentin-en-Yvelines, near Paris with 50 electric cars and 13 stations. During this programme, a technical solution for the relocation of empty vehicles was developed with the platooning concept (3) which was a first step towards full automation (4) and introduced the concept of dual-mode vehicle with manual or fully automated modes.

In 1997, a bold system with four fully automated electric vans was put in place at Schiphol airport by the company Frog Navigation Technologies and operated without any accident for several years. At about the same time, the University of Bristol developed the ULTra, a PRT (Personnal Rapid Transit) based on fully automated electric road vehicles and INRIA in France developed the CyCab, an innovative electric vehicle for manual (joystick) or fully automated operation (5).

At that time, it became clear to many that a collaborative approach was needed to bring the concepts of the CTS to reality. An informal consortium was therefore formed to present research projects for financing to the European Commission. These projects that introduced the concept of the cybercars and CTS started in 2000 and have been since

then constantly supported by various Directorates of the European Commission (EC).

National and European Research Projects

The first cooperative projects financed by the Commission on the CTS were the CyberCars and CyberMove projects. They lasted from June 2000 until December 2004. These 2 projects received about 2.5 millions euros of funding each, one from the INFSO Directorate (Information Society), one from the Research Directorate. Both programmes had roughly the same partners that included research organizations (INRIA, Bristol University, Technion Israel, La Sapienza in Rome, TNO), industrial companies (Yamaha Europe, Robosoft, Frog, Ligier), an urbanist (GEA) and a transport operator (Veolia). The CyberCars project focused on the technology and demonstrated various techniques for navigation and collision avoidance. The CyberMove focused on the implementation of CTS in cities and the impacts that could be expected.

The technology developments continued with Cybercars-2 (2006-2008) which included cooperative behavior of the vehicles through communications and dual-mode vehicles (where driving could be switched between manual, assisted or fully automatic driving). The research center of Fiat (CRF) was involved in the development of such vehicles.

In parallel, the large scale project (Integrated Project in the EC language) CityMobil (2006-2011) looked at a bigger picture of automated urban transport and had as an objective the presentation of these technologies to potential cities. Three large scale demonstrations were therefore defined plus a number of “showcases”. The big demonstrations were the PRT system (in fact a CTS on dedicated tracks) of Heathrow which is now in operation, the BRT system of Castellion in Spain with guided hybrid buses on a dedicated infrastructure and a CTS for the exhibition center of Rome. The showcases presented cybercars and dual mode vehicles to a number of cities throughout Europe: Daventry in UK, La Rochelle in France, Vantaa in Finland, Trondheim in Norway, Clermont-Ferrand in France and Formello and Orta in Italy.

The work of the consortium in CityMobil was to study the difficulties and the advantages on implementing these systems in real environments and to issue recommendations for further deployment. One key issue was the certification process that is still a big hurdle for the introduction of automated road transport. Progress is being made with the work of TNO to help the cities and their suppliers introduce the systems.

Due to the success of the showcases and the interest of the European cities in knowing more about the potential of these

technologies, a further funding was granted by the Commission with the CityNetMobil (2009-2011). Its main goal besides further showcases was to set a network of cities interested in the implementation of CTS and dual mode carsharing systems.

The next European project that is supporting the development of CTS is the PICA project (2009-2011), also financed by the Research Directorate. The goal of this project is to develop a specific tiny urban vehicle dedicated to ancient cities of Europe. This vehicle is developed to be used either as a CTS or a dual-mode vehicle. The city for experimentation is the city of Genoa in Italy.

The last project, which started in 2010, was financed first by the French state (in 2008), then by the Research Directorate of the EC. It is the CATS project. This project is also developing a new urban vehicle but of larger size (up to 6 passengers). This vehicle could be used as a regular electric carsharing vehicle but it is also designed to be used as a variable length bus with a professional driver at peak times. Two techniques to implement this function are considered: a mechanical connection or an electronic one. The company developing the vehicle is the French Lohr company, an enterprise already well known in the transportation field for its tramway on rubber wheels and for the new generation of the automated metro VAL (in cooperation with Siemens).

European Cooperation on CTS

All these projects have brought in Europe a rich field of lasting cooperation between a large numbers of entities over the years. Many of the key players have known each other for more than ten years. This has allowed strong cooperation for the dissemination of knowledge among the different partners but also has fostered dissemination among the potential users. Several new industrial players have also emerged from research centers through these projects and we have now in Europe quite a number of striving companies ready to enter the field of CTS.

Among the key industrial players that can propose CTS, we should mention (starting from the oldest):

- 2GetThere (NL) issued from Frog Navigation
- ATS Ltd (UK) issued from Bristol University
- Robosoft (FR) issued from INRIA
- Induct (FR) also issued from a cooperation with INRIA
- CriticalMove issued from Coimbra University

But we should also mention the research lab of Fiat (CRF) that early on thought about the concept of the dual-mode vehicle for advanced carsharing and CTS and the Lohr (FR)