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CityMobil

Towards advanced transport for the urban environment

Rome demonstration requirements

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SIXTH FRAMEWORK PROGRAMME

Foreword

This deliverable was drafted under the responsibility of ITR (Ingegneria dei Trasporti s.r.l.) by the CityMobil consortium.

Significant contributions have been made by all the partners of Rome demonstration.

Table of contents

Figures

Executive Summary

The global objective of the CityMobil project is to achieve a more effective organisation of urban transport, resulting in a more rational use of motorised traffic with less congestion and pollution, safer driving, a higher quality of living and an enhanced integration with spatial development.

The concepts, methods and tools developed in CityMobil will be validated and demonstrated in a number of different European cities under different circumstances. Three of the demonstrations (Heathrow, Rome and Castellón) will be real implementations of innovative new concepts. In practice these will be the first stages of automated transport systems that are really integrated in an urban environment. A number of other cities studies will be carried out to show that an automated transport system is not only feasible, but will also contribute to a sustainable solution for the city's mobility problems, now and in the future.

Rome is one of the three major CityMobil demonstrations and it contributes to the project objectives of demonstrating the feasibility, public acceptance and performances of innovative automated transport systems. Rome demonstration is a short distance transport service using small automated vehicles, “Cybercars”, to collect people from their parking slot or from the train station and to bring them to the entrance of the new Rome exhibition building. With respect to previous “Cybercars” applications this new installation has a number of technical and integration features, which will contribute to supply a service of extremely high quality that is therefore expected to have a good impact on the public. This deliverable reports the major requirements to be satisfied to make the demonstration operating. The report is organised in six main sections.

The first section gives an overview of the CityMobil project and its objectives, focusing the attention on the Rome demonstration role inside the project.

The second section reports a complete description of the Rome demonstration. It quantifies the present situation of the structure for the new exhibitions, which is being built and the car-parks designed for the visitors reaching it by private car. In particular the section shows the main characteristics of the CTS (Cybernetic Transport System) which is designed to be implemented inside the biggest car-park and the changes it will make, both in terms of car-park re-design and user needs satisfaction.

The third, the fourth and the fifth sections are the main sections of this report. The third section reports the technological requirements of the new system, in terms of CTS structural requirements and CTS management requirements. The fourth section is devoted to the infrastructural requirements, connected with the accesses to the car-park and their management and to the areas in which the “Cybercars” stay when they are not operating (depots and

recharging stations). The fifth section reports the safety requirements and the certifications required to homologate such new systems.

The sixth section reports the time foreseen to make the system operating, the future steps and the contributions expected from the other sub-projects (SPs).

Based on the analyses made in the Rome demonstration, the major requirements for the operation are:

- A system for the communication of the network status in terms of status of the vehicles, traffic control and power management;
- A system for the communication between the vehicles;
- A system for the management of the network intersections, in terms of priority of vehicles passing the same intersection;
- Systems for the management of visitors' requests (through human-machine interface (HMI) in the automated gates), in terms of car-slot and vehicle selection and verifying of the right position of the cars inside the car-park;
- Techniques for the management of peak hours, considering at the same time the recharging operations of the vehicles;
- Safety measures, especially linked with the obstacle detection;
- Certifications for the homologation of the new "Cybercar" system.

Such requirements could be satisfied by interaction with the other sub-projects, especially SP2 for CTS homologation, SP3 for obstacle detection and avoidance, platooning technique, intersection management and communication between the vehicles, and SP4 for advanced CTS network management (including car-slot selection and verification of the right position of the cars, vehicle selection and recharging) and system integration with the car-park.

Such interactions are required before the end of 2007 (with the exceptions of obstacle detection and avoidance and platooning, which are not necessary required at this stage), because of now Rome Municipality is calling for tenders for the car-park management and the work will start in the beginning of 2007 and will finish at the end of the same year.

1 Introduction

1.1 Background

The mobility problems in cities have been clearly identified; the solutions to face and solve such problems are still in the initial phase.

The actually preferred trend in order to solve them is a mix of land-use policies and a shift from the private car to a multi-modal approach. The solution for the implementation of the multi-modal approach (including and encouraging soft modes such as walking or cycling) must recognise the need for both high speed scheduled mass transport and individual on-demand short distance transport. However, such individual on-demand trips should not use the private car, especially in the densest parts of the cities, which are not well adapted for the private cars in terms of space, energy and safety.

In this scenario, new solutions have to be tested. Such solutions can be based on: advanced city vehicles in car-sharing mode, fully automated vehicles running on new infrastructures (PRT, personal rapid transit) or dual-mode vehicles. This last category of vehicles, considered as a transition to fully automated road transport, is made of traditional vehicles, which can be driven manually in mixed traffic or run automatically in reserved areas or dedicated infrastructures.

Similar technologies can be adapted for freight transport in cities with a multi-modal approach using dispatch centres outside the cities with clean vehicles running inside in manual or automatic modes.

The CityMobil project is in line with such research for the understanding of the capabilities of the new technologies to be adopted to solve mobility problems and of what the gains to be expected in different city-situations could be.

1.2 CityMobil Objectives

The global objective of the CityMobil project is to achieve a more effective organisation of urban transport, resulting in a more rational use of motorised traffic with less congestion and pollution, safer driving, a higher quality of living and an enhanced integration with spatial development.

In order to achieve this goal, three sub-objectives have to be reached:

1. The development of advanced concepts for advanced road vehicles for passengers and goods transport.
2. The introduction of new tools for managing urban transport.
3. The take away of the barriers, which are in the way of large-scale introduction of automated systems.

1.3 Rome demonstration objectives

Rome is one of the three major CityMobil demonstrations and it contributes to the Project objectives of demonstrating the feasibility, public acceptance and performances of innovative automated transport systems.

As described in the next section the Rome demonstration is a short distance transport service using small automated vehicles, "Cybercars", to collect people from their parking slot or from the train station and to bring them to the entrance of the new Rome exhibition building. With respect to previous "Cybercars" applications this new installation has a number of technical and integration features, which will contribute to supply a service of extremely high quality that is therefore expected to have a good impact on the public.

The technical complexity is high because, although segregated from external traffic, the transport system will be on a network and with a high vehicle density (8 vehicles in a slightly more than 2 km length of network) requiring good vehicle to vehicle communication to manage priority at the intersections and the short headways needed to give high capacity.

The system will provide a fully on-demand service, and vehicle reservation will be integrated in the car-park management; each time a car enters the car-park-gate it receives the number of the slot where to park and an automated vehicle is called to wait for the car occupants at the right stop. The waiting time will be greatly diminished without hampering the vehicle occupancy. As for the train station at each train arrival (every 15 minutes) a platoon of "Cybercars" will go to the station, taking people, who are leaving the exhibition and ready to collect those who are coming in by train.

All these features contribute to the achievement of four different objectives:

- Improvements in transport performance.
- Increased public acceptance of public transport services.
- Proof of financial viability.
- Demonstration of the technical maturity of the technology.

Transport performances improvement

Under the transport performance point of view the Rome installation will need to demonstrate that:

- Waiting time can be diminished to negligible values;
- Overall travel time can be significantly diminished by the new transport system;

- Integration between different modes can be improved so to eliminate any mode transfer barrier even for impaired mobility people;

- Energy spent per passenger kilometre is lower than that of conventional transport modes;

- System safety and security (a particularly sensitive point for Rome administration today after Madrid and London terrorist attacks and direct indication from terrorists on the web of Rome being one of the next targets) is higher than all the other transport modes.

Public acceptance increase of a public transport service

The objectives of Rome demo in terms of public acceptance are to have the users satisfied with:

- The quality of the service;

- The easiness of system use;

- The system accessibility;

- And the integration between transport modes.

Financial sustainability proof of such systems

The demonstration will also be the first ever occasion to keep under close control for a five years period all the cash flows of the installation, operation and maintenance of such a system. It will give the occasion to validate the assumptions about the necessary system maintenance (and its costs) over the years and to verify whether the initial investment will be re-paid and when.

Demonstration of the technical maturity of the technology

The Rome demonstration:

- Will define what is still needed in terms of technology, operational and certification aspects to make these systems more widely diffusible to contribute to the CityMobil research;

- Will be a benchmark for the new technologies, operational and certification strategies, which are developed in the Project;

- Will contribute in putting the first step stones in the road-map for such system wide diffusion.

1.4 Role and structure of this document

To provide the requirements according to the features and the needs of the demonstration, section two reports a brief description of the car-parks designed for the new building for exhibitions in Rome, in terms of the changes that have to be made inside them. The main description is for the P1 car-park, the biggest one, because of a CTS (Cybernetic Transport System) is designed to be implemented inside it, in order to collect people from their parking slots or from the train station (which is near the P1 and P2 car-parks) and to bring them to the entrance of the new exhibition building.

Section three, four and five are the core sections of the document.

Section three reports the technological requirements of the demonstration in terms of the CTS technological specifications (vehicles to adopt, control station for the management of vehicle requests, control and wireless communication systems) and the problems to be solved in terms of management of the entire system (intersection management, communication between the "Cybercars", techniques to avoid congestion in the peak hours).

Section four reports the changes to be made in the car-park to make it operating with the CTS, considering the automated gates for the access in the car-park and their management, the depots and the recharging stations for the vehicles and the user information, including the signs to be made inside the car-parks.

The fifth section concerns the safety measures to adopt once the system will be operating and the certifications required to homologate the system and consequently to allow the start of the demonstration.

A sixth section, in which the conclusions in terms of the requirements and the contributions are reported, is expected to satisfy them. The time foreseen to make the system operating and the future steps on the basis of this work ends the document.

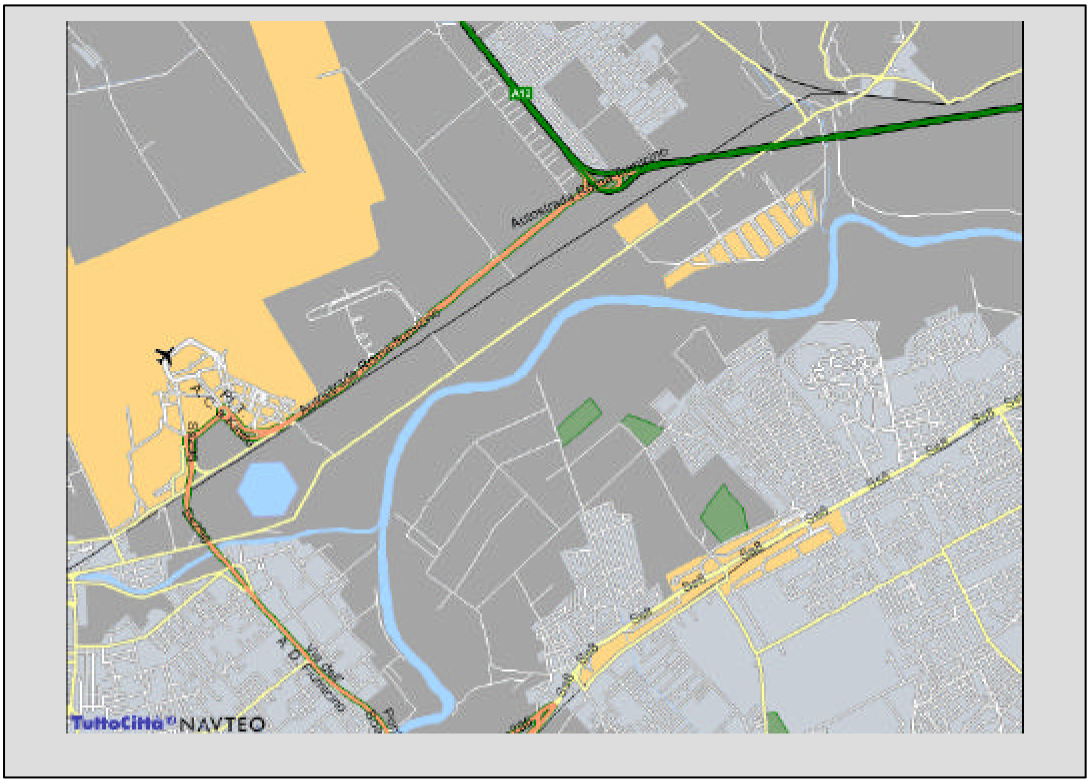
2 The Rome Demonstration

Rome is building a new exhibition centre to replace the old one. The old one is currently inside Rome with big problems of parking, public transport and with a limited exhibition area. The new one aims to become one of the important European exhibition areas.

It will be located in the direction of Fiumicino airport (the main international airport of the city) on the west side of the city 3 km outside of the outer ring road and 16 km away from the city centre, along the airport highway and railway link.

The area where the new exhibition is being built is on the lower side of the airport highway and railway link and it is shown in Figure 2.1, whereas the new building for the Rome exhibition centre is shown in Figure 2.2. Around a 1.5 km long central corridor, each block represents an exhibition stand of 72 by 12 metres each.

Figure 2.1: The area where the new exhibition is being built



In front of the building, there is a car-park with about 2500 car-slots. The building can be reached not only with the private car, but also with the train by using the railway from Fiumicino Airport to Rome (FM1). The distance between the railway station and the nearest building entrance is about 500 metres.

The transport system that will be the core of the Rome demonstration will serve the car-park and the railway station with two objectives:

- To improve visitors' accessibility to the buildings, for people coming both by car and by train;

- To eliminate the shuttle, which would be needed to serve the farthest car-slots.

A further objective in the longer term is to demonstrate the economic viability of automated systems for providing an effective feeder transport service to and from the railway; if successful, similar systems are expected to cover the feeder public transport needs for the new housing currently under construction along the railway and toward the airport.

With respect to the initial design, the car-park in front of the building has been re-designed in order that a "Cybercar" network can be built inside it. Its aim is to pick-up the visitors once they have parked their private cars and to bring them to the building entrance. On the return trip a "Cybercar" drives them to their car-slots. The "Cybercar" also provides the same service to people reaching the exhibition by train. The visitors are picked-up at the railway station and driven to the building entrance; then, after visiting the exhibition, they are returned to the station by "Cybercar".

Figure 2.2: New building for Rome exhibitions

To dimension the operating "Cybercar" network, the car-park size and the demand have been estimated on the basis of data from other European exhibition centres of similar size to Rome's. 8 vehicles with space to carry 20 passengers are reckoned to be sufficient to serve the demand of the car-park zones further than 200m from the entrance.

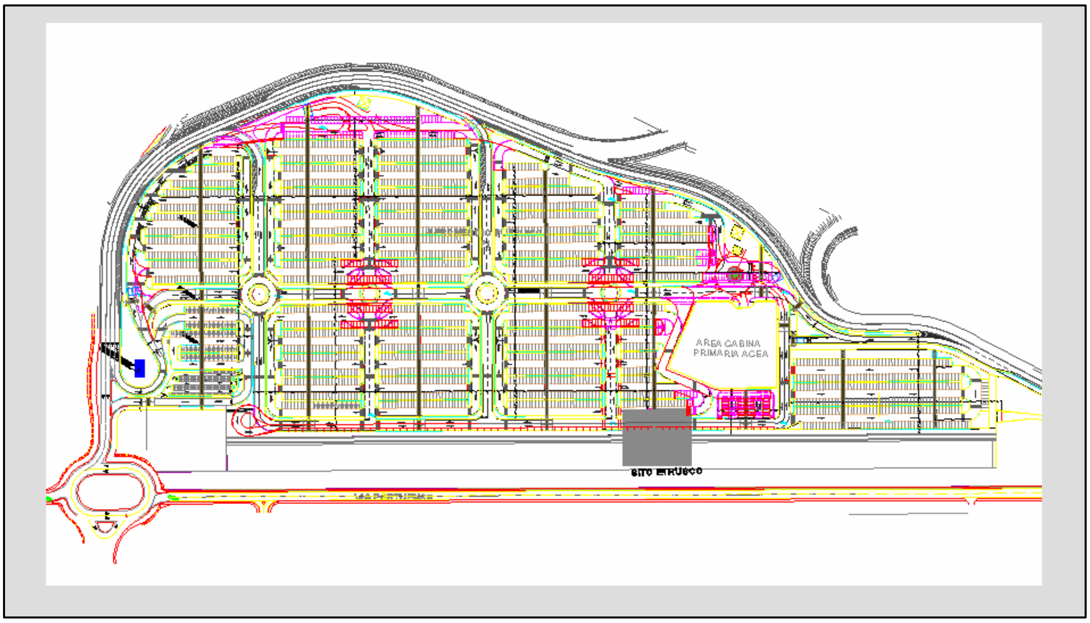
The foreseen car-park capacity with the present design is 2 500 car-slots. Visitors park their cars in the slots without any order searching for a free place at their arrival. However there are parking zones inside the car-park about 600-700 metres distant from the building entrance, meaning that some people would need to walk for more than 10 minutes to reach the exhibition, and to return to their cars. In such cases, it is common experience in Italy, to park illegally in the proximity of the entrance rather than use parking spaces. In order to avoid this problem, the car-park has been re-designed introducing a "Cybercar" network inside it to pick-up visitors once they have left their cars and to bring them to the building entrance. Once they finish their visit inside the building, the "Cybercar" returns them near to their cars.

The new structure of the car-park is shown in Figure 2.3.

The main features of the new system car-park – "Cybercar" network are:

- A "car corridor" around the car-park to allow car owners to reach the slots, which they have been addressed at the car-park entrance gate;
- A central "Cybercar corridor" from the left to the right with five vertical joined corridors to serve all the car-park as reported in Figure 2.3;
- Car-slots for impaired mobility people cars near the entrance of the building.

Figure 2.3 New car-park structure after the insertion of the CTS



In this configuration the "Cybercar" is segregated and the maximum allowed speed is 30 km/h, according to CyberMove results, (2004a and 2004e).

Furthermore this new configuration avoids congestion problems due to the absence of intersections between “Cybercars” and cars and parking-search traffic, because each car is addressed to a specific slot at the car-park entrance gate.

At the two car-park entrances (one on the west side and one on the east side), there are automated gates: once a car enters, the driver states how many passengers there are in his/her car and receives a ticket which shows in which car-slot he/she has to park. Immediately a “Cybercar” vehicle is sent to the “Cybercar” stop, which is the nearest to the car-slot and is waiting there for the visitor to arrive at their designated parking slot.

The new configuration of the car-park has 3,000 car-slots. The total length of the “Cybercar” network is 2.2 km. 20-place “Cybercar” vehicles have been chosen to serve the visitors. The number of “Cybercar” stops is 9 (six roundabouts and three intermediate stops on the vertical corridors), each one is identified by a number. Those from 2 to 9 are inside the car-park. Stop 1 is at the entrance to the building. It is the end-point of all the trips from the car-park and from the railway station, and the start-point of all the return trips. Depots and recharging stations (which include a vehicle washing facility) are near the exhibition entrance (stop 1).

3 Technological requirements

The technological requirements can be summarized in two different categories: those directly linked with the technology used to “build” the CTS and those concerning the management of the system once it has been built.

3.1 CTS technological requirements

The first category consists of the vehicles circulating on the network, the “Cybercars”, the control station for the management of the vehicle requests, and the control and wireless communication systems.

20-place vehicles are the most appropriate, to provide the service. Such capacity allows serving the entire demand and avoids three problems:

1) Using smaller capacity vehicles, a higher number of vehicles circulating on the network would be required, thus providing congestion in the peak hours

2) Higher capacity vehicles would run empty in some periods of the day

3) The use of higher capacity vehicles would increase the passengers’ waiting times at the stops. On the basis of the study made to find the most appropriate vehicles, 8 vehicles have been calculated as sufficient to serve the entire network during the exhibitions, also considering the train station link with the building entrance.

The dimensions of the vehicles (length 6 m, width 2 m and height 2.75 m) allow them to circulate inside the lanes previously designed for the cars without changing their width.

The maximum allowed vehicle speed is 30 km/h, the maximum allowed acceleration and deceleration are 1.2 m/s^2.

Concerning the manoeuvring capabilities, the vehicles should be able to reverse their direction. To perform this operation, they have to be equipped with doors for the board/alight operations on both of their sides, or they have to be able to turn on themselves. If they are designed with one of such capabilities, the construction of roundabouts at the end of each “Cybercar” corridor can be avoided.

This vehicle requirement is directly linked with the required turning radius. One of the two mentioned vehicle capabilities (reverse their direction and turn on themselves) is required to avoid the building of new roundabouts at the end of each “Cybercar” corridor, which would provide new structural changes in the car-park. Consequently the slots near the new roundabouts would have to be removed to allow the building of the roundabouts.

If the vehicles are able to reverse their direction, requirements concerning the turning radius are not needed. In case the vehicles are able to turn on themselves the turning radius is half the vehicle length and thus it is inside the 6 m lanes, which are available for the “Cybercars”. If none of these two capabilities can be provided, 17 m diameter roundabouts have to be constructed and a 7.5 m turning radius is required, considering the vehicles’ width of 2 m.

The control station will be used to manage the exhibition visitors’ requests for the vehicles, in order to minimize the waiting and travel times of the passengers. It is assumed to be a single 10-square meter room.

Concerning the control and wireless communication systems, the vehicles have to communicate with a supervisory system by wireless-LAN. The main tasks of such communication will be the provision of information about the status of the vehicles, traffic control, operation control and power management. Furthermore, each vehicle will be provided with an on-board camera, which will allow observing directly what happens inside each vehicle.

3.2 CTS management

The services provided with the CTS network have to be managed in order to be satisfactory for the users in all the possible conditions and situations inside the car-park. The second category of technological requirements aims for the development of a control and management system, which is able to avoid or solve problems connected with the service itself.

A first problem is represented by the intersections. If two vehicles are going to cross the same intersection of the network, a system is needed for the priorisation of the right of way of both vehicles. In such a way, problems can be avoided, in case two or more vehicles are operating in adjacent zones of the car-park.

The communication between the operating vehicles is another important requirement. The vehicles are continuously communicating with the control station, as reported in section 3.1. Furthermore each vehicle has to be equipped with a navigation system, which is able to make a vehicle-vehicle communication. Such a communication can also be realised by transmitting the data collected by the control station to all the vehicles (infrastructure-vehicle communication). In this way all the vehicles are informed about the situation on the network and their circulation on it can be easily managed.

The vehicle-vehicle communication provides a solution for the intersection management problem: when two vehicles are going to cross the same intersection, the vehicle-vehicle communication minimizes the duration of the communication between them, thus avoiding possible accidents due to a delayed communication (the duration of the communication would be higher in case of the communication of vehicle1 with the control station and the control station with vehicle2).

The CTS management system has also to be able to solve the problems in the peak hours (S.T.A. 2002), during which the requests for a “Cybercar” are more frequent than during the other periods of the day. During the service, the vehicles will circulate continuously in five different peak time intervals (about 30 minutes per interval), providing a frequent service. This system has to be able to serve the passengers with low waiting times and minimize the travel times especially in those intervals.

A technique which can be useful to solve the peak hours problems is platooning. The headway distance between the vehicles can be reduced, in case the demand is focused in one zone of the car-park. Thus the vehicles connect themselves in a platoon, which is able to collect a high number of passengers at the CTS stops. The system has to be able to manage the “train of Cybercars” by platooning the vehicles and by separating them depending on the zones of the network they cover. For example, to pass a roundabout, the vehicles have to be separated before the roundabout and once they passed it they have to be connected again.

4 Infrastructure requirements

4.1 Gates management

At the car-park entrances there are automated gates: once a car enters, the driver states how many passenger are in his/her car and receives a ticket, which shows in which car-slot the driver has to park. Immediately a "Cybercar" stops close to that car-slot and waits for the people to park contemporary to the car arrival at the slot.

The automated gates management is the first infrastructure requirement. Such a management is made of two different sub-managements: one is linked with the physical changes to do in order to insert the gates in the car-park and the structure of each gate, and the other one is linked with the connections passenger-"Cybercar" and gate-"Cybercar".

The structural changes to do once the gates have to be inserted in the car-park are mainly linked with the lanes in which they will be.

A total of 6 gates are required. Each gate has to be 3.1 m wide and 5 m long; they have to be constructed at the two car-park entrances (on the east and the west side of the car-park), 3 per entrance. At the same time, the access lanes to the gates have to be modified in order to avoid congestion at the gates, especially at the peak hours. With such a number of gates congestion can be avoided by providing little changes in the access lanes, mainly concerning the zones near the gates.

Inside each gate, a HMI is required. By using it, the car drivers are able to state if they want to use a "Cybercar" to reach the building entrance and how many passengers are in their cars in that case.

In this way the data, which is reported through means of the HMI can be transmitted to a central unit, which is the core of the second sub-management.

The task of such a central unit is to recover the data of each car driver. On basis of the data the car-slot for the car and the "Cybercar", which is the nearest to the CTS stop, are chosen and sent.

Furthermore a video-supervision system is required to verify if the passengers have correctly parked in the car-slots, thus avoiding parking problems. Such system will be installed in all the car-parks and will allow to monitor all the car-slots. The live video of the car-park will be transferred to a control room, where the personnel will be able to observe in real-time all the car-parks. The personnel will also be able to enlarge the shots and to spin the cameras.

4.2 CTS depots and recharging stations

The second infrastructure requirement concerns the areas in which the "Cybercars" are recharged during the service and recovered when they are not operating.

Considering the 8 vehicles used to cover the network, both depot and recharging stations areas will be considered in proportion to the number of vehicles.

The circulation of the vehicles on the network has to be managed also in consideration of their recharging operations; the system has to be able to choose the vehicles to use and the zones, in which to use them on the basis of their charging state more than on the basis of passenger requests, which is reported in section 4.1.

During the 15 hours of service, each vehicle needs 3 hours for the recharging operations. Such operations are divided in 5 stops, each one of 36 minutes in average. In this way the vehicles are operating for more than 2 hours between two recharging stops in average, and another last recharging is done after the end of the service where it is needed.

4.3 User information and car-parks signs

The new system supposes that the drivers use the car-parks correctly.

In order to ensure the correct use of the car-parks, a correct user information and special signs to help visitors inside the car-parks are required.

From that the following requirements result:

- Signboards at the entrance of each car-park, reporting the instructions on how to park ("Automated car-park, park your car in the assigned slot").
- Variable message panels at the entrance of each car-park, reporting the available slots;
- At the two entrances of the P1 car-park sign-boards, reporting information on how to use the "Cybercars";
- At the HMI at the entrance gates a message with the instructions on how to park once the ticket with the assigned car-slot have been received;
- Two sign-boards for each car-park area (one at the beginning and the other at the end of the area) with the letter of the area, inside all the car-parks;
- Sign-boards with the area letter, the first and the last slot number for each slot corridor inside all the car-park areas (e.g. "P1, B1-B50", meaning P1 car-park, B area, slots from 1 to 50);

- A sign on the ground in each car-slot, reporting the area, in which it is and its number (e.g. C27);

- Only in the P1 car-park: for each car-slot sign-boards to make easy to find the nearest CTS stop have to be available. The signboards have to display arrows, which show the direction to reach the nearest stop (its name has also to be reported on the sign-boards) and how to reach the exhibition building on foot (if the visitors are not interested in the use of a "Cybercar").

5 Safety and Certification requirements

5.1 Obstacle detection

Concerning the safety of the service provided, the major requirement is the obstacle detection.

The CTS will be segregated, in order to avoid the contact between cars and “Cybercars”. However the “Cybercars” have to be able to detect any kind of obstacle, which could be on their route. They have to stop immediately without hitting other obstacles. For an example pedestrians, which cross the lane, have to be detected and allowed to cross before the vehicle passes

As a further safety measure, the vehicles need to be equipped with a bumper, which can move as soon as it is in contact with an obstacle. If the obstacle detection fails for any reason and a vehicle is not able to stop itself before the collision with the obstacle, the pressure sensor of the bumper will activate directly the fail-safe break of the vehicle.

5.2 Certification and homologation

With regards to the certification and the ratification of the CTS, an integrated approach, which bases on two different fields, is needed.

On one side, contacts with the Ministry of Transport are needed in order to understand the legal requirements, which have to be satisfied by the system. On the other side, a sort of bibliography of similar cases has to be provided. In this way a database on the automatic system installation could be useful for the legal implementation of the CTS.

The first requirement provided after the first interaction with the Ministry is the total segregation of the system. Such requirements have however to be reviewed and discussed during the working progress of the demonstration.

Furthermore the CityMobil project have to be a sort of integrator of the different European experiences in this field, in order to allow the Italian demonstration to adopt the results of such experiences in its work.

6 Risk assessment

6.1 Institutional and economical risks

From the technical side the Rome demonstration should not meet many problems whereas from the institutional and political point of view the project could meet some difficulties, because the demonstrator will be funded by the P1 car-park fees. In order to avoid economical risks and to give to the institutional partners the opportunity to evaluate the economical sustainability of the project, the CTS will be probably first implemented in P1 car park. Once the economical sustainability will be proved, the extension of the CTS to the train station will follow.

The implementation of the CTS in P1 car-park will give important information about how efficiently it will handle a demand spread over an area and information about its management cost.

6.2 Certification and homologation

CTS has never been homologated before in any European Country and the homologation process could take more time than planned. For this reason it could be useful during the first phase of CityMobil project to have some informal suggestions from Ministry of Transport (responsible for the homologation) before preparing a final project for the system. In a second phase, probably a small demonstrator with two Cybercars, will be implemented in the P1 car-park and the homologation procedure will start. Unfortunately at present it is not possible to know how much time this second phase will require.

7 Conclusions, timing and future steps

The Rome demonstration aims at supplying a service of extremely high quality, which is expected to have a good impact on the users by developing a short distance service. This service uses small and automated vehicles, which should be able to reduce the travel times of the visitors of the new Rome exhibition building for the route from the car-park (and train station) to the building entrance.

The major requirements of the Rome demonstration are:

- A system for the communication of the network status in terms of status of the vehicles, traffic control and power management;
- A system for the communication between the vehicles;
- A system for the management of the network intersections, in terms of priority of vehicles passing the same intersection;
- Systems for the management of visitors' requests (through the HMI at the automated gates), in terms of car-slot and vehicle selection and verifying of the right position of the cars inside the car-park;
- Techniques for the management of the peak hours, considering at the same time the recharging operations of the vehicles;
- Safety measures, especially linked with the obstacle detection;
- Certifications for the homologation of the new "Cybercar" system.

On the basis of such requirements, the contributions expected from the other CityMobil SPs are:

- SP2 – Future Scenarios (especially WP2.5 – Legal and administrative issues): CTS homologation;
- SP3 – Vehicles and technological issues: obstacle detection and avoidance, platooning technique, intersection management and communication between the vehicles;
- SP4 – Operational issues: advanced CTS network management (including car-slot selection and verification of the right position of the cars, vehicle selection and recharging), system integration into the car-park.

Currently Rome Municipality is calling for tenders for the car-park management; the call for tenders should be published before the end of summer 2006 and awarded before the end of 2006. Therefore the work will start at the beginning of 2007 and should be finished at the end of 2007.

Interactions with SP2 and SP4 are expected before the end of 2007, as the system will be operating before this date. Interaction with SP3 should be provided at a later stage. The interaction concerning the vehicle communication and intersection management is expected before the end of 2007, whereas obstacle detection and avoidance and platooning should be expected at last because of the total segregation first proposed for the system.

8 Sources

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