The ARGO Project

University of Parma and University of Pavia, Italy

WWW.ARGO.CE.UNIPR.IT

The Project:

The ARGO Project started in 1996 at the University of Parma, Italy, after the experience in the PROMETHEUS European Project, whose main goal was the investigation of innovative technological solutions to enhance road safety. Within this project the first vision algorithms and computer architectures were developed and tested on MOB-LAB, the MOBile LABoratory available to all the Italian Research Units involved in the Project.

The original target of the ARGO project was the development of a system able to improve road safety by controlling and supervising the driver activity. Further developments, however, allowed to extend the functionality to automatic driving.

The specifications that characterize the system developed within our research project are that

- its cost must be kept small;
- it must not rely on speficic road infrastructures;
- it must not use active sensors.

Fundings:

The ARGO prototype vehicle was developed at the Dipartimento di Ingegneria dell'Informazione of the University of Parma, under the framework of the Progetto Finalizzato Trasporti 2 of the Italian National Research Council (CNR). Later also the Dipartimento di Informatica e Sistemistica of the University of Pavia got involved in the research, and received fundings from the CNR.

The Research Group:

The research group consist of staff people from the Engineering Faculty of both Parma and Pavia Univeristies. The worldwide relevance of the research group in the Intelligent Transportation Systems (ITS) field is witnessed by the number of invited talks, tutorials, and journal special issues that they have been invited to organize.

Among others, the Project Coordinator also acted as Program Chair of the most important scientific event worldwide in the field of intelligent vehicles –the IEEE Intelligent Vehicles Symposium 2000 (Detroit, Oct 3-5, 2000)– and as Associate Editor of the IEEE Transactions on Intelligent Transportation Systems. He is also the Editor of a department on ITS published regularly on IEEE Intelligent Systems Magazine, and is the Editor of the IEEE ITS Council Newsletter.

The Prototype Vehicle:

ARGO is able to compute its relative position with respect to the lane, to extract the geometry of the road, to localize any ahead vehicle and potential obstacles obstructing the driving path (pedestrians included). A computing engine processes the images acquired by a stereo vision system whose cameras are localized behind the windscreen, inside the vehicle; the results are used to drive an electric engine installed on the steering column, which provides automatic steering.

The whole system is based on the processing of visual information in order to remove the negative effects of inter-vehicle interference due to active sensors, and does not need specific road infrastructures.

The ARGO prototype vehicle

Vehicle Characteristics:

- Lancia Thema 2000
- B/W cameras, f=6 mm, 360 lines
- Trinocular acquisition system
- Hall effect speed sensor
- 450 MHz Pentium PC, with Linux OS
- Analog/digital I/O board
- Stereo speakers
- Led and button control panel
- 6" color monitor
- Electric motor for steering control
- Inverter for 220 V @ 50 Hz power supply
- Emergency joystick
- Max automatic speed in automatic mode: 130 km/h
- Internet link via GSM channels

Functionalities:

Manual Driving: the system monitors the driver activity; in case of potential dangerous situations the system warns the driver with acoustic and optic signals

Supervised Driving: in case of dangerous situations, the system takes the control of the vehicle in order to keep it in a safe condition

Automatic Driving: the system drives automatically, following the lane or the vehicle ahead and localizing obstacles on the path; it is able to perform lane changes

Internal view of the ARGO equipment

The "MilleMiglia in Automatico" Test:

In order to extensively test the prototype vehicle under different traffic situations, road environments, and weather conditions, a 2000 km journey was carried out from June 1 to June 6, 1998 along the Italian highway network.

During this test –called **"MilleMiglia in Automatico"**– ARGO drove itself autonomously, passing through flat areas and hilly regions including viaducts and tunnels. The Italian road network is particularly suited for such an extensive test since it is characterized by quickly varying road scenarios including different weather conditions and a generally large amount of traffic.

The tour demonstrated that using only visual information and low-cost general purpose hardware it is possible to drive automatically and safely a vehicle under different road and environmental conditions.

The tour was followed in real-time by many people worldwide (with a peak of 16,000 contacts per hour during the first day) thanks to Internet GSM links that allowed to transmit real-time images from the vehicle throughout the whole demonstration.

Relax during a session of automatic driving

The Future of the Project:

Currently the project is continuing thanks to a financial support that the two Universities of Parma and Pavia are receiving from the Italian National Research Council (CNR). Although limited, it allows the two research teams to remain in the leading edge of worldwide research.

Many different contacts –including industrial, academic, and military– are currently under evaluation in order to improve the effectiveness of the prototype, to build a new prototype, and to extend the research field and transfer the technology to new application domains.

The **MilleMiglia in Automatico Tour** - June 1-6, 1998

Tour Data:

- **Path**: . . . . . about 2000 km in 6 days
- **Speed**: . . . . . average: 90 km/h . . max: 123 km/h
- **Longest Distance in Automatic mode**: . . . . 54 km
- **Percentage in Automatic mode**: . . . . . about 94 %
- **Total Distance in Automatic mode**: about 1950 km

Contacts:

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