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Abstract:

The Artificial Vision and Intelligent Systems Laboratory of the University of Parma (VisLab) is the artificial vision research laboratory of University of Parma, Italy and is directed by Prof. Alberto Broggi.

It started its activities in 1990 and, since then, the research group is focused on vehicular applications. VisLab is regarded as one of the leading centres for artificial vision applied to vehicles.

VisLab's results are regarded as milestones in the vehicular robotics history. Among them, the ARGO Project, the TerraMax vehicle, and the BRAiVE prototype.



Detailed research information:

The VisLab laboratory of the Dipartimento di Ingegneria dell'Informazione is involved in basic and applied research developing machine vision algorithms and intelligent systems for the automotive field. Some of the prototypes developed by VisLab can be considered as milestones for the research in the Intelligent Transportation Systems arena. VisLab undertakes research in many disciplines like machine vision, pattern recognition, low-level image processing, machine learning, artificial intelligence, vehicular robotics, and real-time systems. The research activities of VisLab are witnessed by several patents, publications, and presentations in international journals and conferences (a partial list can be seen in www.vislab.it/public.php)

The laboratory know-how is world renown and was mainly developed together with automotive companies and public or private research centres, including: Volkswagen, Volvo Tech, Centro Ricerche FIAT, Hella, Oshkosh Truck Corp., Rockwell Collins, IBEO, Bosch, DaimlerChrysler, Magneti Marelli, Alenia Spazio, Eurocopter, Dassault Aviation, Mando, and US Army TACOM. Within these cooperation's and within the EU projects PReVENT and PEGASE, the VisLab developed active/passive safety systems, Advanced Driver Assistance Systems, sensing systems for the automotive environment, up to completely autonomous vehicles.

The two VisLab's main research streams are:

Development of autonomous driving systems: VisLab developed different autonomous systems, two of them can be considered as milestones for the research in the field of vehicular robotics:

- the ARGO vehicle, in 1998 was demonstrated during a 2000 km trip of autonomous driving along the Italian highways in real traffic conditions



- the TerraMax vehicle, an Oshkosh truck that entered the final stages of the Grand Challenges (in 2004 and 2005) and of the 2007 Urban Challenge. Besides the official TerraMax vehicle, also two replicas were equipped for tests and presentation to the public.



Development of driving assistant systems: during its 15+ years history, VisLab developed different driving assistance systems: lane detection, vehicle detection, pedestrian detection, obstacle localization, sensor fusion with radar and laserscanner, night vision, start inhibit for trucks.

During its history, VisLab developed and equipped many others prototypes: MobLab (developed within the Prometheus Project, 1989–1994), RAS (a snowcat: Surface Antarctic Robot, developed in cooperation with ENEA, 2000–2001), VW Passat and Touareg (in cooperation with Volkswagen AG, 2001–2005), HMMWV (in cooperation with US Army TACOM, 1999–2008), a VolvoTruck (within the EU PReVENT IP 2005-2008), FIAT demonstrator (within the EU PReVENT IP 2005-2008), VITO (a van for massive data acquisition, developed in cooperation with SITECO, 2001), and others (figure 10). Other research activities concern the development of machine vision and sensor fusion systems for ships' speed estimation, traffic management in urban areas, intelligent pedestrian crossings, machine vision-based quality inspection, and automated storage & retrieval.



VisLab is part of the Dipartimento di Ingegneria dell'Informazione that is the main site of advanced research and graduate studies in Electronics, Computer Engineering, Telecommunications and related fields in Parma.

The researchers of the Department feature expertise in all the Information and Communications Technologies and can cooperate with VisLab in developing communication and electronic systems for intelligent vehicles.

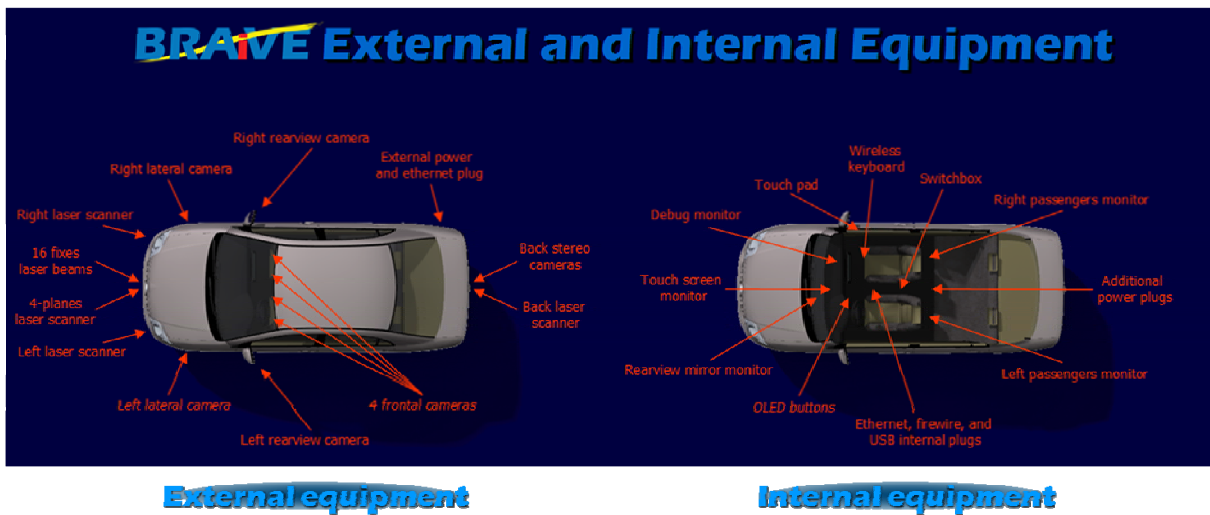
VisLab already owns material and facilities that can guarantee a quick start of new research activities. The available equipment allows the acquisition and processing of preliminary test data concurrently with the design of requirements and specifications. In particular, VisLab owns a development laboratory equipped with several PCs featuring different analogue or digital I/O adapters and framegrabbers for image acquisition. Different sensors are already available and can be used for research activities including laserscanners and more than 40 different cameras (graylevel, colour, stereoheads, near infrared, or far infrared).

Thanks to the funding recently received from European Research Council through an ERC Advanced Grant and from a foundation that decided to support our excellence in the field,

new sensors have been purchased in the last few months and a new experimental vehicle has been developed.



This vehicle (BRAiVE, a short for BRAin driVE), entirely developed by VisLab, incorporates many of the system created by the research group in the last 15 years and, in addition, thanks to a cooperation with MANDO Corp., it features drive-by-wire capabilities.



BRAiVE has been designed to be:

1. A laboratory vehicle to test innovative concepts –that may still be far from the interests of the automotive industry– but that will certainly shape the future of our vehicles; it integrates a large number of sensors (both low-cost and expensive ones) together with specific HMIs for innovative functions
2. A laboratory vehicle to design new Advanced Driving Assistance Systems (matching the market needs); sensors can be partitioned into specific subsets (primarily low-cost sensors suites); expensive ones are used to compare the performance of low-cost solutions and for ground truth data collection
3. A demo vehicle. All sensors, actuation, and controls devices are perfectly integrated, giving passengers the feeling of riding in a normal car BRAiVE has been presented to the press on a public demonstration on April 3rd, 2009 in Parma (Italy) and presented at the 2009 IEEE Intelligent Vehicles Symposium at Xi'an (China).