

# MoPAC: Modular Platform for Automotive Applications

ESG has developed a simulation and demonstration platform for car driver assistance systems.

In today's vehicles, assistants for carrying out driving tasks in full are becoming increasingly commonplace. The latest top of the range vehicle typically features distance control, cruise control, swivelling headlights, lane guard system, parking assistant and navigation system with voice control, etc. These systems are supposed to free the driver from routine tasks and direct his attention to important events in the road traffic. In doing so, the harmonisation of the systems and the interfaces to the driver play an important role.

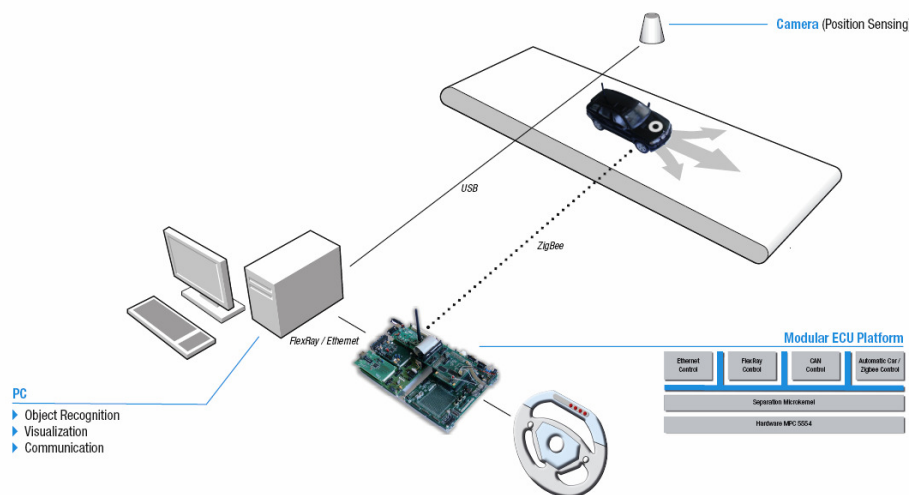
To simulate and demonstrate innovative driver assistance systems of this kind at an early stage, ESG has developed a platform with the name MoPAC, "Modular Platform for Automotive Applications".

The system enables ESG to simulate and assess any present and future assistance functions in a compact construction. Because of the system's diversity of interfaces and its open architecture, a multitude of connection possibilities for enhanced sensor systems and actuating elements is available.

This system uses a central nodal point, based on an MPC5554 (microcontroller), to link various sub-functions to one another and to realise the overall function. A PC with a web-cam is connected over an Ethernet interface. Furthermore, the platform communicates with other sensor systems and actuating elements via FlexRay, LIN, CAN and ZigBee (wireless). A specially adapted conveyor belt is used to simulate the driving surface.

The actuating elements currently consist of a modified R/C vehicle, which has been fitted with an 8-bit platform and an integrated ZigBee receiver module. The ZigBee transfer standard (IEEE 802.15.4 + OSI layer 3-6) originates from the industrial automation sector and was created for low-current and stable communication of sensor systems and actuating elements in the industrial environment. The frequency range used in Europe is 2.4 GHz.

The camera and connected PC constitute the sensor system, which provides the position of the vehicle, as well as further information about obstacles, recognised lanes or other vehicles, on the basis of efficient object recognition algorithms. A standard webcam with a resolution of 640x480 pixels and a frame rate of approx. 25 fps is used for this. The image processing algorithms are based on the open source OpenCV library.

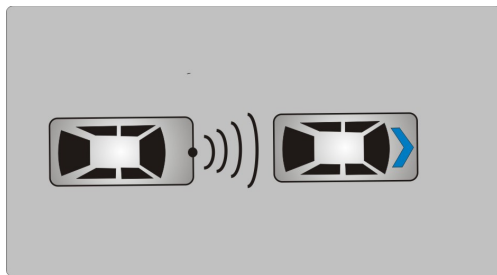


Enhanced control features are implemented on the central PowerPC platform and are strictly separated from the communication drivers both spatially and temporally by a virtualisation concept, so that high safety requirements can be adhered to.

The system is also used to realise camera-based assistance systems, such as automatic distance control and avoidance manoeuvres. In doing so, efficient object recognition algo-

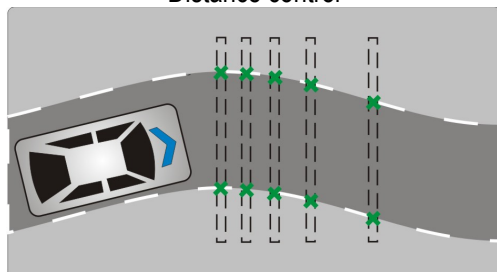
rithms are used to locate vehicles in the setting. The PC takes on image processing and object recognition and supplies the positions of the located objects to the PowerPC via Ethernet. This information forms the basis for the integrated control algorithm, which is used to position a vehicle stably on the conveyor belt and to trigger responses to recognised foreign objects. The stabilised behaviour of the vehicle on the conveyor belt forms the basis on which the system intervenes into the driving process.

### Realisation examples of assistance systems on MoPAC



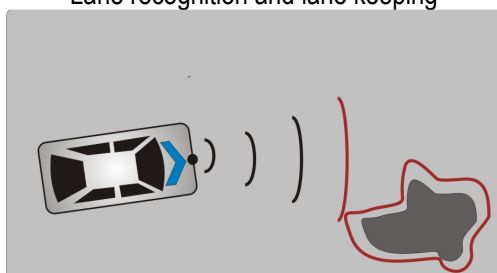
Distance control

Using a combination of distance measurement sensors and camera-based sensors to realise distance control



Lane recognition and lane keeping

Recognition of lane boundaries using line-based edge detection and consequently controlling the vehicle so that it stays within lane



Obstacle recognition and avoidance assistant

Obstacle recognition and avoidance / emergency brake assistance using camera-based object recognition

The concept's modularity means that it is possible to straightforwardly connect various bus systems, integrate enhanced sensor systems and control several vehicles. The concept also facilitates the realisation of assistance functions for which communicating vehicles are a prerequisite. ESG is providing an insight into the possibilities of car assistance

systems and for this reason possesses a suitable integration and simulation environment for such systems.

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