

# One camera, multiple functions – integration of different customer functionalities in a forward-looking camera

Abstract for FISITA 2008

Proposed session: Vehicle safety – Driver Assistance

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In modern cars Driver Assistance Systems (DAS) became a matter of course in the last few years. Whereas systems like the anti-lock brake system or the electronic stability systems are state of the art meanwhile, camera based DAS are being developed actually and can be seen more and more in series cars. These camera based systems can be divided roughly in three types: forward-looking cameras, rear-view cameras and cameras for parking assistance. Within this paper the focus will be put on the forward-looking cameras and the applications which will be enabled by such a sensor. Some investigations and approaches in this area will be presented.

This type of camera covers the medium range in front of the car. Typically it contains a CMOS sensor with a VGA-like resolution. Whereas the Lane Departure Warning (LDW) was one of the first functions in this area and can actually be seen in some series cars, there are several additional applications which can benefit from such a sensor. Conceivable are functions like Traffic Sign Recognition (TSR – e.g. for speed regulating signs), Object Detection (OD) or support for light functions. High beam assist for example switches between low and high beam depending on the presence of other road users in front of the vehicle. Beginning with adaptive and glare-free high beam we will see lighting systems perfectly adapting the light distribution to the driving environment, focussing the driver's alertness to hazard areas (marking light) or even projecting information onto the road (pixel light) in the future. Object detection e.g. can be used to support distance or collision warning systems. The upcoming regulations concerning the pedestrian protection might be another field of interest for such functionality.

Installing an own camera for multiple of these application is neither reasonable from a mechanical nor from a commercial point of view. Therefore the idea of using one camera for several customer functionalities suggests itself. Analysing the precise requirements of each of these applications in more detail it becomes obviously that the communality is not that great as it looks at first sight. Questions e.g. like the adequate viewing angle, the number and exposure of frames and the need of colour information have to be answered in a way that satisfies the demands of all chosen applications. Besides that, the question of the right hardware platform is of importance due to the high computational demands of the image processing functions.

Merging these partly conflicting demands is the challenge for the integration of multiple applications on one camera and the appropriate control unit. Some aspects of such a development will be discussed in the paper and a perspective to future systems and integration approaches will be given.