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ADOSE DELIVERABLE D3.9; PUBLIC SUMMARY
‘*MFOS CAMERA MODULE*

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1. INTRODUCTION

Workpackage 3 of ADOSE project aimed at developing a multifunctional and multispectral camera integrating on a single CMOS sensor imaging and sensing functions. The goal is to detect critical environmental parameters (fog, rain, twilight) providing, at the same time, information on the driving scenario (oncoming vehicles, VRUs in night conditions) through the development of a low cost plastic optical lightguide coupled to a standard CMOS imager. In the developed prototyped, two sensing functions are monitored on two dedicated region of interests positioned in two corners of the imager area.

D3.9 deliverable describes the developed MFOS camera module, the electrical and communication architectures. The camera module comprises the MFOS sensor, the camera hood and the mechanical fastener for the in-vehicle installation to the windshield. The MFOS architecture is based on the ST evaluation kit (VL5510 camera board and mother board) and an embedded PC. An electronic driver has been also designed for the IRLEDs triggering of the fog and rain functions. Finally a detailed description of the electro-optical characterisation reporting the sensor performance and behaviour over a wide range of conditions has been given.

2. MFOS CAMERA MODULE

The final MFOS sensor prototype integrates:

- warning night vision, tunnel (imaging functions);
- fog, twilight, rain (sensing functions).

The sensing functions are monitored on two dedicated region of interests positioned in two corners of the imager area.
The prototype housing has been designed with the twofold goal of guaranteeing the required precision to couple the optics components and to pursue an easy to assembly procedure.
The sensor core module is based on the imager board coupled to a molded optical element suited to collect the optical radiation on dedicated portions of the imager dye.
The dioptric lightguide and the collimating optics of the infrared illuminator (fog function) have been fabricated in a pre-series moulding line using PMMA. Particular care was made for the

design of the injection tools and the fabrication of the optical inserts with single point diamond turning technology and the use of diamond tools. Finally, a board objective allows to image the front scene on the main imager ROI.
The sensor housing has been prototyped by aluminum machining: the considered tolerances are compatible for the realization in production using PC.

In Figure 1 the components of the camera module, designed in a CAD SW tool, are shown:

- Mechanical fastener (yellow)
- MFOS sensor (purple)
- Camera hood (orange)

The mechanical fastener, realized by tooling, is glued on the interior side of the windshield and allows the MFOS sensor to be attached to the windshield without gaps. The camera hood goal is to prevent straight light to hit the imager. It has two apertures, one for the camera objective and the other for the four IRLEDs dedicated to the rain function. It has been designed to match the FIAT IDEA internal rearview mirror layout securing it to the MFOS sensor through two screws.
All the camera module cables, LVDS imaging signal, temperature signals and LED power supplies are positioned under the mirror fastener (dark green) towards the cabin glow.

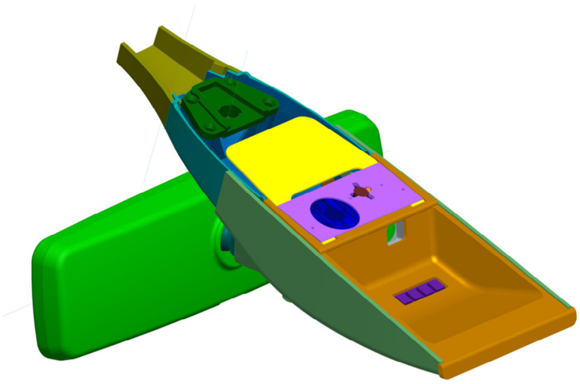

Figure 1 - CAD showing the camera module components

Figure 2 - MFOS camera prototype integrated in the internal rearview mirror

The optical components (plastic lenses, lightguides, optical objective) and the IR illuminators have been characterised in CRF's electro-optics lab. Particularly, measurements were carried out to verify the optical channel efficiencies and the focusing properties of the lightguides. Since a main goal of the ADOSE project is the achievement of low cost sensors, the MFOS easy-to-assemble process has been evaluated with respect to the position tolerances between the imager and the optical lightguides affecting the performance reliability. The sensors were also tested at functional level. Twilight and fog functionalities were evaluated by electro-optical measurements.
Furthermore, the housing of one prototype sensor has been designed and fabricated and the sensor has been installed in the internal rear view mirror of the demonstrator vehicle.

Finally, outdoor tests for the twilight, tunnel/bridge and warning night vision functions were performed (Figure 3) to assess the overall performances.

Figure 3 - Outdoor test of MFOS sensor (fog, tunnel and warning night vision).