Modular imaging measurement systems to cover automotive applications

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1.   Introduction

Display and ambient lighting applications are becoming more and more prevalent in today's cars. At the same time, customer's expectations for the quality of these devices is increasing, based on their experience with smartphones and other consumer electronics. In order to assure the quality of displays within the car, measurement systems that characterize them are necessary. Here, imaging systems provide an advantage compared to spot-based systems, as they can measure entire displays in one shot, which allows capturing features such as uniformity or pixel defects in addition to luminance and color. Still, the large variety of display types ranging from head up displays all the way to VR applications, requires very different measurement setups and different optics. This talk will highlight the various needs of different applications, and show how a modular measurement setup can cover many of them in a single system.

2.   Imaging System Requirements

Imaging colorimeters allow contextual evaluation, such as identifying defects or blemishes, however, in order to do so properly, they must fulfil some basic requirements, ranging from cooling of the CCD chip in order to achieve a good signal to noise ratio, all the way to various calibrations (e.g. CCD response, vignetting, color of the source). These necessary requirements, along with further beneficial features (such as electronically controlled components) will be discussed.

3.   Demands and Recommendations for Specific Automotive Display Applications

The various display applications within the car set different demands for the measurement system intended to characterize them. For instance, head-up displays (HUD) require high resolution imaging systems, which frequently need to be used at much longer than typical working distances in order to focus on virtual images, in particular in AR HUDs. They also need to be evaluated for different criteria, such as ghosting and distortion, which are not commonly of interest in traditional devices. In contrast, augmented and virtual reality devices share some of the same evaluation criteria with HUDs, but again have different requirements for the optics, such as objectives with close to eye distances. This talk will detail the demands of, as well as the optics recommended for various applications, such as HUDs, AR/VR devices, digital mirrors/camera monitor systems, facial recognition and infotainment displays.

4.   Advantageous Software Features

Finally, in addition to requirements placed on the measurement hardware, it can be very beneficial to control measurement and analysis via an automated software. This also opens up several possibilities that can make it easier to obtain results, or even improve their quality. In this context, this talk will detail the benefits of having a software that can automatically register the active display area within the obtained image so that evaluation can be limited to only that part of the image, which improves processing time, and for some measurements, such as uniformity, is absolutely mandatory. Additionally, the benefit of an automated Moiré removal calculation will be highlighted. Such a functionality allows removing aliasing effects from the measurement that would hinder evaluation, without requiring the measurement to be defocused. This preserves information such as pixel level defects that would otherwise be impossible to find as much of their contrast would be lost if the image was not in focus.

5.   References

[1] "How to Use Imaging Colorimeters for Automated Visual Inspection of Displays" (https://www.radiantvisionsystems.com/learn/white-papers/how-use-imaging-colorimeters-automated-visual-inspection-displays)

[2] D. Kreysar, E. Eisenberg, "Optics Replicate Human Vision in AR/VR display testing", Laser Focus World, Vol. 55, No. 6, pp. 76-78, June 2019.

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