

Development of Illumination System with Dynamic Masking Function for Real-Time Scenario-Simulation Application

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A Bachelor Thesis Project

Introduction:

In this project, we aim to investigate the effects of different illuminating conditions on visual performance of a car driver in real-time driving-scenario simulation. For example, we want to examine the possible influence of different luminance levels of the tunnel entrance on a car driver's driving performance. A dynamic illumination system with masking function is required in order to achieve our targets. The first task is to build up a control system for the spotlights which enables fast and precise dimming/lighting and switching on/off adjustments. The second task is to create a dynamic masking mechanism for the spotlights which is used for changing the illuminated area (size, geometry, etc.) on the projection wall. The illumination system, together with the dynamic masking mechanism, should be synchronized with the real-time scenario simulation.

Objective:

- Acquaint the student with the operation and the idea of the scenario-simulation environment
- Design & build up a control system which adjusts the spotlights (dimming/lighting, switching on/off, etc.) precisely and rapidly
- Design & make a dynamic masking system, e.g. a sliding cardboard-mask on a track which locates between the lights and the projection wall, which enables accurate and stable changes of the size/shape of the illuminated area
- Connect all aforementioned functions together, and operate the whole system as a real-time application

Working condition:

- Documentation / Weekly status update and discussion / Final presentation
- Main working place - ETH Zürich SEC

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Reference Information

Hardware setting

- **Projection system:** BarcoSIM5plus DLP dual-projectors, SXGA resolution (1400 x 1050); Vertical screen at 3-meters; Max. screen size- 3 x 3 m²; Aspect ratio- 4 : 3
- **Driver's control interface:** Logitech G25, steering wheel with position sensor, force feed-back & incorporated vibrators, gas & brake pedal sensors
- **Control and record system:** HP xw9400 workstation with video scenario building tools, measurement recording tools using NI hardware and LabVIEW
- **Illuminating system:** Dual-spotlights (Spotlight EVO 12 DC ZS, 1200W, discharge lamp) with DMX control interface (ENTTEC Open DMX USB)
- **Motor-control system:** Stepper motors, stepper motor controller (Nanotec SMC133-1, positioning control with closed-loop controller, USB interface)



Any ideas?

- How to real-time control the lights (dimmer & rapid on/off switch @ exact timing)? DMX control interface or stand-alone mechanical shutter (external)?
- How to dynamically mask the non-illuminated area with a smooth & precise way? (mechanisms, electrically-controlled)
- Further more, how to design & build a mirror-system which enhances the illuminating performance (e.g. luminance level ↑, →homogeneous distribution, etc.)?

