

Projektbeskrivelse for LUCIA projektet.  
VR-plattform til præsentation af projektet.

## Indholdsfortegnelse

<i>About LUCIA</i> .....	2
<i>Why:</i> .....	2
<b>Functions in detail:</b> .....	<b>2</b>
<i>Design and Construction</i> .....	2
○ <i>Parameters</i> .....	3
○ <i>Luminaires and Sensors</i> .....	3
○ <i>Menu</i> .....	3
○ <i>Interfaces</i> .....	4
○ <i>Hardware</i> .....	5
○ <i>Software</i> .....	5
○ <i>Eastereggs</i> .....	6
<b>Implementation phases and billing</b> .....	<b>7</b>
• <i>Draft</i> .....	7
• <i>Software Creation</i> .....	7
• <i>Implementation</i> .....	7
• <i>Handover</i> .....	7

## About LUCIA

LUCIA helps municipalities in the Baltic Sea region to unlock the enormous potential of energy efficient urban lighting solutions. Thus, it provides decision makers and experts with state-of-the-art lighting knowledge, covering aspects of environment, technology, economy, social acceptance, urban planning and green public procurement. LUCIA is aimed to set up as well an online urban lighting knowledge centre to connect city lighting managers in the Baltic Sea Region to exchange experiences on planning procedures and selection of urban lighting solutions.

Albertslund participates with the focus on activity-based lighting solutions. To save energy there is a need of developing advanced solutions such as movement sensors which help turning down the lighting to the minimum. To control a combined road with both pedestrian, bike and car lanes, there will be test installations in DOLL Living Lab, which is an international visitor destination on smart lighting installations. At the DOLL Living Lab of the City of Albertslund, 5 different zones will be demonstrated and upgraded with new movement sensors, new control of traffic signals and a new presentation platform for integration of lighting solutions. Each zone demonstrates different technology via a series of poles and with different luminaires.

## Why:

Aim of this tender is a software which transports the real installations into a virtual world. Via the standard laptops of the DOLL team, the employees can connect to the real site and guide visitors through the solutions. The virtual experience is close to be photorealistic. People visiting the virtual and the real experience will immediately recognize the scenarios. The virtual world will display status of luminaires and sensors live. Data of the past can be loaded and demonstrated in the virtual scene, which allows visitors travelling in time, **re-experiencing past scenarios based on recorded data and future scenarios, based on potential data**. Parameters related to lighting can be changed in runtime, based on a simple to use user interface. This includes a realistic display of time, sun, weather and season. In the DOLL control centre a VR experience and a connected DALI controlled outdoor luminaire will round up the experience. This setup is moveable and can be transported for usage on fairs. **The DALI luminaire in the DOLL center can mirror any on-site-installed luminaire in regards to dimming level and colour temperature.**

## Functions in detail:

### Design and Construction

Creation of the virtual scenes of the 5 zones. In the draft phase all relevant details will be discussed. When DOLL recognizes, missing elements in the draft, which are relevant for the recognition of the scene, these elements must be added without extra costs.

- 5 levels, which can be loaded on request
- Roads and paths, as well as all allocated devices (city furniture, poles, luminaires, bus station, trees, bushes, fences, ...) must be constructed in 3D, based on physically based material (albedo/normal/ambient occlusion/specular) in photorealistic look and feel.
- Visible facades and other landmarks must be included, when they are clearly recognizable, while walking the defined road. Look and feel must be realistic.
- A set of traffic participants per type must be available to simulate the measured traffic on the road. All participants in photorealistic quality. Animations and movement, especially of

people must be realistic.

Type

- Private Cars
- Business transport (Lorries, Trucks, Busses, Vans)
- Bicycles
- Pedestrians

○ **Parameters**

The virtual scene must adapt to the change of the following parameters. Those are to be changed per Combo Box (Options), **SpinBox** or Slider (**both** flexible between given range). Each parameter can be placed as keyboard shortcut as part of the final implementation spec.

- Movement (Walk Mode, Fly Mode, VR Mode)
- Time (Slider)
- Weather (4 Options: Sun, Overcast, Rain/Snow, Fog)
- Season (Slider, Trees to adapt)
- Traffic (10 Options, i.e. "Bus and Car form the left")
- Time based lighting functions (10 dedicated curves to increase or decrease of lighting levels based on activity or time)
- Road surfaces (Combo Box)
- Greyscale (Slider)
- Contrast (Slider)
- Quality Levels (Combo Box, based on Effect Quality, Resolution and Raytracing Options)
- Bookmarks (10 spawn points per zone)

○ **Luminaires and Sensors**

Luminaires and Sensors are constructed in photorealistic manner. Available lighting distributions, material parameters, **surface brightness (within technical possibilities)** and technical parameters are included.

- IES profiles for lighting distribution (Combo Box)
- Light level (Slider)
- Colour Temperature (Slider)
- Lighting Scenes (6 per Zone, dimming level and colour temperature will be defined)
- Pole Height (Slider)
- Bracket Dimension (Slider)
- Material Pole/Luminaire (Combo Box)
- Sensor status (Data)
- Dimming profiles (Curves, Adaptable to real-time scenario and options, i.e. brightness level to return after traffic is gone)

○ **Menu**

The user interface will be based on a combination between GUI and Keyboard Shortcuts. A help system will be implemented. Three languages will be offered (Danish, English and German). The menu can be adapted after the draft phase, based on feedback from DOLL, without extra costs.

- Creation of a HUD interface, using the top and bottom line of the screen for basic functions (i.e. Movement mode, Zones, Bookmarks, Further Menus, Logo)
- Creation of detailed menus (max. 5 parameters per submenu screen)

- Creation of keyboard shortcuts for raytraced screenshot, time menu, lighting menu, quality levels, bookmarks (1-0), movement, rotation, elevation
  - Creation of a stand-alone training workflow for each zone. This allows the choice of status regarding time, weather and lighting. Via the menu traffic participants can be added to the scene. Via the installed sensors the virtual scenario reacts like the real scenarios.
  - Creation of an energy monitor, which shows the “virtual” energy consumption of the actual zone. The last 10 mins are recorded and can be displayed per menu/keyboard shortcut.
  - Creation of a help menu with detailed instructions on movement and keyboard short cuts.
  - Creation of two single scenes in pixel streaming mode to be added to the websites. People can choose between 10 positions in the demonstrated zone, change lighting parameters and start min. three traffic scenarios. The lighting will adapt to the virtual sensors detecting the traffic.
- **Interfaces**
- The LUCIA project in Albertslund covers 5 zones with different outdoor lighting management systems. The installed lighting management systems have APIs. This tender covers the workload to access the live data of those systems and import the luminaire and sensor data for controlling the luminaires, sensor and traffic in the virtual world.
- Creation of Interfaces to the 5 CMS solutions in place. Via the APIs of each installed solution, the sensor data and lighting data has to be fetched in real time from the real world and displayed via the virtual luminaires and sensors. A visible sensor feedback based on the actual given data must be implemented (i.e. housing colour).
  - Creation of a json, csv and text importing function. Via these functions past sets of data can be loaded via menu and displayed in the virtual world. A play function shows the scenario. Traffic participants are assumed and included based on the sensor data.
  - Creation of a DALI interface. Via the DALI interface a real luminaire can be linked to any of the virtual luminaires of the 5 zones. Each change to the virtual luminaire will happen to the real luminaire as well. Via the DALI interface a DALI switch can be connected to the actual zone and controls the scenes and timing level of the virtual world.

### ○ Hardware

The project covers the installation of VR and lighting devices plug and play in the control centre. With little effort the hardware can be transported to fairs and exhibitions, which DOLL/LUCIA takes part in it.

- VR station with inside out tracking, min. 2k resolution and min. 90FPS. The whole setup is plug and play. The visible VR scenario can be streamed to a TV screen for further visitors. The VR station can work as a local stand-alone station. It can also join a hosted session of DOLL employees on their laptops. When joining a running session, the VR user can move in the scenario, but not change parameters. Adapting parameters would be done via the host computer.
- DOLL can link up to 6 computers in one session. The host can change parameters. Others can move individually, but not change the scenario.
- A 2m Pole with mounted outdoor DALI luminaire in tuneable white. Via an installed DALI interface the hardware is linked to the VR station. It mirrors the lighting level and colour temperature of a real luminaire. One luminaire is chosen as a default of the software. Via the menu, this default can be changed to any luminaire in the 5 zones.
- A remote DALI switch connected to the DALI line of the above-mentioned pole. It allows to switch 4 scenes, change brightness and colour temperature between 0 and 100% of the given range. Via the DALI commands the virtual reality adapts. When changing zones, the DALI commands of the switch are transferred to the actual zone.

### ○ Software

The software must run on different systems. For demonstration, knowhow transfer and marketing the software is used in a variety of location and systems.

- The main users will run the software on MacBook Pro. It must reach 15 FPS for demonstration purposes. The users can check the FPS values based on a hidden keyboard command.
- A software version for windows 10 must be created in parallel for distribution to further partners. On those version quality levels can be adapted on runtime via keyboard commands. A low-quality version should reach 15 FPS at a min. resolution of 800 to 480 pixels on a “standard” laptop bought 2018 or later.
- **The software runs on a website. The website is branded according to LUCIA and DOLL standards. The website must be provided for a minimum of 3 years after handover. Streaming can be organized as on-demand service. A budget of 100€ per months must allow 10 hours of streaming for 2 users. if DOLL/Gate21 or Lucia want to increase budget, this must be possible without extra setup costs at a maximum rate of 10€/hour.**
- Logo: During visibility of the zones **in the virtual world**, the branding is according to LUCIA / DOLL standards. **This might be different company logos in each zone.**

- **Eastereggs**

In order to create a hook, animations are integrated, which makes it easier to remember the details of the virtual experience.

- In each of the zones a dedicated surface is foreseen for graffiti. Per Keyboard defined messages or live data (i.e. energy consumption, lighting level, ... ) is sprayed onto wall, road, ...
- The transfer from one zone to another is created with a “Beam me further”-Scotty animation. The clothing of the virtual person, responsible for the beam process, can be branded by the contractor.

## Implementation phases and billing

- **Draft:**
  - 4 weeks after signature the contractor offers a draft, which will demonstrate the software in all relevant aspects. In a dedicated meeting, the details of the next phase are fixed. The contractor can charge up to 20% after acceptance of the draft and the signed meeting protocol.
- **Software Creation**
  - 4 weeks after the draft the VR station and the software are installed and ready to be presented in standalone mode. Design, Construction, Parameters, Menu, Eastereggs are ready. The contractor can charge up to 50% after installation and acceptance by DOLL.
- **Implementation:**
  - In the next 4 weeks, and in accordance with DOLL and the single CMS providers, the system is linked to the live data and to DOLL hardware. In parallel the installation of the 2m pole will be made and linked. The contractor can charge up to 60% after installation and acceptance by DOLL. **In case single zones are not working at the end of the phase- the charge is reduced by 20% per zone. As soon as they are working the full value can be charged. A minimum of 3 zones working is relevant to continue to handover phase.**
- **Handover:**
  - The system is finally handed over in a training session to DOLL employees. A handbook for the hard- and software is available. 2 weeks after the training a final protocol confirms the quality. The contractor can charge up to 80%
  - After a period of 4 weeks with successful operation, The contractor can charge up to 100%