Short report

Creating a computer assisted adviser for retrofitting lighting systems in non-residential buildings

(based on a compilation of technical, energy-related, and economic characteristics of typical existing lighting systems and retrofitting solutions)

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1   Task

The lighting retrofit adviser is intended to enable users to do a quick assessment of the reference situation on site while ensuring sufficient accuracy. This functionality is based on doing simple, visual comparisons of the existing system with a database containing images and characteristic data of lighting applications. On this basis, the tool selects retrofitting solutions, which have been rated under energy-related and economic aspects. Additionally provided, qualitative information supports decision-makers and planners in selecting a variant retrofitting solution. Besides, the collected data may be included in activities pursued by BBR (the Federal German Office for Building and Regional Planning) with regard to standardization and the regulation of the energy performance of buildings (for instance, in the form of a data catalogue containing characteristic data of typical existing lighting solutions).

2   Implementation of the project

The following steps were carried out to implement the project:

1. Based on previously gained experience, research on both existing and designed lighting solutions in buildings was conducted and documented, including the determination of associated economic and energy-related parameters, classification and typology. The results were compiled and stored in a database.

2. An assessment model was created, which combines both energy-related and economic aspects. This model was linked to the database and validated.

3. An easy-to-use interface was designed, a prototype of which was implemented.

4. The design was discussed with the Contractor. Useful suggestions for improvement were integrated.

5. The entire system designed for integration in mobile devices including the interface was implemented.

6. The beta version was tested against an exemplary object and optimised.

7. The lighting retrofit adviser was handed to the funding body for testing. Useful suggestions for improvement were integrated.

8. Along with a brief final report, the final version of the lighting retrofit adviser was submitted to the funding body.

3　General performance characteristics

The new software features the following performance characteristics and concepts for on-site recording of existing lighting installations and the subsequent assessment of energy-related and economic saving potentials when retrofitting lighting systems:

- An optimized building inspection workflow allows for time-efficient reporting and assessment, supporting the user's selections by providing graphs, images, and explanations. Realistic data input is supported by continuously monitoring the technological connections (plausibility checks).

- The simple, intuitive handling of the tool - thanks to its logical structure, the direct help, graphical illustrations, cascading screen structure (from easy access up to more detailed evaluation) - is achieved by not prompting any data that is irrelevant for energy performance rating.

- Besides considering purely technical aspects, the automatic generation of variant retrofitting scenarios (including energy-related and economic evaluation) is also based on decision matrices, which reflect optical expertise.

- Due to the implemented multizone model it is possible to inspect individual spaces of the building and to summarize them for combined analysis. Depending on the user's priority, it is further possible to combine different variant retrofitting scenarios aiming to obtain optimum results with regard to energy performance or cost efficiency. This feature provides an individual decision-making aid for lighting solutions in separate rooms, according to the user's preference. Various parameters that are relevant to energy performance, climate, and cost efficiency (like absolute or specific delivered energy / primary energy needs, CO_2 emissions, different types of cost, amortisation periods, Total Cost of Ownership, interest on capital) are graphically illustrated for each zone and for the entire project to provide the user with a clear overview of the project.

- To avoid double input when further processing the collected data, there is an option that allows to export data to other applications. A reporting function produces a printable report including all relevant project data for review. The calculations are based on the latest standards (DIN EN 12464 and DIN V 18599).
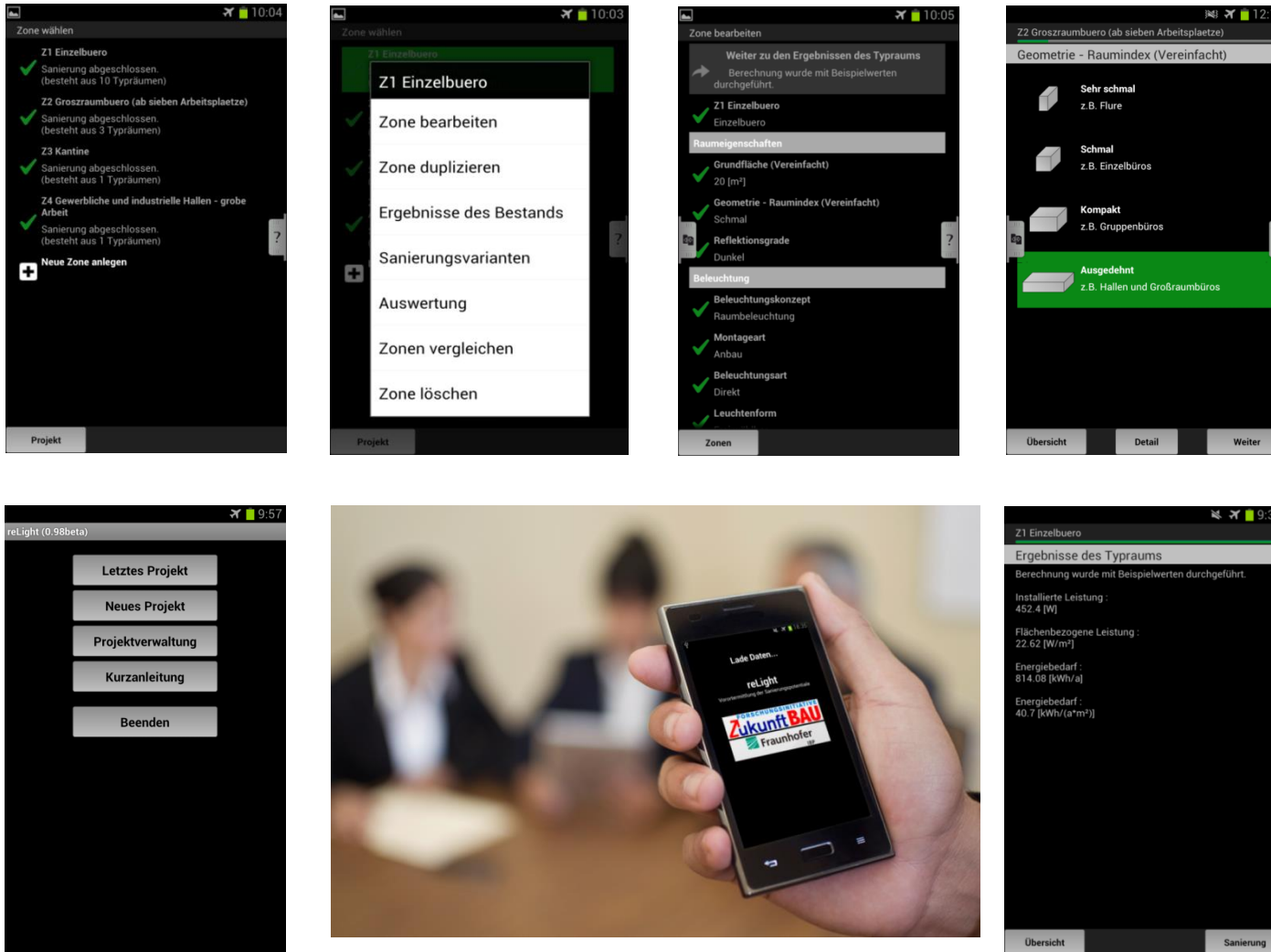
4 Screenshots

Fig. 1:
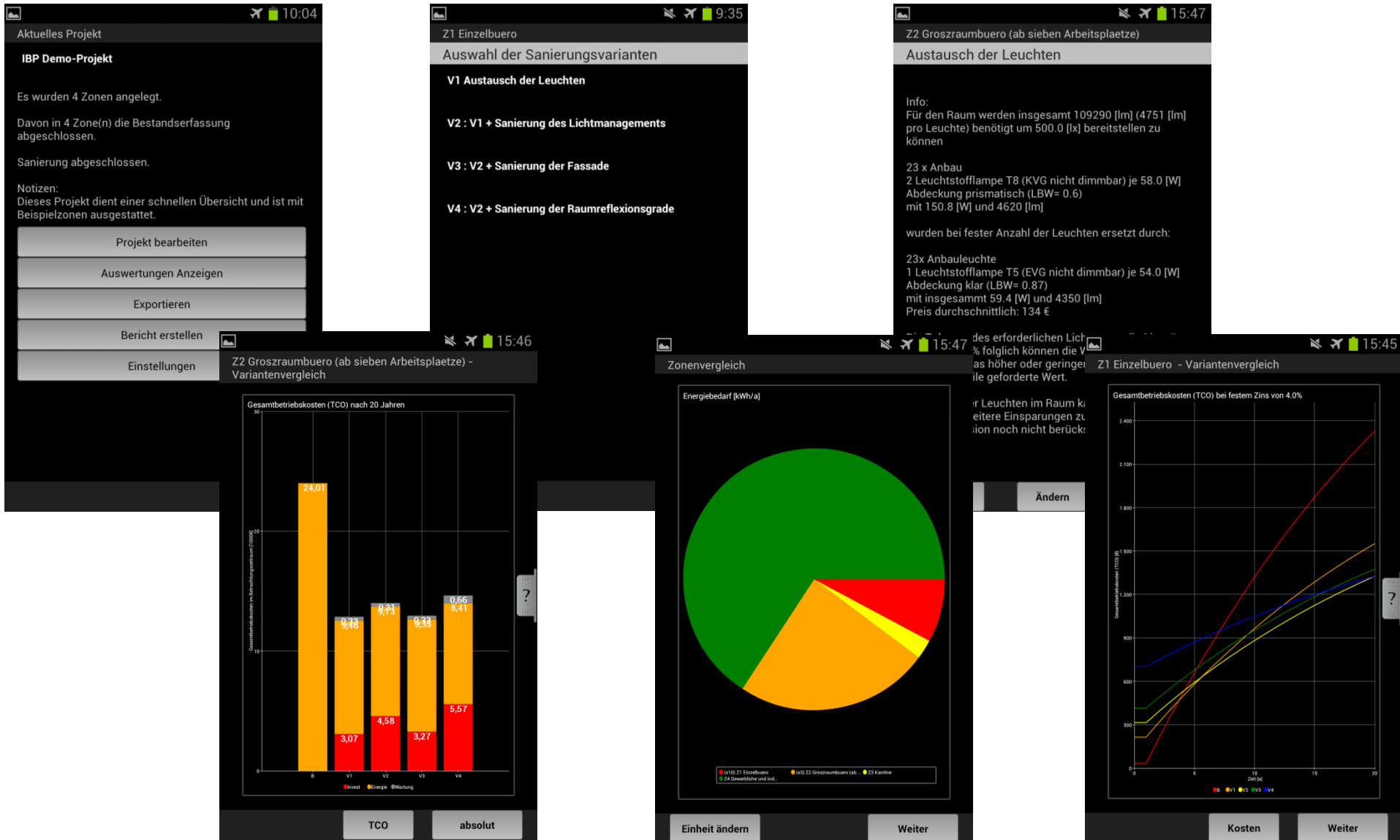Screenshots of the project data collection.

Fig. 2:
Screenshots from project administration and data analysis sections.

5 Summary

The tool "reLight" was developed during the research project entitled "Creating a computer assisted adviser for retrofitting lighting systems in non-residential buildings, based on a compilation of technical, energy-related, and economic characteristics of typical existing lighting systems and retrofitting solutions", which is part of the initiative "Future building" launched by the Federal Institute for Research on Building, Urban Affairs and Spatial Development. This tool allows to assess the lighting situation when doing a first on-site inspection of the building, enabling planners to evaluate first proposals for possible retrofitting measures with regard to energy consumption and cost considerations. The tool is based on research done with regard to lighting solutions in existing buildings and planned solutions for retrofit lighting systems, classification and typology. The lighting solutions were collected in a database. The tool is linked to an assessment model for energy-related and economic analyses. A user-friendly interface allows to use this assessment model, which is linked to a database. A beta version of the tool was tested and optimised using an exemplary building.

The application "reLight" is not only suited for input and storage of lighting installation data of existing buildings (as a type of building inspection report), it also supports the user by providing graphical selection elements and descriptions as well as by continuously checking the consistency of the data entries made. In addition, the collected data describing the existing building situation and the proposed retrofit scenarios can be exported to be used in other applications; also, they can be documented as pdf-reports. The tool is available for download at the Google App Store website [1]. Further information is provided on the tool website [2].

6 References

[1]   https://play.google.com/store/apps/details?id=de.fhg.ibp.wt.relight

[2]   http://www.relightapp.de