An Automated Lighting Fixture Creation and Component Identification Framework using Deep Learning and Image Processing

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Abstract

The issue of design of individual lighting installations in large interior spaces is one of the most important spheres of architecture and interior design, as during the design, both accuracy and creativity are needed. The purpose of this research study is to make the generation of such lighting fixtures for the plans automation and use of machine learning with image processing techniques. The system achieved a detection accuracy of 91.7% for floor plan components and an 88% precision in identifying key elements like walls and doors, resulting in a reduction of manual design time by 40% and a 30% increase in design efficiency. The main goal is the application of an automated approach based on Detectron2 and Retina Net to guarantee reliable floor plan recognition, as well as, an identification of floor plan components such as doors, walls, and windows. Aids of image processing also improve the identification and categorization of these standard parts, including the ability to design lighting layouts that incorporate the detected components within the floor layout. Adenau about the effectiveness of this innovative system revealed by the result of this study which offers a great geographical contribution as a tool for the architect or internal designer by reducing the burden of generating the lighting plans. The project also highlights obstacles, especially when handling CAD-produced ground plans, for example. To counter this challenge, the research employs floor plans in image format, making image processing and object detection achievable. However, the study provides a unique contribution to the application of advanced technologies in architectural designing and provides direction in which future research could be carried out to enhance the automated lighting system.

Keywords: *Deep learning, Floor plan recognition, Image processing, Interior design, lighting automation*