AUTOMATION OF SOLAR RADIATION CALCULATIONS FOR RESIDENTIAL BUILDINGS USING BIM TECHNOLOGIES

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THE REQUIREMENT TO VERIFY INSOLATION FOR THE PURPOSE OF THE EXPERT EVALUATION.

Any architectural firm knows that in order to obtain a building permit, a project must successfully pass an inspection for compliance with health and safety standards, particularly regarding the duration of sunlight exposure. Previously, this required complex manual calculations. Today, however, with the development of BIM technologies, there is a strong market demand for automating this routine process. Despite high interest among designers, there are currently virtually no substantial practical developments in Ukraine, which makes our research particularly urgent.

Development of an algorithm for automatically determining the duration of sunlight exposure using BIM (ArchiCAD, Revit) during the design phase.

The primary goal of our work was to develop an effective algorithm that would enable the automatic determination of sunlight exposure duration as early as the design phase using ArchiCAD or Revit. To achieve this goal, we analyzed the existing software market, thoroughly studied the classical calculation methodology, and compared it with current regulatory requirements.

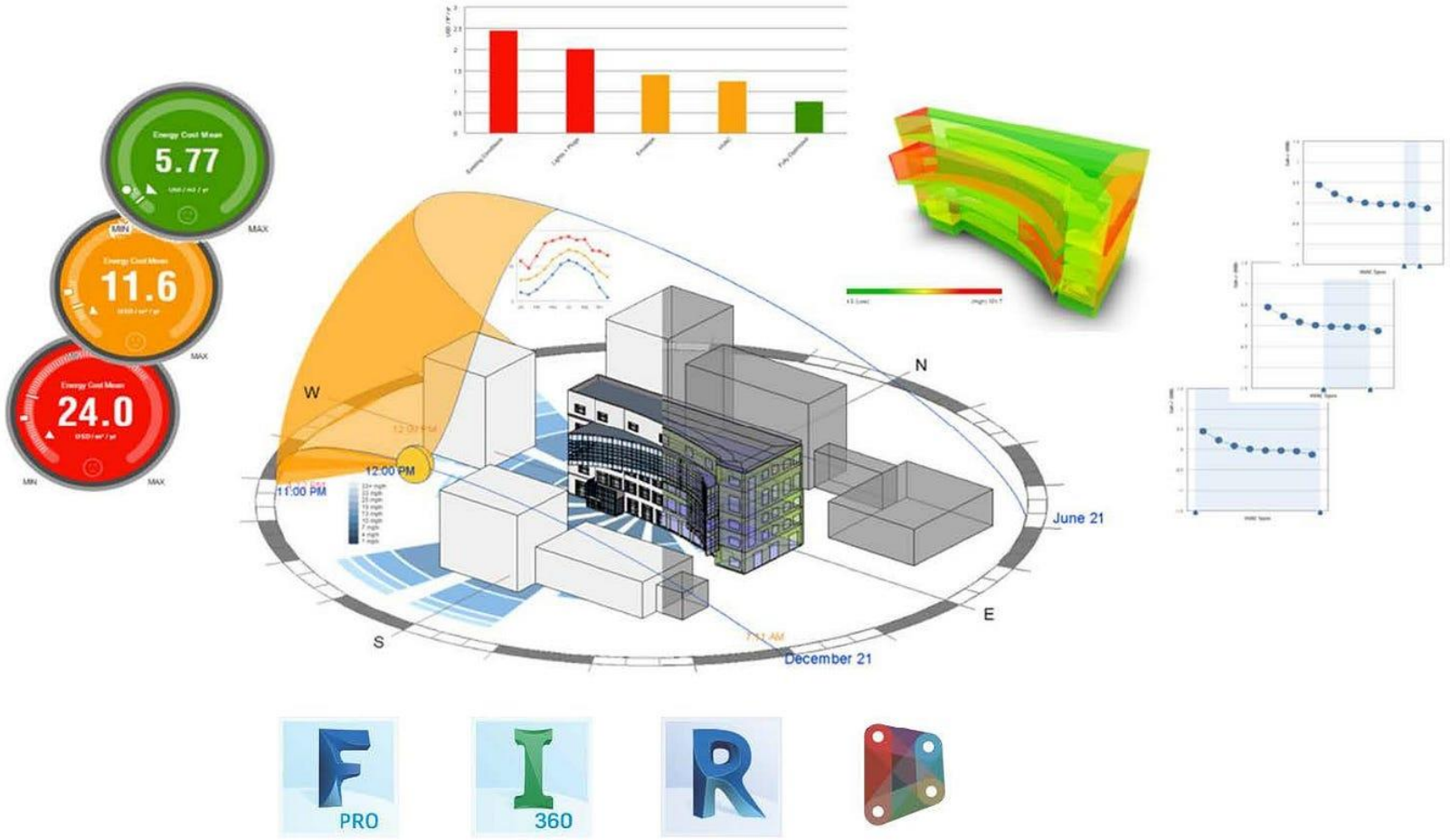


Fig. 1:Visualization of a solar analysis in Revit

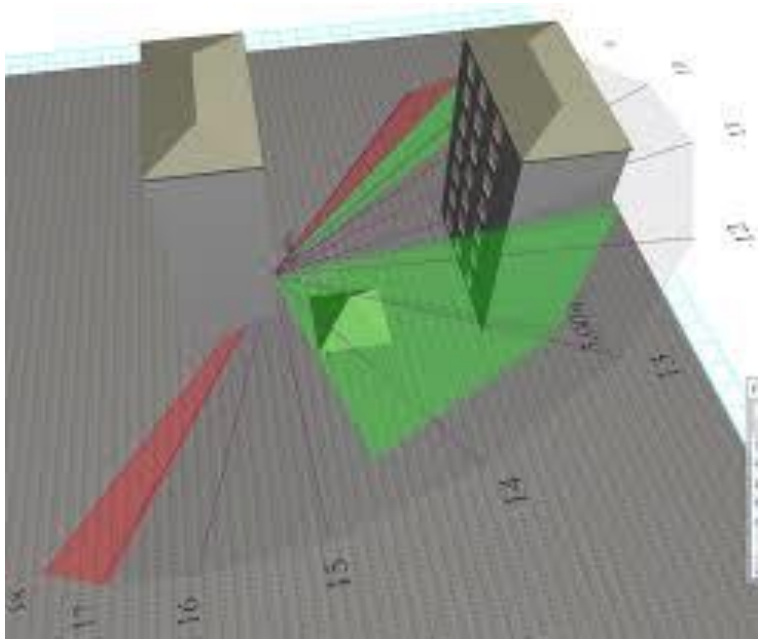
DIGITAL MODEL OF A 25-STORY RESIDENTIAL BUILDING (CHERKASY).

The practical basis for our study was a digital information model of a proposed 25-story residential building with integrated and attached spaces in the city of Cherkasy. We chose the most widely used software-ArchiCAD and Revit-as our tools, applying methods of digital modeling and numerical analysis to verify the building’s compliance with health and safety standards.

Fig. 2 Determining an apartment's insolation using the LabPP_Insolation tool in Archicad

ARCHICAD. ADD-ONS LABPP_INSOLATION

The actual calculations were performed in ArchiCAD using the LabPP_Insolation plugin and the “Sun Trajectory” tool. However, the most critical stage of the work was verification. To demonstrate the program’s accuracy, we created control test cases and calculated them manually using the standard regulatory methodology. Comparing these data confirmed the correctness of the algorithm.



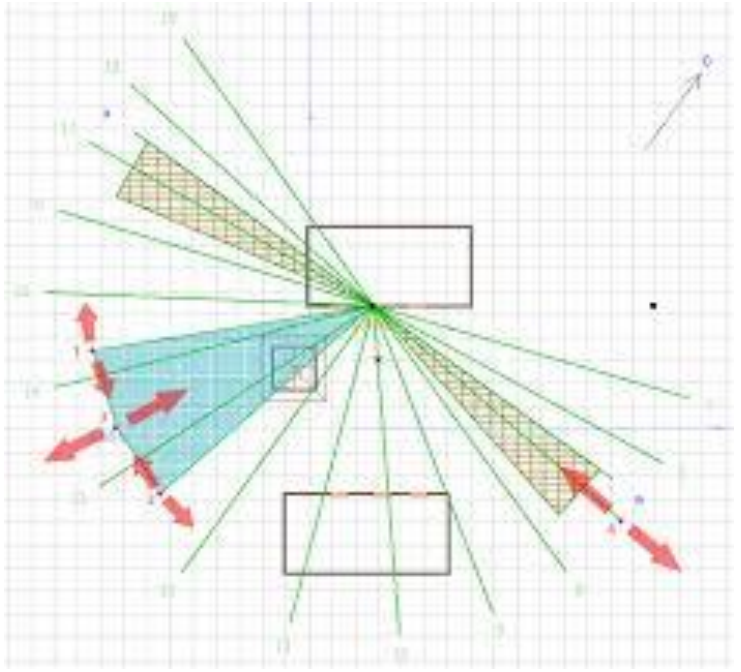


Fig. 3 Example of use in Archicad using the LabPP_Insolation add-on

TO SUMMARISE
THE BENEFITS OF IMPLEMENTATION INCLUDE:

- Significant reduction in human involvement in routine operations.
- Acceleration of the design process.
- Minimization of human-error-related mistakes.
- Simplification of the review process.

The results of our work have direct practical value for project and expert organizations. Implementing the described algorithm makes it possible to delegate routine tasks to a machine, minimize the likelihood of human error, and significantly speed up the overall process of preparing documentation for expert review.